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OPERABLE UNIT 3 WORK PLAN ADDENDUM
VOLUME 1 OF 2, SECTIONS 1-7,
APPENDICES A-C
DECEMBER 1992

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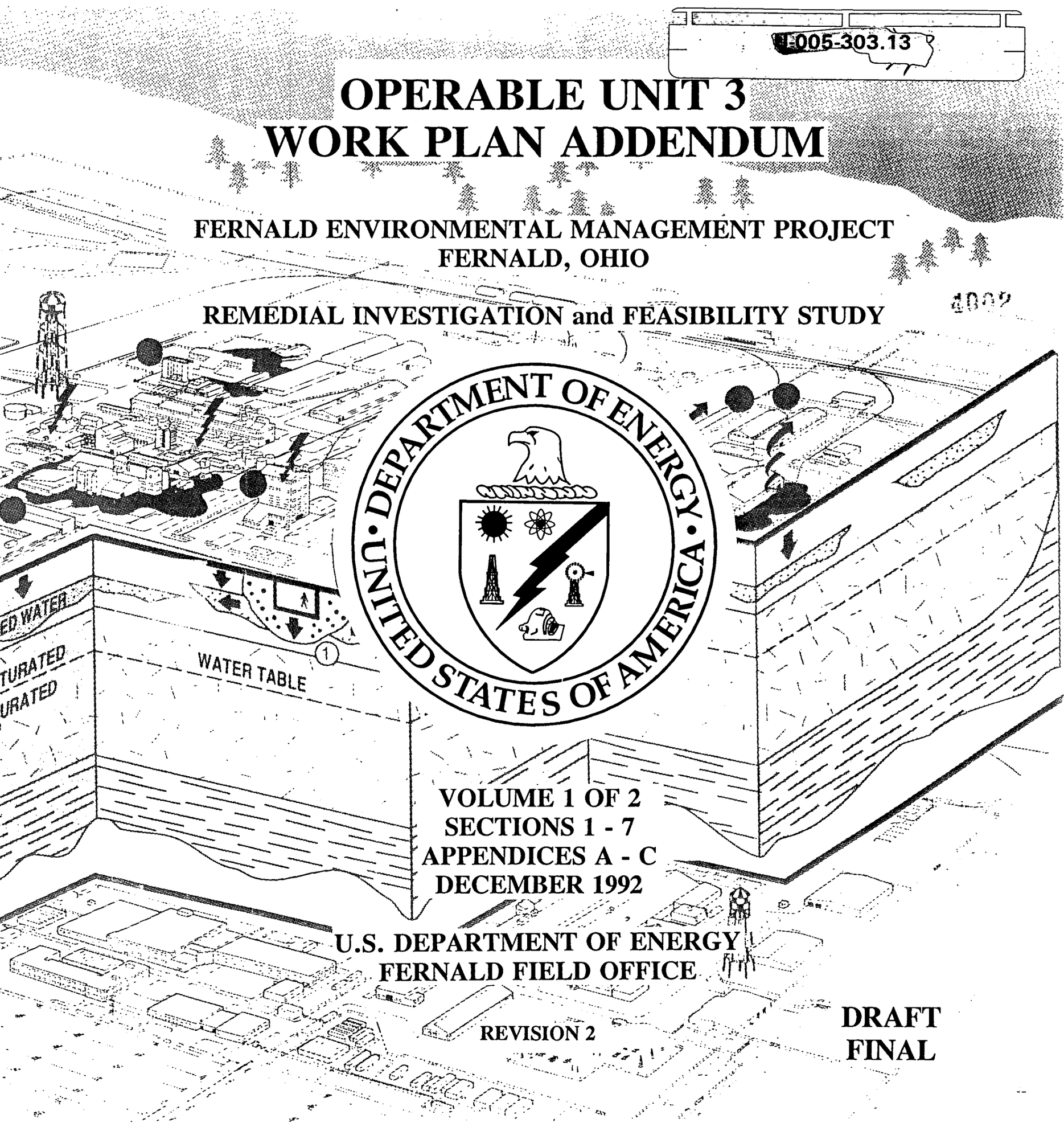
OPERABLE UNIT 3
WORK PLAN ADDENDUM

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

REMEDIAL INVESTIGATION and FEASIBILITY STUDY



VOLUME 1 OF 2
SECTIONS 1 - 7
APPENDICES A - C
DECEMBER 1992

U.S. DEPARTMENT OF ENERGY
FERNALD FIELD OFFICE

REVISION 2

DRAFT
FINAL

OPERABLE UNIT 3
WORK PLAN ADDENDUM

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FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

VOLUME 1 OF 2
SECTIONS 1 - 8 AND APPENDICES A, B, & C

DECEMBER 1992

U.S. DEPARTMENT OF ENERGY
FERNALD FIELD OFFICE

Revision 2

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FINAL

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Abbreviations, Acronyms, and Initialisms

ACM	asbestos-containing material
AEC	Atomic Energy Commission
ALARA	as low as reasonably achievable
ALI	annual limit on intake
ARAR(s)	applicable or relevant and appropriate requirement(s)
ASAP	Automated Sampling and Analysis Program
ASI&IT	Advanced Sciences Inc. & International Technology
ASL(s)	analytical support level(s)
AWWT	advanced wastewater treatment
BDAT	best demonstrated available technology
BDN	biodenitrification
BRA	baseline risk assessment
CEDE	committed effective dose equivalent
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CRQL(s)	contract required quantitation limit(s)
CRP	Community Relations Plan
CSF	Central Storage Facility
DAC	derived air concentration
DCG	derived concentration guide
DE(s)	drum equivalent(s)
DEI	Diagnostic Engineering Incorporated
DFO	Director's Findings and Orders
DFP	decontamination facility pad
DL	decision level
DMSRD	Data Management System Results Database
DOD	Department of Defense
DOE	Department of Energy
DOE-FN	Department of Energy — Fernald Field Office
DQO(s)	data quality objective(s)
EDL	economic discard level
EE/CA	engineering evaluation/cost analysis
EIS	environmental impact statement
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
ERMA	Environmental Resource Management and Analysis
ERMC	environmental restoration management contractor
FACTS	Fernald Analytical Computerized Tracking System
FEMA	Federal Emergency Management Agency
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation

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FFCA	Federal Facilities Compliance Agreement
FICWD	Federal Interagency Committee for Wetland Delineation
FMPC	Feed Materials Production Center
FS	feasibility study
FS/PP	feasibility study and proposed plan
FSP	field sampling plan
FUSRAP	Formerly Utilized Remedial Action Program
FWP	Field Work Package
FY	fiscal year
GC	gas chromatography
GM	gross measurement
GOCO	government-owned, contractor-operated
GRA	general response action
HEAST	Health Effects Assessment Summary Tables
HEPA	high-efficiency particulate air
HSL	Hazardous Substances List
HSP	Health and Safety Plan
HVAC	heating, ventilating, and air conditioning
HWMU	hazardous waste management unit
I&E	internal and external
IRS&T	Industrial, Radiological Safety and Training Department
ISA	initial screening of alternatives
LDR	land disposal restrictions
LLI	lower large intestine
LLW	low-level waste
LSA	low specific activity
LWBR	Light-Water Breeder Reactor
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MCW	Malinkrodt Chemical Works
MSDS(s)	Material Safety Data Sheet(s)
MSL	mean sea level
NAR	nitric acid recovery
NCP	National Contingency Plan
NFS	Nuclear Fuel Services
NEPA	National Environmental Policy Act
NLO	National Lead of Ohio
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NTS	Nevada Test Site
OSHA	Occupational Safety and Health Administration
OU1	Operable Unit 1

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OU2	Operable Unit 2
OU3	Operable Unit 3
OU4	Operable Unit 4
OU5	Operable Unit 5
OVA	organic vapor analyzer
PIC	pressurized ion chamber
PID	photoionization detector
PMCL	proposed maximum contaminant level
POTW	publicly owned treatment works
PPE	personal protective equipment
PRG(s)	preliminary remediation goal(s)
PSMCL	proposed secondary maximum contaminant level
PTO	permit to operate
QA	quality assurance
QC	quality control
RA	removal action
RAA(s)	remedial action alternative(s)
RAO(s)	remedial action objective(s)
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RI/FS	remedial investigation and feasibility study
RLO	Richland Operations (Hanford, Washington)
RME	reasonable maximum exposure
RMI	Reactive Metals Inc.
ROD	record of decision
RPD	relative percent difference
RSE	removal site evaluation
S.R.	State Route
SAA	satellite accumulation area
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SCQ	Sitewide CERCLA Quality Assurance Project Plan
SFMP	Surplus Facilities Management Program
SHSO	Site Health and Safety Officer
SMCL	secondary maximum contaminant level
SMP	scrap metal pad
SOP(s)	standard operating procedure(s)
SOW(s)	statement(s) of work
SOWC	Southwest Ohio Water Company
SRP	Savannah River Plant
SRPC	soil and rubble pile cover
STEL	short-term explosive limit
TBC	to be considered
TCLP	toxic characteristics leaching procedure
TS	tension support
TSCA	Toxic Substances Control Act

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TSS	tension support structure
UMTRAP	Uranium Mill Tailings Remedial Action Program
UST	underground storage tank
UV	ultraviolet
WEMCO	Westinghouse Environmental Management Company of Ohio
WL	working level
WP	work plan
WQC	water quality controls
XRF	X-ray fluorescence
Y-12	an Oak Ridge, Tennessee, facility

Chemical Symbols and Abbreviations

Ac	actinium
ADU	ammonium diuranate
$BaCl_2$	barium chloride
$BaSO_4$	barium sulfate
Ca	calcium
DAAP	diamyl amyl phosphonate
DSBPP	di-sec-butyl phenyl phosphonate
FeO	ferrous oxide
Fe_2O_3	ferric oxide
H_2	hydrogen
HCl	hydrochloric acid
HF	hydrogen fluoride
HNO_3	nitric acid
H_2O	water
H_2SO_4	sulfuric acid
I	iodine
KCl	potassium chloride
KF	potassium fluoride
KOH	potassium hydroxide
Mg	magnesium
MgF_2	magnesium fluoride
$Mg(OH)_2$	magnesium hydroxide
N_2	nitrogen
NaCl	sodium chloride

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Na_2CO_3	sodium carbonate
NaF	sodium fluoride
NaI (Tl)	sodium iodide (thallium)
NaOH	sodium hydroxide
NH_3	ammonia
NO_x	nitric oxides
Pa	protactinium
PCB(s)	polychlorinated biphenyl(s)
Ra	radium
Sr	strontium
SVOC(s)	semivolatile organic compound(s)
TBP	tributyl phosphate
TCA	trichloroethane
TCE	trichloroethylene
Th	thorium
ThF_4	thorium tetrafluoride
U	uranium
U-235	uranium-235
UF_4	uranium tetrafluoride (sometimes called "green salt")
UF_6	uranium hexafluoride
UNH	uranyl nitrate
UO_2	uranium dioxide (sometimes called "brown oxide")
UO_3	uranium trioxide (sometimes called "orange oxide")
U_3O_8	uranium oxide
VOC(s)	volatile organic compound(s)
$ZnCl_2$	zinc chloride

Units of Measure

Ci	curie(s)
µCi/g	microcuries per gram
pCi/g	picocuries per gram
pCi/L	picocuries per liter
cm	centimeter(s)
cm^2	square centimeter(s)
d	day(s)
°F	degree(s) Fahrenheit
°C	degree(s) Celsius
dpm	disintegrations per minute
ft	foot (feet)
ft^2	square foot (feet)

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ft^3	cubic foot (feet)
ft^3/s	cubic feet per second
g	gram(s)
kg	kilogram(s)
µg	microgram(s)
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
mg	milligram(s)
mg/L	milligrams per liter
gal	gallon(s)
gal/d-ft^2	gallons per day per square foot
gal/d-mi^2	gallons per day per square mile
h	hour(s)
in.	inch(es)
L	liter(s)
lb	pound(s)
m	meter(s)
m^2	square meter(s)
mi	mile(s)
mi^2	square mile(s)
mph	miles per hour
mrad	millirad(s)
mrem	millirem(s)
oz	ounce(s)
ppb	parts per billion
ppm	parts per million
yd^3	cubic yard(s)

1 INTRODUCTION

1.1 OVERVIEW OF THE FEMP AND OPERABLE UNIT 3

The Fernald Environmental Management Project (FEMP), formerly known as the Feed Materials Production Center (FMPC),* is located on a 1,050-acre site in a rural agricultural area about 18 mi northwest of downtown Cincinnati, Ohio (Figure 1.1). The site is near the villages of Fernald, New Haven, Ross, and Shandon, Ohio.

The FEMP is a government-owned, contractor-operated federal facility that produced high-purity uranium metal products for the U.S. Department of Energy (DOE) and its predecessor agencies during the period 1952-1989. Thorium also was processed, but on a smaller scale, and still is stored on the site. Production activities were stopped in 1989, and the production mission of the facility was formally ended in 1991. The FMPC was included on the National Priorities List in 1989.

The current mission of the facility is environmental restoration of the site. Response actions at the FEMP are being conducted in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA).

The FEMP is divided into five separate *operable units*. The subject of this work plan addendum is Operable Unit 3 (OU3), which consists of the former Fernald Production Area and production-associated facilities and equipment. It incorporates all above- and below-grade improvements, including, but not limited to, all structures, equipment, utilities, drums, tanks, solid waste, waste, product, thorium, effluent lines, K-65 transfer line, wastewater treatment facilities, fire training facilities, scrap metal piles, feedstocks, and coal pile. The former Production Area occupies about 136 acres near the center of the FEMP site and contains many buildings, scrap metal and soil piles, containerized materials, storage pads, a parking lot, roads, railroad tracks, above- and underground tanks, utilities, and equipment. Several impoundments, ponds, and basins also are included. Operable Unit 3 does not specifically include the soil and groundwater under the various improvements, but

*Throughout this report, the acronym "FEMP" is used for this facility, even though it was known as the FMPC when in operation.

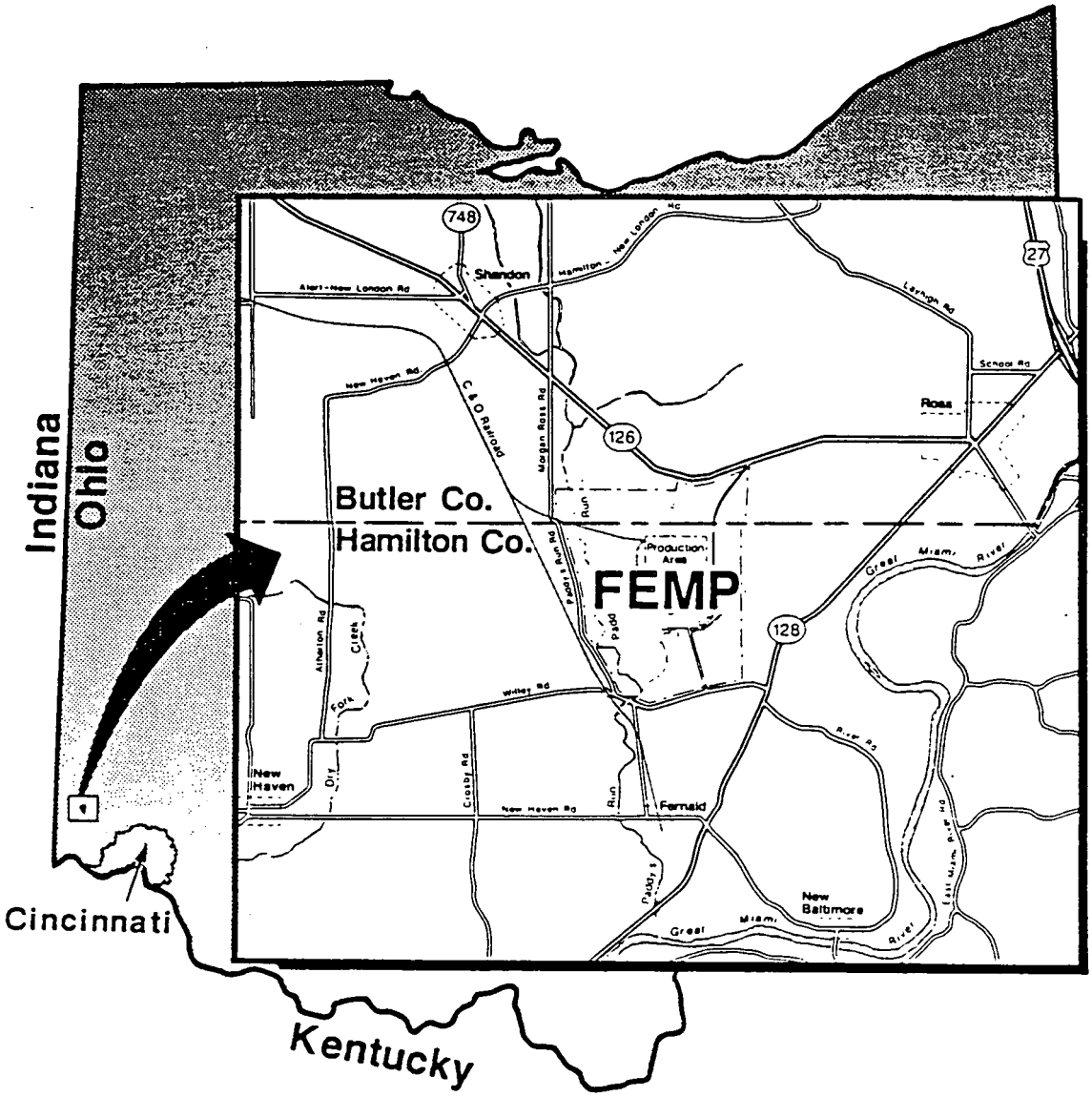


FIGURE 1.1 The FEMP and Vicinity

those resources are important as potential pathways between sources of contamination in the operable unit and receptors.

No future use has been identified for the former Production Area and associated improvements other than for activities related to the site's mission of environmental restoration. Consistent with that remaining mission, it is envisioned that all production and support structures will be dismantled as a consequence of remedial or removal actions. Many structures date from the early 1950s and have already exceeded their intended design life; others are approaching their design life, which will be exceeded by the time remedial actions for the FEMP are completed. It is anticipated that any structures retained in OU3 to support ongoing remedial operations for OU3 and other operable units will be removed at the completion of remedial action.

Various CERCLA removal actions that have been or will be implemented at the FEMP will affect OU3. Of particular importance are the removal of waste inventories and the safe shutdown of the Production Area. The safe shutdown removal action will provide for the proper disposition of all uranium materials, production-related materials, and associated equipment of value. Because of the nature of the removal actions and the number of facilities affected, those activities will have a major effect on the production area and will significantly influence the remedial investigation and feasibility study (RI/FS) process, in particular the program presented in this work plan for characterization of OU3.

1.2 JUSTIFICATION FOR AND OBJECTIVES OF REMEDIAL ACTION FOR OU3

Although minimized by DOE's control of the site and site maintenance activities, the potential exists for uncontrolled release of contaminants from several sources within OU3. These sources include contaminated buildings and other components, their contents, and piles of contaminated materials. Contaminants could be released by such mechanisms as precipitation and runoff, wind, and disturbance by humans or animals. In addition, although unlikely for humans because of access control, unauthorized entry could result in the direct exposure of humans or animals to contaminants. Therefore, activities are needed to prevent and reduce the potential for any such releases and exposures.

The overall objective of any remedial action for OU3 is to eliminate, reduce, or otherwise mitigate the potential for exposure to contaminants and thus minimize associated

risks to public health and the environment. The general objectives of the RI/FS process for OU3 are as follows:

- Characterize radiological and chemical contamination in OU3 as necessary to allow evaluation of remedial action alternatives and to support the needs of the baseline risk assessment,
- Assess potential risks to human health and the environment that could result from exposure to contaminants for baseline conditions,
- Identify and mitigate any immediate hazards resulting from existing conditions in OU3, and
- Evaluate potential remedial action alternatives and select and implement the most effective remedy.

Specific objectives are discussed in Sections 3 and 4 when data needs and data collection approach are considered.

Any remedial action activities for OU3 will be conducted in accordance with all applicable or relevant and appropriate requirements (ARARs) to the extent required by CERCLA.

1.3 PURPOSE AND ORGANIZATION OF THIS WORK PLAN ADDENDUM

The purpose of this Work Plan Addendum is to document the approach developed for RI/FS activities for OU3. The work plan includes an evaluation of available information; an identification of data needed to evaluate risks and alternatives, as well as for other purposes; and an approach for collecting missing data. Also included are discussions of the various RI/FS tasks, the schedule for these activities, and project management.

The following subsections in this introduction provide an overview of environmental compliance issues for OU3 and summarize the overall approach presented in this work plan for addressing data gaps. The role of other agencies and the public in RI/FS activities is also discussed.

Section 2 summarizes historical and existing conditions for OU3. First, the history of the site and the various processes that have been used in the Production Area are discussed, and a detailed description of the Production Area is presented. Next, the

environmental setting for OU3 is summarized, and available information on the nature and extent of contamination in the operable unit is provided. The section closes with a discussion of interim actions that will affect RI/FS activities in OU3.

Section 3 evaluates data needed for RI/FS activities. The conceptual site model for OU3 is presented, and various issues related to baseline risk assessment for the operable unit are discussed. Data needed for the baseline risk assessment are identified. A preliminary identification of regulatory requirements is presented, and preliminary remedial action objectives, general response actions, and remedial action alternatives are discussed. Data needed for the evaluation of remedial action alternatives are identified. Finally, health and safety considerations and associated data needs are described. An overall summary of data gaps is also provided.

Section 4 describes the approach to be used in data collection. Included in the section is a discussion of the development of necessary data quality objectives. The Sampling and Analysis Plan, the Community Relations Plan, the Health and Safety Plan, and the Data Management Plan for OU3 are summarized.

Section 5 summarizes the various RI/FS study tasks, beginning with project planning and continuing through post-RI/FS support activities. Section 6 presents the schedule for RI/FS activities, and Section 7 discusses project management. References cited in the previous chapters are listed in Section 8.

Supplemental information is provided in appendices. Appendix A summarizes information on the nature of OU3 (e.g., descriptions of buildings, potential contaminants, nature and extent of contamination, quantities of drummed material) to support the discussion in Section 2. Appendix B lists preliminary ARARs for OU3. Appendix C contains detailed maps for the operable unit. Appendix D contains the Sampling and Analysis Plan.

1.4 OVERVIEW OF ENVIRONMENTAL COMPLIANCE ISSUES

The RI/FS process for the FEMP and OU3 is affected by several major factors related to environmental compliance at the site: agreements between DOE and other agencies, active regulatory programs that are in place, and National Environmental Policy Act (NEPA) requirements. These topics are discussed in the following paragraphs.

The CERCLA activities for the FEMP and OU3 are affected by several agreements, including the following:

- In 1986, DOE entered into a Federal Facilities Compliance Agreement (FFCA) with the U.S. Environmental Protection Agency (EPA) that provided for a remedial investigation/feasibility study and remedial action at the site.
- In 1988, DOE entered into a Consent Decree with the State of Ohio that provided for management of water pollution and hazardous wastes.
- In 1990, DOE and EPA entered into a Consent Agreement that amended the 1986 FFCA.
- In 1991, the 1990 Consent Agreement also was amended (EPA 1991c). The Amended Consent Agreement redefined five separate operable units at the site: OU1, the Waste Pit Area (waste pits 1-6, clearwell, burnpit, berms, liners, and soil within the operable unit boundary); OU2, 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); OU3, the Production Area;* OU4, Silos 1-4 (silos 1, 2, 3, and 4, berms, decant tank system, and soil within the operable unit boundary); OU5, Environmental Media (groundwater, surface water, soil not included in the definitions of OU1-4, sediments, flora, and fauna). In addition, the Amended Consent Agreement defined a Comprehensive Site-Wide Operable Unit.

The DOE has submitted an RI/FS work plan (DOE 1988c) to EPA. Furthermore, on the basis of the Amended Consent Agreement (which has established the schedule for the RI/FS process) DOE also has submitted to EPA a Risk Assessment Work Plan Addendum for the site (DOE 1992b) and has prepared this RI/FS Work Plan Addendum for OU3. Also on the basis of the 1991 agreement, DOE will conduct and report on an Initial Screening of Alternatives (draft due March 28, 1995), an RI/Baseline Risk Assessment (draft due March 13, 1996), an FS/Comprehensive Response Action Risk Evaluation (draft due August 7,

*Before this redefinition, OU3 was defined as encompassing the Production Area and a number of areas of suspected contamination outside the Production Area and addressed soils and perched groundwater that had been contaminated by activities in those areas. Because of disagreement over the scope of OU3, OU3 was redefined in the Amended Consent Agreement.

1996), a Proposed Plan (draft due August 7, 1996), and a proposed draft Record of Decision (due May 2, 1997) for OU3. Those documents will be prepared in accordance with the Amended Consent Agreement and the requirements of CERCLA, as amended.

CERCLA activities are being conducted in parallel for the five separate operable units at the FEMP. Interaction among the participants in the CERCLA activities at the operable units is essential, and DOE will coordinate the activities to ensure consistency of approach. For OU3, the relationship and interaction with OU5 activities are particularly important. The OU5 activities address contaminated environmental media, including media located around and under the buildings and other components in OU3. Activities in OU3 may also result in additional contamination of surrounding media and will likely generate quantities of contaminated soil during remediation. The remedy selected for contaminated environmental media will be specified in the Record of Decision for OU5.

Cumulative long-term residual risks associated with implementation of alternatives for the various operable units, including OU3, will be evaluated as part of the FS developed for each operable unit and as part of the analysis done for the Site-Wide Operable Unit, as provided in the 1991 Amended Consent Agreement. In addition, as discussed below, DOE is integrating requirements of NEPA with the CERCLA process at the FEMP. An analysis of long-term cumulative impacts (as well as qualitative analysis of potential short-term cumulative impacts) will also be conducted to meet requirements of NEPA. Such analyses will be included in the feasibility study prepared for OU3. This process will ensure that levels of any residual risk for OU3 and the site as a whole are acceptable.

Various active regulatory programs still apply to the FEMP and OU3. Because the FEMP was recently an active production facility, the site continues to seek a permit for the storage of hazardous wastes under the terms of Ohio hazardous waste regulations. Requirements of the Resource Conservation and Recovery Act (RCRA) will continue to be met. Forty-eight hazardous waste management units are located in OU3, and efforts will be made to close those units in accordance with RCRA requirements. Final closure may be through implementation of remedial actions for OU3. Material remaining on the FEMP site (including in OU3) will be inventoried under the terms of proposed amendments to the 1988 Consent Decree and in accordance with Ohio hazardous waste regulations to identify RCRA-regulated wastes. An active program also exists for storage and disposal of polychlorinated

biphenyls (PCBs) at the FEMP in accordance with the requirements of the Toxic Substances Control Act (TSCA). Radioactively contaminated PCBs are currently stored in OU3.

Active programs related to the Clean Air Act and the Clean Water Act also are in place. An active National Pollutant Discharge Elimination System (NPDES) permit covers discharges from the site (primarily from OU3) to the Great Miami River, and the permit is expected to remain in place as long as activity continues at the site. An application will also be filed for a permit to discharge storm-water runoff to Paddys Run. The site has Ohio permits to operate (PTOs) for active sources of atmospheric emissions from OU3 and will continue to renew those permits for active sources that are not related to specific CERCLA activities (e.g., the boiler plant). The DOE is also identifying any sources that may require additional permits.

The DOE will comply with the requirements of NEPA during the RI/FS planning process at the FEMP. DOE policy on NEPA/CERCLA integration is stated in DOE Order 5400.4 (1989). According to that policy, integration is to be accomplished by conducting the NEPA and CERCLA environmental planning and review procedures concurrently. Integration is intended to (1) avoid duplicate effort and the larger commitment of resources that would be needed to implement NEPA and CERCLA separately, (2) avoid conflicts in analysis and the choice of a remedial alternative, and (3) minimize the risk of delaying remedial actions on procedural grounds. The primary instrument for DOE's NEPA-CERCLA integration is to be the RI/FS process, supplemented as needed to meet the procedural and documentation requirements of NEPA. Thus, all FEMP CERCLA documents will contain specific language to facilitate compliance with NEPA.

For the NEPA/CERCLA integration approach published in the notice of intent to prepare an environmental impact statement (EIS) for FEMP remedial activities (DOE 1990a), it was concluded that:

- An RI/FS-EIS is the appropriate level of NEPA documentation for the "lead" operable unit.
- NEPA/CERCLA integration will also be provided in the remaining operable unit RI/FS-NEPA reports. These documents will be "tiered" to (or reference) the "lead" RI/FS-EIS and will present impacts specific to

the operable units and update site-wide and cumulative impacts, as necessary.

The lead documents for the FEMP RI/FS are the OU2 RI and FS.

The NEPA/CERCLA integration approach described above will be implemented on the basis of a number of key assumptions concerning the content of the RI/FS-EIS:

- The lead RI/FS-EIS will evaluate the impacts of various site-wide alternatives (e.g., an engineered waste management facility) that may be proposed for use in the handling and disposal of waste from some or all operable units. However, only information available at the completion of the first operable unit FS (OU2) will be used for this assessment. This analysis will be updated in subsequent operable unit RI/FS-NEPA documentation, including documentation for OU3.
- The lead RI/FS-EIS will consider only remedial alternatives that are being developed for the Fernald facility and not national DOE waste management strategies.
- Environmental impacts of removal actions are being addressed in separate NEPA documentation.

1.5 SUMMARY OF WORK PLAN APPROACH

The approach followed in this work plan consists of four basic steps:

- Summarize existing information for OU3,
- Identify data required to carry out the RI/FS-NEPA process for OU3,
- Determine data gaps, and
- Develop a program to collect the needed data.

The relationship of these activities is summarized in Figure 1.2, which shows the various sources of available data and the activities for which data are needed during the RI/FS process.

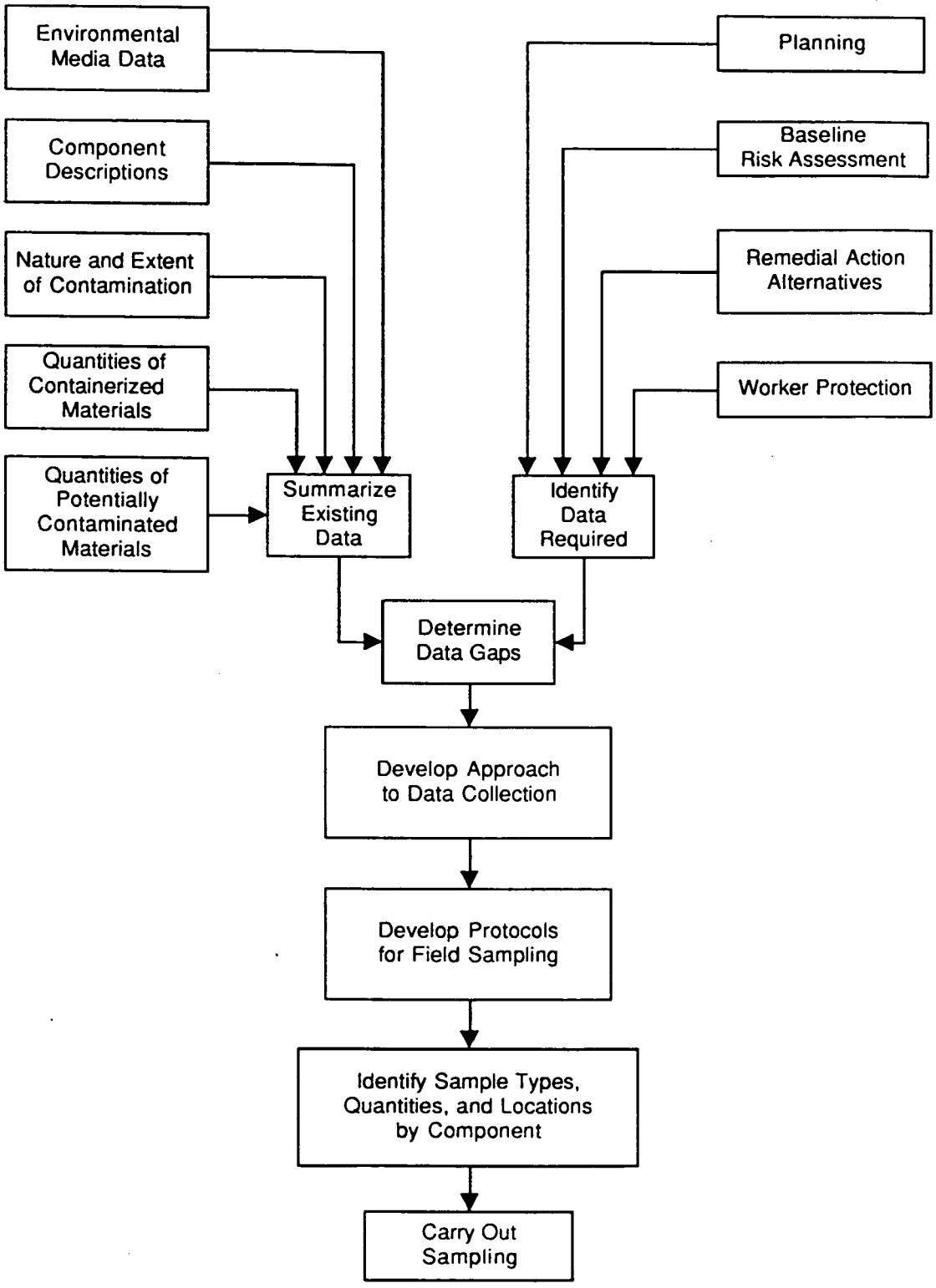


FIGURE 1.2 Work Plan Approach

Characterization of OU3 will be focused on the materials present in the operable unit in order to provide the information necessary to evaluate remedial alternatives. DOE's decision that all structures will be removed from OU3 limits the range of alternatives requiring evaluation and means that the baseline risk assessment will not attempt to demonstrate that no remediation is necessary. Therefore, the decision that structures have no long-term use focuses the data collection program for the operable unit, because that program need only provide information necessary to allow a conservative assessment of baseline conditions and to evaluate a limited range of alternatives.

The complexity of OU3 (i.e., the numerous buildings of different types and the variety of other components [pads, waste piles, utilities, basins] present in the operable unit) makes it helpful to classify the various components into similar categories to facilitate their efficient management during the RI/FS process. Such categories have been developed and used in conjunction with information on the various individual buildings and other components to prioritize and schedule activities for the field program. The potential exists for conflicts between field sampling activities and any interim response actions or other ongoing activities in OU3 that might limit access to portions of, or affect conditions in, OU3, and field sampling activities will be coordinated with these other activities.

The Sampling and Analysis Plan (SAP), as appended to this document (Appendix D), includes sufficient detail for implementation at the component-specific level. The SAP was written to be a stand-alone document that encompasses all OU3 data collection and analytical needs. The SAP provides necessary field sampling protocols and discusses needed sampling and analysis procedures. Component-specific information, including preliminary sampling locations and numbers of samples, are provided for all components. The plan is sufficiently flexible to accommodate changing conditions and priorities as the field characterization program progresses.

1.6 ROLE OF OTHER AGENCIES AND THE PUBLIC

Executive Order 12580 delegated to DOE the authority to conduct remedial actions at sites under its control. Therefore, DOE is the lead agency for remedial actions at the FEMP, including those actions involving OU3. Such actions are subject to EPA oversight under CERCLA. For the FEMP, that oversight is provided by EPA Region V. The 1991

Amended Consent Agreement defines the role of the EPA relative to RI/FS documents produced by DOE for the FEMP. In particular, Section XII (Consultation with U.S. EPA) establishes the procedures to be followed by DOE and EPA relative to appropriate notice, review, comment, and response to comments regarding specified RI/FS documents, including this Work Plan Addendum.

Review and comment by EPA are to be carried out in consultation with the State of Ohio (Ohio EPA). Ohio EPA also has oversight responsibility for compliance with requirements of RCRA, the Clean Water Act, and the Clean Air Act (along with the U.S. EPA, which has oversight responsibility for radionuclide emissions). The U.S. EPA has oversight responsibility for compliance with the requirements of TSCA.

The DOE is committed to a program of public participation in the remedial action process and has established a formal community relations program for the FEMP. Under that program, DOE is maintaining a dialogue with the community throughout the RI/FS process for OU3. Part of this dialogue involves communication with representatives of local governments — Hamilton and Butler counties, townships, and incorporated communities — as well as with community groups and individuals who have expressed interest in the FEMP. The process by which this dialogue is maintained is addressed in the site's community relations plan, which is discussed in Sections 4.6 and 5.2 of this Work Plan Addendum. Public participation requirements of NEPA also are addressed by the community relations plan.

2 SITE BACKGROUND AND ENVIRONMENTAL SETTING

Section 2 summarizes basic information relevant to OU3, including the history of the site, descriptions of the buildings and other components included in OU3, the environmental setting, the nature and extent of contamination within the unit, and interim and other related activities that may be significant for the RI/FS process for OU3. Figure 2.1 presents a flow diagram for information summarized in this section.

Section 2.1 discusses site history and considers the various processes used in the FEMP Production Area. The discussion includes general information on the types of materials processed, where they were processed, and the time periods when processing occurred. Section 2.2 describes the components that make up OU3 and outlines the system for categorizing and identifying those components that is used throughout this OU3 Work Plan.

Knowledge of the environmental setting in which the FEMP operations functioned is necessary in evaluating the potential fate of any released contaminants. Relevant environmental information is summarized in Section 2.3.

Information about the nature and extent of contamination in OU3 is discussed in Section 2.4. A preliminary list of potential contaminants, developed on the basis of process history, is discussed. The results of past sampling activities are summarized, and a classification of components based on level of contamination is presented. Preliminary estimates of waste volumes are given for OU3. A variety of other activities underway or planned at the FEMP that have the potential to affect RI/FS activities in OU3 are summarized in Section 2.5.

A detailed map of the Production Area is provided in Plate 1, located in the pocket at the end of this volume.

2.1 SITE HISTORY

The Feed Materials Production Center (FMPC) was constructed in the early 1950s to produce materials needed for the nation's nuclear weapons program. The facility provided high-grade uranium metal used for plutonium production in government reactors at Richland, Washington, and Savannah River, South Carolina. The site produced uranium and other special products for 37 years. Production operations at the site ended in 1989, and

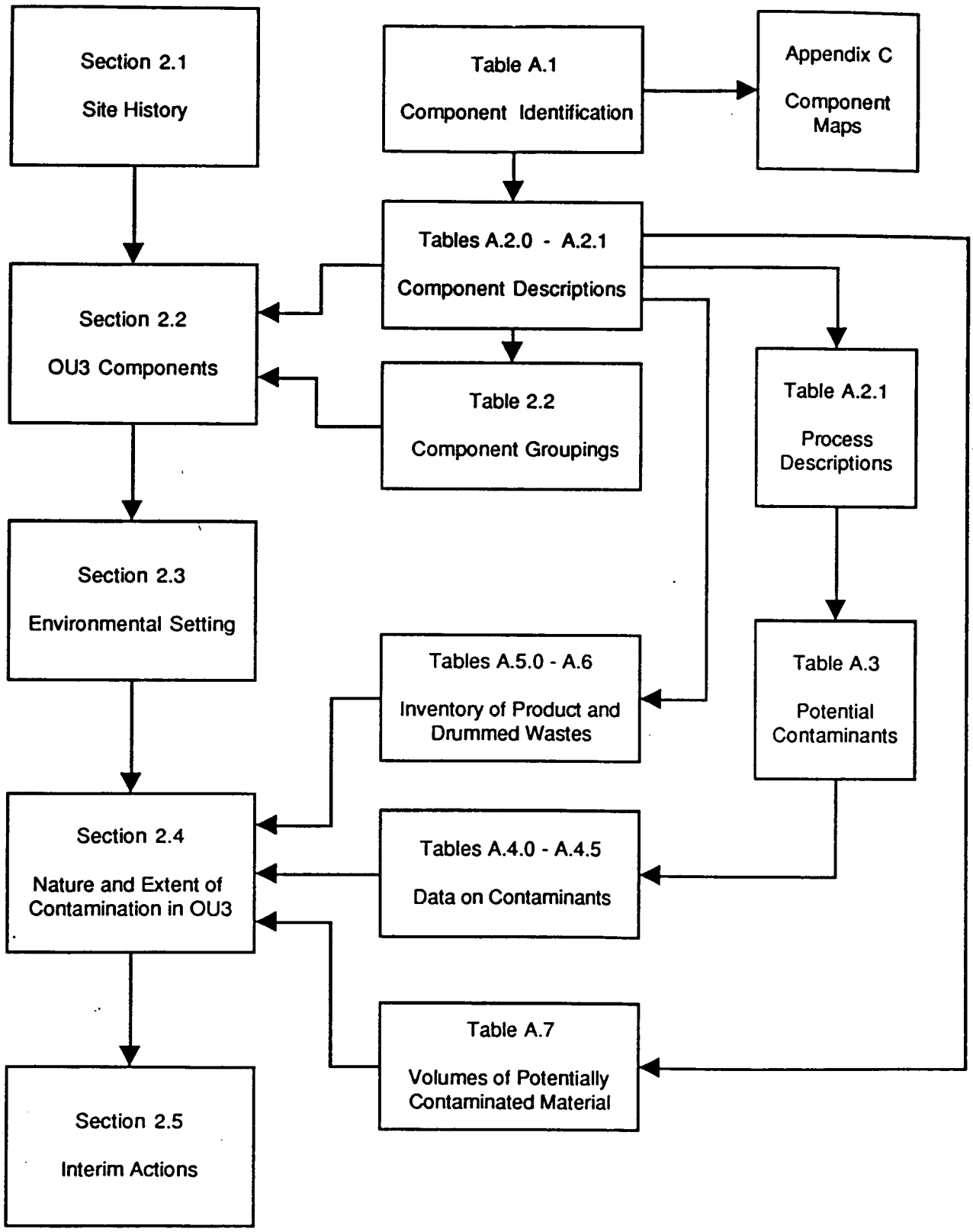


FIGURE 2.1 Section 2 Information Flowchart

subsequently the site was renamed the Fernald Environmental Management Project (FEMP), reflecting the new mission of environmental restoration. The site is referred to as the FEMP throughout the rest of this report.

2.1.1 Construction

The original Fernald project was developed on an accelerated schedule by the Atomic Energy Commission (AEC) with the aid of the U.S. Army Corps of Engineers. The site was selected in 1950, and site preparation and construction began in May 1951. Construction of the main facilities (including ore receiving, refinery, hydrofluorination, hexafluoride reduction, reduction and casting, metals fabrication, special products, pilot plant, recovery, laboratory, boiler plant, and administration facilities) was completed in a period of about three years, and operation was begun by May 1954. The Plant 1 Ore Receiving Facility was the first production building to be completed.

2.1.2 Uranium Operations

The processes installed at the site were directly scaled from laboratory work performed elsewhere, without the benefit of extensive full-scale testing. Therefore, the early operation of the uranium production facilities involved not only routine equipment start-up testing, but also included verification testing to ensure that the processes were capable of producing the high-quality uranium metal and intermediates needed for national defense programs. For the most part, the equipment and production processes eventually operated both faster and better than designers had planned.

The FEMP was capable of receiving raw ore from uranium mines and producing finished uranium metal rods for use in reactors that produced plutonium for nuclear weapons. Other precision metal shapes created at the facility have been used as tank armor, tank penetrator projectiles, and radiation shielding. Other uranium products included uranium trioxide (UO_3) and the uranium oxide (U_3O_8) used for enrichment cascade feed. The major uranium processes used at Fernald are described below and are schematically diagramed in Figure 2.2. Table 2.1 highlights the uranium (and thorium) products of each major Fernald facility, as well as associated feed materials and wastes.

Over the course of the Fernald site's 37-year production history, the isotopic level of the bulk of the uranium production shifted from normal (naturally occurring level of 0.711%

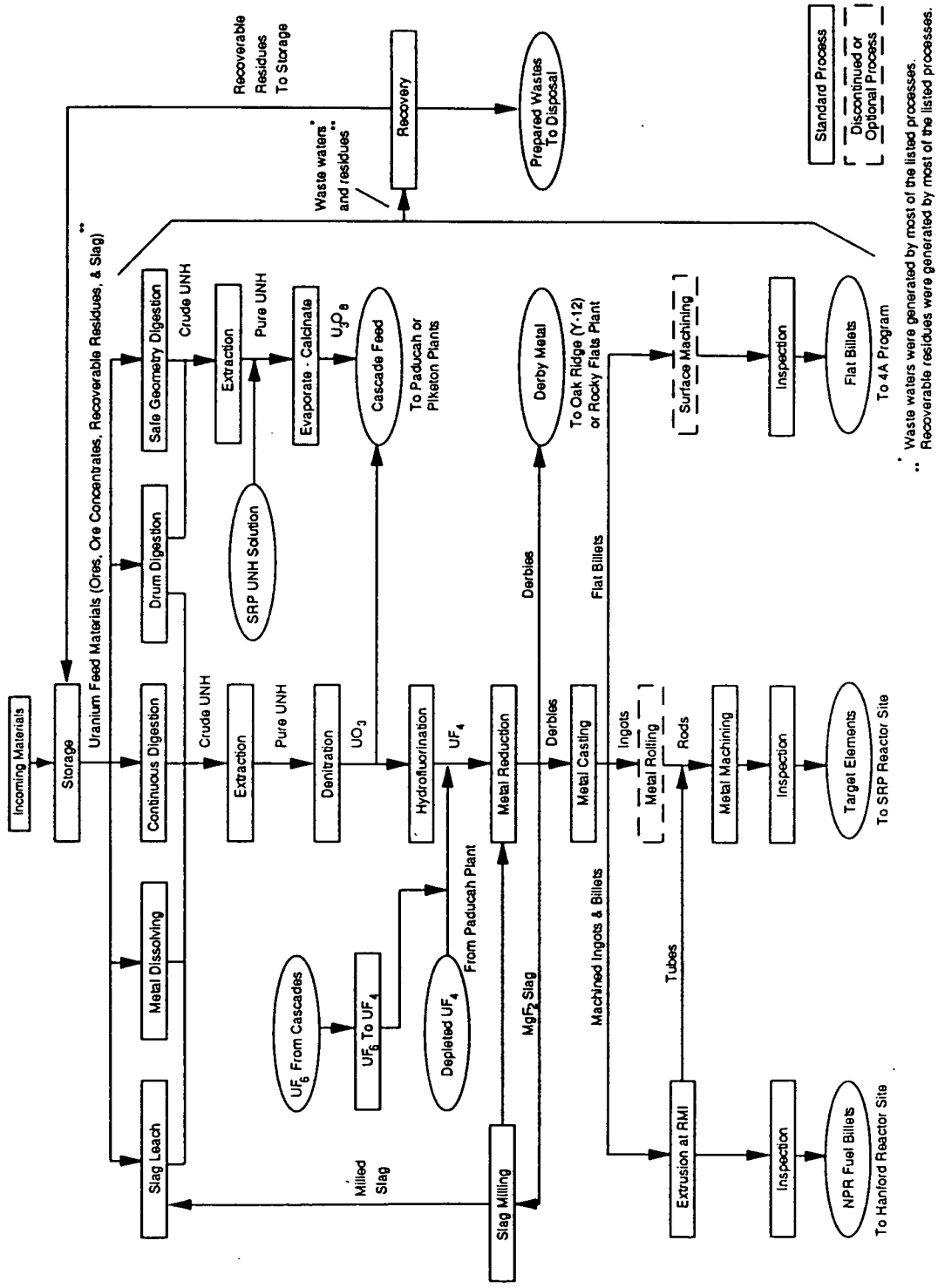


FIGURE 2.2 Schematic Diagram of the FEMP Processes for Uranium

TABLE 2.1 Facility Production Information

Facility	Production Feed Materials	Final and Intermediate Products	Waste/By-Product Streams
Plants 1, 2, & 3	Uranium feed, HNO_3, TBP, kerosene, Na_2CO_3, NaF, water, and MgF_2	UNH, UO_3, and MgF_2	TBP, kerosene, aqueous raffinate, NO_x fumes, and filter cakes
Plant 4	UO_3, NH_3 (gas), HF (anhydrous), H_2, KOH, and water	UO_2, UF_4, H_2, and N_2 (gas)	N_2, HF (aqueous), and KF
Plant 5	UF_4, Mg, MgF_2, graphite, and UO_3	Uranium derby, uranium ingot, and MgF_2	Uranium slag and graphite
Plant 6	Ingots, NaCl, KCl, K_2CO_3, Li_2CO_3, water, oil, HNO_3, and caustics	Uranium billets, uranium cores/tubes, briquettes	Bath waters, bath oil, uranium turnings, contaminated HNO_3, and contaminated heat treating salts
Plant 7	UF_6 and NH_3	H_2, N_2, UF_4, and HF (anhydrous)	HF (aqueous)
Plant 8	Slag/sump cakes, floor sweepings, dust collector materials, furnace salts, HCl, NH_3, water, lime, dicalite, uranium residues, ThF_4, graphite, and H_3PO_4	ADU, uranyl ammonium phosphate, uranium oxides, and dried filtrates	Waste tailings and aqueous raffinate from ADU precipitator, and nonrecoverable residues
Plant 9	Dolomite, MgF_2, UF_4, Mg, derbies, HNO_3, K_2CO_3, Li_2CO_3, HF, caustic, reject cores, graphite, thorium nitrate, Ca, and $ZnCl_2$	Ingots, derbies, ThF_4, thorium metal, and briquettes	Heat bath oil, uranium turnings, contaminated HNO_3, contaminated heat treating salts, spent acids, Zn, MgF_2, and graphite
Pilot Plant	DAAP, UF_6, NH_3, ingots, derbies, TBP, kerosene, UNH, Ca, $ZnCl_2$, oxalic acid, HNO_3, thorium compounds, caustic, $BaCl_2$, H_2SO_4, graphite, and DSBPP	UF_4, thorium compounds, ingots, derbies, thorium derbies, UNH, $BaSO_4$, HF (anhydrous), and graphite	HF (aqueous), TBP, kerosene, aqueous raffinate, NO_x fumes, filter cakes, DAAP, DSBPP, MgF_2, and Zn

uranium-235 [U-235]) at the outset of operations, to slightly enriched (0.86, 0.95, 1.25, and 2.10% U-235) during the 1960s and 1970s, and to primarily depleted products (0.14 and 0.20% U-235) during the 1980s. Throughout its production history, the FEMP produced a relatively consistent product line consisting of uranium and thorium compounds or metal.

2.1.2.1 Ore Receiving (Plant 1)

Uranium ores were transported (primarily by rail) from the mine sites to the Ore Receiving Facility (Plant 1) at the FEMP. The ores were weighed and assayed and sent for crushing and milling. The milled ores were used as feeds for digestion processes at Plant 2/3. Ore concentrates were also received and handled at Plant 1 in a similar procedure.

2.1.2.2 Refinery (Plant 2/3)

In the FEMP Refinery (Plant 2/3), nitric acid digestion processes were used to convert uranium ores, oxides, metal, and residues into uranyl nitrate (UNH) solutions that were then purified. Purification was accomplished with a countercurrent aqueous/organic solvent extraction system. The purified uranium stream was further processed to concentrate the UNH and then was thermally processed to decompose the nitrate to form uranium trioxide (UO_3 — orange oxide). The raffinate stream from the extraction was dewatered and handled as a waste. Ore raffinates from ores with high radium content were stored in the K-65 storage silos (silos 1 and 2) on the western edge of the site. Less radioactive raffinates (from ore concentrates or recycle residues) were stored in silo 3 and in the waste pits west of the Production Area.

Production activities were initiated in February 1954 on uranium ores (identified by the code Q-11) from the Belgian Congo (now Zaire). These Q-11 ores were pitchblende ores with associated equilibrium decay products, such as radium, and were processed primarily in radiation-shielded equipment or buildings.

Soon after the Fernald Refinery began operation, U.S. and Canadian ore concentrates became available (in about 1956). Concentrates were preprocessed, usually at the mine site, to remove most of the radium. Concentrates were received from many mines in this and other countries and were primarily of three types — U_3O_8, magnesium salts, or sodium salts

(resulting from either $Mg[OH]_2$ or NaOH precipitation of uranium leached from ores). Each concentrate type had its own characteristics and impurities.

By 1957, Canadian ores, with thorium content, were a major feed, and the Refinery had been expanded in 1956 to handle the production capacities required. By 1960, the more efficient operation of the ore refinery at the Malinkrodt Chemical Works (MCW) at Weldon Spring, Missouri, forced the FEMP Refinery to operate on ores of lesser quality. By 1962, the FEMP Refinery had completed processing of ore and ore concentrate inventories to UO_3 and was placed on stand-by status.

Refinery operations at the FEMP resumed in April 1966 after shutdown of the MCW refinery. Uranium residues from operations at the FEMP and elsewhere in the weapons production complex became the feed materials for uranium recovery and production processes. Approximately 20,000 drums of ore concentrates and residues were transferred from MCW to the FEMP and used as feed in this process.

In 1968, residues with up to 2% U-235 were processed at the FEMP Refinery. By 1969, the Refinery was able to process all backlog residues awaiting reclamation, thus demonstrating the system's ability to recycle uranium already in the complex. In 1971, the Refinery began processing ore concentrates from the Atomic Energy Commission (AEC) inventory to produce UO_3 for feed to the cascade enrichment process at Paducah, Kentucky.

Both the north and south refinery process systems were active during the mid-1970s. The enriched evaporator/calciner was used to process high-assay materials for cascade feed during the period 1972-1977. The denitration process was operated for short periods in the 1980s to expend the inventory of UNH. During this period, trace elevated levels of plutonium and neptunium were identified in refinery liquors and products. These radionuclides were linked to the feed materials associated with recycled reactor products. A process was developed and demonstrated to remove the two elements from the refinery product. However, because of the shutdown of production, the contaminated UNH has remained in storage tanks at the site.

2.1.2.3 Hydrofluorination (Plant 4)

The process conducted at the Hydrofluorination Plant (Plant 4) at Fernald involved contacting UO_3 at high temperature with hydrogen gas (from catalytic cracking of ammonia)

in a two-stage fluidized bed to form uranium dioxide (UO_2 — brown oxide). The UO_2 was passed through multiple stages of horizontal reaction tubes countercurrent to hydrogen fluoride gas to produce uranium tetrafluoride (UF_4 — green salt). Aqueous hydrofluoric acid generated from off-gas scrubbing was a saleable by-product.

Production of metal-grade UF_4 was initially only possible with the UO_3 produced at the FEMP Refinery. As processes were optimized around the complex and the hydrofluorination process was adjusted to compensate for lower quality feeds, UO_3 feeds from the Port Hope Refinery, Richland Operations (RLO), and the Savannah River Plant (SRP) were received and processed.

During the mid-1960s, the FEMP was able to handle the many different feed types simultaneously, with as many as five different isotopic levels run in parallel, without significant material crossover. After shutdown of the MCW facility in 1966, the FEMP hydrofluorination process faced seven years of declining demand. In 1974, the needs of the "N" Reactor program at Hanford, Washington, once again provided a consistent customer for the process.

2.1.2.4 UF_6 to UF_4 (Plant 7 and Pilot Plant)

A second type of process was also used for uranium tetrafluoride (UF_4) production. Uranium hexafluoride (UF_6) produced as feed for enrichment cascades at either Oak Ridge, Paducah, or Piketon facilities (or produced as a waste by operations there) was reacted with hydrogen gas (from catalytic cracking of ammonia) at high temperature to form UF_4. Aqueous and anhydrous hydrofluoric acid were by-products.

The original UF_6 to UF_4 "hex" facility at the FEMP (Plant 7) operated only two years. Natural and depleted isotopic levels were processed. The process was evidently dismantled quickly; however, a small hex process in the Pilot Plant operated between 1952 and 1957 and again from 1962 through 1967. This process was replaced by construction of another facility in 1984. Isotopic levels up to 2.0% U-235 were processed to UF_4, but the greatest demand was for 0.20% U-235 product. An expansion facility was under construction in 1988 to handle the increasing demand when the Department of Defense (DOD) canceled further product orders.

2.1.2.5 Reduction (Plant 5)

In Plant 5, UF_4, either from on-site sources or from Paducah, was combined with magnesium metal turnings in a magnesium fluoride refractory-lined vessel. The sealed contents were heated to initiate a thermite-type (auto-initiating highly exothermic) chemical reaction. The reaction products were a uranium metal "derby" and magnesium fluoride "slag." The magnesium fluoride was milled and reused as refractory to line the reaction vessels. Excess magnesium fluoride from depleted uranium processing was sent to on-site waste pits or drummed for off-site disposal. Excess magnesium fluoride from normal and enriched uranium processing was stored for eventual recovery in the refinery.

The FEMP hydrofluorination process and the UF_6 to UF_4 operation constituted the only UF_4 feed sources to the reduction process through 1962. Between 1963 and 1966, UF_4 from MCW was also used. Beginning in 1967, UF_4 produced at Paducah, Kentucky, from cascade tails (depleted of U-235 to about 0.16-0.20%) was processed through reduction to produce uranium metal for use at Savannah River and Y-12 (an Oak Ridge, Tennessee, facility). Before this time, depleted UF_4 had been reduced to metal at the Special Products Plant (Plant 9). Normal and enriched UF_4 continued to be produced by hydrofluorination until the UF_6 to UF_4 facility at the Pilot Plant was replaced in 1984.

Operation of the reduction process remained essentially the same over the entire history of operations, except for the replacement (in 1956) of ground dolomite with magnesium fluoride, a reduction reaction by-product, as the reduction pot liner. A milling facility (Plant 5) was constructed in 1956 to produce a refractory powder from the magnesium fluoride and return it to the process.

2.1.2.6 Remelt and Casting (Plants 5 and 9)

The uranium metal derbies from the reduction process were combined with other uranium metal sources (e.g., briquetted machining chips, chemical reject ingots, physical reject ingots, and extrusion ends) in a graphite crucible to prepare them for remelting and casting in Plants 5 and 6. Vacuum induction furnaces were used to heat the metal for casting into ingots of various shapes. The ingots were removed from the graphite molds and prepared for further processing.

Beginning in 1953, 5-in.-diameter solid cylindrical uranium ingots were produced. Over the next 36 years of production, a large assortment of ingot shapes, sizes, and enrichments were produced at the request of various federal customers: SRP, Y-12, RLO, DOD, and others. Cylindrical ingots were produced in sizes from 5 to 13 in., hollow or solid. Enrichments ranged from 0.2 to 2.1% U-235. Flat ingots of 2- and 4-in. thicknesses also were produced. Casting operations for specialized uranium alloys also were undertaken: uranium/molybdenum in FY 1954 through FY 1958 and uranium/titanium in FY 1975.

Enriched metal was first cast in 1958; however, recycling of this material from RLO in 1960 necessitated high security precautions at the FEMP because reactor design might be inferred from comparison of feeds and products. Product support for the RLO N Reactor continued until production ended in 1989.

Until 1965, both the Special Products Plant (Plant 9) and the Metals Production Plant (Plant 5) produced ingots by casting, but lack of demand for products forced consolidation of the two operations in Plant 5. Casting later resumed in Plant 9 to support N Reactor production.

2.1.2.7 Rolling Mill (Plant 6)

Uranium billets from the FEMP casting operations were shaped into tubes or rods in the rolling mill (Plant 6). A series of mechanical and thermal operations were used to process the metal to the desired shape and metallurgical grain structure for use in reactor core assemblies.

Solid uranium ingots from the FEMP casting processes were the primary feed to the rolling mill from 1953 to 1958. Reactor cores were produced for both RLO and SRP. Dingots (large derbies used as ingots) from MCW were also used as feed between 1959 and 1966.

Starting in 1958, extrusion, rather than rolling, became the process of choice for SRP core production. Extrusion was initially performed by the Bridgeport Brass Co. in Adrian, Michigan. The extrusion press was later moved to Ashtabula, Ohio, for Reactive Metals, Inc. (RMI) to extrude uranium.

Isotopically enriched metal was first rolled at the FEMP in 1958 (RLO N Reactor), but beginning in 1962, off-site extrusion also was used for these cores. RLO "interior and

exterior" (I&E) ingots, representing the majority of production, continued to be rolled at the FEMP until 1971. The enriched tubes from extrusion, or rods from rolling, were machined and heat-treated to finished product at the FEMP.

After 1966, demand for the rolling mill steadily decreased as the RLO reactors were closed. The rolling mill was used for only minor work packages, primarily DOD penetrator programs, in the five years after 1971.

2.1.2.8 Machining (Plants 6 and 9)

Machining operations (Plants 6 and 9) were involved in processing almost all metal products at the site. Uranium metal shapes were machined to exact shapes and sizes. Uranium metal turnings from the processes were collected and briquetted for recycle to the casting operations.

2.1.2.9 Pilot Plant

Operations of the Pilot Plant began in October 1951. Initial activities centered on training operators for machining operations to be set up in the Metals Fabrication Plant (Plant 6). The Pilot Plant operated as a general use facility for testing and for smaller operations. Processes employed ranged from pilot scale to full scale. Tests of new processes were often run in the Pilot Plant before they were implemented at full scale in the main plant.

Over the years of operation, Pilot Plant processes included aqueous/organic extractions of uranium and thorium, calcining, vacuum furnace casting, reduction of UF_6, reduction of UF_4 to uranium metal, briquetting, heat treating, centrifugal casting, reject core reclamation, and various wet tankage processes. A series of thorium processing operations also were undertaken in Pilot Plant equipment. Those operations are discussed in Section 2.1.4.

2.1.2.10 Process and Storm-Water Treatment

Process water from operations and storm water from within the process area were collected and treated to remove uranium and regulated metals. Separate sump treatment systems were operated in most of the main process facilities to provide customized treatments

for wastewaters near the generation point. Two major treatment processes, one at Plant 8 and one at the general sump, provided secondary treatment for these wastewaters.

Storm-water retention basins were installed in 1986 and 1989 to collect storm-water runoff from the site and allow settling time for uranium particulate and controlled release of storm water to the Great Miami River rather than to Paddys Run. A biodenitrification (BDN) process was installed for treatment of high-nitrate wastewaters before their discharge to the Great Miami River.

2.1.2.11 Miscellaneous Support Processes

Typical support processes also were conducted at the FEMP — water treatment for drinking and fire protection, sewage treatment, steam production, breathing air and compressed air distribution, and fuel gas distribution. Each of these processes was essentially identical to conventional counterparts in other industries, and most will continue in support of the new site mission and throughout the majority of the planned CERCLA response for the site.

2.1.3 Residue Operations

As typical of all processes, by-products and wastes were generated by FEMP production processes. A special facility (the Recovery Plant, or Plant 8) to reclaim uranium from wastes and by-products for recycle, was part of the original construction at the site. A variety of milling, drying, oxidation, precipitation, dissolution, and filtration processes were used to recover uranium (or thorium) from waste streams.

Operations in Plant 8 were originally sized to recover 30 tons of uranium per month; however, by 1954 the plant was recovering more than 37 tons of uranium per month from residue materials. Temporary contracts were established with off-site processors — Vitro Rare Earths Corp. and Union Carbon and Carbide Corp. — to assist in uranium recovery from residues. The recovery plant was expanded in 1955 to handle the high volumes of residue generated from on-site processes.

Residue inventories reached a high of about 5,200,000 lb of uranium in about 70,000 drums awaiting recovery in 1963. That stockpile was recognized as a potential threat to local groundwater (because of pad runoff) at that time. Emphasis was placed on reduction

of the inventory in terms of total drums rather than by uranium content. The situation had improved greatly by 1966, even with the transfer of the 20,000-drum residue inventory to the FEMP from the MCW after its shutdown. Thereafter, the residue generation rate greatly decreased with decreased product demand.

Residue recovery continues at a limited rate even now, since generation of residue occurs even though production has halted. Certain Recovery Plant processes may be useful during the CERCLA response actions at the FEMP.

2.1.4 Thorium Operations

The Pilot Plant was a main location for many of the thorium processes operated at the FEMP. Pilot Plant processes could produce purified thorium nitrate, thorium oxalate, thorium hydroxide, or metal. Thorium operations were also performed at the Metals Fabrication Plant (Plant 6), the Recovery Plant (Plant 8), the Hydrofluorination Plant (Plant 4), the Refinery (Plant 2/3), and the Special Products Plant (Plant 9).

Thorium cores were produced from 1954 to 1956 for Hanford (RLO) and SRP. Purified thorium nitrate was produced from 1964 to 1980 for a variety of uses. Dense thorium oxide was produced for Hanford between 1966 and 1969. Thorium oxide was produced by the oxalate process for the Light-Water Breeder Reactor (LWBR) program from 1970 to 1973. High-purity thorium metal was produced from 1964 to 1972, and thorium recovery operations occurred in 1959 and from 1966 through 1971. Because of FEMP's capacity to refine thorium and separate it from uranium (with a special thorium extraction process), the site was able to demonstrate an overall capability superior to that of MCW.

Because of its extensive thorium operations and capabilities, the FEMP was designated as the national repository for DOE thorium. Much of the thorium stored at the FEMP has now been designated as excess to the needs of the DOE, clearing the way for its disposal.

2.1.5 Major Events

Major events in the history of the Fernald facility, such as major projects, changes in operations, changes in management, and notable accidents, are highlighted below:

- 1951 — Construction of the Feed Materials Production Center began.
- 1953 — Uranium operations commenced at the FEMP under the management of National Lead Company of Ohio (NLO).
- 1954 — Thorium production operations commenced in support of Hanford and SRP.
- 1959 — A liquid uranyl nitrate release of about 1,000 kg occurred at the refinery.
- 1960 — The site produced 10,000 tons of uranium, its highest production year.
- 1964 — A major release of UF_6 gas occurred.
- 1966 — The Malinkrodt Chemical Works, the site's sister plant, was closed.
- 1970 — Consideration was given to phasing out operation at the site because of diminished need for FEMP products.
- 1981 — The site began planning and staffing for higher throughputs and major facilities renovation projects because of an expected need for uranium products.
- 1984 — Failure of a dust collector bag in Plant 9 caused a release of uranium oxide dust to the environment, which brought a large amount of news media coverage to the site.
- 1985 — Westinghouse Materials Co. of Ohio (currently known as Westinghouse Environmental Management Company of Ohio [WEMCO]) won a five-year contract to operate the FEMP, succeeding the NLO after 30 years of operation of the site.

- 1986 — A vessel crack in the UF_6 to UF_4 process released several kilograms of uranium (UF_6) within (and contained by) a process building.
- 1988 — A release of UNH from the refinery boildown operation generated an investigation and resulted in redesign of the operation.
- 1988 — An elevated airborne uranium level was identified at the site boundary. The source was traced to the UO_3 gulping process at the Refinery (previously assumed an insignificant emitter).
- 1989 — The site was designated as a CERCLA National Priorities List (NPL) site. Production operations ceased.
- 1991 — The Consent Agreement was amended, resulting in significant redefinition of OU3. Formal production shutdown was announced for the site.
- 1992 — Fluor Daniel Environmental Restoration Management Corporation was named Environmental Restoration Management Contractor for the FEMP.

2.1.6 Recent Major Site Programs

The following programmatic actions have played a major role in the recent history of the site. Additional detail for each is available in other sections as referenced.

2.1.6.1 Production Shutdown

Many of the FEMP production processes were shut down in 1989 because of a shift in priorities to site cleanup activities. Product demands were shifted to off-site suppliers in anticipation of formal closure of operations at the FEMP. All production processes were placed on standby in July 1989, and formal notification of shutdown came in 1991. A thorough and orderly shutdown of all production equipment was not possible at that time. Since the closure notification, programmatic funds from the DOE have been identified to

complete a "safe shutdown." The safe shutdown activity is managed as a removal action within OU3 (see Section 2.5.3).

2.1.6.2 Waste Management

The waste management program at the FEMP is an ongoing effort to move nonhazardous radioactive wastes from the site to improved off-site storage. The Nevada Test Site has received a large portion of the FEMP low-level radioactive wastes since the on-site waste pits system was closed between 1984 and 1986. The effort is to be continued as an ongoing removal action within OU3 (see Section 2.5.9). The program also includes the management of sanitary wastes and a formal program to promote waste minimization.

2.1.6.3 RCRA Compliance

A RCRA program for the site was initiated in response to U.S. EPA application of RCRA regulations to federal facilities. The Ohio EPA has been delegated authority to administer the base RCRA program in Ohio by the U.S. EPA. A Consent Decree issued by a federal court for the Fernald site mandated the dates and methods for the facility to come into compliance with requirements of RCRA.

An Amended Consent Decree has been negotiated and is in review for signature. The Amended Consent Decree will revise compliance schedules and further specify details of compliance. A major effort to revamp site procedures was undertaken to support the program. A major site emphasis has been placed upon compliance.

To further the integration of CERCLA and RCRA compliance, all future RCRA activities within OU3 boundaries, including future characterization and closure action, will be fully integrated into the OU3 RI/FS process.

2.2 OPERABLE UNIT 3 COMPONENTS

Because of the complexity and large number of components included in OU3, the planning process for the OU3 RI/FS required the categorization of these components. Traditionally, the RI/FS process addresses environmental media such as soils and groundwater. The OU3 RI/FS includes, but is not limited to, a variety of buildings, a parking

lot, roads, and basins. Environmental media associated with these components will be addressed in the OU5 RI/FS. The following subsections categorize components by similarity of structure and of use.

2.2.1 Component Identification and Description

A consistent basis for identifying and categorizing OU3 components was applied to aid in developing a comprehensive work plan for the operable unit. The term *component* is applied to the smallest physically distinct unit considered separately in the development and implementation of this OU3 Work Plan. The OU3 components include buildings, piles of scrap metal and soil, containers and containerized materials, a parking lot, roads, railroads, aboveground and underground tanks, utilities and equipment, and several basins. Table A.1 in Appendix A provides a comprehensive list of more than 200 OU3 components. For each component, the table lists the name, designated number, and a map grid number indicating location on the facility maps in Appendix C. The Table A.1 list includes all elements of OU3 designated as components as of the date of this Work Plan Addendum. This list, however, may change as the program progresses. For example, components would be taken off the list if removal actions resulted in their disposal. Components also could be consolidated (e.g., soil or debris piles), or significantly change form (e.g., demolition of a structure to create a debris pile). The list of components will be updated as new information warrants.

Table A.2.0 in Appendix A summarizes the typical types of construction of the buildings in OU3. To support the development of remedial alternatives and to estimate waste volumes, the buildings have been grouped into four main categories on the basis of their primary construction materials. Most of the structures fit within the definition of a single category; however, because of additions and annexes, several buildings are identified as being hybrid designs.

Table A.2.1 in Appendix A provides descriptive information about the various structures and other components in OU3. Eleven major process facilities, 6 major administrative facilities, 20 major warehouse facilities, and essentially all major structures in the operable unit have been detailed. In total, more than 200 entries are described in Table A.2.1. The table summarizes structural design information and identifies each entry

with a unique alphanumeric component designator. These component designations are consistent with Table A.1 and the maps provided in Appendix C.

Each item on the component list was reviewed for past and current uses. Many of the facilities have been used for more than one type of process during the 39-year history of the site. Table A.2.1 in Appendix A describes these processes and the major associated equipment and provides a subdivision of the major components by processes performed. Segregation by process provides a basis for more detailed description of activities within each facility and supports a structured approach to identification of potential contamination resulting from past and current activities.

2.2.2 Component Categories

The OU3 Work Plan data-collection strategy is based in part on a system of grouping components by similarity of structure and/or function. Components are categorized on the basis of physical similarity or use into 11 separate component groups. The grouping of components permits identification of more specific data requirements relative to (1) risk assessment, (2) remedial action objectives (RAOs), (3) remedial action alternatives (RAAs), (4) applicable or relevant and appropriate requirements (ARARs) (i.e., standards and regulations), and (5) worker health and safety concerns. Application of specific definitions for each group ensures that all components within OU3 are addressed.

Groups 1-4 consist of those OU3 components classified in the general category of structures, facilities, and/or buildings. The four groups are separated by basic function. Within each of these groups, individual components are considered to include such associated items as equipment, machinery, inside sumps, utilities, and piping (tank/distribution systems), provided that those items are considered integral parts of the component. Such items not considered to be integral parts of the component are placed in group 9 or 10 (piping/utilities/equipment). Groups 1-4 do not include hold-up materials in process lines, containerized liquid or solid wastes, or product inventories.

The 11 groups are defined as follows:

Group 1. *Administrative/Support Buildings* — Group 1 includes all administrative and support buildings.

Group 2. *Warehouse/Storage Buildings* — Group 2 consists of all warehouse and storage buildings.

Group 3. *Process Buildings* — Group 3 includes all buildings that housed major processing activities.

Group 4. *Process Support Buildings* — Group 4 includes all buildings that provided or provide support for plant operations.

Group 5. *Containers/Containerized Material, Aboveground* (includes all drums) — Group 5 includes all aboveground containers (whether empty or not) and containerized material; all waste and product inventories, including hold-up material; and all uranium, thorium, and copper inventories. Group 5 does not include tanking/piping/distribution systems or bulk stored materials.

Group 6. *Containers/Containerized Material, Belowground* — As for Group 5, except components are belowground.

Group 7. *Bulk Material* (includes waste piles) — Group 7 includes all existing scrap piles, soil piles, and similar items within OU3 scope. It also is intended that this group will include any newly generated soil piles, rubble piles, and the like that result from ongoing activities both in and out of the scope of OU3.

Group 8. *Storage Pads/Parking Lot/Roads/Railroads* — Group 8 consists of waste storage or handling pads, railroads, roads, the parking lot, and sidewalks.

Group 9. *Piping/Utilities/Equipment, Aboveground* — Group 9 includes all aboveground piping and utility systems, including outside tank and distribution systems.

Group 10. *Piping/Utilities/Equipment, Belowground* — Group 10 includes all underground piping and utility systems.

Group 11. *Ponds and Basins* — Group 11 includes surface impoundments, ponds, and basins. The largest of these are the biodenitrification (BDN) surge lagoon and the storm-water retention basins.

Table 2.2 lists the OU3 components by group and gives the grid map location of each (see Appendix C for grid maps).

2.3 ENVIRONMENTAL SETTING

Although environmental media are not considered part of OU3, they are part of the potential transport and exposure pathways that must be considered. Therefore, this section includes brief descriptions of the local surface features, meteorology and climatology, surface water hydrology, geology and hydrogeology, soils, ecology, population, land use, and archaeological and historical resources. More extensive discussions of these topics are provided in the *Site-Wide Characterization Report* for the FEMP (DOE 1992a).

2.3.1 Surface Features

The FEMP is in the Till Plains Section of the Central Lowland Physiographic Province, characterized by structural and sedimentary basins and domes. Among these features, the Cincinnati Geoanticline is structurally significant in this region. The underlying bedrock in the region is shale and fossiliferous limestone of Middle and Late Ordovician age (Fenneman 1916). It outcrops on steep valley walls. In some areas, it is overlain by glacial deposits up to 400 ft thick.

The main physiographic features in the area are gently rolling uplands, steep hillsides along the major streams, and the Great Miami River valley, which is a relatively broad, flat-bottomed valley flanked on either side by bluffs that rise to a maximum of 300 ft above the general level of the valley floor.

A topographic map of the region is provided in Figure 2.3. Maximum elevation along the northern boundary of the FEMP property is slightly more than 700 ft above mean sea level (MSL). The Production Area and Waste Storage Area of the FEMP are on a relatively level plain at about 580 ft MSL. The plain slopes from 600 ft MSL along the eastern boundary of the FEMP to 570 ft MSL at the K-65 silos and then drops off towards Paddys Run at an elevation of 550 ft MSL. All drainage on the FEMP is from east to west into Paddys Run, with the exception of the extreme northeastern corner, which drains east toward the Great Miami River.

TABLE 2.2 Operable Unit 3 Component Identification List by Group

Group/Component Name	Component Designation	Map Grid[a]
1. Buildings — Administrative/Support		
NAR Control House	3 C	19
Service Building	11	14
Administration Building	14 A	14
Security Building	28 A	14
Human Resources Building	28 B	14
Guard Post on South End of D St.	28 C	7
Rust Engineering Building	45 A	25
Health & Safety Building	53 A	14
In-Vivo Building	53 B	14
Fire Brigade Training Center Building	73 A	33
Skeet Range Building	90	8
Process Trailers	G-006	
Nonprocess Trailers	G-007	
2. Buildings — Warehouse/Storage		
Plant 1 Storage Shelter	1 B	27
Plant 4 Warehouse	4 B	13
Plant 5 Filter Building	5 E	12
Plant 5 Covered Storage Pad	5 F	12
Plant 5 Ingot Storage Shelter	5 G	12
Plant 6 Covered Storage Area	6 B	6
Plant 7	7 A	13
Cylinder Storage Building	12 B	11
Lumber Storage Building	12 C	11
Chemical Warehouse	30 A	18
Drum Storage Warehouse	30 B	27
Magnesium Storage Building	32 A	2
Building 32 Covered Loading Dock	32 B	2
Pilot Plant Shelter	54 B	26
CP Storage Warehouse	56 A	17
Storage Shed (west)	56 B	17
Storage Shed (east)	56 C	17
Quonset Hut #1	60	16
Quonset Hut #2	61	16
Quonset Hut #3	62	16
KC-2 Warehouse	63	9
Thorium Warehouse	64	2
(Old) Plant 5 Warehouse	65	2
Plant 1 Thorium Warehouse	67	24
Pilot Plant Warehouse	68	26
General In-Process Warehouse	71	27
Drum Storage Building	72	27
Finished Products Warehouse (4A)	77	3
Plant 6 Warehouse	79	4
Plant 8 Warehouse	80	20

TABLE 2.2 (Cont.)

Group/Component Name	Component Designation	Map Grid[a]
2. Buildings — Warehouse/Storage (Cont.)		
Plant 9 Warehouse	81	3
Tension Support Structure #1	TS-001	17
Tension Support Structure #2	TS-002	17
Tension Support Structure #3	TS-003	17
3. Buildings — Process		
Preparation Plant	1 A	27
Ore Refinery Plant	2 A	19
Metal Dissolver Building	2 D	19
Hot Raffinate Building	3 E	19
Green Salt Plant	4 A	13
Metals Production Plant	5 A	12
Metals Fabrication Plant	6 A	6
Plant 6 Electrostatic Precipitator (south)	6 C	6
Plant 6 Electrostatic Precipitator (north)	6 E	6
Plant 6 Salt Oil Heat Treat Building	6 F	6
Plant 6 Sump Building	6 G	6
Recovery Plant	8 A	20
Rotary Kiln/Drum Reconditioning	8 C	20
Special Products Plant	9 A	3
Plant 9 Sump Treatment Facility	9 B	3
Electrostatic Precipitator	9 F	3
Pilot Plant Wet Side	13 A	26
Sump Pump House	13 C	26
Laboratory	15	21
Biodenitrification Towers	18 D	19
Clearwell Pump House	18 G	31
BDN Effluent Treatment Facility	18 H	20
Engine House/Garage	31 A	7
Pilot Plant Annex	37	26
Incinerator Building	39 A	19
Waste Oil Decant Shelter	39 B	19
Six to Four Reduction Facility #1	54 A	26
Slag Recycling Building	55 A	12
Slag Recycling Pit/Elevator	55 B	12
Drum Reconditioning Building	66	27
Decontamination Building	69	1
4. Buildings — Process Support		
General/Refinery Sump Control Building	2 B	19
Bulk Lime Handling Building	2 C	19
Maintenance Building	3 A	19
Ozone Building	3 B	19
Refrigeration Building	3 G	19
Electrical Power Center Building	3 L	19
Plant 4 Maintenance Building	4 C	13
Plant 5 Ingot Pickling	5 B	12

TABLE 2.2 (Cont.)

Group/Component Name	Component Designation	Map Grid[a]
4. Buildings — Process Support (Cont.)		
Plant 5 Electrical Substation	5 C	12
West Derby Breakout/Slag Milling	5 D	12
Plant 8 Maintenance Building	8 B	20
Plant 8 Railroad Filter Building	8 D	20
Plant 9 Substation	9 D	3
Plant 9 Cylinder Shed	9 E	3
Boiler Plant	10 A	10
Boiler Plant Maintenance Building	10 B	10
Wet Salt Storage Bin	10 C	10
Main Maintenance Building	12 A	11
Pilot Plant Maintenance Building	13 B	26
Electrical Substation	16 B	14
Main Electrical Switch House	16 D	7
Tank Farm Control House	19 C	11
Pump Station and Power Center	20 A	11
Water Plant	20 B	10
Well House #1	20 E	25
Well House #2	20 F	25
Well House #3	20 G	26
Gas Meter Building	22 A	6
Storm Sewer Lift Station	22 B	14
Truck Scale	22 C	4
Scale House and Weigh Scale	22 D	25
Railroad Scale House	24 A	16
Railroad Engine House	24 B	11
Chlorination Building	25 A	32
Manhole #175/Effluent Line/Sampling Building	25 B	32
Sewage Lift Station Building	25 C	7
UV Disinfection Building	25 D	32
Digester and Control Building	25 E	32
Pump House-High Pressure Fire Protection	26 A	25
Main Electrical Strainer House	26 C	7
Guard Post on West End of 2nd St.	28 D	24
Propane Storage	38 A	10
Incinerator Sprinkler Riser House	39 C	19
Utility Shed East of Rust Trailers	45 B	25
Heavy Equipment Building	46	7
Six to Four Reduction Facility #2	51	26
Pilot Plant Dissociator Shelter	54 C	26
Decontamination and Decommissioning Building (under constr.)	78	2
Receiving/Incoming Mat'ls. Insp.	82	4
5. Containers/Containerized Material — Aboveground		
Plant 1 Ore Silos	1 C	27
Nuclear Fuel Services Storage and Pump House	2 E	27

TABLE 2.2 (Cont.)

Group/Component Name	Component Designation	Map Grid[a]
5. Containers/Containerized Material — Aboveground (Cont.)		
NAR Towers	3 D	27
Harshaw System	3 F	19
Refinery Sump	3 H	19
Combined Raffinate Tanks	3 J	19
Pilot Plant Thorium Tank Farm	13 D	26
General Sump	18 B	19
Methanol Tank	18 J	31
High Nitrate Storage Tank	18 M	31
Main Tank Farm	19 A	11
Pilot Plant Ammonia Tank Farm	19 B	26
Old North Tank Farm	19 D	11
Elevated Potable Storage Tank	20 D	4
Process Water Storage Tank	20 H	10
Trickling Filters	25 H	32
Elevated Water Storage Tank	26 B	25
Fire Training Tank	73 C	33
Confined Space Burn Tank	73 E	33
Drums (non-RCRA)	G-009	
RCRA Drums	G-010	
Inventory	G-011	
Mobile Containers (sea/land)	G-012	
6. Containers/Containerized Material — Belowground		
Fire training burn trough	73D	33
Underground Storage Tanks	G-005	
7. Bulk Material		
Soil Piles	G-013	
Rock Salt Pile South of Building 61 (rock salt)	P-001	16
Sand Piles South of Building 61 (sand)	P-002	16
Gravel North of Building 56 (gravel)	P-003	17
Copper Metal Scrap Pile (copper)	P-004	17
Coal Pile (coal)	P-005	10
Scrap Metal Pile (metal)	P-006	1
Outside Equipment Storage Area (metal)	P-007	9

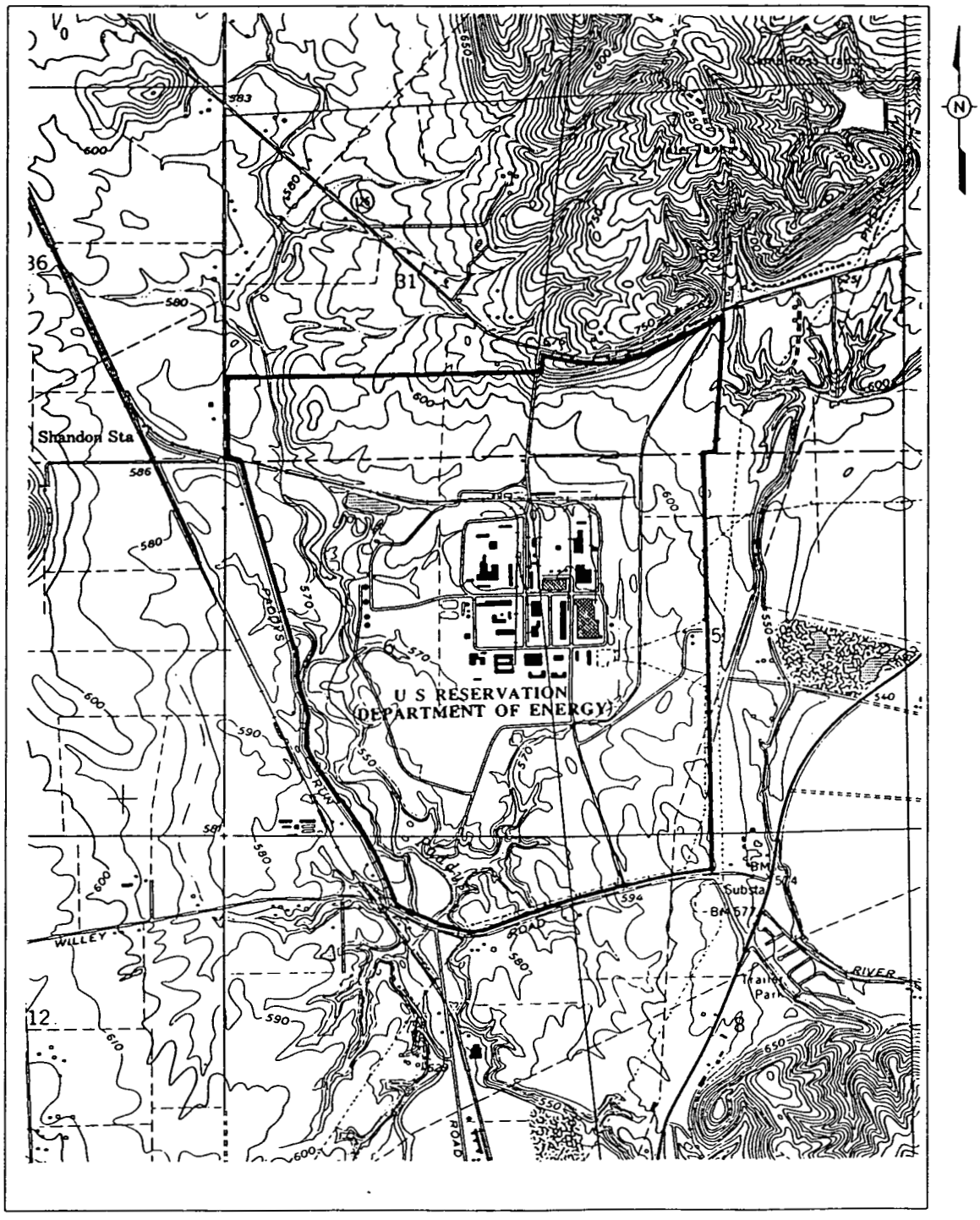
TABLE 2.2 (Cont.)

Group/Component Name	Component Designation	Map Grid[a]
8. Storage Pads/Parking Lot/Roads/Railroads		
Cont. Oil/Graphite Burn Pad	10 D	10
Old Ten Ton Scale	30 C	18
Old Truck Scale	31 B	7
Plant 2 East Pad	74 A	19
Plant 2 West Pad	74 B	19
Plant 8 East Pad	74 C	20
Plant 8 West Pad	74 D	20
Plant 4 Pad	74 E	13
Plant 7 Pad	74 F	13
Plant 5 East Pad	74 G	12
Plant 5 South Pad	74 H	12
Plant 6 Pads	74 J	6
Plant 9 Pad	74 K	3
Building 65 West Pad	74 L	2
Building 64 East Pad and Railroad Dock	74 M	2
Building 12 North Pad	74 N	11
Decontamination Pad	74 P	1
Plant 8 Old Metal Dissolver Pad	74 Q	20
Plant 8 North Pad	74 R	20
Building 63 West Pad	74 S	9
Plant 1 Storage Pad	74 T	27
Pilot Plant Pad	74 U	26
Laboratory Pad	74 V	21
Building 39A Pad	74 W	19
Parking Lot	89	15,8
Railroad Tracks	G-001	
Roads	G-002	
9. Piping, Utilities, Equipment — Aboveground		
Cold Side Ore Conveyor	2 F	19
Hot Side Ore Conveyor	2 G	19
Plant 6 Electrostatic Precipitator (central)	6 D	6
Plant 7 Overhead Crane	7 B	13
Plant 8 Old Drum Washer	8 F	20
Drum Conveyor Shelter	8 E	20
Plant 9 Dust Collector	9 C	3
Building 14 Emergency Operations Center Generator Set	14 B	14
Main Electrical Station	16 A	7
Electrical Panels and Transformer	16 C	7
Main Electrical Transformers	16 E	7
Trailer Substation 1	16 F	7
Trailer Substation 2	16 G	7
Cooling Towers	20 C	11
Meteorological Tower	23	30

TABLE 2.2 (Cont.)

Group/Component Name	Component Designation	Map Grid[a]
9. Piping, Utilities, Equipment — Aboveground (Cont.)		
Cylinder Filling Station	38 B	10
Sewage Treatment Plant Incinerator	39 D	32
Pipe Bridges	G-008	
10. Piping, Utilities, Equipment — Belowground		
Conveyor Tunnel (from Plant 1)	2 H	19
Old Cooling Water Tower	3 K	19
Utility Trench to Pit Area	22 E	25
Clearwell Line	88	31
Storm-Sewer System	G-003	
Utility Lines	G-004	
11. Ponds and Basins		
BDN Surge Lagoon	18 A	31
Coal Pile Runoff Basin	18 C	11
Storm-Water Retention Basin	18 E	30
Low Nitrate Tank	18 K	31
High Nitrate Tank	18 L	31
Sludge Drying Beds	25 F	32
Primary Settling Basins	25 G	32
Fire Training Pond	73 B	33

[a] Refers to grid map designations in Appendix C.



SCALE
1:24,000

FIGURE 2.3 Topographic Map of the FEMP (Source: USGS 1981)

2.3.2 Meteorology and Climatology

The meteorology of the FEMP site is typical of conditions throughout southwestern Ohio, but surface winds are often affected by the local terrain. The Great Miami River valley and the ridges surrounding the FEMP are the predominant features that influence wind patterns at the site. The gently rolling hills immediately surrounding the site and the larger hills in the distance form the boundaries of the valley. The minimum distance from the FEMP site to the larger hills is about 0.5 mi to the north and 1.5 mi to the south-southeast.

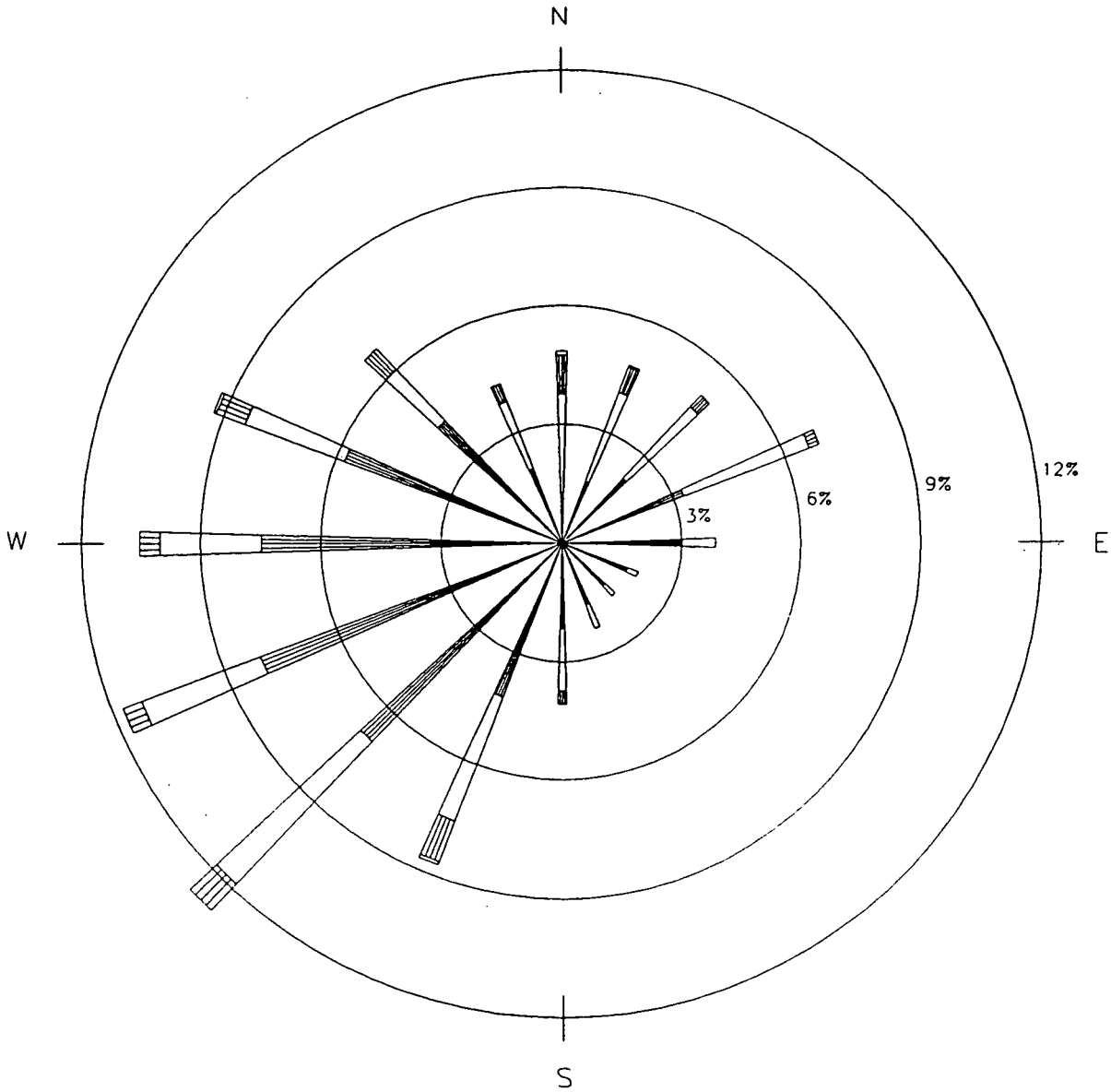
Meteorological data have been collected from a tower in the southwestern area of the FEMP site since August 1986. Figure 2.4 shows wind speed and direction at the 10-m level of the FEMP tower for 1989. Instruments at the meteorological tower also measure temperature, lapse rate, dew point, relative humidity, barometric pressure, and precipitation.

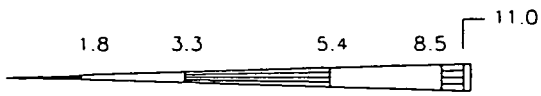
The climate of southwestern Ohio is characterized as continental, and temperature varies widely throughout the year. Climatological data recorded at the Greater Cincinnati Airport indicate that average monthly temperatures for the area range from 29°F in January to 76°F in July. On average, each year experiences about 20 days when the temperature exceeds 90°F and 25 to 30 days when the temperature remains at or below freezing (32°F). The average annual precipitation, including melted snow, is 41 in. The average annual snowfall is 24 in. Average monthly wind speeds range from 7 mph in August to 11 mph in March (National Oceanic and Atmospheric Administration 1989).

2.3.3 Surface Water Hydrology

2.3.3.1 General

The surface waters of primary concern with respect to the FEMP are the Great Miami River, which is the receiving stream for the major NPDES-permitted discharge from the FEMP, and Paddys Run, which drains the western side of the FEMP and receives NPDES-permitted emergency overflows from the storm-water retention basin through the storm-sewer outfall ditch (Figure 2.5).





WIND SPEED CLASS BOUNDARIES
(METERS/SECOND)

NOTES:

DIAGRAM OF THE FREQUENCY OF OCCURENCE FOR EACH WIND DIRECTION. WIND DIRECTION IS THE DIRECTION FROM WHICH THE WIND IS BLOWING. EXAMPLE - WIND IS BLOWING FROM THE NORTH 4.8 PERCENT OF THE TIME.

-1989-
10-METER LEVEL
94.6 PERCENT DATA RECOVERY

FIGURE 2.4 Wind Rose for 10-Meter Level at the FEMP during 1989

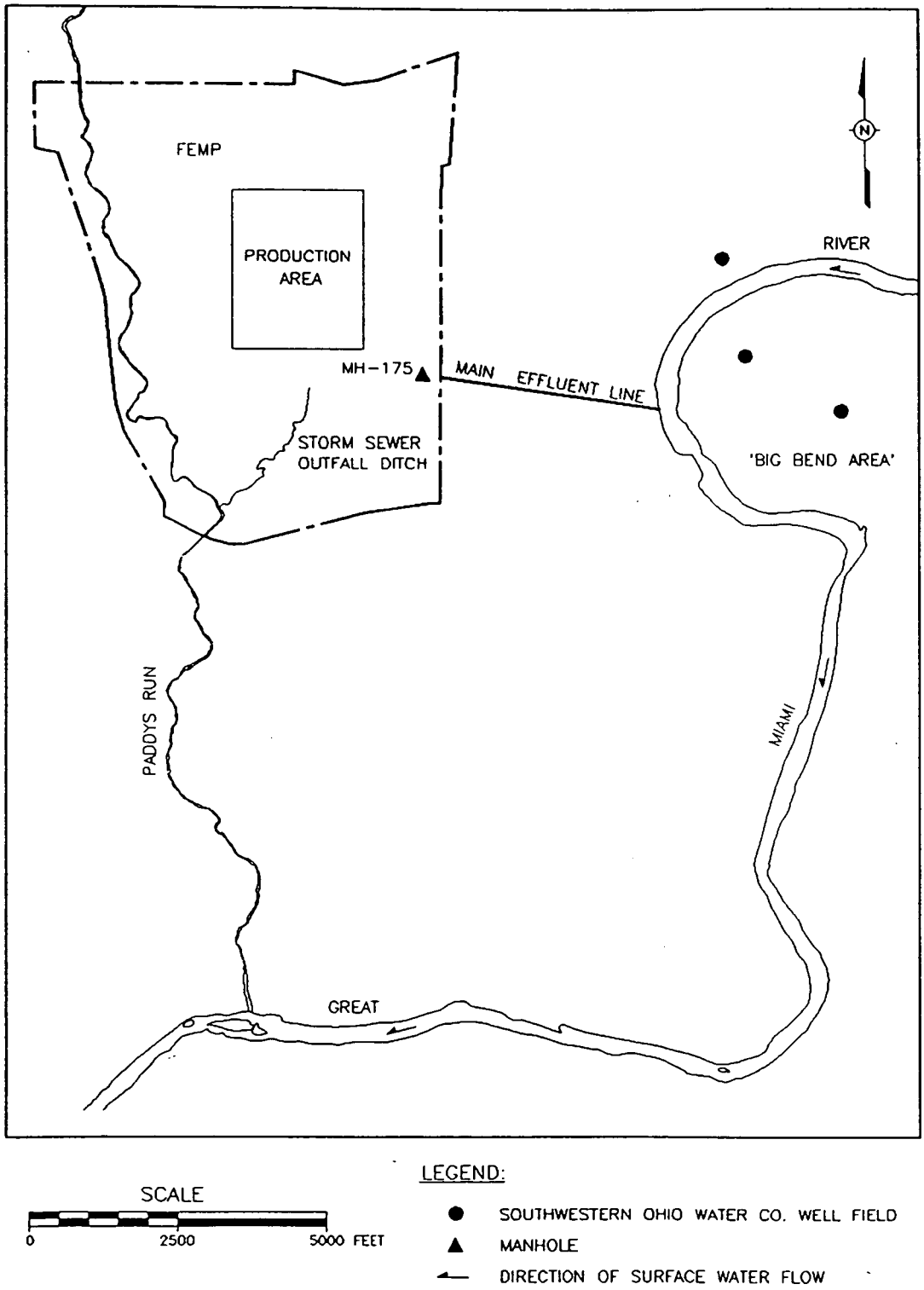


FIGURE 2.5 Surface Water Hydrology

The Great Miami River is the main surface water feature in the vicinity of the FEMP (Figure 2.5). The river flows generally to the southwest and has a drainage area of approximately 3,360 mi^2 at the Hamilton gage, which is located about 10 mi upstream from the FEMP outfall. Meandering patterns in the river result in sharp directional changes over distances of less than 3,000 ft. Directly east of the FEMP and within the RI/FS study area, the river passes through a 180-degree curve known as the "Big Bend" (Figure 2.5). A 90-degree bend in the river also occurs near New Baltimore, approximately 2 mi downstream from the FEMP outfall.

Natural surface drainage from the FEMP is primarily to Paddys Run, which originates north of the facility, drains southward along the western boundary of the FEMP, and enters the Great Miami River approximately 1.5 mi south of the FEMP (Figure 2.5). Paddys Run is approximately 8.8 mi long and drains an area of 15.8 mi^2. Paddys Run is an extremely steep-sided stream, having cut to depths of 6.1 ft or more through the geological deposits upon which the FEMP is situated. This stream loses flow to the underlying aquifer along much of its course because of the highly permeable channel bottom, which is carved into the Great Miami Aquifer.

Paddys Run is an ungaged, intermittent stream that flows primarily between January and May, with an estimated discharge for this period ranging between 0.2 and 4.0 ft^3/s. Peak flows have not been measured. Between January and May, flow is generally continuous in the stream throughout its length. Between June and December, flow north of silos 1 and 2 is reduced to a trickle, and there is typically no flow south of the silos except during and immediately following rainfall.

A principal drainage feature of the FEMP is the unnamed tributary of Paddys Run that drains a large area south and east of the storm sewer outfall ditch and provides the discharge path from the outfall ditch to Paddys Run. This drainage originates east of the Production Area, flows southwest across the southern portion of the facility, and enters Paddys Run near the southwest corner of the property (Figure 2.5). Much of the stream bottom of this drainage, which also collects runoff from an area east of the Production Area, is composed of sand and gravel. Vertical seepage rates through the stream bottom are similar to those in Paddys Run. This drainage is generally dry most of the year, with flows occurring during and immediately after precipitation.

For the most part, surface water runoff within the Production Area is collected by a storm sewer system. Before construction of the storm-water retention basins, the storm-sewer outfall ditch conveyed surface water runoff from the Production Area directly to Paddys Run when the capacity of the storm-sewer lift station, which diverts low-flow storm water directly to the river via manhole 175, was exceeded. The storm-water retention basins were constructed in October 1986 and December 1989 at the head of the storm-sewer outfall ditch, and storm-water runoff from the Production Area is now conveyed to these retention basins. The storm-water retention basins are designed to retain the runoff from a 10-year, 24-hour rainfall. After at least a 24-hour retention period to allow for settling of suspended solids, the water is pumped out of the basins to the Great Miami River through the FEMP's main effluent line. Storm water from the Production Area now enters the storm-sewer outfall ditch only as a result of overflows from the storm-water retention basin.

2.3.3.2 Floodplains and Wetlands

Within the FEMP property, floodplains are confined to the north-south corridor containing Paddys Run (Figure 2.6). Outside the boundaries of the FEMP, the 100-year floodplain of the Great Miami River extends west of the "Big Bend" area nearly to the eastern boundary of the facility (Figure 2.6). The 100-year floodplain of the river also extends northward along Paddys Run from the confluence of the two streams to a point about 2,000 ft from the southern boundary of the FEMP. Because of the steep embankments at the edges of the plain on which the FEMP lies, the 500-year floodplain extends to the same point.

Within FEMP boundaries, jurisdictional wetlands, as defined by the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (Federal Interagency Committee for Wetland Delineation [FICWD] 1989), were identified and delineated with the "off-site" method described by the FICWD (1989), supplemented by an on-property field reconnaissance. Details of that study are provided in the Site-Wide Characterization Report. Results of the field reconnaissance indicated that wetlands at the FEMP are limited to a small forested wetland of approximately 50 acres in the northern portion of the facility and emergent wetlands associated with tributaries and drainage ditches that feed into Paddys Run (Figure 2.7).

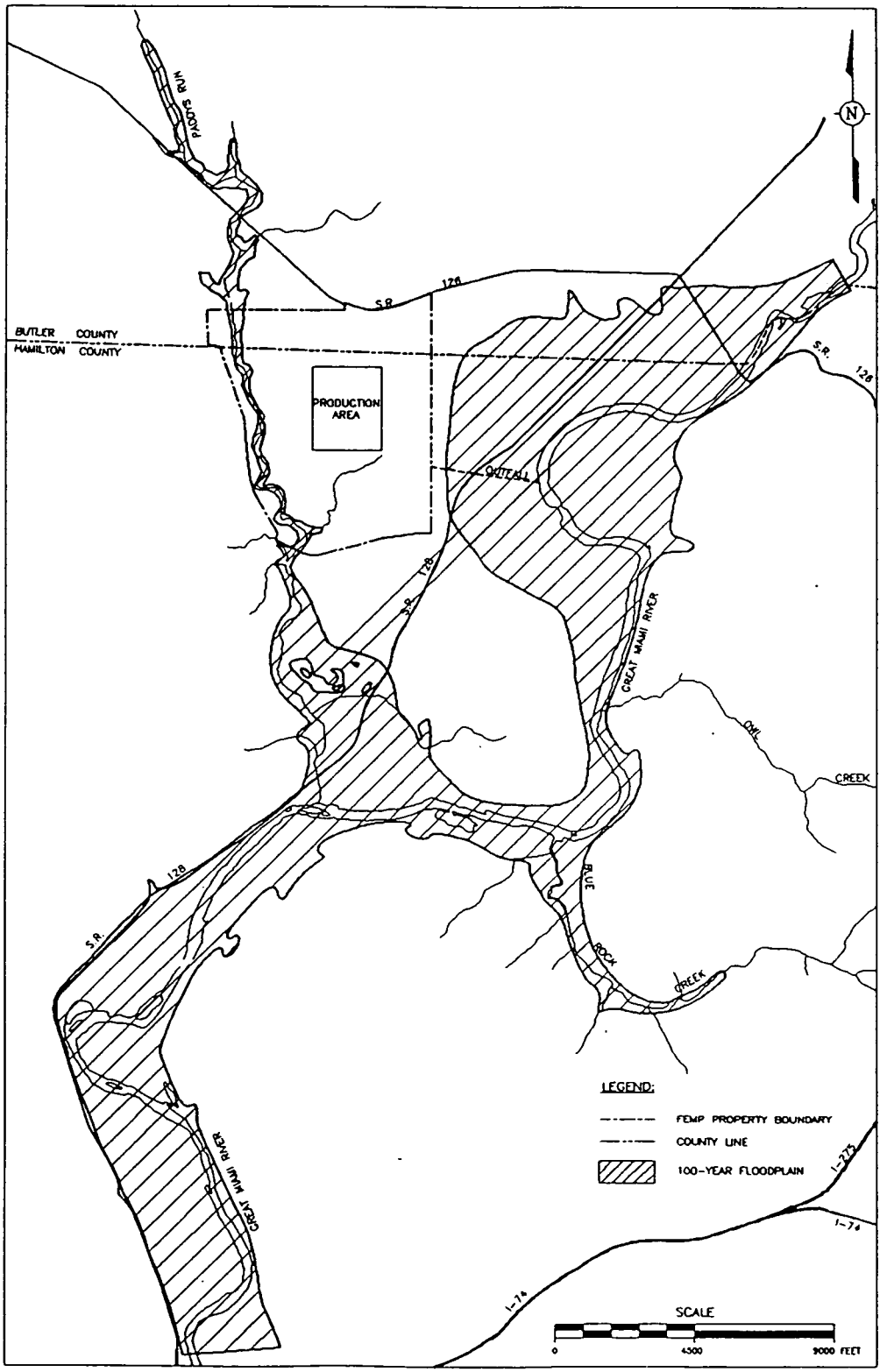


FIGURE 2.6 Great Miami River and Paddys Run Floodplain (Source: Federal Emergency Management Agency 1982)

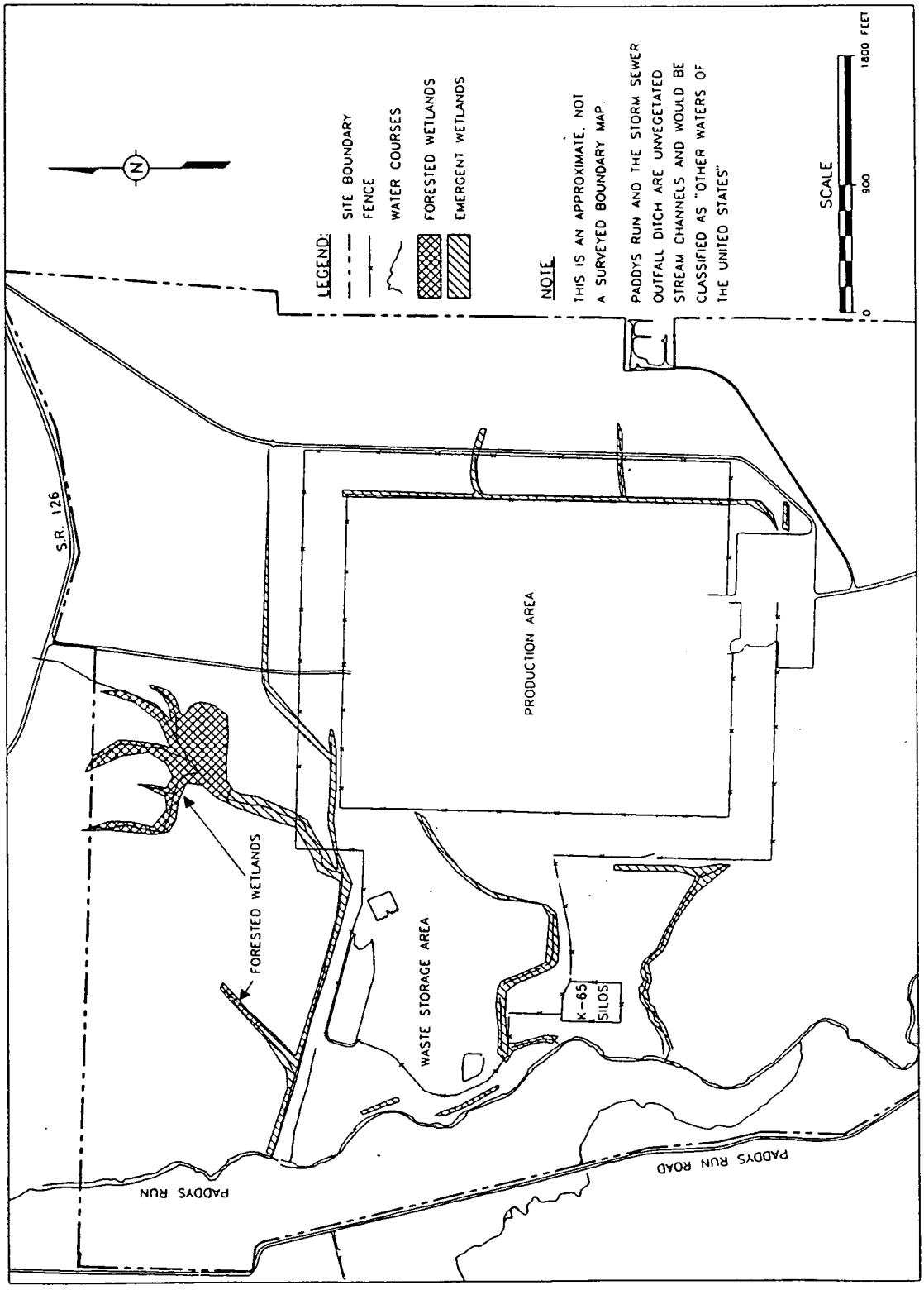


FIGURE 2.7 Approximate Boundaries of Jurisdictional Wetlands at the FEMP

2.3.4 Regional Geology and Hydrogeology

The FEMP is located within a 2- to 3-mi-wide subterranean valley known as the New Haven Trough. This valley formed as a result of Pleistocene glaciation and subsequently filled with glacial outwash materials and till. The bedrock in the vicinity of the FEMP consists of predominantly flat-lying, olive-gray Ordovician shales with thin, interbedded layers of limestone. The shale forms the floor and valley walls of the New Haven Trough. The buried valley is generally carved into this shale between 60 ft and more than 200 ft below the pre-erosional land surface in the vicinity of the FEMP.

Unconformably overlying the shales in the bedrock channel are approximately 150 ft of regionally extensive Pleistocene glacial valley fill deposits. Figure 2.8 is a generalized stratigraphic column of the valley fill deposits. As indicated by the hydrogeologic cross section (Figure 2.9), the buried valley is about 0.5 mi to more than 2 mi wide and is U-shaped, having a broad, relatively flat bottom and steep valley walls. Interbedded glacial till deposits occur within the outwash deposits, but in most cases these deposits are of limited lateral extent. The till deposits consist primarily of poorly sorted pebbles, cobbles, and boulders in a predominantly clay matrix.

Within some areas, glacial overburden deposits overlie the bedrock uplands and portions of the outwash materials where they form the thick, unconsolidated sediment layers beneath the soil zone. This glacial overburden is composed of dense, silty clay that varies in composition vertically and laterally. The glacial overburden contains lenses of poorly sorted fine- to medium-grained sand and gravel, silty sand, and silt with layers of silty clay.

Large groundwater supplies occur in the outwash deposits of the buried channel aquifer and are recharged by three principal sources: recharge from bedrock, precipitation recharge, and recharge by stream infiltration. Although the shales and limestones have a low permeability, small amounts of water occur in erratically distributed joints and cracks and produce seepage into the glacial deposits. The average permeability of the bedrock has been estimated to be five gallons per day per square foot (5 gal/d·ft^2) of contact with the glacial deposits. Recharge by precipitation amounts to approximately 570,000 gal/d·mi^2 of catchment area and represents the dominant source of recharge on a regional basis. Under natural conditions, the gradient of groundwater flow is from the aquifer to the Great Miami

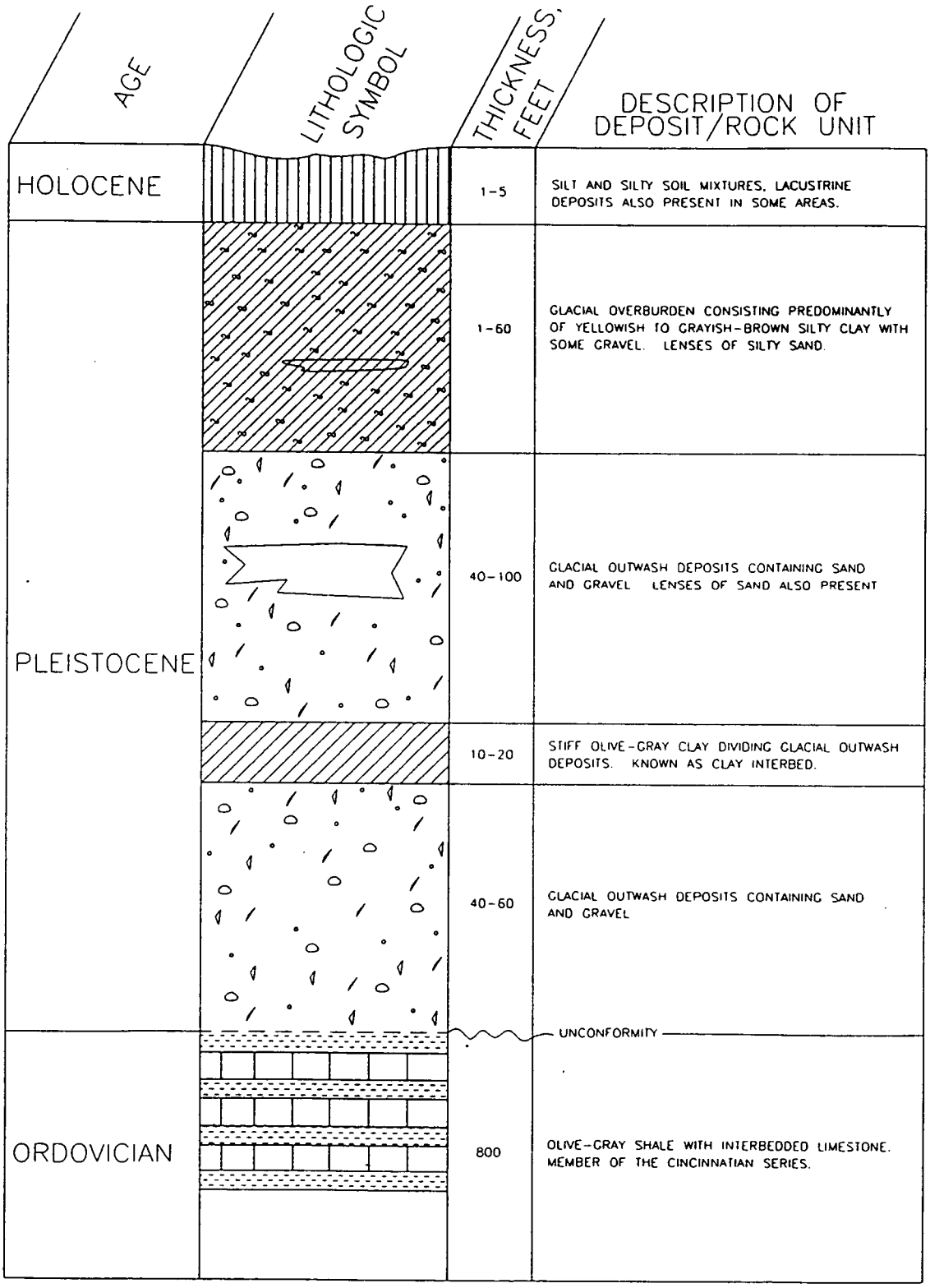
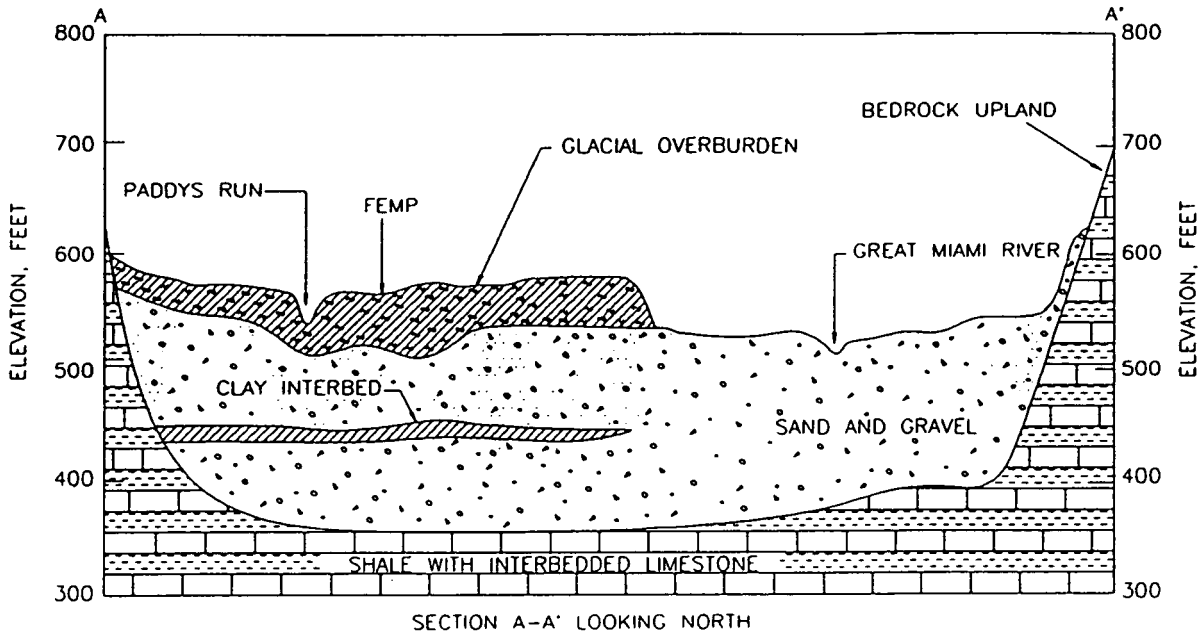


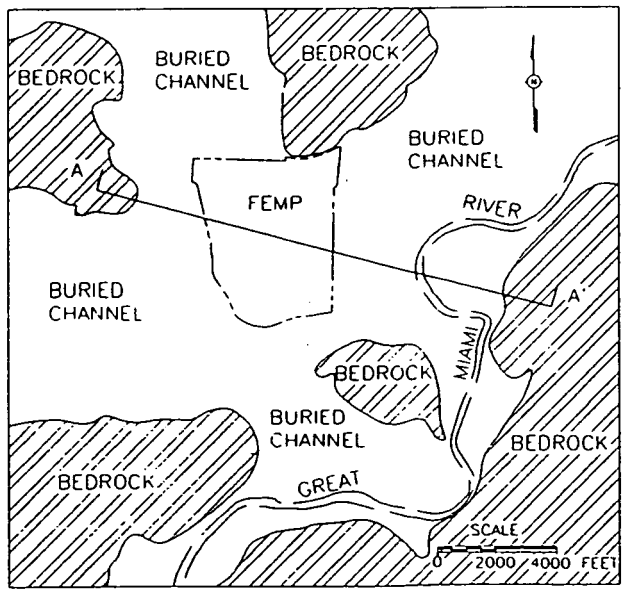
FIGURE 2.8 Generalized Stratigraphic Column of the FEMP Region



SECTION A–A' LOOKING NORTH

NOTES.

INFORMATION CONCERNING THE DEPTH AND ATTITUDE OF THE BEDROCK SHALE WAS OBTAINED FROM IT CORPORATION DRAWING 303317-8208.



LOCATION OF CROSS SECTION

FIGURE 2.9 Schematic Cross Section of Buried Channel

River, except during dry periods, when the gradient is reversed. Intermittent recharge to the aquifer also occurs along Paddys Run.

The groundwater in the regional aquifer enters the FEMP study area from the buried valleys on the west, north, and east. Natural gradients cause the groundwater to exit the FEMP study area by either flowing east to the Great Miami River upstream from New Baltimore, or by flowing south through the branch of the bedrock channel west of New Baltimore. In either case, the Great Miami River is the ultimate receptor of all groundwater in the study area (Figure 2.10).

The large pumping wells of the Southwest Ohio Water Company (SOWC) in the Big Bend meander of the Great Miami River east of the FEMP produce a pronounced and persistent cone of depression in the potentiometric surface centered on the pumping wells. Groundwater elevation maps indicate that the cone of depression from the SOWC wells influences groundwater flow patterns beneath the FEMP. In particular, a groundwater flow divide is created such that groundwater underlying the northern portion of the FEMP, including those areas underlying the Waste Storage Area and the Production Area, flows to the east toward the SOWC wells and the Great Miami River. Groundwater from the southern and southwestern portion of the FEMP continues to flow along the natural gradient to the south-southwest through the buried valley. Near the southwestern corner of the FEMP, a groundwater component from the west is also present because of the western leg of the buried channel (Figure 2.10). This situation causes the recharge from certain reaches of Paddys Run to flow east-southeast until the regional southern component of flow is encountered.

2.3.5 Glacial Overburden Geology and Hydrogeology

The major hydrogeologic unit beneath the Production Area is the glacial overburden that was deposited during a series of advances and retreats by a small lobe of ice that was part of the leading edge of the Wisconsin glacier. This lobe was approximately 1½-2 mi wide and advanced over the entire FEMP. The leading edge of the ice sheet probably advanced and retreated many times across the site. Each advance would have scraped and mixed the

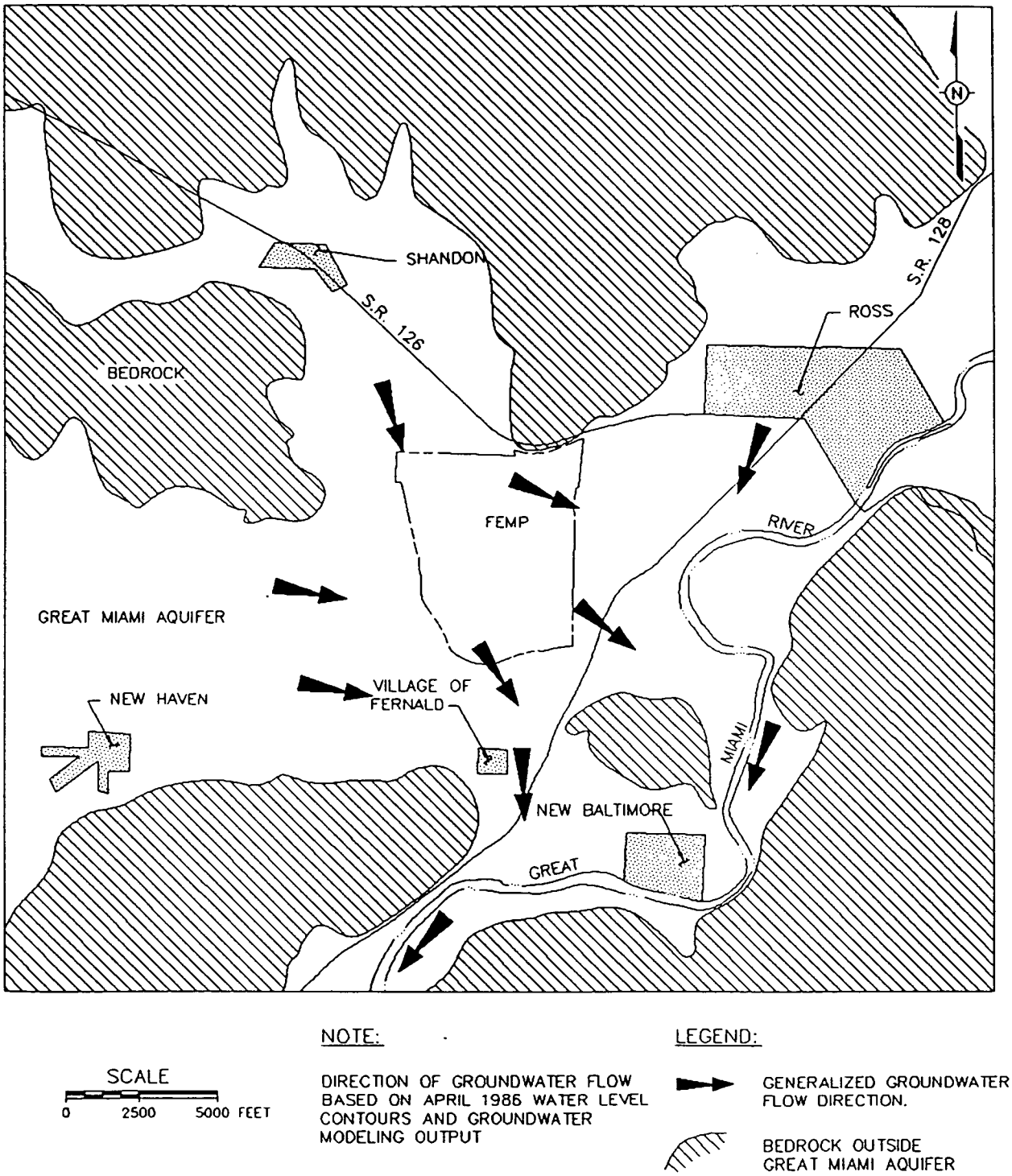


FIGURE 2.10 Generalized Groundwater Flow in Buried Channel Aquifer

retreat deposits, as well as carried new till into the area. The net result of the successive advances and retreats was creation of the heterogeneous mix of sand and silt lenses in clays that make up the glacial overburden on top of the Great Miami Aquifer.

The glacial overburden ranges from about 20 to 50 ft thick across the Production Area, thickening to the west. Discontinuous sand lenses are scattered throughout the glacial overburden. These lenses are more prevalent and thicker under the western half of the Production Area than under the eastern half, where almost no sand lenses are found.

The clay units within the glacial overburden vary in color, generally appearing either gray or yellow-brown. These color differences are due to weathering of the unit rather than depositional differences. In general, the gray color is caused by iron present in the soils in the FeO state and is indicative of unweathered material. The color change to yellow-brown is the result of iron being oxidized to the Fe_2O_3 state, which is rust. Weathering occurs as oxygen and weak acids are carried into the subsurface by the infiltration of surface water. The oxygen and weak acids in the infiltrating water react with the sediments and chemically alter or weather the materials in the soil. Because of the presence of joints, fractures, root tubes, and insect burrows, the weathered zone typically has an enhanced bulk hydraulic conductivity relative to the unweathered zone.

The presence of yellow-brown clay below gray clay is direct evidence that perched groundwater is moving laterally within the glacial overburden. Groundwater flow within the clays is controlled by joints and fractures. Large blocks of clay can remain unweathered because of the lack of fractures, while weathering is occurring around and below the block in a more fractured portion of the clay. This occurrence of flow and contaminant transport along fracture systems makes the prediction of flow paths within the dominantly clay-bearing zones much more difficult than when flow occurs in more uniformly permeable sand beds.

Beneath the Production Area, the depth of weathering in the glacial overburden is variable, typically ranging from 7 to 14 ft. Overall, there is no systematic variation; however, the depth of weathering may be relatively constant over wide areas.. Weathered glacial overburden is missing entirely in a few locations where the surface is protected from infiltration. This is evident in borings in the Plant 1 area and under Plant 6. The most consistent depth of weathering is found in the northeastern portion of the Production Area,

where the glacial overburden is composed primarily of clay with relatively few sand or silt beds. The depth of weathering is 9-12 ft over most of the northeastern quadrant.

Because many piezometers and wells in the glacial overburden do not yield significant amounts of water, the flow system is considered to be discontinuous, with very limited potential for lateral groundwater flow over large areas.

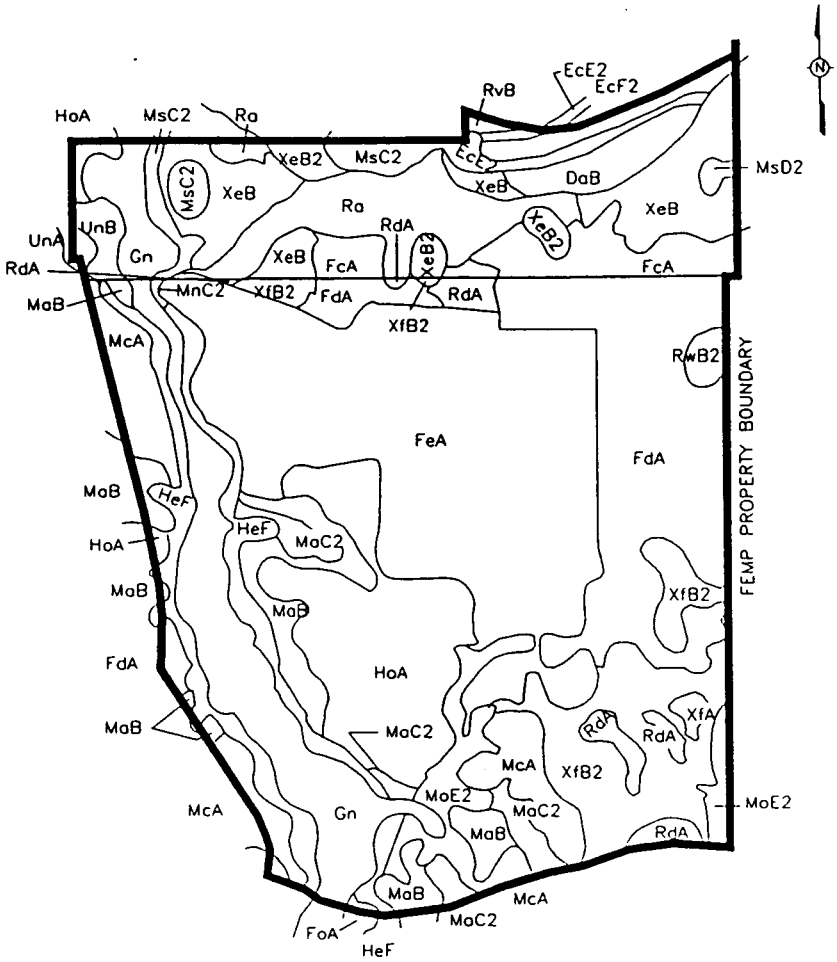
2.3.6 Soils

Soils in the region were formed from source materials deposited by the action of Wisconsin and Illinoisan glaciers. These materials consist mainly of glacial till, but also include sand, gravel, glacial lake clays, and silty clays.

Three major soil associations occur in the vicinity of the FEMP — Russell-Xenia-Wynn, Fincastle-Xenia-Wynn, and Fox-Genesee (U.S. Department of Agriculture 1980, 1982; Lerch et al. 1982). The soils are usually light-colored, acidic, and well-drained. Many of the soils have developed on windblown material (loess), except along present and old river basins where the Fox-Genesee soils are of glacial till origin. The soils are moderately high in productivity and support such agricultural activities as growing cash crops and producing livestock. Figure 2.11 is a soils map of the area.

Soils at the FEMP site are primarily categorized as Fincastle-Xenia silt loams. These soils are light colored, medium acidic, and moderately high in productivity when properly managed. Moisture-supplying capacity is moderate, as is fertility and organic content. Soils have formed 18-40 in. of loess over limy loam till of Wisconsin age. Fincastle soils have poor drainage; in areas where these soils are predominant, artificial drainage is required for moderate crop productivity. If artificial drainage is not used, the water table remains high for extended periods in winter and spring. Fincastle-Xenia soils cover large areas west of the FEMP.

Before development of the FEMP, soils of the Production Area consisted primarily of Fincastle silt loams. Fincastle soils are characterized by low permeability, moderate productivity, seasonal wetness, and low soil strength. Because of Production Area development, native soils have been covered by gravels, paving materials, and facilities; and



LEGEND:

SOIL SYMBOL BY COUNTY

SOIL NAME	BUTLER COUNTY	HAMILTON COUNTY
DANA	DoB	N/A
EDEN	EcE2, EcF2	N/A
FINCASTLE	FcA	FdA, FeA
FOX	N/A	FoA
GENESEE	Gn	Gn
HENNEPIN	N/A	HeF
HENSHAW	HoA	HoA
MARKLAND	N/A	MaB, MaC2
MARTINSVILLE	N/A	McA
MIAMIAN	N/A	MnC2
MIAMIAN-HENNEPIN	N/A	MoE2
MIAMIAN-RUSSELL	MsC2, MsD2	N/A
RAGSDALE	Ra	N/A
RAUB	N/A	RdA
RUSSELL	N/A	RwB2
UNIONTOWN	UnA, UnB	N/A
XENIA	XeB, XeB2	XfA, XfB2

SCALE
0 900 1800 FEET

FIGURE 2.11 FEMP Soils Map (heavy line is the FEMP boundary) (Sources: U.S. Department of Agriculture 1980, 1982)

backfill materials have been introduced around structure foundations. Areas that are currently planted with grass and maintained as lawns or buffer zones tend to represent native Fincastle soils.

Soils along Paddys Run are categorized as Fox-Genesee loams. These soils are light-colored, highly productive, moderately fertile, and contain moderate amounts of organic matter. Fox soils are slightly to medium acidic, have a moderate moisture-supplying capacity, and are well drained. They generally contain 24-40 in. of silty materials over sand and gravel. Fox-Genesee soils are well drained, high in moisture-supply capacity, and are subject to flooding.

Soils in a small area on the northern side of the site are classified as Russell-Xenia-Wynn, which develop on sloping topography. These upland soils are light colored and medium acidic and have formed from windblown silty material on limy loam glacial till, 18-40 in. thick.

2.3.7 Ecology*

The FEMP is in the Oak-Hickory Forest Section of the Eastern Deciduous Forest, as described by Bailey (1978). Ecological communities consist of grazed and ungrazed pastures, two pine plantations, deciduous woodlands, riparian woodlands, and a reclaimed fly ash pile area. Animal species recorded at the FEMP include 47 species of trees and shrubs, 190 species of herbaceous plants, 8 species of mammals, 98 species of birds, 10 species of amphibians and reptiles, 21 species of fish, 47 families of benthic macro-invertebrates, and 132 families of terrestrial invertebrates.

Typical grasses found on the FEMP are red fescue, Kentucky bluegrass, timothy, and red top. Herbs include teasel, red and white clovers, and goldenrod. The dominant tree species in the pine plantations is white pine, with Norway spruce occurring occasionally. Common trees in the deciduous woodlands are white ash, American elm, shellbark hickory,

*The ecological information in this section has been summarized from *Biological and Ecological Site Characterization of the Feed Materials Production Center* (Facemire et al. 1990). Additional source documents are cited in the text.

and slippery elm. Dominant tree species in the riparian woodlands are eastern cottonwood, hackberry, American elm, and box elder. A reclaimed fly ash pile at the site is dominated by American elm, eastern cottonwood, and black locust.

Mammal species observed on the FEMP include white-tailed deer, coyote, red fox, opossum, raccoon, groundhog, eastern cottontail, fox squirrel, and several species of bats. Common small mammals are the white-footed mouse, short-tailed shrew, meadow vole, meadow jumping mouse, and eastern chipmunk. The most common birds breeding on the site include the mourning dove, American robin, blue jay, American crow, American goldfinch, northern bobwhite, and common grackle. Species occurring in the greatest density are the goldfinch, song sparrow, and robin. Raptor species observed are the northern harrier, red-shouldered hawk, Cooper's hawk, red-tailed hawk, and American kestrel. The eastern screech owl and great horned owl also are common.

Amphibians and reptiles that occur on the FEMP include the American toad, spring peeper, eastern box turtle, and snapping turtle. Among the several species of snakes that occur are the eastern garter snake, Butler's garter snake, black rat snake, northern water snake, and the queen snake. Approximately 130 insect families from 15 orders are represented in FEMP habitats. Leaf hoppers are abundant in all habitats, while less abundant groups include short-horned grasshoppers, leaf beetles, springtails, fruit flies, dark-winged fungus gnats, ants, bees, and wasps.

Paddys Run and adjacent aquatic habitats harbor small fish, amphibians, and a variety of benthic macroinvertebrates. The most common fish are the bluntnose minnow, creek chub, and stoneroller minnow. The most common benthic macroinvertebrates are non-biting midges, riffle beetles, mayflies, and stoneflies.

No federally listed threatened or endangered species have been observed on the FEMP or in its immediate vicinity. Suitable habitat for one species of mammal listed as federally endangered, the Indiana bat, occurs along Paddys Run; however, the Indiana bat was not found on the site. The cave salamander, recognized as state endangered, has been reported in the vicinity of the FEMP but has not been observed within the FEMP boundaries (DOE 1992a). Marginal habitat occurs along Paddys Run. A raptor (the northern harrier) that is listed as state endangered has been observed on the FEMP. Further ecological study of the site will not be required to specifically support implementation of the OU3 Work Plan.

2.3.8 Population

Figure 2.12 depicts the calculated 1990 residential population distribution within 1-mi intervals for 16 compass directions up to 5 mi from the FEMP. The residential population within the 5-mi radius totals 22,927 persons (Ohio Data Users Center 1991). The heaviest concentrations of population are in a corridor extending from the east-northeast to the southeast of the FEMP. This corridor includes portions of the villages of Ross and New Baltimore and some low-density residential areas in Colerain Township.

Another measure of the number of people within the area is the "daytime population," which includes residents who remain in the area during the day (e.g., children, homemakers, and retirees plus the people who come to the area to work. Figure 2.13 presents the calculated daytime residential/employment population distribution within the 5-mi radius of the FEMP. The number in the center of the circle represents employment at the FEMP. Daytime residential/employment population figures for each of the 80 segments were calculated by first subtracting the estimated labor force living in that segment from the residential population to derive the daytime residential population. The estimated number of people working in that segment then was added to the daytime population to get the segment's total daytime residential/employment population. Within the 2-mi notification zone, employment figures were obtained directly from each of the local employers and FEMP representatives. The estimated daytime residential/employment population within the 5-mi radius of the center of the FEMP was 17,921 in 1990, increasing to 21,237 when enrollment of the schools in the area was included.

2.3.9 Land Use

In Hamilton and Butler counties, urban development associated with high concentrations of commercial, industrial, and residential usage is predominantly located in and near the cities of Cincinnati, Hamilton, and Middletown and along the transportation axes connecting those cities. With the exception of scattered smaller towns and suburban residential areas, the remainder of the land use in the counties is associated with open space usages, such as agriculture, parkland, water resources, and land restricted from intense development (such as in floodplains or areas too highly sloped). Some of this open space has been determined to be prime agricultural land.

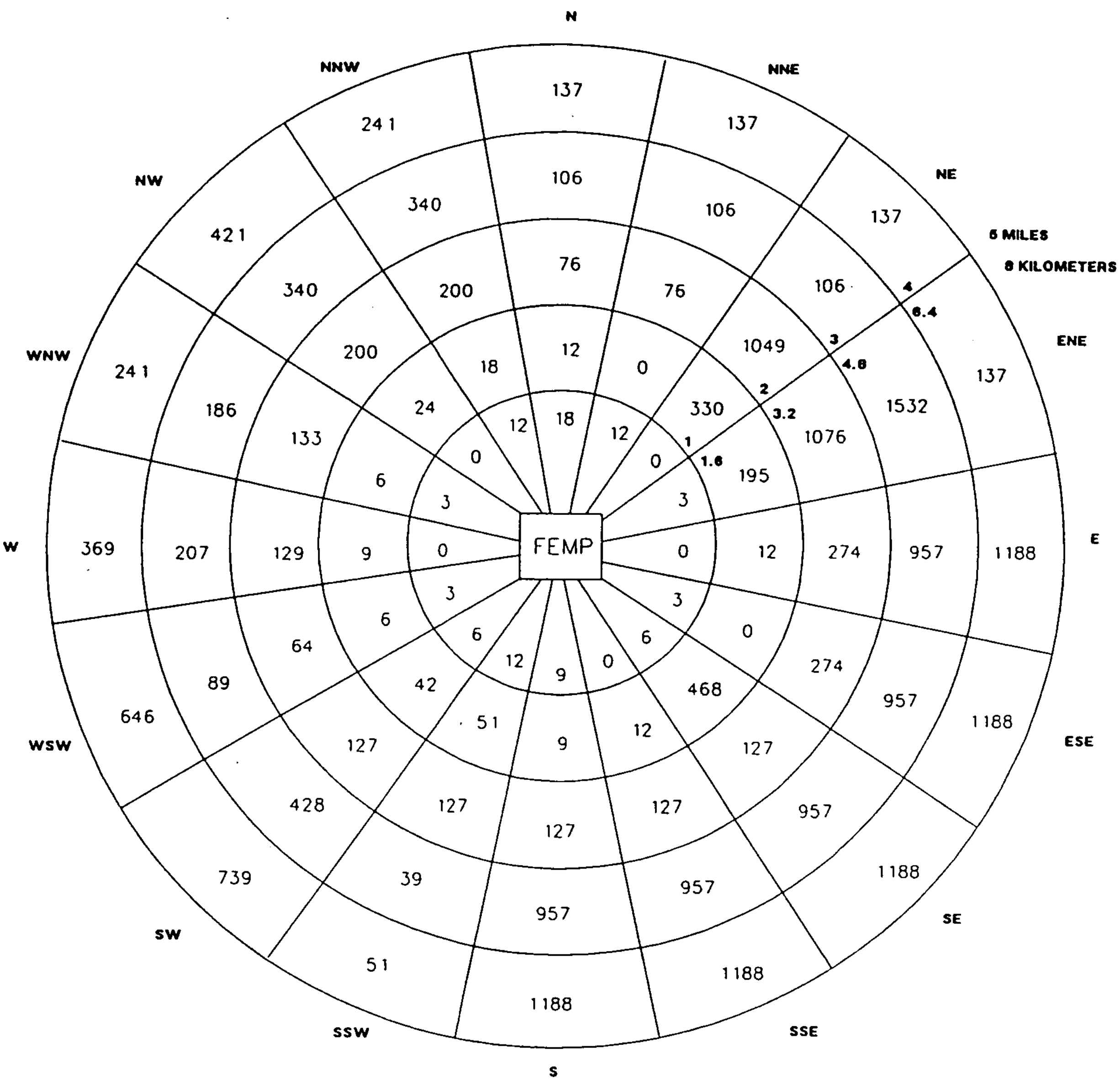


FIGURE 2.12 Residential Population Distribution within a Five-Mile Radius of the FEMP, by Distance and Direction, 1990

4002

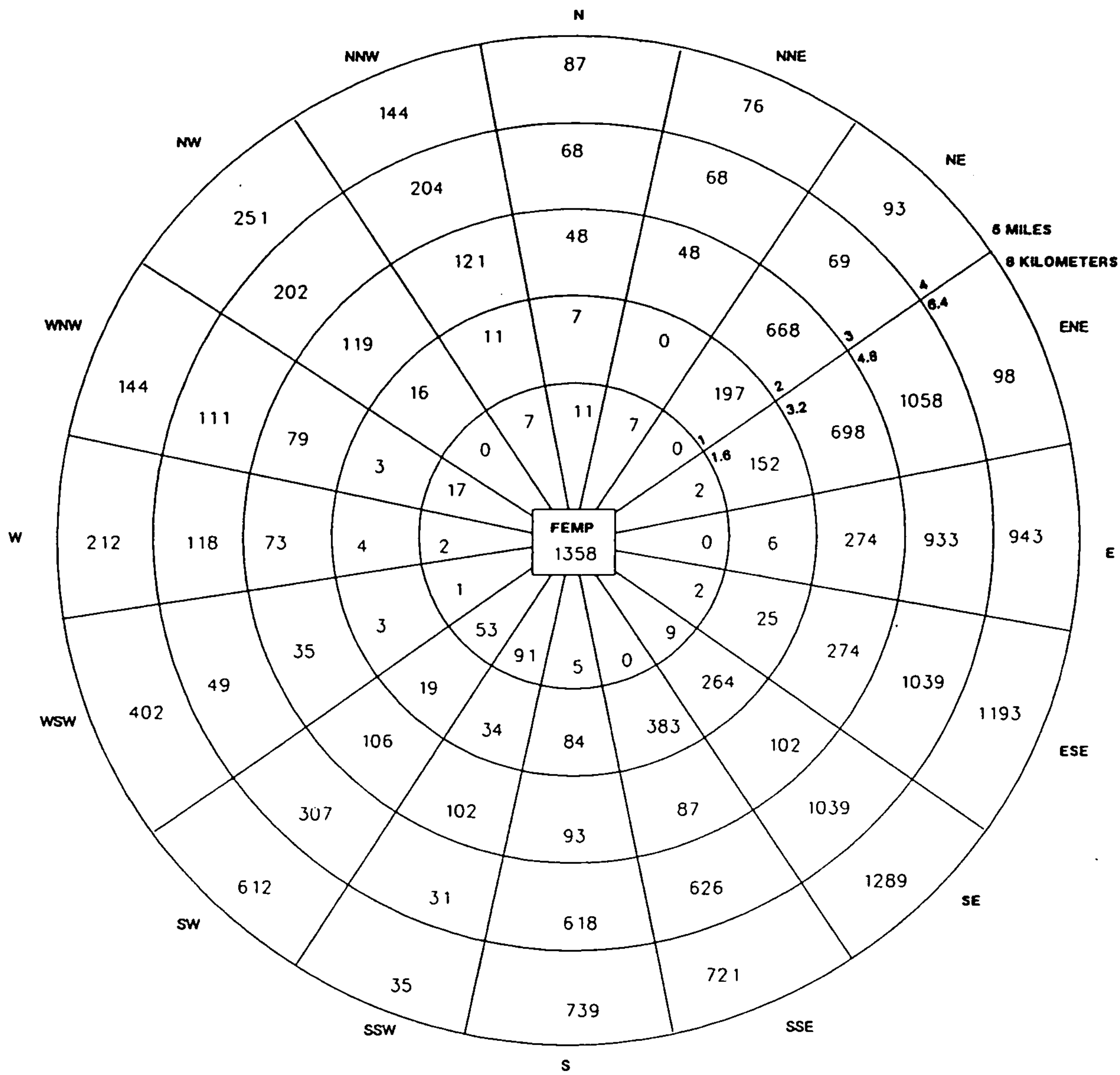


FIGURE 2.13 Daytime Residential/Employment Population Distribution within a Five-Mile Radius of the FEMP, by Distance and Direction, 1990

As indicated in Figure 2.14, the land adjacent to the FEMP is primarily devoted to open land uses such as agriculture and recreation. A number of permanent seasonal produce markets and one retail nursery also are in the area. Commercial activity is generally restricted to Ross and along State Route (S.R.) 128 just south of Ross. Industrial usage is concentrated in the areas south of the FEMP, along Paddys Run Road, in Fernald, and in a small industrial park on S.R. 128 between Willey Road and New Haven Road. Concentrations of residential units are situated northeast of the FEMP in Ross and directly east in a trailer park adjacent to the intersection of Willey Road and S.R. 128. Other residences are scattered around the area, generally in association with farmsteads. More than 400 acres of the open acreage on the FEMP is currently being leased to three local dairymen for livestock grazing. These areas are shown on Figure 2.15.

2.3.10 Archaeological and Historic Resources

A number of significant archaeological and historic resources remain in the area, both registered and as yet unrecorded (new archaeological sites). Three Adena and Hopewell mounds are located within 3 mi of the boundary of the FEMP. The Adena Circle on the grounds of Camp Ross Trails in Ross Township is 0.75 mi northeast of the northeastern corner of the FEMP. The Demoret Mound is 1 mi north of the northern boundary of the FEMP. The Hogen-Borger Mound Archeological District is approximately 2.5 mi northeast of the northeastern corner of the FEMP. All three mounds are included on the *National Register of Historic Places* (NRHP). Also included in the NRHP are the Colerain Works Archaeological District and the Dunlap Archaeological District, which lie along the Great Miami River just east of the FEMP. Additionally, the Schomaker Farm Site is a few miles east-northeast of the FEMP adjacent to the Great Miami River. These locations are the known significant archaeological sites near the FEMP. A number of additional studies have been conducted in the vicinity and all indicate that it is likely that there are additional significant sites that remain undiscovered (DOE 1992a).

Historic resources in the area are equally abundant. The settlement pattern and economic development of the area have been conducive to the retention of large parcels of farmland by single families. For this reason, several early settlement farmsteads have remained well preserved. According to records kept by the Miami Purchase Association for

4002

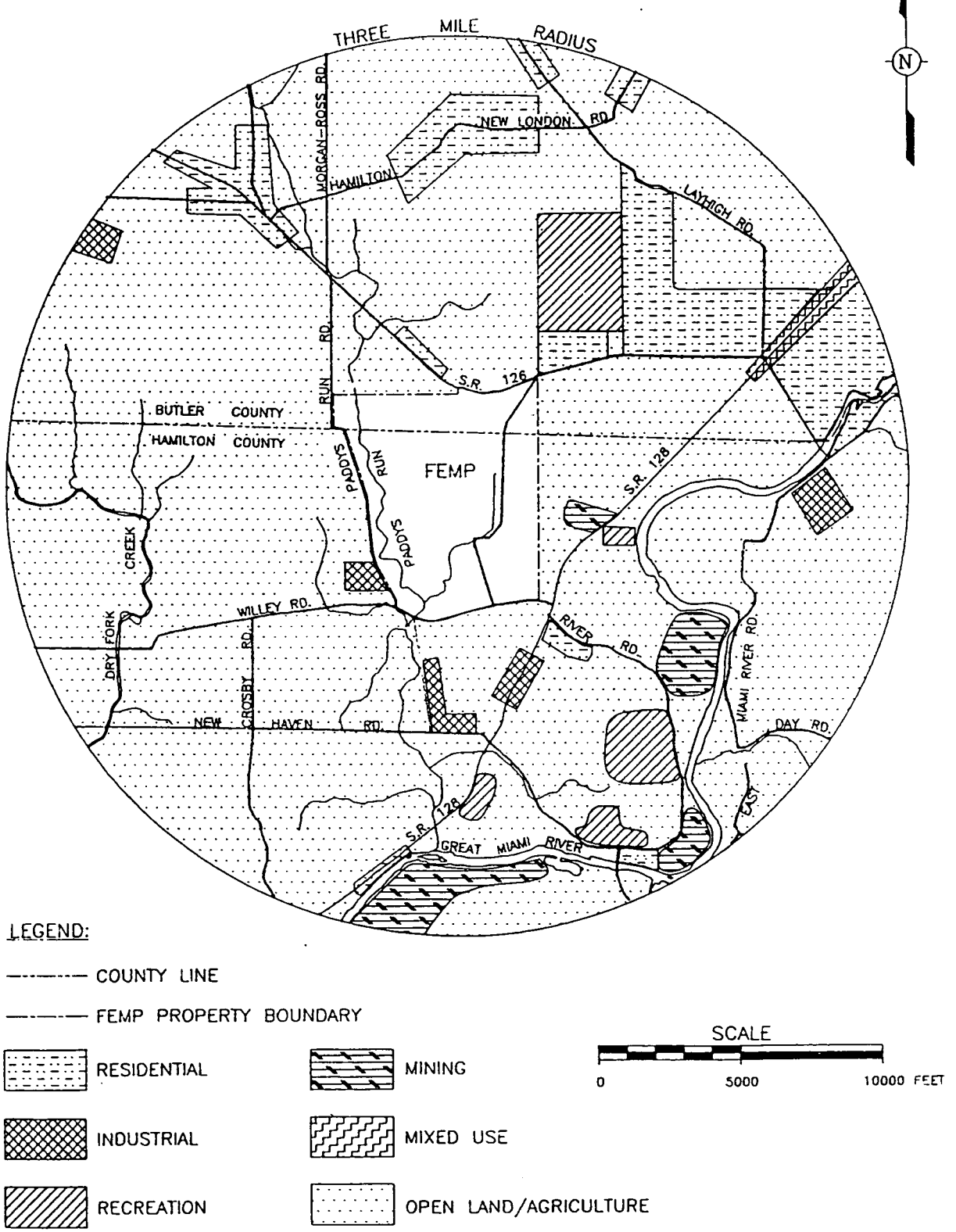


FIGURE 2.14 Land Use Adjacent to the FEMP

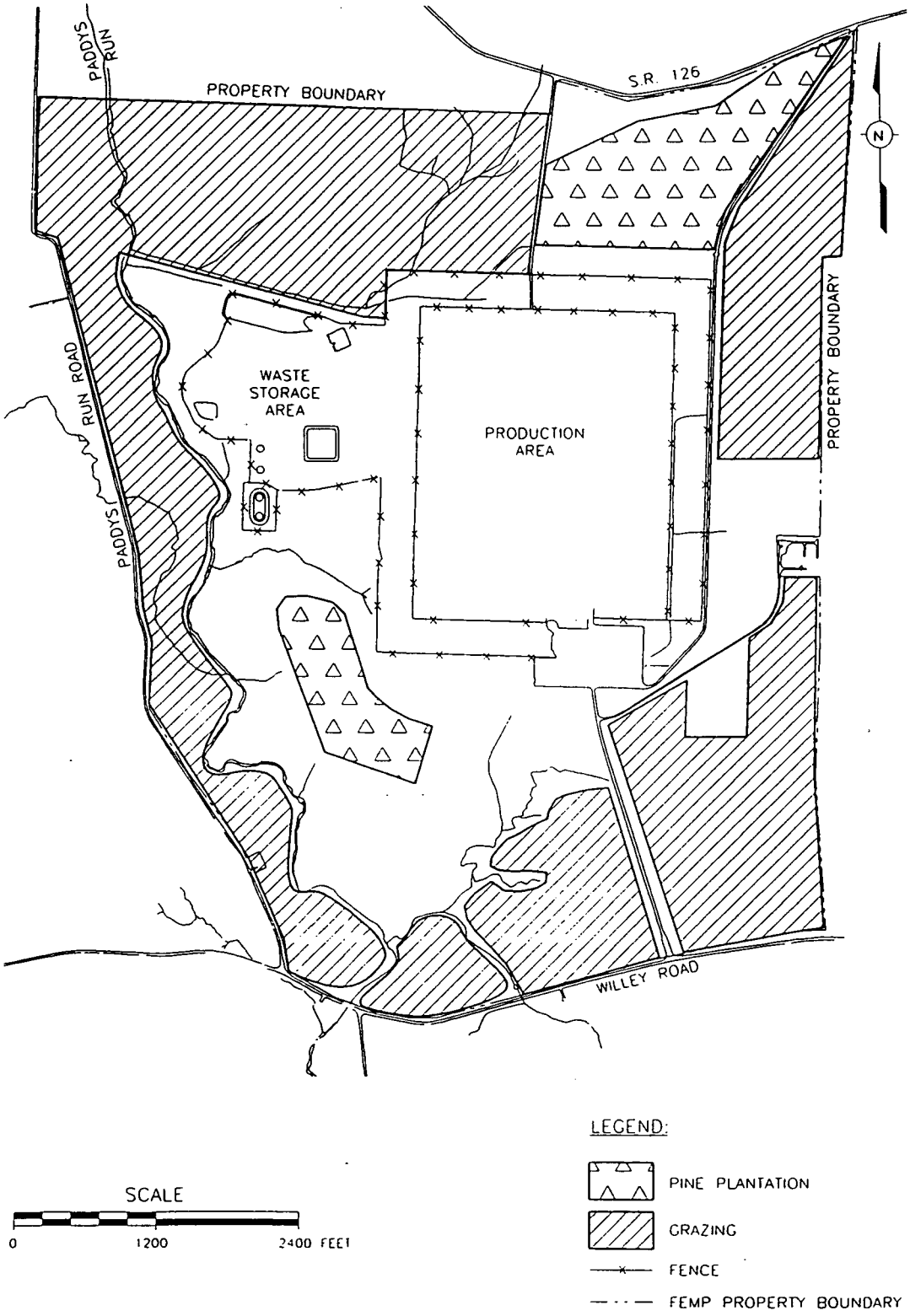


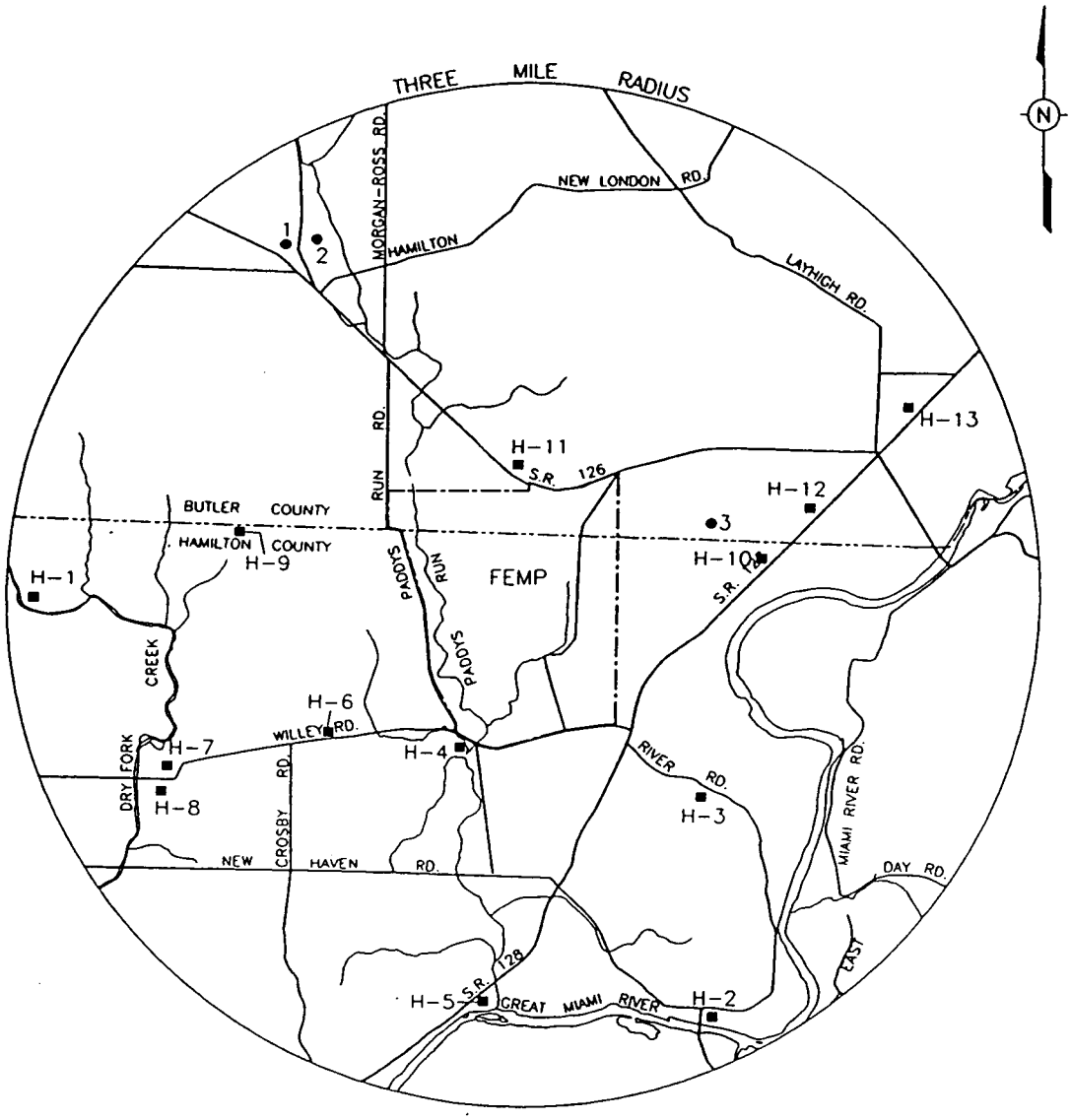
FIGURE 2.15 Land Use on the Open Areas of the FEMP

Historic Preservation, an unusually high percentage of the existing nineteenth century buildings in the township are historically important. Three properties listed in the NRHP are located within a 2-mi radius of the FEMP — the Thomas Select School log cabin in Shandon northeast of the FEMP, the Vaughn-Francis House also near Shandon, and the Shaw Farm on Cincinnati-Brookville Road. The following additional structures within a 3-mi radius of the FEMP have been inventoried by the Miami Purchase Association and deemed eligible for inclusion in the NRHP (Figure 2.16):

- Abner Atherton House (c. 1845) on Atherton Road between Willey and Howard roads,
- Blue Rock Street Bridge (c. 1914) spanning the Great Miami River south of New Baltimore,
- Clinton D. Buell House (c. 1830) west of S.R. 128 on River Road,
- Rainbow arch bridge (c. 1931) over Willey Road near its intersection with Paddys Run Road,
- A. Reed Stone House (c. 1830) on the river side of S.R. 128 just south of New Haven Road,
- Joseph Sater Farm (c. 1876) on Willey Road west of Crosby Road,
- William Sater Farm (c. 1831) north of Willey Road near Atherton Road,
- Joab Whipple House (c. 1840) south of Willey Road near Atherton Road,
- Daniel Wilkins Farm (c. 1845), home and laundry outbuilding, just west of Paddys Run Road, and
- Israel B. Willey House (c. 1910) on S.R. 128 immediately north of its intersection with Willey Road.

2.4 NATURE AND EXTENT OF CONTAMINATION IN OU3

During operations at the FEMP, feed materials, products, and waste residues were handled in a manner that lead to the spread of contamination inside and outside of buildings, structures, and other components. The spread of contamination has resulted in detectable



LEGEND:

H-1 ABNER ATHERTON HOUSE (CIRCA 1845)
H-2 BLUE ROCK STREET BRIDGE (CIRCA 1914)
H-3 CLINTON D. BUELL HOUSE (CIRCA 1830)
H-4 RAINBOW ARCH BRIDGE (CIRCA 1931)
H-5 A. REED STONE HOUSE (CIRCA 1830)
H-6 JOSEPH SATER FARM (CIRCA 1876)
H-7 WILLIAM SATER FARM (CIRCA 1831)
H-8 JOAB WHIPPLE HOUSE (CIRCA 1840)
H-9 DANIEL WILKINS FARM (CIRCA 1845)
H-10 ISRAEL B. WILLEY HOUSE (CIRCA 1910)
H-11 HENSHAW LOG CABIN
H-12 NEMIAH WADE HOUSE (CIRCA 1842)
H-13 BUTTERFIELD HOUSE (1830)

SCALE
0 1 2 MILES

LEGEND (Cont.):

NRHP SITES

• 1 THOMAS SELECT SCHOOL (1803)
• 2 VAUGHN-FRANCIS HOUSE (1814)
• 3 SHAW FARM (1804)

FIGURE 2.16 Historic Properties near the FEMP

quantities of radiological and chemical contaminants in soil, water (surface water and groundwater), and the air (as a result of soil and particulate resuspension). Many of the components within OU3 are likewise contaminated and could serve as sources for continued migration of contaminants to the environment. Information on the nature and extent of contamination in OU3 has been assembled into summary tables presented in Appendix A. This discussion of the nature and extent of contamination in OU3 is based on evaluation of the information contained in those summary tables. The tables have been placed into seven groups:

1. Component Identification,
2. Component and Process Descriptions,
3. Potential Contaminants,
4. Evaluation of Existing Contamination Data,
5. Drummed Waste Inventory,
6. Product Inventory, and
7. Estimated Volumes of Potentially Contaminated Material.

Table A.1 provides the current list of OU3 components. Each component is assigned a unique alphanumeric designation that allows consistent cross referencing between tables. This common designation is also used to locate all components on the FEMP OU3 site maps in Appendix C. In addition, the FEMP has been further defined by 33 map grids encompassing all of the site except the far northern and southern sides. In Table A.1, components have been identified with their corresponding grid location.

Tables A.2.0 and A.2.1 provide component type and size descriptions, process descriptions, past use information, and equipment and contents. Much of the information contained in those tables is based on process knowledge.

Table A.3 summarizes potential contaminants for each component. The list of potential contaminants provided in Table A.3 is an extension of information presented in Table A.2.1 and is also based on information sources for significant quantities of materials used, RCRA reports, spill logs, incident reports, history of the FEMP, waste characterizations,

material distribution information, and additional sampling performed for interim actions and related activities (Section 2.5).

Summary Tables A.4.0 through A.4.5 are compilations of existing data about components and contaminants and give an overview of documented contamination in OU3. Summary Tables A.5.0, A.5.1, and A.6 illustrate the extent of stored waste and product inventories by storage location and enrichment code. (Because of ongoing activities at the site, the drum inventory may have changed somewhat from that shown in the tables.) Table A.7 summarizes available information on the volumes of potentially contaminated materials by component. The information in Table A.7 provides preliminary estimates of volumes and types of material to be addressed by the RI/FS process and is discussed further in Section 2.4.4. Sections 2.4.1 and 2.4.2 discuss existing information on radiological and chemical contamination. A classification of components is then presented in Section 2.4.3 on the basis of radiological levels of surface contamination. This classification serves as input to decisions related to the sampling program and also provides an overview of existing information on the components. The classification is based on radiological contamination because much more information is available on radiological contamination than on chemical contamination. Surface contamination is used because no other component-specific information is generally available. Section 2.4.4 summarizes preliminary estimates of waste volumes. Section 2.4.5 provides an overview and summary of conditions for OU3.

2.4.1 Radiological Contamination

Historical information and process knowledge indicate that the primary radiological contaminants in OU3 are uranium (isotopes 234, 235, 236, 238, and, to a lesser degree, 233), thorium (isotopes 228, 230, and 232), radium (isotopes 226 and 228), radon (isotopes 220 and 222), and the associated decay products (daughters), including isotopes of lead, polonium, and bismuth. Additional radionuclides that have been identified through analysis at the site include isotopes of neptunium, plutonium, technetium, strontium, cesium, and ruthenium.

The summary Tables A.4.0 through A.4.4 in Appendix A present detailed information on potential radiological contaminants by component, radiological smear and direct survey samples by component, radiological smear and direct survey samples of abandoned-in-place

equipment, radon and thoron (radon-220) monitoring, and airborne alpha- and beta-emitting particles. In addition, the tables generally indicate sampling locations (e.g., equipment, floors, and sumps), ranges and average values, sample sizes, and dates of sampling.

Existing data on radiological contamination will be used to help identify areas for sampling during the RI field investigations and to help estimate radiation exposure rates.

The smear and direct survey samples for components and equipment (Tables A.4.0 through A.4.2) were collected in an ongoing radiation survey program at the FEMP. These radiation surveys are an integral part of the FEMP's radiation control program, which is designed to provide comprehensive controls and policies to address the potential hazards from radiation exposure and radiological contamination. The specific responsibilities, policies, and protective measures that are employed are documented by Westinghouse Environmental Management Company of Ohio (WEMCO 1992). That documentation is based upon the requirements and recommendations of DOE, EPA, the National Council on Radiation Protection and Measurements, the International Commission of Radiological Protection, the U.S. Department of Transportation, the U.S. Nuclear Regulatory Commission, and the State of Ohio, as well as on standards that have been reviewed and accepted by the U.S. Public Health Service and the U.S. Department of Labor (Occupational Safety and Health Administration).

Responsibilities related to administering radiation control requirements include:

- Conducting routine radiological monitoring of personnel areas, buildings, equipment, materials, vehicles, and trash;
- Providing radiological monitoring of chemical and metal plant activities, receipts and shipments of radioactive materials; and renovation, construction, decontamination and decommissioning projects;
- Evaluating work conditions and practices for adequacy of radiological protection;
- Providing technical support for assessment of radiological impacts of new or modified facilities and procedures;
- Identifying areas that require radiological posting and labeling; and
- Operating a site-wide radiation source control program.

The FEMP radiological controls are required to be integrated with as-low-as-reasonably-achievable (ALARA) requirements. Locations, operations, and conditions that have the potential to cause significant personnel exposures to radiation are identified, and a routine surveillance program is maintained, including air sampling and surface contamination measurements, in all nominally occupied areas. In addition, collection, analysis, and validation of radiological data and information as they pertain to the radiation protection/ALARA programs, RI/FS activities, and other efforts to ensure that occupational radiation exposures meet ALARA objectives are documented. Radiation surveys are carried out to ensure that exposures comply with ALARA requirements. Results obtained from surveys are used to:

- Evaluate tasks for ALARA considerations;
- Establish radiation procedures;
- Provide a baseline for trend analysis, correction, and investigation of unusual conditions; and
- Identify the origin of radiation exposures.

Specific procedures have been developed at the FEMP to ensure that data meet the objectives of the radiation controls program. These procedures establish detailed protocols and methodologies for conducting surveys and recording data. Applicable procedures are the following:

- SP-P-35-023 — Radiological Contamination Surveys,
- SP-P-35-046 — Counting Smears with Field Survey Instruments,
- SP-P-35-025 — Radiological Posting,
- SP-P-35-019 — Quality Control of Radioactivity Counting Systems, and
- SP-P-35-028 — Inspection and Performance Testing of Portable Radiation Survey Instruments.

Procedure SP-P-35-023 (Radiological Contamination Surveys) defines the method used to schedule, perform, and document contamination surveys. Surveys to measure loose and fixed beta/gamma radiation are conducted with a portable beta-gamma instrument equipped with a pancake probe. Dry smears are collected whenever direct frisk with the

probe indicates activity that exceeds applicable limits for removable activity for a location. Alpha radiation measurements for loose and fixed contamination are collected with an alpha instrument. Dry smears are also taken whenever direct frisk indicates activity that exceeds applicable limits for removable activity for a location. Smear samples are analyzed according to procedure SP-P-35-046 (Counting Smears with Field Survey Instruments). If thorium compounds are being measured, a stationary, low-background counting system is used.

Sufficient samples are collected to adequately characterize an area to preclude the possibility of personnel exposure to elevated levels of radiation. Locations and radiation readings are documented when survey areas indicate significant sources (twice levels for the general area). Survey areas are randomly selected to include normally occupied areas, overheads, and "paths of travel."

Survey data are recorded on FEMP Radiological Survey Reports and include information on sample location, the date the survey was performed, radiation levels, type of instrument used, and calibration due date. The frequency of radiation surveys is specified in procedure SP-P-35-023 (Radiological Contamination Survey). The frequencies vary from weekly to annually, depending on the level of contamination. Access points for contaminated areas are monitored more frequently. Areas are designated in accordance with radiation levels as established by Procedure SP-P-35-025 (Radiological Posting).

Procedure SP-P-35-019 (Quality Control of Radioactivity Counting Systems) provides technical procedures to establish quality control for low background radioactivity detection and measurement. The procedure also addresses instrument calibration. Procedure SP-P-35-028 (Inspection and Performance Testing of Portable Radiation Survey Instruments) assigns responsibilities and establishes the procedures for ensuring that all portable radiation survey instruments are maintained in a satisfactory operating condition.

2.4.2 Chemical Contamination

The nature and extent of chemical contamination are more difficult to address than the nature and extent of radiological contamination, because virtually no data on chemical contaminants are available to directly characterize the components in OU3: The quantity and quality of current chemical (nonradiological) contaminant information is significantly less than that for the radiological constituents. This situation is due in part to the emphasis

placed on radioactive materials over the years and the specific routine testing performed for radiological contaminants. Table A.3 lists potential contaminants (radiological and nonradiological) for specific locations within each component throughout the site. The source of the information for each activity is also included (e.g., process knowledge, spill logs). Volatile organic compounds listed include solvents such as trichloroethylene (TCE) and 1,1,1-trichloroethane (1,1,1-TCA). Inorganic compounds include elements such as arsenic and barium, among others. Surveys for asbestos are summarized in Table A.4.5. With the exception of asbestos, these information summaries are limited relative to describing the extent of chemical contamination within OU3, but they do provide a reasonable qualitative assessment of the potential nature of chemical contamination.

Solvents and degreasers, such as TCE and 1,1,1-TCA, were widely used within certain components. The existence of these materials in the perched groundwater under Plants 2/3, 6, 8, and 9 further indicates the extent of contamination; however, the degree of component contamination is unknown. Sampling during RI/FS field activities will provide the primary source of information on chemical contamination of OU3.

2.4.3 Classification of Components on the Basis of Radiological Contamination

To provide a consistent basis for evaluating OU3 components in terms of existing contamination, components have been classified by level of surface radiological contamination. Existing information is inadequate for classification on the basis of chemical contamination or other than surface radiological contamination; however, the most widespread form of contamination is expected to be surface radiological contamination. The classification of components presented supports the identification of components that need to be sampled. However, other factors are also used in identifying components for sampling.

Components are classified with respect to radiological contamination on the basis of allowable levels of residual surface radioactive contamination identified in DOE Order 5400.5 (Table 2.3). These levels are the maximum allowable levels of residual surface contamination that can be present on any material to be released for reuse without radiological restrictions. Component classification is based on levels of uranium contamination. This approach is valid because the radioactive contamination within OU3 is largely surficial, and uranium and its

TABLE 2.3 Guidelines for Surface Contamination

Radionuclide[b]	Allowable Total Residual Surface Contamination[a] (dpm/100 cm^2)		
	Average[c,d]	Maximum[d,e]	Removable[d,f]
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129[g]	100	300	20
Th-natural, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000	3,000	200
U-natural, U-235, U-238, and associated decay products	5,000 α	15,000 α	1,000 α
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above[h]	5,000 β-γ	15,000 β-γ	1,000 β-γ

[a] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[b] Where surface contamination by both alpha- and beta-gamma-emitting radionuclides exists, the limits established for alpha- and beta-gamma-emitting radionuclides should apply independently.

[c] Measurements of average contamination should not be averaged over an area of more than 1 m^2. For objects of less surface area, the average should be derived for each such object.

[d] The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h and 1.0 mrad/h, respectively, at a depth of 1 cm.

[e] The maximum contamination level applies to an area of not more than 100 cm^2.

[f] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping an area of that size with dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area should be based on the actual area, and the entire surface should be wiped. It is not necessary to use wiping techniques to measure removable contamination levels if direct scan surveys indicate that total residual surface contamination levels are within the limits for removable contamination.

[g] Guidelines for these radionuclides are not given in DOE Order 5400.5. Levels provided are from the Nuclear Regulatory Commission, *Termination of Operating Licenses for Nuclear Reactors*, Regulatory Guide 1.86 (June 1974).

[h] This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 that has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

Source: U.S. Department of Energy, DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, Office of Environment, Safety and Health (February 1990), except as noted.

associated daughters are the major contaminants. Components are classified as having significant or no significant levels of radioactive contamination on the basis of the criteria in Table 2.4, which was developed on the basis of the information given in Table 2.3.

A limited number of components may have thorium as a significant contaminant. These components include the warehouses storing thorium (60, 64, 65, 67, 68)* and the Pilot Plant wet side (13A) and thorium tank farm (13D). These components are not classified in this section unless classification with available data yields a level of significant contamination when criteria for uranium are applied. Several other components may also have significant nonuranium contamination. These components include the Plant 1 ore silos (1C), the hot raffinate building (3E), and certain areas of Plants 6, 8, and 9. However, all of these components are classified as having significant contamination on the basis of criteria for uranium and are, therefore, retained in the classification in this section.

The classification of components is based on average values obtained from radiological surveys conducted for OU3 components (Tables A.4.0 and A.4.1). The survey results are presented as the amount of removable and total alpha and beta-gamma radiation in terms of disintegrations per minute (dpm) per 100 cm^2. In general, the beta-gamma values per unit area are significantly larger than the alpha values per unit area. On the basis of the number of alpha and beta particles emitted by uranium-238 and its associated daughters, these two values would be expected to be comparable. The much lower values obtained for alpha contamination (in terms of dpm/100 cm^2) may be due to undercounting of the actual number of alpha particles emitted by the various radionuclides. Alpha particles have a very short range and can be effectively shielded by rust and dirt, which were likely to be prevalent when the surveys were performed. Because beta particles and gamma rays are much more penetrating than alpha particles, beta and gamma forms of radiation are much easier to detect with field instruments and are likely to be much more representative of the actual levels of contamination present than are the alpha readings.

Because the number of alpha and beta particles are comparable for uranium-238 and associated daughters, the measured beta-gamma values can also be used in conjunction with

*Throughout this report, the alphanumeric and numeric codings appearing in parentheses after specific facilities are the OU3 component designations for those facilities. These designations are listed in Table 2.2.

TABLE 2.4 Basis for Relative Contamination Designation Used for Classification of FEMP Components[a]

Contamination Class	Average Removable Surface Contamination (dpm/100 cm^2)	Average Total Surface Contamination (dpm/100 cm^2)
No Significant Contamination	0 - 1,000	0 - 5,000
Significant Contamination	Above 1,000	Above 5,000

[a] Values apply to either alpha or beta-gamma radiation.

the classes presented in Table 2.4 to determine the relative levels of contamination in OU3 components. Therefore, as indicated in Table 2.4, comparison is made with both measured alpha and measured beta-gamma values when classifying components. The results of this classification are summarized in the following subsections. Values reported below are for beta-gamma radiation, unless noted. Components for which no data are available have not been classified. Components with incomplete data (e.g., no total surface contamination) are included in the classification. However, the nature of missing data is noted, and the classification of such components developed in this section will not be used in identifying components that require no sampling.

The classification used does not address the extent of contamination in a component. Therefore, a component with only localized contamination might still be placed in the "significant contamination" class. Use of maximum values would aggravate this problem. However, the use of average values means that areas of higher levels of contamination may be present in components placed in the "no significant contamination" class. Average values cannot be representative of all areas of large components.

The following subsections present the classification of components by category on the basis of the approach presented above.

2.4.3.1 Administration Buildings

Radiological survey data are available for 10 of the 13 administration building components. Data gathered before 1992 are available for all 10 of these components, and 7 of the 10 components also have data available from 1992. On the basis of data gathered before 1992 (Table A.4.0), all 10 of the components except for the Rust Engineering Building (45A) have average total surface contamination values below 5,000 dpm/100 cm^2, with a maximum of 4,700 dpm/100 cm^2 for accessible areas in the NAR control house (3C). The Rust Engineering Building has an average total surface contamination value of 12,000 dpm/100 cm^2 for floors on the basis of pre-1992 data. The results for 1992 (Table A.4.1) show no components with average total surface contamination levels above 5,000 dpm/100 cm^2, including 45A. Average removable surface contamination levels are well below 1,000 dpm/100 cm^2 for all components for both sets of data. Therefore, among the administration building components for which data are available, only the Rust Engineering

Building (45A) is in the significant contamination category. Component contamination classification is shown in Table 2.5.

2.4.3.2 Warehouse and Storage Buildings

Radiological survey data are available for 25 of the 34 warehouse and storage buildings. Data gathered before 1992 are available for 10 components, and 25 components have data from 1992. Nine components have data for both years. On the basis of data gathered before 1992, only Plant 7 (7A) has average removable surface contamination above 1,000 dpm/100 cm^2, namely 2,500 dpm/100 cm^2 for accessible areas. Surveys performed in 1992 show five components with average removable surface contamination greater than 1,000 dpm/100 cm^2 (Plant 5 ingot storage shelter [5G], Plant 7 [7A], quonset hut #2 [61], [old] Plant 5 warehouse [65], and the Plant 1 thorium warehouse [67]). The ingot storage shelter has the highest average levels of the five, with a value of 4,300 dpm/100 cm^2. On the basis of total surface contamination results obtained before 1992, Plant 6 warehouse (79) has an average value of 8,000 dpm/100 cm^2; 1992 data show two more components with average total surface contamination values greater than 5,000 dpm/100 cm^2: the Building 32 covered loading dock (32B) and the general in-process warehouse (71). Only nine components have data available on total surface contamination. Components 60, 64, 65, 67, and 68 are thorium warehouses. Of these three, Components 65 and 67 are classified as having significant contamination of the basis of the classification system for uranium. Therefore, these components are placed in the significant contamination category. The same classification system applied to Components 60, 64, and 68 suggests no significant contamination. However, the components are not classified here because of possible thorium contamination. Component classification is shown in Table 2.6.

2.4.3.3 Process Buildings

Radiological survey data are available for 23 of the 31 process buildings. These 23 components represent the major sources of contamination in OU3 and have the highest recorded levels of radioactivity. The average removable surface contamination ranges from less than 50 to 36,000 dpm/100 cm^2 (for accessible areas in Plant 6A), and the average total surface contamination ranges up to 300,000 dpm/100 cm^2 (for floors in Component 13C).

TABLE 2.5 Contamination Classification for Administration Buildings[a]

Significant Contamination	No Significant Contamination
Rust Engineering Building (45A)[b]	NAR Control House (3C) Service Building (11) Administration Building (14A) Security Building (28A) Human Resources Building (28B) Health & Safety Building (53A)[b,c] In-Vivo Building (53B) Process Trailers (G-006)[d] Nonprocess Trailers (G-007)[c]

[a] See Table 2.4 for ranking criteria.

[b] Classification based on total contamination criteria.

[c] Incomplete data for removable contamination.

[d] No data for total contamination for some trailers.

TABLE 2.6 Contamination Classification for Warehouses and Storage Buildings[a]

Significant Contamination	No Significant Contamination
Plant 5 Ingot Storage Shelter (5G)[d,e]	Plant 1 Storage Shelter (1B)[c,e]
Plant 7 (7A)[c,d]	Plant 4 Warehouse (4B)[c]
Building 32 Covered Loading Dock (32B)[b,e]	Plant 5 Covered Storage Pad (5F)[c,e]
Quonset Hut #2 (61)[c,d,e]	Cylinder Storage Building (12B)[e]
(Old) Plant 5 Warehouse (65)[c,d,e,f]	Lumber Storage Building (12C)[e]
Plant 1 Thorium Warehouse (67)[c,d,e,f]	Chemical Warehouse (30A)
General In-Process Warehouse (71)[b,e]	Drum Storage Warehouse (30B)[c]
Plant 6 Warehouse (79)[b]	Pilot Plant Shelter (54B)[c,e]
	CP Storage Warehouse (56A)[c]
	Quonset Hut #3 (62)[c,e]
	KC-2 Warehouse (63)[e]
	Finished Products Warehouse(4A) (77)[c]
	Plant 8 Warehouse (80)[c,e]
	Plant 9 Warehouse (81)

[a] See Table 2.4 for ranking criteria.

[b] Classification based on total contamination criteria.

[c] No data available for total contamination.

[d] Classification based on removable contamination criteria.

[e] Classification based on 1992 data; no pre-1992 data available.

[f] Thorium warehouse.

Nineteen of the 23 components are categorized as having significant contamination. The Pilot Plant wet side (13A) has possible thorium contamination. It is classified as having significant contamination on the basis of the criteria for uranium. Component classification is shown in Table 2.7.

2.4.3.4 Process Support Buildings

Radiological survey data are available for 34 of the 49 process support buildings. Nine components have been classified as significantly contaminated. Eight components have average total surface contamination levels ranging from 6,000 to 168,000 dpm/100 cm^2 based on data gathered both before and during 1992. The railroad scale house (24A) has an average total surface contamination value of 7,600 dpm/100 cm^2 based on 1992 data only. Component classification is shown in Table 2.8.

2.4.3.5 Aboveground Containers

Of the 23 aboveground container components, only 12 have radiological survey data available. Three of the components have values that indicate significant contamination based on data gathered before 1992. The Plant 1 ore silos (1C), NAR towers (3D), and the Harshaw system (3F) all have average total surface contamination values exceeding 19,000 dpm/ 100 cm^2, with the ore silos at 108,000 dpm/100 cm^2 total alpha for a small number of floor samples. The ore silos also have average alpha removable values for floors of 5,000 dpm/100 cm^2. The Pilot Plant thorium tank farm (13D) is not classified here because of possible thorium contamination. Component classification is shown in Table 2.9.

2.4.3.6 Belowground Containerized Material

Neither of these two components have been surveyed for radiological contamination.

2.4.3.7 Bulk Material

Bulk material consists of the scrap metal, soil, rock salt, sand, gravel, and coal piles resulting from various construction activities and maintenance actions on the site. Of the total of eight bulk material components, only one has significant radiological information

TABLE 2.7 Contamination Classification for Process Buildings[a]

Significant Contamination	No Significant Contamination
Preparation Plant (1A)[d,e]	Rotary Kiln/Drum Reconditioning (8C)[c,e]
Ore Refinery Plant (2A)[d]	Biodenitrification Towers (18D)
Metal Dissolver Building (2D)[b]	BDN Effluent Treatment Facility (18H)[c,e]
Hot Raffinate Building (3E)[d]	Drum Reconditioning Building (66)[c]
Green Salt Plant (4A)[c]	
Metals Production Plant (5A)[d]	
Metals Fabrication Plant (6A)[d]	
Recovery Plant (8A)[d]	
Special Products Plant (9A)[d]	
Pilot Plant Wet Side (13A)[d,e]	
Sump Pump House (13C)[d]	
Laboratory (15)[b]	
Engine House/Garage (31A)[b]	
Pilot Plant Annex (37)[b,e]	
Incinerator Building (39A)[b]	
Six to Four Reduction Facility #1 (54A)[b,e]	
Slag Recycling Building (55A)[d]	
Slag Recycling Pit/Elevator (55B)[d]	
Decontamination Building (69)[b,e]	

[a] See Table 2.4 for ranking criteria.

[b] Classification based on total contamination criteria.

[c] No data available for total contamination.

[d] Classification based on both total and removable contamination.

[e] Classification based on 1992 data only.

TABLE 2.8 Contamination Classification for Process Support Buildings[a]

Significant Contamination	No Significant Contamination
General/Refinery Sump Control Building (2B)[b]	Electrical Power Center Building (3L)[d,e]
Bulk Lime Handling Building (2C)[b]	Plant 4 Maintenance Building (4C)[d]
Maintenance Building (3A)[b]	West Derby Breakout/ Slag Milling (5D)[d,e]
Ozone Building (3B)[b]	Boiler Plant (10A)
Refrigeration Building (3G)[b]	Boiler Plant Maintenance Bldg. (10B)[d]
Plant 8 Maintenance Building (8B)[b]	Pilot Plant Maintenance Bldg. (13B)[d]
Main Maintenance Building (12A)[b]	Tank Farm Control House (19C)[d,e]
Railroad Scale House (24A)[b,e]	Pump Station & Power Center (20A)[e]
Heavy Equipment Building (46)[b]	Water Plant (20B)
	Well House #1 (20E)[e]
	Well House #2 (20F)[e]
	Well House #3 (20G)[e]
	Gas Meter Building (22A)[e]
	Storm Sewer Lift Station (22B)[d,e]
	Scale House & Weigh Scale (22D)[e]
	Railroad Engine House (24B)[e]
	M.H.#175/Eff. Line/Sampling Bldg. (25B)
	Sewage Lift Station Building (25C)[e]
	U.V. Disinfection Building (25D)
	Digester & Control Building (25E)
	Pump House-HP Fire Protection (26A)[e]
	Propane Storage (38A)[e]
	Incinerator Sprinkler Riser House (39C)[d,e]
	Six to Four Reduction Facility #2 (51)[e]
	Receiving/Incoming Mat'ls. Insp. (82)

[a] See Table 2.4 for ranking criteria.

[b] Classification based on total contamination criteria.

[c] No measurements for removable contamination available.

[d] No measurements for total contamination available.

[e] Classification based on 1992 data only.

TABLE 2.9 Contamination Classification for Aboveground Containers[a]

Significant Contamination	No Significant Contamination
Plant 1 Ore Silos (1C)	NFS Storage & Pump House (2E)[c,e]
NAR Towers (3D)[b]	Refinery Sump (3H)[c,e]
Harshaw Digestion Fume Recovery (3F)[b]	Combined Raffinate Tanks (3J)[c]
	General Sump (18B)[c]
	Main Tank Farm (19A)[c]
	Elevated Potable Storage Tank (20D)[e]
	Process Water Storage Tank (20H)[c,e]
	Elevated Water Storage Tank (26B)[d,e]

[a] See Table 2.4 for ranking criteria.
[b] Classification based on total contamination criteria.
[c] No measurements for total contamination are available.
[d] No measurements for removable contamination are available.
[e] Classification based on 1992 data only.

available at this time. That component is the copper metal scrap pile (P-004). On the basis of data gathered before 1992, it has been ranked as having significant contamination, with an average surface total contamination value of 34,000 dpm/100 cm^2. No data are available for removable contamination.

2.4.3.8 Pads, Parking Lot, Roads, and Railroads

Radiological survey data are available for 19 of the 27 components in this category. Eight components are classified as having significant contamination on the basis of average total surface contamination levels that range from about 7,000 to over 60,000 dpm/100 cm^2, generally on the basis of pre-1992 data. Component classification is shown in Table 2.10.

2.4.3.9 Aboveground Equipment, Utilities, and Piping

Radiological survey data are available for four of the 18 components in this category. The sewage treatment Plant Incinerator (39D) has a total surface contamination level of 1,000,000 dpm/100 cm^2 based on one measurement taken before 1992. The other three components with data (hot side ore conveyor [2G], Plant 9 dust collector [9C], and the cooling towers [20C]) have average removable surface contamination levels (for 1992) below 1,000 dpm/cm^2; no data are available for total surface contamination. Component classification is shown in Table 2.11.

2.4.3.10 Belowground Equipment, Utilities, and Piping

The old cooling water tower (3K) is the only component in this category for which radiological survey data are available. Average removable surface contamination results for 1992 indicate that this component is not significantly contaminated. No data are available for total surface contamination.

2.4.3.11 Basins and Ponds

Of the eight components in this group, radiological survey data are available only for the sludge drying beds (25F). The average total surface contamination for the component

TABLE 2.10 Contamination Classification for Pads, Parking Lot, Roads, and Railroads[a]

Significant Contamination	No Significant Contamination
Plant 2 East Pad (74A)[b]	Railroad Tracks (G-001)[e]
Plant 2 West Pad (74B)[b]	Roads (G-002)[e]
Plant 8 West Pad (74D)[b,e]	Plant 8 East Pad (74C)
Plant 4 Pad (74E)[b]	Plant 7 Pad (74F)[d,e]
Plant 5 East Pad (74G)[b]	Plant 5 South Pad (74H)[d,e]
Plant 6 Pads (74J)b	Building 65 West Pad (74L)[e]
Plant 9 Pad (74K)[b]	Building 64 East Pad & R.R. Dock (74M)[e]
Decontamination Pad (74P)[b]	Plant 8 North Pad (74R)[d]
	Plant 1 Storage Pad (74T)[d,e]
	Pilot Plant Pad (74U)[d,e]
	Parking Lot (89)

[a] See Table 2.4 for ranking criteria.

[b] Categorized using total contamination.

[c] No data available for removable contamination.

[d] No data available for total contamination.

[e] Classification based on 1992 data only.

TABLE 2.11 Contamination Classification for Aboveground Equipment, Utilities, and Piping[a]

Significant Contamination	No Significant Contamination
Sewage Treatment Plant Incinerator (39D)[b]	Hot Side Ore Conveyor (2G)[c,d]
	Plant 9 Dust Collector (9C)[c,d]
	Cooling Towers (20C)[c,d]

[a] See Table 2.4 for ranking criteria.

[b] No data available for removable contamination.

[c] No data available for total contamination.

[d] Classification based on 1992 data only.

on the basis of pre-1992 measurements is 18,000 dpm/100 cm^2, and the component is classified as significantly contaminated. No information is available on removable surface contamination.

2.4.4 Waste Volumes

Table 2.12 summarizes preliminary estimates of volumes of potentially contaminated materials in OU3 by material type. Estimated volumes by component are provided in Table A.7. Those estimates are based on the assumption that all material in OU3 except that in clean draw piles (rock salt, sand, gravel) is contaminated. The estimates given are only for the volumes of materials included within the definition of OU3. For example, the only soil included is that in existing soil piles. The estimates represent in-place volumes of materials. Potential treatment or disposal volumes are different because of the compaction or bulking of some materials that would occur before treatment or disposal. Possible effects of removal actions on such volumes have not been considered. Volumes were generally estimated from drawings for the individual components. Table 2.12 does not include estimates of any quantities of drummed wastes and product. Those estimates are provided separately in Tables A.5.0, A.5.1, and A.6 of Appendix A.

As indicated in Table 2.12, several types of potentially contaminated materials are present in OU3. By volume, the major categories of these materials are concrete, soil/rubble, and building contents. Building contents are listed in the "other" category in Table 2.12 and consist principally of equipment and furniture or fixtures.

The major uncertainty associated with the estimates provided in Table 2.12 involves the volume of building contents. Accurate estimates of such volumes are not available. The estimate provided here is based on the assumption that contents generally occupy a fixed fraction of all building interior volumes. The major uncertainty associated with the estimated volume of structural materials in buildings involves quantities of structural steel used in walls; the volumes provided underestimate the quantity of such materials. Because of the irregular shapes and/or extent of some components, significant uncertainties also exist for estimates for the container and piping groups. With the exception of building volumes, the volumes provided are generally underestimates of actual materials present because only known volumes are included.

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TABLE 2.12 Volumes of Potentially Contaminated Materials in OU3[a]

Component Category	Volume (1,000 ft^3) by Material Type								
	Concrete	Cement Block	Steel	Transite	Other Metal	Soil/Rubble[b]	Asphalt	Other/Misc.[c]	Total
Buildings									
Structural materials	1,700	300	31	40	0	0	0	39[d]	2,100
Contents[e]	0	0	0	0	0	0	0	2,700[e]	2,700
Containers, etc.	130	0	7	0	0	0	0	4[f]	140
Bulk material	0	0	2	0	550[g]	980	0	190[h]	1,700
Pads, etc.	440	0	2	0	0	0	450	34[i]	920
Piping, etc.	56	0	12	0	0	0	0	20[j]	88
Ponds and basins	5	0	0	0	0	0	0	13[k]	19
Miscellaneous materials	41	0	4	0	0	0	0	9[i]	53
Totals	2,400	300	58	40	550	980	450	3,000	7,700

[a] Source: Table A.7; estimates are preliminary and are for in-place volumes. Columns may not add to totals due to independent rounding. Zeros in the table mean either that no material of the type indicated is present in that category or that the quantity is small compared with that in other major categories for which estimates are provided. Note, however, that the "other" category may include materials that could be placed in one or more of the other categories if more information were available.

[b] Includes all types of rubble, including concrete. No soil surrounding any structures, piping, etc., is included.

[c] Includes material that may be a combination of materials listed in other columns.

[d] Includes various materials such as wood, fabric, and roofing.

[e] Estimated on the assumption that the volume of contents generally equals 10% of the interior volumes of buildings. Includes all contents of buildings.

[f] Tiles and bricks.

[g] Various scrap metals, uncompacted.

[h] Coal.

[i] Wood.

[j] Wood and electrical equipment.

[k] Crushed limestone.

2.4.5 Summary of Conditions

The nature of information available on contamination in OU3 varies considerably. Radiological contamination in OU3 is fairly well known for many components, at least regarding total activity, but chemical contamination remains essentially unquantified. Locations and quantities for some nonradiological contaminants, such as PCBs, are known to a moderate degree because of ongoing related programs. In particular, asbestos has been evaluated extensively. Given the cumulative information regarding both radiological and chemical contaminants and the knowledge of process operations history, the potential extent of contamination is widespread within OU3. Details, including the physical form and, in general, the magnitude of contamination, are yet to be determined. What is expected, however, is extensive uranium contamination, with thorium contamination in some components, prevalent asbestos sources, and local contamination with PCBs and other contaminants. Isotopes in the uranium and thorium decay chains are the most widespread contaminants and the most likely contributors to the observed radiological measurements. Asbestos was widely used in building materials, and PCBs were essential materials in electrical components. Contamination of primarily porous building materials with VOCs is likely to be insignificant, because of the potential for ready diffusion of the contaminants to air pathways. Conversely, inorganic and nonvolatile contaminants might tend to collect in these same materials.

Because of similarities in general activities, original construction materials, and process materials at the FEMP, a base group of potential contaminants applicable to all process-related components has been identified: uranium, asbestos, lead, PCBs, and mercury. The same base group of potential contaminants applies to most non-process-related components also. However, administrative buildings are not expected to contain significant levels of hazardous substances.

2.5 SUMMARY OF INTERIM ACTIONS

2.5.1 Introduction

Several interim removal actions that will affect OU3 components are ongoing or being planned for the site. Depending on the specific action, these activities could affect

physical conditions, the nature and extent of contamination, or accessibility for conducting RI/FS field studies.

Components that will be disposed of or dismantled as part of a removal action will be characterized through sampling and analysis defined in work plans or procedures for that removal action. In some instances, the interim activities will generate data needed for the OU3 RI/FS program. For example, information gathered by field characterization of wastes (debris) generated during demolition of a component as part of an interim action will be used as input to decisions concerning treatment or disposal of the generated waste (if processing of that waste is included as part of OU3 remedial action). Most of the interim activities are directly supportive of the objectives for continued safe and environmentally protective maintenance of the facility during the CERCLA remediation process.

This section describes specific work scopes and schedules for these ongoing and future activities at the FEMP to facilitate the integration of those activities into the RI/FS and remedial action process.

The DOE will develop and perform CERCLA removal actions in accordance with the provisions of Section IX of the Consent Agreement to abate, minimize, stabilize, mitigate, or eliminate the release or threat of release of hazardous substances, pollutants, contaminants, or hazardous constituents at or from the FEMP. The Consent Agreement also stipulates that the DOE is to notify the EPA in writing of proposed removal actions (i.e., through submittal of removal action work plans) and allow EPA an adequate opportunity for timely review and comment (with the exception of emergency removal actions). The submitted work plans include milestone schedules that become enforceable under the Consent Agreement.

Several CERCLA removal actions are in various stages of development within OU3. These actions can be categorized as (1) CERCLA removal actions that were in progress before the renegotiated Amended Consent Agreement of September 1991 (referred to as phase I removal actions), (2) CERCLA removal actions identified in the Amended Consent Agreement of September 1991 (referred to as phase II removal actions) and (3) new removal actions that have been identified by DOE in correspondence (January 1992) to the EPA subsequent to the signed Consent Agreement. The initial set of new removal actions is referred to as phase III removal actions in the Amended Consent Agreement. The existing removal actions, as well as the need for additional removal actions, are to be reviewed annually by DOE.

Thirteen removal actions that can affect the implementation of the RI/FS for OU3 have been identified and are described below. Included are one phase I action (Section 2.5.2), six phase II actions (Sections 2.5.3 and 2.5.5 through 2.5.9), five phase III actions (Sections 2.5.10 through 2.5.14), and one emergency action (Section 2.5.4).

The five new phase III removal actions identified at this time address Plant 7 dismantling, the Pilot Plant sump, the nitric acid tank car/area, management of contaminated structures, and the ongoing asbestos-abatement program. Potential new removal actions are evaluated through the removal site evaluation (RSE) process on a case-by-case basis at the FEMP. The RSE process evaluates whether a removal action is warranted under the criteria of the National Contingency Plan (NCP). The Amended Consent Agreement of September 1991 allows for development of a phased approach for CERCLA removal actions to facilitate and expedite the identification and implementation of removal actions at the FEMP. As response actions at the site progress, DOE has agreed to review the existing removal actions and the need for additional removal actions on or before January 15, 1993, and every year thereafter through the record of decision (ROD) for OU3.

The one emergency removal action currently identified within OU3 addresses the disposition of approximately 226,000 gal of uranyl nitrate (UNH) solution in the refinery area. Small UNH piping leaks were discovered on September 17, 1991; therefore, this project was designated as an emergency removal action on September 30, 1991.

The scope of work and the data obtained for future removal actions are to be compatible with the ongoing RI/FS process at the FEMP. Therefore, data collected for phase III and future removal actions, in order to be useable in the OU3 RI/FS, must be consistent with the data quality objectives of this document. The schedule information provided in the following sections depends on reasonable review and approval cycles and receipt of all necessary requested funding.

2.5.2 Plant 1 Pad Continuing Release Removal Action

Plant 1 was the sampling plant for the FEMP and was, therefore, the location of large amounts of uranium metal process residues and waste materials. The concrete storage pad associated with Plant 1 (74T), which has been designated as a hazardous waste management unit (HWMU), has been used for drum storage to support these operations since

1952. The Plant 1 pad and adjacent unpaved area comprise approximately 12 acres on the northwestern side of the process area. As of January 1992, the pad held about 42,000 drums of material, plus scrap pallets and the scrap copper storage pile.

Some of the carbon steel drums used to store materials on the pad have deteriorated because of extended exposure to the elements, thereby increasing the risk of release of hazardous materials to the environment. The pad has a number of cracks and control joints that may permit released contaminants to migrate to the underlying soils. For these reasons, a CERCLA removal action is underway for the Plant 1 pad. This project is identified as Removal #7 in the Amended Consent Agreement of September 1991.

The proposed removal action contains three stages of activity. Stage I involves the installation of a membrane on the western edge of the Plant 1 pad extending into the adjacent grassy area where contaminated runoff has occurred. The membrane will provide a clean surface to direct rainwater to the storm-sewer system and provide run-on control during construction in this area. Stage II involves removal of soils from the area until an average total uranium concentration of 35 pCi/g is attained in the grassy area west of the existing Plant 1 pad. A new 100,000-ft^2 pad will be constructed, including two 40,000-ft^2 covered controlled storage structures. Stage III involves installation of a clean layer of concrete, sealed between two impermeable barriers, over the 375,000 ft^2 of existing Plant 1 pad. A 22,500-ft^2 covered storage area and new curbing will also be erected on the new concrete. Closure of the Plant 1 pad is not intended at this time. A Part B application for a RCRA storage permit for the Plant 1 pad has been submitted to the Ohio EPA. The proposed removal action is protective of human health and the environment and will be conducted consistent with all CERCLA and RCRA requirements.

Stage I of this removal action was completed in January 1992. Stage II was completed in December 1992. Stage III is scheduled to begin in 1993 and to be completed by February 1995.

2.5.3 Safe Shutdown

In July 1991, the FEMP initiated a "safe shutdown program" to provide planning, engineering, and program control for the proper disposition of uranium products and in-process residue materials, excess supplies, chemicals, and associated process equipment.

The program also is intended to ensure the proper characterization, emptying, and de-energization of the majority of existing previously operated, production-related items of equipment. This project was designated as Removal #12 in the Amended Consent Agreement of September 1991.

One of the major objectives of the safe shutdown program involves the removal of materials from previously operated production-related equipment. After confirmation of characterization, these materials will be transferred to appropriate containers and either stored at approved locations awaiting final disposition under the CERCLA program for OU3 or disposed of consistent with criteria and requirements of Removal #9, "removal of waste inventories." With the transfer of materials to storage containers, the potential for an incident or release to the environment will be significantly reduced. The equipment will then be de-energized, disconnected, and disposed of according to established DOE orders and any currently applicable FEMP policies and procedures. Another major objective of the safe shutdown activities is to identify off-site customers or users for existing FEMP equipment. The equipment will be decontaminated to the required level of its end use (e.g., equipment sent to other DOE sites for reuse may require less decontamination than equipment to be reused by the private sector). Equipment will be characterized (for the purpose of disposition), and any easily releasable/migratible contamination will be removed under the safe shutdown program. Equipment and materials will be characterized on the basis of process knowledge, existing RCRA determinations, applicable Material Safety Data Sheets (MSDSs), and radiological contaminant surveys.

The safe shutdown removal action is to be an ongoing activity at the FEMP up to the ROD for OU3. The work procedures detailing activities to be performed during safe shutdown were submitted to the U.S. EPA and the Ohio EPA on October 31, 1991. These procedures will be updated every June throughout the program. Activities of this removal action are scheduled to continue through 1997 and will address the Pilot Plant and Plants 1, 2/3, 4, 5, 6, 8, and 9.

The activities of the safe shutdown program can be delineated as follows:

1. Perform a preliminary assessment of equipment, including calculated holdup material, utilities servicing equipment, associated permits, and

associated sumps; and evaluate existing data, such as previous RCRA determinations based on the material source code of the equipment.

(Field Activities Begin)

2. Remove excess material to an approved storage location.
3. Isolate utilities for process equipment.
4. Gain entry to contaminated process equipment.
5. Transfer holdup material to storage containers.
6. Transfer the filled storage containers to an approved storage location.

(Field Activities End)

7. Document activity (information to be transferred to OU3).

The schedule of field activities for the safe shutdown program is given in Table 2.13.

2.5.4 Uranyl Nitrate Stabilization

Stabilization and disposition of approximately 226,000 gal of UNH solution in the Refinery area was initiated as an emergency removal action on September 30, 1991, because small UNH piping leaks discovered on September 17, 1991, posed an imminent threat to the environment.

The field activities to be performed under the safe shutdown program for this project include:

1. Transfer 226,000 gal (in 10 or more batches) of UNH solution from 20 aboveground storage tanks in the Refinery area to blend tanks.
2. Blend the UNH solution in the blend tanks to a uniform mix, adding water to create the optimum concentration for neutralization and subsequent uranium precipitation.
3. Transfer the blended UNH solution to receiving tanks in the Refinery sump.

TABLE 2.13 Safe Shutdown Schedule Goals[a]

Plant (Component No.)	Tentative Start of Field Activities	Tentative Finish of Field Activities
Plant 9 (west side) (9A)	July 1993	May 1994
Plant 8 (dry side) (8A)	October 1992	July 1993
Pilot Plant (13A, 37, 54A)	October 1992	January 1996
Plant 6 (6A)	July 1993	March 1995
Plant 1 (1A)	October 1992	January 1996
Plant 5 (5A)	July 1993	March 1995
Plant 2/3 (2A, 3E, 3J, 3H, 3D)	October 1992	November 1996
Plant 4 (4A)	May 1994	January 1996
Plant 8 (wet side) (8A)	November 1996	September 1997
Plant 9 (east side) (9A)	October 1992	July 1993

[a] The schedule information provided is based on preliminary estimates and depends on funding and the disposition of equipment.

4. Precipitate the uranium content (100 metric tons nominal amount) from the UNH solution by the addition of magnesium hydroxide slurry and/or lime.
5. Transfer the precipitated uranium slurry to Plant 8 receiving tanks.
6. Filter the uranium slurry through the east and/or west Eimco water treatment process filters (in Component 8A).
7. Collect, sample, and drum the wet filter cake from the Eimco filters.
8. Store the drummed filter cake on the Plant 1 pad (74T) until analysis of the filter cake is complete.
9. Transfer the drummed filter cake to the appropriate storage area, depending on the analytical results.

2.5.5 Plant 1 Ore Silos

The Plant 1 ore silos (1C) were constructed in 1953 for use in sampling and blending ores before processing in the Refinery (Plant 2/3). This system proved to be inefficient and was removed from service. In about 1955, the silos were used temporarily as overflow storage for the cold metal oxides stream, which was a by-product of ore processing. In 1962, the ore silos were emptied and the material they contained was shipped off-site. Since 1962, the small amounts of residues remaining within the silos have fallen off the inner sides and collected in cones at the bottom of the silos. The estimated heights of these cones of material range from 0 to 4 ft.

The ore silos include the two groups of silos south of Plant 1, consisting of eight glazed tile silos to the west and six reinforced concrete silos to the east. Four of the glazed tile silos are 44 ft tall and the other four are 10 ft tall. The six reinforced concrete silos are 10 ft tall. The eight glazed tile silos sit on a separate superstructure from the six reinforced concrete silos. The superstructure for the glazed tile silos is approximately 38 ft tall and connects the silos by a mezzanine.

Spalling of the tile shells because of weathering was first observed on the eight tile silos in the 1970s. This deterioration has continued to the present. The steel support structures exhibit signs of extensive corrosion, with rust evident throughout. Because of the

questionable integrity of the silos and their supporting structures, a structural evaluation was performed in late 1990 and early 1991, and it was recommended that the entire facility be demolished. The structural condition of the silos poses a threat to human health and the environment. This threat was examined in a removal site evaluation (RSE), and DOE issued an Action Memorandum determining that a "Time Critical Removal Action" was appropriate. This project was identified as Removal #13 in the Amended Consent Agreement of September 1991.

The removal action work plan outlines the approach to remove the eight tile silos, the six concrete silos, and their associated structural steel supports and support piers down to the concrete pad. The work will include (1) installing protective structures for nearby facilities; (2) installing temporary containment systems; (3) erecting scaffolding and preparing the silos for removal; (4) removing the silos; (5) segregating, reducing the size, and packaging wastes for disposal; (6) removing, reducing the size, decontaminating, and disposing of the structural steel; and (7) cleaning and decontaminating the equipment and the area. All activity will be controlled to prevent the spread of contamination. The work areas will be isolated with physical barriers and a ventilated containment system. Ventilated air will be filtered through prefilters and high-efficiency, particulate air (HEPA) filters before discharge to the atmosphere. The following waste streams are expected to be generated by this removal action:

- Low-specific-activity radiological waste,
- Waste and materials that can be released without radiological restrictions,
- Cleaning and decontamination waste,
- Asbestos-containing material (in the form of transite panels), and
- Hazardous and/or mixed waste.

In addition to the above wastes, organic materials, such as gear box oil or transformer mineral oil, will be separated and transferred to existing on-site storage facilities for eventual treatment or disposal. Lead in the paint on the steel structures is nonleachable, and the paint will not be removed except in cases where burning is required to reduce the size of structural steel. The removal action work plan for this project was submitted to EPA

on January 10, 1992. The work plan was approved, with comments, on May 20, 1992; and the final revised work plan was submitted to EPA on July 15, 1992.

2.5.6 Contaminated Soils Adjacent to Sewage Treatment Plant Incinerator

The solid waste incinerator (39D) is located in the northwestern corner of the sewage treatment plant area at the FEMP. This incinerator was operated from November 1954 through December 1979, when a new incinerator (39A) was placed in service.

The original incinerator at the sewage treatment plant was used to burn both contaminated and uncontaminated trash. Soil sampling results from the RI/FS and other studies indicate that concentrations of radionuclides in the soils adjacent to the solid waste incinerator are above background levels. The concentrations of uranium-238 range from 1.8 to 25,670 pCi/g in surface soil (0-6 in. deep). The highest concentrations were found in contaminated soil in the immediate vicinity of the incinerator, with evidence of downwind dispersion to the northeast of the incinerator.

The incinerator is located within the fenced area of the sewage treatment plant compound, but several areas of contaminated soils are located outside the fenced boundary. Under a lease agreement with DOE, a neighboring landowner uses some of the area outside the fence for cattle grazing. A new electric fence was installed in the leased area during April 1991 to control access by the cattle. A removal action work plan was prepared for contaminated soils from the incinerator area at the sewage treatment plant. During walk-over radiation surveys, investigators using gamma survey instruments also detected additional contamination near the primary settling basins in the southeastern corner of the treatment plant compound.

Before initiation of field activities, no analyses had been conducted for nonradiological parameters, such as organic materials and metals, for the incinerator site. Effluent from the incinerator stack is not likely to have produced any soil contamination by volatile or semivolatile compounds, because these compounds are unlikely to survive the incineration temperatures. However, trace metals and thermally stable compounds could be present. The sampling and analysis section of the removal action work plan includes additional characterization and analysis to identify additional contaminants that may be present.

The proposed activities for this removal action were originally subdivided into three phases. The first phase of work established a grid for subsequent walkover surveys and postexcavation sampling. An unshielded 2-in. x 2-in. NaI detector was used to detect hot spots for later soil sampling. Soils with greater than 100 pCi/g of total uranium were marked for excavation. The original plan was to excavate all soils with total uranium contamination greater than 100 pCi/g; however, the area was found to be too large to effectively manage. As a result, a higher, interim action level of 300 pCi/g total uranium was established, and excavations were initiated in September 1992. Preliminary excavations, as well as additional sampling activities to better define the extent of contamination across the 100-pCi/g boundary, were completed in October 1992. The current plan is to submit a work plan addendum to EPA on January 6, 1993, detailing any further characterization or excavation activities required to complete the removal action.

2.5.7 Scrap Metal Piles

The FEMP has stored scrap metal on the decontamination pad (74P) in the northeastern section of the Process Area and on the Plant 1 pad; this scrap metal pile inventory falls within the scope of OU3. The DOE has committed to conduct the "scrap metal piles removal action" (identified as Removal #15) at the FEMP under the Amended Consent Agreement of September 21, 1991. This removal action is being conducted because of preliminary indications that the open storage of contaminated scrap metal is contributing to the presence of elevated uranium concentrations in the air and in storm-water runoff. The inventory of scrap metal to be included in this removal action is as follows:

- 240 tons of high-count* contaminated recoverable ferrous metal,
- 2,850 tons of low-count† contaminated recoverable ferrous metal,
- 55 tons of high-count contaminated recoverable nonferrous metal,
- 140 tons of low-count contaminated recoverable nonferrous metal, and
- 1,370 tons of copper (with asbestos-containing wraps).

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*High-count is defined as fixed alpha contamination greater than 200,000 dpm per probe area.

†Low-count is defined as fixed alpha contamination less than 200,000 dpm per probe area.

With the exception of the copper, all of the scrap metal was generated at the FEMP and stockpiled on the site. The material came from demolition projects, abandoned equipment, drums, and upgrade of facilities and vehicles. The copper was generated by a cascade upgrade project at another DOE facility in Paducah, Kentucky, and was sent to the FEMP for shredding and casting. However, the project was later abandoned because of the high concentrations of uranium in the copper.

The waste material included in this removal action is considered to have properties that make it attractive for resource recovery. Disposition of the waste metals will emphasize recycling or beneficial reuse, including both release of the materials without radiological restrictions, as allowed by federal regulations and DOE orders, and controlled reuse in place of virgin resources that might eventually become radioactively contaminated and thus classified as low-level waste.

The DOE will initiate two separate requests for solicitation of commercial services associated with the scrap metal piles removal action. One request will involve the copper metal piles (P-004), and the other will involve the recoverable ferrous and nonferrous metal pile (P-006). The multiple objectives of this removal action are as follows:

1. Provide safe interim storage and/or final disposition of the recoverable ferrous and nonferrous metal located on the decontamination pad and the scrap copper located north of the current Plant 1 pad, pending completion of the OU3 RI/FS and initiation of final remedial action.

2. Process the recoverable portion of the scrap metal pile located at the decontamination facility pad for beneficial reuse or release without radiological restrictions.

3. Containerize solid waste materials generated incidental to performing the operations of bulk packaging and decontamination of the subject metals. (Containerized solid waste material will be managed consistent with the procedures and supporting documentation for Removal #9, see Section 2.5.9).

4. Conduct all operations in a safe and efficient manner, considering ALARA principles and best management practices, and use the

appropriate controls to mitigate potential releases from removal operations.

The removal action work plan for this project was submitted to the EPA on January 31, 1992. EPA approval was obtained on May 15, 1992.

2.5.8 Improved Storage of Soil and Debris

As a result of the operation of the FEMP, various types of contaminated soil and debris have been, and will continue to be, generated, managed, treated, and disposed of. Waste soil and debris are generated at the site during removal actions, remedial actions, construction projects, and maintenance activities. Because of limited disposal capacity and uncertainty regarding the required disposition of these waste materials, soil and debris are currently being accumulated on the site in open piles. However, left uncovered, these piles are exposed to the weather, and contaminants could be transported to surrounding uncontaminated areas. This removal action is being undertaken to provide improved storage of these open waste piles, as well as to establish procedures for the management and storage of soil and debris generated in the future. This removal action is identified as Removal #17 by the Amended Consent Agreement of September 1991.

The goal of this removal action is to establish a site-wide management concept and implementation strategy for the improvement of contaminated soil and debris storage at the FEMP. The soil and debris managed by this program will be sampled and evaluated for remediation under this OU3 Work Plan Addendum.

The scope of work for this removal action includes the installation of four containment structures, as follows:

1. Central Storage Facility (CSF) — The CSF containment structure will be used to store contaminated soil (contaminated with radionuclides above 100 pCi/g and/or contaminated with other hazardous substances) and nonrecoverable debris generated from various areas throughout the FEMP. Materials will be segregated in the containment structure on the basis of the type of contamination (e.g., asbestos, PCBs, and petroleum hydrocarbons). Material will remain in the CSF until it can be decontaminated, treated, or packaged for final disposal.

2. Decontamination Facility Pad (DFP) — This containment structure will be located near a new decontamination facility (Component 78). The DFP will be used to store contaminated recoverable metal, materials, and equipment until they can be decontaminated.

3. Scrap Metal Pad (SMP) Cover — This containment structure will be built over the existing pad for the scrap metal pile. The contaminated metal will be stored there until it can be sent for decontamination or shipped off-site for disposal.

4. Soil and Rubble Pile Cover (SRPC) — This containment structure will be built over the existing soil and rubble pile located in the northwestern corner of the Production Area on Third Street. The contaminated material will remain in this in-place containment structure until it can be decontaminated, treated, or packaged for final disposal.

About 20 soil and debris stockpiles containing more than 50,000 yd^3 of material are located on the site. The largest of these stockpiles is located north of the Plant 1 pad near the CP storage warehouse (56A) on Third Street. Approximately 4,000 yd^3 of soils excavated during the UST removal/remediation projects at the FEMP also is being addressed by this action. The removal action work plan for this project was submitted to the EPA on March 25, 1992, and was approved on October 5, 1992.

2.5.9 Removal of Waste Inventories

In August 1985, the FEMP initiated a large-scale off-site waste shipment program involving the transfer of inventoried and newly generated waste to the Nevada Test Site. That program involves the characterization, treatment, packaging, and transport of waste in a manner that ensures full compliance with DOE orders, Department of Transportation shipping requirements, and Nevada Test Site waste acceptance criteria. To date, approximately 300,000 drum equivalents (DEs) have been transferred from the FEMP to the Nevada Test Site for disposal. The future actions for this project are subdivided into two distinct programs: (1) low-level radioactive waste (LLW) management and (2) thorium

management. This program does not currently include chemical (nonradiological) or mixed (chemical/radiological) wastes.

This ongoing waste shipment program began before the CERCLA RI/FS process was initiated at the FEMP. However, the Consent Agreement provided that DOE would submit a compilation of existing procedures and other documentation to support the reconfiguration of the existing waste shipment program into a removal action under the terms of the Consent Agreement and would continue ongoing activities consistent with current procedures while the EPA was reviewing the submittal. This position was intended to provide for the continuity of ongoing site operations, the elimination of unnecessary or duplicative documentation, and the desire not to adversely affect ongoing cleanup initiatives. This action was identified as Removal #9 by the Amended Consent Agreement of September 1991.

Both the LLW and the thorium programs of the "removal of waste inventories removal action" are within the scope of OU3 of the ongoing site-wide RI/FS. The implementation of this removal action clearly supports the remedial objectives for OU3 by providing a necessary preliminary step for preparation of these areas for subsequent remedial activities. Both program actions are consistent with final remedial actions because mitigation of personnel and environmental risk and safe, permanent disposition of FEMP wastes and materials are ultimate goals. Establishment of safe storage configuration or off-site disposition of wastes currently in inventory at the FEMP will allow for the development of permanent disposition for the large quantities of wastes associated with remedial action. In addition, characterization of these materials will only be required as part of the OU3 field program for residues that have not been disposed of under this removal action.

This removal action is envisioned as an ongoing activity at the FEMP through the ROD for OU3. Close coordination will be maintained with the ongoing RI/FS for OU3 to ensure that the activities of this removal action appropriately support RI/FS field investigations and evaluations of alternatives.

2.5.10 Plant 7 Dismantling

Plant 7 (7A) is an abandoned facility at the FEMP that formerly was used for reduction of uranium hexafluoride to uranium tetrafluoride. Plant 7 has been designated for dismantling by a CERCLA removal action. This removal action is to be considered the

prototype of future decontamination and dismantling efforts at the FEMP under OU3. The work scope of this removal action addresses the aboveground portion of the main structure. The Plant 7 structure will be dismantled down to its concrete foundation. Disposition of auxiliary structures, such as a crane and substation, will be addressed by the RI/FS process for OU3. Utilities supplying the facility will be appropriately isolated by this removal action.

Preliminary estimates indicate that Plant 7 incorporates about 1,468,000 lb of structural steel and 665,000 lb of transite (166,000 ft^2). The remaining equipment and drums within the plant will be relocated before decontamination and dismantling activities begin. The structure is to be decontaminated in place before it is dismantled. The dismantled steel will be decontaminated as appropriate for potential release without radiological restrictions. The concrete and debris will be disposed of in accordance with guidelines being developed for Removal #17 (Section 2.5.8). The dismantled transite will be handled according to existing FEMP procedures for asbestos-containing material. The removal action work plan for this project is to be submitted to the EPA by April 20, 1993.

2.5.11 Pilot Plant Sump

The Pilot Plant sump (13A) is located at the southwestern side of the Pilot Plant. The sump is a stainless steel cylinder approximately 2 ft in diameter and 10 ft deep. It was built to remove liquids from the floor drains of the Pilot Plant and was actively used only during the renovation of the plant in 1969. The sump is filled with a thick liquid and sludge. Analyses of the sump contents show high concentrations of metals (lead, chromium, barium, and cadmium), as well as thorium and volatile organic compounds (1,1,1-trichloroethane). This sump has been identified as an HWMU under the RCRA program at the site.

The proposed field actions for this project include removal of the liquid and sludge from the sump and removal of the tank to mitigate the potential for a release to the environment. The sump may still be connected to the abandoned floor drain system in the Pilot Plant. The proposed removal action will include efforts to verify any connection and to remove contamination associated with the floor drain system, if possible. The removal action work plan for this project was submitted to the EPA on July 23, 1992.

2.5.12 Nitric Acid Tank Car/Area

The nitric acid rail car is located on the northern perimeter of the Production Area east of Building 63. The RCRA Part A and Part B application for the FEMP identifies this tank car and the area surrounding it as an HWMU.

The high-grade stainless-steel tank car has a capacity of about 100,000 lb and measures approximately 10 ft wide, 40 ft long, and 15 ft high. The tank car was used from 1952 until about 1989 to store nitric acid at the FEMP. Recent analysis indicates that the tank car now contains about 50-100 gal of nitric acid.

The proposed field actions for this project include removal of the contents, followed by decontamination and disposition of the tank car. In addition, soils in the surrounding area will be analyzed for contaminants that may have been released from the tank car. As appropriate, contaminated soils will be excavated and disposed of. The removal action work plan for this project was submitted to the EPA on October 30, 1992.

2.5.13 Management of Contaminated Structures at the FEMP

The Amended Consent Agreement of September 1991 stipulates that DOE is to perform and report upon a study detailing existing buildings and facilities that will be needed during remediation of the site. That study is to identify buildings that are no longer needed and can, therefore, be removed. The study is intended to allow for the systematic planning of removal actions that address structures in the Production Area. The study will be submitted to the EPA by January 15, 1993, and will be reviewed annually and updated as needed. An engineering evaluation/cost analysis (EE/CA) is also to be submitted to the EPA by December 16, 1992, to support the proposed removal actions for managing contaminated structures or facilities.

The EE/CA will document the selection of responses that will mitigate the potential threat to workers, the general public, and the environment associated with these structures or facilities and will address health and environmental impacts associated with the proposed action. The EE/CA will be completed in a manner consistent with the technical approach contained in this OU3 RI/FS Work Plan Addendum. The EE/CA is to consider interim disposition issues addressed in the OU3 Work Plan, as well as issues related to ongoing site activities and integration with other operable units.

The goal of this activity is to establish a broad-based removal action to support the implementation of cleanup actions for contaminated facilities at the FEMP. On the basis of the annual facility utilization study (Section IX.E.4 of the Amended Consent Agreement) and an assessment of available funding, the DOE will propose, within the annual removal action review, dates for submitting work plans describing discrete actions to be taken within the framework of the removal action. The work plans will be submitted to EPA for approval consistent with Section IX.C of the Amended Consent Agreement. These actions for the management of contaminated structures and facilities at the FEMP are expected to continue up to, and possibly beyond, the ROD for OU3.

2.5.14 Asbestos-Abatement Program

Asbestos-removal program activities were identified as a phase III removal action to document the ongoing asbestos-abatement activity at the FEMP. The primary objective of the ongoing asbestos-abatement program is to mitigate the potential risk to site employees and the environment from asbestos at the site. Future remediation efforts at the site are expected to generate large volumes of asbestos-containing material (ACM) that will require abatement, storage, and disposition. The Asbestos Survey and Assessment report depicting the location of asbestos and ACM at the FEMP was submitted to WEMCO on February 28, 1992 (Diagnostic Engineering, Inc. 1992). The survey identified 56 of 74 facilities surveyed as having ACM. The survey results are summarized in Table A.4.5 in Appendix A. The results of the report will be used to determine future asbestos projects at the FEMP.

Minor asbestos projects have been, and will continue to be, addressed by the Fernald asbestos team that has been specifically trained to perform these tasks. These projects consist primarily of repairing, abating, and encapsulating asbestos and ACM that pose an immediate threat to employees or the environment. Asbestos and ACM generated on past projects have been packaged and shipped to the Nevada Test Site for disposal. Approximately 1,500 containers (Sea/Lands, wooden boxes, drums, and white metal boxes) of ACM currently are stored at the FEMP. New regulations pertaining to the disposal of ACM may require that these stored containers be opened and the contents repackaged as part of the removal action. The future disposition of ACM from the FEMP is not resolved at

this time. Shipments of ACM to Nevada have ceased, and new alternatives are being developed.

Major asbestos projects at the FEMP will be conducted by private contractors through a bid and award process. These projects are defined as repair or abatement to damaged transite panels and abatement of large volumes of pipe insulation. Several major asbestos-removal projects anticipated at the FEMP during 1992 and 1993 are as follows:

1. West end of the extraction area in Plant 2/3 (2A) (transite panels),
2. Scrap pickling area in Plant 6 (6A) (transite panels),
3. Digestion area in Plant 2/3 (2A) (transite panels),
4. Metal dissolver building (2A) (transite panels),
5. Two areas in the hot raffinate building, and
6. Asbestos removal in Plant 7 prior to building demolition (see Section 2.5.1.9).

The disposition of the asbestos/ACM generated by these six actions, as well as of the previously mentioned 1,500 containers stored at the site, is to be determined later.

The activities of the asbestos program are expected to continue up to, and possibly beyond, the ROD for OU3. Action on all asbestos/ACM not posing an immediate threat will be deferred to be addressed by the RI/FS process. Therefore, the activities of the RI/FS process and the asbestos program at the FEMP will require close coordination. The procedures and documentation for the asbestos-abatement activities at the FEMP were submitted to the EPA on May 19, 1992.

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3 EVALUATION OF DATA NEEDS

The objectives of Section 3 are to (1) identify the data needed to carry out the RI/FS process for OU3, (2) compare the data needed with those available (as discussed in Section 2), and (3) identify any unfulfilled data needs. Data are needed for the RI/FS process for general planning and for conducting specific tasks, as discussed in the following paragraphs.

A general understanding of OU3 is needed to successfully plan and conduct the RI/FS process for that unit. In particular, general knowledge of the contaminated areas, the sources of contamination, the potential contaminants, and the general location of contaminants is needed for planning purposes. Such information is also useful in identifying any areas with elevated levels of contamination and, thereby, avoiding any inadvertent exposure of workers to unexpectedly high levels of contamination during OU3 RI/FS activities. The type of general information needed for these purposes is available from the historical knowledge of operations at the site before it was shut down and from ongoing general surveys of the site for contamination. Many OU3 components have been surveyed recently.

General information about OU3 components is also needed for programmatic reasons. For example, the buildings that will be put to interim use during the RI/FS process will have to be surveyed and, if necessary, decontaminated commensurate with their intended uses. Information needed for such specific action will not be collected as a specified part of the OU3 remedial investigation. However, available RI data and data from other sources will be used as necessary to support programmatic decisions and activities.

In addition to the general requirements discussed above, data will be needed for the following specific tasks:

- Preparing the baseline risk assessment (Section 3.1),
- Evaluating the remedial action alternatives during preparation of the FS (Section 3.2), and
- Protecting workers during the RI field program (Section 3.3).

The data needs for these specific tasks are discussed in the sections indicated. Those sections also discuss the availability of the needed data. The unfulfilled data needs are then

summarized in Section 3.4. These data gaps will be filled during the RI phase of the RI/FS process. A strategy for obtaining the needed data is provided in Section 4. The Sampling and Analysis Plan (Appendix D) presents the detailed protocols and procedures that will be used to collect data during the RI phase.

3.1 PREPARATION OF THE BASELINE RISK ASSESSMENT

This section discusses the general approach to be used in conducting the baseline risk assessment for OU3 and identifies the data needed for that assessment. The baseline risk assessment provides a consistent framework for collecting information for decision making. Section 3.1.1 presents and discusses a conceptual site model for OU3 that provides the basis for the discussions that follow. Section 3.1.2 discusses issues involving the baseline risk assessment that relate to identification of data needs. Finally, Section 3.1.3 describes the data needed for the baseline risk assessment. The FEMP *Risk Assessment Work Plan Addendum* (DOE 1992b) provides more specific information on the methodology to be used for the baseline risk assessment.

3.1.1 Conceptual Site Model for Operable Unit 3

A conceptual site model was developed for the FEMP in the 1988 RI/FS Work Plan (DOE 1988a). Although the 1988 model included elements of OU3, a conceptual model specific for OU3 is included in this document. A unit-specific model is useful in providing a consistent basis for assessing risks posed by OU3 components, both in the event that no remedial actions are taken and under a series of cleanup alternatives. A conceptual model also establishes a framework for identifying data needs and assists in the development of general response actions. The conceptual model does not address risks to environmental receptors because such risks are considered under OU5, Environmental Media.

The elements necessary for a completed exposure pathway are represented in the conceptual model for OU3; these elements are:

- Contaminant sources,
- Release mechanisms,
- Contaminant pathways,

- Exposure routes, and
- Receptors.

Sections 3.1.1.1 and 3.1.1.3 through 3.1.1.5 discuss these elements in some detail. In addition, potential contaminants are discussed in Section 3.1.1.2. Section 3.1.1.6 provides a general summary by component group.

Relevant portions of the conceptual model for baseline conditions are presented in Figures 3.1 through 3.4 for each of the component groupings. The figures summarize paths that hazardous substances may take to reach potential receptors. Although many exposure pathways are possible, the conceptual site model focuses on those pathways that are most likely to contribute significantly to overall risks. More extensive discussion of exposure pathways is presented in Section 5 of the *Risk Assessment Work Plan Addendum* (DOE 1992b).

3.1.1.1 Contaminant Sources

In Section 2.2, OU3 components were discussed and categorized to group components that potentially act in a similar manner in releasing contaminants to the environment. Additional information on the component categories as sources of hazardous substances is presented below.

Buildings

Buildings have been placed in one of four categories — the administrative/support group, the warehouse/storage group, the process group, and the process support group — as discussed in the following paragraphs.

The administrative and support building group consists of 13 components for which previous characterization data and process knowledge indicate that little or no contamination should be present. These structures have been used primarily for office space and analytical laboratories. In general, these buildings have low levels of surface radiological

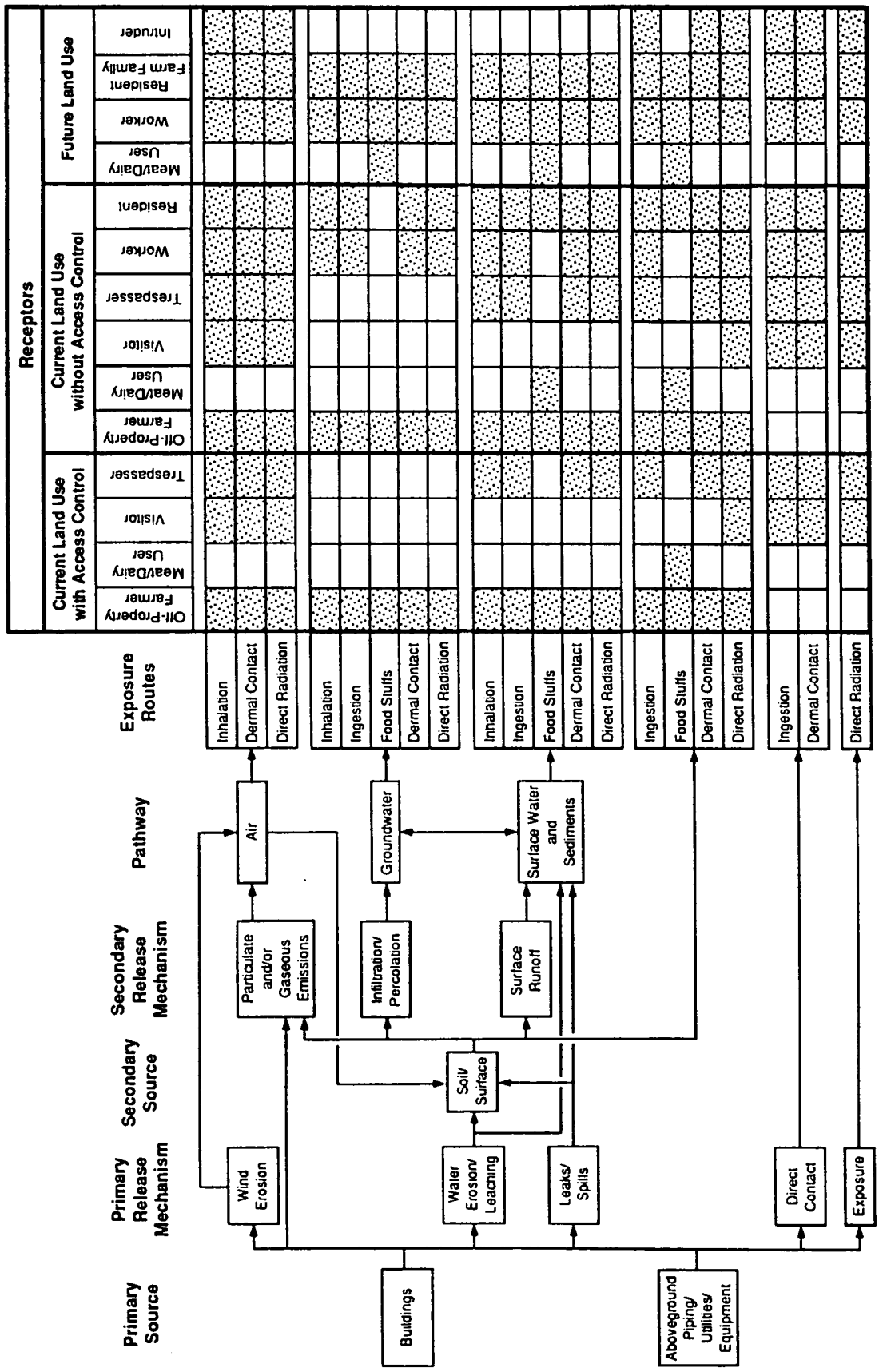

FIGURE 3.1 OU3 Conceptual Model — Buildings and Aboveground Piping, Utilities, and Equipment (Receptors are discussed in Section 3.1.1.5.)

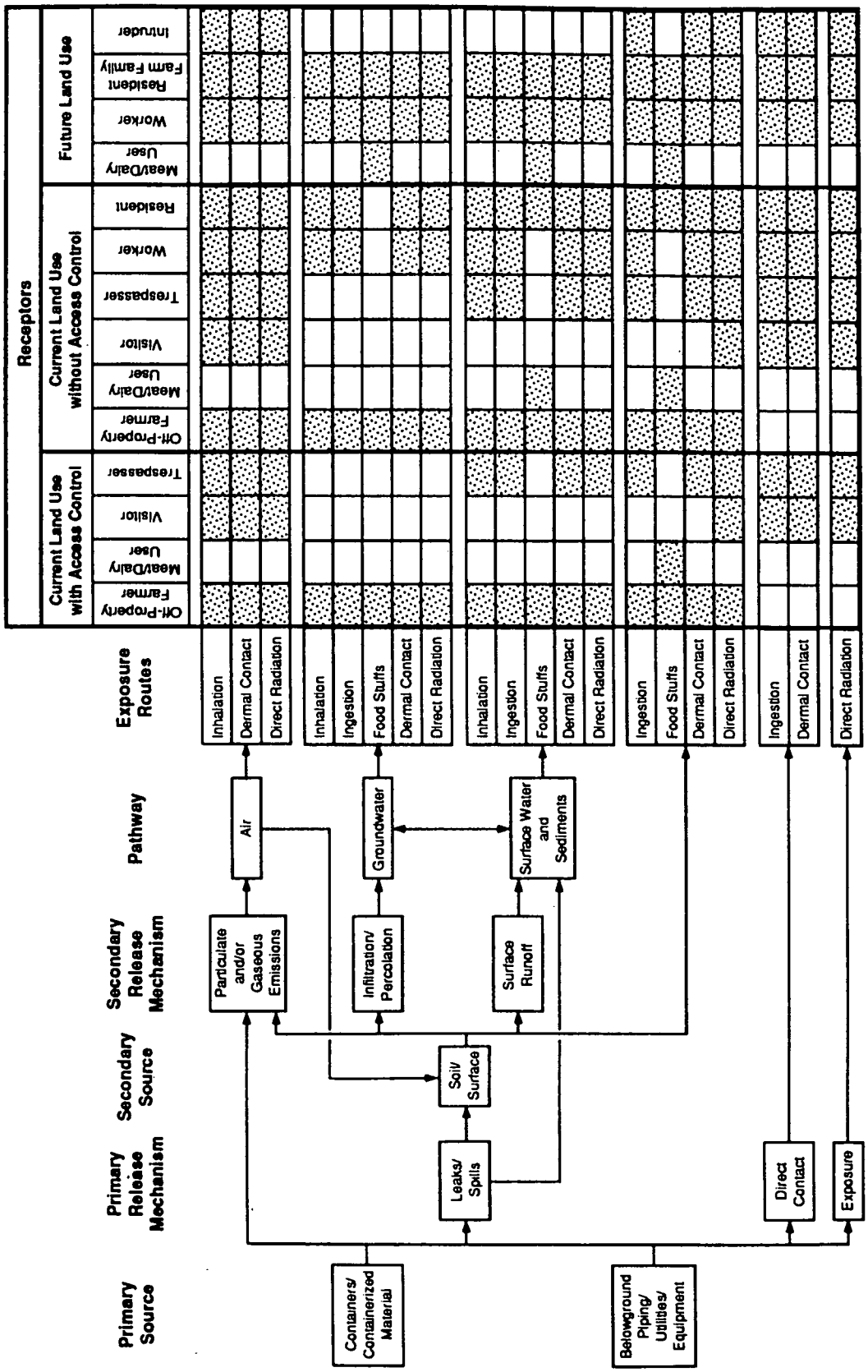

FIGURE 3.2 OU3 Conceptual Model — Containers and Containerized Materials and Belowground Piping, Utilities, and Equipment (Receptors are discussed in Section 3.1.1.5.)

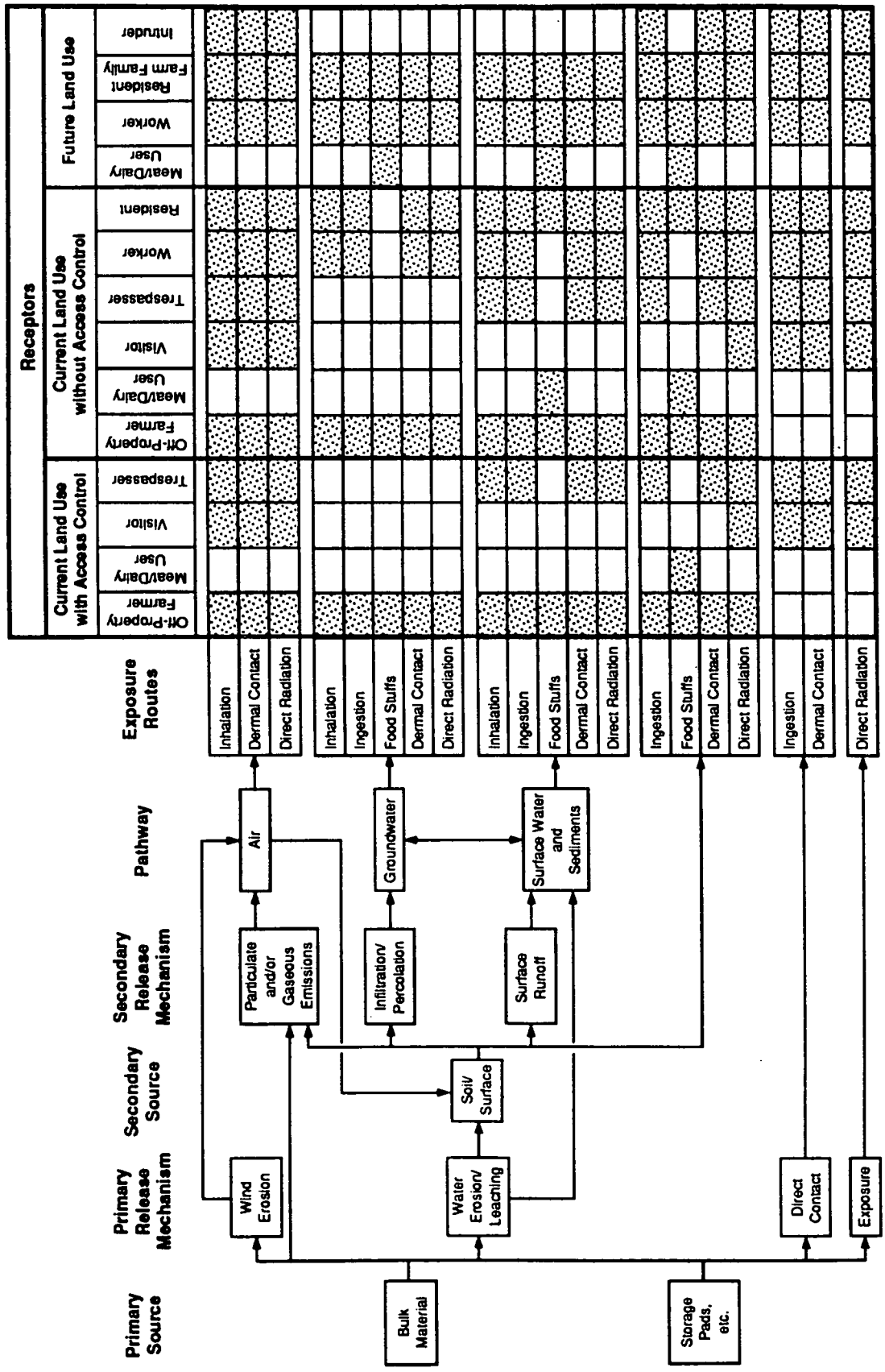

FIGURE 3.3 OU3 Conceptual Model — Bulk Material and Storage Pads, etc. (Receptors are discussed in Section 3.1.1.5.)

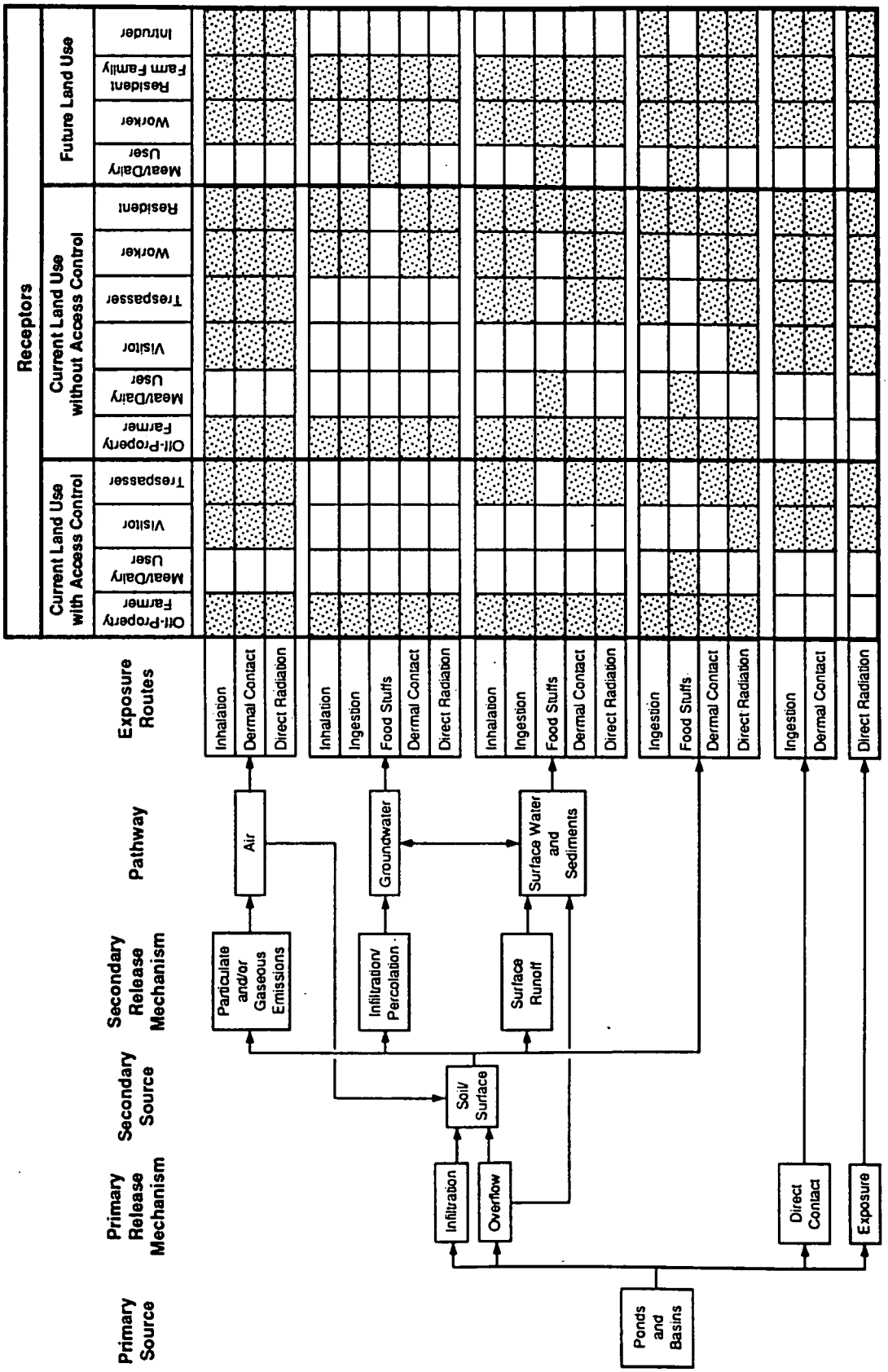

FIGURE 3.4 OU3 Conceptual Model — Ponds and Basins (Receptors are discussed in Section 3.1.1.5.)

contamination, both fixed and removable, and were not part of a materials process system or waste storage area. Although one component in this group (Building 45A) was previously used for machining and rolling uranium products, all process equipment has been removed and the area decontaminated on a gross basis. However, radioactive contaminants are present in quantities that could result in a direct radiation exposure hazard.

The warehouse/storage building group includes 34 structures used to store containerized waste materials. These structures act as secondary containment for the waste, and any fixed and removable contamination results from leakage from the waste containers. The risks associated with these buildings will be low as long as the waste containers remain intact. The containers and containerized materials themselves are placed in different component groupings, as discussed below. Disposition of the containers will potentially be addressed by a removal action (Section 2.5).

The process building group comprises 31 buildings and areas where potential contaminants have been used as part of plant operations. These components exhibit both fixed and removable radiological contamination and currently contain significant quantities of waste material (radiological, chemical, and mixed) in equipment, pipes, and ducts. Some of that material will be removed during the safe shutdown removal action. Still, this grouping is expected to be one of the most significant sources of contaminants for OU3. Potential exposure to direct radiation sources could be significant in these buildings.

The process support building group includes 49 structures that house operations currently used to treat contaminated media or to support activities necessary to maintain the site. These structures support daily activities and ongoing and proposed removal actions at the FEMP. The physical distribution of contaminants is varied and consistent with the diverse nature of the process support buildings group.

Containers and Containerized Materials

Containers and containerized materials are categorized in one of two groups — aboveground or belowground. The aboveground containers group consists of 23 components that now contain (or previously contained) potential contaminants and/or waste materials. Drummed materials may be exposed on concrete pads or protected in structures. Inventory materials are generally protected from the weather. Certain of these containers hold residual

quantities of waste material that will not be removed during safe shutdown activities. The pads on which the drums rest are likely to be contaminated by past spills; these pads are in another component group discussed below.

The belowground containers group includes two buried components that contain (or previously contained) wastes, product, or chemicals. These containers hold residual quantities of material that will not be removed during safe shutdown activities. Leakage from the containers is a potential source for contamination of soil and groundwater. The soil surrounding these containers is likely contaminated by past spills and/or leakage and will be addressed by OU5.

Bulk Material

The bulk material group includes eight areas with large volumes of material containing low levels of contaminants and stored without containment. These materials are exposed to natural forces and, as a result, present a potential risk to the public and the environment. Contamination is of both a fixed and removable nature.

Storage Pads, Parking Lot, Roads, and Railroads

The storage pads, parking lot, roads, and railroads group consists of 27 components, most of which provided support for the transport or storage of waste, process, and raw materials. These areas are, or have the potential to be, contaminated by leakage. The soil surrounding these areas may also be contaminated and will be addressed by OU5.

Piping, Utilities, and Equipment

Piping, utilities, and equipment are divided into two separate groups — those aboveground and those belowground. The aboveground group includes 18 structures, some of which contained or transported potentially hazardous substances. The interiors of such structures are contaminated. Exterior surfaces may have been contaminated by leakage or disposition during production activities. These components are also exposed to natural forces.

The belowground group contains six structures that are buried under the ground; some of these components contained or transported potentially hazardous substances. The

interiors of such structures are contaminated; exteriors may be contaminated by the leakage of contents. That leakage is also a potential source of contamination of soil and groundwater.

Ponds and Basins

The ponds and basins group consists of eight structures or areas where liquids containing potentially hazardous substances are, or can be, stored without secondary containment. Some of these components contain large volumes of water with relatively small amounts of contamination. They also contain sediments with more concentrated quantities of contamination. These areas are exposed to natural forces.

3.1.1.2 Potential Contaminants of Concern

Contaminants tentatively identified on the basis of the historical use of the site that may be present in OU3 are summarized by component in Table A.3 of Appendix A. Table 3.1 summarizes potential contaminants of concern for OU3 on the basis of historical use of the site. The contaminants potentially present in OU3 components include radionuclides in the uranium-238, thorium-232, and uranium-235 decay series (including protactinium-231, radium-226, thorium-230, and thorium-232), inorganic substances (e.g., metals, acid anions, asbestos), and organic substances (e.g., PCBs, volatile and semivolatile organic compounds). Section 2.4 discusses the nature and extent of contamination associated with OU3.

Results of the OU3 characterization activities conducted during the RI will be evaluated during the baseline risk assessment to identify the final list of contaminants that contribute significantly to the total risk for OU3 (i.e., contaminants of concern). The baseline risk assessment will be performed to estimate the risk potentially posed by OU3 if remedial action is not performed (i.e., no action). Criteria described by EPA (1989a, 1991a,b) and by DOE (1992b) will be used to screen or evaluate the contaminants identified during site characterization. In general, contaminants identified as being present at concentrations greater than naturally occurring background levels would be included in the risk assessment.

TABLE 3.1 Potential Contaminants of Concern for OU3

Radionuclides
- Americium-241
- Cesium-137
- Lead-210
- Neptunium-237
- Plutonium-238, 239, 240, 241, and 242
- Polonium-210
- Radium-226, and 228
- Strontium-90
- Thorium-228, 230, 232, and 234
- Technetium-99
- Uranium-233, 234, 235, 236, and 238

Volatile Organics
- 1,1-Dichloroethene
- 1,1,1-Trichloroethane
- 1,2-Dichloroethane
- Acetone
- Benzene
- Carbon Tetrachloride
- Chlorobenzene
- Chloroform
- Ethylbenzene
- Methanol
- Methylene Chloride
- Methyl Ethyl Ketone (2-butanone)
- Tetrachloroethane
- Tetrachloroethene
- Toluene
- Trichloroethene
- Vinyl Chloride
- Xylenes

Semivolatile Organics
- Chlordane
- Diamyl Amyl Phosphonate
- Ethylene Glycol
- PCBs
- Pentachlorophenol
- Tributyl Phosphate

Petroleum, Oil, and Lubricants (POL)
- Diesel Fuel
- Fuel Oil
- Gasoline
- Hydraulic Oil
- Kerosene
- Lubricating Oil
- Motor Oil
- Naphtha Spirits

Inorganics
- Aluminum
- Arsenic
- Barium
- Beryllium
- Cadmium
- Calcium
- Chromium
- Cobalt
- Copper
- Europium
- Germanium
- Lanthanum
- Lead
- Lithium
- Magnesium
- Mercury
- Molybdenum
- Nickel
- Niobium
- Platinum
- Potassium
- Selenium
- Silver
- Sodium
- Tin
- Titanium
- Vanadium
- Yttrium
- Zinc
- Zirconium

Anions
- Chloride
- Fluorides
- Nitrates
- Phosphates
- Sulfates

Other
- Ammonia
- Asbestos
- Cyanide
- Phenols (total)
- Sulfide

This action would ensure the determination of total dose from exposure to pertinent site radionuclides. For chemicals, aside from comparison of detected levels to naturally occurring background (in the case of metals) and anthropogenic levels (in the case of organic compounds), other factors would also be considered in determining the final list of chemicals of concern. These other factors could include the following: (1) detection frequency of the chemical, (2) whether the chemical is essential as a nutrient for human health, and (3) the outcome of a concentration and toxicity screen. Toxicity assessment is discussed in Section 8 of the Risk Assessment Work Plan Addendum.

3.1.1.3 Release Mechanisms

Characterization activities conducted for other FEMP operable units have revealed that many of the OU3 components have contaminated the surrounding soils and possibly groundwater through such mechanisms as spills or leaks, water erosion and leaching, wind erosion of particulate contaminants, gaseous or vapor emissions, overflows, and infiltration. These releases can contaminate the soil, which then becomes a secondary source for additional contaminant releases and potential exposures. Contaminated soils and groundwater that currently exist at the FEMP are addressed in OU5, except for the soils in the bulk material group addressed in OU3. However, even with complete remediation of these media by OU5, they would continue to be available as pathways for source operable units such as OU3. Table 3.2 summarizes the primary release mechanisms identified by the conceptual model.

3.1.1.4 Contaminant Pathways and Exposure Routes

Once released to the environment, contaminants could follow numerous pathways to reach potential receptors. The conceptual site model (Figures 3.1 through 3.4) summarizes pathways that are likely to contribute significantly to overall risks for OU3. This section discusses those pathways and the potential exposure routes associated with them. (As noted, existing contamination within environmental media [e.g., groundwater, soil, and sediment] is not within the scope of OU3.)

TABLE 3.2 Primary Release Mechanisms

Component Group	Release Mechanism	Comments
Buildings	Direct Contact	The direct contact of a receptor with contaminated surfaces or materials could result in the ingestion or dermal uptake of the contaminant.
	Exposure	Gamma-emitting radionuclides are present in contaminated buildings and their contents. Gamma radiation is capable of traveling significant distances in air and inducing carcinogenic effects.
	Leaks/Spills	As piping and equipment age, any corrosive material that they may contain can reduce their ability to hold fluids. The corrosion can proceed to the point that fluids begin to leak out of the piping and equipment. The leaked fluids would drain to sumps inside buildings, where they could act as a source of contamination. They could also be released to the ground, where environmental forces could move them toward human receptors.
	Water Erosion/Leaching[a]	For contaminated surfaces exposed to the weather, water could loosen contamination. Once the contamination was available for movement, wind and water could move it to receptor locations.
	Wind Erosion[a]	Loose contamination on surfaces exposed to wind could become airborne and be distributed over a wide area.
Containers/Containerized Materials	Direct Contact	As for buildings.
	Exposure	Many drums (aboveground containers) and inventoried product contain uranium and/or thorium and decay daughter products. Many of these radionuclides are gamma-emitters that represent a health risk to nearby individuals.
	Leaks/Spills	With exposure to weathering processes or due to internal corrosion, containers could fail and release their contents to the environment, either directly due to in-place structural failure or as a result of movement by a future occupant of a site building. The material could then be leached by rainwater or moved by wind.

TABLE 3.2 (Cont.)

Component Group	Release Mechanism	Comments
Bulk Material	Direct Contact	As for buildings.
	Exposure	Gamma-emitting radionuclides are present in contaminated materials in this group.
	Water Erosion/Leaching	Rainwater falling on contaminated bulk materials could leach and erode contaminants, further contaminating surrounding soils and possibly contaminating surface water and sediments (through runoff) and groundwater (through infiltration).
	Wind Erosion	Contaminants are available to weathering action in scrap metal piles and exposed soil piles. While water erosion and leaching are expected to be the major release mechanisms, particulate resuspension by wind forces also could occur.
Storage Pads/Parking Lots/ Roads/Railroads	Direct Contact	As for buildings.
	Exposure	Several storage pads have significant quantities of radioactive materials embedded or distributed on their surfaces. Information on direct radiation exposure rate is not available, but such exposure may represent a risk to individuals near the pads.
	Water Erosion/Leaching	Contaminants are generally fixed or embedded in the structural materials of these components. The surfaces of drum storage pads (concrete) show measurable contaminant levels. For surfaces exposed to weathering forces, running water and freeze/thaw action would tend to loosen and release contaminants.
	Wind Erosion	Freeze/thaw actions would tend to loosen embedded contaminants, which (along with loose spilled materials) would then be available for translocation by wind.

TABLE 3.2 (Cont.)

Component Group	Release Mechanism	Comments
Piping/Utilities/Equipment	Direct contact	As for buildings.
	Exposure	As for bulk material.
	Leaks/Spills	Failure due to corrosion or some other mechanism could result in the release of contaminants to the surrounding environment.
	Water Erosion/Leaching	As for buildings for aboveground components.
	Wind Erosion	As for buildings for aboveground components.
Ponds and Basins	Direct Contact	As for buildings.
	Exposure	As for bulk materials.
	Overflow	Without maintenance, basins and ponds that generally are used as a buffer storage for treatment systems would overflow, discharging any contained contaminants to the surrounding soils, surface streams, and sediments.
	Infiltration	Although most ponds and basins have engineered containment liners (many with secondary containment systems), system failure can occur with time, allowing contaminant-bearing liquids to leak into the soils below the structures and eventually into groundwater.

[a] Without a long-term active maintenance program, structural deterioration in OU3 components would be inevitable. This deterioration would ultimately lead to collapse of a component's structure. The collapse would mobilize some of the contaminants contained in the component. The remaining contamination would be exposed to the weather, which would release contaminants from the building's interior surfaces and equipment by the mechanisms of water erosion/leaching and wind erosion.

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Soils

Soils are considered as a primary source in OU5; they are considered as a secondary source in OU3. In addition, for OU3, soils represent a potential exposure pathway to human receptors via incidental ingestion, pica, dermal contact, and direct radiation. Plants can accumulate contaminants from soil and provide a route of exposure to humans directly through ingestion and indirectly through consumption of meat and milk.

Air

Removable contamination from building surfaces, equipment, containerized waste, and contaminated soils could be suspended (or resuspended) into air by wind action or by human action. Human-induced suspension could result from a simple act such as walking or could result from construction, agricultural, or transportation activities. In addition to transporting particulate matter, air could also serve as a transport pathway for volatile organic compounds or gaseous radionuclides such as radon. Radon emanation from containers could be concentrated in structures because of poor air exchange.

Exposure routes for the air pathway could include inhalation and dermal contact with particulates. While irradiation of an individual enveloped by radioactive gases is a potential exposure route, because of the nature of the release and the types of radionuclides present at the FEMP, such exposure is not expected to be significant.

Groundwater

Material from OU3 components could cause groundwater contamination through any of several mechanisms. Evidence from site characterization activities to date suggests that direct leakage from tanks, process line, building sumps, and/or waste pipelines may have directly contaminated perched groundwater zones. Deep excavations for basements facilitates this direct transfer. Groundwater could also be contaminated by the leaching of hazardous constituents from soils contaminated by OU3 source components. Contamination of the Great Miami Aquifer, which is a significant source of water, must be considered for hypothetical future development of residential wells.

Exposure routes for the groundwater pathway could include ingestion, inhalation and dermal contact during showering, human consumption of livestock and crops that used

groundwater, and dermal contact during recreational activities (e.g., swimming in a swimming pool filled with contaminated water).

Surface Water and Sediments

From the perspective of OU3, the surface waters and associated sediments of Paddys Run and its tributaries could be contaminated by runoff from leaks or spills, the erosion of contaminants from soils and scrap materials piles, and the deposition of contaminated particulates originating from building and storage pad surfaces. Seepage of groundwater could also contaminate surface water, as could overflow from ponds and basins.

Exposure routes for this pathway could include direct human consumption of contaminated water, dermal contact, incidental sediment ingestion, direct radiation exposure, consumption of livestock watered with contaminated surface waters, consumption of crops irrigated with contaminated surface waters, and consumption of fish from contaminated surface water bodies.

Direct Contact

Direct contact is not strictly a pathway, but rather is a release mechanism. However, direct contact allows the direct transfer of contaminants from a component to a receptor via dermal contact or ingestion. Direct contact is included here because it provides a potentially significant pathway for the transfer of contaminants to on-site receptors.

Radioactive Decay

While not strictly a pathway either, radioactive decay must be viewed in such a context because components of OU3 represent direct radiation hazards. The risk imposed by a radionuclide depends on its type and, to a lesser degree, the energy of the radiation it emits. For beta and alpha radiation, the only significant hazard results from the ingestion or inhalation of radioactive contaminants, with the subsequent local disposition of energy into cells and tissues. Such is not the case for gamma radiation because no other medium or transfer mechanism is required to assist in the deposition of the "dose" to the receptor for gamma radiation.

3.1.1.5 Exposure Scenarios and Potential Receptors

The exposure scenarios discussed below were developed to support the identification of data needs to be addressed during OU3 site characterization. No attempt has been made at this time to determine the relative significance of any exposure route or judge which should be addressed quantitatively as opposed to qualitatively. Such determination will best be made upon completion of characterization activities. Development of exposure scenarios is discussed in Section 5 of the Risk Assessment Work Plan Addendum.

For OU3, the baseline risk assessment will consider two cases under current land use. In the first case, *current conditions without access restrictions*, all activities at the site would cease, and access restrictions would be discontinued without any remedial action taken. This case constitutes the most conservative risk baseline against which remediation scenarios will be compared. In the second case, *current conditions with access restrictions*, DOE would maintain control of the site even after all site activities ceased. While this latter case deviates from conventional EPA practice in performing risk assessment, DOE feels that federal ownership of a facility represents a condition that warrants this approach. For the second case, a health and safety program would continue to ensure the protection of workers and visitors to the site.

Exposures of FEMP employees not involved with remediation will be assessed under the FEMP Health and Safety Program, as discussed in Section 5.1.4.4 of the Risk Assessment Work Plan Addendum (DOE 1992b). Therefore, the baseline risk assessment will consider only site visitors over short periods of exposure in a controlled environment. For the baseline case without access restrictions, the baseline risk assessment will also consider members of the public who might take up temporary or permanent residence on the site (or property building users). Trespassers will be considered for both baseline cases under current land use. All of these potential receptors could be exposed to concentrated sources of chemical and radioactive contamination.

The baseline risk assessment will also consider future land use scenarios. These scenarios will include activities requiring development time (e.g., home building, planting, and similar activities).

Case of Current Land Use with Access Control

Current land use at the FEMP (and specifically OU3) can best be described as industrial. This use is in stark contrast to that of surrounding properties, which are primarily farmland. On the basis of this observation, the following exposure scenarios have been initially identified for the case of current land use with access controls:

- *Off-Property Farmer Scenario* — This exposure scenario assumes that all production activities at the facility have ceased. The federal government maintains ownership of the property and enforces its proprietary rights, preventing unauthorized use of the property and installation of on-site water supply wells. The scenario further presumes that a farm family lives adjacent to the FEMP property boundary. Exposure routes for this farm family include:

  - Ingestion of groundwater;
  - Inhalation of fugitive dust, vapors, and gases;
  - Consumption of farm-produced foodstuffs, including vegetables, meat, and milk;
  - Direct radiation from and dermal contact with soils;
  - Incidental ingestion of soil; and
  - Dermal contact with and inhalation of water while showering using groundwater as a source of water.

  The scenario will also include sediment ingestion from a surface-water drainage ditch by an exploring child (age 6-17).

- *Visitor Scenario* — For the visitor scenario, conditions of the property, including its control and use, are as in the off-property farmer scenario. In this scenario, an individual makes periodic visits to OU3 for delivery or property inspection. The visitor is not covered by the FEMP health and safety and radiation protection programs. The exposure routes for the site visitor include:

  - Inhalation of fugitive dust, vapors, and gases;

- Direct radiation from contaminated soils; and
- Direct radiation from and dermal contact with components such as buildings, drums, pads, equipment, and bulk materials.

- *Trespasser Scenario* — This hypothetical exposure scenario considers the risk incurred by a trespasser who is not covered by the FEMP health and safety and radiation protection programs. Because regular security patrols would be conducted, it is assumed that the trespasser would be detected and have only short periods of exposure. Exposure routes for the trespasser include:
  - Inhalation of fugitive dust, vapors, and gases;
  - Direct radiation from and dermal contact with contaminated soils and surface water and sediments; and
  - Direct radiation from and dermal contact with OU3 components.
- *On-Property Grazing* — This scenario considers risks associated with off-property use of animal products from cattle currently grazing on FEMP property. Receptors evaluated are meat and dairy users, including an off-property farm family. The primary exposure route is consumption of meat and dairy products from cattle grazing in areas on the FEMP site with soils that may be contaminated by releases from OU3.

Case of Current Land Use without Access Control

In the case of current land use without access control, all exposure scenarios assume that environmental restoration of the property has ceased and that present access restrictions are discontinued. All waste products and inventory (except those for which in-progress removal actions result in their removal from the site) would remain.

While the uncontrolled release by the federal government of radiologically contaminated buildings, equipment, materials, and waste of this quantity is highly unlikely, the scenario is required in order to meet the *loss of institutional control* requirement of the NCP for baseline risk assessments. A more reasonable scenario would be the release of the property by the government to unrestricted use following decontamination and

decommissioning to meet the criteria contained in various DOE administrative orders; however, for the previously stated reason, such a scenario will not be explored.

This case considers only the current, unimproved condition of OU3. Any activities requiring development time (e.g., building a home, planting and harvesting crops) are addressed under the future land use case. The following scenarios have been developed for this case:

- *Off-Property Farmer Scenario* — This hypothetical scenario assumes that a farm family lives immediately adjacent to the FEMP property boundary. Since portions of the FEMP property are currently used for cattle grazing, this practice is assumed to continue but with no access restrictions. No food would be assumed to be grown within the FEMP fence line. Exposure routes include those listed under the case with access controls.

- *Visitor Scenario* — This hypothetical scenario is similar to that defined for the case with access controls. The visitor scenario is similar to the trespasser scenario but involves fewer exposure routes, access to fewer OU3 components, and shorter exposure periods.

- *Trespasser Scenario* — In this hypothetical scenario, individuals are assumed to regularly move about the property. Access to exterior waste storage, scrap metal piles, and other such components is assumed. The trespasser may remove (salvage) components from OU3 and transport them to off-site locations. Exposure routes include:

  - Inhalation of fugitive dusts, vapors, and gases;
  - Incidental ingestion of soils;
  - Direct radiation from and dermal contact with contaminated soil and surface water and sediments; and
  - Direct radiation from and dermal contact with OU3 components.

  An identical scenario will be evaluated for an exploring child, aged 6 through 17. Only the direct radiation and dermal contact exposure

routes will be considered for receptors at off-site locations exposed to material removed from the site.

- *On-Property Grazing* — This hypothetical scenario is similar to that defined for the case with access restrictions. However, grazing animals would have unrestricted access to the FEMP and OU3.

- *Worker Scenario* — In this hypothetical scenario, risk to a non-FEMP-related worker present on the site is evaluated. The individual might conduct work activities in any building in OU3. These activities could include maintenance, construction, movement of drummed material (to make space available for more productive use), and/or equipment operation near waste materials. The existing water supply wells for the FEMP would be used for process and drinking water. Exposure routes include:

  - Direct radiation from and dermal contact with components;
  - Inhalation of fugitive dust, vapors, and gases;
  - Dermal contact with and inhalation of groundwater while utilizing it as process water;
  - Direct radiation from and dermal contact with surface water and sediment;
  - Incidental ingestion of soils; and
  - Direct radiation from and dermal contact with soils.

- *Resident (On-Property Building User) Scenario* — In this hypothetical scenario, it is assumed that a family would occupy a building as a private residence. Because no crops are currently grown within the FEMP fence line, the family could not eat contaminated vegetables from the property. However, they could use animal products from livestock or wild animals on the property. The exposure routes also include:

  - Inhalation of fugitive dust, vapors, and gases;
  - Direct radiation from and direct contact with OU3 components;

- Incidental soil ingestion;
- Direct radiation from and dermal contact with soils;
- Ingestion of groundwater;
- Inhalation and dermal contact while showering with groundwater; and
- Direct radiation from and dermal contact with water and sediment in surface drainage features (including ponds and basins).

Case of Future Land Use

It is reasonable to assume that after the useful life of the FEMP OU3 facilities, the land use in the production area would change to residential and agricultural. It is unlikely that at that time the buildings would be used for anything more than storage of feed and storage or maintenance of equipment. Four exposure scenarios will initially be considered, as described below:

- *Resident Farmer Scenario* — In this hypothetical scenario, a family is assumed to reside on the property and conduct agricultural activities there. Typical activities can include food and feed production, livestock production, and general farm work. Exposure routes include:
  - Inhalation of fugitive dust, vapors and gases;
  - Ingestion of groundwater;
  - Dermal contact and inhalation while showering with groundwater;
  - Consumption of foodstuff grown on the property, including vegetables, meat, and milk;
  - Direct radiation from and dermal contact with soil and sediments;
  - Incidental ingestion of soil and sediments; and
  - Direct radiation from and dermal contact with OU3 components.
- *Worker Scenario* — The worker scenario for the future land use case is essentially the same as the worker scenario under the case of current

land use without access control. However, the worker might consume foodstuffs grown on the site.

- *Intruder Scenario* — Home builders constitute a group of receptors who may be exposed to on-property contamination in the future. In this hypothetical scenario, an individual demolishes a building and constructs a residence with a basement. The exposure routes of this scenario include:
  - Inhalation of dust, vapors, and gases;
  - Incidental ingestion of soil;
  - Direct radiation from and dermal contact with soil; and
  - Direct radiation from and dermal contact with OU3 components.
- *On-Property Grazing* — This hypothetical scenario is similar to that defined for the case of current conditions without access controls. However, grazing animals would have access to areas irrigated with groundwater.

Other exposure scenarios similar to those for current land use conditions may also be evaluated for the future land use case, including the off-property farmer scenario. Off-property receptors could also be exposed as a result of the removal of contaminated materials from OU3. Expenditure of capital to demolish buildings to reclaim land for agriculture use is unlikely and is only slightly more likely for the construction of housing. However, such scenarios have been included in the Risk Assessment Work Plan Addendum (DOE 1992b).

3.1.1.6 Summary by Component Groups for Baseline Conditions

In this section, the general discussions in previous sections regarding contaminant conditions, exposure pathways, and risks are applied to the individual component groupings. Some judgments as to the significance of certain components as sources of contaminant release to the environment are made on the basis of the available characterization information.

Administrative and Support Buildings

The conceptual model for buildings is shown in Figure 3.1. Information currently available indicates that the administrative and support buildings contain only minor amounts of contamination, so they pose relatively little risk to receptors either on-site or off-site. The exposure pathways to be evaluated are (1) exposure to radiation, (2) direct contact between the contaminant and the skin, (3) ingestion of contaminants, and (4) inhalation of contaminants. Removal of contaminated items to an off-site location also would contribute to risk.

Selection of receptors for this grouping would depend on whether access restrictions were in place. If access restrictions existed, the principal receptors would be trespassers (scavengers). If access restrictions were not in place, the administrative buildings would likely be the first buildings to be inhabited by new "residents." These receptors would, therefore, be exposed to the contaminants on a continuous basis. For both cases, off-site receptors would include those individuals exposed to contaminated items deliberately removed from the site.

Warehouse and Storage Buildings

Under current plans, the drummed waste currently stored in warehouses and storage buildings in OU3 will be removed from the site under an ongoing removal action (see Section 2.5).* Therefore, for the baseline conditions, which correspond to the conditions at the time the baseline risk assessment is issued, the drums are expected to have been removed from these buildings. If indeed no drums are present, the conceptual model for this group of buildings would be similar to the model for the administrative and support buildings. In the unlikely event that the drums were still in the buildings, the principal release mechanisms would be those that involve loss of drum integrity or direct exposure to the drums:

- Corrosion-induced leakage, which causes the drums to lose integrity from the inside;

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* The drummed waste is not a part of the warehouse and storage building group, as is discussed in Section 2.2.

- Direct contact and exposure when trespassers and others open drums and possibly remove material;
- Direct contact and exposure when people remove material from drums to an off-site location; and
- Direct exposure when individuals are close to drums.

The principal pathways to be evaluated are those associated with direct exposure to contaminants that may have leaked from drums, as well as direct exposure to the drums. Any contaminants leaking from the drums would be able to migrate once they came in contact with water.

Selection of receptors for this group would depend on whether access restrictions were in place. If access restrictions existed, the principal receptors would be trespassers who entered these buildings. If access restrictions were not in place, the warehouse buildings might be used for storage or as a stable. However, their overall level of use would likely be limited. In particular, they would not likely be used for human habitation. The visitors to and any residents of these buildings would have the greatest chance to be exposed to contaminants in a concentrated form. In both cases, the principal off-site receptors would be individuals exposed to contamination deliberately removed from the site or to any emissions from the buildings to the atmosphere.

Process Buildings

The principal potential release mechanisms for the process buildings are the following:

- Corrosion-induced leakage, which causes piping and/or equipment to lose integrity from the inside;
- Direct contact and exposure when trespassers and others use equipment and material on-site; and
- Direct contact and exposure when individuals remove equipment and material to an off-site location.

In addition, emissions from the buildings to the atmosphere would be possible.

The pathways to be evaluated include those associated with direct exposure to contaminants. As for the previous group, any contaminants released due to leakage would be able to migrate once they came in contact with water.

If access restrictions existed, principal receptors would be trespassers who entered these buildings. If access restrictions were not in place, the process buildings would likely be used as a source of material for on-site residents. Use of the buildings for storage would also be possible. Portions of these buildings might also be used for human habitation. Principal off-site receptors would be those individuals exposed to contamination deliberately removed from the site or released to the atmosphere.

Process Support Buildings

The release mechanisms and potential receptors for the process support buildings would be similar to those for the process building group discussed above.

Containers and Containerized Material — Aboveground

The conceptual model for the aboveground container group is shown in Figure 3.2. The principal release mechanisms for this category are the following:

- Corrosion-induced leakage, which causes containers to lose integrity from the inside;
- Emissions of tank contents caused by solar heating;
- Direct contact and exposure when trespassers and others use parts of the containers or containerized material on-site; and
- Direct contact and exposure when individuals remove parts of containers or containerized material for off-site use.

The pathways to be evaluated include those associated with direct exposure to contaminants that have leaked from the containers. Any contaminants released would have the ability to migrate, because the containers are exposed to the weather. Releases also could occur directly to the environment if parts were removed for either on-site or off-site use. Such removal could allow container contents to drain onto a support pad.

If access restrictions existed, principal receptors would be trespassers who came in contact with released contaminants. If access restrictions were not in place, on-site residents would be the principal receptors. Human receptors who visit container locations have the greatest chance to be exposed to the contaminants in concentrated form. Off-site receptors would be those individuals who were exposed to contamination deliberately removed from the site or released to the atmosphere.

Containers and Containerized Material — Belowground

The principal release mechanisms for the belowground container group are corrosion-induced leakage and emissions of volatile components through soil and/or vents. The pathways to be evaluated include those associated with migration of contaminants through groundwater. These pathways involve the use of groundwater for drinking and domestic water, for irrigation, and for stock water.

Under current conditions, principal receptors would be off-site residents who used well water. Under future conditions, on-site residents would likely install wells for water supplies and would also be the principal receptors.

Bulk Material

The conceptual model for the bulk material group is shown in Figure 3.3. Components included in this group are soil piles and piles of metals and other waste material. The principal release mechanisms for this group are the following:

- Direct contact and exposure on-site by residents, trespassers, or workers;
- Direct contact and exposure off-site when individuals remove materials for off-site use; and
- Wind erosion and water erosion/leaching, which could release contaminants to environmental pathways.

The pathways to be evaluated will include those associated with direct exposure to contaminants.

If access restrictions existed, the principal receptors would be trespassers (scavengers). If access restrictions were not in place, on-site receptors would be trespassers,

residents, or workers. In both cases, off-site receptors would be those individuals exposed to contaminated materials deliberately removed from the site or released to the environment by water or wind erosion.

Storage Pads, Parking Lot, Roads, and Railroads

The conceptual model for this grouping is shown in Figure 3.3. Release mechanisms would be similar to those for bulk material, although direct contact and exposure due to removal of material for off-site use is less likely. Receptors for this grouping would also be similar to those for bulk materials, with a similar qualification concerning off-site use of material.

Piping, Utilities, and Equipment — Aboveground

The conceptual model for the aboveground piping, utilities, and equipment group is shown in Figure 3.1. The principal potential release mechanisms for this group are the following:

- Corrosion-induced leakage, which causes piping and/or equipment to lose integrity from the inside;
- Direct contact and exposure when trespassers and others use components on-site;
- Direct contact and exposure when individuals remove equipment and material for off-site use; and
- Wind erosion and water erosion/leaching, which could release contaminants to environmental pathways.

The pathways to be evaluated are similar to those for process buildings. Principal receptors are likely to be trespassers (scavengers), residents, and workers.

Piping, Utilities, and Equipment — Belowground

The release mechanisms and potential receptors for the belowground piping, utilities, and equipment group are similar to those for the belowground container group. The conceptual model is shown in Figure 3.2.

Ponds and Basins

The conceptual model for the ponds and basins group is shown in Figure 3.4. The principal release mechanisms involve releases of water by overflow or infiltration from the ponds or basins and direct contact with and exposure to the components. The pathways to be evaluated include those associated with direct exposure to contaminants and those involving movement of contaminants through surface water pathways.

If access restrictions existed, the principal receptors would be trespassers. If access restrictions were not in place, the ponds and basins could be used for recreation and food production by on-property residents. For both cases, off-site receptors could include members of an off-property farm family exposed to any surface water releases.

3.1.2 Risk Assessment Issues

As noted in Section 1, it is anticipated that all components in OU3 will be removed and have no use beyond the period of remediation. Therefore, it is unnecessary for the baseline risk assessment to demonstrate that no remediation is necessary because the requirement for remediation is already assumed. As a consequence, a conservative approach to assessing risks will be used throughout the baseline risk assessment. In particular, the following approaches will be used:

- On-site risks associated with direct exposure to or direct contact with contamination will be estimated for each component category by evaluating the risk associated with a single component selected to yield a conservative estimate of risk for that category. Preliminary identification of these components is presented in Section 4 of this document on the basis of existing information. Baseline risks will be assessed with these preliminarily identified components, for which data will be collected early in the RI field program. However, to ensure that the selection is sufficiently conservative, the final selection of these components will be made after RI data have been evaluated. If the components selected are changed because of this final evaluation of data, then the corresponding baseline risks will be re-evaluated. The assessment of risks will be based on measurements of exposure rate and

surface contamination for the most contaminated (but still habitable or accessible) portions of the component selected for each component category.

- Off-site risks and on-site risks not associated with direct contact or exposure (e.g., ingestion of contaminated food by a resident farm family) will be conservatively estimated on the basis of average measured levels of contamination by material type for each component category. Averages for a component category will be used because such risks will generally be associated with contaminants originating from multiple sources (components) rather than from a particular component (removal of contaminated material off-site is one example of an exception). Measurements will be taken only in areas known or suspected to have elevated levels of contamination, increasing the probability that the resulting estimate of risk is conservative.

The conservative approach to assessing baseline risks will focus sampling in each component on a limited number of areas with elevated levels of contamination. This approach, which is a consequence of DOE's decision that no long-term use will be made of OU3 components, will limit data requirements for the baseline risk assessment, because that data need only provide conservative risk estimates.

Risks will be estimated for all contaminants of concern that are identified during the baseline risk assessment (as discussed in Section 3.1.1.2). These risk estimates will be based on all measurements for which the contaminants are present at concentrations above nondetection levels. Because of the survey and sampling approach to be used (i.e., measurements taken only in areas of known or suspected contamination), it is anticipated that the only measurements included in risk estimates will be those made in areas with levels of contamination well above both nondetection levels and background levels for the major contaminants in a component.

The baseline risk assessment will include the following steps:

- Quantification of source terms (determining the quantity of contaminants available for release by some mechanism) and release mechanisms,

- Selection and use of appropriate transport models,
- Identification of potential receptors,
- Quantification of exposures, and
- Risk characterization.

Sections 3.1.2.1 and 3.1.2.2 discuss the first two steps. Identification of receptors is considered in Section 3.1.1.5. Quantification of exposures and risk characterization are discussed in Sections 7 and 9 of the Risk Assessment Work Plan Addendum (DOE 1992b), which is based on available EPA guidance, in particular EPA (1989a). The baseline risk assessment will determine contaminant intakes for potential receptors with reasonable maximum exposures (RME receptors), select the human RME receptor, and develop risks associated with that receptor's intakes. Figure 3.5 summarizes the approach to be used for risk assessment.

Recent guidance from EPA (EPA 1992) has addressed the issue of including estimates of "central tendency" exposures in addition to reasonable maximum exposures and has indicated that such central tendency estimates will be used in discussing uncertainties. Methods for including central tendency estimates in risk assessments are being developed for the FEMP. When approved, these methods will be provided as an addendum to the FEMP Risk Assessment Work Plan Addendum and will be used in the assessment of risks for OU3 for both the baseline and feasibility study cases.

Data needs for the baseline risk assessment are related to the requirement to quantify release mechanisms and source terms. The discussion of release mechanisms and source terms presented in Section 3.1.2.1 is intended to be general and is included only to support the development of data needs for the baseline risk assessment. The details associated with quantification of source terms and release mechanisms will be provided in the baseline risk assessment.

3.1.2.1 Release Mechanisms and Source Terms

Each release mechanism described in Table 3.2 requires the development of a source term for each component grouping and a quantitative estimate of the rate at which the source

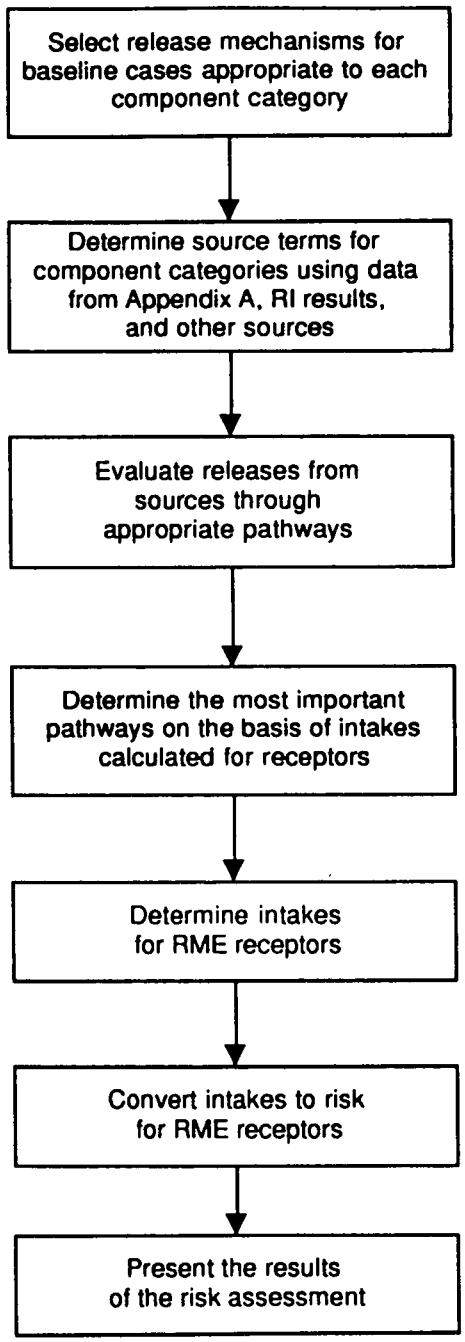

FIGURE 3.5 Approach to Risk Assessment

term can be released. The process of developing the necessary source terms, the release rates, and the assumptions made in this process are described below. The discussion includes particulate and/or gaseous emissions and wastewater and storm-water releases, although these release mechanisms are not in included in Table 3.2.

Direct Contact and Exposure

The direct contact and exposure release mechanisms can be significant for the baseline risk assessment in two cases:

- On-site access when receptors are close to contaminated sources; and
- Unauthorized removal of contaminated material off-site when off-site receptors may be near contaminated material.

Risks associated with potential on-site direct contact and exposure are the major concern for the baseline risk assessment. Therefore, development of source terms for this case is particularly important.

For baseline conditions without access restrictions, members of the public are assumed to (1) take up residence in administrative buildings or the sections of other buildings where natural light exists and (2) have access to other contaminated components. For purposes of risk assessment, the most contaminated areas of a conservatively selected building within each building category will be used to determine risk. Similarly, trespassers will be assumed to have access to such contaminated areas.

Source terms for on-site access will be quantified on the basis of measured levels of removable surface contamination and radiation exposure rates for the most contaminated areas of the component selected for each category. Quantification of the release mechanisms of exposure and direct contact (i.e., quantification of exposure) will require the definition of various parameters in the baseline risk assessment, in particular, exposure duration, exposure frequency, and absorbed dose from dermal contact. However, definition of these parameters will require no data to be collected by the OU3 RI effort.

For baseline conditions without access controls, members of the public are assumed to remove equipment and piping from OU3 components for their personal use. For purposes of risk assessment, it is assumed that the most contaminated equipment and material

available would be taken for this purpose. Source terms will be based on measured levels of removable surface contamination and radiation exposure rates. As is the case for on-site access, quantification of the release mechanisms will require definition of various parameters in the baseline risk assessment, but will impose no additional data requirements on the RI effort.

Water Erosion and Leaching

Without continued DOE control at the FEMP, structures would degrade over time and ultimately fail. In the case of no access control, it is assumed that after a period of years all structures at the FEMP would lose their ability to prevent rainwater from contacting and mobilizing contaminants. In addition, all contamination outside of buildings is assumed to be susceptible to erosion by water.

The quantity of contaminants available for release will be estimated on the basis of average measured surface concentrations of contaminants by material type by component group. The rate at which removable surface contamination would be released due to erosion or leaching by water will be estimated from information available in the literature or will be based on conservative assumptions. Estimates of the rate at which fixed surface contamination would be released by leaching will be based on measured leaching rates for selected materials.

Wind Erosion

Wind erosion could be significant for any component grouping in which contamination is available for mobilization by the wind or vehicles (e.g., bulk storage areas). Wind erosion might also be significant for other groups once their structural integrity was impaired.

As noted, without continued DOE control of the FEMP, structures would degrade over time and ultimately fail. In the case of no access restrictions, all structures at the FEMP are assumed to collapse over a period of 50 years. It is assumed that once the structures collapsed, any contaminants of concern remaining in them would be exposed to the forces of wind and water.

Quantities of contaminants available for release by wind erosion will be estimated from average measured levels of removable surface contamination by material type by component group. Release rates will be estimated with information from the literature or will be based on conservative assumptions.

Leaks and Spills

Any container (e.g., drum, tank, or pipe) with corrosive contents will ultimately fail without some form of remedial action. Also, when contaminants of concern are stored in containers, spills are possible. Quantification of impacts due to leaks or spills requires knowledge of the volume of materials available for release and of the concentrations of contaminants in the materials, as well as some approach for estimating the rate at which such materials would be released to the environment by leaks or spills. Conservative estimates for the rate of release of materials and associated exposure scenarios will be developed on the basis of visual inspections of the components where spills are possible. Estimates for evaporation rates for materials that might be spilled are also needed.

Infiltration and Overflow

Both failure of containment (e.g., the liner) and overflow of ponds and basins are possible. For evaluation of baseline risks, it will be assumed that a loss of integrity of all ponds and basins occurs and that all inflow infiltrates to the subsurface beneath the components. Such infiltration will be assumed to occur for a period of years; the concentration of contaminants in the water is assumed to be equal to the average measured concentrations of contaminants in the water in the ponds and basins.

Overflow of ponds and basins will also be assumed to occur for baseline conditions. The scenario for overflow will assume that the ponds and basins are full, that a 100-year rainstorm occurs, and that overflow is released to drainages leading to Paddys Run. The concentration of contaminants in the overflow is assumed to be equal to the average measured concentrations of contaminants in the water in the ponds and basins.

Particulate and Gaseous Emissions

Releases of contaminants to the air would expose on-site receptors to airborne contaminants inside buildings and expose on-site and off-site receptors to airborne contaminants in open areas. Risks from exposure to airborne contaminants in buildings under baseline conditions will be estimated on the basis of measured air concentrations of contaminants in buildings. Risks due to exposure to airborne contaminants in outdoor areas both on- and off-site will be estimated from (1) measured values for releases from building stacks under current conditions, (2) estimates for releases obtained on the basis of measured interior concentrations of contaminants, or (3) results for outdoor air concentrations available from site monitoring. Although the last approach would overestimate contributions from OU3 sources (because other sources would be included), it would provide a conservative estimate for off-site concentrations.

Wastewater and Storm-Water Releases

Controlled off-site release of treated wastewater and of storm water occurs from OU3 as a whole and therefore has not been included as a release mechanism for any individual component category. For baseline conditions involving access controls, such controlled wastewater and storm-water releases could continue. The character and rate of current releases from the site will be used to describe such releases.

3.1.2.2 Selection of Environmental Transport Models

Many approaches are available to address transport of contaminants through environmental and exposure pathways. Section 6 of the *Risk Assessment Work Plan Addendum* (DOE 1992b) describes the transport models that will be used in the risk assessments for OU3. Models will be used, as needed, to address the transport of contaminants in order to estimate contaminant concentrations at potential exposure locations, as well as to account for direct exposure.

The computer code AIRDOS-PC will be used to model the transport of airborne emissions. Transport in surface water will be accounted for with simple dilution calculations. Release and transport in groundwater will be modeled with the ST1D, ODAST, and SWIFT-III computer codes. The RESRAD and MICROSHIELD models will be used for direct

exposure calculations for radiological contaminants. In addition, other models discussed in the Risk Assessment Work Plan Addendum may be applied, and computations based on fundamental principles will be used as necessary for all transport pathways and exposure calculations.

3.1.3 Data Needs

The data needs of the OU3 baseline risk assessment fall within the following categories:

- Identification of contaminants;
- Determination of contaminant concentrations (quantity) in the sources and media of interest;
- Characterization of contaminant sources to support estimation of source quantity and release potential; and
- Development of environmental characteristics that affect the transport and fate of the contaminants.

Contaminant concentrations must be established to permit estimation of source terms for use as input to environmental fate and transport calculations. Exposure rate information is also critical because the direct exposure pathway is likely to dominate the risk to many receptors for some components. The degree to which contaminated materials are available for release to the environment must be established. However, information on environmental characteristics needed to support transport modeling is available from previous or on-going activities at the FEMP, or from the general scientific literature.

Table 3.3 summarizes the anticipated data needs for the OU3 baseline risk assessment. The table makes a general statement of the data needed, the intended use for the data, and the availability of the data. The data needs identified in the table are based on the discussion in Section 3.1.2.1. As already noted, data needs for the baseline risk assessment are reduced by DOE's decision that the buildings and facilities of the FEMP have, or soon will have, exceeded their design life and that restoration of these facilities to an alternate use is impractical, therefore warranting their decommissioning. In particular,

TABLE 3.3 Summary of Data Needs for the Baseline Risk Assessment

Data Need	Data Use	Data Availability
Fixed surface contamination for radionuclides and for chemical species in components	Used to determine the source terms available for release due to wind and water erosion or leaching for all components except ponds and basins.	To be obtained during the RI phase.
Removable surface contamination for radionuclides and for chemical species in components	As above. Also used to determine the risk due to direct contact.	To be obtained during the RI phase.
Erosion/leach rates for removable and fixed surface contamination by media	Used to determine the release rate of contaminants to air and water due to wind and water erosion or leaching.	For removable contamination, can be estimated with information from the literature or on basis of conservative assumptions. For fixed contamination, to be obtained during the RI phase.
Fraction of contaminated area exposed to wind and water erosion under current and future conditions	As above.	For current conditions, readily available by visual inspection. For future conditions, will be estimated on basis of assumptions.
Radiation exposure rates in components	Used to determine the risk due to direct external exposure to radiation.	To be obtained during the RI phase.
Dimensions and geometry of components	Used to calculate the exposure rates for on-site receptors.	Already known or easily measured.
Air concentrations of contaminants in buildings	Used to determine the on-site risks in buildings due to particulate and/or gaseous emissions under current conditions.	To be obtained during the RI phase.
Emission rate of contaminants from building stacks and/or air concentrations of contaminants in open areas	As above except used for off-site risks or on-site risks in open areas.	Existing data and programs are generally adequate to meet this data need.
Quantity of contaminated liquids or other containerized materials in components	Used to determine the source terms available for release due to leaks or spills.	To be obtained during the RI phase.
Concentration of contaminants in liquids or other containerized materials	As above.	To be obtained during the RI phase.

TABLE 3.3 (Cont.)

Data Need	Data Use	Data Availability
Release rate of liquids or other containerized material to environment	Used to determine the release rate of contaminants due to leaks or spills.	Conservative estimates can be developed from visual inspections.
Volatility of contaminants in liquids or other containerized material	Used to determine the release rate of contaminants following leaks or spills.	Will be estimated from handbook values.
Concentration of contaminants in water and sediment in ponds and basins	Concentration in water used to determine the source terms available for release from ponds and basins due to infiltration and overflow. Concentrations in water and sediments used to determine the on-site risks due to direct contact.	To be obtained during the RI phase.
Infiltration and overflow rate of water from ponds and basins	Used to determine the release of contaminants from ponds and basins due to infiltration and overflow.	Can be estimated on basis of available information.
Rate of release of treated wastewater and of storm-water from the FEMP	Used to determine the quantity of contaminants released in wastewater and storm-water discharges.	Existing data and programs are adequate to meet this data need.
Concentration of contaminants in treated wastewater and in storm water	As above.	As above.

detailed characterization of components is unnecessary to support the needs of the baseline risk assessment, and only conservative results are needed.

3.2 PREPARATION OF THE FEASIBILITY STUDY

This section discusses a number of topics related to preparation of the feasibility study for OU3 and the data needs associated with that feasibility study. Section 3.2.1 provides a preliminary identification of regulatory requirements. Section 3.2.2 discusses preliminary remedial action objectives. General response actions, potential technology types, and process options are considered in Section 3.2.3; an identification of preliminary remedial action alternatives is provided in Section 3.2.4. Section 3.2.5 discusses the approach to be used to evaluate remedial action alternatives, and Section 3.2.6 describes the data needs associated with evaluating those alternatives.

3.2.1 Preliminary Identification of Applicable or Relevant and Appropriate Requirements and To-Be-Considered Criteria

Pursuant to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR 300), remedial actions are required to meet all federal and state applicable or relevant and appropriate requirements (ARARs). Section 300.430(b)9 of the NCP provides that the identification of ARARs and other "to-be-considered" (TBC) criteria be initiated during the scoping phase of the RI/FS. This identification process is started during the scoping phase in order to support the development of preliminary remedial action objectives, goals, and alternatives.

ARARs consist of promulgated standards — for example, public laws codified at the state or federal level — that may be applicable to a proposed action or that may be relevant and appropriate to all or part of that action. To-be-considered requirements consist of standards or guidelines that have been published but not promulgated and that may have significance for all or part of the action. (DOE orders are not promulgated standards and are therefore treated as TBC requirements, even though such orders are applicable to all DOE actions.) Potential TBC requirements are typically considered only if no promulgated requirements exist that are either applicable or relevant and appropriate or if necessary where ARARs alone would not be sufficiently protective.

Guidance from the EPA (1987) defines *applicability* as implying that the proposed action or site circumstances satisfy all of the jurisdictional prerequisites of the requirement. *Relevant* and *appropriate* requirements are defined as those that address problems or situations sufficiently similar to those encountered at the site in question that their use is well suited to the particular site. Any standard, requirement, criterion, or limitation under any federal or state law may be considered either applicable or relevant and appropriate to a specific action. Promulgated state requirements become ARARs if they are (1) legally enforceable and generally applicable (i.e., consistently applied) and (2) are more stringent than federal laws. A determination of applicability is made for the requirement as a whole; a determination of relevance and appropriateness may be made for only specific portions of the requirement.

ARARs are divided into three categories: (1) contaminant-specific ARARs address certain contaminants or a class of contaminants and relate to the level of contamination allowed for a specific pollutant in various environmental media (e.g., soil, water, and air); (2) location-specific ARARs are based on the specific setting and nature of the site; and (3) action-specific ARARs are related to specific technology or activity-based requirements for response actions proposed for implementation at the site. The preliminary identification of potential ARARs for the proposed remedial action at OU3 is based on the location of OU3, the nature of the contamination, and the proposed actions. Table 3.4 provides a general listing of environmental statues, executive orders, DOE orders, and other potentially applicable guidance pertinent to the proposed action. Preliminary determinations of whether ARARs or TBCs are applicable (or potentially applicable) or relevant and appropriate (or potentially relevant and appropriate) are presented in Appendix B. The preliminary requirements listed in Appendix B are abstracts from statutes and regulations. Before ARARs are determined and a remedial action is chosen, the full text of the applicable statutes and regulations must be consulted to ascertain if there are specific exclusions or special applications to actions, locations, or contaminants outside these general requirements. Under the NCP (40 CFR 300.430), other lead and support agencies may also identify other pertinent advisories, criteria, or guidance. ARARs should be modified, as necessary, as more information becomes available. Final ARARs must be determined in consultation with DOE General Counsel and in conjunction with the appropriate regulatory agencies when the remedy is selected.

TABLE 3.4 Federal and State Statutes, Executive Orders, DOE Orders, and Nuclear Regulatory Commission Guidance Potentially Pertinent to the Proposed Remedial Action at OU3

Federal Laws

Antiquity Act/Historic Sites Act
Archeological and Historic Preservation Act of 1974
Archeological Resources Protection Act of 1979
Atomic Energy Act of 1963, as amended
Clean Air Act of 1963, as amended
Clean Water Act, as amended (also referred to as Federal Water Pollution Control Act of 1972, as amended)
Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986.
Department of Energy Organization Act of 1977
Endangered Species Act of 1973, as amended
Fish and Wildlife Coordination Act of 1934, as amended
Hazardous Materials Transportation Act of 1974, as amended
National Historic Preservation Act of 1966, as amended
Noise Control Act of 1972
Noise Pollution and Abatement Act of 1970
Occupational Safety and Health Act of 1970
Safe Drinking Water Act of 1974, as amended
Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended by the Hazardous and Solid Waste Amendments of 1984
Toxic Substances Control Act of 1976
Uranium Mill Tailings Radiation Control Act of 1978, as amended

State Statutes

Ohio Air Pollution Control Law, Ohio Revised Code, Title 37 - Health-Safety-Morals, Chapter 3704
Ohio Air Pollution Control Regulations, Ohio Administrative Code, Title 3745 - Environmental Protection Agency, Chapters 3645-15, -16, -19, -21, -25, -26, -31, -35, -45, -49, -73, -74
Ohio Ambient Air Quality Standards, Ohio Administrative Code, Title 3745 - Environmental Protection Agency, Chapters 3745-17, -18, -23, -71
Ohio Water Pollution Control Law, Ohio Revised Code, Title 61, Water Supply-Sanitation-Ditches, Chapter 6111
Ohio Safe Drinking Water Act, Ohio Revised Code, Title 61, Water Supply-Sanitation-Ditches, Chapter 6109
Ohio Wastewater Treatment Regulations, Ohio Administrative Code, Title 3745 - Environmental Protection Agency, Chapter 36 - Regulation os Discharge of Nondomestic Wastewater into a POTW
Ohio Non-Point Source Regulations, Ohio Administrative Code, Title 1501 - Department of Natural Resources, Chapter 1501:15-1, -3, -5
Ohio NPDES Permit Regulations, Ohio Administrative Code, Title 3745 - Environmental Protection Agency, Chapters 3745-33-01 through 3745-33-10
Ohio Drinking Water Regulations, Ohio Administrative Code, Title 3745 - Environmental Protection Agency, Chapter 81 - Public Water System Primary Contaminant Control

TABLE 3.4 (Cont.)

State Statutes (Cont.)

Ohio Water Quality Regulations, Ohio Administrative Code, Title 3745 - Environmental Protection Agency, Chapter 1
Ohio Effluent Guidelines and Standards, Ohio Administrative Code, Title 3745 - Environmental Protection Agency, Chapter 3 - Pretreatment Requirements and Standards
Ohio Solid and Hazardous Waste Disposal Law, Ohio Revised Code, Title 37, Health-Safety-Morals, Chapter 3734
Ohio Solid Waste Disposal Regulations, Ohio Administrative Code, Title 37, Health-Safety-Morals, Chapter 27
Ohio Conservation of Natural Resources, Ohio Revised Statutes, Title 15 - Division of Wildlife
Ohio Department of Natural Resources Regulations, Chapters 1501:18 - Endangered Species and 1501:31 - Division of Wildlife

Executive Orders

Executive Order 11490, Assigning Emergency Preparedness Functions to Federal Departments and Agencies
Executive Order 11514, Protection and Enhancement of Environmental Quality
Executive Order 11593, Protection and Enhancement of the Cultural Environment
Executive Order 11738, Providing for Administration of the Clean Air Act and the Federal Water Pollution Control Act with Respect to Federal Contracts, Grants, or Loans
Executive Order 11807, Occupational Safety and Health Programs for Federal Employees
Executive Order 11988, Floodplain Management
Executive Order 11990, Protection of Wetlands
Executive Order 11991, Relating to the Protection and Enhancement of Environmental Quality
Executive Order 12088, Federal Compliance and Pollution Control Standards
Executive Order 12146, Management of Federal Legal Resources
Executive Order 12580, Superfund Implementation

Department of Energy Orders

Order 1540.1 Materials Transportation and Traffic Management
Order 4240.1H Designation of Major System Acquisition and Major Projects
Order 4320.1A Site Development and Facility Utilization Planning
Order 4700.1 Project Management System
Order 5000.3 Unusual Occurrence Reporting System
Order 5400.1 General Environmental Protection Program
Order 5400.3 Hazardous and Radioactive Mixed Waste Management (was Chapter II of 5480.1A)
Order 5400.4 Comprehensive Environmental Response, compensation and Liability Act Program
Order 5400.5 Radiation Protection of the Public and the Environment
Order 5440.1C Implementation of the National Environmental Policy Act
Order 5480.1B Environment, Safety and Health Program for Department of Energy Operations
Order 5480.3 Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes (was Chapter III of 5480.1A)
Order 5480.4 Environmental Protection, Safety and Health Protection Standards
Order 5480.11 Radiation Protection for Occupational Workers
Order 5481.1B Safety Analysis Review System
Order 5482.1B Environmental Protection, Safety and Health Protection Appraisal Program

TABLE 3.4 (Cont.)

Department of Energy Orders (Cont.)	
Order 5483.1A Occupational Safety and Health Program for DOE Employees at Government-Owned, Contractor-Operated Facilities	
Order 5484.1 Environmental Protection, Safety and Health Protection Information Reporting Requirements	
Order 5500.2 Emergency Planning, Preparedness, and Response for Operations	
Order 5700.6B Quality Assurance	
Order 5820.2 Radioactive Waste Management	
Nuclear Regulatory Commission Guidance	
NRC Regulatory Guide 1.86, Termination of Operating Licenses for Nuclear Reactors	
NRC Branch Technical Position Paper, 46 FR 52061, Disposal or On-Site Storage of Residual Thorium or Uranium from Past Operations.	

3.2.2 Preliminary Remedial Action Objectives

Remedial action objectives are medium-specific or operable-unit-specific goals for protecting human health and the environment. The overall objective of the remedial action for OU3 is to clean up, stabilize, or otherwise control contamination to ensure protection of public health and the environment. Remedial action objectives for OU3 are also evaluated on a site-wide basis to ensure that exposures resulting from all operable units at the FEMP are within accepted risk-based criteria. Preliminary remedial action objectives for OU3 are identified in Table 3.5. Because risks to environmental media are addressed by OU5, Table 3.5 does not include any specific objectives for protection of the environment.

Preliminary remediation goals are initial cleanup goals for individual contaminants for a specific medium and a specific future land use. Preliminary remediation goals are based on readily available information or standards (e.g., ARARs). As new information and data are collected during the remedial investigation and baseline risk assessment, the preliminary remediation goals will be appropriately modified. Final remediation levels are contaminant-specific clean-up levels that will be documented in the ROD.

It is anticipated that after remedial activity is completed, all material that is a part of OU3 will either be placed in a disposal cell (located either on- or off-site, with the material in either a treated or untreated state, or both) or released from the site with or without radiological restrictions. For such conditions, with no material left in place, the only preliminary remediation goals would be those that apply to material released from the site. Such material could contain some level of contamination that could result in exposures of some members of the public.

Equipment or material may be released with radiological restrictions. In such a case, access would continue to be restricted, and members of the public would not be exposed. Remediation goals would not apply in such cases.

It is anticipated that if any material is released from the site without radiological restrictions, it will be nonporous (e.g., steel). The preliminary remediation goal for such material is provided in DOE Order 5400.5, which specifies levels for surface radiological contamination. If additional guidelines are developed in the future that could apply to the release of materials from the site, they will also be considered as preliminary remediation goals for OU3.

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TABLE 3.5 OU3 Preliminary Remedial Action Objectives[a,b]

- Prevent exposure of any member of the public to radionuclides and/or chemicals related to OU3 that would result in an excess lifetime cancer risk that exceeds a value in the range of 10^{-4} to 10^{-6} for all exposure pathways. [Basis: 40 CFR 300 (National Oil and Hazardous Substances Pollution Contingency Plan)]

- Prevent exposure of any member of the public to toxic chemicals related to OU3 that would result in a hazard index of 1 or greater for all exposure pathways. [Basis: 40 CFR 300 (National Oil and Hazardous Substances Pollution Contingency Plan) and EPA 540/1-89-002 (Risk Assessment Guidance for Superfund, Volume 1 - Human Health Evaluation Manual)]

- Prevent exposure of any members of the public to radiation sources related to OU3 that would result, in a year, in an effective dose equivalent greater than 100 mrem for all exposure pathways. [Basis: DOE Order 5400.5 (Radiation Protection for the Public and the Environment)]

- Prevent emissions of radionuclides to the ambient air that would result in an effective dose equivalent due to inhalation to any member of the public in any year of greater than 10 mrem. [Basis: 40 CFR 61, Subpart H (National Emission Standards for Emissions of Radionuclides other than Radon for DOE Facilities)]

- Prevent the release from OU3 without radiological restrictions of any materials and equipment with surface contamination levels that exceed those specified in DOE Order 5400.5.

- Prevent the release from OU3 without radiological restrictions of any building or habitable structure with external gamma radiation levels, surface contamination levels, or airborne radon decay product levels that exceed those specified in DOE Order 5400.5.

[a] Remedial action objectives are to be applied to impacts from components within OU3 and to cumulative impacts for the site as a whole.

[b] OU3 does not include environmental media. The media within OU3 consist of those materials from which the components are constructed.

Preliminary remediation goals for groundwater, surface water, surface soils, and waste material have been developed for all operable units at the FEMP and are presented in the Site-Wide Characterization Report (DOE 1992a). Because OU3 does not include environmental media, the preliminary remediation goals for environmental media are not relevant. However, if any soil from the OU3 soil piles or any rubblized concrete waste were left in place, the goals developed for soils and waste materials would be relevant.

It is not anticipated that risk-based preliminary remediation goals will be developed for OU3 because DOE Order 5400.5 already addresses surface radiological contamination, which is the major issue relevant to release of materials from the site without radiological restrictions. However, if such risk-based goals are developed, the approach used will be based on the guidance provided by the EPA (1991a).

3.2.3 General Response Actions, Potential Technology Types, and Process Options

General response actions are those that will satisfy the remedial action objectives. Similar to remedial action objectives, general response actions are medium-specific; they can be applied either alone or in combination. General response actions for each of the OU3 component groups are listed in Table 3.6.

Potential technology types and process options that could be implemented to achieve the objectives of remedial action for OU3 also are presented in Table 3.6. The overview is based on the current understanding of site contamination. In this work plan, the term *technology type* refers to general categories of technologies, such as chemical treatment or capping. The term *process option* refers to specific processes within each technology type. Within the thermal treatment technology type, for example, process options would include incineration and vitrification.

Following their identification, potentially applicable technology types and process options will be screened for further evaluation in the feasibility study on the basis of technical implementability. This screening will be based on currently available information and information gathered during the RI site characterization activities. Process options will then be evaluated in terms of effectiveness, implementability, and cost as part of technology screening in the feasibility study.

TABLE 3.6 General Response Actions, Technology Types, and Process Options for OU3 Component Categories

Component Category	General Response Actions	Remedial Technology Types	Process Options
1-4. Buildings (four categories)	No action/institutional control actions:	No action/institutional options:	
	No action	Fencing, guards, signs	Proprietary ownership and care with differing levels of access control
	Access restrictions	Proprietary ownership, deed restrictions	
		Environmental monitoring	
	Removal/treatment/disposal actions:	Removal options:	
	Removal/disposal	Demolition	Arc saw, plasma arc, oxygen burner, thermite lance, laser cutting, mechanical cutting, explosive cutting, blasting, air/hydraulic rams, rock splitter, sawing, flame cutting, expansive compounds, explosive cutting
	Removal/treatment/disposal	Dismantlement	
	Decontamination/removal/disposal		
		Excavation	Excavation, debris removal
		Decontamination/treatment technologies:	
		Mechanical cleaning	Vacuuming, scarification, washing/brushing, flame spalling, blasting, strippable plastic membranes, high pressure steam/water ultrasonic decontamination, pavement breakers, grinding
		Chemical/electrochemical decontamination	Spraying, swabbing, electrochemical decontamination, electropolishing, freon cleaning
		Melting/smelting	Melting/smelting
		Solids processing	Crushing, grinding, screening
		Disposal technologies:	
		On-site	Engineered disposal cell, vault
		Off-site	Off-site landfill, off-site hazardous waste site, low-level waste site, mixed waste disposal facility

TABLE 3.6 (Cont.)

Component Category	General Response Actions	Remedial Technology Types	Process Options
1-4. Buildings (Cont.)		Material recycle/reuse	Release without radiological restrictions, transfer to other DOE facility
5-6. Containers/containerized material (two categories)	No action/institutional control actions: No action Access restrictions	No action/institutional options: Fencing, guards, signs Proprietary ownership, deed restrictions Environmental monitoring	Proprietary ownership and care with differing levels of access control
	Removal/treatment/disposal actions: Removal/disposal Removal/treatment/disposal	Removal technologies: Drum removal	Drum removal
		System purge	Vacuuming, draining, emptying
		Bulk removal (tanks)	Pumping, vacuuming, physical removal (shoveling, etc.)
		Treatment technologies: Physical treatment	Oxidation, coagulation/flocculation, adsorption, evaporation, oil/water separation
		Chemical treatment	Oxidation, neutralization, contaminant extraction, ion exchange
		Solidification	Sorption, encapsulation, cementation
		Biological treatment	Aerobic/anaerobic treatment, cultured micro-organisms
		Thermal treatment	Oxidation, incineration, vitrification
		Solids processing	Crushing, grinding, screening
		Dewatering	Gravity thickening, belt filter, vacuum filtration

TABLE 3.6 (Cont.)

Component Category	General Response Actions	Remedial Technology Types	Process Options
5-6. Containers/containerized material (Cont.)		Disposal technologies:	
		On-site	Engineered disposal cell, vault
		Off-site	Off-site landfill, off-site hazardous waste site, low-level waste site, mixed waste disposal facility
7. Bulk material	No action/institutional control:	No action/institutional options:	
	No action	Fencing, guards, signs	Proprietary ownership and care with differing levels of access control
	Access restrictions	Proprietary ownership, deed restrictions	
		Environmental monitoring	
	Containment actions:	Containment technologies:	
	Containment	Capping	Multilayer, clay, asphalt, soil, and vegetation
		Vertical barriers	Slurry wall, sheet piling
		Horizontal barriers	Liners, grout injection
		Surface controls	Diversion/collection, grading, vegetation
	Removal/treatment/disposal actions:	Removal technologies:	
	Removal/disposal	Excavation	Solids excavation
	Removal/treatment/disposal		
		Debris removal	Debris removal
		Treatment/decontamination technologies:	
		Physical treatment	Size reduction, adsorption, oxidation
		Chemical treatment	Contaminant extraction, soil washing, cyclonic separation

TABLE 3.6 (Cont.)

Component Category	General Response Actions	Remedial Technology Types	Process Options
7. Bulk material (Cont.)	Removal/treatment/disposal actions: (Cont.)	Solidification	Cementation, encapsulation, sorption
		Solids processing	Crushing, grinding, screening
		Thermal treatment	Vitrification, incineration
		Decontamination See buildings component group	See buildings component group
		Disposal technologies:	
		On-site	Engineered disposal cell, vault
		Off-site	Off-site landfill, off-site hazardous waste site, low-level waste site, mixed waste disposal facility
		Material récycle/reuse	Release without radiological restrictions, transfer to other DOE facility
8. Storage pads/parking lot/roads/railroads	No action/institutional control: No action Access restrictions	No action/institutional options: Fencing, guards, signs Proprietary ownership, deed restrictions Environmental monitoring	Proprietary ownership and care with differing levels of access control
	Containment actions: Containment	Containment technologies: Capping	Multilayer, clay, asphalt, soil and vegetation
		Vertical barriers	Slurry wall, sheet piling
		Horizontal barriers	Liners, grout injection
	Removal/treatment/disposal actions: Removal/disposal Removal/treatment/disposal Decontamination/removal/disposal	Removal options: Demolition	Explosive cutting, controlled blasting, air/hydraulic rams, rock splitter, sawing, flame cutting, expansive compounds

TABLE 3.6 (Cont.)

Component Category	General Response Actions	Remedial Technology Types	Process Options
8. Storage pads/parking lot/roads/railroads (Cont.)	Removal/treatment/disposal actions: (Cont.)	Decontamination/treatment technologies:	
		Mechanical cleaning Chemical decontamination	Vacuuming, scarification washing/brush, flame spalling, abrasive blasting, fixation, high-pressure steam/water, spraying, swabbing
		Solids processing	Crushing, grinding, screening
		Disposal technologies:	
		On-site	Engineered disposal cell, vault
		Off-site	Off-site landfill, off-site hazardous waste site, low-level waste site, mixed waste disposal facility
		Material recycle/reuse	Release without radiological restrictions, transfer to other DOE facility
9-10. Piping/utilities/equipment (two categories)	No action/institutional control actions: No action Access restrictions	No action/institutional options: Fencing, guards, signs Proprietary ownership, deed restrictions Environmental monitoring	Proprietary ownership and care with differing levels of access control
	Containment actions (belowground components): Containment	Containment technologies: Capping	Multilayer, clay, asphalt, soil and vegetation
		Vertical barriers	Slurry wall, sheet piling
		Horizontal barriers	Liners, grout injection

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TABLE 3.6 (Cont.)

Component Category	General Response Actions	Remedial Technology Types	Process Options
9-10. Piping/utilities/equipment (Cont.)	Removal/treatment/disposal actions: Removal/disposal Removal/treatment/disposal Decontamination/removal/disposal	Removal options:	
		Excavation	Excavation/debris removal
		Demolition Dismantlement	Arc saw, plasma, arc, oxygen burner, thermite lance, laser cutting, mechanical cutting, explosive cutting, blasting, air/hydraulic rams, rock splitter, sawing, flame cutting, expansive compounds, explosive cutting
		Decontamination/treatment technologies:	
		Mechanical decontamination	See building component group
		Chemical/electrochemical decontamination	See building component group
		Melting/smelting	Melting/smelting
		Disposal technologies:	
		On-site	Engineered disposal cell, vault
		Off-site	Off-site landfill, off-site hazardous waste site, low level waste site, mixed waste disposal facility
		Recycle/reuse	Release without radiological restrictions, transfer to other DOE facility
11. Ponds and basins	No action/institutional control actions: No action Access restrictions	No action/institutional options: Fencing, guards, signs Proprietary ownership, deed restrictions Environmental monitoring	Proprietary ownership and care with differing levels of access control

TABLE 3.6 (Cont.)

Component Category	General Response Actions	Remedial Technology Types	Process Options
11. Ponds and basins (Cont.)	Containment actions:	Containment technologies:	
	Containment	Capping	Multilayer, clay, asphalt, soil, and vegetation
		Vertical barriers	Slurry wall, sheet piling
		Horizontal barriers	Liners, grout injection
	Removal/treatment/disposal actions:	Removal technologies:	
	Removal/disposal	Bulk sludge removal	Semi-solids excavation, pumping
	Removal/treatment/disposal	Excavation	Solids excavation
		Treatment technologies:	
		Physical treatment	Oxidation, coagulation/flocculation, adsorption, evaporation, oil/water separation
		Chemical treatment	Oxidation, neutralization, contaminant extraction, ion exchange
		Solidification	Sorption, encapsulation, cementation
		Biological treatment	Aerobic/anaerobic treatment, cultured microorganisms
		Thermal treatment	Oxidation, incineration, vitrification
		Solids processing	Crushing, grinding, screening
		Dewatering	Gravity thickening, belt filter, vacuum filtration
		Disposal:	
		On-site	Engineered disposal cell, vault
		Off-site	Off-site landfill, off-site hazardous waste site, low-level waste site, mixed waste disposal facility

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As previously discussed in Section 2, OU3 contains a considerable quantity of building structural materials and contents that potentially require demolition/dismantlement and decontamination. Table 3.7 presents a brief synopsis of process options identified in Table 3.6 for decontamination and demolition/dismantlement of buildings. Buildings contain the majority of the material available for disposition. A more detailed evaluation of the process options for all component categories will be completed in the OU3 Initial Screening of Alternatives (ISA) report required pursuant to the Amended Consent Agreement.

3.2.4 Identification of Preliminary Remedial Action Alternatives

This section describes development of preliminary remedial action alternatives appropriate to the preliminary remedial action objectives and general response actions applicable to the contaminated materials in OU3.

When alternatives are assembled, general response actions and potential technology types for each medium are combined to form alternatives for the operable unit as a whole. Preliminary alternatives for remedial action at OU3 were developed on the basis of the general response actions identified in Table 3.6 and the categories specified in the NCP. The two categories of final remedial action alternatives discussed in the NCP are source control response actions and groundwater response actions. Only source control response actions are applicable to OU3. Source control actions are response actions that reduce the toxicity, mobility, or volume of contaminants. These actions range from alternatives that involve little or no treatment and rely on engineered controls to prevent or control exposures, to alternatives that employ treatment that removes or destroys contaminants to the maximum extent feasible, thereby minimizing the need for long-term management.

A limited number of preliminary remedial action alternatives have been identified for OU3 on the basis of the general response actions and technologies described in Section 3.2.3. These preliminary alternatives address the radiologically and chemically contaminated components in OU3 (buildings; containers and containerized material; bulk material; storage pads, parking lot, roads, and railroads; piping, utilities, and equipment; and ponds and basins). The alternatives are as follows:

- Alternative 1: No Action;
- Alternative 2: In-Situ Stabilization/Containment;

TABLE 3.7 Decontamination and Demolition/Dismantlement Process Options for Buildings

Process Option	Application
Decontamination	
Chemical decontamination by spraying/swabbing/internal circulation in piping systems or tanks (chemical)	Processes employing nonaqueous solvents such as Freon can by very useful for decontaminating motors, precision parts, electronic equipment, etc. Also, gels, foams, and pastes containing chemical reagents can be used to decontaminate slightly porous and nonporous surfaces. The substances are coated onto the surface where they dissolve and trap the contaminants, which are then removed by washing or stripping.
Electrochemical decontamination (chemical)	Removal of surface contaminants from metallic surfaces by electrochemical processes such as electropolishing or electropickling. The contaminated item is immersed in an electrolyte bath and used as the anode in an electrolytic cell. It can also be applied to relatively complex shapes. Volumes of secondary waste solutions are low but may require chemical treatment before disposal.
Electropolishing (electrochemical)	Electropolishing is an electrochemical decontamination technique that establishes an electrical potential between the contaminated item (the anode) and a cathode in an acid electrolyte. Any contamination on the surface or in the pores of the surface is removed and released in the electrolyte by the surface dissolution process. Desirable if the item being decontaminated is to be reused.
Freon cleaning (chemical)	This process removes loose contamination from surfaces and equipment by use of commercial Freon (trichlorotrifluoroethane) cleaning solvents. Freon systems have been successfully used to clean clothing, plastics, rubber items, electrical cables and motors, tools, and delicate parts.
Vacuuming (mechanical)	Vacuuming is a nondestructive process that has little effect on the surface and is most effective on small amounts of loose contamination. The method is simple and efficient and can be used for loose particles on both wet and dry surfaces.
Scarification (mechanical)	Scarification is a destructive process that removes surface layers from concrete floors. This technique tends to produce significant quantities of dust and fragments that must be controlled with properly filtered vacuum collection systems to prevent recontamination of the cleaned concrete areas.

TABLE 3.7 (Cont.)

Process Option	Application
Washing/brushing (mechanical)	The washing/brushing process is most effective on more firmly attached contamination.
Flame spalling (mechanical)	Flame spalling is a destructive process that removes layers of the surface to varying degrees. This process removes layers of concrete about 50 mm thick in relatively large fragments while producing a minimum of dust. Most useful on walls and ceilings.
Abrasive blasting (wet/dry) (mechanical)	Blasting a contaminated surface with wet or dry high-velocity particles, sand, or ceramic is a fairly rapid process for removing surface contamination, but the process produces large quantities of contaminated abrasive that must be conditioned for disposal. A variation of this technique, employing frozen CO_2 pellets, is an alternative. The abrasion rates for the CO_2 pellets are slow, but this technique does not produce contaminated abrasive for disposal. Concrete and steel surfaces have been effectively decontaminated by removing thin surface layers with air or water abrasive jetting. Also effective in cleaning contamination layers off other materials, such as rubber, plastic, and wood, and in removing coatings such as paint and rust.
Strippable plastic membranes (polyethylene, caseins, or polyvinyl chloride) (mechanical)	These coatings can be used to prevent contamination of a surface when applied before contamination, or can be used to remove surface contaminants when applied after contamination is present.
High-pressure steam/water lance (mechanical)	This method consists of a high-pressure pump, and an operator-controlled gun with directional nozzle that provides a high-pressure flow used to blast surface contamination loose. This process can be applied to assist in the decontamination of equipment or areas in high radiation fields or to reach inaccessible places.
Ultrasonic decontamination (mechanical)	This technique uses ultrasonic energy in liquid to agitate and remove contamination films from materials and components. Chemical solvents or liquids with abrasives can be used to increase decontamination effectiveness. Ultrasonic decontamination is well suited to the decontamination of small tools and equipment.

TABLE 3.7 (Cont.)

Process Option	Application
Pavement breakers (mechanical)	Pavement breakers remove concrete and asphalt by mechanically fracturing localized sections of the surface. Pavement breakers are recommended for use on floors to remove small areas that are inaccessible for heavy equipment.
Grinding (mechanical)	In this technique, the surface is abraded with coarse-grained abrasives such as water-cooled diamond grinding wheels or multiple tungsten carbide surface grinding discs.
Melting/smelting	Melting under a slag cover can be used to remove uranium from most metals. The uranium is preferentially converted to an oxide and transferred to the oxide slag. Plutonium can also be removed from steel, stainless steel, nickel, and copper. The method is totally destructive of components and is effective only for contaminants that are volatile or more soluble (e.g., plutonium) in the slag than the molten metal. The decontamination efficiency varies widely, depending on the radioisotope being removed.
Demolition/Dismantlement	
Arc saw (metal cutting)	An arc saw is a circular, toothless saw blade that cuts any conducting metal without physical contact with the work piece. Cutting action is obtained by maintenance of a high-current electric arc between the blade and the material being cut. The arc saw can operate underwater or in air.
Plasma arc (metal cutting)	Plasma arc cutting is based on the establishment of a direct current arc between a tungsten electrode and any conducting metal. The arc is established in a gas such as argon that flows through a constricting orifice in the torch nozzle to the work piece. The constricting effect results in high current densities and high temperatures in the stream. This technique is capable of cutting all metals. In-air use will penetrate thicker sections than underwater use. Cutting depths up to 7 in. for carbon steel in air are possible.
Oxygen burner	Also known as oxyacetylene cutting, oxygen burning consists of a flowing mixture of a fuel gas and oxygen ignited at the orifice of a torch. Only metals that undergo exothermic oxidation can be cut with this method.

TABLE 3.7 (Cont.)

Process Option	Application
Thermite reaction lance	A thermite reaction lance is an iron pipe packed with a combination of steel, aluminum, and magnesium wires through which a flow of oxygen gas is maintained. The lance is ignited in-air by a high-temperature source, such as an oxygen burning torch or an electric arc. Use of the lance is practical only in the handheld mode. It is capable of cutting away metal, and the maximum depth is limited by the ability to keep the kerf clear of the molten metal. Because significant smoke is generated, adequate ventilation and control must be provided.
Laser cutting	The high-power dynamic continuous wave CO laser can be focused to produce power densities well in excess of 10,000,000 W/cm^2. Cutting is achieved by melting and vaporizing the material and removing it from the fluid zone with a high-velocity assist gas jet.
Mechanical cutting	Mechanical cutting processes include milling, grinding, sawing, nibbling, and shearing. In general, remote machining of thick metal sections is a relatively slow process requiring very rugged equipment and massive supports because of the large reaction forces.
Explosive cutting (misc. material)	Explosive cutting is a method of segmenting metal or other material by use of an explosive that is formed in a geometric shape especially designed and sized to produce the desired separation of the work piece. RDX is normally used as the explosive. Cutting is accomplished by a high-explosive jet of detonation products and deformed casing metal. The jet forms a directed shock wave that cuts the target material (any material that is not configuration limited).
Controlled blasting (concrete)	Controlled blasting is ideally suited for demolition of massive or heavily reinforced, thick concrete sections. One process consists of drilling holes in the concrete, loading the holes with explosives, and detonating the explosives with a delayed firing technique. Delayed firing increases fragmentation and controls the direction of material movement. Each bore hole fractures radially during the detonation to form a fracture plane.

TABLE 3.7 (Cont.)

Process Option	Application
Air and hydraulic rams	Rams can be used for demolition of reinforced concrete structures up to about 2 ft thick. The impact ram has a moil or chisel point attachment and is usually mounted on the arm of a backhoe. Reinforced concrete will crack, but exposed rebars must be cut by other means.
Rock splitter	This method consists of a hydraulically operated expanding wedge placed into a drilled hole to fracture the surrounding concrete. Exposed rebar will require cutting by other means. The process is well suited for limited access areas.
Sawing	A motor-driven diamond or carbide saw blade can be used to cut a kerf through concrete floors or wall. The blades can cut through rebar, provided the rebar is at approximately right angles to the cut. The saw blade is water cooled, which provides concrete dust and metal particle airborne contamination control.
Flame cutting	Flame cutting of concrete is a thermite reaction process whereby a mixture of iron and aluminum powders is oxidized in an oxygen jet. The jet mass flow rate literally blows the molten concrete away from the kerf.
Expansive compounds	Certain compounds poured into predrilled holes in concrete will expand, developing a force capable of causing cracks to form along a predetermined fracture line. Except for hole drilling, there is no noise, dust, or gas release for the process. Mixtures of material such as Bristar (a concrete demolition compound composed of limestone, siliceous material, gypsum, and slag) are capable of exerting a force of over 4,300 lb/in.^{2}.
Explosive cutting	Explosive cutters of the type described above can also be used to demolish concrete. They are generally used for precision cutting rather then for massive demolition.

- Alternative 3: In-Situ Decontamination and Removal/Disposal;
- Alternative 4: Removal and Disposal; and
- Alternative 5: Removal, Treatment/Decontamination, and Disposal/Recycle.

The alternatives, briefly described below, represent basic combinations of potential response actions. Table 3.8 provides a preliminary assessment of the applicability of each alternative to the OU3 component groupings. Variations of the options may be identified within each of the action alternatives (alternatives 2 through 5) as the RI/FS process develops in order to incorporate different elements specific to certain components (or groups of components) within each alternative to form comprehensive site-wide alternatives. For example, within the in-situ decontamination alternative, some components may need to be removed and disposed of because of the physical characteristics of the component or the nature of contamination in the component. In addition, disposal may be off-site or on-site, thus resulting in two options for each disposal alternative.

Alternative 1: No Action — The no-action alternative is included pursuant to the requirements of CERCLA and NEPA to provide a baseline for comparison with other alternatives and to assess the impacts on human health and the environment from current and future conditions at the site. Under this alternative, no reduction in contaminant toxicity, mobility, or volume would result. Potential exposures to contaminants would continue and could increase with time as a result of off-site migration of contaminants.

Alternative 2: In-Situ Stabilization/Containment — Alternative 2 would involve in-situ stabilization of bulk materials (soils only), parking lots, storage pads, roads, railroads, piping (below grade), utilities (below grade), and basins through the use of caps and subsurface barriers, as appropriate. On a component-specific basis, additional stabilization techniques (including shallow soil mixing and/or pressure injected grout) may be used to further reduce contaminant transport.

Alternative 3: In-Situ Decontamination and Removal/Disposal — Alternative 3 would utilize in-situ decontamination technologies to treat the buildings, parking lot, storage pads, roads, railroads, aboveground piping and utilities, and equipment to the extent

TABLE 3.8 Preliminary Evaluation of Applicability of Remedial Action Alternatives[a]

Component Category	No Action	In-Situ Stabilization/ Containment	In-Situ Decontamination and Removal/Disposal	Removal and Disposal	Removal, Treatment, and Disposal/Recycle
Buildings	•		•	•	•
Containers and containerized material	•			•	•
Bulk material	•	•		•	•
Storage pads, parking lot, roads, and railroads	•	•	•	•	•
Piping, utilities, and equipment	•	•	•	•	•
Ponds and basins	•	•		•	•

[a] A bold dot denotes applicability.

necessary to allow appropriate reuse in accordance with future long-term use scenarios. As discussed in Section 1, the FEMP production mission permanently ended in 1991. The remaining facility mission is limited to environmental restoration and site decontamination and dismantlement. Consistent with this current site mission, it is envisioned that all production and support structures will be dismantled as a consequence of remedial or removal actions. Structures housing remedial systems (e.g., water treatment) will be decontaminated (if necessary) and dismantled after their cleanup objective is attained. In accordance with this position, it is envisioned that in-situ decontamination for future use will only be used to a limited extent for those facilities required to support remediation or remedial systems.

Several decontamination methods could be used for buildings, piping, utilities, and equipment, depending on whether the end use of those structures or facilities was to be restricted or unrestricted. The methods used would depend on the types of material contaminated (e.g., wood, concrete), the extent of contamination, and the specific contaminants.

Decontamination would generate treatment residuals, the quantity and characteristics of which would depend on the decontamination method employed. These treatment residuals would require further treatment and/or stabilization and disposal in an on-site or off-site facility. Sampling and analysis would be required to verify that cleanup had met established criteria. If the soil surrounding the component was contaminated, another alternative (e.g., removal or in-situ containment) might be optimal. Those components of the operable unit that could not be managed by in-situ decontamination and reuse would require removal and disposal with treatment/decontamination, as applicable.

Alternative 4: Removal and Disposal — This alternative would involve the removal and disposal of contaminated materials. Disposal could be at an off-site facility or in an on-site engineered disposal facility. Removal of contaminated materials would reduce exposures at the initial source of contamination, mitigate future migration from source areas, and reduce contaminant mobility by encapsulating contaminated materials in an engineered disposal facility, thus isolating the materials from the environment. This alternative would result in the largest quantity of material requiring disposal, and contaminant toxicity of that material would remain unchanged.

Direct removal and disposal of the materials in the buildings and piping, utilities, and equipment component groups generally would not represent a prudent course of action relative to cost or environmental protection if significant contamination was present. Decontamination methods would be used to the extent practical to maximize recycle/reuse and minimize materials requiring greater confinement disposal.

Alternative 5: Removal, Treatment/Decontamination and Disposal/Recycle — Alternative 5 would involve the removal and treatment/decontamination of contaminated materials to reduce the potential for contaminant migration or to reduce volumes for disposal. This alternative would also involve disposal of contaminated materials or release of materials for reuse or recycle without radiological restrictions. Decontamination and treatment residues would require further treatment and disposal. Disposal of contaminated materials could be at an off-site facility or an on-site engineered disposal facility.

For the buildings; the storage pads, parking lot, roads, and railroads; and the piping, utilities, and equipment component groupings, decontamination could be used either in-place or following demolition, dismantlement, or both, depending on the nature of the contamination and the building material involved. Limited in-place decontamination is anticipated for all materials exhibiting gross removable contamination in order to reduce worker exposures and minimize off-site release during demolition/dismantlement. Decontamination would be employed to the extent practical to maximize reuse and recycle and minimize the requirement for disposal.

Treatment options for containerized waste and bulk soil materials include the application of a wide range of technologies commensurate with the large quantities and types of envisioned waste and product materials in OU3. On-going treatability programs for the other four FEMP operable units may provide significant information pertinent to a number of the envisioned OU3 waste types. Additional treatability studies are envisioned to support OU3 to demonstrate the effectiveness of specific treatment and decontamination options as applied to OU3 waste materials.

3.2.5 Evaluation of Alternatives

During the detailed analysis of alternatives, each alternative will be assessed against nine evaluation criteria: (1) overall protection of human health and the environment; (2) compliance with ARARs; (3) long-term effectiveness and permanence; (4) reduction of toxicity, mobility, or volume; (5) short-term effectiveness; (6) implementability; (7) cost; (8) state acceptance; and (9) community acceptance. State and community acceptance will be addressed in the ROD, after comments have been received on the RI and FS reports and the proposed plan. Evaluation of the overall protection of human health and the environment will be based on assessments conducted under other evaluation criteria. Issues related to the remaining six evaluation criteria are discussed in the following sections.

3.2.5.1 Compliance with ARARs

A preliminary identification of ARARs and TBCs is provided in Section 3.2.1. Documentation will be provided in the feasibility study of whether ARARs will be attained by specific alternatives. Assessing compliance with ARARs and TBCs involves the following major activities: (1) identification of cultural and environmental resources that might be adversely affected by remedial activity; (2) prediction of the concentrations or release rates of various radionuclides during remedial activity and the doses received by workers and the public as a result of remedial activity; (3) prediction of the releases to or concentrations in environmental media of chemical contaminants as a result of remedial activity; and (4) determination of the levels of PCBs, asbestos, and hazardous waste characteristics in OU3 source or waste materials. The major issues associated with carrying out these activities are addressed under the short-term effectiveness, the long-term effectiveness, and the implementability evaluation criteria, which are discussed below.

3.2.5.2 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence criterion has two components: the magnitude of residual risk and the adequacy and reliability of controls used to manage treatment residuals or untreated wastes that may remain on the site. A future exposure risk assessment will be conducted to assess the magnitude of residual risks associated with each

remedial alternative. The estimated risks will be compared with remedial action objectives to ensure that human health is protected after remedial action activities are complete.

The long-term effectiveness of all alternatives will be evaluated under two exposure scenarios: (1) a resident farmer scenario in the case of no future DOE control of the property, and (2) a trespasser in the case of continued DOE control of the property.

- *Resident Farmer Scenario* — This scenario is similar to the resident farmer scenario for future land use conditions for the baseline risk assessment. However, following remediation, contaminated components for OU3 generally would be contained, placed in an on-site disposal cell, or removed from the site. Therefore, exposure routes would involve only potential releases from any residual contamination remaining in OU3 (e.g., contaminated underground utilities, deep foundations, etc.), if any contaminated material were left in place under an alternative. (For the no-action alternative, conditions would be the same as for the future land-use scenario.)
- *Institutional Control/Trespasser Scenario* — This scenario is similar to that for the trespasser for the case of current land use with access controls for the baseline risk assessment, except for the same qualifications given above for the resident farmer scenario. For the no-action alternative, the exposure routes would remain the same.

3.2.5.3 Reduction of Toxicity, Mobility, or Volume through Treatment

The reduction through treatment criterion considers the extent to which treatment processes that would be part of an alternative would reduce the toxicity, mobility, or volume of hazardous substances present in OU3. Evaluation of alternatives against this criterion will necessitate information on the treatment processes included in the alternatives, the quantity of contaminated material to be treated, the extent to which the toxicity, mobility, or volume of contaminants will be reduced, and the nature and character of residuals produced by the treatment process.

3.2.5.4 Short-Term Effectiveness

The short-term effectiveness criterion will be used to evaluate the impacts that may occur during implementation of the remedial alternatives. In particular, impacts to the public, workers, and the environment while each remedial alternative is underway will be considered. A risk assessment will define the short-term risks associated with each remediation alternative. Because environmental media and flora and fauna are included in OU5, consideration of impacts to those resources will necessitate coordination between OU3 and OU5 activities.

In the case of remedial activities, both remediation workers and the general public would potentially be at risk as a result of on-site exposure. Because they would handle, treat, package, store, and dispose of contaminated materials, workers would be more at risk than the general public during the remediation phase.

For action alternatives, restricted access is assumed for the site during implementation of the alternative. The following scenarios will be considered for the action alternatives:

- *Remediation Worker Scenario* — In this scenario, workers are assumed to be exposed to contaminated materials during remediation. Exposure routes include:
  - Inhalation of fugitive dusts, vapors, and gases; and
  - Direct radiation from and dermal contact with contaminated materials and soils.

  In addition, worker-related construction accidents will also be considered.
- *Transportation Worker Scenario* — Transportation workers are assumed to be exposed to direct radiation from materials being transported. Transportation accidents involving worker injury or fatality will also be considered.

- *Off-Property Farmer Scenario* — This scenario assumes that a farm family is living adjacent to the FEMP property boundary during remediation. Exposure routes include:
  - Inhalation of fugitive dust, vapors, and gases;
  - Consumption of farm-produced foodstuffs, including vegetables, meat, and milk;
  - Direct radiation from and dermal contact with soils; and
  - Incidental ingestion of soil.
- *Off-Property General Public* — This scenario involves several sub-scenarios: a nearby nonfarmer resident, meat and dairy users, and members of the public near transportation routes. For the nearby nonfarmer resident, exposure routes are the same as for the off-property farmer scenario, except that no consumption of farm-produced foodstuffs is assumed. For the meat and dairy user, consumption of farm-produced foodstuffs is assumed to be the only significant exposure route. For individuals located near a transportation route, the exposure routes include:
  - Direct radiation from contaminated materials being transported as the result of a member of the public repeatedly being in proximity to transport vehicles; and
  - Inhalation of fugitive dust as the result of a transportation accident that releases contaminated material to the atmosphere.

Worker exposure to contaminants of concern will be limited by FEMP procedures that implement DOE orders, including a requirement for consistency with Occupational Safety and Health Administration (OSHA) regulations. The risk assessment will assume that these limitations are in place. An estimate will be made (on the basis of the most contaminated component or series of components) of whether such limits will likely be reached. Average risk to remedial workers will also be estimated.

Direct exposure of workers and the public to radiation would occur during transport of wastes to off-site locations. Estimates of risks for any alternative involving off-site

transport will be based on average levels of contamination in the wastes being transported and expected exposure periods for workers and the public. The estimates of risks to the public associated with an off-site spill will be based on the assumed presence of the most contaminated wastes from OU3. It is assumed that any on-site spills will be contained with minimal risk. The expected number of transportation accidents and fatalities associated with any off-site transportation will also be estimated.

Fugitive emissions are a serious concern associated with many remedial activities, and, therefore, a major effort will be made to minimize such emissions. Structures will be sealed (or isolated if necessary) and decontaminated in place before dismantlement. Dust-suppression methods will be used for all potential sources exposed to wind or traffic action. The site boundary will be monitored during remediation, and if increased releases from site are detected, controls will be increased. Releases from buildings are not expected to be at significant levels at the site boundary. Any significant off-site releases are anticipated to be due only to sources exposed directly to wind or traffic. Such releases will be quantified on the basis of an average source for each appropriate category, assuming dust suppressants are applied as needed, and will rely on EPA-approved methods (such as those described in EPA 1984, 1985).

Emissions from buildings will be estimated on the basis of expected filter efficiencies and expected levels of air contamination in buildings (based on measurements of in-place contamination for OU3 and experience at other locations for similar actions).

Treatment alternatives for remedial actions may also involve discharges of treated water to the environment. The volumes of wastewater and the concentrations of contaminants in that water will be estimated for each appropriate feasibility study alternative. The evaluation will consider National Pollutant Discharge Elimination System (NPDES) permit limits, the efficiency of expected treatment processes, and estimated concentrations of contaminants in untreated wastewater. Estimates of concentrations of contaminants in untreated wastewater will be based on the alternatives being evaluated.

3.2.5.5 Implementability

The implementability criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required

during its implementation. From the perspective of this work plan, the major issue related to this criterion is the availability of adequate services for the off-site treatment, storage, or disposal of materials from OU3 if required under an alternative. Acceptance criteria for wastes that might be sent to off-site locations will relate to the level of radiological contaminants present in any waste and the presence of hazardous waste. Acceptance of wastes for land disposal will require that the material meet limitations on hazardous waste characteristics because of land disposal restriction under RCRA.

3.2.5.6 Cost

All alternatives will be evaluated in terms of capital costs, postconstruction annual operating and maintenance costs, and present-worth costs. The major factors affecting the evaluation of this criterion are the volume and character of materials in OU3 that will require handling, treatment, and disposal or other disposition.

3.2.6 Data Needs

Table 3.9 summarizes the data needed for evaluation of alternatives during the feasibility study, with the exception of the data needed for the evaluation of compliance with ARARs and TBCs. The data needs are based on the discussion in Section 3.2.5. The table identifies data needs, data uses, and data availability. The evaluation criteria that result in the data need are also indicated.

The information on environmental characteristics necessary to support the transport modeling required for the risk assessments used in assessing compliance with short-term and long-term effectiveness is available from previous or ongoing studies at the FEMP or from the general scientific literature. No additional data needs are involved. The primary data need for the risk assessments is related to the requirement to quantify source terms.

Table 3.10 provides a general assessment of the data needed during the feasibility study to assess compliance with the ARARs and TBCs. (Note that the data discussed here are not needed to demonstrate compliance but to assess whether compliance would be achieved if an alternative were to be implemented. Any data needed to demonstrate compliance will be collected during or following remediation.) The availability of the needed

TABLE 3.9 Summary of Data Needs for Evaluation of OU3 Remedial Action Alternatives for Criteria other than Compliance with ARARs

Data Need	Data Use[a]	Data Availability
Volumes of material by material type	Used to determine the total volumes of the various materials in OU3 that may be treated or otherwise handled. (LT, ST, I, C)	Generally available. Refined estimates for building contents are needed.
Types and levels of contaminants by material type in components; depth of contamination	Used in estimating volumes of materials contaminated with various contaminants. Used to aid in the screening of treatment technologies, based on their effectiveness with selected contaminants at various depths in the various media. Also used to assist in assessing short-term effectiveness of the various alternatives, for which data on the type of contamination are needed. (LT, TMV, ST, I, C)	To be obtained during the RI phase.
Physical and chemical characteristics of materials and contaminants	Used to aid in the screening/evaluation of treatment technologies, based on their effectiveness with various types of media and contaminants. (TMV, I, C)	To be estimated from handbook values or obtained from treatability studies.
Radiation exposure rate in components	Used to determine the on-site risk to workers during remedial actions due to direct external exposure to radiation. (ST)	To be obtained during the RI phase.
Removable surface contamination for radionuclides and for chemical species in components	Used to determine the on-site risk to workers during remedial actions due to direct contact. (ST)	To be obtained during the RI phase.
Characteristics of media and contaminants in treated wastes; characteristics of any emissions associated with treatment; volume of treated wastes	Used to determine the effectiveness of various remedial alternatives relative to the reduction of toxicity, mobility, or volume of wastes and to assist in assessing the applicability of various disposal options for the final waste forms. Volume estimates will be used to assist in projecting the long-term effectiveness of the various alternatives and in determining potential transportation requirements. Emissions characterization needed to assess short-term effectiveness. (LT, TMV, ST, I, C)	If available information is inadequate, will be addressed by treatability studies, as appropriate.

[a] Letters in parentheses indicate the criteria that the data are used to evaluate: LT = long-term effectiveness; TMV = reduction of toxicity, mobility, or volume; ST = short-term effectiveness; I = implementability; and C = cost.

TABLE 3.10 Identification of Data Needed during Preparation of the FS to Assess Compliance with Potential ARARs and TBCs

Data Need	Potential ARARs and TBCs for which Compliance Will Be Assessed	Data Availability
Environmental and Cultural Protection		
List of cultural and environmental resources that might be adversely affected by the proposed action, including:	Antiquity Act; Historic Sites Act [16 USC 431-433; 16 USC 461-467; 40 CFR 6.301(a)]	The data needed have been previously collected in support of the OU2 FS/EIS. No additional data collection is required.
• Historic buildings and natural landmarks	National Historic Preservation Act, as amended [16 USC 470 et seq.; 40 CFR 6.303(b); 36 CFR 800]	
• Properties at or around the site that are included in or eligible for the National Register of Historic Places	Archeological and Historic Preservation Act [16 USC 469; 40 CFR 6.301(c); PL 93-291; 88 Stat.174]	
• Prehistorical, archeological resources	Archeological Resources Protection Act [16 USC 470(a)]	
• Architectural resources	Protection and Enhancement of the Cultural Environment [Executive Order 11593; 40 CFR 6.301]	
• Threatened and endangered species and critical habitat	Endangered Species Act, as amended [16 USC 1531-1543; 50 CFR 17.402; 40 CFR 6.302(h)]; Migratory Bird Treaty Act [16 USC 703 et seq.]; Bald & Golden Eagle Protection Act [16 USC 668-668(d)]	
• Floodplains at or around the site	Floodplain Management [Executive Order 11988; 10 CFR 1022]	
• Jurisdictional wetlands	Protection of Wetlands [Executive Order 11990; 10 CFR 1022]	

TABLE 3.10 (Cont.)

Data Need	Potential ARARs and TBCs for which Compliance Will Be Assessed	Data Availability
Worker Protection		
Information required to predict the following for each of the remedial alternatives: • Effective dose equivalent received by workers and dose equivalents to specific organs of workers • Annual effective dose equivalent received by an embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman • Air concentrations of radionuclides in areas occupied by the workers • Intake of radionuclides by workers due to ingestion and inhalation	Radiation Protection for Occupational Workers [DOE Order 5480.11] Standards for Protection Against Radiation [10 CFR 20, Subpart C - Occupational Dose Limits] Radiation Protection Rules, Ohio Administration Code, Chapter 3701-38: General Radiation Protection Standards; Rules 3701-38-13, 3701-38-15 and 3701-38-16.	The data needed are also required to evaluate short-term effectiveness of alternatives and are addressed in Table 3.9. Assessing compliance with ARARs will add no additional data requirements.
Public and Environmental Radiation Protection		
Information required to predict the following for each of the remedial alternatives: • The total effective dose equivalent to a member of the public and the effective dose equivalent to specific organs of a member of the public from all pathways combined	Radiation Protection of the Public and the Environment [DOE Order 5400.5] Standards for Protection Against Radiation [10 CFR 20, Subpart D - Radiation Dose Limits for Individual Members of the Public]	The data needed are also required to evaluate short-term and long-term effectiveness of alternatives and are addressed in Table 3.9. Data on environmental media will be available from OU5. Assessing compliance with ARARs will add no additional data requirements.

TABLE 3.10 (Cont.)

Data Need	Potential ARARs and TBCs for which Compliance Will Be Assessed	Data Availability
• The total annual effective dose equivalent to a member of the public from the air pathway • External gamma radiation exposure rates in occupied or habitable areas	Radiation Protection Rules, Ohio Administration Code, Chapter 3701-38: General Radiation Protection Standards; Rules 3701-38-13, 3701-38-15 and 3701-38-16.	
• Average radon-222 emission rate to ambient air and increase in the annual average radon-222 concentration in air outside the site	National Emissions Standards for Hazardous Air Pollutants [40 CFR 61], Subpart H, National Emission Standards for Emissions of Radionuclides Other Than Radon from DOE Facilities	
• Radon-222 and radon-220 concentration in air in uncontrolled areas • Annual average (or equivalent) radon decay product concentration, including background, in any habitable building	National Emission Standards for Hazardous Air Pollutants [40 CFR 61], Subpart Q, National Emission Standards for Radon Emissions from DOE Facilities, and Subpart T, National Emission Standards for Radon Emissions from the Disposal of Uranium Mill Tailings	
• The dose received by a member of the public in an unrestricted area from external sources in any one hour and from all sources in any one hour or any consecutive seven days	Environmental Radiation Protection Standards for Nuclear Power Operation [40 CFR 190] Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings [40 CFR 192]	

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TABLE 3.10 (Cont.)

Data Need	Potential ARARs and TBCs for which Compliance Will Be Assessed	Data Availability
• The concentrations of radioactive material released in gaseous and liquid effluent at the boundary of an unrestricted area		
• Concentrations of radionuclides in air in uncontrolled areas		
Environmental Media (Air, Soil, Water, Noise) Protection		
Information required to estimate the point source discharges of regulated substances from air emission sources during remediation	Clean Air Act, as amended [42 USC 7401-7642]; National Primary and Secondary Ambient Air Quality Standards [40 CFR 50]; Ohio Air Pollution Control Regulations, Ohio Administrative Code, 3745-17-02	Data needed are also required to evaluate the short-term effectiveness of alternatives and are addressed in Table 3.9. Assessing compliance with ARARs will add no additional data requirements.
Average concentration (averaged over an area of 100 m^2) of radium-226, radium-228, thorium-230, thorium-232, and other radionuclides in the soil piles associated with OU3	Regulations concerning soil contamination [40 CFR 192, DOE Order 5400.5]	Data needed are also required to evaluate the short-term effectiveness of alternatives and are addressed in Table 3.9. Assessing compliance with ARARs will add no additional data requirements.
Information required to predict concentrations of various contaminants in groundwater as a consequence of each remedial alternative	Safe Drinking Water Act [42 USC 300G; PL 93-523]; National Primary and Secondary Drinking Water Regulations; [40 CFR 141] and [40 CFR 143]; Ohio drinking water regulations; other ground water regulations	Data needed are also required to evaluate short-term and long-term effectiveness of alternatives and are addressed in Table 3.9. Environmental media data will be available from OU5. Assessing compliance with ARARs will add no additional data requirements.

TABLE 3.10 (Cont.)

Data Need	Potential ARARs and TBCs for which Compliance Will Be Assessed	Data Availability
Information required to predict concentrations of various pollutants in surface waters and in surface water discharges as a consequence of each remedial alternative	Surface Water Regulations [40 CFR 440], Subpart C; Clean Water Act, Water Quality Criteria [40 CFR 122], Ohio Water Quality Standards; Ohio NPDES permits; DOE Order 5400.5	Data needed are also required to evaluate short-term and long-term effectiveness of alternatives and are addressed in Table 3.9. Environmental media data will be available from OU5. Assessing compliance with ARARs will add no additional data requirements.
Toxic Substances Control		
Concentrations of PCBs in OU3 source material	Toxic Substances Control Act, as amended [40 CFR 761], Subpart A, General	Existing data are available on the inventory of waste materials containing PCBs. Additional data to be collected during the RI phase to evaluate other criteria.
Inventory of friable asbestos-containing materials	Ohio Air Pollution Control Regulations, Ohio Administrative Code, 3745-20-04 and -05, Demolition and Renovation Procedures for Asbestos Emission Control	Data available from an existing site program.
Waste Management Requirements		
Information required to predict, for each of the remedial alternatives, the annual effective dose equivalent to a member of the public (and to specific organs) from waste management operations	Radioactive Waste Management [DOE Order 5820.2A]; Licensing Requirements for Disposal of Radioactive Waste [10 CFR 61, Subpart C and D]	Data needed are also required to evaluate the short-term and long-term effectiveness of alternatives and are addressed in Table 3.9. Assessing compliance with ARARs will not add additional data requirements.

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TABLE 3.10 (Cont.)

Data Need	Potential ARARs and TBCs for which Compliance Will Be Assessed	Data Availability
The nature of existing hazardous waste within OU3 and of hazardous waste that will be generated as a consequence of each remedial alternative	Solid Waste Disposal Act, as amended [42 USC 6901, et seq.; 40 CFR 261 - 268]	Hazardous waste determinations are either complete or underway for existing stored waste inventories. Planned treatability studies will provide process-specific information regarding the nature of any hazardous wastes to be generated as a consequence of viable remedial alternatives. Hazardous waste determinations for selected materials that are not part of a stored waste inventory will be made during the RI phase.

data is also indicated. As can be seen from the table, data required to evaluate remedial alternatives for compliance with these potential ARARs and TBCs are generally either currently available or are addressed under the data needs of other criteria for evaluation of remedial alternatives. ARAR and TBC identification will continue throughout the RI/FS process as a better understanding is gained of the site conditions, contaminants of concern, and remedial action alternatives. Accordingly, the identification of data needed to evaluate remedial alternatives for compliance with these ARARs and TBCs will continue throughout the RI/FS process, as needed.

3.3 HEALTH AND SAFETY PLANNING

3.3.1 Potential Worker Impacts during the Field Program

Activities during the field program will potentially expose workers to four types of hazards: (1) physical hazards, (2) chemical hazards, (3) ionizing radiation hazards, and (4) nonionizing radiation hazards.

Potential physical hazards include cold stress, heat stress, hazards from overhead and underground utilities, traffic accidents, and confined space entries. These hazards can also include crushing, puncture, and stored energy hazards posed by process equipment and materials inside buildings.

Chemical hazards include the presence of process chemicals in pipes, tanks, and equipment, as well as contamination on equipment and building surfaces. These hazards may also include structural materials (e.g., asbestos).

Ionizing radiation hazards include all of the radioisotopes that have been used at the FEMP. These radioisotopes pose hazards through both external exposure and internal deposition. Nonionizing radiation hazards include a variety of electromagnetic sources, such as power lines, microwave generators, and large pieces of electrical equipment.

Depending on the areas in which they are working, on-site personnel may be exposed to any or all of these hazards. These hazards can cause a variety of acute effects, such as burns, trauma, loss of consciousness, or even death. Furthermore, steps taken to protect workers may themselves create a hazard. For example, use of protective clothing during hot weather may increase the risk of heat stress. Identification of these hazards before work

begins and development of plans to avoid them are the keys to success in protecting worker health.

3.3.2 Worker Protection Program

Each worker is ultimately responsible for self-protection from hazards present during FEMP field activities. The FEMP RI/FS project has a variety of tools to assist the worker in this vital task. The principal tools are the FEMP RI/FS Health and Safety Plan (HSP) and a team of health and safety professionals assigned to the project. The goal of the HSP is to establish a program maintaining personnel exposure to potential hazards at levels as low as reasonably achievable, but in no case more than regulations allow. A component-specific Health and Safety Plan will be developed before field program activities are begun in a component. The health and safety program includes the following elements:

- Education/training,
- Medical surveillance,
- Standard operating procedures,
- Access control to hazard areas,
- Personal protective equipment, and
- Work place monitoring.

Education and training are provided to each employee commensurate with their proximity to potential hazards (i.e., general site worker, occasional site worker, and site supervisor). The training includes course work (e.g., 40 hours of training consistent with the requirements of 29 CFR 1910.120), on-the-job training, and daily tailgate safety meetings to keep safety foremost in workers' minds.

Medical surveillance assists the workers by certifying their fitness for performing the field tasks at the FEMP, including the use of respirators. Periodic surveillance checks workers for potential chemical accumulations and the presence of other adverse effects resulting from exposure to hazards. Appropriate restrictions may be placed on workers if warranted to prevent an effect from becoming more serious.

Standard operating procedures (SOPs) document the appropriate methods for workers to use in protecting themselves. The SOPs cover the typical operations that workers will face during removal action and RI/FS activities.

Access control provides a mechanism to ensure that workers do not inadvertently enter an area where a hazard exists. It also ensures that workers in an area can be checked for exposure to hazards before they leave the area.

The SOPs specify use of personal protective equipment where it is needed to prevent exposure to a hazard. Finally, work-place monitoring provides a means to ensure that hazard levels remain safe in an area where people are working.

To assist workers in the vital task of protecting themselves, the FEMP project has a team of health and safety professionals under the direction of the Site Health and Safety Officer (SHSO). The SHSO is responsible for the following:

- Reviewing proposed work activities to confirm the validity of SOPs and issuing activity-specific addenda when necessary,
- Providing the necessary activity-specific training that field personnel need in order to avoid hazards, and
- Providing field assistance in controlling access and monitoring field conditions in the work area.

The SHSO will periodically evaluate the effectiveness of the health and safety program and the status of compliance with it. When necessary, the program will be modified to enhance worker protection and to improve compliance.

3.3.3 Data Needs

The data needed for the health and safety program are those used to plan protective measures and to monitor their effectiveness. For physical hazards, the data needed are temperature, wind chill factors, and information on the physical layout of facilities, especially for underground utilities.

For chemical hazards, data are needed to determine the location, identity, and concentration of chemical constituents. The ionizing radiation data needed are similar to those for the chemical hazards. Additional data needed include ambient exposure rates for

external radiation. Nonionizing radiation data needed include power densities for the frequencies of interest in the areas where personnel will be located.

The health and safety staff will collect all of these data for each component before site investigation teams begin their work. Therefore, the health and safety program will impose no requirements on the RI effort.

3.4 SUMMARY OF UNFULFILLED DATA NEEDS

Initial evaluation of the overall data needs for the RI/FS process for OU3 has been presented in previous sections of this chapter. In those sections, the data needed for various specific tasks were discussed. The availability of the needed data was also evaluated.

On the basis of the discussions provided in previous sections, the data items that are not currently available or that are available but are not adequate for the purposes of the RI/FS process are identified as unfulfilled data needs and are summarized in Table 3.11. The table lists the unfulfilled data needs that will be satisfied as part of the OU3 field characterization program described in Section 4.5 and in the Sampling and Analysis Plan, through inspections and through activities carried out pursuant to an OU3 treatability study work plan, if necessary.

TABLE 3.11 Summary of Unfulfilled Data Needs[a]

Task	Data Needs Summary
Baseline Risk Assessment	Identity and level of radiological and chemical contaminants as fixed and removable contamination on surfaces. Identity and concentration of contaminants in water and sediment of ponds and basins. Leach rates of contaminants in fixed surface contamination for representative materials. Presence and characteristics of contaminated liquids in OU3. Radiation exposure rates in components. Air concentrations of contaminants in buildings.
Feasibility Study (Evaluation of Alternatives)	Identity and levels of radiological and chemical contaminants by material types, including depth of contamination and removable surface contamination. Radiation exposure rates in components. Refined estimate of the volumes of building contents by material type. Physical and chemical characteristics of materials and contaminants. Physical, chemical, and radiological characteristics of decontamination and process treatment residues and treated wastes. Volumes of these wastes and residues. Hazardous waste determinations for selected materials that are not part of a stored waste inventory.

[a] This table provides only a brief summary of information in Tables 3.3, 3.9, and 3.10.

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4 STRATEGY FOR DATA COLLECTION

This section presents the approach to field characterization that will be used to satisfy the unfulfilled data needs identified in Section 3. The section begins with a discussion of considerations related to data collection for OU3 (Section 4.1). The requirements for data collection are then presented in Section 4.2 in terms of data quality objectives (DQOs). Section 4.3 discusses the approach to data collection for OU3. The schedule for data collection activities is given in Section 4.4. The Sampling and Analysis Plan (Appendix D) that has been developed to achieve the DQOs is summarized in Section 4.5. Finally, Section 4.6 summarizes other major plans (the Community Relations Plan, the Health and Safety Plan, and the Data Management Plan) that are important for the collection of data for OU3.

4.1 BACKGROUND

DOE has decided that all structures in OU3 will be removed, and that they have no use beyond the period of remediation. This decision limits the range of remedial alternatives requiring evaluation. In particular, decontamination of structures for reuse is not a reasonable alternative. In addition, since the requirement for remediation is already assumed, the baseline risk assessment will not attempt to demonstrate that no remediation is necessary. Therefore, the decision that structures have no further use has major implications for the nature of the data collection program for OU3. Data are required to make conservative decisions, but detailed characterization of OU3 structures is unnecessary. All materials in OU3 will be thoroughly surveyed during remediation or before any releases of material without radiological restrictions. Therefore, actual disposition of materials will not be affected by a failure to identify and characterize all areas of contamination in components during the RI field program.

The materials that make up OU3 are heavily concentrated in a relatively small fraction of the largest components. As a consequence, uncertainties over conditions in small components will have little effect on decisions concerning the operable unit. Estimates of quantities of materials by major material type are generally available for all components in OU3 (Table A.7). The material types are concrete, cement block, steel, transite, other metals (e.g., copper), soil and rubble, asphalt, and miscellaneous (e.g., wood and brick). These material types also generally correspond to the sampling media types discussed throughout

this section. However, the media types used in this section include masonry, consisting of both cement blocks and bricks.

For purposes of the data collection program, components in OU3 are divided into two major groups: (1) those for which contamination is known to be present or for which contamination is likely, and (2) those for which significant contamination is unlikely. In general, components in the second group will not be sampled. Treatment technologies found applicable to contamination in the first group of components will be applied to components in the second group, as necessary, to achieve performance-based requirements. For this reason and because of the small volume of contaminated material that they are expected to be contain, components in the second group do not require routine sampling to support the baseline risk assessment or feasibility study. However, confirmatory sampling will be carried out in representative components in the second group.

Sampling during the field program will be focused on materials. The types of contaminants present in a given type of material (e.g., concrete, steel) are assumed to be the same throughout a given process area within a particular component. For areas in which processing occurred, a process area is the area taken up by a particular chemical process. For other areas, the term process area is used to indicate contiguous areas with common activities. All parts of each component (except for components in the bulk material category) are assigned to some process area. Process areas are identified by component in the Sampling and Analysis Plan (Section D.9). Given the definition of a process area, uniformity of types of contaminants within a particular material within a process area is a reasonable assumption. Expected uniformity of types of contaminants limits the need for multiple samples within a given medium in a process area. For bulk material (e.g., scrap metal piles, soil piles) contamination is likely to be heterogeneous. Only limited sampling of such components is anticipated, and it will be focused on determining locations of maximum contamination to provide conservative results for the component.

4.2 DATA QUALITY OBJECTIVES

4.2.1 Overview

Data quality objectives (DQOs) are scoping and planning tools applicable to every environmental sampling effort at the FEMP. DQOs are quantitative and qualitative descriptions of the measurements required to fulfill one or more of the purposes, or uses, for which the data are being collected. The data needs identified in Section 3 indicate that the primary reasons for the collection of additional data during the OU3 RI field program are to provide information for use in the evaluation of remedial action alternatives and to a lesser extent for use in the baseline risk assessment. DQOs need to be specified for all data collection activities in order to ensure that appropriate data are collected to support the decisions to be made on the basis of the evaluation of alternatives and the assessment of baseline risks.

The DQO development process results in a logical approach to specifying the level of sampling and analysis. The outcome of the process includes a determination of whether measurements and collection of samples are necessary; the types of samples to collect; the sample locations and quantities; analytical requirements, including precision, accuracy, comparability, completeness, and sensitivity of the methods; and the overall confidence level that the data will fulfill their requirements.

One of five FEMP-defined analytical support levels (ASLs) will be assigned to all data to be collected, depending on the intended use of the data and the quality assurance/quality control (QA/QC) methods required to achieve the desired level of quality. The specific definitions of the five ASL levels (A-E) are provided in the FEMP Site-Wide CERCLA Quality Assurance Project Plan (SCQ) (DOE 1992a) and are summarized in Table 4.1. These levels are analogous to the 1987 EPA-defined analytical levels 1 through 5. Because a large proportion of the analyses supporting FEMP programs and projects involve radionuclides and because radionuclide analysis methods have been used and verified by DOE and DOE contractors for many years, it is appropriate to address these measurements as standard. The QA/QC requirements for ASLs are provided in the SCQ (Volume 11,

TABLE 4.1 Analytical Support Levels for the OU3 Work Plan

Support Level	Description	Typical Data Uses
A	*Qualitative Field Analysis* — This level is characterized by the use of portable instruments that can provide real-time data to assist in the optimization of sampling point locations and in providing health and safety support. Data can be generated regarding the presence or absence of contaminants (e.g., radionuclides, volatiles) at sampling locations. Analogous to EPA analytical level 1.	Site characterization Monitoring during implementation
B	*Qualitative, Semi-Quantitative, and Quantitative Analyses* — This level may include the use of more sophisticated screening techniques, such as portable analytical instruments that can be used on-site or in mobile laboratories stationed near a site (close-support laboratories). Depending upon the types of contaminants, sample matrix, and QC checks applied, qualitative and quantitative data can be obtained. Analogous to EPA analytical level 2.	Site characterization Evaluation of alternatives Engineering design Monitoring during implementation
C	*Quantitative with fully defined QA/QC* — Laboratory analyses generated with full QA/QC checks of types and frequencies specified for ASL D according to FEMP-specified analytical protocols for radiological and nonradiological parameters. The analytical methods are identical to ASL D for QA/QC sample analysis and method performance criteria. However, the data package does not typically contain raw instrument output but does include summaries of QA/QC sample results. ASL C may be used when analyses require a rigid, well-defined protocol, but where other information is available, so that a complete raw data package validation effort is not required. Laboratories are required to retain, in the project file, raw instrument data to upgrade ASL C reports to ASL D. Analogous to EPA analytical level 3.	Risk assessment Site characterization Evaluation of alternatives Engineering design Monitoring during implementation

TABLE 4.1 (Cont.)

Support Level	Description	Typical Data Uses
D	*Confirmational with complete QA/QC and reporting* — Provides data generated with a full complement of QA/QC checks of specified types and frequencies according to FEMP-specified analytical protocols for radiological and non-radiological parameters. The data package includes raw instrument output for validation. These data may be used to confirm data gathered at ASLs B and C, and when full validation of raw data is required. Analogous to EPA analytical level 4.	Risk assessment Evaluation of alternatives Engineering design
E	*Nonstandard* — Analyses by nonstandard protocols that often require method development or validation (e.g., when exacting detection limits or analysis of an unusual chemical compound are required). New methods may be developed for ASL E data to allow for parameters or matrices that cannot be analyzed by existing standard methods. Analogous to EPA analytical level 5.	Risk assessment

Appendix A, Table 2-2). Analytical methods for use for each ASL also are defined in the SCQ (Attachment I, Volumes III through V) and further discussed in Section D.6 and Attachment D.I of the SAP with respect to new procedures.

For OU3, the requirements for specific types and quality of data needed to support baseline risk evaluations are heavily influenced by the fact that many of the decisions that would normally be made on the basis of these evaluations have already been made for some of the components, at least on a preliminary basis. For example, nearly all of the components are known to be contaminated, and data are not needed to support a detailed baseline risk assessment in order to show that remediation is necessary. For this situation, data with a relatively high level of uncertainty can be used if the baseline risk assessment takes a sufficiently conservative approach, thereby serving to confirm the need for remediation.

The combination of widespread contamination, outdated design, and poor physical condition of most components precludes decontamination for use without radiological restrictions as a viable remedial alternative, and thus detailed data are not necessary to support extensive evaluation of this alternative. Data are necessary, however, to support decisions on the selection among alternatives for removal, treatment, and recycle or disposal.

DQOs are developed to the extent possible before data collection and are incorporated into the planning process, thus producing a well thought out sampling and analysis plan that describes the general sampling and analysis options chosen. The DQO development process presented here focuses specifically on the data needs developed and presented in Section 3 and on the major considerations that influence the data collection approach. These considerations include: (1) all structures in OU3 will be removed, thus limiting the range of remedial alternatives requiring evaluation; (2) the baseline risk assessment will not attempt to demonstrate that no remediation is necessary, since remediation is already assumed to be required; (3) the types of contaminants present in a given type of material are assumed to be the same throughout a given process area within a particular component; (4) past monitoring programs are assumed to have identified all major areas of radiological contamination in OU3; (5) the portion of the record of decision for OU3 addressing buildings will be performance based and will involve only a selection of general technologies (e.g., decontamination of metal surfaces) and the nature of the final disposition of materials; and (6) anomalies or unusual conditions may result in requirements for additional field sampling

beyond that anticipated, with such requirements identified before or during the sampling of individual components.

The overall strategy for data collection reflects the above needs and considerations and uses existing data and process knowledge to guide screening efforts, which then support sampling for analysis at higher ASLs. Specifically, each component is first evaluated to determine the need to sample on the basis of past use and available data and to specify preliminary locations of intrusive samples. On the basis of this evaluation, nonintrusive sampling (i.e., screening) will be performed to locate areas for prospective intrusive sampling. Considerable information on radiological surface contamination is available (Tables A.4.0 and A.4.1) and continues to be generated. These data will be evaluated in the field for adequacy before any additional data are collected from the specific components from which the existing data were obtained. This screening will be followed by the systematic collection and analysis (at higher ASLs) of intrusive samples from contaminated major media (i.e., major construction materials such as concrete, masonry, and structural steel) in OU3 and by supplemental intrusive sampling to address other specific data needs. This overall strategy will reduce the amount of sampling and analysis that is of limited usefulness, but also will provide for any follow-up sampling and analysis that may be required to collect data needed to support adequate RI/FS decision making.

4.2.2 Development of Data Quality Objectives

Data quality objectives are developed in this document to ensure that all data collected as part of the RI/FS program are appropriate to meet the needs identified in Section 3. The level of detail and data quality needed, by necessity, vary depending on the intended use of the data.

All investigative activities for OU3 must be conducted and documented in a manner that ensures (1) that sufficient data of known quality are collected to support sound decisions concerning selection of a remedial alternative and (2) that the uncertainty concerning the decisions is maintained within specified limits. To this end, DQOs are specified for each of the types of media to be sampled. As target values for data quality, the DQOs specified are not necessarily criteria for acceptance or rejection of data collected.

The SCQ presents a structured eight-step process for the development of DQOs. This structured process provides the rationale for deciding what data are necessary, what quality and type of data are required, how the data will be technically defensible, and how risk is comprehended and minimized to ensure sound decisions throughout the remediation process. The process will help to identify areas of concern, the selection of equipment, quality assurance requirements, and analytical support levels. This process leads to the generation of a DQO summary form, which is intended to provide a quick overview of the major aspects of the data collection effort and the associated objectives. The summary form translates the development of DQOs into a concise field document that identifies media-specific ASLs and sampling and analysis procedures. The form summarizes the analytical and sampling requirements contained in DOE orders, environmental regulations, the Federal Facilities Compliance Agreement, Ohio Environmental Protection Agency Director's Findings and Orders, and the EPA and DOE Consent Agreements. The form is based on the relationship between sample media and the analytes of concern. A sample DQO summary form is provided in Appendix B of the SCQ. All DQOs developed for OU3 will be approved and documented in a separate document controlled by the FEMP sampling and analysis management coordinator. That document will consist of the DQO process worksheet and the DQO summary form.

The development of the DQOs for the OU3 sampling program, in accordance with the SCQ eight-step process, is summarized in the following subsections.

4.2.2.1 Problem Statement (Step 1)

OU3 contains many components, a substantial fraction of which are contaminated. The potential exists for on-site exposure of receptors to contaminants and for the release of contaminants from the site in the future if the components are allowed to deteriorate. The potential pathways by which receptors could be exposed to contaminants under current conditions are summarized in the site conceptual model discussed in Section 3. DOE has decided that no long-term use will be made of the structures in OU3 and that they will be removed. The removal of OU3 buildings and other components will create large volumes of various types of waste materials that will require disposition. These waste materials will be contaminated to various degrees with radiological and possibly nonradiological contaminants.

The handling and treatment of these materials will pose a potential exposure hazard to workers, as well as provide the potential for possible off-site releases of contaminants.

4.2.2.2 Identification of a Decision that Addresses the Problem (Step 2)

As a consequence of DOE's decision concerning OU3 components, the decision that remains to be made is what approach to implement for the remediation of OU3. In particular, decisions must be made concerning what level of treatment, if any, is required for the various materials in OU3 and what method will be used to dispose of the various materials.

4.2.2.3 Identification of Inputs that Affect the Decision (Step 3)

The inputs required to make a decision concerning the approach to be used to remediate OU3 are discussed in Section 3.2, where the data needed for evaluation of remedial action alternatives are identified. Various inputs will affect the decision and need to be addressed. A major input is the identity and levels of radiological and chemical contamination found in the various materials in the components. In addition, refined estimates of volumes of potentially contaminated building contents of various types are needed, as is the depth of contamination in porous materials. Other inputs that are needed include the physical and chemical characteristics of major OU3 materials (for assessing treatability), and the locations of elevated gamma exposure rates (for assessing potential exposures).

4.2.2.4 Specification of the Domain of the Decision (Step 4)

The decision concerning selection of a remedial alternative for OU3 will be based on the character and volume of contaminated materials (e.g., concrete, steel) in the operable unit. These materials determine the domain to which the decision is applied. The smallest subpopulations for which the decision will be made are the materials within a particular type of process area. It is expected that within a particular material within a process area that the types of contaminants present will be the same, although the level of contamination will vary.

4.2.2.5 Development of Logic Statements (Step 5)

The major use of data will be to evaluate alternatives. The general approach to evaluation of alternatives and to how data will be used for that evaluation is discussed in Section 3. In general, the intent is to obtain conservative or representative estimates for use in alternatives evaluation. The approach will allow a determination of a conservative estimate of potential impacts associated with alternatives and will allow a conservative decision to be made concerning the need for management of contamination within OU3.

4.2.2.6 Establishment of Constraints on Uncertainty (Step 6)

The purpose of this step is to establish an acceptable probability of making an incorrect decision based on study findings. For OU3, a decision error would be the selection of an inappropriate alternative. A false negative error would be a decision to select, on the basis of RI sampling and analysis results, an alternative that did not involve the treatment of waste material when treatment is found to be necessary on the basis of detailed characterization during remediation. A false positive error would be a decision to select, on the basis of RI sampling and analysis results, an alternative that did involve the treatment of waste material when treatment is found to be unnecessary on the basis of detailed characterization during remediation. Such errors could occur if RI field characterization indicated that contamination levels are lower (or higher) than is actually the case. The consequence of a decision error would be largely economic, because appropriate treatment would be provided on the basis of characterization done during remediation. In the case of a false positive error, treatment capability would be provided when it would not be needed. In the case of a false negative error, treatment capacity would not be available when needed and a delay in remediation could result. Neither error is desirable. However, a false negative error is of somewhat greater concern because of the potential for delay. The level of concern increases in either case as the magnitude of the error increases because of the increase in economic consequences. It is desirable that false negative error almost never occur because of the potential for delay. The conservative approach to be used will ensure a low likelihood for such errors. It is also desirable that false positive errors not occur, but these are of less concern. For the purposes of the FS, however, the magnitude of the errors would need to be fairly large to be of significance, because the acceptable uncertainty is +50%/-30% for cost estimates.

If contamination levels are thought to be higher than they actually are, this may result in certain technologies and/or disposal options being dropped from consideration because of the capability of the treatment technology to treat these higher levels and/or eliminating certain disposal options because the levels of contamination are seemingly above what is acceptable for that disposal option. False positive errors could also indicate that certain contaminants are present that actually are not. This situation could result in certain treatment/disposal options being needlessly dropped because they are not appropriate for a contaminant that is purportedly present in the media, or could result in a treatment/disposal option being needlessly retained because it is thought to be necessary to treat a contaminant that is purportedly present in the media. The more false positive errors there are, the greater the potential for the screening process to be ineffective.

For false negative errors, if contamination levels are thought to be lower than they actually are, or if certain contaminants are not found during the sampling but actually do exist, this may also result in the improper screening of alternatives. As with the false positive errors, the more errors there are, the greater the consequences of this improper/ineffective screening.

4.2.2.7 Development of a Cost-Effective Design for Obtaining Data (Step 7)

Three considerations have a major influence on the design for data collection. First, it is assumed that the type of contaminants present are the same throughout a given material within a process area. Second, it is assumed that all major areas of radiological contamination in OU3 have been identified. Third, samples will generally be collected to provide an estimate of the maximum level of contamination within a material in a process area in order to provide conservative results.

The following summarizes the sampling plan approach developed to cost-effectively meet the identified data needs and uncertainty constraints for the OU3 RI/FS:

- Regions of components with expected contamination will be surveyed with nonintrusive instruments (i.e., screening will be done) to locate areas of contamination, particularly the locations of highest radiological contamination on surfaces of major sampling media (e.g., concrete, masonry, structural steel);

- One intrusive sample (more if there are distinct areas of chemical and radiological contamination, in which case separate samples will be collected for analysis for radionuclides, metals, and PCBs, as necessary) will be collected at the location of highest known contamination, per major medium per process area for laboratory analysis to establish the types and levels of radiological and chemical contamination;
- For porous major media, the depth of contamination will also be determined;
- Supplemental sampling will be used in a variety of cases, including sampling of loose solids, liquids, bulk materials, sediments, and media at runoff or collection points, to assess types and levels of contamination, contaminant mobility, and release mechanisms;
- Regions and levels of maximum gamma exposure rates will be determined for components to assess direct exposure hazards; and
- Air sampling will be carried out in buildings to determine the levels of airborne contaminants.

The approach to data collection is discussed in more detail in Section 4.3 and in the Sampling and Analysis Plan.

Laboratory analyses of samples will be done with a level of QA/QC corresponding to sample ASLs, and data will be fully validated by the participating laboratories. Therefore, complete in-house data validation is not necessary. Accordingly, it is proposed that the samples generally be submitted for ASL C analysis/data package. As a quality check on laboratory performance and data validation, however, it is proposed that 10% of the samples undergo complete in-house validation, requiring a complete ASL D raw data package from the laboratories. It is proposed that approximately 5% of such samples be randomly chosen (e.g., every 20th sample submitted for analysis) for ASL D analysis/data package. An additional 5% of such samples will be selected for ASL D analysis/data package in a biased manner (e.g., to meet specific requests or to ensure proper coverage of all laboratories and/or analyses).

Precision will be assessed through the establishment of a routine program of duplicate and replicate analyses, as directed by the SCQ. Accuracy will be evaluated through the establishment of a routine program involving the assessment of analytical results for method blanks, matrix spike/matrix spike duplicates, field blanks, and container blanks, as directed by the SCQ. Sensitivity will be monitored by ascertaining the achievement of specified method detection limits and quantitation limits. Completeness will be assessed based on the percentage of usable data points from the total set of data points collected, analyzed, and available. Pursuant to the SCQ, completeness is expected to be at least 90% for the FEMP. If sufficient valid data points are not obtained to meet project objectives, the valid data obtained will be used, and additional sampling and analysis may be considered to meet project objectives. Comparability will also be assessed through the establishment of a routine program of duplicate and replicate analyses.

4.2.2.8 Summary (Step 8)

To support the above approach, ASLs A-D will be required, with screening expected to be ASL A/B, since it will consist of field measurements (which generally provide qualitative data). The major media and supplemental samples will require data generated with QA/QC checks corresponding to those indicated in the SCQ for ASL C. As indicated above, however, 10% of the samples will require a complete raw data package as provided for ASL D in order to allow confirmation of laboratory validation. All media will be analyzed for a standard group of radionuclides and chemicals, intended to address a conservative group of potential contaminants, independent of location. The analytes to be used are discussed in Section 4.3.1.2 and in Sections D.4.2 and D.4.3 of the SAP.

4.2.3 Discussion

Table 4.2 summarizes the approach to be used for the collection of data. The data needs shown in the table are those identified in Section 3. The table shows the use for the data, the data objective, the approach to be used to collect the data, and the required ASL for the data. A discussion of the data collection approach for addressing data needs requiring sampling and analysis is provided below and in greater detail in Section D.3 of the SAP.

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TABLE 4.2 Data Collection Approach

Data Need	Data Use	Data Objective	Data Collection Approach to Meet Objectives	Required ASL
Volumes of material by material type	Used to determine the total volumes of the various materials in OU3 that may be treated or otherwise handled. (FS)[a]	Total potential quantity of materials to be remediated, by material type (concrete, steel, etc.) and process type (wet/dry) (+50%/-30%).	Estimates by material and component are available. Estimates by process area will be obtained from process knowledge and site history. Refined estimates for building contents will be obtained by inspections.	NA[b]
Quantity of contaminated liquid or other containerized material in components	Used to determine the volume of contaminated liquid or other containerized material that may be treated or otherwise handled. (FS) Used to determine the source terms available for release due to leaks or spills. (BRA)	Total volume of liquid or other contaminated material per container and/or material type.	Measurement of container dimensions will be made as necessary.	NA
Types and levels of contaminants by material type in components; depth of contamination	Used in estimating volumes of materials contaminated with various contaminants. Used to aid in the screening of treatment technologies, based on their effectiveness with selected contaminants at various depths in the various media. Also used to assist in assessing short-term effectiveness of the various alternatives, for which the types and levels of contamination are needed. (FS) Types and levels of contaminants in fixed surface contamination are also used to determine source terms available for release due to wind and water erosion or leaching. Type and levels of contaminants in sediments and water in ponds and basins are used to determine (1) the source terms available for release due to infiltration and overflow and (2) the on-site risks due to direct contact. (BRA)	*Major Media (concrete, masonry, and structural steel)* — Type and conservative estimate of the surface levels of contaminants for each of the major media within each of the process areas in each component. Conservative estimate of depth of contamination for porous media and other media as necessary, by type of process.	Radiological screening will be used to locate or confirm locations (based on available radiological survey data) with the highest levels of contamination. Chemical screening will be carried out at the locations of highest radiological contamination and at other areas with suspected chemical contamination. One intrusive sample (more if there are distinct areas of chemical and radiological contamination) will be taken for laboratory analysis from each major media at the location of highest known contamination within each of the process areas in each component as determined based on process knowledge and survey data. Information on the media type and process (wet/dry) will be used to determine if surface scrapings or sectioned core samples are to be taken.	A/B C/D[c]

TABLE 4.2 (Cont.)

Data Need	Data Use	Data Objective	Data Collection Approach to Meet Objectives	Required ASL
		Supplemental Sampling, Transite — Type and conservative estimate of concentrations of chemical contaminants in transite for representative locations selected on an OU3-wide basis.	Intrusive samples will be collected in a limited number of representative components at locations expected to have the greatest potential for chemical contamination.	C/D[c]
			Radiological surveys will be made to determine the presence and general levels of radiological contamination at the locations of intrusive sampling to identify the potential for radiological contamination in the samples.	A/B
		Supplemental Sampling, Heating, Ventilating, and Air Conditioning Equipment — Type and representative estimate of concentrations of contaminants in air filter media in buildings.	Samples of air filter media will be collected on a component basis, as available.	C/D[c]
		Supplemental Sampling, Collection Points — Type and average concentrations of contaminants for collection points (sumps, pits, drains, and runoff locations).	Samples of liquids, sediments, or sludges will be collected from collection points identified during preliminary inspections when sufficient quantities of material are present to support analyses.	C/D[c]
		Supplemental Sampling, Loose Solids — Type and representative estimate of the concentration of contaminants in unknown and/or uncharacterized loose solids.	Radiological and chemical screening will be used to determine the presence and general levels of radiological and chemical contamination.	A/B
			Grab samples will be collected in areas most likely to contain elevated concentrations of contaminants determined on the basis of screening results.	C/D[c]

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TABLE 4.2 (Cont.)

Data Need	Data Use	Data Objective	Data Collection Approach to Meet Objectives	Required ASL
		Supplemental Sampling, Bulk Material, Asphalt and Dry Freeboard or Beach Areas Peripheral to Impoundments — Type and conservative estimate of component-specific concentrations of contaminants.	Radiological screening will be used to determine the presence and general levels of radiological contamination.	A/B
			Intrusive samples will be collected at the locations of highest radiological contamination for each component as identified through screening.	C/D[c]
		Supplemental Sampling, Sediment and Liquids in Ponds and Basins — Type and average value of component-specific concentrations of contaminants in sediment and liquids in ponds and basins.	One composite of grab samples will be collected for water and for sediment per component; the number and location of the samples to be composited will depend on the size of the component.	C/D[c]
Concentration of contaminants in liquids or other containerized material	Used to determine the volume of contaminated liquid or other containerized material that may be treated or otherwise handled. (FS) Used to determine source terms available for release due to leaks or spills. (BRA)	Average concentration of contaminants in each container or material type.	One or more grab samples of unknown liquid or other containerized material will be collected followed by laboratory analysis.	C/D[c]
Physical and chemical characteristics of materials and contaminants	Used to aid in the screening/ evaluation of treatment technologies, based on their effectiveness with various types of materials and contaminants. (FS)	Representative values of physical/chemical characteristics (e.g., density, friability, permeability, destructibility, hardness) for the various material types and characteristics such as solubility, volatility, leachability, for contaminants.	Estimates will be developed using handbook values. Detailed analysis will be performed as part of treatability studies, based on the specific needs of vendors/technologies, if necessary.	NA
Radiation exposure rate in components.	Used to determine on-site risks during remedial actions and for baseline conditions due to direct external exposure to radiation. (FS, BRA)	Conservative value and maximum and minimum values for contaminated areas of each component.	Biased direct measurements will be made in each component.	B

TABLE 4.2 (Cont.)

Data Need	Data Use	Data Objective	Data Collection Approach to Meet Objectives	Required ASL
Removable surface contamination for radionuclides and for chemical species in components	Used to determine on-site risks during remedial actions and for baseline conditions due to direct contact. Also used to determine the source terms available for release due to wind or water erosion or leaching. (FS, BRA)	Conservative value for each component.	Swipe samples will be taken from the surfaces of major media in each process area. The locations for which the swipes will be taken will be selected from areas expected to have the highest levels of contamination based on process knowledge and survey data. The swipes will be screened for radiological contamination. Levels of removable chemical contamination will be estimated conservatively using total surface levels obtained from intrusive sampling.	A/B
			Those swipes for which radiological contamination is above a specified decision level will be composited to produce one composite swipe sample for the component to be analyzed in the laboratory.	C/D[c]
Erosion/leach rates for fixed surface contamination by media	Used to determine the release rate of contaminants to air and water due to water erosion or leaching. (BRA)	Conservative value per media.	A few representative samples will be collected from each media and will be analyzed in the laboratory for leaching.	C/D[c]
Concentrations of airborne contaminants in buildings	Used to determine the on-site risks in buildings due to particulate and/or gaseous emissions under current conditions. (BRA)	Average concentration of airborne contaminants in each building.	Air samples will be collected, followed by screening for radiological contamination.	B
			Laboratory analysis of samples, as needed.	C/D[c]
Identification of the presence of hazardous wastes (other than stored waste inventory)	Used to assess compliance with ARAR related to land disposal restrictions under RCRA. (FS)	Conservative estimates.	A sample of each medium that could potentially be classified as hazardous waste will be collected at the locations of highest radiological/chemical contamination in representative components and subjected to TCLP extraction and the extract analyzed.	C/D[c]

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TABLE 4.2 (Cont.)

Data Need	Data Use	Data Objective	Data Collection Approach to Meet Objectives	Required ASL
Characteristics of materials and contaminants in treated wastes; characteristics of any emissions associated with treatment; volume of treated wastes	Used to determine the effectiveness of various remedial alternatives relative to the reduction of toxicity, mobility, and volume of wastes, and to assist in assessing the applicability of various disposal options for the final waste forms. Volume estimates will be used to assist in projecting the long-term effectiveness of the various alternatives and in determining potential transportation requirements. Emissions characterization needed to assess short-term effectiveness. (FS)	Representative estimates of the physical/chemical characteristics of the waste form/residues/emissions. The types and representative levels of contaminants in the wastes/residues/emissions, and the ability of these contaminants to leach out, or otherwise be released from the waste form/residue. Total quantity of material generated (+50%/-30%).	If information available on technologies and from site characterization is inadequate to screen or evaluate technologies, this objective will be addressed by treatability studies.	NA

[a] Abbreviations indicate whether data are to be used in the feasibility study (FS) or the baseline risk assessment (BRA).

[b] NA = Not applicable

[c] Ten percent of all samples will be analyzed at ASL D to provide confirmation of ASL C analysis.

As indicated previously, the SCQ provides that DQOs developed through the eight-step process be approved and documented in a separate, controlled document. This development, review, and approval has been completed for the DQOs proposed for the RI/FS field program. Approved DQOs and their assigned DQO numbers (for purpose of site-wide identification) are listed in Table 4.3.

4.3 DISCUSSION OF THE APPROACH TO DATA COLLECTION

The approach to data collection for OU3 involves four major areas of activity: (1) a preliminary evaluation of components to be sampled and of some general issues related to fulfilling data needs; (2) the systematic nonintrusive sampling of media in components; (3) the systematic collection and analysis of intrusive samples of contaminated major media; and (4) supplemental intrusive sampling. These activities are discussed in Sections 4.3.1 through 4.3.4. Section 4.3.5 discusses how sampling may be limited in some components on the basis of trends observed during field characterization. Additional detail on the approach to data collection is provided in the SAP.

4.3.1 Preliminary Evaluation

A variety of preliminary activities have been carried out related to defining the details of the sampling program. These activities include (1) verifying processes that occurred in components and identifying process areas, (2) identifying major media types within process areas for sampling, (3) identifying locations with maximum measured values of radiological contamination by media type, (4) identifying locations with potential chemical contamination, (5) developing refined maps for components. Results from these activities are provided in Section D.9 of the SAP.

Section 4.3.1.1 discusses additional required efforts related to development of engineering estimates. Section 4.3.1.2 discusses the determination of analytes and Section 4.3.1.3 discusses the preliminary specification of locations for intrusive samples.

TABLE 4.3 Approved DQOs and their Assigned Numbers

DQO	DQO Number
Sampling of air in buildings	AR-007
Sampling of surfaces of major media in plant components	MS-006
Sampling of sediments beneath liquid surfaces	SD-003
Sampling of soils, soil piles, and dry freeboard or beach areas peripheral to impoundments	SL-006
Sampling of surface water in ponds, basins, and other impoundments within OU3	SW-003
Sampling of solids/loose material (e.g., salts, sludges, organic/inorganic residues) from tanks, drums, and other containers, as well as collection points in pipes and ducts, on beams, and other such locations	WS-006
Sampling of various media in waste piles	WS-007
Sampling of liquids (aqueous, organic/inorganic) from tanks and other containers, as well as collection points in pipes, ducts, sumps, and other locations	WW-003

4.3.1.1 Development of Engineering Estimates

Data are needed in several areas that require development of improved engineering estimates or the use of engineering judgment: refinement of the volume and nature of building contents, development of improved estimates of the quantity of containerized materials, assessment of container integrity, review of available data on stack emissions, review of available information on wastewater and storm-water releases, estimation of infiltration and overflow rates for ponds and basins, estimation of the fraction of contaminated areas exposed to natural weathering, and assembly of handbook values on the physical and chemical characteristics of materials. These activities involve no sampling and will be based on the use of existing information and inspections.

4.3.1.2 Determining Radiological and Chemical Analytes

In the development of a list of contaminants for which analysis will be carried out for samples collected during the RI field program for OU3, a list of potential contaminants was first assembled. In the preparation of this list, the nature of the various functional processes carried out in each OU3 component was reviewed. The results of this review are summarized in Table A.2.1. Next, an inventory of known process materials involved, and any reagents used directly or indirectly in each process area of each component was assembled. A list of potential radiological and chemical contaminants associated with the various process materials was then compiled (Table A.3). On the basis of this information, the list of potential contaminants of concern presented in Table 3.1 was prepared.

To ensure that a sufficient number of analytes are considered to address possible chemical contaminants not included on the list of potential contaminants of concern developed using process knowledge, a list of analytes was prepared that contains all the chemical parameters (except for pesticides) on the EPA Target Analyte List (TAL) for inorganic compounds and the Target Compound List (TCL) for organic compounds. Substances on the TAL/TCL were compared with chemical contaminants on the list of potential contaminants of concern. Those substances not on the TAL/TCL but on the list of potential contaminants could be eliminated as necessary analytes on the basis of the small quantities of the substances used, isolated use, or low toxicity. The justification for each such potential contaminant eliminated is provided in Section D.4 of the SAP.

Table 4.4 provides the conservative list of radiological parameters (which consists of all radiological contaminants of potential concern as identified through process knowledge) and chemical parameters (TAL/TCL except for pesticides) that will be used for analysis of all intrusive samples, regardless of location, to ensure data sufficiency. The list will be invoked to the maximum extent afforded by the existence of an analytical procedure for a matrix. Analytical procedures exist, or will be written, for all parameters that are reasonable for a given matrix. They are listed in Tables D.6-3 and D.6-4.

4.3.1.3 Preliminary Specification of Intrusive Samples

Two types of intrusive sampling will be conducted in components during the field program: (1) sampling of major media by process area, and (2) supplemental sampling of loose media, bulk material, sediment, etc. A preliminary inspection of designated components has been carried out to support this effort, and results are included in Section D.9 of the SAP.

Locations on major media with elevated levels of radiological contamination have been identified in components on the basis of data from past radiological surveys. The preliminary location designated for sampling a given major medium is the location with the highest survey reading. If survey data are unavailable for a given medium, a sample is designated for the medium without specifying the location. The medium will be surveyed before sampling to determine the sample location. Potential locations for collecting supplemental samples have been determined from a review of conditions within components.

4.3.2 Nonintrusive Sampling

Nonintrusive sampling will fulfill various specific data needs, as well as support the intrusive sampling discussed in the following subsection. In particular, nonintrusive sampling will involve determining radiation exposure rates, measuring levels of airborne contaminants in buildings, collecting swipe samples, and carrying out a variety of chemical monitoring. Nonintrusive sampling will also provide a basis for finalizing the selection of locations to be used for intrusive sampling.

Swipe samples will be the primary means of characterizing removable contamination on surfaces, a major identified data need. A specified area of each appropriate media will be

TABLE 4.4 Analytes for OU3

Radionuclides	2-Nitroanilene	N-Nitrosodiphenylamine
	2-Nitrophenol	Pentachlorophenol
Isotopic uranium	2,2-Oxybis-(1-Chloropropane)	Phenanthrene
Isotopic thorium	2,4-Dichlorophenol	Phenol
Isotopic plutonium and 241	2,4-Dimethylphenol	Pyrene
Radium-226 and 228	2,4-Dinitrophenol	
Neptunium-237	2,4-Dinitrotoluene	*TCL PCBs*
Americium-241	2,4,5-Trichlorophenol	
Cesium-137	2,4,6-Trichlorophenol	Aroclor-1016
Strontium-90	2,6-Dinitrotoluene	Aroclor-1221
Lead-210	3-Nitroaniline	Aroclor-1232
Polonium-210	3,3-Dichlorobenzidine	Aroclor-1242
Technetium-99	4-Bromophenyl-phenyl ether	Aroclor-1248
	4-Chloro-3-methylphenol	Aroclor-1254
TAL Inorganics	4-Chloroaniline	Aroclor-1260
	4-Chlorophenyl-phenyl ether	
Aluminum	4-Methylphenol	*TCL Volatile Organics*
Antimony	4-Nitroaniline	
Arsenic	4-Nitrophenol	1,1-Dichloroethane
Barium	4,6-Dinitro-2-methylphenol	1,1-Dichloroethene
Beryllium	Acenaphthene	1,1,1-Trichloroethane
Cadmium	Acenaphthylene	1,1,2-Trichloroethane
Calcium	Anthracene	1,1,2,2-Tetrachloroethane
Chromium	Benz(a)anthracene	1,2-Dichloroethane
Cobalt	Benzo(a)pyrene	1,2-Dichloroethene (total)
Copper	Benzo(b)fluoranthene	1,2-Dichloropropane
Iron	Benzo(g,h,i)perylene	2-Butanone
Lead	Benzo(k)fluoranthene	2-Hexanone
Magnesium	Bis(2-chloroethyl) ether	4-Methyl-2-pentanone
Manganese	Bis(2-chloroethoxy) methane	Acetone
Mercury	Bis(2-ethylhexyl)phthalate	Benzene
Nickel	Butylbenzylphthalate	Bromodichloromethane
Potassium	Carbazole	Bromoform
Selenium	Chryzene	Bromomethane
Silver	Dibenzofuran	Carbon disulfide
Sodium	Dibenz(a,h)anthracene	Carbon tetrachloride
Thallium	Diethylphthalate	Chlorobenzene
Vanadium	Dimethylphthalate	Chloroethane
Zinc	Di-n-butylphthalate	Chloroform
Cyanide	Di-n-octylphthalate	Chloromethane
	Fluoranthene	cis-1,3-Dichloropropene
TCL Semivolatile Organics	Fluorene	Dibromochloromethane
	Hexachlorobenzene	Ethylbenzene
1,2-Dichlorobenzene	Hexachlorobutadiene	Methylene chloride
1,2,4-Trichlorobenzene	Hexachlorocyclopentadiene	Styrene
1,3-Dichlorobenzene	Hexachloroethane	Tetrachloroethene
1,4-Dichlorobenzene	Indeno(1,2,3-cd)pyrene	Toluene
2-Chloronaphthalene	Isophorone	Total xylenes
2-Chlorophenol	Naphthalene	trans-1,3-Dichloropropene
2-Methylnaphthalene	Nitrobenzene	Trichloroethene
2-Methylphenol	N-Nitroso-di-n-dipropylamine	Vinyl chloride

swiped with a suitable material, which will be surveyed in the field for gross radioactivity with appropriate instruments. The swipes will also be analyzed with a low-background laboratory counter in order to obtain best results. All swipes from within a component whose levels exceed by an order of magnitude the surface contamination guidelines in DOE Order 5400.5, will be composited as a single sample for laboratory analysis of individual radionuclides.

4.3.3 Intrusive Sampling — Major Media

Intrusive sampling will be used to determine the types and concentrations of contaminants present in materials in OU3. In general, samples will be taken for laboratory analysis at locations of elevated contamination (selected on the basis of surveys and inspections, historical knowledge, and the availability of media for sampling) for major construction materials in each process area of each component sampled. Corings will also be taken at selected locations to determine the depth of contaminant migration. Such sampling, combined with the supplemental sampling discussed in Section 4.3.4, will fulfill the data requirements to be addressed by the site characterization phase of the RI.

Little or no intrusive sampling is anticipated on a site-wide basis for a number of construction materials found in OU3. These materials are transite, metals other than structural steel, asphalt, and selected other construction materials. The reasons for limiting sampling of these other materials are the following:

- All transite is assumed to be radiologically contaminated. It is expected that the transite will not be treated before disposal. For this reason, the only intrusive sampling that will be carried out for transite will be on a limited scale for OU3 as a whole, as supplemental sampling, rather than for each component that contains transite. (See additional discussion in Section 4.3.4.)
- Metals other than structural steel have only limited options for treatment or recycle and reuse. In addition, such options may be difficult to carry out. For these reasons, no intrusive sampling of other structural metals is planned during site characterization.

- Limited treatment options are available for asphalt and wood, which are concentrated in a small number of components. Sampling of asphalt and wood in those few components is classified as supplemental.
- Other construction materials (primarily wall board) have limited treatment options and intrusive sampling will be carried out only during remediation, if necessary.

Because of the exceptions just noted, the major construction materials for which component-by-component sampling will be used are concrete, masonry, and structural steel. These are defined as major media for sampling.

4.3.4 Intrusive Sampling — Supplemental

Additional intrusive samples will be taken to supplement those samples identified in Section 4.3.3. The additional samples will be used (1) to interpret and/or validate the data taken systematically, (2) to confirm assumptions, and (3) to address specific data needs. Supplemental samples are divided into two types, those that apply site wide, and those that are component specific.

Site-Wide Supplemental Sampling:

- Transite. A small number of samples will be taken from transite at site locations with the greatest potential for chemical contamination. All samples will undergo the toxicity characteristic leaching procedure (TCLP) test because classification as a hazardous waste on the basis of this test would have a significant effect on disposal options. If leachable chemical contamination is below toxicity characteristic levels, transite will be assumed to be contaminated with only asbestos and radiological constituents.
- Media for Leaching Tests. To support estimates of quantities of contaminants released by wind and water erosion for use in the baseline risk assessment, several samples will be collected from media throughout the site for leaching tests. Sampling will be in areas with

elevated levels of chemical or radiological contamination as discussed in Section D.9.0.8.

Component-Specific Supplemental Sampling:

- Heating, Ventilating, and Air Conditioning Equipment. Air filtration units will be sampled on a component basis. Within the major office buildings (e.g., administration [14A], laboratory [15], health and safety [53A]), available air filters will be sampled in order to perform chemical and radiological analyses. Analysis of the material collected by air filters will allow identification of airborne particulate contaminants within the component since the filter was installed. The information obtained from analysis of filter media may support a general evaluation of contamination throughout a component and provide a check on the types and identity of contaminants observed in the component.

- Collection Points (sumps, pits, drains, and runoff locations). Collection points to be sampled for each of the sampled components were determined during preliminary inspections. These collection points will be sampled when sufficient quantities of liquids, sediments, or sludges are found to support chemical and/or radiological analyses. The objective of this sampling is to evaluate the transfer of contaminants to environmental media.

- Loose Solids. Loose materials that are likely to represent conditions in major media will be sampled. Such loose solids could include particulate material deposited on horizontal surfaces. When significant quantities of uncharacterized loose materials are found, a sample may be collected for chemical and radiological analyses. Objectives of this sampling also include determining potential health and safety risks during decontamination and dismantling of components and the presence of residual loose contamination throughout the process area.

- Bulk Material, Asphalt, Wood, and Dry Freeboard or Beach Areas Peripheral to Impoundments. Intrusive samples will be collected at locations of highest radiological contamination determined through

screening. Included in this group will be the copper and scrap metal piles if they are not removed prior to completion of the RI/FS.

- Liquids and Other Containerized Materials. In cases in which unknown liquids or other containerized materials are identified in a component, a grab sample will be collected and analyzed for contaminants.
- Ponds and Basins. One composite of grab samples will be collected from the water and sediment of each pond and basin. The samples will be analyzed to determine the identity and concentration of contaminants that could be released to the environment or directly contacted by a receptor.
- Determination of the Presence of Hazardous Wastes. Representative locations in media (outside the stored waste inventory) that could potentially be classified as hazardous waste (e.g., sediments, loose media) will be sampled. The samples will be subjected to TCLP testing.

The term "loose media" will be used in this document to refer collectively to loose solids, sediment, soil, and sludges.

4.3.5 Limiting Sampling Based on Observed Trends

During the implementation of the SAP, data will be analyzed as they become available. The purpose of the analysis will be to determine any correlations among and trends in the data to help focus the scope of the subsequent sampling and analysis activities. An interim report summarizing the results of this trending analysis will be prepared for submittal to the U.S. EPA and the Ohio EPA. On the basis of the outcome of the analysis, and if appropriate, DOE may modify its sampling and analysis program. With the revisions, DOE would seek to focus the sampling and analysis program so that the remaining sampling and analysis activities would be conducted in a more efficient and effective manner.

The data will be analyzed (1) to develop various possible correlations among variables, such as process types, process environments, media, identity of contaminants, location of contaminants, and depth of contamination; and (2) to determine any trends in

various measured quantities. Correlations and trends that may be established include, but are not limited to:

- A trend in variation of depth of penetration of contaminants in wet process areas,
- Correlations among the various non-intrusive measurements and concentrations of contaminants in certain media,
- A pattern in the concentrations or activities of certain analytes (e.g., equilibrium ratios), and
- A correlation between the types of contaminants observed and those expected from the process knowledge (Table A.3).

To facilitate the maximum data use and to provide focused guidance for future data gathering activities under the OU3 SAP, the field program will start with selected large and diverse components in the process building component category, specifically with three wet process buildings (the Ore Refinery Plant [2A], the Recovery Plant [8A], and the Pilot Plant wet side [13A]) and a dry process building (the Green Salt Plant [4A]). Selection of these components is discussed in Section 4.4.2. The information obtained from sampling these and possibly other components will be evaluated and the results will be discussed in the interim submittal.

On the basis of the results of the trending analysis and through use of the most up-to-date knowledge about the OU3 components (e.g., from ongoing removal actions), the type, number and location of samples collected during the subsequent sampling program, as well as the number of analytes for those samples, may be modified. It is the intent of DOE that such changes would be instituted only if they would make the subsequent sampling and analysis program more cost effective and efficient without affecting the credibility and comprehensiveness of the program. It is expected that in addition to increasing the cost effectiveness and efficiency of the sampling and analysis program for OU3, the trending analysis will also provide a consistency check on the data collected. Thus, it will provide an added mechanism for assuring that the data are of high quality.

4.4 SCHEDULING PRIORITIES AND CONSTRAINTS FOR THE OU3 FIELD CHARACTERIZATION PROGRAM

This section discusses the overall approach to scheduling the OU3 field characterization program activities during the RI phase of the RI/FS process. The discussion focuses on scheduling priorities for the activities subject to programmatic and technical constraints. The factors considered in the development of RI schedules are listed in Table 4.5. The effect of each factor is discussed separately in Section 4.4.1. An algorithm for developing the RI schedule on the basis of the factors discussed is presented in Section 4.4.2. Section 6 provides the overall RI/FS schedule for OU3; timing of the field characterization program activities is included. Further discussion of the field characterization program schedule is provided in Appendix D, Section D.8.

4.4.1 Factors Affecting the Schedule of the OU3 Field Characterization Program

Factors considered in developing the schedule for OU3 field characterization program are listed in Table 4.5 and discussed below.

Data Needed for Evaluation of Trends: To provide the data necessary to support the analysis of trends discussed in Section 4.3.4, selected components must be sampled early during the field program. Selection of these components is discussed in Section 4.4.2.

Baseline Risk Assessment Needs: The approach to be followed in conducting the baseline risk assessment for OU3 is outlined in Section 3.1. The approach calls for identification and use of a high-risk component in each component category to conservatively represent on-site risk for that category of components. In the baseline risk assessment, the on-site receptors will be assumed to be exposed to contamination in the high-risk components selected. For timely completion of the baseline risk assessment report, those components preliminarily identified for use in each category need to be selected and characterized early in the RI phase.

OU3 Removal Actions: Section 2.5 discusses the ongoing and planned removal actions for OU3. When the field characterization program activities for OU3 are scheduled, the effects

TABLE 4.5 Factors Considered in Developing the Schedule of the OU3 Field Characterization Program

- Data needed for evaluation of trends
- Baseline risk assessment needs (Section 3.1)
- OU3 removal actions (Section 2.5)
- Development of remedial action alternatives for the FS (Section 3.2)
- Other site activities (e.g., RCRA activities)
- Estimates of the level of effort required to sample components
- Availability of resources (staffing and costs)

of removal actions will be considered from the following perspectives: (1) possible changes in level of contamination or contents related to the removal action, and (2) accessibility — parts of a component may not be accessible because of stored waste, product inventory (e.g., drums), or equipment to be disposed by a removal action. When possible, the sampling schedules for components will be integrated with the schedules for the removal actions. If possible, component sampling will be postponed until completion of the removal action. The removal actions must be finished before September 1994 to allow for RI/FS component sampling before December 5, 1994 (field sampling completion date). If the removal action extends beyond September 1994, the removal action sampling must be consistent with the approach in the OU3 RI/FS Work Plan Addendum. Figure 4.1 illustrates the strategy for integrating removal actions into the RI/FS process.

Development of Remedial Action Alternatives for the FS: The preliminary remedial alternatives to be considered for OU3 are discussed in Section 3.2. On the basis of type, form, and location of contaminants associated with a component, different decontamination methods and/or waste treatment technologies may be appropriate. However, component characterizations performed during the initial stages of the RI phase to satisfy the data needs for the baseline risk assessment should be sufficient to provide adequate guidance for the initial evaluation and screening of RAAs. Therefore, the needs of RAA development are not expected to have a significant effect on the sampling schedules for OU3 components.

Other Site Activities: Site activities other than removal actions (e.g., RCRA activities) may influence the OU3 field characterization program. These activities will be accommodated to the extent practicable without deleteriously affecting the OU3 RI/FS schedule. In some instances, these activities may provide data to fill some of the identified RI/FS data gaps; however, it is not anticipated that any of the these activities will completely eliminate the need for further RI sampling.

Estimates of the Level of Effort Required to Sample Components: Estimates of the number of samples to be taken in each component and the amount of time required to take and analyze the samples were made during preparation of the OU3 SAP (Section 4.5 and Appendix D). The duration, in terms of days required to take and analyze samples, was also

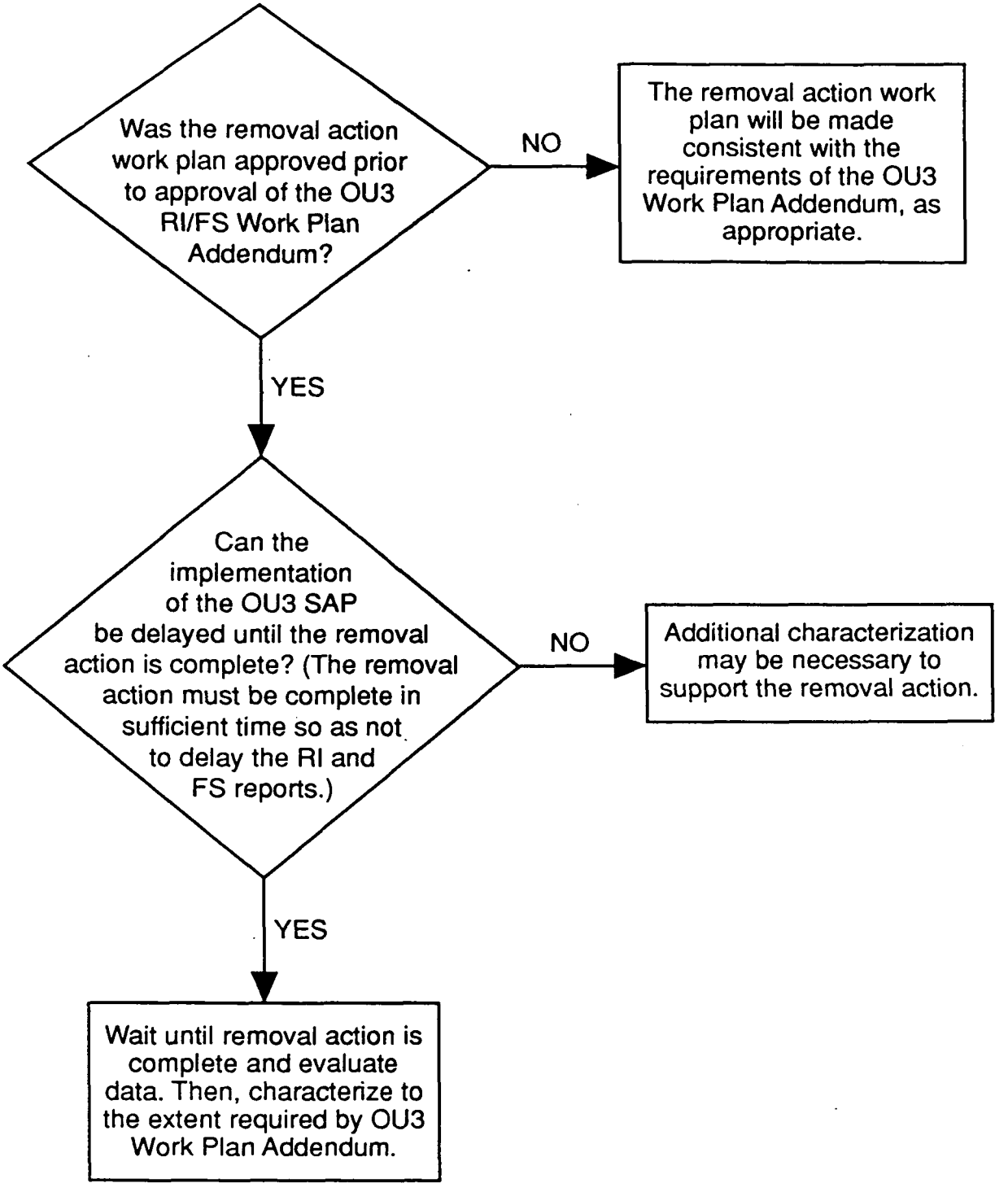

FIGURE 4.1 Strategy for Integrating Removal Actions into the RI/FS Process

estimated. These estimates were used in setting the schedules for the OU3 field characterization program.

Availability of Resources: Available resources (the number of workers available to collect and analyze the samples) and budget estimates were used as the basis for scheduling RI activities.

4.4.2 Approach to Scheduling the OU3 Field Characterization Program

Several major factors influence the period chosen for sampling a component: (1) Is the component likely contaminated? (2) Will confirmatory sampling be required for components with no expected significant contamination? (3) Will data collected for the component be used to support the trending analysis? and (4) Will data collected for the component likely be used in assessing on-site risks in the baseline risk assessment? On the basis of these major factors, Figure 4.2 illustrates the process used to determine the appropriate sampling periods for components.

Components have been selected to support development of a trending analysis for media and contaminants, with the objective of potentially focusing or limiting the site-wide sampling program. The components selected are process buildings with (1) expected high levels of radiological contamination, (2) a variety of media to be sampled, (3) a large volume of material to be managed, and (4) representative wet and dry process areas. The four components selected are Ore Refinery Plant (2A), Green Salt Plant (4A), Recovery Plant (8A), and Pilot Plant wet side (13A). These four components will be the first components sampled and are therefore in the early sampling period.

Preliminary identification of components for use in a conservative baseline risk assessment is necessary to allow early assessment of baseline risks. The components selected are those with the greatest expected risks due to direct exposure or direct contact in each component category. Risk assessment approaches will be developed on the basis of these components, but the final selection of components to be used in the risk evaluation will occur after completion of the field characterization program. One component has been selected for each component category; the components selected are listed in Table 4.6. These components will be sampled in the early sampling period.

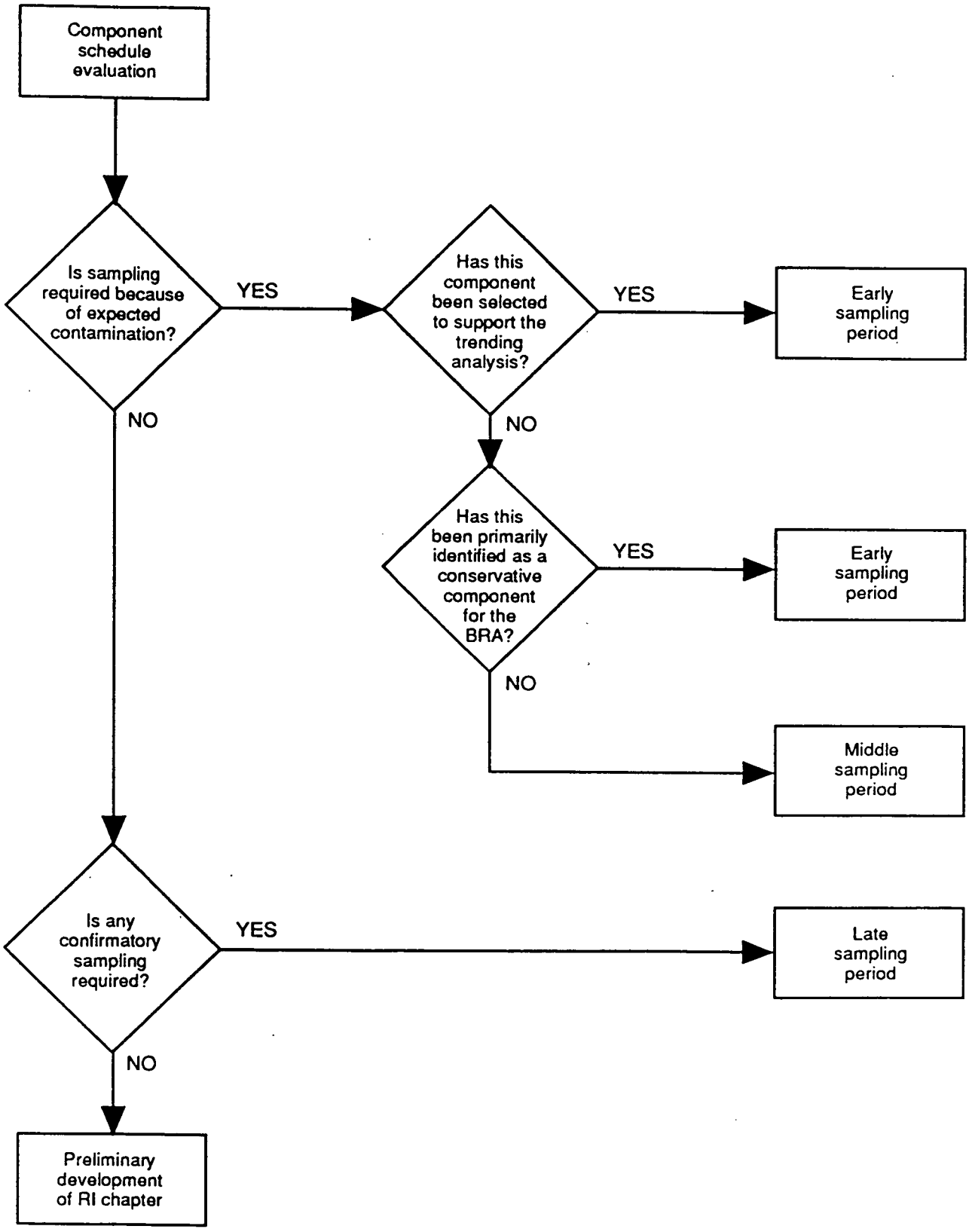

FIGURE 4.2 Development of Component Sampling Periods

TABLE 4.6 Components Selected for Conservative On-Site Baseline Risk Assessment

	Component Category	Component Selected
1.	Administration Buildings	Rust Engineering Building (45A)
2.	Warehouse/Storage Buildings	(Old) Plant 5 Warehouse (65)
3.	Process Buildings	Ore Refinery Plant (2A)
4.	Process Support Buildings	Main Maintenance Building (12A)
5.	Aboveground Containers	Pilot Plant Thorium Tank Farm (13D)
6.	Belowground Containers	Fire Training Burn Trough (73D)
7.	Bulk Material	Soil Piles (G-013)
8.	Parking Lots/Roads/Pads	Plant 8 North Pad (74R)
9.	Aboveground Equipment	Sewage Treatment Plant Incinerator (39D)
10.	Belowground Equipment	Utility Trench to Pit Area (22E)
11.	Ponds and Basins	Fire Training Pond (73B)

All other components that are not selected for use with the trending analysis or the baseline risk assessment are placed in the middle or late sampling periods. If a component is likely contaminated, it is sampled in the middle sample period. If a component requires only confirmatory sampling, it is sampled in the late sample period.

Factors listed in Table 4.5 were considered for scheduling within the middle and late periods. The development of the actual schedules required balancing among the constraints imposed by the factors, in part based on judgment, and involved several iterations. For the components in the middle sampling period, it was determined if any removal actions had an effect on the component. In general, the sampling of the affected component is delayed as a whole or in part until after the removal action is completed if the removal action is scheduled to be completed between April 1993 and September 1994 (the presently defined OU3 RI/FS sampling window). Such a delay will allow sampling of the component after completion of the removal action during October and November 1994. If the removal action is not scheduled to be completed before September 1994, then the affected component will be sampled by the field characterization program to the extent possible commensurate with the OU3 RI/FS data needs. Therefore, consideration of removal actions changes the designated order within the sampling period for some components.

Next, other site activities were considered. Similar to the case for removal actions, if an ongoing or planned site activity is likely to alter the state of a OU3 component, and if the activity will be completed in time to allow characterization of the component for the RI/FS, then it was decided that the sampling for that component would be done after the site activity is completed.

Finally, the estimates of the time and level of effort required to characterize each component, along with the availability of resources, were used to calculate the total time it will take to characterize all of the OU3 components. Section D.8 in Appendix D provides background information and detailed assumptions concerning the amount of time required to take samples for various types of analyses from OU3 components. Also provided in Section D.8 are the number of samples and the effort required (in terms of crew-hours) to take those samples in each OU3 component. The scheduling priorities and constraints provided in this section are combined with the data and assumptions provided in Section D.8 to prepare the detailed schedules for characterization of OU3.

Initial field schedules are complete, but ongoing site activities and programs may influence the component sampling order. Schedules of removal actions may change, and new removal actions may be proposed. Therefore, the schedule of the field characterization program will evolve with the changing conditions of OU3.

4.5 SAMPLING AND ANALYSIS PLAN

The Sampling and Analysis Plan (SAP) in Appendix D contains the specific guidance and requirements for the remedial investigation (RI) characterization of the components within OU3. The SAP differs somewhat in organization from that suggested in guidance in that a distinct Quality Assurance Project Plan (QAPjP) is not a self-contained element thereof. Instead, the SCQ contains, or will contain, all of the QA elements required for the FEMP, including OU3. The relevant sections of the SCQ are included in the SAP by reference to fulfill the requirements of a QAPjP.

The SAP defines the organization and responsibilities necessary to carry out the sampling program. Objectives are related to information needs and to the means to obtain that information. A suite of protocols is established to implement field activities, including conducting field instrument surveys and determining the location and types of intrusive samples required to fill information needs. Specific sampling and analysis procedures are identified for making field measurements, collecting samples, and analyzing samples. Finally, the operational plans and schedules are provided, and the required personnel resources are identified.

The main activities of the SAP are applied on a component basis within OU3. Some data needs, however, are addressed on a site-wide basis, where sampling is required in only selected components. Before RI characterization activities are started for a specific component, a field work package (FWP) will be prepared for the individual component on the basis of specific information needs identified in the SAP. The FWP will reference the protocols and procedures specified in the SAP. Development of the SAP and all activities defined by the SAP are conducted in accordance with the SCQ.

The SAP describes component-specific details concerning approximate sample locations, total number of intrusive samples, contaminants to be analyzed, and the media to

be sampled. These specifications were developed on the basis of the following information contained in the SAP:

- A comprehensive list of radiological and chemical analytes for all components,
- Specification of media to be sampled and types of supplemental samples to be collected,
- General sampling and measurement protocols that address a comprehensive set of sampling contexts for OU3 and employ specified approaches to field measurement and sampling activities,
- Descriptions of appropriate field instruments and measurement procedures,
- Descriptions of expected sample media and specific sampling procedures for various media,
- Identification of analytical methods and procedures for each contaminant/media, and
- Specification of sample numbers, types, and approximate locations for each component.

The condition of some components within OU3 will change during the RI as a result of scheduled interim actions (which include removal actions for major quantities of product, feed inventory, contaminants, and wastes). So as to minimize premature field data collection, characterization of the components will be scheduled after completion of the interim actions, if possible. Some affected components may require at least partial characterization before completion of interim actions in order to meet the committed schedule of the RI for OU3.

A health and safety screening of general contamination levels will be conducted for worker protection on all OU3 components as part of the RI field characterization activities. The health and safety screening results will be used to assist in the FWP development for components for which little or no specific knowledge exists on contaminant levels.

Table 4.7 summarizes the number of samples anticipated for all of OU3 on the basis of component-specific estimates provided in Section D.9 of the SAP. Those estimates were developed through the approach to data collection outlined in Section 4.3. Table 4.7 provides an overview for the entire operable unit in terms of numbers of samples by type of medium sampled and by component category.

The samples summarized in Table 4.7 generally represent locations with elevated levels of contamination for each medium in each process area of each component. (The exceptions are for liquids and airborne particulates, for which samples will represent average conditions.) Therefore, when viewed together, the results from these samples will provide a conservative upper bound on conditions in contaminated materials in the operable unit. In addition, given the substantial number of samples by media type, the results will also provide considerable detail by type of material within the operable unit as well. The major decisions to be made for OU3 involve how to manage the expected large quantities of waste materials that will result from remedial activities. These decisions will generally be made by material type, rather than by individual component. When viewed on this basis, the summary of samples provided in Table 4.7 illustrates that a substantial number of samples will be collected for major materials to support conservative operable-unit-wide decisions.

Table 4.7 also shows that a substantial number of samples will be taken for those component categories with large volumes of construction materials, diverse uses, and diverse populations of potential contaminants (i.e., warehouse/storage buildings, process buildings, and process support buildings). A significant number (more than half) of all supplemental samples identified in component inspections will be taken in the process and process support buildings. Table 4.7 also shows that component categories with smaller components, smaller numbers of components, and less diversity will have fewer samples.

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TABLE 4.7 Summary of Samples by Component Category and Sample Type[a]

	Type of Sample									
	Intrusive Samples — Major Media				Intrusive Samples — Supplemental[b]			Nonintrusive Samples[c]		
Component Category	Concrete Chips	Concrete Cores	Masonry	Structural Steel	Loose Media	Liquid	Transite	Composite Swipes	Airborne Particulates	Total Samples
1 - Administrative/ support buildings	10	1	9	2	0	1	0	6	6	35
2 - Warehouse/storage building	28	1	4	24	0	0	1	22	22	102
3 - Process buildings	58	48	40	85	23	32	9	26	27	348
4 - Process support buildings	10	15	17	20	2	6	0	20	20	110
5 - Aboveground containers	4	10	4	10	4	10	NA[d]	10	13	65
6 - Belowground containers	NA	NA	NA	NA	8	1	NA	NA	1	10
7 - Bulk material	NA	NA	NA	NA	20	NA	NA	NA	1	21
8 - Pads, etc.	24	4	1	NA	8	6	NA	5	21	69
9 - Piping, etc., aboveground	9	1	NA	5	0	0	NA	4	6	25

TABLE 4.7 (Cont.)

	Type of Sample									
	Intrusive Samples — Major Media				Intrusive Samples — Supplemental[b]			Nonintrusive Samples[c]		
Component Category	Concrete Chips	Concrete Cores	Masonry	Structural Steel	Loose Media	Liquid	Transite	Composite Swipes	Airborne Particulates	Total Samples
10 - Piping, etc., belowground	1	2	NA	1	3	3	NA	2	2	14
11 - Ponds and basins	1	1	NA	NA	9	9	NA	2	8	30
Total Samples	145	83	75	147	77	68	10	97	127	829

[a] The sample quantities in this table include additional samples beyond those required to satisfy basic data needs as identified in Table 4.2. Component-specific estimates are given in Section D.9 of the SAP.

[b] Not included are samples from media for leaching tests or from heating, ventilating, and air conditioning equipment.

[c] Includes only samples that require laboratory analysis.

[d] NA indicates that no appropriate media exist for this category.

4.6 OTHER MAJOR PLANS

4.6.1 Community Relations

4.6.1.1 Community Relations Plan

Under CERCLA, an ongoing dialogue between the DOE and the community continues throughout the RI/FS process. The 1991 Amended Consent Agreement identifies a Public Involvement and Response Plan that responds to the need for an interactive relationship between DOE and all interested community elements. The framework within which this dialogue occurs at the FEMP is discussed in the *Community Relations Plan (CRP) for the Remedial Investigation / Feasibility Study and Removal Actions at the U.S. Department of Energy Fernald Environmental Management Project, Fernald, Ohio.* The CRP is Volume III of the EPA-approved RI/FS work plan (DOE 1988a).

The CRP includes background information about the FEMP, community concerns and information needs, specific public participation activities, useful community contact information, and addenda that contain similar information for all non-emergency removal actions at the FEMP. It also identifies communication strategies to be used throughout the entire RI/FS. The CRP was originally issued in 1988, underwent a major revision in 1990, and was revised/updated in August 1992.

4.6.1.2 Rationale for Recommended Revisions to the CRP

The 1991 Amended Consent Agreement affected the scope and schedule of all five operable units and added a comprehensive site-wide operable unit. The exact changes in definition and schedule, as well as the context of those changes, were included in the CRP to meet EPA requirements "to adjust (the CRP) to changes either in community attitudes or in the schedule for technical activities at a site" (EPA 1988). The new operable unit definitions and schedule were added to the draft 1992 revision of the CRP.

Of all the operable units, OU3 underwent the most substantial change in scope and schedule. The new schedule for the OU3 RI/FS extends the timeframe of previously existing public participation programs to 1997, while the complexity of OU3 places new demands in terms of the volume and type of information that DOE shares with the community. For

example, the type of sampling required for the former production area will vary from the sampling activities that the public has been hearing about in the RI/FS updates over the past few years. These changes also raise an important issue regarding the relationship of OU3 to removal actions, as well as other interim actions, in the former production area. Additional modifications to the CRP to be considered in aiding public understanding of RI/FS activities related to OU3 are:

- Updated discussions of the relationship between OU3 and related removal actions,
- A brief summary of the OU3 site characterization effort, and
- Identification of OU3-specific reports to be included in the Administrative Record.

4.6.1.3 Discussion

Each of the communication tools identified in Section 4.3 (Program Highlights) of the CRP can be used in a dialogue about OU3 between the FEMP and the community. The following list identifies the most relevant public information activities to be used to discuss OU3-specific issues. These activities are designed to enhance the public's understanding of the complexity of OU3, as well as to inform and solicit public opinion about information presented in OU3 RI and FS primary documents and related removal action documents:

- Discuss the status of OU3 and related removal actions at quarterly RI/FS community meetings, beginning with the first community meeting to be held after EPA approves the OU3 Work Plan Addendum;
- Report on the status of OU3 and related removal actions in the *Fernald Project Cleanup Report*;
- Hold periodic community roundtables focusing on OU3 and related removal actions;
- Provide the community with opportunities to see visible signs of progress in remediating the former production area, via site tours and/or videotapes; and

- Solicit community opinion relevant to OU3 during public comment periods or through a community assessment, and document the findings in Section 3.0 of the CRP.

This ongoing dialogue provides concerned citizens opportunities to become involved in the overall CERCLA process at the FEMP and in OU3. Specific opportunities for the public to become involved are identified in the FEMP CRP and are listed below:

- Attend quarterly FEMP community meetings, availability sessions, community roundtables, and workshops;
- Receive written FEMP materials, such as the *Fernald Project Cleanup Report*;
- Participate in site tours;
- Review Administrative Record documents and other materials, such as videotapes, in the FEMP Public Environmental Information Center located on Route 128 near the FEMP; and
- Participate in public comment periods focusing on specific documents, such as the 1991 Amended Consent Agreement or the OU3 Proposed Plan (when a public comment period focuses on the operable unit's Proposed Plan, this comment period provides the mechanism for EPA to determine whether the community acceptance criterion [required for approval of the Proposed Plan] is met).

4.6.2 Health and Safety Plan

Health and safety issues for field data collection activities at the FEMP are identified and discussed in the Health and Safety Plan for the RI/FS (DOE 1988b). The approach for all health and safety issues is to establish the general procedures for all field-related activities at the FEMP and publish addenda to these general procedures, as required. For example, all sections of the Health and Safety Plan are general and apply to all surface-sampling field activities. With this approach, every component-specific field work package to be developed before sampling a component will have a section (a component-specific Health and Safety Plan) that will identify all specific hazards and the required health and safety

procedures to deal with those hazards. Each of these component-specific plans will be individually tailored for the component and the specific instrument and/or sampling procedures required for that component.

4.6.3 Data Management Plan

The data management systems, subsystems, hardware and software requirements, and software development standards necessary for development and implementation of the requirements, activities, and work specified in the RI/FS OU3 work plan addendum conform with the planning and requirements of Appendix F, Data Management Plan, in the SCQ. The data systems and associated operating features comprising the FEMP-site data management system will be employed to the maximum extent possible and practicable.

Because certain capabilities are not expected to be available when the site-wide OU3 sampling program is being prepared and conducted, FEMP-site data management systems will be augmented as necessary with appropriate and existing systems.

Once fully developed and operational, FEMP site-wide data systems will provide a centralized, consistent, accurate, and flexible repository for data collected at the FEMP. Each subsystem of the FEMP data management system, linkages between subsystems, overall hardware and software environments, general guidelines for future development of data management systems, and augmenting systems are part of the Data Management Plan to permit planning and utilization in accordance with the needs of the activities specified in the RI/FS OU3 work plan addendum. The goal is to provide a centralized data repository for a very large quantity of environmental data of known quality that satisfy regulatory requirements and project DQOs and that can support a wide range of ad hoc and routine data requests for assessment and reporting in a timely manner.

Several integrated environmental data management systems have been, or are in the process of being, developed for the FEMP to support the broad range of these data-related activities. Central to the FEMP environmental data management systems is a data repository that stores analytical and field observation results, related QA/QC information, sampling station information, and cross references to original hard copy documents. Each of the other FEMP environmental systems interfaces with this central data repository, either by using repository data as input or by serving as a data input point to the repository.

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5 REMEDIAL INVESTIGATION/FEASIBILITY STUDY TASKS

The EPA has defined a series of standard tasks for the RI/FS process. That task structure will generally be used in implementing the RI/FS process for OU3. Use of this approach should enhance coordination with and review by EPA Region V, the State of Ohio, and local citizens and officials. The RI/FS tasks are briefly described in Sections 5.1 through 5.15. Reference is included to other sections of this Work Plan Addendum or other project documents to explain the approach being used to implement the various tasks.

5.1 PROJECT PLANNING

The project planning task initiated the RI/FS process and established the project basis by:

- Collecting and documenting scoping information (Sections 1 and 2),
- Collecting and evaluating existing data (Section 2.4),
- Developing a conceptual site model (Section 3.1),
- Examining baseline risk assessment issues (Section 3.1),
- Compiling a list of potential ARARs (Section 3.2),
- Identifying preliminary response objectives, general response actions, and remedial action alternatives (Sections 3.2),
- Defining the approach to worker protection (Section 3.3),
- Determining data needs and data gaps (Section 3),
- Establishing data quality objectives (Section 4.2),
- Defining the approach to data collection (Section 4.3),
- Identifying and integrating interim activities with OU3 RI/FS activities (Sections 2.5 and 4.4),
- Preparing the major project plans, including the sampling and analysis plan (Sections 4.5 and 4.6),
- Documenting RI/FS tasks (remainder of Section 5),

- Developing schedules for completion of major project elements (Section 6), and
- Identifying project organization and project management (Section 7).

All of these elements are included in this Work Plan Addendum. Some elements are summaries of more comprehensive documents. Information in this plan will be updated in the future, as appropriate.

5.2 COMMUNITY RELATIONS

The community relations task includes all efforts related to the preparation and implementation of the site-wide Community Relations Plan (CRP). The site-wide CRP describes the activities that DOE will undertake to ensure a full program of public participation. The site-wide CRP was originally issued in 1988, revised in 1991, and last updated in January 1992. The site-wide CRP has been approved by EPA. Additional revisions to the site-wide CRP are being considered, as discussed in Section 4.6.1. Efforts related to community relations for OU3 will continue until the RI/FS process has been completed and the selected remedy is implemented.

The DOE has been providing information about remedial action activities related to OU3 to officials, the public, and the media in the Fernald area; relevant activities are discussed in Section 4.6.1. An information repository has been established at the FEMP Environmental Information Center located on Route 128 near the FEMP to provide the public with access to documentation related to the RI/FS process.

5.3 FIELD INVESTIGATION

All efforts related to field work performed for the remedial investigation phase of the RI/FS process are included in the field investigation task. Field work is necessary to obtain adequate data to support the baseline risk assessment and the development and evaluation of alternatives in the feasibility study. The field investigation task begins with the procurement of any needed technical support and continues through the demobilization from the field of all contractors and subcontractors performing portions of the task.

Plans for field investigations are discussed in detail in Section 4 and documented in the Sampling and Analysis Plan (SAP). The approach developed covers the full range of

components present in OU3. Field investigations will be directed at the various components contained within the operable unit and will not generally include activities related to more typical environmental media (e.g., soil and water). Both field measurements and sampling of components will be conducted.

5.4 SAMPLE ANALYSIS/VALIDATION

Sample analysis/validation will be in accordance with the guidance and requirements contained in the FEMP SCQ. This task consists of sample management; chemical and radiological analysis; quality control; and data reduction, validation, and reporting. These subjects are discussed in detail in the SCQ.

Sample management and control will be in accordance with Section 7 (*Analytical Laboratory Sample Custody*) of the SCQ. Sample custody will be maintained and documented from time of collection through analysis. Appropriate records will be maintained in the chain-of-custody process for sample tracking and control.

Analysis of samples and laboratory analytical procedures generally will be in accordance with Section 9 (*Analytical Procedures*) of the SCQ in conjunction with Appendix E of the SCQ. For chemical analyses, EPA-approved methods will be used as the FEMP method source for all analyses for which such methods exist. Where EPA methods do not exist, verified methods will be submitted to EPA for approval. Radiological sample preparation and analysis methods are specified in Appendix I of the SCQ.

Performance requirements defined in Appendix E (*Analytical Laboratory Performance Requirements*) and Appendix A (*Approved Laboratories and Support Level Capabilities*) of the SCQ will be used to evaluate an analytical laboratory's capability to provide specific analytical services for the FEMP. A list of analytical laboratories performing work for the FEMP is included in Table 3.2 of Appendix A of the SCQ. Other laboratories may be added to this list subject to FEMP approval and EPA audit.

Sample quality control (QC) will be carried through analytical processes to maintain and verify the quality standards initiated in the field and to verify the quality of measurements taken in the field, laboratory investigation, and associated tasks. Details on the quality assurance (QA) program objectives, as defined in Section 4 of the SCQ, include field quality assurance; analytical quality control samples; training requirements; records

administration; document control; and requirements for completeness, representativeness, comparability, precision, accuracy, and sensitivity.

Data reduction, validation, and reporting for each ASL will be in accordance with Section 2.3.3 (DQOs) of the SCQ. Numerical analysis, including manual calculations, mapping, and computer modeling, will be documented and subjected to QC and peer review. The Data Validation Plan is presented in Appendix D and the Data Management Plan is presented in Appendix F of the SCQ.

5.5 DATA EVALUATION

Data evaluation includes efforts related to the analysis of sample data once they have been validated and verified as being of acceptable accuracy and precision. The OU3 FEMP field program is designed with the objective of satisfying (1) the unfulfilled data needs necessary to complete the characterization of materials present in OU3 and (2) the data quality objectives. The field sampling program will be conducted in accordance with the SAP. The data obtained will be controlled and analyzed/validated by specialists in appropriate technical fields in accordance with Section 5.4 of this Work Plan Addendum. These data will then be evaluated to determine applicability to fulfill data needs. The data evaluation task continues through preparation of the RI report until it is determined that no additional data are required.

The evaluation process will entail the application of sample data to satisfy the various RI/FS data needs and will consist of a systematic use of sample data, comparison of these data with the data needs, development of summaries of results and findings, and reporting of results and findings. Typical products of the data evaluation task will include tabulations of contaminant levels, quantification of potential contaminant releases and relevant migration pathways (transport modeling), and tabulation of engineering data (e.g., waste volumes by type of material, type of contaminant, and level of contamination) needed to evaluate remedial action alternatives. The evaluation process will yield information about the accuracy of the conceptual site model, potential health effects, potential environmental effects, the need for interim response actions, identification of additional potential regulatory requirements, and potentially new data gaps.

5.6 RISK ASSESSMENT

The National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 300) contains the basic guidance for conducting remedial investigations and feasibility studies. Specifically, Section 300.430 describes the process for collecting data, determining the risk to off-site receptors, and determining the appropriate remedial action to implement.

In the area of risk assessment, the regulations discuss the need to evaluate the current conditions at the site, as well as the conditions after various remedial alternatives are completed. The first assessment (the baseline risk assessment) is conducted as part of the RI phase of the project. The latter assessments are prepared in conjunction with the feasibility study.

5.6.1 Risk Assessment Process

The approach to risk assessments for the FEMP is discussed in Section 2.0 of the FEMP RI/FS Risk Assessment Work Plan Addendum (DOE 1992b). That section describes the process in four steps:

1. Data collection and analysis, where potential contaminants of concern are identified and data are collected on their concentration and location;
2. Toxicity assessment, where the ability of chemicals to cause both toxic effects and the incidence of cancer are documented;
3. Exposure assessment, where the potential pathways through which contaminants of concern may reach ecological and human receptors are analyzed and the concentrations of these contaminants at receptor locations are quantified; and
4. Risk characterization, where the exposure and toxicity assessments are combined to determine the effect on human and ecological receptors.

The baseline risk assessment is completed as part of the RI phase of the project and represents the hazards posed by the site in its current condition. In the FS phase of the project, a risk assessment is conducted for each remediation alternative, both while

remediation is underway and after it is completed. For comparison purposes, the baseline risk assessment acts as an evaluation of risk for the "no-action" alternative.

Each risk assessment also contains an evaluation of the uncertainty in the risk determination. Knowing the level of uncertainty is crucial to being able to demonstrate compliance with the overall remediation goals of keeping excess cancer incidence at or below the range of 10^{-4} to 10^{-6} and the hazard index less than 1.0.

5.6.2 Risk Assessment Process Applied to OU3

Risk assessment activities for OU3 will generally follow the process outlined above. However, potential contaminants of concern have already been identified and are listed in Section 3.1. Data needs related to contaminants have been determined for a variety of activities, including the baseline risk assessment and the evaluation of alternatives. Any gaps between the data available and those needed to complete the RI/FS process will be addressed in the RI phase of OU3. Data collection requirements are documented in the SAP.

The toxicity assessment and the exposure assessment will be carried out in parallel. The toxicity assessment will be based on approaches described in Section 8.0 of the FEMP Risk Assessment Work Plan Addendum. Releases and exposure pathways will be evaluated for each component grouping on the basis of the conceptual model and approach described in Section 3.1. Methods described in Section 6.0 of the Risk Assessment Work Plan Addendum will be used to convert data on potential releases into concentrations at receptor locations. The factors contained in EPA (1991a) will be used to convert these concentrations into intakes. Alternatively, intake factors specific to the FEMP may be used if they are found to be significantly different from those used by the EPA. The intakes will be used to establish the RMEs for each component grouping in OU3. These RME locations and the magnitude of the intakes will be utilized in the development of remediation alternatives. Scenarios and assumptions used in the baseline and feasibility study risk assessments are discussed in Sections 3.1 and 3.2.

The risk assessment phase will combine the exposure and toxicity assessments to develop two common measures of the impact of each action on receptors. These measures will be the risk of cancer incidence and the potential for toxic effects. As mentioned above,

the baseline risk assessment will evaluate the effects of taking no action on the site. For OU3, no action can mean either site abandonment or long-term institutional control. Scenarios to be evaluated are discussed in Section 3.1. Each remedial alternative risk assessment will be compared with the baseline and with the other alternatives to determine which is most protective of human health and the environment. In all cases, results will be presented by component group and for OU3 as a whole.

The risk assessment also will evaluate the uncertainties associated with the risks. This evaluation is needed because each of the preceding steps has an associated uncertainty level. It is necessary to understand the confidence level for the final risk estimate to ensure that remediation goals can be achieved. Knowing the uncertainty in the risk values will also be important in identifying which receptors represent the RMEs.

As discussed in Section 3.1, recent guidance from EPA (EPA 1992) has addressed the issue of including estimates of "central tendency" exposures in addition to reasonable maximum exposures and has indicated that such central tendency estimates will be used in discussing uncertainties. As noted, methods for including central tendency estimates in risk assessments are being developed for the FEMP. When approved, these methods will be provided as an addendum to the FEMP Risk Assessment Work Plan Addendum and will be used in the assessment of risks for OU3 for both the baseline and feasibility study cases.

The baseline risk assessment will be issued as a part of the RI report. Its format is discussed in Section 5.8. The risk assessments associated with the remediation alternatives will be issued in conjunction with the FS report.

5.7 TREATABILITY STUDIES

Treatability studies are conducted as needed to collect additional information necessary to evaluate the technologies identified during the development of alternatives. Treatability studies are conducted to provide sufficient data to allow treatment alternatives and technologies to be fully developed and evaluated during the detailed analysis of alternatives and to support the remedial design of a selected alternative. Treatability studies provide information necessary to reduce the uncertainties associated with the performance and costs of a technology in a site-specific application and thereby facilitate the selection of a remedial alternative that can achieve response objectives.

Treatability testing of a technology that may be applicable to some or all of the components at OU3 will be initiated when the existing site data and technological data are not adequate to screen or evaluate the alternative. The need for treatability testing will be identified early in the RI/FS process. The process will take into account the cost and time required to complete the testing and the value of the information gained with respect to resolving uncertainties associated with the effectiveness, implementability, and/or cost of the technology. Treatability studies will be carried out in a manner consistent with EPA guidelines (e.g., EPA 1989b).

5.8 REMEDIAL INVESTIGATION/BASELINE RISK ASSESSMENT REPORT

All efforts related to the reporting of RI findings once the data have been evaluated under the two earlier tasks are included in this task, which includes all draft and final RI reports. The proposed outline of the RI report is shown in Table 5.1. Section 2 of the proposed outline discusses field activities, Section 3 summarizes the site setting, Section 4 presents the results of characterization of OU3, Section 5 discusses contaminant fate and transport, and Section 6 is a summary of the baseline risk assessment, which will be contained in Appendix A of the document. The proposed outline of the baseline risk assessment is shown in Table 5.2.

5.9 REMEDIAL ALTERNATIVES DEVELOPMENT AND SCREENING

A range of distinct alternatives for remediation or control of any contaminated media in OU3 will be developed and screened under this task. The alternatives identified will include those that reduce the toxicity, mobility, or volume of contaminants. These alternatives will range from those that involve little or no treatment and rely on engineered controls to prevent or control exposures, to those that employ treatment that removes or destroys contaminants to the maximum extent feasible, thereby minimizing the need for long-term management.

The preliminary step in this process is the development of remedial action objectives and the identification of general response actions. Remedial action objectives specify contaminants and media of concern, potential exposure pathways, and preliminary

TABLE 5.1 Proposed Outline of the OU3 Remedial Investigation Report

Executive Summary	
1.0 Introduction	
1.1 Approach and Objectives	
1.2 Site Description and History	
1.3 OU3 Description	
1.4 Process History of OU3 Components	
1.5 Previous Investigations	
1.6 Relationship between Field Activities and Interim Actions	
1.7 Prioritization of OU3 Investigations	
1.8 Report Organization	
2.0 Operable Unit 3 Investigation	
2.1 OU3 Component Characterization	
2.2 Summary of Any Special Studies	
3.0 Site Setting	
3.1 Surface Features	
3.2 Climate	
3.3 Surface Water Hydrology	
3.4 Geology/Groundwater Hydrology	
3.5 Ecology	
3.6 Land Use and Demography	
4.0 Nature and Extent of Contamination	
4.1 Administrative/Support Buildings	
4.2 Warehouse/Storage Buildings	
4.3 Process Buildings	
4.4 Process Support Buildings	
4.5 Containers — aboveground	
4.6 Containers — belowground	
4.7 Bulk Material	
4.8 Pads/Roads/Railroad Rights-of-Way	
4.9 Piping/Utilities/Equipment — aboveground	
4.10 Piping/Utilities/Equipment — belowground	
4.11 Ponds/Basins	
5.0 Contaminant Fate and Transport	
5.1 Identification of Exposure Pathways	
5.2 Contaminant Migration	
5.3 Concentrations at Receptor Locations	

TABLE 5.1 (Cont.)

6.0 Baseline Risk Assessment	2
7.0 Summary and Conclusions	3
Appendix A Baseline Risk Assessment	4
Appendix B Analytical Data	5

TABLE 5.2 Proposed Outline of the OU3 Baseline Risk Assessment (Appendix A of the RI)

Executive Summary	3
A1.0 Introduction	4
A1.1 Risk Assessment Objectives	5
A1.2 Site Background	6
A1.3 Scope of Risk Assessment	7
A1.4 Report Organization	8
A2.0 Identification of Contaminants of Potential Concern	9
A2.1 Data Collection and Evaluation Considerations	10
A2.2 Selection of Contaminants of Potential Concern	11
A2.3 Summary	12
A3.0 Exposure Assessment	13
A3.1 Characterization of Exposure Setting	14
A3.2 Identification of Exposure Pathways	15
A3.3 Quantification of Exposure	16
A3.4 Identification of Uncertainties	17
A3.5 Summary	18
A4.0 Toxicity Assessment	19
A4.1 Toxicity Information for Noncarcinogenic Effects	20
A4.2 Toxicity Information for Carcinogenic Effects	21
A4.3 Chemicals for Which No EPA Toxicity Values Are Available	22
A4.4 Uncertainties Related to Toxicity Information	23
A4.5 Summary	24
A5.0 Risk Characterization	25
A5.1 Current Conditions with Access Controls	26
A5.2 Current Conditions without Access Controls	27
A5.3 Future Land Use Conditions	28
A5.4 Uncertainties	29
A5.5 Summary	30
A6.0 Summary	31
A6.1 Contaminants of Concern	32
A6.2 Exposure Assessment	33
A6.3 Toxicity Assessment	34
A6.4 Risk Characterization	35

remediation goals. Preliminary remediation goals are based on readily available information and are refined as the RI/FS process develops. General response actions are broad-based categories of responses that can satisfy the remedial action objectives identified for OU3, which are discussed in Section 3.2 of this Work Plan Addendum, as are remedial action objectives.

On the basis of the remedial action objectives and general response actions, specific remedial technologies will be identified and screened relative to their applicability to the contaminants present, their physical matrix, and other characteristics of the site, as appropriate. This screening will be based primarily on the ability of the technology to effectively address the contaminants of concern, but also will take into consideration implementability and cost.

Potential technologies identified in the previous step will then be assembled into operable-unit-wide remedial action alternatives. These alternatives will be described in sufficient detail to support the screening of alternatives based on the general criteria of effectiveness, implementability, and cost (described below). The alternatives will be screened in order to limit the number of alternatives that will be evaluated in detail and to allow consideration of the most promising process options. Potentially applicable remedial technologies and process options and preliminary remedial action alternatives are discussed in Section 3.2.

The effectiveness of an alternative is defined by its ability to protect human health and the environment from contaminant-associated risks in both the short term and the long term. Measures of effectiveness include reduction of potential risks; reduction in contaminant toxicity, mobility, or volume through treatment; and consistency with regulatory requirements.

The implementability of an alternative is defined by its technical feasibility, the availability of resources, and administrative feasibility. Administrative feasibility addresses both the acceptability of an alternative by other agencies and groups and pertinent ARARs, including the need for permits, as appropriate.

The cost of an alternative is considered in a comparative manner at the screening stage to evaluate relative costs. For alternatives that are of similar effectiveness and implementability or that use similar controls to achieve remedial action objectives, relative

cost becomes an important screening criterion. (If one of the similar alternatives is much more expensive than another, the more costly alternative can be screened from further consideration.) Also, if the cost of an alternative is grossly excessive in relation to the effectiveness it provides, that alternative can also be screened from further consideration.

5.10 INITIAL SCREENING OF ALTERNATIVES REPORT

This task includes all activity related to preparation of the *Initial Screening of Alternatives Report* (ISA Report) required for OU3 by the Amended Consent Agreement. Draft, draft final, and final reports will be prepared as required in the Amended Consent Agreement. After submittal of the draft report to EPA, the State of Ohio will be requested to identify potential state ARARs. The ISA Report will discuss remedial action objectives and general response actions, consider relevant technologies, describe remedial action alternatives, carry out an initial screening of these alternatives, and identify those alternatives retained for detailed analysis. A proposed outline of the ISA Report is provided in Table 5.3.

5.11 DETAILED ANALYSIS OF ALTERNATIVES

Those alternatives identified for further analysis in the ISA Report will be examined in detail in this task. The analysis of the alternatives will be based on the use of the nine criteria established by EPA for evaluation of final alternatives for remedial action at a contaminated site. The criteria are (1) overall protection of human health and the environment, (2) compliance with ARARs, (3) long-term effectiveness and permanence, (4) reduction of contaminant toxicity, mobility, or volume through treatment, (5) short-term effectiveness, (6) implementability, (7) cost, (8) state acceptance, and (9) community acceptance. Because state and public comments will not be available during detailed evaluation of the alternatives, the final two criteria will be addressed in the proposed plan, responsiveness summary, and the ROD, as appropriate. Evaluation of the alternatives will require detailed analysis of potential short-term and long-term human health, environmental, and institutional impacts associated with implementation of each of the alternatives. Because environmental media and flora and fauna are part of OU5, consideration of environmental impact will require coordination between OU3 and OU5, as already noted in

TABLE 5.3 Proposed Outline of the OU3 ISA Report

Executive Summary	2
1.0 Introduction	3
1.1 Background	4
1.2 Site History	5
1.3 Purpose of RI/FS	6
1.4 OU3 Background	7
1.5 Purpose and Organization of Report	8
2.0 Identification and Screening of Technologies	9
2.1 Introduction	10
2.2 Remedial Action Objectives	11
2.3 General Response Actions	12
2.3.1 No Action/Institutional Controls	13
2.3.2 In-Situ Containment	14
2.3.3 Removal	15
2.3.4 Treatment	16
2.3.5 Disposal	17
2.4 Identification and Screening of Technology Types and Process Options	18 19
2.4.1 Screening Criteria	20
2.4.2 Technology Descriptions	2[illegible]
2.4.3 Initial Screening: Buildings	2[illegible]
2.4.4 Initial Screening: Containerized Material	23
2.4.5 Initial Screening: Bulk Material	24
2.4.6 Initial Screening: Parking Lots/Storage Pads/Roads/RRs	25
2.4.7 Initial Screening: Piping/Utilities/Equipment	26
2.4.8 Initial Screening: Ponds and Basins	27
2.5 Evaluation of Screened Technologies and Process Options	28
3.0 Development and Description of Preliminary Remedial Action Alternatives	29
3.1 Development of Alternatives	30
3.2 Description of Alternatives	31
3.2.1 Alternative 1	32
3.2.2 Alternative 2	33
3.2.3 Alternative 3	34
4.0 Screening of Preliminary Alternatives	35
4.1 Criteria for Screening Alternatives	36
4.2 Screening of Alternatives	37
4.2.1 Alternative 1	38
4.2.2 Alternative 2	39
4.2.3 Alternative 3	40
5.0 Summary of Alternatives Retained for Detailed Analysis	41

Section 3.2. Both an individual and comparative analysis of the alternatives against the criteria will be conducted. A comprehensive response action risk evaluation will be developed as required in the Amended Consent Agreement. The evaluation will examine the risks associated with the final alternatives, including the cumulative residual risks associated with the other operable units at FEMP.

The evaluation of alternatives will be expanded to ensure that the individual and comparative analysis of alternatives addresses NEPA issues as well. In particular, the following will be addressed:

- All reasonable alternatives, as required by NEPA (including impacts to off-site affected environment related to alternatives);
- Cumulative effects, both short-term and long-term, associated with alternatives;
- Population doses due to radiological exposures;
- Potential socioeconomic impacts and potential impacts on historical and cultural resources, and on floodplains and wetlands;
- Mitigation of adverse impacts;
- Unavoidable adverse impacts;
- Commitment of resources and energy requirements, and conservation potential of alternatives and mitigative measures; and
- The relationship between short-term use and long-term productivity.

Evaluation of potential ecological impacts, including impacts to threatened and endangered species will be considered in the RI/FS documentation for OU5.

The basis for NEPA/CERCLA integration and the general approach used are discussed in Section 1.4. The supplements to the OU3 FS report to accommodate this integration are discussed in Section 5.12.

Evaluation of potential cumulative impacts will be based on the nature of the alternatives considered for OU3 and the expected or "leading" alternatives for other operable units. Cumulative impacts will consider the relative timing and locations of activity for OU3 and other operable units.

5.12 FEASIBILITY STUDY REPORT

This task includes all efforts related to the preparation of the draft, draft final, and final FS reports. The comprehensive response action risk evaluation will be included as an appendix to the report as required by the Amended Consent Agreement. The task ends when the FS report is released to the public. A proposed outline of the FS report is presented in Table 5.4. The outline has been supplemented to include topics related to NEPA (i.e., cumulative impacts, mitigative measures, unavoidable adverse impacts, irreversible and irretrievable commitment of resources, and short-term uses and long-term productivity issues).

5.13 POST-RI/FS SUPPORT

This task includes all activities after release of the FS to the public. It includes all efforts related to preparation of the proposed plan, the responsiveness summary, support for development of the ROD, and any needed predesign activities.

5.14 MISCELLANEOUS SUPPORT

This task is used to report on any work associated with OU3 that is outside the scope of the other RI/FS tasks. These tasks may include the following:

- Specific support for coordination with and review of activities and reports of the Agency for Toxic Substances and Disease Registry, and
- Support for review of special projects.

5.15 INTERIM RESPONSE ACTION PLANNING

This task is used to carry out planning activities for proposed removal actions, including preparation of removal action work plans. Interim response actions currently proposed for OU3 are listed in Section 2.5, and additional interim actions will be proposed.

TABLE 5.4 Proposed Outline of the OU3 Feasibility Study Report[a]

Executive Summary	
1.0 Introduction	
1.1 Purpose and Organization of Report	
1.2 Background	
1.2.1 OU3 Description	
1.2.2 Site History	
1.2.3 Nature and Extent of Contamination	
1.2.4 Contaminant Fate and Transport	
1.3 Overview of the Environmental Compliance Process	
1.4 Summary of the Baseline Risk Assessment	
2.0 Identification and Screening of Technologies (summary from ISA report)	
2.1 Introduction	
2.2 Remedial Action Objectives	
2.3 General Response Actions	
2.4 Identification and Screening of Technology Types and Process Options	
3.0 Development and Screening of Preliminary Alternatives (summary from the ISA report)	
3.1 Development of Alternatives	
3.2 Screening of Alternatives	
3.3 Identification of Final Alternatives	
4.0 Detailed Analysis of Final Alternatives	
4.1 Introduction	
4.2 Individual Analysis of Alternatives	
4.2.1 Alternative 1	
4.2.1.1 Description	
4.2.2.2 Assessment (based on seven criteria)	
4.2.2 Alternative 2	
4.2.2.1 Description	
4.2.2.2 Assessment	
4.2.3 Alternative 3	
4.2.3.1 Description	
4.2.3.2 Assessment	
4.2.4 Potential Cumulative Impacts	
4.2.4.1 Health Impacts	
4.2.4.2 Environmental Impacts	

TABLE 5.4 (Cont.)

4.3 Comparative Analysis of Alternatives	
4.3.1 Threshold Criteria	
4.3.2 Primary Balancing Criteria	
4.3.3 Mitigative Measures	
4.3.4 Unavoidable Adverse Impacts	
4.3.5 Irreversible and Irretrievable Commitment of Resources	
4.3.6 Short-term Uses and Long-term Productivity	
Appendix A Comprehensive Response Action Risk Evaluation	

[a] NEPA-related requirements have been integrated into this outline consistent with the FEMP plan for NEPA-CERCLA integration.

6 SCHEDULE

The milestones for activities associated with the OU3 RI/FS are shown in the following bar chart (Figure 6.1). This schedule is consistent with the Amended Consent Agreement of September 19, 1991, except for modifications to the schedule for treatability studies. The start date for that activity has been delayed until January 4, 1993, with the delivery of the treatability studies work plan to EPA on August 12, 1993. The program milestones for the treatability studies have been modified because of the delay in approval of the OU3 Work Plan Addendum.

The following global assumptions have been incorporated into the schedule:

- Laboratory capacity exists to support OU3 sampling as proposed in this work plan;
- No secondary sampling is envisioned:
  - Sufficient data resulting from sampling/measurement activities are validated to complete the RI;
  - Removal actions after completion of the OU3 sampling program will provide sufficient data to document any changes to component characterization;
- No drum sampling will occur.

Section D.8 of the SAP provides additional detailed assumptions used for schedule development.

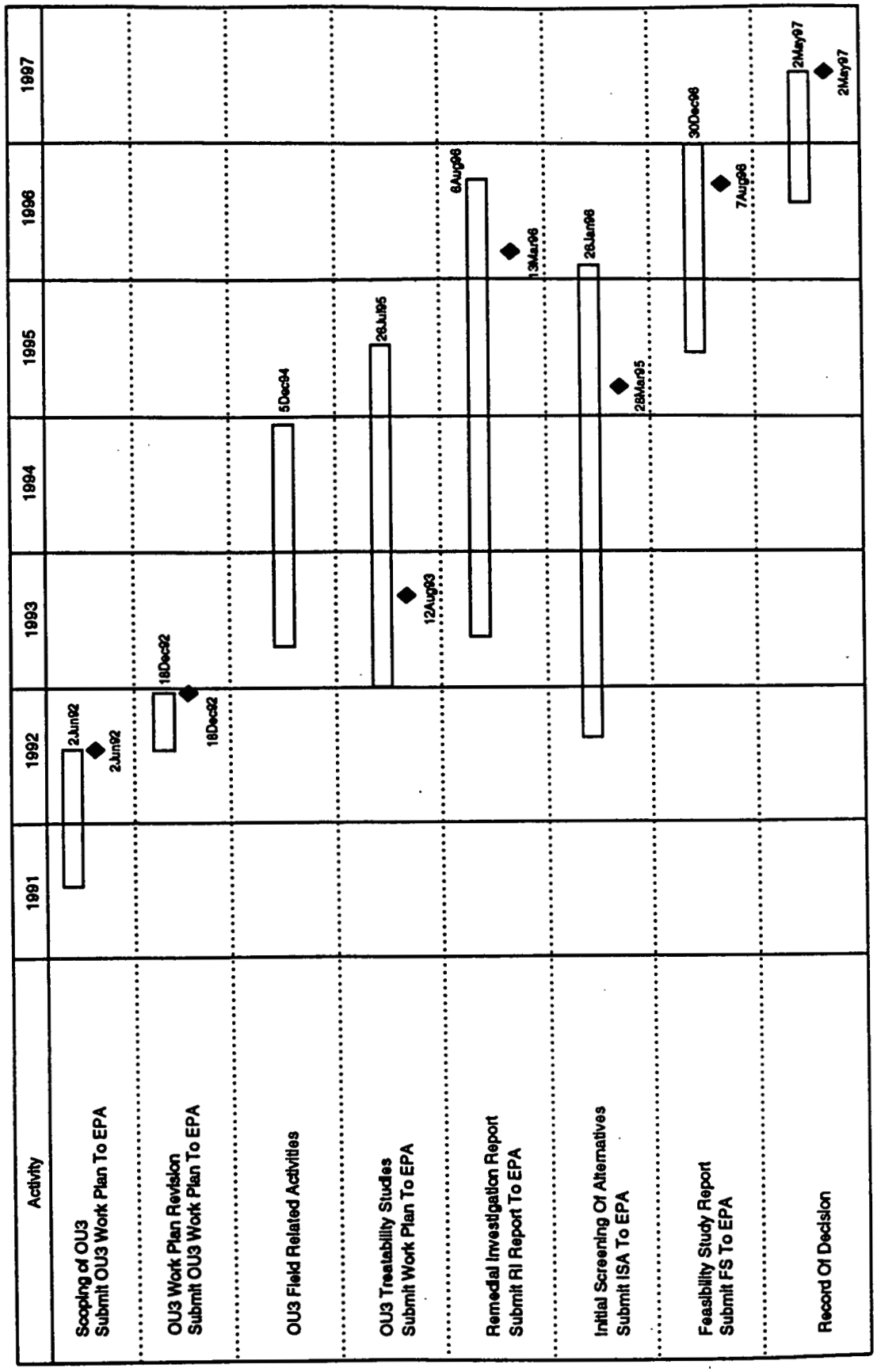

FIGURE 6.1 Milestone Chart for OU3 RI/FS Activities

7 PROJECT MANAGEMENT

7.1 ORGANIZATION

This section describes the organizational and management structure to be used in implementing the approved OU3 RI/FS Work Plan Addendum at the FEMP. Figure 7.1 illustrates the relationships between the various organizations involved. An Environmental Restoration Management Contract (ERMC) approach has been implemented at the FEMP site to manage the restoration activities, with Fernald Environmental Restoration Management Corp. (FERMCO), a wholly owned subsidiary of Fluor Daniel Inc., currently serving as the ERMC. The ERMC, reporting directly to the Department of Energy Fernald Field Office (DOE-FN), will act as the main contractor for FEMP activities and coordinator of technical support and remediation subcontractors. Under the current FERMCO organizational structure, OU3 activities will be the responsibility of CERCLA/RCRA Unit 3 (CRU3), with such activities being conducted by individuals of various disciplines matrixed to CRU3 from other FERMCO departments. Implementation of the OU3 Work Plan Addendum will be the specific responsibility of the Environmental Section within CRU3, as illustrated in Figure 7.2.

7.2 RESPONSIBILITIES

This section summarizes the organizational responsibilities associated with the implementation of the OU3 RI/FS program. The summary integrates the standard RI/FS tasks described in Section 5 and the functional organizational chart in Figure 7.2.

Primary responsibilities for implementing the OU3 Work Plan Addendum will rest with the Environmental Section matrixed to CRU3 of the FERMCO organization, with additional necessary support provided through matrixing from other FERMCO departments and through subcontracts as appropriate to ensure quality and timeliness. Task-specific responsibilities will be implemented as follows:

1. Complete overall planning, integration, execution, and support of the OU3 RI/FS program. Implementation of these activities is the responsibility of the Environmental Section matrixed to CRU3.

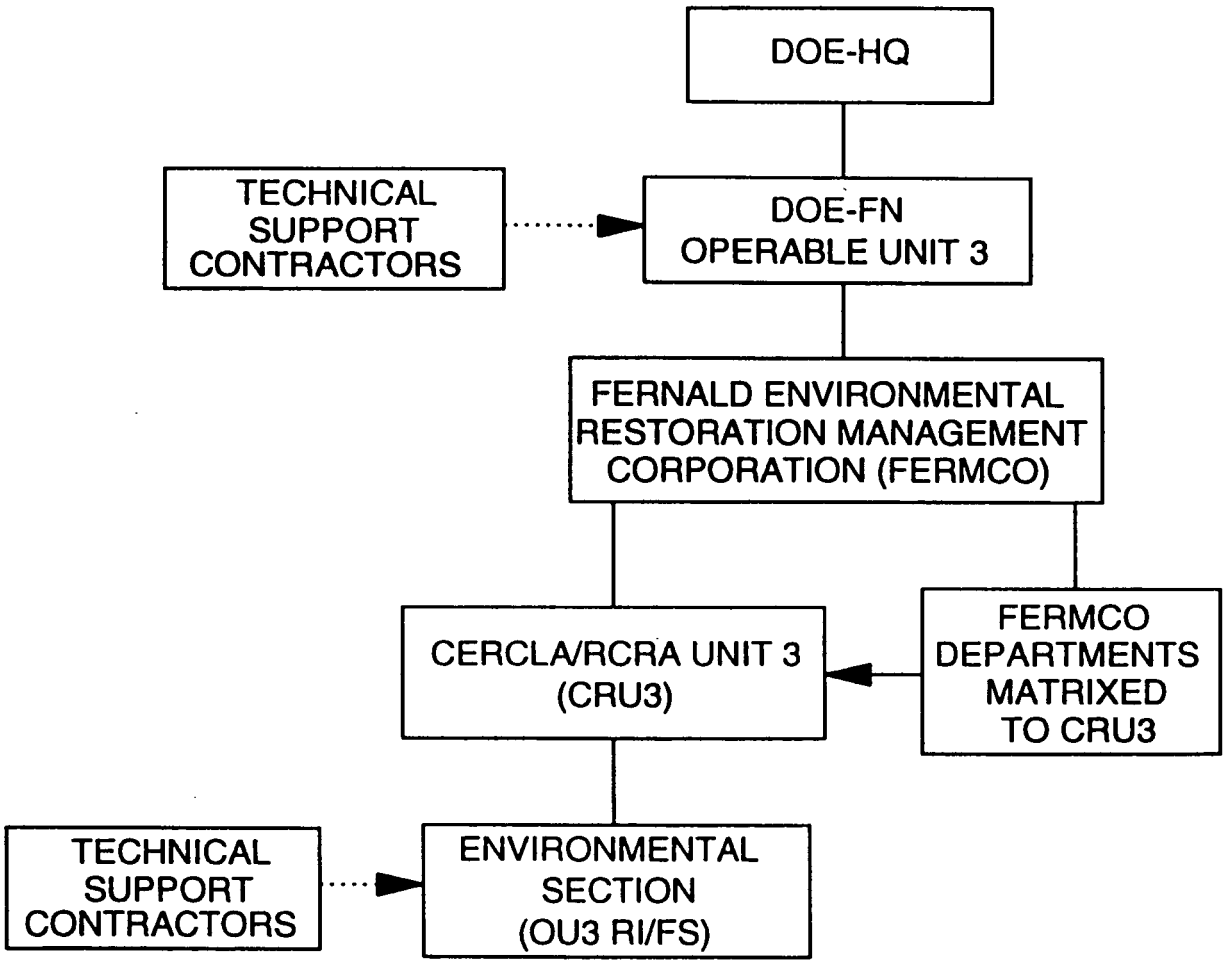

FIGURE 7.1 FEMP OU3 RI/FS Organization

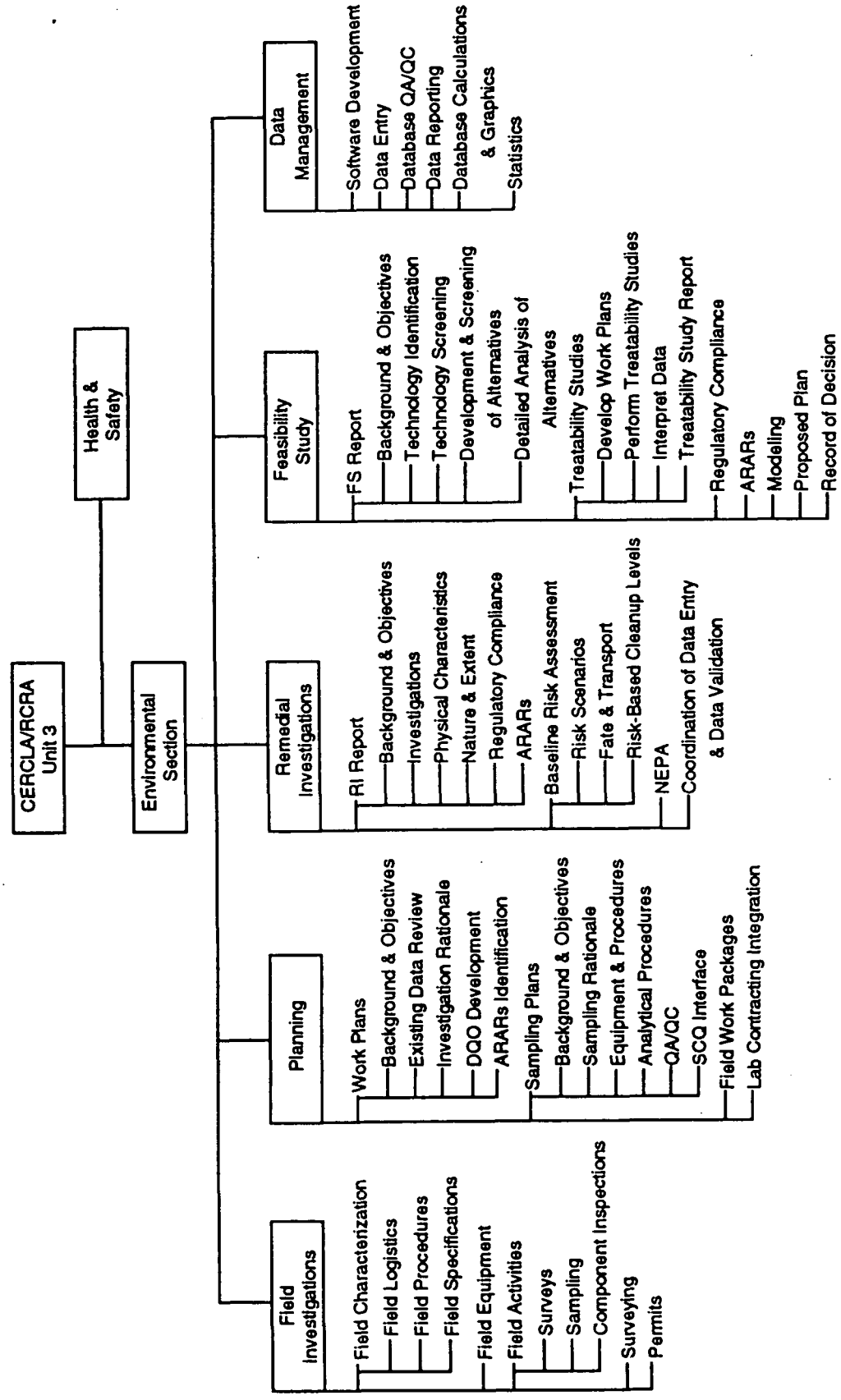

FIGURE 7.2 OU3 RI/FS Functional Organizational Chart

2. Prepare and obtain approval of OU3 sampling and analytical procedures. Development of any new procedures will be the responsibility of the Planning Group within the Environmental Section of CRU3. New procedures will be submitted to the EPA for approval, as addenda to the SCQ.

3. Prepare component-specific field work packages (FWPs) according to the approach outlined in Section D.4 of this Work Plan Addendum, utilizing the component-specific sampling approach presented in Section D.9. FWPs must be prepared, reviewed, and approved for each component before sampling of that component can begin. These activities will be the primary responsibility of the Planning Group within the Environmental Section of CRU3. Each FWP will be provided to the U.S. EPA and the Ohio EPA for their information before sampling activities are initiated on the component.

4. Conduct the field program in accordance with the SCQ, established procedures, and the FWPs, including all aspects of monitoring, sampling, and shipment of samples. The Field Investigations Group of the Environmental Section will provide the necessary matrixed support to CRU3 to ensure completion of these tasks.

5. Review and validate data collected during field sampling/field characterization program. This task will be conducted by the Data Management Group of the Environmental Section matrixed to CRU3, on an ongoing basis throughout the data collection and reporting processes. These tasks will be performed in accordance with the approved SCQ data validation procedures. Validated data will be entered into the FEMP RI/FS database.

6. Assess and evaluate the field characterization data to verify attainment of the data quality objectives of the Work Plan Addendum and define additional data needs (those not fulfilled by data collected in the field program). If necessary, additional information needs and/or sampling efforts will be identified, and a

supplemental FWP will be prepared. Various facets of this task will be the responsibility of various groups within the Environmental Section of CRU3, including the Planning Group, the Remedial Investigations Group, and the Data Management Group.

7. As a part of data analysis, evaluate past data to provide guidance to future data gathering. In particular, as outlined in Section D.3, evaluate trends in sampling results from some select, initially sampled components and detail these trending results in an interim submittal to U.S. EPA and Ohio EPA. Responsibility for this task will fall on various groups within the Environmental Section of CRU3.

8. Complete the OU3 RI report and the baseline risk assessment (BRA) report and submit them to U.S. EPA and Ohio EPA for review and approval. Completion of the activities under this task will be the responsibility of the Remedial Investigations Group in the Environmental Section of CRU3. The RI will summarize the results of the field program. The BRA will utilize the RI results and follow the approach outlined in Section 5.6 of the OU3 RI/FS Work Plan Addendum.

9. Perform remedial action alternative screening to develop and submit the initial screening of alternatives (ISA) report to U.S. EPA and Ohio EPA for review and approval. This task is the responsibility of the Feasibility Study Group in the Environmental Section of CRU3.

10. Develop and submit to the U.S. EPA and Ohio EPA, for their review and approval, a treatability study work plan for gathering technical feasibility information for lead alternatives. Upon approval of the work plan, oversee the performance of proposed treatability studies, analyze and interpret the data, and prepare a treatability study report for submission to U.S. EPA and Ohio EPA for their review and approval. Responsibility for treatability studies rests primarily

on the Feasibility Study Group in the Environmental Section of CRU3.

11. Complete and submit the feasibility study and proposed plan (FS/PP) report to U.S. EPA and Ohio EPA for review and approval. This activity is primarily the responsibility of the Feasibility Study Group in the Environmental Section of CRU3.

12. Develop and submit the draft record of decision (ROD) for OU3. Responsibility for this task will probably fall on various groups within the Environmental Section of CRU3.

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APPENDIX A

SUMMARY TABLES

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A.1 Operable Unit 3 Component Identification A-5

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TABLE A.1

OPERABLE UNIT 3 COMPONENT IDENTIFICATION LIST

Table A.1 identifies the manmade structures and facilities on the site that have been assigned a specific component identifier. The component identifier usually consists of a number followed by a letter. The number portion usually identifies a facility or group of related structures. In most cases, the letter "A" refers to the major structure of the facility, with other letter designations referring to support structures for that facility. In other cases, a number has been assigned to a specific functional class of structure or facility (e.g., 16 for electrical support structures and 18 for water processing support).

Certain categories of components have identifiers that consist of a letter followed by a three-digit number. The general category (G-000) refers to structures located throughout the site that are too numerous or too common to identify each separately (e.g., utility lines and storm sewers). The piles category (P-000) refers to specific piles of materials. These materials are construction soil, construction rubble, gravel, sand, rock salt, coal, copper, and miscellaneous scrap metal. The tension support structures (TS-000) are used to cover drum storage on the Plant 1 storage pad and will remain until remedial disposition of the drummed material.

The third column of the table refers to the component grid location. Individual grid maps are provided in Appendix C. The letters "NA" in the third column mean that no grid location is applicable.

TABLE A.1 Operable Unit 3 Component Identification

Component	Component Designation	Category	Grid	Component	Component Designation	Category	Grid
Preparation Plant	1 A	3	27	Electrical Panels & Transformer	16 C	9	7
Plant 1 Storage Shelter	1 B	2	27	Main Electrical Switch House	16 D	4	7
Plant 1 Ore Silos	1 C	5	27	Main Electrical Transformers	16 E	9	7
Ore Refinery Plant	2 A	3	19	Trailer Substation #1	16 F	9	7
General/Refinery Sump Control Building	2 B	4	19	Trailer Substation #2	16 G	9	7
Bulk Lime Handling Building	2 C	4	19	BDN Surge Lagoon	18 A	11	31
Metal Dissolver Building	2 D	3	19	General Sump	18 B	5	19
NFS Storage & Pump House	2 E	5	27	Coal Pile Runoff Basin	18 C	11	11
Cold Side Ore Conveyor	2 F	9	19	Biodenitrification Towers	18 D	3	19
Hot Side Ore Conveyor	2 G	9	19	Storm Water Retention Basin	18 E	11	30
Conveyor Tunnel (From Plant 1)	2 H	10	19	Clearwell Pump House	18 G	3	31
Maintenance Building	3 A	4	19	BDN Effluent Treatment Facility	18 H	3	20
Ozone Building	3 B	4	19	Methanol Tank	18 J	5	31
NAR Control House	3 C	1	19	Low Nitrate Tank	18 K	11	31
NAR Towers	3 D	5	19	High Nitrate Tank	18 L	11	31
Hot Raffinate Building	3 E	3	19	High Nitrate Storage Tank	18 M	5	31
Harshaw Digestion Fume Recovery	3 F	5	19	Main Tank Farm	19 A	5	11
Refrigeration Building	3 G	4	19	Pilot Plant Ammonia Tank Farm	19 B	5	26
Refinery Sump	3 H	5	19	Tank Farm Control House	19 C	4	11
Combined Raffinate Tanks	3 J	5	19	Old North Tank Farm	19 D	5	11
Old Cooling Water Tower	3 K	10	19	Pump Station & Power Center	20 A	4	11
Electrical Power Center Building	3 L	4	19	Water Plant	20 B	4	10
Green Salt Plant	4 A	3	13	Cooling Towers	20 C	9	11
Plant 4 Warehouse	4 B	2	13	Elevated Potable Storage Tank	20 D	5	4
Plant 4 Maintenance Building	4 C	4	13	Well House #1	20 E	4	25
Metals Production Plant	5 A	3	12	Well House #2	20 F	4	25
Plant 5 Ingot Pickling	5 B	4	12	Well House #3	20 G	4	26
Plant 5 Electrical Substation	5 C	4	12	Process Water Storage Tank	20 H	5	10
West Derby Breakout/ Slag Milling	5 D	4	12	Gas Meter Building	22 A	4	6
Plant 5 Filter Building	5 E	2	12	Storm Sewer Lift Station	22 B	4	14
Plant 5 Covered Storage Pad	5 F	2	12	Truck Scale	22 C	4	4
Plant 5 Ingot Storage Shelter	5 G	2	12	Scale House & Weigh Scale	22 D	4	25
Metals Fabrication Plant	6 A	3	6	Utility Trench to Pit Area	22 E	10	25/31
Plant 6 Covered Storage Area	6 B	2	6	Meteorological Tower	23	9	30
Plant 6 Electrostatic Precipitator (South)	6 C	3	6	Railroad Scale House	24 A	4	16
Plant 6 Electrostatic Precipitator (Central	6 D	9	6	Railroad Engine House	24 B	4	11
Plant 6 Electrostatic Precipitator (North)	6 E	3	6	Chlorination Building	25 A	4	32
Plant 6 Salt Oil Heat Treat Building	6 F	3	6	M.H.#175/Eff. Line/Sampling Bldg.	25 B	4	32
Plant 6 Sump Building	6 G	3	6	Sewage Lift Station Building	25 C	4	7
Plant 7	7 A	2	13	U.V. Disinfection Building	25 D	4	32
Plant 7 Overhead Crane	7 B	9	13	Digester & Control Building	25 E	4	32
Recovery Plant	8 A	3	20	Sludge Drying Beds	25 F	11	32
Plant 8 Maintenance Building	8 B	4	20	Primary Settling Basins	25 G	11	32
Rotary Kiln/Drum Reconditioning	8 C	3	20	Trickling Filters	25 H	5	32
Plant 8 Railroad Filter Building	8 D	4	20	Pump House–HP Fire Protection	26 A	4	25
Drum Conveyor Shelter	8 E	9	20	Elevated Water Storage Tank	26 B	5	25
Plant 8 Old Drum Washer	8 F	9	20	Main Electrical Strainer House	26 C	4	7
Special Products Plant	9 A	3	3	Security Building	28 A	1	14
Plant 9 Sump Treatment Facility	9 B	3	3	Human Resources Building	28 B	1	14
Plant 9 Dust Collector	9 C	9	3	Guard Post on South End of 'D' St.	28 C	1	7
Plant 9 Substation	9 D	4	3	Guard Post on West End of 2nd St.	28 D	4	24
Plant 9 Cylinder Shed	9 E	4	3	Chemical Warehouse	30 A	2	18
Electrostatic Precipitator	9 F	3	3	Drum Storage Warehouse	30 B	2	27
Boiler Plant	10 A	4	10	Old Ten Ton Scale	30 C	8	18
Boiler Plant Maintenance Bldg.	10 B	4	10	Engine House/Garage	31 A	3	7
Wet Salt Storage Bin	10 C	4	10	Old Truck Scale	31 B	8	7
Cont. Oil/Graphite Burn Pad	10 D	8	10	Magnesium Storage Building	32 A	2	2
Service Building	11	1	14	Building 32 Covered Loading Dock	32 B	2	2
Main Maintenance Building	12 A	4	11	Pilot Plant Annex	37	3	26
Cylinder Storage Building	12 B	2	11	Propane Storage	38 A	4	10
Lumber Storage Building	12 C	2	11	Cylinder Filling Station	38 B	9	10
Pilot Plant Wet Side	13 A	3	26	Incinerator Building	39 A	3	19
Pilot Plant Maintenance Bldg.	13 B	4	26	Waste Oil Decant Shelter	39 B	3	19
Sump Pump House	13 C	3	26	Incinerator Sprinkler Riser House	39 C	4	19
Pilot Plant Thorium Tank Farm	13 D	5	26	Sewage Treatment Plant Incinerator	39 D	9	32
Administration Building	14 A	1	14	Rust Engineering Building	45 A	1	25
Building 14 EOC Generator Set	14 B	9	14	Utility Shed East of Rust Trailers	45 B	4	25
Laboratory	15	3	21	Heavy Equipment Building	46	4	7
Main Electrical Station	16 A	9	7	Six to Four Reduction Facility #2	51	4	26
Electrical Substation	16 B	4	14	Health & Safety Building	53 A	1	14

TABLE A.1 Operable Unit 3 Component Identification

Component	Component Designation	Category	Grid	Component	Component Designation	Category	Grid
In-Vivo Building	53 B	1	14	Decontamination Pad	74 P	8	1
Six to Four Reduction Facility #1	54 A	3	26	Plant 8 Old Metal Dissolver Pad	74 Q	8	20
Pilot Plant Shelter	54 B	2	26	Plant 8 North Pad	74 R	8	20
Pilot Plant Dissociator Shelter	54 C	4	26	Building 63 West Pad	74 S	8	9
Slag Recycling Building	55 A	3	12	Plant 1 Storage Pad	74 T	8	27
Slag Recycling Pit/Elevator	55 B	3	12	Pilot Plant Pad	74 U	8	26
CP Storage Warehouse	56 A	2	17	Laboratory Pad	74 V	8	21
Storage Shed (West)	56 B	2	17	Building 39A Pad	74 W	8	19
Storage Shed (East)	56 C	2	17	Finished Products Warehouse(4A)	77	2	3
Quonset Hut #1	60	2	16	D & D Building(Under Constr.)	78	4	2
Quonset Hut #2	61	2	16	Plant 6 Warehouse	79	2	4
Quonset Hut #3	62	2	16	Plant 8 Warehouse	80	2	20
KC-2 Warehouse	63	2	9	Plant 9 Warehouse	81	2	3
Thorium Warehouse	64	2	2	Receiving/Incoming Mat'ls. Insp.	82	4	4
(Old) Plant 5 Warehouse	65	2	2	Clearwell Line	88	10	31
Drum Reconditioning Building	66	3	27	Parking Lot	89	8	15,8
Plant 1 Thorium Warehouse	67	2	24	Skeet Range Building	90	1	8
Pilot Plant Warehouse	68	2	26	Railroad Tracks	G-001	8	NA
Decontamination Building	69	3	1	Roads	G-002	8	NA
General In-Process Warehouse	71	2	27	Storm Sewer System	G-003	10	NA
Drum Storage Building	72	2	27	Utility Lines	G-004	10	NA
Fire Brigade Training Center Bldg.	73 A	1	33	Underground Storage Tanks	G-005	6	NA
Fire Training Pond	73 B	11	33	Process Trailers	G-006	1	NA
Fire Training Tank	73 C	5	33	Non-process Trailers	G-007	1	NA
Fire Training Burn Trough	73 D	6	33	Pipe Bridges	G-008	9	NA
Confined Space Burn Tank	73 E	5	33	Drums (Non-RCRA)	G-009	5	NA
Plant 2 East Pad	74 A	8	19	RCRA Drums	G-010	5	NA
Plant 2 West Pad	74 B	8	19	Inventory	G-011	5	NA
Plant 8 East Pad	74 C	8	20	Mobile Containers (Sea-Land)	G-012	5	NA
Plant 8 West Pad	74 D	8	20	Soil Piles	G-013	7	NA
Plant 4 Pad	74 E	8	13	Rock salt pile	P-001	7	16
Plant 7 Pad	74 F	8	13	Sand piles	P-002	7	16
Plant 5 East Pad	74 G	8	12	Gravel pile	P-003	7	17
Plant 5 South Pad	74 H	8	12	Copper metal scrap pile	P-004	7	17
Plant 6 Pads	74 J	8	6	Coal pile	P-005	7	10
Plant 9 Pad	74 K	8	3	Scrap metal pile	P-006	7	1
Building 65 West Pad	74 L	8	2	Outside Equipment Storage Area	P-007	7	9
Building 64 East Pad & R.R. Dock	74 M	8	2	Tension Support Structure #1	TS-001	2	17
Building 12 North Pad	74 N	8	11	Tension Support Structure #2	TS-002	2	17
				Tension Support Structure #3	TS-003	2	17

TABLE A.2.0

DESCRIPTION OF TYPES OF BUILDING CONSTRUCTION IN OU3

Table A.2.0 describes the predominant types of construction used in buildings on the site. These descriptions are referenced, by type, in Table A.2.1 to allow concise descriptions of structures.

TABLE A.2.0 Description of Types of Building Construction in OU3

Construction Type	Description
Type A	Consists of structural steel frame on reinforced poured concrete base, reinforced poured concrete ground floor, transite (concrete panels reinforced with asbestos fiber) siding panels with insulation sandwiched between inner and outer panels, transite interior walls, transite roof panels, lead bolt covers and sill moldings, glass windows, some with basement sections, most with sloped roof. Approximation of a typical volumetric content of concrete, steel, and transite is not practical, since each facility varies greatly in volume-to-perimeter ratio.
Type B	Consists of cement block construction on reinforced poured concrete footers, with reinforced poured concrete floors, glass windows, and flat reinforced poured concrete roofs. Typically these structures are volumetrically composed of approximately 50% cinder block and 50% concrete. Larger structures also employ reinforced concrete columns and/or steel frames. Reinforced poured concrete second floors may be present in some structures.
Type C	A pre-engineered facility consisting of structural steel frame on reinforced poured concrete base, reinforced poured concrete ground floor, sloped steel roof panels, steel siding panels (some with insulation sandwiched between inner and outer panels), and glass windows. Typically these structures are volumetrically composed of approximately 40% steel and 60% concrete.
Type D	Consists of wood framed construction, wood siding and sloped roofing, and glass windows.

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TABLE A.2.1

DESCRIPTION OF STRUCTURES AND PROCESSES

Table A.2.1 discusses in some detail the size of the components (structures and facilities) and types of construction materials used, the processes and uses within the component, and the equipment contained in the component. The equipment and contents column does not detail all equipment contained in the components. Associated minor and support equipment and utilities generally are not included in this compilation. Only large or unusual equipment is highlighted in this table. An area or equipment that has been declared a hazardous waste management unit (HWMU) by the FEMP RCRA program has been highlighted, with italic type.

The following notes pertain to Table A.2.1:

a = Associated minor and support equipment and utilities are not detailed in this compilation.

b = Unit declared a RCRA Hazardous Waste Management Unit (HWMU).

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Preparation Plant (Plant 1) (1A)	Building type A, 82- x 202-ft multilevel building with 4 levels, 50 ft high, and 2 enclosed drum conveyors to the third floor. Irregular shape.	**Drum Sampling** - Obtain representative samples of incoming ore concentrates, in-process material, and residues for reclamation or discard.	-Original equipment replaced by new.
		Crushing/Milling - Crushing, milling, grinding, and classification of feed materials for FMPC processing at up to 9.1 metric tons per hour in a variety of milling/grinding machines. Drum conveyors brought ores and ore concentrates to the mill. A thaw tunnel heated ore concentrates prior to milling.	-Jaw crushers, ring roller mills (Williams Titan and Zenith), conveyors, thaw tunnel.
		Enriched Materials Reclamation - Safe storage (rabbit hutches), milling (pin cutter and small Fitzpatrick mill), and digestion of higher enriched materials (up to 16% U-235 in safe geometry and higher in the lab digestion system) for use as isotopic sweetener (replenishing U-235 lost in the reactor cycle). Unirradiated Loft fuel rods, Hallum fuel, various university receipts, and a large variety of materials were reclaimed using the processing options in the facility.	-Hammer mill (Fitzpatrick), pin cutter (Thorr Mill), safe geometry digestion system, and *sump*,[b] lab digestion.
		Drum Washing - Used to clean ore concentrate drums for reuse.	-Drum washers.
		Solvent Reclamation - Used to distill used dry-cleaning solvents to purify for reuse.	-*Detrex solvent still*.[b]
		Waste Water Handling - Waste waters were collected and particulates were removed prior to transfer to the general sump.	-Filters, storage tanks.
		Repackaging - Leaking drums found on the storage pad were moved to building 1A, where they were dumped into new drums and/or overpacked for secondary containment. Paducah ash was also repackaged.	-Only a barrel-turning truck involved.
Plant 1 Storage Shelter (1B)	A 90-x 142-ft steel structure with steel roof and no sides, 18 ft high, covering storage pad, north of building 1A.	**Covered Storage** - Drums were stored and staged for Plant 1 processes.	-Drum storage.
		Copper Shredding - Separated copper from insulation materials and shredded for dense storage.	-Shredder/classifier.
		Drum Straightening - Re-rolled 30- and 55- gal drums for reuse.	-30- & 55-gal drum expanders and re-rollers (removed).

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Plant 1 Ore Silos (1C)	A 54- x 115-ft multilevel open steel structure, 80 ft high with 4 floors and 6 concrete and 8 tile silos.	**Milled Ore Storage** - Intended to store milled ores for transfer to Plant 2 processes. Transfer would occur under 2nd Street via subgrade conveyor (2H). The silos stored dried raffinate from the spray calciner process in facility 3J for a short period.	-14 ore storage vessels and support structure.
Ore Refinery Plant (2A)	Building type A, 62- x 382-ft multilevel building, 50 ft high with 5 floors.	**Digestion** - Prepared ores and uranium-bearing residues were dissolved in nitric acid for purification processing in the extraction area. **Drum Digestion** - Drum digesters were used for dissolution of higher enriched residues ($\leq 5\%$ U^{235}) for use as sweetener (isotopic adjustment). **Extraction** - Purification of digested liquors by liquid-liquid countercurrent solvent extraction in perforated plate pulse columns. Raffinate (waste) was sent through a mixer-settler system to reduce uranium content prior to transfer to the hot raffinate building (3E). Solvent was recovered by treatment with nitric acid and soda ash, then centrifuged.	-Digester *and uranyl nitrate storage tanks,*[b] dust collection equipment, and fume scrubbers. -Portable stainless steel drums used for digestion, filter, and scrubber. -Extraction columns, tanks (inside), pulse generators, deionized water generators, and centrifuges.
		Denitration - Concentration of uranyl nitrate (UNH) liquor from extraction columns by evaporation and boildown; denitration of the concentrated liquor in gas-fired pots and pneumatically conveying, milling, and packaging the UO_3 product. Thorium nitrate was also denitrated in 1968.	-Denitration pot, evaporator, hammer mills, dust collection equipment, and related tanks.
		Enriched Calcining - Safe geometry rotary calciner in which up to 10% enriched UNH solution was calcined to produce black oxide (U_3O_8) for use as sweetener.	-Electrically heated rotary calciner, related tanks, and pumps.
General Sump/ Refinery Sump Control Building and Annex (2B)	Building type A/C, 39- x 43-ft multilevel building, 20 ft high with a 20- x 20-ft annex.	**Sump Control** - MgO is slurried in water and transferred to the refinery sump operation to be used for precipitation of uranium compounds from the waste waters. Barium oxide was used for precipitation also.	-MgO slurry tank, control panels.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Bulk Lime Handling Building (2C)	Building type A, 17- x 28-ft single-level building, 10 ft high and an 18-ft diameter steel silo, 50 ft tall.	**Bulk Lime Handling** - Bulk quantities of lime (CaO) were unloaded from railroad cars into an overhead storage silo. Lime was then conveyed to a rectangular steel tank and slaked into water (dissolved to $Ca(OH)_2$) for treatment of refinery effluents requiring uranium removal.	-Storage hopper, conveyor, slurry tank, and unloading station.
Metal Dissolver Building (2D)	Building type A, 39- x 50-ft multilevel building, 20 ft high with 2 floors.	**Metal Dissolution** - Dissolution of uranium metal with nitric acid in a temperature-controlled stainless steel tank to provide recycle feed for the extraction process. Also digested baled drums as required.	-Digester tank, heat exchanger.
		West Metal Dissolution - Dissolution of higher grade uranium-bearing residues (oxides typically) in nitric acid for extraction feed.	-Digester tank, drum dumper.
		Charcoal Treatment - Reclamation of dirty extraction "solvent" by treatment with charcoal and subsequent filtration. The process removed particulates and miscellaneous organics collected in the process.	-Rotary vacuum filter, tanks, drum dumper, and filter precoat tank.
NFS Storage Tanks and Pump House (2E)	Building type B, 14- x 16-ft single-level block pump house, 9 ft high and 51- x 61-ft concrete diked area with 4 tanks.	**NFS Storage** - UNH received from other DOE sites by tank truck were stored in 4 horizontal tanks. Receipts were from NFS, Inc., the Hanford reservation, and the Savannah River Plant. The UNH went to the enriched calciner.	-4 temperature-controlled *uranyl nitrate storage tanks.*[b]

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Tanks Outside Plant 2A (no number)	Seven concrete diked storage areas with storage tanks, north and south of building 2A.	***Uranyl Nitrate Storage***[b] - 4 stainless steel tanks (25,000 gal each), in a diked area (NW) north of the digestion area stored uranyl nitrate. 2 stainless steel tanks in the same diked area (NW) stored tank leakage and water from the dike and sumps.	-6 stainless steel tanks.
		TBP/Kerosene Storage - 2 diked areas (NNW & NNE) north of the extraction area stored TBP/kerosene mix from extraction and slops to be cleaned. 5 stainless steel tanks are employed.	-5 stainless steel tanks.
		Clean Storage - 3 stainless steel tanks, TBP, kerosene, and cleaned TBP/kerosene mix are housed in the diked area (NE) north of the denitration area.	-3 stainless steel tanks.
		Bulk Unloading - Bulk quantities of TBP, kerosene, and nitric acid were unloaded at this station north of the denitration area.	-Sloped pad.
		Uranyl Nitrate Storage[b] - 4 stainless steel tanks in a diked area southeast of the denitration area stored uranyl nitrate ahead of evaporation and denitration.	-4 stainless steel tanks.
		Nitric Acid Storage - 3 stainless steel tanks in a diked area south of the digestion area stored nitric acid for use in digestion.	-3 stainless steel tanks.
		Sulfuric Acid Storage - A tank in a diked area south of the extraction area stored sulfuric acid for regeneration of refinery deionizers.	-1 Tank.
Plant 2 Cold Side Ore Conveyor (2F)	Conveyor shed, dumper building, bucket elevator, and subgrade concrete elevator pit.	**Cold Side Elevator Pit** - Ores or residues were dumped to the bucket elevator system in a 20-ft deep concrete elevator pit for south side digestors.	-2 bucket elevators, 2 drum conveyors, 2 drum dumpers, 2 screw conveyors, conveyor shed, and drum dumper building
Plant 2 Hot Side Ore Conveyor (2G)	Conveyor shed, dumper building, bucket elevators, and subgrade concrete elevator pit.	**Hot Side Elevator Pit** - Ores or residues were dumped to the bucket elevator system in a 20-ft deep concrete elevator pit for north side digestors. The system was initially designed to handle ores (and the associated radioactivity from radium content).	-Bucket elevator, drum conveyor, drum dumper, screw conveyor, conveyor shed, and drum dumper building.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Conveyor from Plant 1 Ore Silos (2H)	Subgrade conveyor system in a 15- x 190-ft concrete trench.	**Ore Conveying** - This unit was intended to transport ores to the hot side elevator of the refinery for processing as feed for digestion.	-Conveyor (unverified).
Maintenance Building (3A)	Building type A, 60- x 60-ft single-level building, 14 ft high.	**Maintenance and Spare Parts Storage** - Store equipment and tools for maintenance of equipment in Plants 2 and 3. Store miscellaneous spare parts. Perform maintenance of some equipment in Plants 2 and 3.	-Spare parts, miscellaneous tools and equipment, and offices.
Ozone Building (3B)	Building type A, 27- x 33-ft multilevel building, 14 ft high.	**Acid Bleaching** - Ozone was created for "bleaching" nitric acid from the nitric acid recovery process (NAR) in facility 3D.	-Office equipment, 2 refrigerators (original equipment removed).
NAR Control House (3C)	Building type A, 26- x 110-ft single-level building, 14 ft high.	**NAR Control** - Electrical control panels for the nitric acid recovery system are housed in this building, in addition to a small conference room, offices, and a restroom.	-Electrical control panel, offices.
NAR Towers and Tanks (3D)[b]	Approximately 46- x 60-ft multi-level open area steel support structure, 60 ft high with 4 floors in a 70- x 108-ft diked area.	**Nitric Acid Recovery** - The system consists of 2 absorber towers in which nitrogen oxide (NO_x) fumes were drawn through a series of bubble caps. NO_x fumes were collected from the Plant 2 metal dissolver, digestion, extraction, and denitration (fumes passing through the pot scrubbers) processes. Nitric acid was produced for reuse in Plant 2 processes.	-2 Absorber towers, storage tanks, concentrator, surge storage tanks, and blowers.

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Hot Raffinate Building (3E)	Building type A, 52- x 91-ft multilevel building, 60 ft high with 3 floors and heavy concrete shielding.	**Hot Raffinate** - Received and filtered raffinate slurry and slag leach (nitric acid washed magnesium fluoride solids from building 2A) slurry through rotary vacuum filters. The filter cake was slurried with water and conveyed to the K-65 silos or waste pits, depending upon the nature of the material and whether it was within economic discard specifications. The filter was drummed and dried in Plant 8 after the waste pits closed. Filtrates were returned to refinery processes. The building was specially designed to handle higher radiation materials.	-2 Rotary drum filters, *3 receiver tanks (uranyl nitrate* raffinate, refinery thickener slurry),[b] 2 reslurry tanks, 2 filtrate tanks, and support tanks.
Harshaw Digestion Fume Recovery (3F)	A 19- x 40-ft multilevel open steel structure, 35 ft high.	**Harshaw Fume Recovery** - The Harshaw system was installed to relieve the fume load of the NAR in facility 3D. Nitrogen oxide fumes from the metal dissolver and digestion were collected to produce nitric acid.	-Absorber towers, tanks.
Refrigeration Building (3G)	Building type A, 16- x 44-ft single-level building, 11 ft high.	**Refrigeration** - Provided cooling for the Harshaw NO_x fume scrubber system in facility 3F.	-Original equipment removed. Currently used as file storage and for small instrument repairs. To be used for storage of returned chain-of-custody samples.
Refinery Sump (3H)	Diked acid brick tank area, approximately 55- x 100-ft, adjoining the general sump.	**Refinery Sump** - Treated Plant 2/3 effluents with MgO (magnesium oxide) to precipitate uranium. MgO is slurried with water in building 2B for use in the process. Treated refinery sump effluents are transferred to the adjacent general sump. Recovered U as cake slurry was recycled through the digestion area of the refinery.	-2 Sump receiving tanks, precipitator tanks, effluent tanks, thickener tank, and 3 filters.
Combined Raffinate Tanks (3J)	A 39- x 169-ft multilevel open area structure on a controlled concrete pad, 20 ft high.	**Combined Raffinate** - Received and concentrated (by evaporation) raffinates and slag leach filtrates for reprocessing in the refinery. Spent Zirnlo acid was transferred to the digestion area of the refinery.	-Evaporator with tube-type heat exchanger and 17 tanks.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Old Cooling Water Tower (3K)	Remaining grade and below-grade structure, approximately 30 x 50 ft.	**Process Water Cooling** - A wooden cooling tower provided process water cooling for the Harshaw System (3F) and the nitric acid concentrator.	-Original equipment removed. Concrete basin and diked pad remain.
Electrical Substation North of 3A (3L)	Building type A, 24- x 91-ft single-level building, 10 ft high.	**Electrical Distribution** - Receives 13,200-volt feeds from the main electrical station. Feeds 480-volt lines to the plant.	-Transformers, disconnects.
Green Salt Plant (4A)	Building type A, 146- x 194-ft multilevel building with 5 floors, 71 ft high.	**Ammonia Dissociation** - Catalytically cracked anhydrous ammonia to H_2 and N_2 (dissociated ammonia - DA) for use in the hydrofluorination process.	-Catalytic ammonia dissociator reactors.
		Hydrofluorination - UO_3, produced at the FMPC; Port Hope, Canada; Mallenerodt Chemical Works at Weldon Spring, Mo.; and the DOE Hanford works (UO_3 first converted to U_3O_8), was reduced to UO_2 with DA in heated fluid bed reactors and passed countercurrent to anhydrous hydrofluoric acid (AHF) in 3-stage heated horizontal continuous-flow reactor banks to produce UF_4 product.	-Fluid-bed reactors, horizontal ribbon-screw reactors, dust collection equipment, blending equipment, excess H_2 burner.
		AHF Vaporization - AHF provided from the main tank farm is vaporized for use in the hydrofluorination process.	-Vaporizers, superheaters.
		Hydrofluoric Acid Recovery - Excess HF from the hydrofluorination process is filtered and scrubbed for recovery. Aqueous HF is transferred to the main tank farm.	-Filters, condensers, scrubbers.
		UF_4 Repackaging - UF_4 received from the DOE Paducah facility and FMPC operations are blended and repackaged for quality control.	-Material handling equipment, blending equipment, dust collector.
		Moving Bed Experimental Reactor - (1955-1958) Vertical reactor for hydrofluorination.	-Reactor in place minus related equipment.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Green Salt Plant (4A) (Cont.)		**Nitrogen Generation** - Produced and stored nitrogen gas for purging operations in Plant 4.	-Original nitrogen generator system replaced with new.
		HF Refrigeration - Used to reclaim HF fumes as anhydrous from Plant 4 and Plant 7 operations.	-Equipment removed.
		Thorium Tetrafluoride - (1954) Thorium oxide from Plant 9 was hydrofluorinated in bank 7 and returned to Plant 9.	-Existing reactor bank 7 equipment.
		Water Treatment - Originally, one of two steel tanks received floor sump liquids, was lime neutralized, and filtered to the second tank, which pumped to the general sump. Filter cake was drummed and sent for sampling. In more recent years, no processing was done. Collected liquids were transferred to the general sump or Plant 8 directly.	-Steel tank (one removed), plate & frame filter.
		Storage - Drummed materials and hoppers (UF_4, UO_3, *HF residues*,[b] etc.) have been stored at various times in many areas of the plant.	-Currently storing drums.
Plant 4 Warehouse (4B)	Building type C, 60- x 202-ft single-level warehouse, 13 ft high.	**UF_4 Storage** - Covered storage for UF_4 resulting from Plant 4 and pilot plant UF_6 to UF_4 operations.	-UF_4 stored in drums.
Plant 4 Maintenance Building (4C)	Building type A, 60- x 60-ft single-level building, 14 ft high.	**Maintenance** - Maintain equipment from the chemical areas, primarily Plant 4. Used for storage of UF_4 and empty drums before conversion to maintenance in mid-1980's.	-Tools, equipment, spare parts, offices.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Metals Production Plant (5A)	Building type A, 100- x 560-ft multilevel building, 34 ft high, with 2 floors in the primary areas of the building. Irregular shape.	**South Staging & Storage** - Stored raw materials (UF_4 magnesium and magnesium fluoride) and spare equipment for the Plant 5 reduction process.	-Storage for magnesium metal, MgF_2 (in 2 of 4 bins), UF_4, and spare equipment for the process.
		Reduction - Reduction pots were lined with a refractory-like by-product of magnesium fluoride in jolters fed from the MgF_2 mill (55A). UF_4 and magnesium metal were blended and charged into the pots (F machines). After being capped with MgF_2, the charge was lidded and furnaced in resistance element furnaces to initiate the exothermic reduction to uranium metal and magnesium fluoride. The charge was subsequently cooled in air and then water and then "broken out" (breakout booth) to separate the uranium metal "derby" from the magnesium fluoride. The magnesium fluoride was screened and sized for transfer to the Plant 55 milling circuit for recycle or to the Plant 1 mill.	-11 slag liner (Herman) jolters, 4 charge blenders in 4 F machines, 49 Rockwell (resistance) furnaces, 2 air cooling wells, 2 water cooling wells, 2 breakout systems, dust collection equipment. Currently storing drums.
		Casting (Remelt) - For 4A campaign, the crucibles were coated with refractory material; the crucibles were not coated for Hanford or Savannah River campaigns. Uranium derbies, scrap, and recycle metal were charged in graphite crucibles, then conveyed to vacuum induction furnaces for melting, offgasing, and pouring to coated graphite molds. Cast shapes were removed from molds. Uranium ingots were sent to cropping. Residual uranium was flame oxidized from crucibles. Molds were cleaned and recoated. Two of the west remelt furnaces were used in 1981 for a copper ingot casting campaign.	-2 casting furnace lines, 2 breakout booths, mold painting area, vacuum oil recovery units,dust collection equipment. Currently storing drums.
		Ingot Cropping - Cast uranium ingots were top cropped and sawn to size.	-Two 3-ft diameter cold saws.
		Saw Sharpening - Saw blades were sharpened, retoothed, and maintained.	-Spare saws, saw repair equipment.
		Mold Preparation and Reconditioning - After molds and ingots were separated, molds entered the mold cleaning booth, where they were rotated, scraped clean, recoated with terrapaint (zirconia silicate), and dried for reuse. Crucibles for flat ingots were plasma sprayed at the pilot plant instead.	-Mold cleaning booths, dust collectors.

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Metals Production Plant (5A) (Cont.)		***Hilco Oil Reclaimer***[b] - Dirty oil from the remelt furnace vacuum pumps was collected in a tank and processed for recovery (heated and filtered). Processed oil was sent to a cleaned oil tank for reuse.	-2 tanks, 2 vacuum pumps, 2 earth filters, 2 heat exchangers, 2 heaters.
		North Staging & Storage - Stored graphite for machining and staged molds, crucibles and metal for casting process.	-Storage for graphite and staging for metal for casting.
		Graphite Machining - Graphite blanks for crucibles, molds, and pour plugs were machined to specifications.	-Lathes, drill presses, and variety of machines, dust collection equipment.
		Water Treatment - All floor sumps were pumped to a 6000-gal stainless steel tank which pumped through a plate and frame filter to the general sump. Beginning in 1983, the collected material was pumped to Plant 6 for treatment.	-Tank, filter press, pump
		Plasma Spraying - Similar to the unit utilized in the Pilot Plant annex (37).	-Crucible cleaning equipment, spray unit.
		Maintenance - Maintained Plant 5 equipment.	-Tools, equipment, spare parts.
Plant 5 West Side Separation and Pickling (5B)	Building type C, 28- x 62-ft multilevel building, 15 ft high with 2 floors (partial basement), west of and adjoining building 5A.	**Ingot Separation and Pickling** - (New) Ingots cast in Plant 5 were to be transferred here for separation, mold cleaning, and ingot pickling. The facility was never used.	-New unused equipment - Ingot pickling tanks, nitric acid tank, wash water tank, ingot conveyor, scrubber, ingot robot, mold separation/cleaning booth.
Plant 5 Electrical Substation (5C)	Building type C, 16- x 30-ft single-level building, 30 ft high.	**Electrical Distribution** - Receives 13,200-volt feeds from the main electrical station. Feeds 480-volt lines to the plant.	-Transformers, disconnects.
Plant 5 West Side Slag Milling & Derby Breakout (5D)	Building type C, 41- x 160-ft multilevel building, 50 ft high, west of and adjoining 5A.	**Slag Milling** - (New) Similar to existing facility (55A) on the east side of building 5A, intended to provide milling, storage, and distribution of magnesium fluoride slag for pot liner, and drumming of wastes. New system, never started up.	-New unused equipment - bins, conveyors, screens, ball mill, bucket elevators, dust collector.
		Derby Breakout - (New) Replaced west side derby breakout originally housed within building 5A. Received cooled reduction pots, separated the metal (derby) from the liner and slag components. Magnesium fluoride was conveyed to the west side slag milling. New system, never started up.	-New unused equipment - pot conveyors, jolter, grizzly conveyor, screen, crusher, dust collector.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Plant 5 Filter Building (5E)	Building type C, 54- x 70-ft single-level building, 22 ft high.	**Storage** - Originally constructed to house dust collection equipment expected in the renovation of Plant 5, however production was halted and no dust collector installed.	-Miscellaneous storage, excess equipment, new stores, etc.
Plant 5 Covered Storage (5F)	Steel structure with roof and no sides, 85 x 142 ft, covering a storage pad north of Plant 5.	**Storage** - Originally an uncovered storage area. Pad and cover recently constructed. Originally stored all types of uranium metal (scrap for remelt, derbies, ingots, graphite, etc.) for use in Plant 5. West half currently unused, east half storing drums of residues, metal, dicalite, empty drums, and excess equipment.	-Currently storing drums.
Plant 5 Ingot Storage Shelter (5G)	Steel structure with roof and no sides, 30 x 62 ft, covering a storage pad east of Plant 5.	**Metal Storage** - Used for temporary storage of Plant 5 metal products (ingots and derbies), feed stock (scrap and briquettes), and excess materials.	-Currently storing derbies, briquettes, and other uranium metal.
Metals Fabrication Plant (6A)	Building type A, 200- x 520-ft single-level building, 31 ft high with a partial basement 20 ft below grade level. Irregular shape.	**Rolling Mill** - Uranium billets were conveyed to a preheat ingot furnace (75/25 blend of potassium carbonate and lithium carbonate), through the blooming mill (to reduce the ingot to size), the crop shears (to cut off the ends), the finishing mill (to roll to final size), placed in an equalizer furnace (to anneal the metal), and passed through the stamper-straightener, on to the rollout/cooling table, weighed, bundled, and sent for machining.	-Billet conveyor, ingot furnace, blooming mill, finishing mill, crop shears, equalizer furnace, stamper-straightener, rollout/cooling table, overhead crane, control booths.
		Core Machining - Uranium tubes extruded at RMI were returned to the FMPC to be finished. The rods were cut to length in either the Griddly or B&O lathe and then heat treated. The cores produced were milled to exact tolerances in the Cross transfermatic machine and sent for inspection.	-2 Bardon & Oliver lathes, 3 Acme-Griddly machines, Warner-Swasey machine.
		Miscellaneous Machining - Flat ingots were surface-machined, and miscellaneous odd jobs were performed on the Plant 6 machines.	-Surface machine.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Metals Fabrication Plant (6A) (Cont.)		**Coolant Clarifiers** - Coolant oil from the Griddly, B&O, and Cross machines went through clarifiers, where the insoluble oil layer was removed from the top via rake. Clear liquid was returned for reuse.	-3 clarifiers with rakes, 3 pumps.
		Chip Briquetting - Machining chips, turnings and sawdust from the operations in this plant and from Plants 5 & 9 were collected, washed, pickled (in nitric acid), and crushed to form dense metal briquettes for remelt casting feed.	-Chip conveyors, crusher/screen, process carousel, hydraulic press, briquette conveyor.
		Scrap Metal Pickling - A nitric acid bath was used to remove surface oxidation from metal intended as feed for casting.	-Nitric acid dip tank, 2 rinse tanks.
		Slug Pickling - Uranium slugs (cores) were loaded into baskets, placed on a roller conveyor, dipped into a nitric acid tank, followed by several water rinses, and a heater/dryer.	-4 tanks, compartmented tank, conveyors, vent system.
		Tocco Furnaces/Oil Quench - (1969-1971) These refractory-lined induction furnaces for beta heat treating replaced the earlier Amsler-Morton furnace (salt-water heat treating). The oil tank was integral with the unit. A 50/50 blend of sodium chloride and potassium chloride was utilized.	-3 furnaces.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Metals Fabrication Plant (6A) (Cont.)		**Salt-Water (Nu-Sal) Heat Treating** - Refractory-lined beta heat treating unit to break up large grain structures in uranium billets. Used a 50/50 blend of sodium chloride and potassium chloride salts. Parts were quenched in an adjacent water bath.	-Furnace, quench tank.
		Salt-Oil Heat Treating - See building 6F below.	-See building 6F below.
		NO_x Destructor - Sodium sulfide solution at high pH (NaOH) was used to scrub and neutralize NO_x fumes generated from the scrap metal pickling operation in two packed bed scrubber towers.	-2 Scrubber tanks, feed tanks.
		Inspection - The uranium metal products of the FMPC were inspected prior to packaging and shipping.	-2 ultrasonic testers, derby scale, ingot scale, bander, overpacks.
		Storage - Remaining machining equipment in the plant was moved to allow use of the bulk of the floor space for drum storage.	-Currently storing drums.
		Robot - A five-axis industrial robot was demonstrated for core handling at one of the B&O lathes.	-Robot, control panel.
		Perched Water - The clarifier pit in the scrap pickling area has been used to collect contaminated foundation waters, and along with perched water from wells, pumped from Plant 6 to Plant 8 for treatment to recover uranium and remove organics. (A removal action)	-Pit, wells, piping.
		Water Treatment - Process waters from the plant were acidified to allow separation of the machining oil phase from the water phase. Oils were routed to a clarifier for reuse. The aqueous phase was neutralized with NaOH to precipitate uranium. The resulting sludge was filtered and drummed after analysis. Filtrate was sent to the general sump.	-3 tanks, filter press.
		Tool Fabrication Room - Machine tool elements for Plant 6 and Plant 9 machining operations were fabricated on the vast variety of equipment employed in the tool room.	-Lathes, grinding equipment, miscellaneous milling equipment, and dust collection system.
		Bronze/Tin Heat Treating - An early heat treating/quench process used in conjunction with the rolling mill.	-Furnace, quench tank.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Plant 6 Covered Storage Area (6B)	Steel structure with roof and no sides, 42 x 60 ft, covering a concrete pad.	**Storage** - Stored uranium chips, turnings, briquettes, and residues for processing in Plant 6 or shipment to Plant 8.	-Currently storing excess equipment.
Plant 6 Electrostatic Precipitator South (6C)	Building type C, 16- x 30-ft single-level building, 14 ft high and HEPA filter.	**Precipitron** - Electrostatic precipitator for exhausts vented from machining equipment. Electrostatic elements were typically not powered, since exhausts contained moisture.	-Precipitator, air filters.
Plant 6 Electrostatic Precipitator Central (6D)	Steel precipitator housing and two cyclonic separators in a concrete diked area approximately 12- x 20-ft and 15 ft high.	**Precipitron** - Electrostatic precipitator for exhausts vented from machining equipment. Electrostatic elements were typically not powered, since exhausts contained moisture.	-2 cyclones, precipitator and filters.
Plant 6 Electrostatic Precipitator North (6E)	Building type C, 16- x 30-ft single-level building, 14 ft high.	**Precipitron** - Electrostatic precipitator for exhausts vented from machining equipment. Electrostatic elements were typically not powered, since exhausts contained moisture.	-Precipitator, air filters.
Plant 6 Salt-Oil Heat Treat Building (6F)	Building type A, approximately 25- x 45-ft single-level building, 20 ft high.	**Salt-Oil Heat Treating** - Refractory-lined beta heat treating unit to break up large grain structures in uranium core blanks. Used a 50/50 blend of sodium chloride and potassium chloride salts. Parts were quenched in an adjacent oil bath.	-Furnace, quench tank.
Plant 6 Sump Building (New) (6G)	Building type C, 42- x 90-ft multilevel building, 39 ft high north of building 6A.	**Water Treatment** - (New) Intended to replace the water treatment process identified in building 6A; however, never started up.	-New unused equipment.
Plant 7 (7A)	Building type A, 82- x 112-ft multilevel building, 102 ft high with 7 floors.	**UF_6 to UF_4 Reduction** - (1954-1956) Heated cylinders of UF_6 to vapor under the west shed, then contacted with hydrogen gas in a tubular reactor to reduce UF_6 to UF_4 and by-product HF. Drummed out product and collected HF for transfer to Plant 4's refrigeration system.	-UF_6 to UF_4 reactor and all support equipment removed in early 1950s.
		N_2 Generators - Similar to Plant 4 nitrogen generator. Provided nitrogen for plant uses.	-4 N_2 generators (removed).
		Storage - Store miscellaneous materials.	-Miscellaneous stored materials.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Plant 7 Overhead Crane (7B)	20-ton overhead bridge crane structure, 75 x 350 ft, 20 ft high and concrete pad 75 x 350 ft.	**Loading and Unloading** - UF_6 cylinders, UO_3 hoppers, and depleted UF_4 hoppers were shipped and received by truck or railroad car.	-20-ton crane.
Scrap Recovery Plant (8A)	Building type A, 239- x 280-ft multilevel building, 37 ft high with 2 floors. Irregular shape.	**Drying (Rotary Kiln)** - Used to dry or oxidize a large variety of uranium and thorium process materials, including: sump cakes, magnesium fluoride, machining chips and turnings, thorium oxide, thorium oxalate, and thorium hydroxide. Dry material was fed by screw conveyor, wet feed was by manually raking from a tray. Kiln product could be drummed or conveyed to a silo on the Plant 8 east pad.	-Rotary kiln, fume scrubber, dust collector (removed).
		Multiple Hearth Vertical Furnacing *(Primary Calciner)*[b] - An 8-hearth, gas-fired furnace which dried or roasted magnesium fluoride, sump cakes, dust collector bags and dirty gloves. Also dried wet waste materials for shipments off-site. A crusher and magnetic separator above the calciner were used to reduce the particle size of MgF_2 feed from silos and to remove tramp iron;	-Calciner furnace, scrubber, dust collector, magnetic separator, gyracone crusher, wet cake feeder.
		***(Oxidation Furnace #1)*[b]** - A 6-hearth gas-fired furnace primarily used for oxidizing high-grade scrap (U chips, turnings, and sawdust);	-Furnace, scrubber, dust collector.
		(Oxidation Furnace #2) - A 6-hearth, gas-fired furnace used to reoxidize impure black oxide (U_3O_8) and to oxidize dust collector residues for refinery feed. Most recently used to covert UF_4 and lime to calcium uranate and calcium fluoride; and	-Furnace, scrubber, dust collector, feed hoppers.
		(UAP Furnace) - A 6-hearth, gas- or oil-fired (oil firing unsuccessful) furnace used to roast uranyl ammonium phosphate (UAP) and ammonium diuranate (ADU) cakes for refinery feed.	-Furnace, scrubber, dust collector (all removed).

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Scrap Recovery Plant (8A) (Cont.)		**Single Hearth Furnacing *(Box Furnace)*[b]** - A gas-fired furnace located just north of building 8A used to oxidize scrap uranium to U_3O_8 and to oxidize gloves, rags, filters, and other contaminated burnables for uranium recovery. Material was fed to the furnace in batches and manually rabbled. When oxidation was complete, ash was manually raked into product drums;	-Furnace, scrubber.
		(Muffle Furnace) - A gas-fired furnace used to dry wet sump cakes. MgF_2 with a high free metal content (prill) was fed to oxidize the metal. The furnace was mechanically rabbled.	-Furnace, scrubber, dust collector.
		Graphite Furnace - (1953 to mid-1960s) A moving hearth (chain grate) gas-fired furnace used to oxidize contaminated graphite, mostly furnace crucibles that were jaw-crushed in Plant 5. Operation was discontinued after ~ 3 months due to inefficiency. Uranium turnings were oxidized in the furnace for a short period.	-Furnace, dust collector (all removed).
		Metal Dissolver - (1955-1959) Used to dissolve uranium metal with hydrochloric acid (HCl) for reprocessing. Metallic uranium was placed in "baskets" which were then lowered into HCl in one of two wooden dissolver vessels on the Metal Dissolver Pad (74Q) west of building 8B. Following dissolution, the HCl was returned to the hydrometallurgical system. Cooling coils helped control the reaction.	-2 dissolvers, heat exchanger (all removed); brick-lined quench basin (all on 74Q).
		Greensalt Reversion - (1956-1958) Scrap UF_4 was reverted to U_3O_8 for recovery in a horizontal electrically heated ribbon flight retort reactor. Superheated steam flowed countercurrent to the UF_4.	-Reactor, scrubber, dust collector (all removed).
		Milling - A roller mill was used to reduce the particle size of roasted MgF_2 from the primary calciner for more efficient digestion in the HCl digesters. Also used to mill salts, graphite, and ash. Material was fed from a feed bin. Milled fines passed through an air classifier to feed bins.	-Feed bin, roller mill, dust collector.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Scrap Recovery Plant (8A) (Cont.)		**Crushing** - Lithium carbonate and calcium carbonate salts from Plant 6 heat treating operations were crushed in a large jaw crusher (later replaced with hammer mill) for further processing in the ball mill and digesters. The steel drums containing the cooled salt mass were cut off with acetylene torch. The salt was manually crushed to 4-in. pieces, redrummed, and sent to the crusher or hammer mill.	-Hammer mill, dust collector (all removed).
		Ball Mill - Used for milling scrap uranium residues to facilitate dissolution in HCl digesters. MgF_2 (MCW airport scrap) or crushed carbonate salt was raked into the mill feed chute. Water was circulated through the mill from a recycle tank. The resulting slurry was pumped to a digester for further processing. Equipment located on the east pad.	-Ball mill, recycle tank, feed hopper (all removed).
		Rotexing - Furnace product from oxidizing high grade residues (chips, turnings, etc.) was screened to separate the +8 mesh fraction containing the bulk of unoxidized metal for refurnacing. The -8 mesh became refinery feed.	-Vibrating screen, dust collector.
		Hydrometallurgical System - Two processes were used to recover uranium from low-grade residues: ADU was used 1955-1957 and 1967-1971, and UAP was used 1958-1967. In the UAP process, prepared feed (milled MgF_2) was fed into a digester and dissolved in HCl. Digest liquor was then filtered through the Eimco rotary drum filters. Tailings, called trailer cake, were discarded to the waste pits, filtrate was precipitated with ammonium hydroxide (NH_4OH) and phosphoric acid (H_3PO_4). The precipitate UAP slurry was filtered on the Oliver rotary drum filters and sent to the UAP furnace for drying and to the refinery as feed (UAP ash). The Oliver effluent was neutralized with NaOH or $Ca(OH)_2$, filtered, and pumped to the general sump for discard. The ADU process was similar with additional steps: ADU filter cake was slurried in NaOH solution, filtered again on the Oliver filter and the sodium diuranate cake was roasted in the UAP furnace. The effluent was returned to the caustic leach tanks for recycling.	-Digester tanks, HCl tank, feed tanks, filtrate tanks, precipitator tanks, rotary filters, fume scrubbers.

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TABLE A.2.1 · Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Scrap Recovery Plant (8A) (Cont.)		**WINLO** - (1962-1964) This process was used as a means of returning relatively pure, high assay enriched materials to the production stream without refining. U_3O_8, UAP, and metal dissolver liquor were dissolved in HCl and HNO_3 and filtered on the Eimco rotary drum filter. The filtrate was treated with 30% HF, copper sulfate, and sulfur dioxide to form a $UF_4 \cdot 4H_2O$ precipitate, which was filtered on a horizontal pan filter, passed through a holoflite dryer, and sent to Plant 4 for further dehydration. Pan filter effluent was neutralized with lime slurry and pumped to the waste settling pit. Discontinued in 1964 due to high maintenance costs and high down-time.	-Pan filter, holoflite dryer, 2 scrubbers, SO_2 tank (N of 8A), related tanks (all removed).
		Water Treatment and Filtration - Waste water from floor washing, pump leakage, etc. that went into the floor sump was pumped to the neutralization tank, NaOH added and then filtered on a rotary drum filter. After the hydrometallurgical processes ceased in 1971, the digester tanks were used for sump neutralization with lime. Raffinate slurry and waste water was also received from other areas for treatment and filtration. Spent scrubber solutions from the various Plant 8 operations were also filtered. Effluent from waste water filtration was sampled and pumped to the general sump for discard.	-Neutralization tank, rotary drum filter, drum dumper.
		Oil Centrifuge - Used to remove solids from waste oil. The oil was to be used for heating the UAP furnace. Contaminated waste oil was dumped into a decant tank, where any water was decanted and the oil passed through a small centrifuge to two large storage tanks, located on a diked concrete pad south of building 8A.	-Centrifuge, 2 oil storage tanks, decant tank (all removed).
		Thorium Tetrafluoride Reversion - Thorium hydroxide was produced in Plant 8 for 6 months in 1966. ThF_4 was reverted to thorium hydroxide by heating in a reverter tube (the green salt reverter) with hydrofluoric acid as a byproduct. Approximately 59 metric tons of Th as thorium hydroxide was produced.	-See greensalt reversion (removed).

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Scrap Recovery Plant (8A) (Cont.)		**Thorium Residue Recovery** - (1969-1971) Scrap thorium oxide, oxalate, and hydroxide were processed to thorium hydroxide for return to the production stream. Residues were digested in HCl and filtered on a rotary drum filter. The filtrate was then precipitated with oxalic acid to form thorium oxalate. This was filtered and the resulting cake slurried with water, then treated with NaOH to form thorium hydroxide. The thorium hydroxide was filtered and the filtrate recycled back to the thorium oxalate precipitator. The cake was drummed and fed to the UAP furnace. Dried thorium hydroxide was sent to the pilot plant for processing.	-UAP furnace, pan filter, oxalic acid tank, rotary drum filter (Eimco) (all removed except Eimco).
		Thorium Storage - (1978-1988) Impure thorium compounds were stored in two elevated silos at the east end of Plant 8.	-2 steel silos (removed).
		Bulk Storage - Sodium hydroxide was stored in two horizontal tanks for use in Plant 8. One horizontal tank was used for phosphoric acid and one for sulfur dioxide. The phosphoric acid tanks has most recently been used to store sodium carbonate. All were north of the plant.	-3 steel tanks (1 removed).
Plant 8 Maintenance Building (8B)	Building type B, 30- x 42-ft single-level building, 13 ft high.	**Maintenance** - Maintain equipment from Plant 8. Plant 8 equipment was occasionally moved to maintenance for repair.	-Tools, equipment, spare parts.
Rotary Kiln/Drum Reconditioner (8C)	Building type C, 50- x 100-ft multilevel building, 33 ft high.	**New Rotary Kiln** - New, unused; will receive and dry waste residues for off-site disposal or on-site storage.	-New unused equipment - Rotary kiln, dust collection equipment.
		New Drum Reconditioning - New, unused; will clean and recondition drums.	-New unused equipment - Drum reconditioning equipment.
Plant 8 Railroad Filter Building (8D)	Building type C, 8- x 10-ft single-level building 10 ft high.	**Filtration** - See facility 74C for description of the airport scrap operation, the primary use of this facility. The structure served as a gauge and pump house.	-Subgrade settling basins, sand filter, pump, agitator, car wash pit.
Plant 8 Old Drum Washer (8F)	Steel-enclosed equipment for drum washing.	**Drum Washing** - Used to wash out drums for refurbishing. Drums from all over the site were washed with a sodium hydroxide solution in this unit located on the west pad (74D).	-Drum washer.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Special Products Plant (9A)	Building type A, 201- x 261-ft single-level building, 20 ft high.	**Enriched Uranium Casting** - Enriched uranium derbies and scrap metal were remelted to cast 11-in. and 13-in. ingots for further processing. Graphite crucibles and zirconia-coated graphite molds were utilized in the induction-heated vacuum NPR furnaces. After pouring the ingot, a crucible was inverted and subjected to flame oxidation to "burn out" residual uranium. Ingots were cooled and separated from the molds, top-cropped, sampled, heat treated, and sent for machining. Molds were cleaned and precoated either at Plant 9 or the pilot plant for reuse.	-2 Induction furnaces, dust collection equipment, vacuum system and oil reclaimer.
		Zirnlo Decladding - (1963-1988) Used for decladding non-irradiated fuel cores of copper and zirconium or nickel and aluminum cladding. Cores were sawn to size and placed sequentially in oxidizing and then reducing baths to remove the clad layers.	-Reciprocating saw, open tanks, holding tanks.
		Uranium Machining - A variety of machining capabilities existed for uranium ingots: top cropping, OD turning, hole boring, and chamfering.	-Saws, lathes, drills.
		Derby Cleaning - A molten salt treatment for uranium derbies (35/65 blend of lithium carbonate and potassium carbonate) was used to remove MgF_2 adhering to them. The operation was conducted in resistance element furnaces originally used for reduction.	-8 resistance element furnaces (Rockwell).
		Triple Beta Heat Treating - The ingots produced in Plant 9 were, at one time, beta heat treated 3 times in NuSal salt in a furnace in Plant 9. Later heat treating was one-step and done in Plant 6.	-Ingot heat treating furnace (removed).
		Thorium Metal - (1954-1955) Thorium nitrate was dissolved in nitric acid, precipitated as ThF_4 or ThO_2 with HF and sent to Plant 4 for hydrofluorination to ThF_4, dried, pulverized, blended with calcium and zinc chloride, and thermally reduced to a zinc-thorium derby. The derby was subsequently de-zinced and remelted in an ore melting furnace. Turnings from machining the thorium to a final form were acid washed and briquetted for return to the remelt cycle.	-All equipment removed.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Special Products Plant (9A) (Cont.)		**Uranium Reduction** - Milled dolomite was used as a pot liner for the reduction pot. Liners were formed in jolters, filled with blended UF_4/magnesium mix, lidded, and furnaced. The uranium produced from the reduction reaction was cooled and separated from the magnesium fluoride and dolomite. Magnesium fluoride was later used to line the furnace pots.	-3 Jolters, 6 liner hoppers, pot filling/blending machine, capping and lidding station, 13 reduction furnaces, cooling tanks, and a breakout booth.
		I & E Remelt Furnaces - Four vacuum induction furnaces functioned as remelt furnaces (see description above) and with similar support equipment to above prior to replacement. Some current Plant 5 induction furnaces are identical.	-2 vacuum pumps, 4 furnaces, crucible burnout, charging and mold cleaning stations, separation booth, oil reclaimer (all removed).
		Briquetting - Uranium chips from Plant 9 machining were dumped into a crusher, put into baskets, through a centrifuge, nitric acid bath, two water rinses, centrifuged, and briquetted in a press.	-Nitric tank, 2 rinse tanks, 2 centrifuges, crusher, press, and fume scrubber (all removed).
		Scrap Metal Pickling - A nitric acid bath was used to remove surface oxidation from metal to be used for remelt feed.	-Nitric acid tank, rinse tank, fume scrubber.
Plant 9 Sump Treatment (9B)	Building type A, approximately 20- x 30-ft single-level building, 20 ft high.	**Water Treatment** - Plant 9 waste waters were treated with NH_4OH, originally (and later, lime), to remove the bulk of the contaminants prior to transfer to the general sump.	-Decant tank, acid tank, mix tank, 2 plate & frame filters, 3 filtrate tanks.
Plant 9 Dust Collector (9C)	Steel dust collector housing approximately 20 x 35 ft and 25 ft high.	**Dust Collection** - Dust collector G42-615 was used to collect and filter exhausts from the Plant 9 reduction processes.	-Dust collector, hoffman vacuum pump, 2 cyclones.
Plant 9 Electrical Substation (9D)	Building type A, approximately 25- x 40-ft single-level building, 20 ft high.	**Electrical Distribution** - Receives 13,200-volt feeds from main electrical station. Supplies 480-volt feeds to the plant.	-Transformers, disconnects.
Plant 9 Cylinder Shed (9E)	A 3-sided transite/steel single-level shed, 5 x 10 ft, 8 ft high.	**Cylinder Storage** - Stored full and empty cylinders for Plant 9 use.	-Empty cylinder racks.

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Plant 9 Electrostatic Precipitator House (9F)	Building type C, 16- x 30-ft single-level building, 14 ft high.	**Precipitron** - Electrostatic precipitator handled exhausts from vented machining equipment in Plant 9. Electrostatic elements were typically not powered, since exhausts contained moisture.	-Electrostatic precipitator, air filters.
Boiler Plant (10A)	Building type A, 72- x 163-ft multilevel open area structure, 57 ft high with 2 floors and a basement 72 x 97 x 15 ft. Irregular shape.	**Steam Production** - Four coal-fired steam boilers provide steam to the entire FEMP facility for heating.	-4 coal-fired boilers, 2 electrostatic precipitators, feed conveyors.
Boiler Plant Maintenance Building (10B)	Building type C, 40- x 60-ft single-level building, 16 ft high.	**Boiler Plant Maintenance** - Proved maintenance for the boiler plant equipment.	-Equipment, tools, vented basin for solvent cleaning of equipment.
Wet Salt Storage Bin (10C)	A 17- x 42-ft rectangular concrete tank for salt.	**Wet Salt Storage** - The bin is used to store salt solution for regenerating the zeolite water softeners. Sodium chloride is received by truck, dumped into the bin, and dissolved.	-Salt storage bin, salt solution.
Oil Burner/Graphite Burner Pad (10D)	A concrete pad approximately 55 x 85 ft.	**Graphite Burner** - Small, open, gas-fired furnace used for oxidizing scrap graphite crucibles/molds for uranium recovery.	-Graphite burner.
		Oil Burner - A small refractory brick enclosure housed removable steel pots. Contaminated oil/solvent was continuously fed into the burning pot. Combustion was aided by an air jet into the top of the pot. The oil was pumped from drums into an oil-water separator tank, then into the steam-heated tank (where the oil was preheated) before going to the burner pot. Combustion was self-sustained. Ash was drummed for uranium recovery.	-Oil burner enclosure, tank (other equipment removed).
		Sump - Decanted surface water was pumped from the sub-grade pit into portable tanks and sent to Plant 8.	-Steam eductor (removed).

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Service Building (11)	Building type B, 230- x 322-ft multilevel building, 30 ft high with 2 floors.	**Laundry** - Provides cleaning services for process clothing. Also cleaned clothes from off-site operations.	-Washers, dryers, dry cleaners (refurbished and enlarged in 1987).
		Locker Rooms - Change-out facilities and showers for employees and sub-contractors.	-Locker and shower facilities (refurbished and enlarged in 1987).
		Cafeteria - Provides lunchroom service for employees and sub-contractor. Includes offices and training areas.	-Cafeteria equipment, office equipment.
		Maintenance - the main maintenance center for the administrative areas of the site.	- Tools, spare parts.
Main Maintenance Building (12A)	Building type A/B, 150- x 361-ft multilevel building, 20 ft high with 2 floors.	**Main Maintenance, Stores, and Offices** - The maintenance stores, the main maintenance shops, tool rooms, and associated offices are housed in this building.	-Heavy-duty maintenance equipment, spare parts, *parts cleaner*.[b]
Cylinder Storage Building (12B)	Building type B/C, 31- x 47-ft single-level building, 10 ft high.	**Cylinder Storage** - Used for storage of argon, chlorine, and other gas cylinders used on site.	-Full and empty cylinders.
Lumber Storage Shed (12C)	A steel shelter, 40 x 50-ft, 14 ft high.	**Lumber Storage** - Used for storage of lumber and plywood for building projects on site.	-Plywood, lumber, electric motors.

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Pilot Plant Wet Side (13A)	Building type B, 63- x 155-ft multilevel facility, 35 ft high (extraction area 53 ft high).	**Solvent Extraction** - (1964-1980) Purification of thorium or uranium digested liquors by liquid-liquid counter-current extraction in perforated plate pulse counter-current columns. Diamyl-amyl phosphonate (DAAP) in kerosene and di-sec-butyl phenyl phosphonate (DSBPP) in kerosene made up the extractants for thorium. TBP was also used to remove uranium. Raffinate was neutralized and filtered. Filter cake was drummed, effluent went to the general sump. Solvent was recovered by nitric acid and soda ash treatment and centrifuging. Extraction product (UNH or TNT) was concentrated by heating in tank W-10 (outside west). Two-inch columns were used for processing higher enriched UNH.	-Three 6-in. columns, one 10-in. column, centrifuge, 2 pulse generators, 2-in. pyrex extraction columns.
		Sump Process - All floor sumps were collected in 2 outside tanks (F101, F102) treated batchwise in 2 neutralizing tanks with MgO and NaOH and filtered. Barium carbonate was used to precipitate thorium.	-2 neutralizer tanks (D-15, D-16), two 24-in. plate and frame filters have been removed.
		Thorium Digestion - (1964-1980) Thorium ores, thorium oxalate, and other thorium materials were dissolved in HNO_3 in a single digester for extraction feed. Vented to outside scrubber.	-Digester tank (D-1 removed).
		Thorium Oxalate - (1971-1976) Thorium nitrate tetrahydrate (TNT) was precipitated with oxalic acid to form a wet thorium oxalate, which was filtered and dried. The oxalate was calcined at another location.	-Tanks, plate & frame filter (removed).
		Thoria Gel (hydrated oxide) - (1964-1970, 1977-1979) TNT solution was precipitated with CO_2 and ammonia to form thorium hydroxide. This was slurried with water and ammonia, filtered, dried, and sent to another location for calcining to thorium oxide.	-Tanks, plate & frame filter, shelf dryer (removed).
		Thorium Tetrafluoride Precipitation - (1969-1971) Thorium tetrafluoride (ThF_4) was precipitated by adding hydrofluoric acid to thorium nitrate tetrahydrate (TNT) solution. The $ThF_4 \cdot H_2O$ was filtered, dried, and dehydrated in an HF atmosphere.	-Tanks, pan filter, shelf dryer (removed).
		ZnF_2 Precipitation - (1969-1971) Zinc fluoride was precipitated by dumping bags of zinc oxide into dilute HF. The ZnF_2 produced was filtered, dried, and dehydrated for use in thorium metal production. This process used the same equipment used for ThF_4 precipitation.	-Same as above.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Pilot Plant Wet Side (13A) (Cont.)		**Pot Liner Preparation** - Calcium fluoride from thorium derby breakout was prepared for pot liner material by crushing, ball milling, and screening.	-Jaw crusher, ball mill, dust collector (removed).
		Decladding Fuel Elements - Aluminum-clad, nickel-plated uranium fuel elements were declad by placing in a stainless steel ventilated trough and circulating sodium hydroxide and nitric acid. Declad elements were returned to the production stream in Plant 5 and the spent solution went to Plant 8.	-Tank, trough (removed).
		Enriched Oxidation Furnace - (1956-1985) A small single hearth, gas-fired furnace used to process enriched scrap U_3O_8, U metal, and other residues.	-Furnace, dust collector (removed).
		Barium Chloride Conversion[b] - Barium chloride heat treating salts from the uranium extrusion operation at RMI were converted to barium sulfate.	-Tanks (removed).
Pilot Plant Maintenance Building (13B)	Building type, 30- x 60-ft single-level building, 11 ft high.	**Maintenance** - Maintain equipment in the pilot plant. Required moving equipment into the building for repairs.	-Tools, equipment, spare parts.
Sump Pump House (13C)	Building type B, 12- x 16-ft single-level building, 8 ft high.	**Sump Pump House** - Area includes 2 large sump hold tanks (2 subgrade concrete pits) which received filtered sump effluent, which was sampled and pumped to the general sump. An *abandoned sump*[b] hole may also have been used.	-Tanks (sub-grade pits have been filled).
Pilot Plant Thorium Tank Farm (13D)	A 50- x 75-ft open concrete diked area west of building 13A.	**Thorium Tank Farm** - Used for storage of thorium nitrate tetrahydrate (TNT), HNO_3, NaOH, *spent solvents (T-5 and T-6 tanks)*,[b] and water.	-Tanks (~6,000 gal of TNT remain in T-2).
Administration Building (14A)	Building type B, approximately 143- x 240-ft (equiv.) multilevel building, 24 ft high with 2 floors. This building has a partial basement under part of the west wing.	**Offices** - Main offices for site management, mailroom, central reproduction, central computing, and files storage.	-Office equipment, stored documents, computer hardware.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
EOC Emergency Electrical Generator (14B)	Electrical generator on pad, approximately 10 x 10 ft.	**Emergency Operations** - This unit consists of a diesel engine, fuel tank and electrical generator for use in emergency situations to power the emergency operations center (EOC).	-Engine, diesel tank, generator.
Laboratory Building (15)	Building type B, 253- x 292-ft multilevel building, 20 ft high with 2 floors in some sections, a basement (148 x 293 x 11 ft) under the west corridor, and access tunnels under the north and central corridors. Irregular shape.	**Laboratories** - Housed the analytical, metallurgical, and chemical process labs. Also housed the photography lab, the library, and a significant number of offices. The building has been added to and remodeled.	-Laboratory equipment, office equipment, loading dock, and storage areas.[b]
Main Electrical Station (16A) and Support Equipment (16B-16E)	A 200- x 200-ft area with steel structures and small buildings.	**Electrical Distribution** - The structure provides the main electrical feed to the FEMP. Receives 132,000-volt feeds from the mains and transforms to 13,200-volt feeds to local substations around the facility.	-Steel frames, 3 transformers, 9 circuit breakers, disconnects.
Trailer Electrical Substation 1 (16F)	A small fiberglass enclosure for electrical transformer.	**Electrical Distribution** - Receives 480-volt feeds and transforms to 220-volt feeds for the local office trailers.	-Transformer, disconnect.
Trailer Electrical Substation 2 (16G)	A small fiberglass enclosure for electrical transformer.	**Electrical Distribution** - Receives 480-volt feeds and transforms to 220-volt feeds for the local office trailers.	-Transformer, disconnect.
Biodenitrification Surge Lagoon (18A)[b]	A 400- x 400-ft lagoon, 15 ft above grade, plus 50,000-gal steel tank with integral floating roof.	**Lagoon** - The biodenitrification (Bio-D) surge lagoon (8.6 million gallons) holds general sump effluents waiting processing for nitrate removal in the Bio-D towers (18D).	-Lagoon.
General Sump (18B)	A 113- x 116-ft multilevel open area facility, 25 ft high with 2 floors, resting on a concrete pad.	**General Sump** - Provides treatment of site effluents other than sewage. Responsible for disposition of effluents to the biodenitrification facility or the Great Miami River (via manhole 175).	-Five 56,000-gal tanks, two 15,000-gal tanks, three 20,000-gal tanks, one 12,000-gal tank, and one 5,000-gal tank.
Coal Pile Runoff Basin (18C)[b]	A 54- x 107-ft basin, 11 ft deep.	**Runoff Retention** - The 25,000-gal basin collects storm-water runoff from coal pile P-005 for treatment.	-Runoff water from the coal pile and continuous blowdown from boiler operations.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Biodenitrification Towers Building (18D)	Building type C, 72- x 79-ft multilevel building, 67 ft high with 6 floors.	**Biodenitrification** - The process supports bio-mass on fluidized coal particles to obtain denitrification (removal of nitrates) of liquid effluents.	-Four 30-ft towers, screens.
Storm-Water Retention Basin (18E)	2 adjacent lined collection basins 300 x 300 ft and 200 x 550 ft.	**Storm-Water Retention** - Two basins supply ~10 million gallons of capacity to retain rainwater flow from the site. The retention allows uranium-bearing solids to settle. Decanted liquids are pumped and sampled prior to release out of manhole 175.	-Rainwater, 4 underdrain pumps, 2 decant pumps, sampling station building.
Clearwell Pump House (18G)	Building type A, approximately 10- x 22-ft single-level building, 15 ft high.	**Clearwell Pumping** - Pump clear sampled surface runoff water to the biodenitrification surge lagoon (18A).	-2 pumps.
Biodenitrification Effluent Treatment Facility (18H)	Building type C, 30- x 50-ft single-level building, 15 ft high in a 100- x 100-ft area including process equipment.	**Effluent Treatment** - Biodenitrification system effluents are treated to reduce biological oxygen demand (BOD) and total suspended solids (TSS) prior to transfer to manhole 175(25B).	-Pumps, tanks, chlorinators, filter press, compressors, aerators.
Methanol Tank (18J)	A 25-ft tall × 20-ft diameter stainless steel tank of 50,000-gal capacity, situated on a 31- x 41-ft concrete pad.	**Methanol Storage** - The methanol tank stores methanol, the primary food source for the biomass colony in the biodenitrification process.	-1 tank, methanol.
Low Nitrate Tank (18K)	A 180- x 180-ft polymer-lined temporary steel-sided reservoir of 1,000,000-gal capacity.	**Low Nitrate Tank** - A temporary tank used during the reconstruction of the biodenitrification surge lagoon to hold low nitrate waste waters. Control of nitrate levels to the biodenitrification process was accomplished by blending of the high and the low nitrate tank flows.	-1 lined steel-sided basin.
High Nitrate Tank (18L)	A 180- x 180-ft polymer-lined temporary steel-sided reservoir of 1,000,000-gal capacity.	**High Nitrate Tank** - A temporary tank used during the reconstruction of the biodenitrification surge lagoon th hold high nitrate waste waters.	-1 lined steel-sided basin.
High Nitrate Storage Tank (18M)	A 60-ft diameter vertical steel tank of 500,000-gal capacity in a 112-ft diameter padded diked area.	**High Nitrate Storage** - The tank was intended to store high nitrate wastes from the operation of the refinery. The tank is providing interim storage of filtrate for the uranyl nitrate neutralization project.	-1 steel tank (never used).

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Main Tank Farm (19A)	A 140- x 190-ft open area concrete diked structure, with 5 horizontal tanks and structures up to 20 ft high.	**Bulk Storage** - The tank farm supplied and received bulk liquid chemicals. Railcar and truck loading and unloading facilities exist. The original tanks in the tank farm were: Nitric acid, AHF, DHF, TBP, kerosene, anhydrous ammonia, HCl, ammonium hydroxide, and KF. The original tank farm was not padded or diked, but sloped to *sump*[b]. In 1986 the south end of the tank farm was renovated. New storage tanks were installed in a diked, concrete-padded area with a control room. These tanks were not used. Old tanks remain in the north half. A *railcar of dilute HF*[b] and an empty *railcar for nitric acid*[b] are stored nearby. *HF residues*[b] from tank cleanout were temporarily stored south of the cooling towers (20C).	-5 tanks with load cells, piping, control equipment, loading/ unloading stations.
Pilot Plant Ammonia Tank Farm (19B)	A 40- x 51-ft open area concrete diked structure, partially sub-grade SW of building 13A.	**Ammonia Storage** - Constructed in 1989 and used briefly for anhydrous ammonia storage to supply the pilot plant UF_6 to UF_4 process and the refinery.	-2 tanks.
Main Tank Farm Control Room (19C)	Building type C, 25- x 43-ft single-level building, 10 ft high.	**Offices** - The control room was designed as a control center for tank farm operations, but has not been used in that capacity. Currently used as office space.	-Electrical control panels, office equipment.
Old North Tank Farm (19D)	Remaining north half of the old tank farm, approximately 130- x 130-ft area, containing 7 horizontal steel tanks.	**Bulk Storage** - Seven 25,000-gal horizontal steel tanks stored KF, AHF, and anhydrous ammonia. As part of the renovation of the tank farm, the south end was phased first. The second phase (north end) was not completed, however, catwalks and piping were removed from the north end. Tanks were also made non-functional. *HF residues*[b] from tank cleanout were temporarily stored south of the cooling towers (20C).	-7 horizontal and 1 vertical steel tanks (out-of-service), piping (removed), catwalks (removed).
		Sump[b] - Runoffs and spills were collected in a concrete basin and treated with lime to neutralize acid content. Treated liquids were stored in the old HCl tanks (1 vertical remaining) and/or transferred to the general sump.	-Runoff water, rubber-lined tank (one removed).

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Pump Station & Power Center Building (20A)	Building type A, 17- x 83-ft single-level building, 12 ft high.	**Pumps** - Houses the pumps for the sanitary system and chlorinator, and unit sub-station.	-Steam turbine, pump, chlorinator.
Water Plant Building (20B)	Building type A/C, 50- x 78-ft multilevel building, 19 ft high with 2 floors.	**Water Treatment** - Provides treatment of all water using alum and lime.	-9 sand filters (pressurized), 2 lime feeders, 2 pumps, 2 alum feeders, 2 pumps.
Cooling Towers (20C)	A 31- x 96-ft wooden structure, 42 ft high.	**Water Cooling** - Provides air cooling of site process water in mechanical draft-type towers. Four units exist today. Early site photos show only three as original installed equipment.	-4 forced-draft cooling tower assemblies, 4 electric pumps, steam turbine.
Elevated Potable Storage Tank (20D)	A 30- x 40-ft steel tank structure, 100 ft high.	**Water Storage** - Potable water storage capacity of 210,000 gal for on-site fire protection and potable uses. Water comes from on-site wells, from well houses 1, 2, or 3 (20E, 20F, or 20G, respectively).	-1 water tower.
Well House 1 (20E)	Building type B, 11- x 20-ft single-level building, 9 ft high.	**Water Pumping** - One of three well pumping stations to supply water for fire protection and potable uses on site.	-Pump.
Well House 2 (20F)	Building type B, 11- x 20-ft single-level building, 9 ft high.	**Water Pumping** - One of three well pumping stations to supply water for fire protection and potable uses on site.	-Pump.
Well House 3 (20G)	Building type B, 11- x 20-ft single level building, 9 ft high.	**Water Pumping** - One of three well pumping stations to supply water for fire protection and potable uses on site.	-Diesel engine powered pump, diesel tank.
Process Water Storage Tank (20H)	A 80-ft diameter reinforced concrete tank, 20 ft high.	**Water Storage** - Used to store water, with a 750,000-gal capacity.	-Concrete tank with flexible membrane liner.
Gas Meter Building (22A)	Building type B, 16- x 20-ft single-level building, 11 ft high and 4 ft below grade.	**Gas Metering and Distribution** - Houses the main gas meter for the site and houses distribution piping.	-2 gas meters, incoming distribution piping.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Storm Sewer Lift Station (22B)	Building type B, 10- x 16-ft building, 8 ft high and 20 ft deep.	**Lift Station** - Pumps storm-water runoff to river.	-2 electric pumps, sampling equipment.
Truck Scale (22C)	A 12- x 52-ft structure, 2 ft below grade.	**Truck Scale** - Weigh incoming and outgoing trucks as required. Originally installed near the garage (31A), later moved to the new receiving building (82).	-Truck scale.
Scale House and Weigh Scale (22D)	Building type A, 12- x 52-ft single-level building, 10 ft high and scale with subgrade scale pit.	**Scale Operation** - Incoming and outgoing trucks were weighed as needed to verify shipments. Generally replaced by the truck scale (22C) in use near the new receiving building (82). Used to weigh sea/land containers prior to loading on trucks.	-Scale.
Utility Trench to K-65 Area (22E)	A subgrade steel piping system approximately 1,500 ft long in a 3-ft wide concrete trench.	**Transfer Lines** - Air transfer and slurry transfer lines originally used to fill the storage silos in the K-65 area. Additional lines now support transfers between the biodenitrification process, the clearwell, the waste pits, manhole 175 (not used), etc. The trench is covered with removable concrete slabs.	-3 transfer lines: general sump or hot raffinate - pits or silo #3, BDN surge lagoon - BDN towers, clearwell - manhole 175.
Meteorological Tower (23)	Steel tower.	**Meteorological Tower** - Constructed to provide site-specific weather information during emergencies and for dispersion modeling.	-Tower, meteorological instruments.
Railroad Scale House (24A)	Building type B, 13- x 14-ft single-level building, 9 ft high.	**Scale House** - Provided weighing of incoming and outgoing railcars.	-Scale.
Railroad Engine House (24B)	Building type B, 27- x 45-ft single-level building, 16 ft high.	**Engine Storage** - Provides covered storage and under-carriage maintenance access for the site's locomotive.	-Ethylene glycol, lubricating oil.
Chlorination Building (25A)	Building type B, 6- x 8-ft, single-level building, 8 ft high.	**Chlorination** - Used to treat sewage trickling filter effluent when UV disinfection equipment (25D) is out-of-service.	-Chlorine feeder.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Manhole #175, Sampling Building, and Effluent Line (25B)	Building type C, approximately 12- x 12-ft single-level building, 10 ft high with manhole access to 4,200-ft effluent line to river.	**Manhole 175** - Manhole 175 handles all normal site effluent flows. The manhole serves as the last checkpoint for effluents to the river. The building houses sampling and flow monitoring equipment. Historically some site runoff has also gone directly to Paddys Run creek.	-Control panel and samplers.
		Effluent - The effluent line to the Great Miami River is intended to handle all site liquid effluents. A series of manholes between the sewage treatment plant and the river provide access to the line.	-16-in. diameter pipeline.
Sewage Lift Station Building (25C)	Building type B, 15- x 20-ft single-level building, 9 ft high.	**Lift Station** - Pumps sanitary wastes from the site to sewage plant for treatment.	-2 electric pumps.
UV Disinfection Building (25D)	Poured concrete building, 13- x 15-ft single-level building, 9 ft high.	**Ultraviolet Disinfection** - Sewage effluent is treated with ultraviolet light to destroy residual bacteria from the trickling filter process.	-2 UV disinfection units, sampler, flow meter.
Digester and Control Building (25E)	Building type B, 61- x 40-ft multilevel building, 16 ft high and 40-ft diameter double-walled concrete tank.	**Anaerobic Sewage Digestion** - Houses the anaerobic bacterial digester for site sewage treatment and the control room for the operation.	-Tank, pumps, sewage heater, control panel.
Sludge Drying Beds (25F)[b]	Two 30- x 80-ft concrete enclosures.	**Sludge Settling** - Sludges from site sewage are pumped from the digester (25E) and are settled in one of two concrete basins. Liquids are drained into the trickling filters.	-2 settling basins.
Clarifier Basins (25G)	Two 12- x 32-ft basins, approximately 10-ft deep.	**Clarifiers** - 2 concrete tanks utilized as settlers. Also known as the primary settling basins.	-2 sand filters.
Trickling Filters (25H)	Two 40-ft diameter concrete tanks.	**Trickling Filters** - 2 tanks provide aerobic bacterial digestion of sewage from the site.	2 concrete tanks.
Pump House-HP Fire Protection (26A)	Building type B, 26- x 50-ft single-level building, 11 ft high. Also includes a 35-ft diameter steel tank, 22 ft high.	**Fire Protection Water Pumping** - Three pumps supply water from the holding tank (~300,000 gal) for on-site fire fighting.	-3 pumps, steel tank.

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Elevated Water Storage Tank (26B)	A 60-ft diameter elevated steel tank, 265 ft above grade.	**Water Storage** - Potable water storage capacity of 350,000 gal for on-site fire protection and potable uses. Water is from on-site wells from well houses 1, 2, or 3 (20E, 20F, or 20G, respectively).	-1 water tower.
Main Electrical Strainer House (26C)	Building type B, 10- x 12-ft single-level building, 10 ft high.	**Main Electrical Deluge System** - Heat sensors in the main electrical transformers control activation of this fire suppression (deluge) system.	-Automatic sprinkler control valve.
Security Building (28A)	Building type B, 109- x 82-ft single-level building, 10 ft high, including a turnstile area 50 x 55 ft.	**Security Services** - Provides on-site security headquarters, access services, and employee turnstiles.	-Communication center, office equipment, and classified document vault.
Human Resources Building (28B)	Building type B, 80- x 100-ft single-level building, 10 ft high.	**Offices** - Offices for human resources employees and DOE Inspector General assignees.	-Office equipment.
Security Checkpoint (28C)	Building type C, 10- x 10-ft single-level building, 10 ft high.	**Checkpoint** - Used to store protective clothing (smocks, shoe covers, etc.) for off-site drivers entering the process area.	-Protective clothing.
Guard Post West End of 2nd Street (28D)	Building type D, 15- x 15-ft single-level building, 10 ft high.	**Checkpoint** - Originally used a guardpost to control access to the K-65 silo and waste pit area. Currently used for radiological contamination control upon exit from the area.	-Frisker units, radio.
Chemical Warehouse (30A)	Building type A, 82- x 321-ft single-level building, 16 ft high.	**Chemical Storage** - For storage of operating supplies for use on site. NE area now used for visual inspection of drums for RCRA determination and overpacking of low-level waste.	-Aerosol Paint cans, lime, dicalite, graphite crucibles, etc.
Drum Storage Warehouse (30B)	Building type A, 20- x 33-ft single-level building, 12 ft high.	**Drum Storage** - Former truck dock office and scale house. Used for RCRA sampling. Now is radiological clothing change area.	-Clothing change area.
Old Ten Ton Scale (30C)	A drive-on pallet-size scale.	**Scale Operations** - Received materials were weighed on the scale on the pallets shipped.	-Scale.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Garage - Engine House (31A)	Building type B, 62- x 123-ft single-level building, 17 ft high.	**Garage** - The structure houses offices, and areas for on-site vehicle repairs. Also houses the ambulance and one fire truck for the site.	-Vehicle repair equipment, offices, *waste oil,*[b] fire and ambulance vehicles.
Old Truck Scale Platform (31B)	Concrete platform approximately 15 x 140 ft.	**Scale Operation** - Original location of scale used near the new receiving building (82). Scale was moved. Concrete ramp platform remains.	-Concrete ramps.
Magnesium Storage Building (32A)	Building type B, 52- x 103-ft single-level building, 17 ft high.	**Magnesium Storage** - Stored drummed or bagged magnesium metal turnings for use in the Plant 5 reduction process.	-Used for storage of excess equipment from building 56A.
Magnesium Storage Covered Loading Dock (32B)	Covered concrete railroad dock, approximately 20 x 60 ft.	**Dock** - The dock is covered and has a ramp for vehicle access.	-Miscellaneous.
Pilot Plant Annex (37)	Building type B, 52- x 122-ft single-level building, 25 ft high.	**Grit-Blasting Furnace Crucibles** - Remelt furnace graphite crucibles from Plant 5 were placed in the grit-blaster enclosure and the inside of the crucible was cleaned prior to plasma spray coating.	-Grit-blaster unit, dust collector.
		Plasma Spraying of Crucibles - Grit-blasted crucibles were coated on the inside with calcia-stabilized zirconia by the plasma spray unit. Plasma sprayed crucibles were returned to Plant 5.	-Plasma spray unit, dust collector.
		Oil Reclaimer - A Hilco oil reclaimer was used to filter contaminants from oil used in the de-zincing furnace vacuum pumps.	-Oil reclaimer.
		De-Zincing Furnace - Same operation as de-zincing in building 54A, except this was P-2 furnace. The pilot plant sump processed a small amount of water collected from a subsurface pit under this furnace.	-P-2 furnace.
		Briquetting - UF_4 and magnesium were blended and crushed into pillows to make a higher density reduction charge.	-Briquetting unit.

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Pilot Plant Annex (37) (Cont.)		**Uranium Derby Cleaning (Rotoblaster)** - Uranium derbies were placed on an enclosed revolving table and sprayed with fine uranium pellets to remove traces of MgF_2 from the derby. The pellets were continuously recycled during the operation.	-Rotoblaster, dust collector.
		Milling Thorium Tetrafluoride - Dehydrated ThF_4 was milled (Sturtivant) and packaged for reduction.	-Mill (removed).
		Calcium Metal Storage - Drums of fine calcium metal were stored and weighed for the reduction process.	-Portable scale (removed).
		Box Furnace - Electrically heated multi-purpose furnace. Used for enriched uranium turnings and sawdust oxidation.	-Box furnace (removed).
		Flats Outgassing - 2-inch and 4-inch uranium flat castings were processed in the P-2 vacuum furnace to remove excess hydrogen gas.	-P-2 furnace.
		NuSal Heat Treating - A 50/50 blend of molten sodium chloride and potassium chloride salts was used as a medium for heat treating of uranium core blanks on a pilot scale.	-NuSal salt furnace, quench tank.
		Enriched Derby Production - Test runs were made by technical personnel to produce uranium derbies up to 5% U-235. A small-scale reduction furnace was used to produce a derby approximately 5 inches in diameter.	-Furnace removed.
Propane Storage (38A)	Building type B, 23- x 33-ft building, 10 ft high plus 2 steel tanks.	**Propane Storage** - Two steel tanks with a propane capacity of 33,000 gal each which store propane for use in site vehicles. Original site photos showed 5 tanks in use rather than the two remaining.	-2 propane tanks.
		Propane Distribution - The main building houses monitoring and vaporization equipment and equipment which originally allowed distribution of propane gas to several other locations on site.	-Vaporizer.
Cylinder Filling Shed (38B)	Building type C, 6- x 10-ft single-level building, 8 ft high.	**Propane Cylinder Filling** - A cylinder filling building is located east of the main building (38A).	-Cylinder filling station.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Incinerator Building (39A)	Building type A, approximately 52- x 54-ft multilevel building, 37 ft high with 2 floors.	**Drum Dryer** - Used to dry refinery raffinate cake for discard. Raffinate slurry was filtered on two rotary drum filters, dropped into one of two gas-fired rotary calciner furnaces, dried, milled, and pneumatically conveyed to Silo 3.	-2 rotary filters, drum dryer, dust collection equipment (all removed); 2 rotary calciner furnaces, hammer mill.
		Trash Baler Operation - Trash, primarily paper and cardboard, are baled to provide the greatest density for shipment to off-site disposal.	-Trash baler.
		Liquid Waste Incinerator[b] - (1983-1987) A waste solvent and oil incinerator used for burnable liquids from the site. Residues were treated for uranium recovery.	-Incinerator.
		Solid Waste Incinerator - (1980-1987) A cylindrical fire brick-lined, gas-fired furnace used to incinerate burnable trash from the site. Ash was drummed for uranium recovery processing.	-Incinerator, feed conveyor.
Waste Oil Decant Shelter (39B)	A steel shelter over a concrete pad, 18 x 28 ft, and 12 ft high.	**Oil-Water Separation** - Oils and solvents were decanted to remove the water content prior to incineration in the liquid waste incinerator (39A).	-2 tanks.
Incinerator Building Sprinkler Riser House (39C)	Building type B, 6- x 8-ft single-level building, 8 ft high.	**Incinerator Sprinkler Riser** - Originally supplied fire protection for the nearby wooden cooling tower. Now supplies water for fire protection to the incinerator building (39A).	-Pump.
Sewage Treatment Plant Incinerator (39D)	Outdoor waste incinerator equipment situated on a 16- x 20-ft concrete pad.	**Waste Incineration** - (1954-1979) An outdoor incinerator structure used for a variety of site wastes, including contaminated materials from the process area. Replaced by the building 39A incinerator.	-Incinerator and stack.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Rust Engineering Building (45A)	Building type C, 121- x 150-ft single-level building, 14 ft high.	**Offices** - Currently used by Rust Engineering Company as offices and warehouse. **Machine Shop** - The facility was formerly used as a machine shop for the laboratory building (15). **Miscellaneous Processes** - The facility also housed a small experimental rolling mill in the south bay. After machining equipment was removed from the center and north bays, the north bay was used to cut clad uranium carbide rods, from which the UC and sodium metal plugs were removed. Sodium plugs were placed in kerosene for discard in the scrap pit. The UC was reacted in water to form U_3O_8 in the center bay. The U_3O_8 was packaged and furnaced at Plant 8 for refinery feed.	-Office equipment. -Machining equipment (removed). -Rolling mill (removed).
Utility Shed (45B)	Building type D, approximately 15- x 15-ft single-level building, 10 ft high.	**Storage** - Used for storage of small tools and desk space.	-Tools, desk.
Heavy Equipment Building (46)	Building type C, 60- x 221-ft single-level building, 17 ft high.	**Heavy Equipment Storage** - Provides covered storage for site heavy equipment (cranes, back-hoes, etc.). Also houses offices.	-Fire equipment, street and yard maintenance vehicles, fork trucks, etc.
UF_6 to UF_4 Reduction Facility 2 (51)	Building type C, 165- x 244-ft single-level building, 30 ft high.	**UF_6 to UF_4** - A second process facility for uranium tetrafluoride production from uranium hexafluoride was partially constructed during the 1986-1987 timeframe. The process would have been essentially identical to the process in building 54A. The construction of the building was completed, but the process was not installed. **Advanced Waste Water Treatment** - The structure will house the advanced waste water treatment (AWWT) process intended to further treat site effluents for uranium removal. The process as planned includes superoxidizer technologies and ion exchange technologies.	-New, unused UF_6 to UF_4 process equipment owned by U.S. Army. -None yet installed.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Safety and Health Building (53A)	Building type B, 89- x 221-ft multilevel building, 22 ft high with 2 floors and a partial basement under the west section.	**Offices** - Office and conference areas exist on both main floors.	-Office equipment.
		Medical Services - Houses equipment for emergency medical attention, routine examination and testing, x-ray testing, and medical laboratory.	-Medical equipment, x-ray machine.
		Security - Site security utilizes much of the basement floor as a communications headquarters.	-Communications console.
In-Vivo Monitoring Building (53B)	Building type B, 36- x 72-ft single-level building, 15 ft high.	**In-Vivo Monitoring** - Radiation-shielded facility provides measurement of internal radiation for employees. Measurements are typically for uranium content in the lungs.	-Monitoring equipment.
Pilot Plant UF_6 to UF_4 Facility (54A)	Building type A, 62- x 80-ft structure 44 ft high.	**UF_6 to UF_4** - (1984-1988) Uranium hexafluoride (UF_6) was reduced to uranium tetrafluoride (UF_4) with dissociated ammonia (H_2 and N_2) in one of two reactors. The product UF_4 was sent to Plant 5 for further reduction. Offgases were condensed by a refrigeration unit to produce anhydrous hydrofluoric acid (AHF) which was sent to the main tank farm. Aqueous HF from the wet scrubber recirculated as scrubber liquor until transferred to portable tanks for transport to the main tank farm tanks. If too low a concentration was achieved, the liquor was sent to Plant 8 for disposition.	-2 bridge cranes, 3 autoclaves, 2 tubular reactors, 3 catalytic ammonia dissociators, 3 scrubber tanks, refrigeration unit (replaced in 1988), dust collection equipment, AHF storage tank (S of building 37), DHF storage tank (E of building 37).
		Jolter - Liner material (milled CaF_2) for the thorium and uranium metal processes was jolted into shape.	-Jolter (all removed).
		Furnace Pot Loading - Thorium tetrafluoride (ThF_4) was blended with calcium and zinc fluoride, emptied into CaF_2-lined furnace pots, capped with CaF_2, and lidded. Argon gas purge was used on blender to prevent H_2 gas buildup.	-Blender and enclosure (all removed).

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Pilot Plant UF_6 to UF_4 Facility (54A) (Cont.)		**Reduction Furnaces** - Loaded pots were heated in one of two resistance furnaces to produce a zinc-thorium metal derby and calcium fluoride slag. After cooling, the pots were sent to Plant 9 where the metal and CaF_2 were removed and returned to the pilot plant.	-3 furnaces (all removed).
		Thorium Derby Sampling - The clean derbies were weighed and a thin slice was sawn from each for analysis. Sawdust from sampling was drummed and sent to Plant 8 for oxidation.	-Power hacksaw, weight scale (all removed).
		De-Zincing Zn-Th Derbies - (1969-1971) The Zn-Th derbies from the reduction furnaces were placed in a vacuum furnace (P-1) and heated to boil off the zinc. The purified thorium derbies were then saw-sampled. A total of 809 thorium derbies were produced, containing approximately 51 metric tons of thorium metal. For production of 2 to 4% enriched uranium, perchloroethylene was circulated through the furnace cooling jackets prior to using cooling water.	-1 furnace, perchloroethylene. tank.
		ThF_4 Dehydration - Pre-dried ThF_4 from the thorium precipitation step was stacked in pans and placed in a Rockwell resistance furnace for further dehydration. The dried ThF_4 was then milled on a small Sturtivant mill (building 37), packaged and used for thorium derby production.	-Furnace removed, 6 tray driers.
		Original UF_6 to UF_4 Reduction Process - (1952-1957, 1962-1967) This process was similar to the process that replaced it, in roughly the same location, except for the following: only one reactor, UF_6 cylinders heated in a cradle outside (north of building 54A), only one ammonia dissociator (inside, north wall). All equipment including the structural steel decks were removed to make way for the new process.	-Reactor, scrubber, catalytic ammonia dissociator (all removed).
		PLT Furnace - This was an experimental pressurized low temperature (PLT) furnace used to produce metal by continuous feeding of UF_4 and magnesium and separating the molten MgF_2 from the uranium. No practical application was developed from this experiment.	-Furnace removed.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Pilot Plant UF_6 to UF_4 Facility (54A) (Cont.)		**Casting** - Enriched uranium ingots were produced in furnaces P-1 and P-2 by remelting. Perchloroethylene was used in the cooling coils.	-See above.
Pilot Plant Shelter (54B)	Building type C, 50- x 74-ft single-level building, 10 ft high.	**Storage** - Provide temporary storage for UF_4 and other pilot plant materials. **UF_4 from Paraffin** - Paraffin containing UF_4 was heated in kerosene and centrifuged to collect the UF_4.	-Currently storing drums (UF_4, Freon 11). -Centrifuge (all removed).
Pilot Plant Dissociator Shelter (54C)	Building type C, 20- x 48-ft structure, 19 ft high with 1 floor.	**Ammonia Dissociation** - Catalytically cracked anhydrous ammonia to H_2 and N_2 gases for use in the pilot plant UF_6 to UF_4 process.	-3 catalytic ammonia dissociators.
Slag Recycling Building (55A)	Building type A, 32- x 62-ft multilevel building, 42 ft high with 3 floors.	**Slag Milling** - Received magnesium fluoride (slag) from the Plant 5 breakout system via the old slag plant (55B). Two streams, coarse and fine were stored for processing. The coarse stream (representing material produced by the reduction reaction in Plant 5) was ball milled and passed through a 20-mesh screen and an air classifier to select the product particle distribution. Fines (representing pot liner material from the reduction reaction) were passed through the system; only a small fraction was saved. Both products were stored in bins in Plant 55 and subsequently air-veyed to conveyor feed bins in Plant 5. Excess fines, classifier waste, and larger metal particles from screening were drummed for dispositioning or placed in hoppers for transfer to Pit 6.	-Conveyors (vibrating, flight, and pneumatic), bucket elevators, storage bins, ball mill and Rotex (vibrating) screen.
Slag Recycling Pit/Elevator (55B)	Building type A, 12- x 12-ft multilevel building, 38 ft high with 3 floors.	**Slag Processing** - Received magnesium fluoride from the Plant 5 breakout system. Provided initial screening of the 20-mesh material in fines and coarse material streams. In addition, provided a variety of material handling options including pack out of unsplit stream to mobile hoppers (for transport to waste pits), storage of quantities of slag, and conveyance of stored slag to screening process.	-Conveyors, bucket elevator, storage bin.
CP Warehouse (Butler Building) (56A)[b]	Building type C, 50- x 180-ft single-level building, 14 ft high.	**Storage** - Recently functioned as excess furniture and supply storage for the site. Now used for low-level waste drum storage. Formerly used for electrical transformer storage.	-Currently storing RCRA drums.

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Storage Shed West (56B)	Building type C, approximately 24- x 36-ft single-level building, 14 ft high, west of building 56A.	**Construction Tool Storage** - Provides tool storage for the site's primary construction management subcontractor.	-Construction laborer tools.
Storage Shed East (56C)	Building type C, approximately 30- x 50-ft single-level building, 14 ft high, west of building 56A.	**Construction Tool Storage** - Provides tool storage for the site's primary construction management subcontractor.	-Construction laborer tools.
Quonset Hut 1 (60)	Building type C, 41- x 121-ft single-level building, 20 ft high.	**Storage** - Functioned as a storage area for stores equipment, materials, and miscellaneous items.	-Currently storing drums (thorium compounds from Plant 8 silos).
Quonset Hut 2 (61)	Building type C, 41- x 60-ft single-level building, 20 ft high.	**Storage** - Functioned as a storage area for thorium-contaminated equipment from the Bettis operation.	-Thorium-contaminated equipment.
Quonset Hut 3 (62)	Building type C, 41- x 60-ft single-level building, 20 ft high.	**Storage** - Functioned as a maintenance storage area for spare parts and miscellaneous items of bulk size. Currently storing archived samples (drums) from K-65 silos 1 & 2.	-Currently storing drums.
KC-2 Warehouse (63)[b]	Building type B, 79- x 346-ft single-level building, 16 ft high.	**Storage** - Eight storage bays utilized in the following manner: Bay 1 - maintenance storage for "work order request" materials; Bays 2, 3, 4 - stores and inventory control storage for bulk items; Bays 5, 6, 7 - RCRA waste storage; and Bay 8 - maintenance storage for landscaping and snow removal equipment. *A railcar with nitric acid*[b] is east of this area.	-Currently storing drums, equipment, bulk inventory items, and work order materials.
Thorium Warehouse (64)	Building type C, 50- x 320-ft single-level building, 22 ft high.	**Storage** - Stores drummed thorium compounds, metal, and drummed wastes. Also stores uranium derbies and ingots. Center area used for 90-day storage of material awaiting analysis.	-Currently storing drums, uranium ingots, uranium derbies.
		Overpacking - Equipment used for overpacking deteriorated drums of thorium metal. Also to be used to overpack drums of thorium compounds.	-Overpacking control station, inert gas blanketing equipment, robust fork truck.

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Old Plant 5 Warehouse (65)	Building type C, 50- x 210-ft single-level building, 22 ft high.	**Storage** - Stores drummed thorium compounds.	-Currently storing drums.
Drum Reconditioning Building (66)	Building type C, 38- x 101-ft single-level building, 13 ft high.	**Drum Reconditioning** - Cleaned and straightened 30- and 55-gal steel drums entered the facility for steel shot blasting to remove old paint, repainting in the paint spray booth (inside and out), and drying in an electrically heated oven. Drums not reusable were crushed and baled. Currently baling scrap drums for off-site shipment.	-*Shot blaster (Wheelabrator), dust collector,*[b] paint spray booth, continuous drum drying oven, and scrap drum crusher/baler.
Plant 1 Thorium Warehouse (67)[b]	Building type C, 40- x 100-ft single-level building, 22 ft high.	**Storage** - Stores drummed thorium compounds.	-Currently storing drums.
Pilot Plant Warehouse (68)[b]	Building type A, 50- x 100-ft single-level building, 14 ft high, with significant concrete content.	**Storage** - Stored a Co-60 source, thorium compounds, pilot plant equipment, and RCRA waste drums.	-Currently storing drums.
Decontamination Building (69)	Building type B, 43- x 83-ft single-level building, 18 ft high.	**Decontamination** - Various processes are utilized for radiologically decontaminating equipment, tools, vehicles, and scrap: Acid soak vats, caustic soak vat, high pressure water, and steam spray.	-Tanks, vats, spray units.
General In-Process Storage Warehouse (71)	Building type B, 100- x 241-ft single-level building, 13 ft high.	**Storage** - Built in 1964, acted as site's main receiving area for radioactive materials, and provided storage for miscellaneous materials. Now used for waste shipping. **Isotopic Verification** - Verified enrichment levels of off-site receipts. **Fuel Disassembly** - Non-irradiated fuel rod assemblies were disassembled in this building prior to transfer to pin cutter and Fitzpatrick mills in Plant 1 for reclamation of enriched uranium.	-Drums for RCRA sampling, Loft fuel rods. -Isotopic verification equipment. -None (only hand tools used).
Drum Storage Building (72)	Building type A, 31- x 41-ft single-level building, 11 ft high.	**Storage** - Stored industrial cleaning equipment and control panels for ore silo operation. Now used for enriched drum storage, enriched and normal fuel rods.	-Currently storing drums and fuel rods.

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Fire Brigade Training Center Building (73A)[b]	Building type B, 20- x 30-ft multilevel building, 14 ft high.	**Fire Brigade Training** - Used for "hot" and smoke drills for training site fire brigade members. Straw, wood, tires, etc. were used. A tanker truck and an office-type trailer are abandoned nearby.	-Building (empty and condemned), tanker truck, trailer.
Fire Training Pond (73B)[b]	A 45-ft diameter pond and drain pit.	**Fire Brigade Training** - Used for training brigade members in fighting combustible liquid fires. A small horizontal elevated tank in the center of the pond was used to simulate a combustible liquid tank (never filled). Excess water was drained from the area to the drain pit so that combustible liquids would not overflow the pond.	-Water, empty tank.
Fire Training Tank (73C)[b]	A small horizontal tank above the fire training pond.	See pond 73B.	-See pond 73B.
Fire Training Burn Trough (73D)[b]	A steel trough, 4 x 20 ft.	**Fire Brigade Training** - A steel trough, partly subgrade, for volatile liquid fire training. Used oil was ignited for extinguisher training.	-Burn trough, water.
Confined Space Burn Tank (73E)	An 8-ft diameter horizontal steel storage tank.	**Fire Brigade Training** - A steel storage tank from the old tank farm, with one end cut off, converted for use in simulated rescue training.	-Tank from tank farm (end removed).
Plant 2 East Pad (74A)	Over 5,000 ft^2 of open controlled concrete storage pad.	**Storage** - Used as temporary storage of product UO_3 (in drums and mobile hoppers) and waste residues.	-Drums, subsurface drainage pump, and filter, sea/land containers.
Plant 2 West Pad (74B)	Over 10,000 ft^2 of open controlled concrete storage pad.	**Storage** - Storage of feed materials (ore concentrates, residues, and uranium metal scrap) scheduled for consumption in refinery processes.	-Drums, metal skids, excess equipment.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Plant 8 East Pad (74C)[b]	Concrete storage pads with approximately 10,000 ft^2 of open storage area east of Plant 8.	**Storage** - Open storage of drummed residues for processing, Plant 8 product, portable MgF_2 hoppers. **Airport Scrap** - Bulk MgF_2 from the Weldon Springs DOE facility (MCW) was unloaded from railroad gondolas onto the east pad area, where it was drummed and processed. Gondola residues were washed to the sand filter/decant basin near the unloading station. **Pyrophoric Drum Sprinkler** - Water was circulated from the railcar wash pit settling tank through a series of sprinklers located over a drum storage area on the east pad. Pyrophoric materials (uranium chips, turnings, and sawdust) were stored here awaiting oxidation in Plant 8 furnaces.	-Drummed residues, drummed oil, excess equipment. -Conveyor (removed). -Sprinkler system.
Plant 8 West Pad (74D)[b]	Concrete storage pad with approximately 10,000 ft^2 of open storage west of Plant 8.	**Storage** - Open storage of drummed residues, and empty drums, both dirty and clean. **Drum Washing** - See drum washer (8E).	-Drummed residues, drum washer, subsurface drainage pump and filter. -See drum washer (8E)
Plant 4 Pad (74E)	Uncontrolled concrete areas east and south of Plant 4 and west of Plant 4 warehouse totalling more than 15,000 ft^2.	**Temporary Storage** - Temporarily stored mobile hoppers of UO_3 and depleted UF_4, drummed uranium residues, *drummed HF residues (NW)*,[b] and drummed scrap UF_4.	-T-hoppers, J-hoppers, pipe rack, office trailer, nitrogen storage tanks, nitrogen generator, and drummed waste.
Plant 7 Pad (74F)	Concrete areas west and south of Plant 7.	**Storage** - Used for receiving, shipping, and storage of UF_6 cylinders and receiving, shipping, and storage of "T" Hoppers (UF_4 from Paducah and UO_3 from Hanford). Four subgrade tanks were used to collect condensate from steam-heated UF_6 autoclaves west of Plant 7.	-Empty mobile hoppers, waste, empty UF_4 cans, J-hoppers, cylinder dolly, 3 storage tanks, 4 subgrade tanks (removed), and scale.
Plant 5 East Pad (74G)	Approximately 5,000 ft^2 of open concrete storage area north and south of Plant 55.	**Temporary Storage** - Stored Plant 5 drummed residues, reduction pots, Plant 55 residues.	-Empty drums, excess equipment, metal skids, uranium metal.
Plant 5 South Pad (74H)	Approximately 2,000 ft^2 of open concrete driveway.	**Temporary Storage** - This area was used for temporary storage of feed materials entering the south end of Plant 5 (UF_4, magnesium, etc.).	-Dicalite, sea/land containers, structural steel, pipe rack.

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Plant 6 Pads (74J)	Concrete padded storage east, *north*,[b] and west of Plant 6.	**Temporary Storage** - Stored Plant 6 products and residues. Several diked areas had tanks involved with building processes.	-E - Overpacks, excess equipment. W - Cooling water tanks in dike. *N - Tank*[b].
Plant 9 Pads (74K)	Reinforced concrete storage pads with approximately 10,000 ft^2 of open storage.	**Storage** - Used for temporary storage of process residues (CaF_2, MgF_2, thorium and uranium residues, sump cake, etc.) and thorium and uranium chips and turnings. Metal fires were common on the east pad. Portable tanks were filled by hose from spent Zirnlo acid tanks on the west pad.	-N - metal pallets, empty drums, pipe rack, coolant tank (diked). E - pallets, baskets, overpacks W - portable tanks, filtrate tanks, dust collector.
Building 65 West Pad (74L)	Approximately 20,000 ft^2 of concrete padded storage west of building 65.	**Storage** - Used to store baled scrap drums, scrap metal awaiting decontamination, and uranium and thorium residues.	-Excess equipment, overpacks, concrete shielding.
Building 64 East Pad and Railroad Dock (74M)	Approximately 20,000 ft^2 of concrete padded storage east and north of building 64.	**Storage** - Area used for loading/unloading trailers. Later used for storing drummed uranium and thorium residues and equipment awaiting decontamination. The railroad loading dock was never used.	-Drum storage, J-hoppers, wooden boxes, billet tubes, excess equipment, scrap furnace pots, and UO_3 pot burners.
Building 12 North Pad (74N)	Approximately 7,000 ft^2 of concrete padded storage north of building 12A.	**Storage** - Used by plant stores for storage of pipe, drummed oils, and non-radioactive materials for on-site use.	-Diesel fuel tank, pipe, returnable drums, skids.
Decontamination Pad (74P)	Approximately 50,000 ft^2 of controlled curbed concrete storage pad.	**Storage** - The scrap metal pile is primarily contained on this pad.	-Scrap pile.
Plant 8 Old Metal Dissolver Pad (74Q)	Approximately 1,500 ft^2 of acid bricked concrete pad west of building 8A.	**Metal Dissolver** - See building 8A for process description.	-Collected water, (all equipment removed).
Plant 8 North Pad (74R)	Approximately 5,000 ft^2 of concrete padded storage north of building 8A.	**Storage** - Used for storage of drummed residues and scrap metal for furnacing in Plant 8. Also stored U_3O_8 furnace product prior to shipment to the refinery.	-2 NaOH tanks, 1 $Na_2C_2O_4$ tank, tank pit (2 tanks removed), drums of residues, pump house and effluent tanks, and empty drums.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Building 63 West Pad (74S)	Approximately 2,000 ft^2 of concrete padded storage west of building 63.	**Storage** - Small storage area associated with building 63 operations.	-Pipe rack, excess equipment, refractory brick.
Plant 1 Storage Pad (74T)[b]	Concrete storage pad with over 375,000 ft^2 of open storage north, east and west of building 1A.	**Storage** - Primarily open storage of drums, hoppers, and scrap pallets. New tension support structures have been erected, covering ~100,000 ft^2.	-Scrap pallets removed. Two temporary structures erected to provide covered storage on parts of the pad.
Pilot Plant Pad (74U)	Approximately 5,000 ft^2 of concrete padded storage area south of building 54A.	**Storage** - Provide temporary storage of drummed uranium and thorium compounds, equipment and operating supplies. Cylinders of UF_6 were heated in a cubicle near building 13A for processing in the original UF_6 to UF_4 reduction facility of the pilot plant.	-Dust collector (N of building 13A), liquid N_2 storage (NE of building 13B), dust collectors (SE and SW of building 37), HF tank (E of building 37), portable dumpster containing HF (N of building 13A).
Laboratory Pad (74V)[b]	Approximately 1,500-ft^2 concrete open storage and dock area west of building 15.	**Storage** - Provided temporary storage of drummed lab materials and wastes.	-Drums, construction equipment, sea/land containers, liquid N_2, and argon tanks.
Building 39A Pad (74W)[b]	Approximately 5,500-ft^2 concrete open storage pad east of Building 39A.	**Spray Calciner** - Drying of raffinate slurry wastes prior to air conveyance to silos.	-Spray calciner (removed).
		Contaminated Oil Storage - Interim storage of waste oils awaiting incineration in Building 39A.	-Drums of waste oils (removed).
Finished Product/4A Warehouse (77)	Building type C, 120- x 162-ft single-level building, 12 ft high.	**Storage** - (New) Used as a uranium metal storage facility for flat ingot products before shipment, reject products, and uranium metal awaiting processing.	-Flat uranium ingots, drummed uranium metal (owned by DOD - Army).
Future D&D Facility (78)	Building type C, 80- x 100-ft multilevel building, 21 ft high (under construction).	**Decontamination** - The facility will replace the current decontamination facility (building 69) when construction is completed.	-Construction equipment.
Plant 6 Warehouse (79)[b]	Building type C, 100- x 170-ft single-level building, 15 ft high.	**Hazardous Waste Storage** - Facility currently storing drummed RCRA hazardous wastes.	-Currently storing drums.
Plant 8 Warehouse (80)	Building type C, 60- x 170-ft single-level building, 15 ft high.	**Hazardous Waste Storage** - Facility currently storing drummed RCRA hazardous wastes.	-Currently storing drums.

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Plant 9 Warehouse (81)[b]	Building type C, 80- x 100-ft single-level building, 15 ft high.	**Hazardous Waste Storage** - Facility currently storing drummed hazardous wastes.	-Currently storing drums.
Receiving & Incoming Material Inspection Building (82)	Building type C, 100- x 100-ft single-level building, 17 ft high.	**Storage** - Receiving, inspection of nonradioactive supplies and equipment.	-Offices, daily receipts.
Clearwell Line (88)	A pressurized transfer line approximately 2,000 ft long.	**Rainwater Collection** - Water entering the Clearwell area is collected and transferred via 6-in. line to the biodenitrification lagoon (structure 18A).	-Piping.
Parking Lots (89)	2 asphalt-paved car parking lots,1 approximately 425 x 550 ft (East) and 1 approximately 500 x 700 ft (West).	**Parking Lot** - Provides paved parking for employee and visitor vehicles.	-Concrete barriers.
Skeet Range Building (90)	Building type C approximately 15- x 15-ft single-level building.	**Skeet Range** - The building was used to support the skeet range activities as a storage building.	-Unknown.
Railroad Tracks (G-001)	Approximately 3 mi of track and associated hardware.	**Railroad** - Rail service is provided to the majority of the process area by a connection with CSX northwest of the site.	-Track, switches, crossings, 1 engine, and associated hardware.
Site Roads (G-002)	Approximately 5.5 mi of paved roads.	**Roads** - Provides routes of transportation within the facility and between plants. Primarily constructed of concrete and later overpaved with asphalt. Additional roads exist in the non-process areas. Approximately 3 mi of paved road exists within the process area. Approximately 2.5 mi of paved road exists outside the process area.	-Asphalt, concrete.
Storm-Sewer System (G-003)	Subgrade piping and pumps for handling storm water runoff.	**Storm Sewers** - A network of piping, pumps, and associated equipment used to provide drainage for surface water from the site. Flow is continuously monitored and can be diverted or held in the storm-water retention basins (SWRB).	-Drainage lines, 2 lift station pumps, and diverter valve.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Utility Lines (G-004)	All site underground and above ground utilities.	**Utility Lines** - All utility lines, including: electrical piping, water, sewer, gas, and conduit.	-Utility piping, wires, conduit, insulation, and meters.
Underground Storage Tanks (G-005)	Generally steel tanks for petroleum products underground.	**Storage** - A variety of underground steel storage tanks have been used on the site, primarily for petroleum products. Most have been removed as part of the UST program to date and the surrounding areas are undergoing interim remediation.	-One remaining UST, other buried tanks unverified.
Process Side Office Trailers (G-006)	Various sizes of mobile office trailer.	**Offices** - Provide temporary office space for employees and subcontractors. The total quantity of office trailers in use in the process areas of the FEMP varies significantly.	-Trailers, office equipment.
Nonprocess Side Office Trailers (G-007)	Various sizes of mobile office trailers, often linked into multiplexed units.	**Offices** - Provide temporary office space for employees and subcontractors. The total number of office trailers in use in the non-process areas of the site varies significantly.	-Trailers, office equipment.
Pipe Bridges (G-008)	Over 1 mile of structural steel bridges for support of plant high lines.	**High Lines** - Structural steel supports are used extensively throughout the facility for utility lines and process piping. Total linear distance cover by the bridges is estimated at over 1 mile.	-Steel supports and trusses.
Drums (non-RCRA) (G-009)	Drummed non-RCRA wastes.	**Non-RCRA Wastes** - Drummed non-RCRA wastes are stored in a variety of locations throughout the FEMP.	-Drummed waste.
Drums (RCRA) (G-010)	Drummed RCRA wastes.	**RCRA Wastes** - Drummed RCRA designated wastes are primarily stored in *4 buildings: 79, 80, 81, and 63.*[b]	-Drummed waste.
Product Inventory (G-011)	Inventory of FEMP products.	**Product Inventory** - Products such as uranium metal derbies, flat ingots, round ingots, thorium compounds, UO_3 and UF_4 are stored in a variety of locations at the FEMP.	-Product inventory.
Sea/Land Containers (G-012)	Steel containers for waste shipment.	**Sea/Land Containers** - A fluctuating inventory of sea/land containers is maintained at the site for use as shipping and burial containers for FEMP wastes destined for off-site shipment.	-Empty and full sea/land containers.

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TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Construction Soil, Debris, and Rubble Piles (G-013)	Various contaminated soil and rubble piles around the site.	**Construction Rubble Piles** - A variety of contaminated soil, rubble, and debris piles generated from construction activities at the site totaling approximately 35,000 yd^3.	-Construction soil, debris, and rubble piles.
Rock Salt Pile (P-001)	Rock salt pile.	**Draw Pile** - Rock salt pile used to supply salt for application to roads and parking lots.	-Clean rock salt pile.
Sand Piles (P-002)	Sand piles.	**Construction Draw Piles** - Sand piles drawn upon for fill and constructions.	-Clean sand piles.
Gravel Pile (P-003)	Gravel pile.	**Construction Draw Pile** - Gravel pile drawn upon for fill and construction.	-Clean gravel pile.
Scrap metal copper piles (P-004)	Two scrap metal piles north of facility 1D, both approximately 30 ft high, containing a total of 150,000 ft^3 (1350 tons) of copper scrap.	**Storage** - Stored copper from electrical operations at other DOE sites - awaiting reclamation.	-Copper and associated insulation coatings and miscellaneous conduit.
Coal pile (P-005)	Uncovered coal pile, approximately 189,000 ft^3. Volume varies.	**Coal Storage** - Coal is stored in a pile east of building 10A for use in the boilers.	-Coal pile.
Scrap Metal Pile (P-006)	A 15- to 20-ft-high scrap metal pile.	**Scrap Metal Pile** - Approximately 400,000 ft^3 (uncompacted) of various scrap metals from site operations.	-Scrap metal pile.
Outside Equipment Storage Areas (P-007)	Two open field storage areas NE and NW of building 69.	**Scrap Equipment and Vehicle Storage** - Over 130 contaminated and junk vehicles and wheeled equipment from site operations are stored northwest of the decontamination building (69). Contaminated and junk process equipment from past operations are stored northeast of the decontamination facility building (69).	-2 junkyards.
Tension Support Structure 1 (TS-001)	Self-supporting canvas-covered structure, approximately 90- x 300-ft single-level building north of building 71.	**Storage** - Used to provide cover for drummed materials stored on the Plant 1 pad (74T).	-Currently storing drums.

TABLE A.2.1 Description of Structures and Processes

Structure/Facility	Description	Processes/Uses	Equipment/Contents[a]
Tension Support Structure 2 (TS-002)	Self-supporting canvas-covered structure, approximately 90- x 300-ft single-level building north of building 71.	**Storage** - Used to provide cover for drummed materials stored on the Plant 1 pad (74T).	-Currently storing drums.
Tension Support Structure 3 (TS-003)	Self-supporting plastic-covered structure, approximately 60- x 90-ft single level building north of building 30A.	**Storage** - Used to provide cover for drummed materials stored on the Plant 1 pad (74T).	-Currently storing drums.

TABLE A.3

POTENTIAL CONTAMINANTS

Table A.3 lists potential contaminants for each component. Where applicable, potential contaminants are listed for each process that existed within a component. For each component or process, the table lists the historical information sources that indicate the possible presence of the contaminants. Historical information sources are process knowledge, significant quantities of use, spill logs, history of the FEMP, incident reports, data from the perched water removal action, RCRA drummed waste determinations, RCRA reports, and material distribution information. For every component, potential contaminants of concern include uranium, asbestos, lead (in paints and building structure) PCBs, and mercury. These contaminants are in addition to any other potential contaminants listed in Table A.3. Related by-products, decay products, or breakdown products may also be possible for many of the listed potential contaminants. The listing is presented as a best summary of currently available information.

The following legend applies to Table A.3:

Uranium	=	U-235/236, U-234, U-238, + Daughters (where it is known, the maximum enrichment is given in parenthesis as %E). This designation refers to purified process material.
Ore	=	Pitchblende, Q11, or other unrefined uranium-bearing ores.
Ore concentrates	=	Uranium ore material which was refined somewhat at the mine site (i.e., Kerr McGee, Australian, Colorado, Canadian ore feed materials).
Ore raffinate	=	Material stripped from uranium ores by the FEMP refinery extraction process (including but not limited to: radium, thorium, protactinium, and a variety of other radionuclides and metals).
Thorium or thorium compounds	=	Material which originated as thorium 232. May include metal or any or all of the following compounds: thorium tetrafluoride, thorium hydroxide, thorium oxalate, thorium oxide, or thorium nitrate.
Uranium compounds	=	Any or all of the following compounds; U_3O_8, UO_3, UF_4, UO_2, UNH (where possible, the specific compound is identified).
Solvent residues	=	The residual material from solvents used at the FEMP (primarily 1,1,1 trichloroethane, trichloroethylene, and perchloroethylene).

Sump cake	=	Precipitants from the filtration of uranium or thorium solutions.
High grade residues	=	UF_4, U_3O_8, UO_3, UO_2, uranyl ammonium phosphate (UAP), ammonium diuranate (ADU).
Low grade residues	=	Residual material from magnesium fluoride (MgF_2), sump cakes, heat treating salts.
Prill	=	Metallic beads and blobs of uranium, and magnesium from FEMP reduction process.
Metals	=	Aluminum, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, cyanide, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, silver, sodium, thallium, vanadium, zinc.
—	=	No contaminants other than those common to all components.

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Preparation Plant (Plant 1) (1A)	Uranium (up to 20% E), UO_3, UF_4, U_3O_8, thorium, thorium oxalate, ore concentrates, MgF_2, HF	Drum Sampling	Process knowledge/significant quantities, history of FEMP, RCRA reports, spill log
	Halon 1301, MgF_2, ore, ore concentrates	Crushing/milling	Incident reports, history of FEMP, process knowledge/significant quantities
	Uranium (U-235 up to 20% E), ammonia, cesium-137, radium-226, americium-241, arsenic, cadmium, chromium, lead, uranyl nitrate, nitric acid	Enriched materials reclamation	RCRA reports, process knowledge/significant quantities
	NaOH, solvent residues, ore, ore concentrates	Drum washing	History of FEMP, process knowledge/significant quantities
	Still bottoms, 1,1,1-trichloroethane, trichloroethylene, perchloroethylene, carbon tetrachloride, chlordane, chloroform, 1,2-dichloroethane, 1,1-dichloroethylene, vinyl chloride	Solvent reclamation	Process knowledge/significant quantities, RCRA reports, RCRA drummed waste determinations
	Nitric acid, sump cakes	Waste water handling	Process knowledge/significant quantities
	Nitric acid, sump cakes	Repackaging	Process knowledge/significant quantities
Plant 1 Storage Shelter (1B)	Ores, ore concentrates, 1,1,1-trichloroethane, trichloroethylene, perchloroethylene, copper	Covered storage	Process knowledge/significant quantities
	Uncharacterized low-level radioactive and RCRA drummed wastes	Overpacking operations in Plant 1	Process knowledge, RCRA reports, spill logs, RCRA drummed waste determinations
	Copper, asbestos	Copper shredding	Process knowledge/significant quantities
	Sump cake	Drum straightening	Process knowledge/significant quantities

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TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Plant 1 Ore Silos (1C)	U-234, U-235, U-238, Th-234, Th-232, Ra-228, lead, barium, selenium, mercury, arsenic, cadmium, chromium, metal oxide	Milled ore storage, dried raffinate storage	Samples of ore from ore silos release, spill log, process knowledge
Ore Refinery Plant (2A)	Uranium (up to 5% E), uranyl nitrate, Al_2O_3, ore concentrates, ores, high & low grade residues, ammonia, silver, lead, chromium, arsenic, tetrachloroethylene	Digestion	1,1,1-Trichloroethane up to 100 ppb in perched water wells, process knowledge/ significant quantities, incident reports, history of FEMP, RCRA drummed waste determinations
	Uranium (5% E), uranyl nitrate, ores, high grade residues, ammonia	Drum digestion	Process knowledge/significant quantities, history of FEMP
	Uranyl nitrate, ammonia, H_2SO_4, kerosene, tributyl phosphate, NaOH , soda ash, nitric acid, extraction impurities	Extraction	Process knowledge/significant quantities, incident reports
	Uranium (up to 2% E), uranyl nitrate, UO_3, H_2SO_4, nitric acid, thorium nitrate	Denitration	Process knowledge/significant quantities, history of FEMP
	Uranium (up to 10% E), U_3O_8, uranyl nitrate	Enriched calcining	Process knowledge/significant quantities, history of FEMP
	Nitric acid	Nitric acid storage	Process knowledge
General Sump-Refinery Sump Control Building Annex (2B)	Barium oxide, magnesium oxides, magnesium hydroxide, barium hydroxide	Sump monitoring & control	Process knowledge
Bulk Lime Handling Building (2C)	CaO, $Ca(OH)_2$	Bulk lime handling	Process knowledge/significant quantities

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Metal Dissolver Building (2D)	Uranium metal (up to 1.25% E), ammonia, tetrachloroethane, nitric acid, uranyl nitrate, chromium, barium	Metal dissolution	Process knowledge/significant quantities, spill logs, RCRA drummed waste determinations
	Uranium oxides (up to 5% E), nitric acid, uranyl nitrate, chromium, barium	West metal dissolution	Process knowledge/significant quantities, spill logs, RCRA drummed waste determinations
	Kerosene, tributyl phosphate, nitric acid	Charcoal treatment	Process knowledge/significant quantities, spill logs, RCRA drummed waste determinations
NFS Storage & Pump House (2E)	Uranium (up to 5% E), uranyl nitrate, plutonium/neptunium, nitric acid, barium, chromium	NFS storage (uranyl nitrate)	Process knowledge/significant quantities
Tanks Outside Plant 2 (2A)	Uranyl nitrate, plutonium/neptunium, nitric acid, barium, chromium	Uranyl nitrate storage (6 tanks)	Process knowledge/significant quantities, RCRA reports
	Tributyl phosphate, kerosene, extraction impurities	Tributyl phosphate/kerosene storage (5 tanks)	Same as above
	Tributyl phosphate, kerosene	Clean storage (3 tanks)	Same as above
	Tributyl phosphate, kerosene, nitric acid	Bulk unloading	Same as above
	Uranyl nitrate, plutonium/neptunium, nitric acid, barium, chromium	Uranyl nitrate storage (4 tanks)	Same as above
	Nitric acid	Nitric acid storage (3 tanks)	Same as above
	Sulfuric acid	H_2SO_4 storage (1 tank)	Same as above

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TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Plant 2 Cold Side Ore Conveyor (2F)	Ore concentrates, high & low grade residues	Cold side elevator pit	Process knowledge/significant quantities
Plant 2 Hot Side Ore Conveyor (2G)	Uranium (up to 1.25% E), ore, ore concentrate, high & low grade residues	Hot side elevator pit	Process knowledge/significant quantities
Conveyor from Plant 1 Ore Silos (2H)	Ores	Ore conveying	Process knowledge/ore conveying system
Maintenance Building (3A)	Uranium (up to 5% E), 1,1,1-trichloroethane	Maintenance and spare parts storage	Process knowledge/significant quantities; area contains 2 satellite accumulation areas and a parts cleaner
Ozone Building (3B)	Nitric acid	Acid bleaching	Process knowledge
NAR Control House (3C)	—	NAR control	
NAR Towers & Tanks (3D)	Nitric acid, urea	Nitric acid recovery	Process knowledge/significant quantities
Hot Raffinate Building (3E)	Tributyl phosphate, NaOH, kerosene, MgF_2, low grade residue, ore raffinate, uranyl nitrate, tetrachloroethylene, 1,1,1-trichloroethane, barium, chromium, nitric acid	Hot raffinate	Process knowledge/significant quantities, RCRA drummed waste determinations
Harshaw Digestion Fume Recovery (3F)	Ammonia, nitric acid	Harshaw fume recovery, nitric acid production	Process knowledge/significant quantities, spill log
Refrigeration Building (3G)	Refrigerant	Refrigeration	Process knowledge/significant quantities

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TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Refinery Sump (3H)	Uranyl nitrate, MgO, tributyl phosphate, kerosene, magnesium uranate, nitric acid, chromium, barium	Refinery sump	Process knowledge/significant quantities, RCRA reports
Combined Raffinate Tank Area (3J)	Barium carbonate, alum, ore raffinates, uranyl nitrate	Combined raffinate	Process knowledge/significant quantities
	Ore raffinates	Spray calcination	Process knowledge/significant quantities
	Perchloroethylene, lubricating & cutting oil, trichloroethylene, 1,1,1-trichloroethane	Contaminated oil storage	Process knowledge/significant quantities, oil stored in drums
Old Cooling Water Tower (3K)	—	Process water cooling	The cooling water tower has been removed from this location (only foundation remains)
Electrical Substation North of Building 3A (3L)	PCB oils	Electrical distribution	Process knowledge/significant quantities
Green Salt Plant (4A)	Anhydrous ammonia, catalyst (nickel)	Ammonia dissociation	Process knowledge/significant quantities, spill log
	UF_4, U_3O_8, UO_3, UO_2, anhydrous HF, mercury	Hydrofluorination	Process knowledge/significant quantities, incident reports, spill log, history of FEMP
	Anhydrous HF, mercury, ammonia	AHF vaporization	Process knowledge/significant quantities, incident reports, spill log
	UF_4, HF (up to 30 wt%), KOH, KF	HF recovery	Process knowledge/significant quantities, incident reports, spill log, history of FEMP

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TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Green Salt Plant (4A) (Cont.)	UF_4 (depleted and enriched up to 1.25% E)	UF_4 repackaging	Process knowledge/significant quantities, incident reports
	UO_3, UF_4	Moving bed experimental reactor	Process knowledge/significant quantities; the reactor was tested experimentally but never placed into product use
	Ammonia	Nitrogen generation	Process knowledge/significant quantities
	HF (anhydrous and aqueous)	HF refrigeration	Process knowledge/significant quantities; refrigerants were also used in this process; refrigeration system operated from 1954-1956, then was removed
	Thorium oxide, HF, thorium tetrafluoride	Thorium tetrafluoride	Process knowledge/significant quantities; process only operated in 1954
	UF_4, UO_3, UO_2, HF	Water treatment	Process knowledge/significant quantities, incident reports, history of FEMP
	UF_4, UO_3, depleted UF_4, U_3O_8, aqueous HF residues	Storage	Process knowledge/significant quantities, incident reports, history of FEMP
Plant 4 Warehouse (4B)	UF_4, UO_3	UF_4 storage	Process knowledge/significant quantities, history of FEMP
Plant 4 Maintenance Building (4C)	UF_4, trichloroethylene, 1,1,1-trichloroethane, hydraulic oil	Maintenance	Process knowledge/significant quantities, spill log, incident reports

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Metal Production Plant (5A)	UF_4, UO_3, magnesium, MgF_2	South staging & storage	Process knowledge/significant quantities, history of FEMP, incident reports
	Uranium metal (up to 1.25% E), UF_4, UO_3, MgF_2, magnesium, mercury, lead, chromium, cadmium, MgO	Reduction	Process knowledge/significant quantities, history of FEMP, spill logs, incident reports, RCRA reports
	U_3O_8, lubricating oil, MgO, magnesium, lead, zirconium, chromium, yttria	Casting (remelt)	Process knowledge/significant quantities, incident reports, RCRA reports
	Uranium metal (up to 1.25% E), lubricating oil	Ingot cropping	Process knowledge/significant quantities, incident reports
	—	Saw sharpening	
	U_3O_8, zirconium oxide, MgO, yttria	Mold preparation & reconditioning	Process knowledge/significant quantities, RCRA reports
	Uranium, cooling oil, (Shell Turbo 68 oil) perchloroethylene, benzene	Hilco Oil Reclaimer (uranium-contaminated filter cake)	Process knowledge/significant quantities, RCRA reports
	U_3O_8, uranium (up to 1.25% E)	North staging & storage	Process knowledge/significant quantities
	U_3O_8	Graphite machining	Process knowledge/significant quantities
	U_3O_8, UF_4, hydraulic oil, lubricating oil, cooling oil	Water treatment	Process knowledge/significant quantities, RCRA reports
	Zirconium, zirconium oxide	Plasma spraying	Process knowledge/significant quantities; process never used for production

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TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Metal Production Plant (5A) (Cont.)	U_3O_8, UF_4, trichloroethylene, 1,1,1-trichloroethane	Maintenance	Process knowledge/significant quantities
Plant 5 West Side Separation and Pickling (5B)	—	Ingot separation and pickling	New unit, never used
Plant 5 Electrical Substation (5C)	PCB oils	Electrical distribution	Process knowledge/significant quantities
Plant 5 West Side Slag Milling & Derby Breakout (5D)	—	Slag milling	New unit, never used
	—	Derby breakout	New unit, never used
Plant 5 Filter Building (5E)	—	Storage	Stored excess equipment and clean filters
Plant 5 Covered Storage (5F)	Uranium (up to 1.25% E)	Storage	Process knowledge/significant quantities
Plant 5 Ingot Storage Shelter (5G)	Uranium (depleted)	Metal storage	Process knowledge/significant quantities
Metals Fabrication Plant (6A)	Uranium metal, lithium carbonate, potassium carbonate	Rolling mill	Process knowledge/significant quantities; mill out of service since 1970
	Uranium metal, U_3O_8, hydraulic oils, water-soluble oils	Core machining	Process knowledge/significant quantities
	Uranium metal, cooling and hydraulic oils	Misc. machining	Process knowledge/significant quantities, history of FEMP
	Uranium metal, cooling oil, water-soluble oil, hydraulic oil	Coolant oil clarifiers	Process knowledge/significant quantities, history of FEMP
	Uranium metal, U_3O_8, lubricating oil, hydraulic oil, coolant oil, ammonia	Chip briquetting	Process knowledge/significant quantities, history of FEMP

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Metals Fabrication Plant (6A) (Cont.)	Uranyl nitrate cooling oils, U_3O_8, ammonia, cadmium, chromium, lead, benzene, chlorobenzene, toluene, trichloroethylene	Scrap metal pickling	Process knowledge/significant quantities, history of FEMP, RCRA drummed waste determinations
	Ammonia, hydraulic oil	Slug pickling	Process knowledge/significant quantities
	Uranium metal, cooling oil, sodium chloride, potassium chloride,	Tocco furnaces oil quench	Process knowledge/significant quantities
	Uranium metal, sodium chloride, potassium chloride	Salt-water (Nu-Sal) heat treating	Process knowledge/significant quantities
	Sodium sulfide, NaOH	NO_x destructor	Process knowledge/significant quantities
	Uranium	Inspection	
	Uranium, lead	Storage	Process knowledge/significant quantities
	—	Robot	Never used for production
	Uranyl nitrate, chromium	Perched water & clarifier pit	
	MgO, lithium chloride, NaOH, cooling oils, lubricating oils, trichloroethylene, 1,1,1-trichloroethane, lead, carbon tetra-chloride, barium	Water treatment	Process knowledge/significant quantities
	Machining oils	Tool fabrication room	Process knowledge/significant quantities
	Uranium metal, copper, tin	Bronze/tin heat treating	Process knowledge/significant quantities
Plant 6 Covered Storage Area (6B)	Uranium metal, low & high grade residues	Storage east side	Process knowledge/significant quantities
Plant 6 Electrostatic Precipitator South (6C)	U_3O_8, cooling oils	Precipitron	Process knowledge/significant quantities

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Plant 6 Electrostatic Precipitator Central (6D)	U_3O_8, cooling oils	Precipitron	Process knowledge/significant quantities
Plant 6 Electrostatic Precipitator North (6E)	U_3O_8, cooling oils	Precipitron	Process knowledge/significant quantities
Plant 6 Salt-Oil Heat Treat Building (6F)	Uranium metal, sodium chloride, potassium chloride, cooling oil (quench oil)	Salt-oil heat treating	Process knowledge/significant quantities
Plant 6 Sump (New) (6G)	—	Water treatment	Never used.
Plant 7 (7A)	UF_6, UF_4, UO_2, UO_2F_2, HF (aqueous and anhydrous), ammonia	UF_6 to UF_4 reduction	Process knowledge/significant quantities; plant 7 represents a biohazard due to bird droppings
	Ammonia, catalyst (nickel)	N_2 generator	Process knowledge/significant quantities
	UF_4, UO_3, UO_2F_2	Storage	Process knowledge/significant quantities
Plant 7 Overhead Crane (7B)	UF_6, UF_4, UO_3, UO_2F_2	Loading and unloading	Process knowledge/significant quantities
Scrap Recovery Plant (8A)	UF_4, uranium (up to 0.95% E), thorium, NaOH, high grade/low grade residues, tributyl phosphate, lubricating, hydraulic, cooling oil sludges	Drying (rotary kiln) (uranium-contaminated sump cakes)	Process knowledge/significant quantities, history of FEMP, spill log, incident reports
	Uranium (up to 0.95% E), NaOH, MgF_2, mercury	Primary calciner	Process knowledge/significant quantities, history of FEMP, spill log, RCRA reports
	U_3O_8, uranium metal (up to 1.25% E), high grade residues, oily sludges, ammonium diuranate cakes, mercury	Oxidation furnace 1	Process knowledge/significant quantities, history of FEMP, spill log, RCRA reports
	U_3O_8, UF_4, NaOH, calcium uranate, calcium fluoride, mercury	Oxidation furnace 2	Process knowledge/significant quantities, history of FEMP, spill log, incident reports

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Scrap Recovery Plant (8A) (Cont.)	Uranyl ammonium phosphate cake, ammonium diuranate cake, wet low grade scrap cake, mercury, NaOH	Uranyl ammonium phosphate furnace	Process knowledge/significant quantities, history of FEMP, spill log; furnace out of service since early 1970s
	Uranium metal (up to 1.25% E), oil and solvents (1,1,1-trichloroethane, trichloroethylene, perchloroethylene), magnesium	Box furnace	Process knowledge/significant quantities, RCRA reports
	U_3O_8, MgF_2, arsenic, lead, wet low grade sump cakes, prill, lithium & potassium carbonate	Muffle furnace	Process knowledge/significant quantities, history of FEMP, RCRA reports
	Uranium metal (up to 0.71% E), graphite	Graphite furnace	Process knowledge/significant quantities, RCRA reports; graphite only burned for 3 months
	Uranium metal, Hcl, prill, magnesium	Metal dissolver	Process knowledge/significant quantities
	UF_4, HF (aqueous & anhydrous), KOH	Greensalt reversion	Process knowledge/significant quantities
	Uranium (up to 0.95% E), MgF_2	Milling	Process knowledge/significant quantities, history of FEMP
	Lithium & calcium carbonates	Crushing	Process knowledge/significant quantities
	MgF_2 slag	Ball mill	Process knowledge/significant quantities, history of FEMP
	U_3O_8, UF_4	Rotexing	Process knowledge/significant quantities, incident reports
	Uranium (up to 0.95% E), MgF_2, Hcl, copper, phosphoric acid, ammonium hydroxide	Hydrometallurgical system	Process knowledge/significant quantities, history of FEMP, RCRA reports
	U_3O_8, uranyl ammonium phosphate cake, Hcl, ammonia, aqueous HF, $CuSO_4$, SO_2, UF_4	WINLO	Process knowledge/significant quantities, history of FEMP; WINLO process operated 1962-1964; was removed in mid- 1970s

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TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Scrap Recovery Plant (8A) (Cont.)	Uranium, thorium, NaOH, Hcl, diatomaceous earth	Water treatment & filtration	Process knowledge/significant quantities, spill logs
	Carbon tetrachloride, tetrachloroethylene, trichloroethylene 1,1,1-trichloroethane, acetone, ethylbenzene, methyl ethyl ketone, toluene, xylene	Oil centrifuge	Process knowledge/significant quantities, RCRA drummed waste determinations
	Thorium hydroxide, thorium tetrafluoride, HF (aqueous & anhydrous), KOH	Thorium tetrafluoride reversion	Process knowledge/significant quantities
	Thorium oxalate, thorium hydroxide	Thorium residue recovery	Process knowledge/significant quantities
	Thorium hydroxide, thorium oxalate, thorium oxides	Thorium storage	Process knowledge/significant quantities
	NaOH, H_3PO_4	Bulk storage	Process knowledge/significant quantities, spill log
Plant 8 Maintenance Building (8B)	Lubricating, cooling, hydraulic oils, degreasing solvents	Maintenance	Process knowledge/significant quantities
Rotary Kiln/Drum Reconditioner (8C)	—	New rotary kiln	
		New drum reconditioning	
Plant 8 Railroad Filter Building (8D)	U_3O_8, uranium (up to 1.25% E), MgF_2	Filtration	Process knowledge/significant quantities, history of FEMP
Plant 8 Old Drum Washer (8F)	Uranium metal, thorium, NaOH	Drum washing	Process knowledge/significant quantities, history of FEMP
Special Products Plant (9A)	Uranium (up to 2.1% E), zirconium	Enriched uranium casting	Process knowledge/significant quantities, history of FEMP
	Uranium (up to 2.1% E), NaOH, aqueous HF, ammonia, copper, zirconium, nickel, aluminum	Zirnlo decladding	Process knowledge/significant quantities, history of FEMP, spill log

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Special Products Plant (9A) (Cont.)	Uranium (up to 2.1% E), U_3O_8, lubricating oil	Uranium machining	Process knowledge/significant quantities
	Depleted uranium, lithium & potassium carbonate, magnesium, MgF_2	Derby cleaning	Process knowledge/significant quantities, incident report
	Uranium (up to 2.1% E), NaCl, KCl	Triple beta heat treating	Process knowledge/significant quantities
	Thorium tetrafluoride, zinc fluoride	Thorium metal	Process knowledge/significant quantities
	UF_4, dolomite, MgF_2, magnesium, prill	Uranium reduction	Process knowledge/significant quantities, spill log
	Lubricating/cooling oil	I & E remelt furnaces	Process knowledge/significant quantities, (furnaces removed and location filled with concrete)
	U_3O_8, ammonia, hydraulic oil, cooling oil, lube oil	Briquetting	Process knowledge/significant quantities
	U_3O_8, uranyl nitrate, ammonia	Scrap metal pickling	Process knowledge/significant quantities
Plant 9 Sump Treatment (9B)	Uranium (up to 2.1% E), uranyl nitrate, trichlorethylene, copper, zirconium, nickel, aluminum, NaOH, HF	Water treatment	Process knowledge/significant quantities, history of FEMP, incident report; uranium- and solvent-contaminated perched water detected by removal action sampling of wells in and near Plant 9
Plant 9 Dust Collector (9C)	UF_4, MgF_2, dolomite	Dust collection	Process knowledge/significant quantities
Plant 9 Electrical Substation (9D)	PCB oils	Electrical distribution	Process knowledge/significant quantities
Plant 9 Cylinder Shed (9E)	—	Cylinder storage	

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Plant 9 Electrostatic Precipitator House (9F)	U_3O_8, uranium metal (up to 2.1% E)	Precipitron	Process knowledge/significant quantities
Boiler Plant (10A)	Sulfur, fly ash, mercury, 1,1,1-trichloroethane, lead, oil	Steam production	Process knowledge/significant quantities, RCRA reports, spill log
Boiler Plant Maintenance Building (10B)	Degreasing solvents (1,1,1-trichloroethane), lubricating oils	Boiler plant maintenance	Process knowledge/significant quantities, RCRA reports
Wet Salt Storage Bin (10C)	—	Wet salt storage (brine)	
Oil Burner/Graphite Burner Pad (10D)	Uranium (up to 1.25% E)	Graphite burner	Process knowledge/significant quantities
	Uranium (up to 1.25% E), tributyl phosphate, kerosene, lubricating, hydraulic, machine oils. spent solvents 1,1,1-trichloroethane, perchloroethylene, trichloroethylene	Oil burner	Process knowledge/significant quantities
	Uranium (up to 1.25% E), tributyl phosphate, kerosene, lubricating, hydraulic, machine oils. spent solvents 1,1,1-trichloroethane, perchloroethylene, trichloroethylene	Sump	Process knowledge/significant quantities
Service Building (11)	Uranium, perchloroethylene, trichloroethylene, lead, magnesium, vinyl chloride	Laundry	Process knowledge/significant quantities, RCRA reports, incident reports, RCRA drummed waste determinations
	Uranium	Locker rooms	Process knowledge/significant quantities
	—	Cafeteria	
Main Maintenance Building (12A)	Uranium, thorium, solvents, (1,1,1-trichloroethane, perchloroethylene), motor oils, lubricating oils, hydraulic oil, paint, mercury, silver	Main maintenance, stores, and offices	Process knowledge/significant quantities, spill log, RCRA reports

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Cylinder Storage Building (12B)	—	Cylinder storage	
Lumber Storage Building (12C)	—	Lumber storage	
Pilot Plant Wet Side (13A)	Uranium (up to 1.0% E), thorium, tributyl phosphate, kerosene, diamyl amyl phosphonate, radium, naphtha mineral spirits	Solvent extraction	Process knowledge/significant quantities
	Uranium, thorium, NaOH, ammonia, magnesium oxide, MgF_2, lead, 1,1,1-trichloroethane, NaCl, HF, oxalic acid, tributyl phosphate, kerosene, mercury, copper, nickel, chromium, HF, ammonia, MgO, barium, cadmium, benzene	Sump process	Process knowledge/significant quantities, RCRA reports, spill logs, RCRA sampling of pilot plant sump
	Thorium, ammonia	Thorium digestion	Process knowledge/significant quantities
	Thorium oxalate, thorium nitrate, oxalic acid	Thorium oxalate	Process knowledge/significant quantities
	Ammonia, thorium hydroxide	Thoria gel (hydrated oxide)	Process knowledge/significant quantities
	Thorium tetrafluoride, thorium nitrate, Hcl	Thorium tetrafluoride precipitation	Process knowledge/significant quantities
	Zinc fluoride, HF (aqueous)	ZnF_2 precipitation	Process knowledge/significant quantities
	Calcium fluoride, MgF_2	Pot liner preparation	Process knowledge/significant quantities
	Uranium, aluminum, ammonia, NaOH, nickel	Decladding fuel elements	Process knowledge/significant quantities
	Uranium (up to 2.5% E), U_3O_8	Enriched oxidation furnace	Process knowledge/significant quantities
	Barium chloride, barium sulfate	Barium chloride conversion	Process knowledge/significant quantities, RCRA reports

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Pilot Plant Maintenance Building (13B)	Hydraulic, lubricating oils, mercury	Maintenance	Process knowledge/significant quantities; oils are potentially contaminated with uranium and thorium
Sump Pump House (13C)	Uranium, thorium, NaOH, magnesium oxide	Sump pump house	Process knowledge/significant quantities
Pilot Plant Thorium Tank Farm (13D)	Uranyl nitrate, thorium, thorium nitrate, 1,1,1-trichloroethane, mineral spirits, ammonia, NaOH, diamyl amyl phosphonate, tributyl phosphate, kerosene	Thorium tank farm	Process knowledge/significant quantities, RCRA reports
Administration Building (14A)	—	Offices	
EOC Emergency Electrical Generator (14B)	Diesel fuel	Emergency operations	Process knowledge/significant quantities; new, approximately 1986
Laboratory Building (15)	Uranyl nitrate, U_3O_8, thorium, mercury, 1,1,1-trichloroethane, acetone, PCB's, asbestos, chloroform, ammonia, europium-152, thorium nitrate, tetrachloroethylene, niobium, lanthanum, lead, silver, platinum, acids (nitric, sulfuric, acetic, hydrochloric, hydrofluoric, chromic, perchloric), solvents, plutonium, argon, nitrogen, miscellaneous laboratory chemicals and reagents	Laboratories	Process knowledge/significant quantities, RCRA reports, incident reports, spill log; europium used in rare earth analysis; many other small quantity compounds and standards have been utilized
Main Electrical Station (16A)	PCB oils	Electrical distribution	Process knowledge/significant quantities
Electrical Substation (16B)	PCB oils	Electrical distribution	Process knowledge/significant quantities
Electrical Panels & Transformer (16C)	PCB oils	Electrical distribution	Process knowledge/significant quantities

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Main Electrical Switch House (16D)	—	Electrical distribution	
Main Electrical Transformers (16E)	PCB oils	Electrical distribution	Process knowledge/significant quantities
Trailer Electrical Substation 1 (16F)	PCB oils	Electrical distribution	Process knowledge/significant quantities
Trailer Electrical Substation 2 (16G)	PCB oils	Electrical distribution	Process knowledge/significant quantities
Biodenitrification Surge Lagoon (18A)	Uranium, 1,1,1-trichloroethane, nitrates	Lagoon	RCRA reports, process knowledge/ significant quantities
General Sump (18B)	Uranium, thorium, spent solvents (1,1,1-trichloroethane, trichloroethylene, perchloroethylene)	General sump	Process knowledge/significant quantities
Coal Pile Runoff Basin (18C)	Uranium, 1,1,1-trichloroethane	Runoff retention	Process knowledge/significant quantities, RCRA reports
Biodenitrification Towers Building (18D)	Phosphoric acid, sulfuric acid, methanol	Biodenitrification	Process knowledge
Storm-Water Retention Basin (18E)	Uranium	Storm-water retention	Process knowledge/significant quantities, incident reports
Clearwell Pump House (18G)	Uranium, 1,1,1-trichloroethane	Clearwell pumping	Process knowledge/significant quantities, RCRA reports
Biodenitrification Effluent Treatment Facility (18H)	Uranium, oil	Effluent treatment	Process knowledge/significant quantities, incident reports, spill log

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TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Methanol Tank (18J)	Methanol	Methanol storage	Process knowledge/significant quantities
Low Nitrate Tank (18K)	Uranium, nitrates, 1,1,1-trichloroethane	Low nitrate tank	Process knowledge/significant quantities, RCRA reports
High Nitrate Tank (18L)	Uranium, nitrates, 1,1,1-trichloroethane	High nitrate tank	Process knowledge/significant quantities, RCRA reports
High Nitrate Storage Tank (18M)	—	High nitrate storage	Never used
Main Tank Farm (19A)	Ammonia, dilute HF, anhydrous HF, KF, tributyl phosphate, kerosene, Hcl, oil	Bulk storage	Process knowledge/significant quantities, incident reports, spill log
Pilot Plant Ammonia Tank Farm (19B)	Anhydrous ammonia	Ammonia storage	Process knowledge/significant quantities
Main Tank Farm Control Room (19C)	—	Offices	
Old North Tank Farm (19D)	Anhydrous ammonia & HF, KF, Hcl, dilute HF	Bulk storage	Process knowledge/significant quantities
	Anhydrous HF and residues	Sump	Process knowledge/significant quantities, RCRA reports
Pump Station & Power Center Building (20A)	Chlorine (as hypochlorite)	Pumps	Process knowledge/significant quantities
Water Plant Building (20B)	Alum, lime, sulfuric acid	Water treatment	Process knowledge/significant quantities
Cooling Towers (20C)	Chromium, pentachlorophenol (wood preservative)	Water cooling	
Elevated Potable Storage Tank (20D)	—	Water storage	

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Well House 1 (20E)	—	Water pumping	
Well House 2 (20F)	—	Water pumping	
Well House 3 (20G)	—	Water pumping	
Process Water Storage Tank (20H)	—	Water storage	
Gas Meter Building (22A)	—	Gas metering and distribution	
Storm-Sewer Lift Station (22B)	Uranium	Lift station	Process knowledge/significant quantities
Truck Scale (22C)	—	Truck scale	
Scale House and Weigh Scale (22D)	—	Scale operation	
Utility Trench to K-65 Area (22E)	Uranium (up to 0.71% E), MgF_2, raffinates, ore raffinates	Transfer lines	Process knowledge/significant quantities
Meteorological Tower (23)	—	Meteorological tower	
Railroad Scale House (24A)	—	Scale house	
Railroad Engine House (24B)	Ethylene glycol & lubricating oils	Engine storage	Process knowledge/significant quantities
Chlorination Building (25A)	Chlorine	Chlorination	Process knowledge/significant quantities
Manhole 175 and Sampling Building (25B)	Uranium; trace contaminants in site effluents	Manhole 175 & effluent line	Process knowledge/significant quantities

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TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Sewage Lift Station Building (25C)	Hydrogen sulfide	Lift station	Process knowledge/significant quantities
UV Disinfection Building (25D)	—	Ultraviolet disinfection	
Digester and Control Building (25E)	—	Anaerobic sewage digestion	
Sludge Drying Beds (25F)	1,1,1-trichloroethane, uranium, perchloroethylene, vinyl chloride, trichloroethylene	Sludge settling	RCRA reports
Primary Settling Basins (25G)	—	Clarifiers	Elevated levels from radiological field survey equipment
Trickling Filters (25H)	—	Trickling filters	
Pump House-HP Fire Protection (26A)	Lubricating oils	Fire protection water pumping	Process knowledge/significant quantities
Elevated Water Storage Tank (26B)	—	Water storage	
Main Electrical Strainer House (26C)	Halon	Main electrical deluge system	Process knowledge/significant quantities
Security Building (28A)	—	Security services	
Human Resources Building (28B)	—	Offices	
Security Checkpoint (28C)	—	Checkpoint	
Guard Post West End of 2nd St. (28D)	—	Checkpoint	

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Chemical Warehouse (30A)	Paint, lime, MgO, diatomaceous earth, lithium carbonate, potassium carbonate	Chemical storage	Process knowledge/significant quantities
Drum Storage Warehouse (30B)	—	Drum storage	
Old Ten Ton Scale (30C)	—	Scale operations	
Garage - Engine House (31A)	Waste oil, solvents, 1,1,1-trichloroethane, asbestos, gasoline, H_2SO_4, mercury, ethylene glycol	Garage	Process knowledge/significant quantities, spill log, RCRA reports
Old Truck Scale Platform (31B)	—	Scale operation	
Magnesium Storage Building (32A)	Magnesium	Magnesium storage	Process knowledge/significant quantities
Magnesium Storage Covered Dock (32B)	Uranium, thorium, magnesium	Dock	Process knowledge/significant quantities
Pilot Plant Annex (37)	U_3O_8, uranium	Grit-blasting furnace crucibles	Process knowledge/significant quantities; steel shot was used.
	Zirconia, MgO	Plasma spraying of crucibles	Process knowledge/significant quantities
	Uranium (up to 1.25% E), thorium, lubricating oils, zinc	Oil reclaimer	Process knowledge/significant quantities
	Uranium (up to 1.25% E), thorium, zinc	De-zincing furnace	Process knowledge/significant quantities
	UF_4, magnesium	Briquetting	Process knowledge/significant quantities
	Uranium metal (up to 0.71% E), MgF_2	Uranium derby cleaning (Rotoblaster)	Process knowledge/significant quantities
	ThF_4, ZnF_2	Milling thorium tetrafluoride	Process knowledge/significant quantities

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TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Pilot Plant Annex (37) (Cont.)	Calcium	Calcium metal storage	Process knowledge/significant quantities
	Uranium metal (up to 1.25% E)	Box furnace	Process knowledge/significant quantities
	—	Flats outgassing	Process knowledge/significant quantities
	Quench oil, sodium & potassium chloride	NuSal heat treating	Process knowledge/significant quantities
	Uranium metal (up to 5% E)	Enriched derby production	Process knowledge/significant quantities; reduction furnace out of service since 1970.
Propane Storage (38A)	Propane	Propane storage and propane distribution	Process knowledge/significant quantities
Cylinder Filling Shed (38B)	—	Propane cylinder filling	
Incinerator Building (39A)	Uranium, UO_3, ammonia, raffinates	Drum dryer	Process knowledge/significant quantities, spill log
	Uranium	Trash baler operation	Process knowledge/significant quantities
	Uranium, spent solvents, 1,1,1-trichloroethane, trichloroethylene, perchloroethylene, spent lubricating/hydraulic oils	Liquid waste incinerator	Process knowledge/significant quantities, RCRA reports; uranium- and solvent-contaminated perched groundwater detected by removal action sampling
	Uranium, 1,1,1-trichloroethane, acetone	Solid waste incinerator	Process knowledge/significant quantities, RCRA reports
Waste Oil Decant Shelter (39B)	Spent solvents, (1,1,1-trichloroethane, trichloroethylene, perchloroethylene) spent lubricating and hydraulic oils	Oil-water separation	Process knowledge/significant quantities

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TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Incinerator Building Sprinkler Riser House (39C)	—	Incinerator sprinkler riser	
Sewage Treatment Plant Incinerator (39D)	Uranium, hydraulic and lubricating oil	Waste incineration	Process knowledge/significant quantities
Rust Engineering Building (45A)	—	Offices	Present use
	Uranium metal, uranium carbide, ammonium sulfate, U_3O_8, oil	Machine shop	Process knowledge/significant quantities, RCRA reports, incident reports, (past use)
	Cutting oil	Miscellaneous processes	Process knowledge/significant quantities; Rust's fabrication shop is the present use of this facility
Utility Shed (45B)	—	Storage	
Heavy Equipment Building (46)	Oil	Heavy equipment storage	Process knowledge/significant quantities, RCRA reports; spent spray paint cans were also stored in this area
UF_6 to UF_4 Reduction Facility 2 (51)	—	UF_6 to UF_4	Never used
		Advanced wastewater treatment	Under construction
Safety and Health Building (53A)	—	Offices	
	Mercury, silver	Medical services	Process knowledge/significant quantities, spill log
	—	Security	
In-Vivo Monitoring Building (53B)	Germanium	In-vivo monitoring	Process knowledge

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TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Pilot Plant UF_6 to UF_4 Facility (54A)	UF_6, UF_4, ammonia, anhydrous and aqueous HF, UO_2F_2	UF_6 to UF_4	Process knowledge/significant quantities, incident report
	ThF_4, calcium fluoride, magnesium	Jolter	Process knowledge/significant quantities
	UF_4, ThF_4, calcium & zinc fluoride, MgF_2	Furnace pot loading	Process knowledge/significant quantities, incident report
	UF_4, ThF_4, MgF_2, calcium & zinc	Reduction furnaces	Process knowledge/significant quantities, incident report
	Uranium, thorium, water soluble oil, coolant	Thorium metal sampling	Process knowledge/significant quantities
	Uranium metal, thorium metal, zinc, perchloroethylene	De-zincing Zn-Th derbies	Process knowledge/significant quantities
	ThF_4	ThF_4 dehydration	Process knowledge/significant quantities
	UF_4, UF_6, UO_2F_2	Original UF_6 to UF_4 reduction process	Process knowledge/significant quantities, incident report
	UF_4, magnesium	PLT furnace	Process knowledge/significant quantities, incident report
	Uranium metal (up to 1.25% E), perchloroethylene	Casting	Process knowledge/significant quantities
Pilot Plant Shelter (54B)	Uranium, UF_4, ThF_4, thorium oxalate, thorium hydroxide	Storage	Process knowledge/significant quantities
	UF_4, kerosene	UF_4 from paraffin	Process knowledge/significant quantities
Pilot Plant Dissociator Shelter (54C)	Ammonia, nickel	Ammonia dissociation	Process knowledge/significant quantities

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Slag Recycling Building (55A)	MgF_2, prill, magnesium, uranium	Slag milling	Process knowledge/significant quantities, RCRA reports
Slag Recycling Pit/ Elevator (55B)	MgF_2, prill, magnesium, uranium	Slag processing	Process knowledge/significant quantities, RCRA reports
CP Warehouse (Butler Building) (56A)	KOH, acetic acid, silver nitrate, oil	Storage	Process knowledge/significant quantities, spill log, RCRA reports
Storage Shed West (56B)	—	Construction tool storage	
Storage Shed East (56C)	—	Construction tool storage	
Quonset Hut 1 (60)	Thorium oxide, thorium hydroxide, thorium oxalate	Storage	Process knowledge/significant quantities
Quonset Hut 2 (61)	Thorium	Storage	Process knowledge/significant quantities
Quonset Hut 3 (62)	—	Storage	K-65 silos 1 and 2 samples are stored in this facility
KC-2 Warehouse (63)	1,1,1-trichloroethane, perchloroethylene, fuel oil, acetone, kerosene, PCBs	Storage	Process knowledge/significant quantities, spill log
Thorium Warehouse (64)	Uranium metal (up to 1.25% E), U_3O_8, uranyl nitrate, thorium compounds and metal, hydraulic oil	Storage	Process knowledge/significant quantities, spill log; paint was also stored at this facility
	Thorium oxide	Overpacking	Process knowledge/significant quantities
Old Plant 5 Warehouse (65)	Thorium hydroxide, thorium oxalate	Storage	Process knowledge/significant quantities
Drum Reconditioning Building (66)	Cadmium, xylene	Drum reconditioning	Process knowledge/significant quantities, RCRA reports; paint was also stored in this facility

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TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Plant 1 Thorium Warehouse (67)	Uranium compounds, thorium oxides, silver, cadmium, lead	Storage	Process knowledge/significant quantities, RCRA reports
Pilot Plant Warehouse (68)	Uranium compounds & metal, thorium compounds & metals	Storage	Process knowledge/significant quantities, RCRA reports
Decontamination Building (69)	NaOH, ammonia, sodium silicate, lead, methyl ethyl ketone, used oils and lubricants, nitric acid	Decontamination	Process knowledge/significant quantities, RCRA reports, spill log
General In-Process Storage Warehouse (71)	Uranium (up to 20% E), U_3O_8, thorium oxides, oil	Storage	Process knowledge/significant quantities, spill log
	Uranium (up to 20% E), U_3O_8, thorium oxides	Isotopic verification	Process knowledge/significant quantities
	Uranium (up to 4.6% E)	Fuel disassembly	Process knowledge/significant quantities
Drum Storage Building (72)	Uranium (up to 1.25% E)	Storage	Process knowledge/significant quantities
Fire Brigade Training Center Building (73A)	Uranium, waste solvents and oils	Fire brigade training	Process knowledge/significant quantities, RCRA reports
Fire Training Pond (73B & 73C) w/Tank	Uranium, used oils (hydraulic, lubricating), toluene, waste paint solvents & thinners	Fire brigade training	Process knowledge/significant quantities, RCRA reports
Confined Space Burn Tank (73E)	HF	Fire brigade training	Process knowledge/significant quantities; this tank was a "cleaned" tank from the old tank farm and was never used in the fire training area (probably an out-of-service HF tank)
Fire Training Burn Trough (73D)	Uranium, PCB, waste solvents and oils (hydraulic, lubricating), magnesium	Fire brigade training	Process knowledge/significant quantities, RCRA reports; the burn trough is a reclaimed salt bath trough from Plant 6

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Plant 2 East Pad (74A)	Uranyl nitrate, UO_3 (up to 3% E), uranium (up to 5% E)	Storage	Process knowledge/significant quantities
Plant 2 West Pad (74B)	UO_3, U_3O_8, UO_2, uranyl nitrate, uranyl ammonium phosphate cakes, ore, lead, ore concentrates, ammonium diuranate, MgF_2, aluminum oxide, urea, oil	Storage	Process knowledge/significant quantities, incident reports, spill log, RCRA construction waste sampling
Plant 8 East Pad (74C)	Uranium, uranium metal (up to 1.25% E), thorium compounds, 1,1,1-trichloroethane	Storage	Process knowledge/significant quantities
	MgF_2	Airport scrap	Process knowledge/significant quantities
	Oil, uranium	Pyrophoric drum sprinkler	Process knowledge/significant quantities
Plant 8 West Pad (74D)	Uranium, 1,1,1-trichloroethane, copper	Storage	Process knowledge/significant quantities, spill log, RCRA reports; uranium- and solvent-contaminated perched water has been detected in this area
	Uranium, thorium, oil residues, NaOH	Drum washing	Process knowledge/significant quantities
Plant 4 Pad (74E)	Uranium, UF_4, UO_3, UO_2, U_3O_8	Temporary storage	Process knowledge/significant quantities
Plant 7 Pad (74F)	UF_4, UO_3, UF_6, UO_2F_2	Storage	Process knowledge/significant quantities
Plant 5 East Pad (74G)	Uranium (up to 1.25% E), UF_4, magnesium	Temporary storage	Process knowledge/significant quantities
Plant 5 South Pad (74H)	UF_4, MgF_2	Temporary storage	Process knowledge/significant quantities
Plant 6 Pads (74J)	Uranium metal (up to 1.25% E)	Temporary storage	Process knowledge/significant quantities, incident report, RCRA reports
Plant 9 Pad (74K)	Uranium, uranium metal (up to 2.1% E), U_3O_8, thorium, thorium compounds, ThF_4, radium, strontium-90, MgF_2, CaF_2	Storage	Process knowledge/significant quantities, incident report

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Building 65 West Pad (74L)	Uranium and thorium metal, thorium compounds,	Storage	Process knowledge/significant quantities
Building 64 East Pad and Railroad Dock (74M)	Uranium and thorium compounds, magnesium	Storage	Process knowledge/significant quantities
Building 12 North Pad (74N)	Diesel fuel, ethylene glycol, solvents (1,1,1-trichloroethane, trichloroethylene), lubricating and hydraulic oils	Storage	Process knowledge/significant quantities
Decontam. Pad (74P)	Uranium, thorium, oil	Storage	Process knowledge/significant quantities, spill log
Plant 8 Old Metal Dissolver Pad (74Q)	Hcl, magnesium, prill	Metal dissolver	
Plant 8 North Pad (74R)	Uranium, U_3O_8, uranium metal (up to 1.25% E), thorium metal, magnesium, SO_2, ammonium hydroxide	Storage	
Building 63 West Pad (74S)	—	Storage	
Plant 1 Storage Pad (74T)	Uranium (up to 1.25% E) UO_3, U_3O_8, thorium compounds, ore concentrates, ores, radium, technetium-99 residues, MgF_2, methylene chloride, acetone, lead, barium, 1,1,1-trichloroethane, perchloroethylene, lithium carbonate, arsenic, silver, cadmium, other drummed RCRA wastes, hazardous waste	Storage	Process knowledge/significant quantities, history of FEMP, incident reports, spill log, RCRA reports
Pilot Plant Pad (74U)	Uranium and thorium compounds, UF_6, aqueous HF, ammonia, oil	Storage	Process knowledge/significant quantities, spill log

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Laboratory Pad (74V)	Uranium and thorium samples, ammonia, HF, tributyl phosphate, kerosene, diamyl amyl phosphonate,	Storage	Process knowledge/significant quantities
Finished Product/4A Warehouse (77)	Uranium metal	Storage	Process knowledge/significant quantities; product inventory of this facility is owned by the Department of Defense
Future D&D Facility (78)	—	Decontamination	
Plant 6 Warehouse (79)	Drummed uranium & RCRA wastes, hazardous waste	Hazardous waste storage	All drums have been previously RCRA characterized; facility constructed approximately 1985
Plant 8 Warehouse (80)	Drummed RCRA wastes & uranium, hazardous waste	Hazardous waste storage	All drums have been previously RCRA characterized
Plant 9 Warehouse (81)	Drummed RCRA wastes & uranium, hazardous waste	Hazardous waste storage	All drums have been previously RCRA characterized
Receiving & Incoming Material Inspection Building (82)	—	Storage	
Clearwell Line (88)	—	Rainwater collection	
Parking Lots (89)	Motor oils, ethylene glycol, gasoline	Parking lot	Process knowledge/significant quantities
Skeet Range Building (90)	Lead	Skeet range	Process knowledge/significant quantities
Railroad Tracks (G-001)	Uranium ore, creosote, MgF_2, ammonia	Railroad	Process knowledge/significant quantities
Site Roads (G-002)	Motor oils, hydraulic fluids, ethylene glycol, gasoline, uranium compounds	Roads	

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TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Storm-Sewer System (G-003)	Uranium, lead, barium, solvent wastes	Storm sewers	Process knowledge/significant quantities
Utility Lines (G-004)	Asbestos, uranium (ores, raffinates, and compounds)	Utility lines	Process knowledge/significant quantities
Underground Storage Tanks (G-005)	Petroleum compounds, waste oils, solvents	Storage	
Process Side Trailers (G-006)	—	Offices	
Nonprocess Side Trailers (G-007)	—	Offices	
Pipe Bridges (G-008)	Uranium, asbestos, lead	High lines	Process knowledge/significant quantities
Drums (non-RCRA) (G-009)	Uranium, thorium, etc.	Non-RCRA wastes	Process knowledge/significant quantities
Drums (RCRA) (G-010)	Hazardous wastes	RCRA wastes	Process knowledge/significant quantities, RCRA reports
Product Inventory (G-011)	Uranium, thorium	Product inventory	Process knowledge/significant quantities, RCRA reports
Sea/Land Containers (G-012)		Sea/land containers	
Construction Soil Debris and Rubble Piles (G-013)		Construction rubble piles	

TABLE A.3 Potential Contaminants

Structure/Facility	Potential Contaminants	Associated Process	Reference Source/Comments
Rock Salt Pile (P-001)		Draw pile	Process knowledge/significant quantities
Sand Pile (P-002)		Construction draw pile	
Gravel Pile (P-003)		Construction draw pile	
Scrap Metal Copper Piles (P-004)	Copper, asbestos	Storage	Process knowledge/significant quantities
Coal Pile (P-005)		Coal storage	Process knowledge/significant quantities
Scrap Metal Pile (P-006)	Uranium	Scrap metal pile	Process knowledge/significant quantities
Outside Equipment Storage Areas (P-007)	Uranium, H_2SO_4, ethylene glycol, lead, motor oil, asbestos, motor fuels	Scrap-equipment/vehicle storage	Process knowledge/significant quantities
Tension Support Structure 1 (TS-001)		Storage	
Tension Support Structure 2 (TS-002)	—	Storage	
Tension Support Structure 3 (TS-003)	—	Storage	

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TABLES A.4.0 and A.4.1

OPERABLE UNIT 3 STRUCTURES/EQUIPMENT RADIOLOGICAL SURVEYS

These tables detail, by component, results obtained from on-site radiological surveys. Survey results are reported for alpha and combined beta and gamma detection. Two types of contamination are measured:

- Removable: Loose contamination that readily transfers to a smear with moderate pressure, and
- Total: A combination of removable and fixed contamination.

Up to four reported values are provided for every survey report: alpha removable, alpha total, beta-gamma removable, and beta-gamma total. All removable contamination is collected by swipe samples on a 100-cm^2 area after total contamination levels are measured by a direct frisk of the area with an alpha or beta-gamma instrument. Total contamination values have background subtracted and are normalized to a 100-cm^2 area. Components are surveyed at different frequencies, and not all on-site facilities are monitored, depending on their level of contamination. (See Section 2.4.1 for further discussion.) For each category of reported data, the average of all values, the maximum value, and the sample size are provided. "NA" means that no data of that type are available for the component.

All of the data presented in Table 4.0 were collected throughout 1991. Four categories have been established within each component to differentiate between the sample locations:

- *Accessible* represents any accessible surface (i.e. equipment, walls, desks, etc.);

  Floors represent drain grates, metal platforms, concrete, etc.;
- *Sumps* represent dikes and sumps; and
- *Unaccessible* represents overhead structures or any unaccessible areas.

Data gathered from the last quarter of 1991 through July 1992 are presented in Table A.4.1. All information from the survey reports has been entered into the site-wide database, and values for each component are summarized here. Samples can be from any of the sample locations discussed for Table A.4.0. New data are continually gathered and are processed as they become available.

TABLE A.4.0 Operable Unit 3 Radiological Surveys Prior to 1992

Component	Category	Alpha Removable (dpm/100 sq. cm)			Alpha Total (dpm/100 sq. cm)			Beta-Gamma Removable (dpm/100 sq. cm)			Beta-Gamma Total (dpm/100 sq. cm)		
		Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size
Preparation Plant (1A)	Accessible	242	638	18	NA	NA	NA	538	1,770	18	NA	NA	NA
	Floor	146	1,140	62	NA	NA	NA	200	1,120	62	NA	NA	NA
Plant 1 Ore Silos (1C)	Accessible	497	12,200	41	60,000	60,000	1	243	5,920	42	NA	NA	NA
	Floor	5,585	23,100	85	108,000	140,000	5	2,873	14,400	85	NA	NA	NA
	Sump	1,403	4,860	9	NA	NA	NA	629	2,180	9	NA	NA	NA
	Unaccess.	423	731	4	NA	NA	NA	209	286	4	NA	NA	NA
Ore Refinery Plant (2A)	Accessible	533	10,800	178	9,000	100,000	134	1,541	50,200	179	232,000	1,599,000	176
	Floor	216	42,200	675	8,000	100,000	673	505	115,000	675	85,000	999,000	676
	Unaccess.	456	2,350	15	4,000	40,000	15	1,259	5,010	15	81,000	289,000	15
General/Refinery Sump Control Bldg (2B)	Accessible	78	433	31	1,000	5,000	19	139	1,390	31	40,000	220,000	23
	Floor	51	51	46	1,000	7,000	32	54	77	46	7,000	59,000	40
Bulk Lime Handling Building (2C)	Accessible	42	42	2	180	400	6	47	55	2	1,000	5,000	13
	Floors	42	42	4	170	400	7	36	36	4	9,000	52,000	13
Metal Dissolver Building (2D)	Accessible	70	156	19	4,000	21,000	19	129	323	19	39,000	108,000	18
	Floor	203	1,890	76	9,000	70,000	46	552	6,430	76	71,000	399,000	46
Maintenance Building (3A)	Accessible	60	288	45	1,000	5,000	58	108	755	45	14,000	89,000	60
	Floor	61	340	27	1,000	3,000	55	101	551	27	12,000	69,000	64
	Unaccess.	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,000	1,000	1
Ozone Building (3B)	Accessible	84	261	12	2,000	16,000	15	133	288	12	18,000	150,000	15
	Floor	94	191	12	1,000	2,000	25	184	370	12	17,000	200,000	25
NAR Control House (3C)	Accessible	31	51	26	240	1,000	14	40	59	27	4,700	24,000	37
	Floor	27	51	21	340	1,000	16	35	54	22	2,000	47,000	78
NAR Towers (3D)	All Fixed Beta-Gamma values greater than 25,000 DPM Fixed												
Hot Raffinate Building (3E)	Accessible	184	1,296	37	10,000	31,000	36	316	4,250	37	89,000	199,000	36
	Floor	120	840	80	6,000	30,000	81	225	4,100	80	51,000	379,000	81
Harshaw System (3F)	Accessible	106	209	4	1,000	1,000	15	256	673	5	19,000	70,000	16
	Floor	NA	NA	NA	280	1,000	6	148	148	1	3,000	11,000	9
Refrigeration Building (3G)	Accessible	32	121	11	1,000	2,000	10	96	475	11	8,000	29,000	8
	Floor	20	20	3	1,000	4,000	7	44	73	3	9,000	29,000	7
Combined Raffinate Tanks (3J)	Accessible	384	1,870	8	NA	NA	NA	810	3,180	8	NA	NA	NA
	Floor	268	2,400	16	NA	NA	NA	585	5,560	16	NA	NA	NA
	Sump	137	159	2	NA	NA	NA	304	324	2	NA	NA	NA
	Unaccess.	155	312	4	NA	NA	NA	164	338	4	NA	NA	NA
Green Salt Plant (4A)													
First Floor - Elev. 580	Accessible	2,156	18,100	67	NA	NA	NA	13,263	143,000	67	NA	NA	NA
	Floor	779	26,200	91	NA	NA	NA	2,621	89,200	91	NA	NA	NA
	Unaccess.	4,366	16,200	33	NA	NA	NA	13,529	49,500	33	NA	NA	NA
Elev 588	Accessible	4,982	28,200	25	NA	NA	NA	21,662	109,000	25	NA	NA	NA
	Floor	796	3,670	16	NA	NA	NA	3,139	19,800	16	NA	NA	NA
	Unaccess.	2,604	5,520	9	NA	NA	NA	6,253	16,600	9	NA	NA	NA
Second Floor - Elev 597	Accessible	2,965	31,900	95	NA	NA	NA	16,037	176,000	95	NA	NA	NA
	Floor	1,212	11,800	75	NA	NA	NA	6,072	48,800	75	NA	NA	NA

TABLE A.4.0 Operable Unit 3 Radiological Surveys Prior to 1992

Component	Category	Alpha Removable (dpm/100 sq. cm)			Alpha Total (dpm/100 sq. cm)			Beta-Gamma Removable (dpm/100 sq. cm)			Beta-Gamma Total (dpm/100 sq. cm)		
		Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size
Second Floor (Cont'd) – Elev 605	Accessible	1,432	3,440	14	NA	NA	NA	3,590	9,990	14	NA	NA	NA
	Floor	613	2,070	26	NA	NA	NA	1,065	4,790	26	NA	NA	NA
Elev 610	Accessible	1,429	12,200	27	NA	NA	NA	3,039	26,700	27	NA	NA	NA
	Floor	292	1,070	32	NA	NA	NA	526	1,690	32	NA	NA	NA
	Unaccess.	10,951	10,951	1	NA	NA	NA	28,138	28,138	1	NA	NA	NA
Third Floor – Elev 619	Accessible	624	3,530	54	NA	NA	NA	1,672	17,600	54	NA	NA	NA
	Floor	270	3,330	103	NA	NA	NA	541	9,650	103	NA	NA	NA
	Unaccess.	4,213	9,020	3	NA	NA	NA	9,421	20,000	3	NA	NA	NA
Fourth Floor – Elev 629	Accessible	2,210	8,840	15	NA	NA	NA	6,212	18,400	15	NA	NA	NA
	Floor	985	8,020	125	NA	NA	NA	2,343	26,600	125	NA	NA	NA
Plant 4 Warehouse (4B)	Accessible	312	1,680	30	NA	NA	NA	949	3,360	30	NA	NA	NA
Plant 4 Maintenance Building (4C)	Floor	54	54	20	NA	NA	NA	39	69	20	NA	NA	NA
Metals Production Plant (5A)													
First Floor	Accessible	679	125	860	4,000	200,000	841	6,537	187,000	867	197,000	4,000,000	882
	Floor	297	5,620	1,465	3,000	200,000	1,490	2,007	109,000	1,487	148,000	4,000,000	1,498
	Sump	2,574	4,950	2	2,000	2,000	1	81,115	160,000	2	755,000	1,400,000	2
	Unaccess.	1,656	4,320	13	10,000	32,000	13	17,535	54,300	13	1,928,000	4,000,000	13
Second Floor	Accessible	599	10,400	345	7,000	44,000	348	3,063	74,600	345	62,000	1,000,000	290
	Floor	361	3,490	654	7,000	48,000	653	1,471	21,500	655	123,000	1,800,000	512
	Unaccess.	978	6,840	24	16,000	45,000	24	4,328	38,300	24	171,000	600,000	20
Metals Fabrication Plant (6A)	Accessible	1,251	34,100	1,605	NA	NA	NA	21,767	808,000	1,615	188,000	2,600,000	1,314
	Floor	705	21,300	779	NA	NA	NA	7,592	296,000	782	141,000	1,500,000	609
	Sump	1,837	14,100	30	NA	NA	NA	80,043	783,000	30	331,000	1,700,000	30
	Unaccess.	395	734	14	NA	NA	NA	2,731	5,880	14	90,000	90,000	1
Plant 7 (7A)	Accessible	719	4,780	65	NA	NA	NA	2,499	16,600	65	NA	NA	NA
	Floor	370	26,300	178	NA	NA	NA	864	29,800	178	NA	NA	NA
Recovery Plant (8A)	Accessible	503	23,000	646	3,000	120,000	837	1,147	42,000	646	66,000	1,400,000	845
	Floor	333	26,000	1,168	2,000	60,000	1,684	551	10,000	1,168	45,000	1,000,000	1,684
	Sump	359	1,000	11	2,000	20,000	34	561	2,200	11	32,000	350,000	34
Plant 8 Maintenance Building (8B)	Accessible	19	19	2	170	200	3	26	26	2	6,000	8,000	3
	Floor	19	19	3	310	1,000	7	38	49	3	4,000	9,000	7
Special Products Plant (9A)	Accessible	2,875	46,300	487	NA	NA	NA	36,338	706,000	486	843,000	1,800,000	421
	Floor	767	41,700	450	NA	NA	NA	8,696	600,000	440	231,000	8,570,000	438
	Sump	5,886	28,300	37	NA	NA	NA	86,089	452,000	37	706,000	2,000,000	36
	Unaccess.	3,699	6,524	3	NA	NA	NA	19,174	45,100	3	NA	NA	NA
Boiler Plant (10A)	Accessible	22	50	46	NA	NA	NA	32	220	46	NA	NA	NA
	Floor	30	76	120	NA	NA	NA	28	158	120	NA	NA	NA
Boiler Plant Maintenance (10B)	Accessible	30	392	45	NA	NA	NA	124	2,350	45	NA	NA	NA
	Floor	24	234	29	NA	NA	NA	42	620	29	NA	NA	NA
	Sump	24	24	1	NA	NA	NA	19	19	1	NA	NA	NA
Service Building (11)													
First Floor	Accessible	27	99	86	160	1,000	73	29	236	87	1,000	7,000	99
	Floor	30	235	112	240	2,000	60	33	404	114	1,000	100,000	222

TABLE A.4.0 Operable Unit 3 Radiological Surveys Prior to 1992

Component	Category	Alpha Removable (dpm/100 sq. cm)			Alpha Total (dpm/100 sq. cm)			Beta-Gamma Removable (dpm/100 sq. cm)			Beta-Gamma Total (dpm/100 sq. cm)		
		Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size
First Floor (Cont'd)	Unaccess.	40	52	7	420	1,000	5	30	36	7	2,000	6,000	5
Second Floor	Accessible	23	63	197	160	1,000	157	23	110	196	1,000	11,000	455
	Floor	23	51	195	180	1,000	144	21	119	195	1,000	20,000	439
	Sump	NA	NA	NA	NA	NA	NA	NA	NA	NA	100	100	1
	Unaccess.	19	19	5	NA	NA	NA	15	15	5	440	3,000	68
Main Maintenance Building (12A)													
First Floor	Accessible	106	5,510	303	1,000	20,000	473	199	18,000	310	10,000	319,000	526
	Floor	59	249	449	340	4,000	978	73	15,400	454	3,000	99,000	1,046
Second Floor	Accessible	49	63	9	210	1,000	21	108	438	9	1,000	6,000	70
	Floor	48	48	10	200	200	8	41	41	10	1,000	7,000	96
Pilot Plant Wet Side (13A)	Accessible	930	3,630	9	NA	NA	NA	767	2,770	9	NA	NA	NA
	Floor	582	1,250	11	NA	NA	NA	685	2,680	11	NA	NA	NA
Pilot Plant Maintenance Building (13B)	Floor	31	58	8	NA	NA	NA	58	118	8	NA	NA	NA
Sump Pump House (13C)	Accessible	1,079	4,640	6	242,000	1,000,000	5	2,575	11,200	6	110,000	250,000	5
	Floor	363	941	19	228,000	1,000,000	6	629	3,360	19	308,000	500,000	6
	Unaccess.	181	257	5	2,000	5,000	5	280	396	5	47,000	100,000	3
Pilot Plant Thorium Tank Farm (13D)	Accessible	32	32	1	NA	NA	NA	20	20	1	NA	NA	NA
	Floor	268	629	13	NA	NA	NA	442	1,660	13	NA	NA	NA
Administration Building (14A)													
First Floor	Accessible	21	49	114	140	3,000	111	21	52	116	380	18,000	243
	Floor	21	58	97	100	200	92	21	52	98	360	7,000	322
Second Floor	Accessible	23	58	18	260	1,000	18	37	162	18	1,000	25,000	80
	Floor	19	19	4	170	300	3	18	30	4	370	3,000	80
Laboratory (15)	Accessible	124	30,400	1,552	2,000	80,000	281	178	23,700	1,556	13,000	1,000,000	1,059
	Floor	60	1,438	553	1,000	5,000	31	71	3,990	559	10,000	400,000	404
	Unaccess.	70	229	59	NA	NA	NA	100	773	59	NA	NA	NA
General Sump (18B)	Accessible	446	1,110	13	NA	NA	NA	620	1,780	13	NA	NA	NA
	Floor	173	602	13	NA	NA	NA	396	1,620	13	NA	NA	NA
	Unaccess.	333	543	4	NA	NA	NA	656	1,270	4	NA	NA	NA
Biodenitrification Towers (18D)	Accessible	52	52	13	NA	NA	NA	43	43	13	NA	NA	NA
	Floor	52	76	57	NA	NA	NA	46	76	57	NA	NA	NA
Main Metal Tank Farm (19A)	Accessible	20	20	1	NA	NA	NA	15	15	1	NA	NA	NA
	Floor	20	20	9	NA	NA	NA	15	15	9	NA	NA	NA
Water Plant (20B)	Accessible	12	32	38	NA	NA	NA	19	30	38	NA	NA	NA
	Floor	13	24	35	NA	NA	NA	19	30	35	NA	NA	NA
	Unaccess.	15	15	2	NA	NA	NA	18	18	2	NA	NA	NA
M.H. #175/Eff. Line/Sampling Bldg. (25B)	Accessible	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,000	1,000	1
	Floor	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,000	1,000	1
U.V. Disinfection Building (25D)	Accessible	173	173	1	NA	NA	NA	179	179	1	2,000	9,000	7
	Floor	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,000	1,000	1
Digester & Control Building (25E)	Accessible	22	40	14	NA	NA	NA	48	190	14	3,000	8,000	14
	Floor	22	57	11	NA	NA	NA	25	127	11	4,000	25,000	11
Sludge Drying Beds (25F)	Floor	NA	NA	NA	NA	NA	NA	NA	NA	NA	18,000	26,000	6

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TABLE A.4.0 Operable Unit 3 Radiological Surveys Prior to 1992

Component	Category	Alpha Removable (dpm/100 sq. cm)			Alpha Total (dpm/100 sq. cm)			Beta-Gamma Removable (dpm/100 sq. cm)			Beta-Gamma Total (dpm/100 sq. cm)		
		Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size
Security Building (28A)	Accessible	40	40	5	100	100	3	43	43	5	1,000	2,000	14
	Floor	39	40	42	170	1,000	43	42	47	42	1,000	8,000	57
Human Resources Building (28B)	Accessible	28	40	28	160	1,000	24	26	43	28	270	1,000	39
	Floor	24	40	17	150	1,000	16	19	43	17	400	2,000	55
Chemical Warehouse (30A)	Accessible	40	126	38	NA	NA	NA	73	231	38	NA	NA	NA
	Floor	48	279	71	NA	NA	NA	67	712	71	NA	NA	NA
Drum Storage Warehouse (30B)	Accessible	94	172	8	NA	NA	NA	191	500	8	NA	NA	NA
	Floor	67	67	2	NA	NA	NA	84	95	2	NA	NA	NA
Engine House/Garage (31A)	Accessible	52	61	37	NA	NA	NA	80	214	37	12,000	150,000	37
	Floor	52	52	53	NA	NA	NA	43	120	53	10,000	100,000	53
	Sump	70	70	1	NA	NA	NA	135	135	1	25,000	25,000	1
Pilot Plant Annex (37)	Accessible	51	314	25	NA	NA	NA	89	369	25	NA	NA	NA
	Floor	44	296	35	NA	NA	NA	96	654	35	NA	NA	NA
Incinerator Building (39A)	Accessible	76	121	3	9,000	25,000	3	137	265	3	139,000	800,000	6
	Floors	53	53	5	1,000	2,000	26	71	73	5	18,000	80,000	29
Sewage Treatment Plant Incinerator (39D)	Accessible	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,000,000	1,000,000	1
	Floor	NA	NA	NA	NA	NA	NA	NA	NA	NA	179,000	800,000	14
	Unaccess.	NA	NA	NA	NA	NA	NA	NA	NA	NA	150,000	150,000	1
Rust Engineering Building (45A)	Accessible	26	79	100	1,000	1,000	2	23	135	100	1,000	2,000	67
	Floor	28	244	96	NA	NA	NA	36	886	96	12,000	250,000	74
Heavy Equipment Building (46)	Accessible	60	62	88	NA	NA	NA	48	50	88	6,000	70,000	88
	Floor	60	62	201	NA	NA	NA	47	50	201	8,000	100,000	201
Health and Safety Building (53A)													
Basement	Accessible	NA	NA	NA	200	200	88	NA	NA	NA	1,000	1,000	88
	Floor	NA	NA	NA	200	200	160	NA	NA	NA	1,000	1,000	160
First Floor	Accessible	18	18	2	200	200	86	18	20	2	1,000	1,000	89
	Floor	22	66	11	200	200	177	47	289	9	1,000	2,000	203
	Unaccess.	NA	NA	NA	200	200	3	NA	NA	NA	1,000	1,000	3
Second Floor	Accessible	128	523	6	1,000	2,000	6	180	751	6	460	4,000	80
	Floor	NA	NA	NA	NA	NA	NA	NA	NA	NA	250	2,000	35
In-Vivo Building (53B)	Accessible	19	19	43	NA	NA	NA	17	17	43	1,000	1,000	43
Six to Four Reduction Facility #1 (54A)	Accessible	198	929	25	NA	NA	NA	572	3,450	25	NA	NA	NA
	Floor	104	741	35	NA	NA	NA	205	1,370	35	NA	NA	NA
Slag Recycling Building (55A)	Accessible	168	662	36	NA	NA	NA	1,599	10,700	36	82,000	500,000	36
	Floor	122	334	32	NA	NA	NA	740	2,230	32	60,000	700,000	32
Slag Recycling Pit/Elevator (55B)	Accessible	179	955	40	NA	NA	NA	1,624	5,100	40	6,000	950,000	32
	Floor	92	412	26	NA	NA	NA	1,620	26,900	26	45,000	115,000	24
CP Storage Warehouse (56A)	Floor	40	40	14	NA	NA	NA	43	43	14	NA	NA	NA
Drum Recondition Building (66)	Accessible	152	152	1	NA	NA	NA	547	547	1	NA	NA	NA
	Floor	52	63	8	NA	NA	NA	114	224	8	NA	NA	NA
Pilot Plant Warehouse (68)	Floor	203	1,100	46	NA	NA	NA	281	922	46	NA	NA	NA
General In-Process Warehouse (71)	Accessible	91	180	7	NA	NA	NA	132	554	7	NA	NA	NA
	Floor	48	169	22	NA	NA	NA	56	206	22	NA	NA	NA

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Component	Category	Alpha Removable (dpm/100 sq. cm)			Alpha Total (dpm/100 sq. cm)			Beta-Gamma Removable (dpm/100 sq. cm)			Beta-Gamma Total (dpm/100 sq. cm)		
		Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size
Plant 2 East Pad (74A)	Floor	NA	NA	NA	370	4,500	45	NA	NA	NA	7,200	30,800	51
Plant 2 West Pad (74B)	Accessible	NA	NA	NA	5,000	25,000	7	NA	NA	NA	46,000	146,000	6
	Floor	NA	NA	NA	1,000	20,000	111	NA	NA	NA	18,000	196,000	110
Plant 8 East Pad (74C)	Floor	53	3,220	84	NA	NA	NA	74	4,180	84	NA	NA	NA
Plant 8 West Pad (74D)	Floor	22	262	90	NA	NA	NA	34	350	90	NA	NA	NA
Plant 4 Pad (74E)	Accessible	114	429	20	2,000	10,000	22	237	1,500	20	19,000	310,000	32
	Floor	63	159	98	1,000	15,000	129	67	361	99	14,000	700,000	186
	Unaccess.	NA	NA	NA	NA	NA	NA	NA	NA	NA	2,000	2,000	1
Plant 5 East Pad (74G)	Accessible	258	2,500	200	2,000	32,000	249	455	6,400	199	20,000	370,000	247
	Floor	230	1,400	314	490	30,000	910	325	1,400	314	12,000	450,000	1,003
Plant 6 Pads (74J)	Floor	80	1,830	209	NA	NA	NA	224	4,276	228	60,000	1,000,000	216
Plant 9 Pad (74K)	Floor	78	897	276	3,000	6,000	10	165	2,260	298	154,000	750,000	298
Decontamination Pad (74P)	Floor	130	1,380	31	NA	NA	NA	264	2,340	31	15,000	60,000	31
Plant 8 North Pad (74R)	Floor	28	134	26	NA	NA	NA	36	171	26	NA	NA	NA
Finished Products Warehouse (77)	Accessible	191	762	6	NA	NA	NA	454	2,180	6	NA	NA	NA
	Floor	60	60	29	NA	NA	NA	60	82	29	NA	NA	NA
Plant 6 Warehouse (79)	Accessible	59	59	5	NA	NA	NA	60	60	5	1,000	1,000	5
	Floor	61	105	29	NA	NA	NA	70	247	29	8,000	65,000	29
Plant 9 Warehouse (81)	Accessible	59	59	4	NA	NA	NA	67	78	4	1,000	1,000	3
	Floor	59	59	26	NA	NA	NA	62	71	26	3,000	10,000	26
Receiving/Incoming Material Insp (82)	Accessible	19	19	28	NA	NA	NA	16	19	28	NA	NA	NA
	Floor	19	19	47	NA	NA	NA	15	27	47	NA	NA	NA
Parking Lot (89)	Accessible	0	0	4	100	100	4	0	0	14	160	400	14
	Floor	7	19	7	100	200	21	5	18	63	170	2,000	305
Process Trailers (G-009)													
Trailers South of Plant 7 (G-009)	Accessible	20	20	16	NA	NA	NA	17	32	16	NA	NA	NA
	Floor	20	20	14	NA	NA	NA	18	29	14	NA	NA	NA
Rust Construction Trailers (G-009)	Accessible	19	20	31	NA	NA	NA	15	16	31	1,000	1,000	31
	Floor	16	20	7	NA	NA	NA	12	16	7	1,000	1,000	7
Non-process Trailers (G-010)													
6 Plex East (G-010)	Accessible	20	28	5	208	1,000	56	20	28	5	1,000	10,000	56
	Floor	NA	NA	NA	200	200	90	NA	NA	NA	1,000	1,000	90
7 Plex North (G-010)	Accessible	19	19	146	NA	NA	NA	15	15	146	1,000	1,000	146
	Floor	19	19	7	NA	NA	NA	15	15	7	1,000	1,000	7
	Unaccess.	19	19	7	NA	NA	NA	15	15	7	1,000	1,000	7
10 Plex (G-010)	Accessible	20	28	13	250	2,000	14	20	45	13	430	3,000	12
	Floor	19	19	14	130	300	14	17	22	14	180	1,000	83
Trailers in Grid #7 (G-010)	Accessible	NA	NA	NA	200	200	210	NA	NA	NA	100	100	209
	Floor	NA	NA	NA	200	200	476	NA	NA	NA	100	100	475
Copper Metal Scrap Pile (P-017)	Accessible	NA	NA	NA	NA	NA	NA	NA	NA	NA	34,000	100,000	6

TABLE A.4.1 Operable Unit 3 Component Radiological Surveys For 1992

Component	Component Designation	Alpha Removable (dpm/100 sq. cm)			Alpha Total (dpm/100 sq. cm)			Beta-Gamma Removable (dpm/100 sq. cm)			Beta-Gamma Total (dpm/100 sq. cm)		
		Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size
Preparation Plant	1 A	466	31,000	1,346	5,033	200,000	1,225	1,275	490,000	1,361	39,338	1,400,000	1,227
Plant 1 Storage Shelter	1 B	42	54	10	NA	NA	NA	72	138	10	NA	NA	NA
Plant 1 Ore Silos	1 C	1,747	15,183	52	NA	NA	NA	851	7,743	52	NA	NA	NA
Ore Refinery Plant	2 A	119	3,147	145	NA	NA	NA	257	14,053	155	NA	NA	NA
General/Refinery Sump Control Building	2 B	142	222	131	407	3,400	73	213	400	132	12,423	190,000	74
Bulk Lime Handling Building	2 C	146	1,249	143	NA	NA	NA	331	6,958	143	NA	NA	NA
Metal Dissolver Building	2 D	249	1,094	142	NA	NA	NA	429	2,351	147	NA	NA	NA
NFS Storage & Pump House	2 E	441	1,594	10	NA	NA	NA	881	5,151	10	NA	NA	NA
Hot Side Ore Conveyor	2 G	52	77	27	NA	NA	NA	44	126	27	NA	NA	NA
Maintenance Building	3 A	254	2,597	138	101,995	1,800,000	21	473	8,043	138	168,471	3,000,000	26
Ozone Building	3 B	230	501	108	NA	NA	NA	385	1,039	108	NA	NA	NA
NAR Control House	3 C	70	273	60	NA	NA	NA	131	402	70	NA	NA	NA
NAR Towers	3 D	225	3,896	163	NA	NA	NA	354	7,400	163	5,458	15,000	48
Hot Raffinate Building	3 E	482	2,409	20	NA	NA	NA	1,048	5,161	20	NA	NA	NA
Harshaw Digestion Fume Recovery	3 F	241	241	20	NA	NA	NA	323	323	20	NA	NA	NA
Refrigeration Building	3 G	180	2,300	148	NA	NA	NA	288	1,200	148	NA	NA	NA
Refinery Sump	3 H	45	593	60	NA	NA	NA	75	1,177	60	NA	NA	NA
Combined Raffinate Tanks	3 J	194	1,074	26	NA	NA	NA	652	7,521	36	NA	NA	NA
Old Cooling Water Tower	3 K	62	125	59	NA	NA	NA	50	304	59	NA	NA	NA
Electrical Power Center Building	3 L	63	1,065	162	NA	NA	NA	86	2,089	162	NA	NA	NA
Green Salt Plant	4 A	328	3,839	530	NA	NA	NA	817	14,935	532	NA	NA	NA
Plant 4 Warehouse	4 B	237	1,680	42	NA	NA	NA	697	3,359	47	NA	NA	NA
Plant 4 Maintenance Building	4 C	48	54	35	NA	NA	NA	40	77	35	NA	NA	NA
Metals Production Plant	5 A	101	4,676	611	500	4,000	110	463	60,078	613	27,825	500,000	110
West Derby Breakout/ Slag Milling	5 D	52	52	30	NA	NA	NA	64	84	30	NA	NA	NA
Plant 5 Covered Storage Pad	5 F	52	52	16	NA	NA	NA	63	78	16		NA	NA
Plant 5 Ingot Storage Shelter	5 G	405	3,389	31	NA	NA	NA	4,263	52,541	31	1,000	1,000	14
Metals Fabrication Plant	6 A	110	3,471	1,193	NA	NA	NA	297	24,620	1,195	3,214	48,000	124
Plant 7	7 A	230	2,794	170	NA	NA	NA	1,205	31,714	170	NA	NA	NA
Recovery Plant	8 A	390	6,460	785	14,812	250,000	77	984	60,000	850	13,197	250,000	148
Plant 8 Maintenance Building	8 B	87	146	29	NA	NA	NA	113	440	29	NA	NA	NA
Rotary Kiln/Drum Reconditioning	8 C	41	65	20	NA	NA	NA	46	94	20	NA	NA	NA
Special Products Plant	9 A	274	18,252	302	NA	NA	NA	862	60,675	302	1,305	24,000	220
Plant 9 Dust Collector	9 C	52	52	9	NA	NA	NA	69	139	9	NA	NA	NA
Boiler Plant	10 A	87	200	97	200	200	8	249	2,866	97	3,458	11,000	12
Boiler Plant Maintenance Bldg.	10 B	76	200	35	NA	NA	NA	89	400	35	NA	NA	NA
Service Building	11	89	200	44	NA	NA	NA	383	1,000	156	1,000	1,000	16
Main Maintenance Building	12 A	44	203	777	NA	NA	NA	68	1,490	777	1,970	22,000	117
Cylinder Storage Building	12 B	10	50	113	NA	NA	NA	19	86	113	2,757	10,000	113
Lumber Storage Building	12 C	8	24	67	NA	NA	NA	14	156	67	3,246	12,000	67
Pilot Plant Wet Side	13 A	1,049	17,400	227	46,201	699,000	176	1,374	23,000	227	156,276	1,600,000	161
Pilot Plant Maintenance Bldg.	13 B	209	408	10	NA	NA	NA	423	931	10	NA	NA	NA
Sump Pump House	13 C	875	4,638	16	176,375	1,000,000	16	1,437	11,236	16	159,000	500,000	16

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TABLE A.4.1 Operable Unit 3 Component Radiological Surveys For 1992

Component	Component Designation	Alpha Removable (dpm/100 sq. cm) Average Value	Alpha Removable (dpm/100 sq. cm) Maximum Value	Alpha Removable (dpm/100 sq. cm) Sample Size	Alpha Total (dpm/100 sq. cm) Average Value	Alpha Total (dpm/100 sq. cm) Maximum Value	Alpha Total (dpm/100 sq. cm) Sample Size	Beta-Gamma Removable (dpm/100 sq. cm) Average Value	Beta-Gamma Removable (dpm/100 sq. cm) Maximum Value	Beta-Gamma Removable (dpm/100 sq. cm) Sample Size	Beta-Gamma Total (dpm/100 sq. cm) Average Value	Beta-Gamma Total (dpm/100 sq. cm) Maximum Value	Beta-Gamma Total (dpm/100 sq. cm) Sample Size
Pilot Plant Thorium Tank Farm	13 D	76	1,106	77	NA	NA	NA	80	934	77	NA	NA	NA
Laboratory	15	60	1,115	1,486	NA	NA	NA	179	4,879	1,650	1,902	50,000	290
General Sump	18 B	187	3,784	170	NA	NA	NA	331	7,757	170	NA	NA	NA
Biodenitrification Towers	18 D	60	169	70	NA	NA	NA	75	905	70	2,835	89,000	94
BDN Effluent Treatment Facility	18 H	27	27	20	NA	NA	NA	31	31	20	NA	NA	NA
Tank Farm Control House	19 C	5	5	1	NA	NA	NA	21	21	1	NA	NA	NA
Pump Station & Power Center	20 A	225	230	20	207	500	88	360	360	20	1,339	7,500	88
Water Plant	20 B	98	200	40	NA	NA	NA	146	400	40	400	400	1
Cooling Towers	20 C	42	42	20	NA	NA	NA	43	82	20	NA	NA	NA
Elevated Potable Storage Tank	20 D	229	240	7	NA	NA	NA	398	429	7	1,700	1,700	12
Well House #1	20 E	25	36	21	NA	NA	NA	25	74	21	1,000	1,000	21
Well House #2	20 F	22	36	21	NA	NA	NA	103	385	27	1,147	4,000	113
Well House #3	20 G	23	102	34	NA	NA	NA	38	177	34	4,235	80,000	34
Process Water Storage Tank	20 H	42	42	10	NA	NA	NA	36	36	10	NA	NA	NA
Gas Meter Building	22 A	14	20	46	NA	NA	NA	21	68	46	1,435	8,000	46
Storm Sewer Lift Station	22 B	43	63	30	NA	NA	NA	56	242	30	NA	NA	NA
Scale House & Weigh Scale	22 D	250	250	11	NA	NA	NA	402	402	11	1,180	2,800	60
Railroad Scale House	24 A	32	403	21	NA	NA	NA	99	1,365	21	7,667	100,000	21
Railroad Engine House	24 B	19	67	117	NA	NA	NA	40	220	117	3,647	30,000	92
M.H.#175/Eff. Line/Sampling Bldg.	25 B	NA	NA	NA	NA	NA	NA	400	400	10	NA	NA	NA
Sewage Lift Station Building	25 C	18	86	56	NA	NA	NA	54	831	56	2,788	40,000	56
U.V. Disinfection Building	25 D	NA	NA	NA	NA	NA	NA	400	400	18	NA	NA	NA
Pump House-HP Fire Protection	26 A	225	225	4	NA	NA	NA	385	385	4	2,467	160,000	114
Elevated Water Storage Tank	26 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,015	2,000	145
Human Resources Building	28 B	18	49	151	NA	NA	NA	17	78	151	NA	NA	NA
Chemical Warehouse	30 A	153	294	688	213	900	304	207	577	688	3,838	49,200	304
Drum Storage Warehouse	30 B	56	111	55	NA	NA	NA	63	193	55	NA	NA	NA
Engine House/Garage	31 A	200	200	91	NA	NA	NA	400	400	91	NA	NA	NA
Building 32 Covered Loading Dock	32 B	247	259	49	506	5,900	35	417	434	49	91,121	180,000	99
Pilot Plant Annex	37	158	5,194	222	1,488	10,000	41	480	31,400	217	92,383	1,000,000	41
Propane Storage	38 A	28	119	97	NA	NA	NA	60	389	97	2,284	30,000	97
Incinerator Building	39 A	198	482	99	NA	NA	NA	297	584	99	NA	NA	NA
Incinerator Sprinkler Riser House	39 C	62	128	27	NA	NA	NA	68	233	27	NA	NA	NA
Rust Engineering Building	45 A	62	250	455	NA	NA	NA	92	2,307	463	1,393	23,000	387
Heavy Equipment Building	46	200	200	32	NA	NA	NA	400	400	32	NA	NA	NA
Six to Four Reduction Facility #2	51	19	20	127	NA	NA	NA	16	17	127	1,000	1,000	34
Health & Safety Building	53 A	47	61	70	NA	NA	NA	38	48	70	NA	NA	NA
Six to Four Reduction Facility #1	54 A	323	12,000	868	1,193	28,000	893	915	73,000	868	22,853	1,100,000	895
Pilot Plant Shelter	54 B	42	42	10	NA	NA	NA	40	68	10	NA	NA	NA
Slag Recycling Building	55 A	116	425	30	NA	NA	NA	739	3,754	30	NA	NA	NA
Slag Recycling Pit/Elevator	55 B	452	3,120	20	NA	NA	NA	2,216	12,515	20	NA	NA	NA
CP Storage Warehouse	56 A	40	41	56	NA	NA	NA	41	206	56	NA	NA	NA
Quonset Hut #1	60	49	49	20	NA	NA	NA	40	40	20	NA	NA	NA

TABLE A.4.1 Operable Unit 3 Component Radiological Surveys For 1992

Component	Component Designation	Alpha Removable (dpm/100 sq. cm)			Alpha Total (dpm/100 sq. cm)			Beta-Gamma Removable (dpm/100 sq. cm)			Beta-Gamma Total (dpm/100 sq. cm)		
		Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size	Average Value	Maximum Value	Sample Size
Quonset Hut #2	61	1,093	32,168	34	NA	NA	NA	735	21,547	34	NA	NA	NA
Quonset Hut #3	62	39	39	25	NA	NA	NA	43	155	25	NA	NA	NA
KC-2 Warehouse	63	42	115	83	NA	NA	NA	48	521	83	986	1,000	22
Thorium Warehouse	64	122	2,378	87	NA	NA	NA	484	9,927	87	NA	NA	NA
(Old) Plant 5 Warehouse	65	383	7,370	100	NA	NA	NA	3,110	81,976	100	NA	NA	NA
Drum Reconditioning Building	66	152	2,146	106	NA	NA	NA	558	7,100	106	NA	NA	NA
Plant 1 Thorium Warehouse	67	1,531	31,506	45	NA	NA	NA	1,582	28,882	45	NA	NA	NA
Decontamination Building	69	170	1,700	101	1,654	110,000	87	283	1,400	101	16,143	280,000	87
General In-Process Warehouse	71	287	17,900	561	1,429	140,000	528	405	21,000	566	16,766	799,000	528
Plant 2 East Pad	74 A	202	1,558	484	NA	NA	NA	348	15,400	484	NA	NA	NA
Plant 2 West Pad	74 B	129	843	227	NA	NA	NA	195	1,300	247	NA	NA	NA
Plant 8 East Pad	74 C	167	2,685	51	NA	NA	NA	577	15,495	51	1,150	3,500	20
Plant 8 West Pad	74 D	117	712	104	NA	NA	NA	160	2,000	104	186,216	400,000	37
Plant 7 Pad	74 F	72	296	50	NA	NA	NA	221	1,118	50	NA	NA	NA
Plant 5 South Pad	74 H	52	52	22	NA	NA	NA	61	61	22	NA	NA	NA
Plant 6 Pads	74 J	69	918	116	200	200	6	105	2,624	141	1,000	1,000	6
Plant 9 Pad	74 K	77	897	325	NA	NA	NA	149	2,257	347	68,168	750,000	288
Building 65 West Pad	74 L	225	225	10	208	400	63	360	360	10	1,619	32,000	63
Building 64 East Pad & R.R. Dock	74 M	234	250	117	210	500	117	377	400	117	3,798	14,000	117
Plant 1 Storage Pad	74 T	41	41	6	NA	NA	NA	37	37	6	NA	NA	NA
Pilot Plant Pad	74 U	31	64	163	NA	NA	NA	39	155	163	NA	NA	NA
Finished Products Warehouse(4A)	77	53	124	145	NA	NA	NA	82	652	145	NA	NA	NA
Plant 6 Warehouse	79	71	240	214	NA	NA	NA	81	657	214	NA	NA	NA
Plant 8 Warehouse	80	37	159	102	NA	NA	NA	40	230	102	NA	NA	NA
Plant 9 Warehouse	81	55	134	631	NA	NA	NA	61	340	631	NA	NA	NA
Receiving/Incoming Mat'ls. Insp.	82	200	200	9	NA	NA	NA	NA	NA	NA	400	400	9
Railroad Tracks	G001	83	259	148	NA	NA	NA	110	434	148	4,578	100,000	74
Roads	G002	180	259	552	263	5,900	179	299	435	643	2,230	96,000	248
Process Trailers	G006	80	200	188	NA	NA	NA	123	400	188	1,000	1,000	20
Non-process Trailers	G007	91	200	36	NA	NA	NA	137	400	41	1,000	1,000	15

TABLE A.4.2

RADIOLOGICAL SURVEYS OF ABANDONED-IN-PLACE EQUIPMENT

Radiological surveys of abandoned-in-place (AIP) equipment were performed during July to October 1988 by RI/FS field personnel.

The equipment surveyed has been listed by component and by floor within the components. Survey values are separated into removable and fixed contamination for alpha and combined beta-gamma. The definitions of removable and fixed are:

- Removable: Loose contamination that readily transfers to a smear with moderate pressure, and
- Fixed: Contamination that does not readily transfer to a smear.

The following notes pertain to Table A.4.2:

a = Field personnel were unable to obtain a reading.

b = Readings were not available.

TABLE A.4.2 Radiological Surveys Of Abandoned-In-Place (AIP) Equipment

Component And Component Designation	Equipment Location	Alpha Fixed Max (DPM)	Alpha Removable Max (DPM)	Beta-Gamma Fixed Max (DPM)	Beta-Gamma Removable Max (DPM)
Preparation Plant 1 A	1st Floor				
	Bucket Elevator	4,136	170	3,032	332
	Filter	6,692	800	22,945	1,923
	Magnetic Separator & Screw Feeder	9,081	410	17,859	842
	Overflow Tank	2,615	472	55,263	592
	Sample Box	7,092	503	45,878	947
	Sampler	914	30	5,789	89
	Water Tank	8,382	280	7,226	579
	2nd Floor				
	Tank	3,436	410	9,474	505
	Conveyor Feed Hopper	6,084	12,761	5,263	67,163
	Hopper	7,692	160	2,695	668
	Hopper	18,896	540	76,803	1,326
	Screw Feeder	15,305	1,120	13,526	2,453
	Blender	9,780	330	14,561	1,081
	Weigh Hopper	19,021	17,524	152	92,232
	3rd Floor				
	Carrier Unit	9,929	410	10,457	951
	Grizzly Feeder	8,461	180	69,226	311
	Screw Conveyor	41,945	350	44,437	468
	4th Floor				
	Dust collector	6,361	1,012	a	692
	Dust collector	5,768	839	3,194	1,783
	Metal wash	9,770	560	57,548	79,242
	Metal wash	21,429	300	42,105	575,511
Ore Refinery Plant 2 A	1st Floor				
	Condensor (Outside North)	49,545	496	174,851	431
	NAR Tower	51,141	1,347	24,255	728
	NAR Tower	1,213	43	7,549	164
	NAR Tower	692	12	2,171	22
	Pump	1,481	4	39,913	87
	Pump	1,385	16	4,111	51
	2nd Floor				
	Cooler-Mixer/Settler (Extraction)	15,594	140	45,960	220
	Pump (Harshaw Area)	1,154	16	3,429	79

TABLE A.4.2 Radiological Surveys Of Abandoned-In-Place (AIP) Equipment

Component And Component Designation	Equipment Location	Alpha Fixed Max (DPM)	Alpha Removable Max (DPM)	Beta-Gamma Fixed Max (DPM)	Beta-Gamma Removable Max (DPM)
NAR Towers 3 D	2nd Floor				
	C69-4-14 (NAR tower)	2,783	68	6,667	31
	C70-4-79 (Raffinate Area)	1,986	17	15,714	23
	NAR Tower	6,429	33	5,000	223
	2nd & 3rd Floors				
	NAR Tower	b	33	8,333	223
	Outside				
	NAR Tower	1,043	19	2,776	74
Harshaw System 3 F	1st Floor				
	NAR Tower	1,230	36	894	40
	NAR Tower	598	36	40,451	26
	NAR Tower	<9	78	3,600	165
	Pump	1,528	16	14,722	100
	3rd Floor				
	NAR Tower	923	19	4,549	85
	Outside				
	NAR Tower	1,077	14	246	102
	NAR Tower	1,889	24	5,524	33
	Pump	2,713	16	15,650	40
	Pump	948	8	10,928	124
	Pump Assembly	3,124	19	19,695	118
	Pump-Motor	2,833	7	3,307	26
	NAR	4,969	31	11,747	475
Combined Raffinate Tanks 3 J	1st & 2nd Floors				
	C70-5-33 (Raffinate Area)	17,386	79	76,083	104
Green Salt Plant 4 A	1st Floor				
	Scale	12,183	4,110	25,227	21,632
	Scale	26,154	1,810	28,039	9,737
	Weigh Bin	75,814	2,403	424,444	3,912
	Weigh Bins	30,079	1,143	100,000	1,768
	Weigh Bins	67,576	2,816	764,384	7,838
	Weigh Bin	114,315	1,553	326,596	1,625
	2nd Floor				
	Moving Bed Reactor	31,879	372	49,455	545

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TABLE A.4.2 Radiological Surveys Of Abandoned-In-Place (AIP) Equipment

Component And Component Designation	Equipment Location	Alpha Fixed Max (DPM)	Alpha Removable Max (DPM)	Beta-Gamma Fixed Max (DPM)	Beta-Gamma Removable Max (DPM)
Green Salt Plant (Cont'd)	Moving Bed Reactor	28,417	306	12,580	479
	Moving Bed Reactor	14,286	343	88,285	412
	Talcum Reactor	61,384	538	13,100	712
	Talcum Reactor	50,000	689	272,727	1,237
	Talcum Reactor	50,000	445	50,380	1,196
	Talcum Reactor	50,000	498	57,186	1,128
	Talcum Reactor	26,900	190	37,310	1,100
	Talcum reactor	60,880	766	13,808	819
	Talcum reactor	76,160	1,175	87,104	1,299
	Talcum reactor	39,266	148	42,424	281
	Talcum reactor	37,000	244	29,744	220
	3rd Floor				
	Scale	20,000	790	10,130	2,563
	4th Floor				
	Adams Filter	49,626	467	77,516	1,152
	Control Panel	4,465	750	275,999	1,779
	Hydrogen Burner	5,747	3,536	a	4,284
	Hydrogen Burner	56,743	3,278	a	4,093
Metals Fabrication Plant 6 A	Basement				
	100 HP Motor & Stand	1,094	69	21,151	4,374
	Duct System	223	73	417	156
	Duct System	3,840	91	4,698	141
	Electric Cages	932	104	946	4,140
	Electric Cages	1,434	55	1,259	1,920
	Gear Box	21,159	496	567,526	1,096
	Gears From Motor	6,150	961	173,506	4,340
	Generator	868	83	6,680	171
	Electric Generator/Stand	2,353	77	6,809	156
	Motor & Shaft	161,891	7,955	480,847	10,845
	Motor & Shaft	27,776	1,619	693,744	3,835
	Oil Sump	42,478	4,398	637,759	22,535
	Pressure Regulator	555	b	<bkg	b
	Pump	6,433	1,020	76,885	1,606
	Pump & Cabinet	6,362	2,222	417,360	6,382
	Pump/Motor Assembly	10,400	1,659	131,040	2,124
	Sump Pump	358	659	110,203	1,550
	Sump Pump	15,591	1,335	769,036	1,814
	Sump Tank	4,277	6,119	567,868	7,522
	Vent Blower	4,971	298	16,927	373

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TABLE A.4.2 Radiological Surveys Of Abandoned-In-Place (AIP) Equipment

Component And Component Designation	Equipment Location	Alpha Fixed Max (DPM)	Alpha Removable Max (DPM)	Beta-Gamma Fixed Max (DPM)	Beta-Gamma Removable Max (DPM)
Metals Fabrication Plant (Cont'd)					
	1st Floor Electrical Equipment Room				
	Electric Generator & Stand	613	128	2,907	1,830
	1st Floor				
	ACME Gridleys	15,474	4,455	984,473	18,844
	Cabinet	18,214	673	42,951	1,294
	Chip Conveyor	12,153	1,288	60000+	17,328
	Rolling Mill Control Room	9,498	1,437	34,858	3,809
	Rolling Mill Cooling Bed	39,574	1,497	45,772	2,078
	Furnace & Instrument Panel	8,252	575	58,612	1,378
	Rolling Mill	7,892	450	67,197	516
	Rolling Mill Cabinet	6,288	1,269	a	2,297
	Rolling Mill Control Panel	18,054	825	91,168	4,313
	Rolling Mill Control Room	1,600	351	a	944
	Rolling Mill Control Room	7,647	159	44,011	613
	Rolling Mill Control Room	3,391	1,066	78,641	2,913
	Rolling Mill Electric Equipment Room	2,949	228	6,274	958
	Rolling Mill Generator	1,608	139	5,263	1,416
	Rolling Mill Generator	1,509	188	7,450	490
	Rolling Mill Runout Table	21,261	830	255,335	882
	Rolling Mill Shear Machine	13,662	1,483	145,549	2,381
	Rolling Mill Storage Boxes	16,695	733	121,922	17,963
	Rolling Mill Storage Boxes	14,598	678	15,756	2,310
	Rolling Mill Storage Cabinet	9,488	427	19,741	4,445
	Rolling Mill Storage Cabinet	6,322	2,631	28,034	4,680
	Rolling Mill Storage Cabinet	9,595	2,683	117,281	6,624
	Rolling Mill-1000HP	2,634	887	24,777	1,455
	Rolling Mill-100KW Generator	1,825	162	12,628	396
	Rolling Mill-Adjacent to Quench Tank	20,408	7,527	403,556	65,262
	Rolling Mill-DC Generator & Stand	932	b	1,810	b
	Rolling Mill-DC Generator & Stand	2,010	389	5,322	965
	Rolling Mill-DC Generator & Stand	1,227	475	14,035	3,718
	Rolling Mill-DC Generators	1,010	112	2,886	4,413
	Rolling Mill-Electrical Alley	744	139	110	630
	Rolling Mill-Generator Rack	628	135	1,246	461
	Rolling Mill-Motor & Generator	2,431	206	578,569	639
	Rolling Mill-Motor & Sump	1,651	67	11,738	201
	Rolling Mill-Motors & Generators	1,458	73	8,772	274
	Scale	1,484	767	44,856	1,498
	Transfer Conveyor	13,143	981	723,358	1,738
	Vacuum Cleaner	5,459	1,212	39,607	3,486

TABLE A.4.2 Radiological Surveys Of Abandoned-In-Place (AIP) Equipment

Component And Component Designation		Equipment Location	Alpha Fixed Max (DPM)	Alpha Removable Max (DPM)	Beta-Gamma Fixed Max (DPM)	Beta-Gamma Removable Max (DPM)
Plant 7	7 A	6th Floor				
		Dissociator Unit	7,145	803	72,678	1,124
Pilot Plant Annex	37	1st Floor				
		Briquette maker	61,488	280	131,621	23,147

TABLE A.4.3

OPERABLE UNIT 3 AIR QUALITY DATA

Table A.4.3 includes November 1991 air quality data for several buildings throughout the site. A number of readings were taken from each location using the general area vacuum sampling unit. The number of samples for a given location varies from 1 to 27. The minimum, maximum, and average readings were calculated for each location and are listed in the table. Inhaled materials can be classified according to how rapidly they are removed from respiratory passages. Clearance classes are designated as "D" (removal accomplished in days), "W" (weeks), or "Y" (years). Each class has a set of parameter values for the dynamics of removal. Airborne concentration units are in microcuries per milliliter of total activity and can be compared to the derived air concentration (DAC) standard for the Y class of natural uranium: 2.00E-11 µCi/mL.

When the average reading for a location exceeds 2% of the DAC for a given time, the site Health and Safety Department will investigate to find the cause of the elevated activity. Respirator controls are typically imposed at 25% of the DAC, or 5.00E-12 µCi/mL (based on a time-weighted average).

TABLE A.4.3 Operable Unit 3 Air Quality Data

Component Name	Component Designation	Air Quality Data (Total activity in uCi/ml)		
Preparation Plant	1 A	Location:	1A-585-7C-2B	Center Bay Redrumming
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	9.56E-15	7.33E-15
		Maximum Reading	7.35E-13	4.59E-13
		Average Reading	2.51E-13	2.03E-13
		Location:	1A-585-2E-3C	Lab Area
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.14E-15	1.25E-15
		Maximum Reading	4.47E-13	3.31E-13
		Average Reading	1.08E-13	1.02E-13
		Location:	1A-585-3C-4A	Sampling Station
		Number of Samples:		16
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.36E-15	2.87E-15
		Maximum Reading	1.47E-13	1.88E-13
		Average Reading	7.54E-14	7.73E-14
Plant 1 Storage Building	1 B	Location:	Plant 1 Pad	I/S Storage Tent
		Number of Samples:		1
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	7.10E-13	8.80E-13
		Maximum Reading	7.10E-13	8.80E-13
		Average Reading	7.10E-13	8.80E-13
Ore Refinery Plant	2 A	Location:	2A-580-4C-3C	Dig. S. of Tank DI-10
		Number of Samples:		14
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.14E-15	1.36E-15
		Maximum Reading	1.55E-13	2.95E-13
		Average Reading	8.65E-14	1.45E-13
		Location:	2A-580-12B-4D	Ext. E. of Cont. Pan
		Number of Samples:		14
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.36E-15	1.87E-15
		Maximum Reading	2.63E-13	1.94E-13
		Average Reading	9.91E-14	1.09E-13
		Location:	2A-580-14B-2C	Denitration North Side
		Number of Samples:		10
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.14E-15	1.79E-15
		Maximum Reading	1.53E-13	1.36E-13
		Average Reading	8.53E-14	8.62E-14

TABLE A.4.3 Operable Unit 3 Air Quality Data

Component Name	Component Designation	Air Quality Data (Total activity in uCi/ml)		
Ore Refinery Plant (Cont'd)	2 A	Location:	2A-580-4B-3C	
		Number of Samples:		14
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	3.38E-15	2.49E-15
		Maximum Reading	5.95E-13	3.06E-13
		Average Reading	1.68E-13	1.42E-13
Metal Dissolver Building	2 D	Location:	2D-580-3A-1B	Metal Dissolver Bldg.
		Number of Samples:		12
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	6.36E-14	4.16E-14
		Maximum Reading	8.39E-13	4.87E-13
		Average Reading	1.65E-13	1.22E-13
Maintenance Building	3 A	Location:	3A-580	Maintenance Shop
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.14E-15	1.36E-15
		Maximum Reading	2.52E-13	2.07E-13
		Average Reading	8.39E-14	9.11E-14
Green Salt Plant	4 A	Location:	4A-580-7E-4C	Packout Station #1
		Number of Samples:		22
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.14E-15	1.01E-15
		Maximum Reading	1.81E-13	2.15E-13
		Average Reading	8.24E-14	4.08E-14
		Location:	4A-580-1C-3C	G4-15 Dust Collector
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.37E-15	8.97E-16
		Maximum Reading	3.61E-13	2.95E-13
		Average Reading	1.30E-13	1.13E-13
		Location:	4A-580-8B-4A	South at Scale
		Number of Samples:		13
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	4.12E-14	5.17E-14
		Maximum Reading	3.80E-13	3.32E-13
		Average Reading	1.23E-13	1.17E-13
Metals Production Plant	5 A	Location:	5-580-2D-1	Flat Scale
		Number of Samples:		13
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	6.32E-14	4.74E-14
		Maximum Reading	1.74E-13	2.15E-13
		Average Reading	9.51E-14	1.15E-13

TABLE A.4.3 Operable Unit 3 Air Quality Data

Component Name	Component Designation	Air Quality Data (Total activity in uCi/ml)		
Metals Production Plant (Cont'd)	5 A	Location:	5-592-26E-1	South End of Plant 2nd Fl.
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.71E-15	1.06E-15
		Maximum Reading	1.35E-13	2.79E-13
		Average Reading	9.50E-14	1.35E-13
		Location:	5-592-4E-1	N. of 261 DC Control Panel
		Number of Samples:		14
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.31E-14	1.00E-14
		Maximum Reading	4.51E-13	4.01E-13
		Average Reading	1.81E-13	1.90E-13
		Location:	5-580-7E-4	Lower Remelts
		Number of Samples:		27
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.14E-15	1.32E-15
		Maximum Reading	4.49E-13	6.94E-13
		Average Reading	9.29E-14	9.26E-14
Metals Fabrication Plant	6 A	Location:	*6-580-4C3-2	N. End of Inspection Office
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.14E-15	1.25E-15
		Maximum Reading	2.92E-13	3.23E-13
		Average Reading	1.03E-13	1.07E-13
		Location:	6-580-3C-4	N. of Derby Turnover Eq.
		Number of Samples:		13
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	4.05E-14	3.34E-14
		Maximum Reading	1.48E-13	1.74E-13
		Average Reading	9.99E-14	9.06E-14
		Location:	6-580-29H-1	Chip Briq. Weighing Area
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	3.83E-15	1.94E-15
		Maximum Reading	8.19E-13	4.71E-13
		Average Reading	1.95E-13	1.58E-13
		Location:	6-580-15C-4	South Clarifier Area
		Number of Samples:		13
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	3.42E-14	5.37E-14
		Maximum Reading	1.61E-13	1.62E-13
		Average Reading	1.05E-13	1.22E-13

TABLE A.4.3 Operable Unit 3 Air Quality Data

Component Name	Component Designation	Air Quality Data (Total activity in uCi/ml)		
Recovery Plant	8 A	Location:	8-580-4C-2B	
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	6.53E-15	5.00E-15
		Maximum Reading	8.35E-13	5.51E-13
		Average Reading	2.35E-13	1.85E-13
		Location:	8-600-8C-1A	East Oliver Filter
		Number of Samples:		8
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	5.63E-15	3.42E-15
		Maximum Reading	8.48E-13	4.30E-13
		Average Reading	3.33E-13	2.13E-13
		Location:	8-580-4D-2B	Control Room
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	2.71E-15	2.21E-15
		Maximum Reading	6.52E-13	6.35E-13
		Average Reading	2.36E-13	2.17E-13
		Location:	8-600-10C-4D	Drum Dumper
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	7.43E-15	5.00E-15
		Maximum Reading	4.95E-13	3.16E-13
		Average Reading	2.58E-13	1.72E-13
		Location:	8-580-1B-2B	EIMCO Drumming Station
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	4.28E-15	3.57E-15
		Maximum Reading	3.28E-13	2.63E-13
		Average Reading	1.62E-13	1.32E-13
		Location:	8-580-8D-4B	East Oliver Filter PA
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	2.13E-14	1.59E-14
		Maximum Reading	3.68E-12	2.25E-12
		Average Reading	6.45E-13	4.13E-13
		Location:	8-600-2C-1A	EIMCO Filters
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	2.37E-15	2.49E-15
		Maximum Reading	2.72E-13	2.22E-13
		Average Reading	1.35E-13	1.35E-13

TABLE A.4.3 Operable Unit 3 Air Quality Data

Component Name	Component Designation	Air Quality Data (Total activity in uCi/ml)		
Special Products Plant	9 A	Location:	9-583-10D-4	South of Door on SE Side
		Number of Samples:		8
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.59E-15	1.29E-15
		Maximum Reading	2.08E-13	2.39E-15
		Average Reading	1.28E-13	1.20E-13
		Location:	9-583-4G-1	Bottom Remelt
		Number of Samples:		27
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.48E-15	2.52E-15
		Maximum Reading	7.14E-13	7.21E-13
		Average Reading	1.32E-13	1.53E-13
Service Building	11	Location:	Laundry	West Side
		Number of Samples:	11	23
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	6.97E-15	2.30E-14
		Maximum Reading	9.56E-14	1.18E-13
		Average Reading	2.76E-14	9.31E-14
Laboratory	15	Location:	Laboratory	
		Number of Samples:	9	16
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	7.15E-15	3.57E-14
		Maximum Reading	1.30E-13	1.30E-13
		Average Reading	5.50E-14	6.39E-14
Pilot Plant Annex	37	Location:	37-579-7A-1B	P-2 Furnace
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.14E-15	1.52E-15
		Maximum Reading	6.29E-13	4.47E-13
		Average Reading	1.31E-13	1.23E-13
		Location:	*37-579-2A-1B	Plasma Sprayer
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.32E-15	1.36E-15
		Maximum Reading	3.99E-13	4.76E-13
		Average Reading	1.17E-13	1.06E-13
Incinerator Building	39 A	Location:	39A-588-6D-4B	Near Operator/Inc. Bldg.
		Number of Samples:		4
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.66E-13	1.93E-13
		Maximum Reading	2.34E-13	4.47E-13
		Average Reading	2.08E-13	2.95E-13

TABLE A.4.3 Operable Unit 3 Air Quality Data

Component Name	Component Designation	Air Quality Data (Total activity in uCi/ml)		
Six to Four Reduction Facility #1	54 A	Location:	*54-579-4D-2C	West Autoclave Area
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	1.14E-15	9.02E-16
		Maximum Reading	1.10E-13	1.51E-13
		Average Reading	7.37E-14	8.11E-14
		Location:	54-579-11H-1A	Reactor Area
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	5.85E-15	3.53E-15
		Maximum Reading	1.50E-12	1.00E-12
		Average Reading	3.40E-13	2.33E-13
Drum Recondition Building	66	Location:	66-585-5B-2B	Bldg 66 South End
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	7.20E-15	5.66E-15
		Maximum Reading	7.86E-13	8.15E-13
		Average Reading	3.37E-13	3.52E-13
		Location:	66-585-1B-3B	Bldg. 66 at Drum Crusher
		Number of Samples:		15
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	6.31E-15	4.50E-15
		Maximum Reading	1.10E-12	2.13E-12
		Average Reading	3.12E-13	4.43E-13
Decontamination Building	69	Location:	69-589-2B-4	Decontamination
		Number of Samples:		12
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	4.56E-14	2.90E-14
		Maximum Reading	9.82E-13	5.89E-13
		Average Reading	2.87E-13	2.16E-13
		Location:	69-589-5B-2	Decontamination
		Number of Samples:		12
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	7.05E-14	8.58E-14
		Maximum Reading	1.61E-12	1.05E-12
		Average Reading	4.92E-13	3.82E-13
General In-Process Warehouse	71	Location:	71-585-2C-1A	N. End Package Prep.
		Number of Samples:	19	22
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	7.43E-15	4.73E-15
		Maximum Reading	7.30E-13	7.20E-13
		Average Reading	2.42E-13	1.95E-13

TABLE A.4.3 Operable Unit 3 Air Quality Data

Component Name	Component Designation	Air Quality Data (Total activity in uCi/ml)		
General In-Process Warehouse (Cont'd)	71	Location:	71-585-10A-2B	SW Scale Area
		Number of Samples:	16	21
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading	5.86E-15	7.02E-15
		Maximum Reading	1.10E-12	9.60E-13
		Average Reading	4.28E-13	3.23E-13
Process Trailers	G-006	Location:	Respirator Trailer T-42	
		Number of Samples:	0	1
			Alpha (uCi/ml)	Beta (uCi/ml)
		Minimum Reading		8.90E-15
		Maximum Reading		8.90E-15
		Average Reading		8.90E-15

TABLE A.4.4

RADON (Rn222) AND THORON (Rn220) MONITORING BY LOCATION AND PERIOD

The data presented in this table were collected with Terradex cups placed in several facilities across the site. Until recently, only the thorium warehouses were monitored for levels of radon and thoron. The data for other facilities are unavailable at this time except for Plant 8, the recovery plant.

The Terradex cups are passive collectors that are used over a three-month period. Four cups are used in each facility. Two of these are analyzed for radon and thoron and two are analyzed for radon only. Subtraction of the radon-only average from the radon plus thoron average provides an average thoron value. Also listed are the maximum and minimum thoron values.

Background values for radon have been reported between 0.5 and 0.95 pCi from multiple site documents. This value is location dependent. To protect worker health, the annual average concentration cannot exceed 30 pCi/L above background for radon. For public health, outside the site boundary, an annual average concentration cannot exceed 3 pCi/L above background for radon. Values for radon cannot exceed 100 pCi/L above background at any given point.

During the third quarter of 1990 in the (old) Plant 5 warehouse, the average radon value exceeds the combined average value due to anomalies in the radon measurement.

The following note pertains to Table A.4.4:

a = Values are not applicable due to anomalies in the measurement of radon-220.

TABLE A.4.4 Radon (Rn222) And Thoron (Rn220) Monitoring By Location And Period

Component Name	Component Designation	From	To	pCi/L	Contaminant Sampled	Average Rn222+Rn220	Average Rn222 Only	Average Rn220 Only	Maximum Rn220	Minimum Rn220
3RD QUARTER 1990										
Thorium Warehouse	64	07/11/90	10/12/90	68.7	Rn222+Rn220	63.9	1.4	62.5	67.3	57.7
				59.1	Rn222+Rn220					
				2.0	Rn222					
				0.8	Rn222					
(Old) Plant 5 Warehouse	65	07/11/90	10/12/90	85.0	Rn222+Rn220	76.25	94.5	a	a	a
				67.5	Rn222+Rn220					
				103.3	Rn222					
				85.7	Rn222					
Plant 1 Thorium Warehouse	67	07/11/90	10/12/90	33.0	Rn222+Rn220	33.15	5.55	27.6	27.8	27.5
				33.3	Rn222+Rn220					
				4.2	Rn222					
				6.9	Rn222					
Pilot Plant Warehouse	68	07/11/90	10/12/90	22.1	Rn222+Rn220	20.45	14.55	5.9	7.6	4.3
				18.8	Rn222+Rn220					
				15.7	Rn222					
				13.4	Rn222					
4TH QUARTER 1990										
Thorium Warehouse	64	10/12/90	01/09/91	30.1	Rn222+Rn220	29.15	1.6	27.6	28.5	27.2
				28.2	Rn222+Rn220					
				1.4	Rn222					
				1.8	Rn222					
(Old) Plant 5 Warehouse	65	10/12/90	01/09/91	78.6	Rn222+Rn220	77.85	59.45	18.4	19.2	17.7
				77.1	Rn222+Rn220					
				75.1	Rn222					
				43.8	Rn222					
Plant 1 Thorium Warehouse	67	10/12/90	01/09/91	19.9	Rn222+Rn220	23.55	5.6	18	21.6	14.3
				27.2	Rn222+Rn220					
				6.9	Rn222					
				4.3	Rn222					
Pilot Plant Warehouse	68	10/12/90	01/09/91	10.9	Rn222+Rn220	10.2	7.7	2.5	3.2	1.8
				9.5	Rn222+Rn220					
				6.8	Rn222					
				8.6	Rn222					
1ST QUARTER 1991										
Thorium Warehouse	64	01/09/91	04/10/91	43.0	Rn222+Rn220	42.6	1.1	41.5	41.9	41.1
				42.2	Rn222+Rn220					
				1.2	Rn222					
				1.0	Rn222					

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TABLE A.4.4 Radon (Rn222) And Thoron (Rn220) Monitoring By Location And Period

Component Name	Component Designation	From	To	pCi/L	Contaminant Sampled	Average Rn222+Rn220	Average Rn222 Only	Average Rn220 Only	Maximum Rn220	Minimum Rn220
(Old) Plant 5 Warehouse	65	01/09/91	04/10/91	89.0	Rn222+Rn220	80.1	71.25	8.85	17.8	a
				71.2	Rn222+Rn220					
				80.0	Rn222					
				62.5	Rn222					
Plant 1 Thorium Warehouse	67	01/09/91	04/10/91	17.7	Rn222+Rn220	19.05	1.95	17.1	18.5	15.8
				20.4	Rn222+Rn220					
				1.9	Rn222					
				2.0	Rn222					
Pilot Plant Warehouse	68	01/09/91	04/10/91	32.0	Rn222+Rn220	31.35	5.1	26.25	26.9	25.6
				30.7	Rn222+Rn220					
				5.6	Rn222					
				4.6	Rn222					
2ND QUARTER 1991										
Thorium Warehouse	64	04/10/91	07/03/91	136.6	Rn222+Rn220	158.6	1.6	157	179	135
				180.6	Rn222+Rn220					
				0.9	Rn222					
				2.3	Rn222					
(Old) Plant 5 Warehouse	65	04/10/91	07/03/91	178.0	Rn222+Rn220	197	87.5	109.6	128.5	90.5
				216.0	Rn222+Rn220					
			72938	82.2	Rn222					
				92.7	Rn222					
Plant 1 Thorium Warehouse	67	04/10/91	07/03/91	68.6	Rn222+Rn220	73.6	7.5	66.1	71.1	61.1
				78.6	Rn222+Rn220					
				6.7	Rn222					
				8.3	Rn222					
Pilot Plant Warehouse	68	04/10/91	07/03/91	36.0	Rn222+Rn220	68.4	26.3	42.1	74.5	9.8
				100.7	Rn222+Rn220					
				20.5	Rn222					
				32.0	Rn222					
Recovery Plant	8 A	04/10/91	07/03/91	36.3	Rn222+Rn220	34.3	1.3	33	35	30.9
				32.2	Rn222+Rn220					
				1.3	Rn222					
				1.2	Rn222					

TABLE A.4.5

SUMMARY OF SITE-WIDE ASBESTOS SURVEY RESULTS

Table A.4.5 summarizes the results of the site-wide asbestos survey performed by Diagnostic Engineering, Incorporated (DEI). The report for this asbestos survey was submitted to Westinghouse Environmental Management Company of Ohio by DEI on February 28, 1992. Seventy-four FEMP components were investigated by this survey. Only components identified as potentially having asbestos-containing material (ACM) were investigated (e.g., newer facilities were not investigated because of the ban on use of ACM in construction).

Each facility or component was divided into homogeneous areas to facilitate sampling and characterization of the ACM. A homogeneous area is broadly defined as an area of material having similar type, consistency, color, appearance, or composition. Bulk samples were collected for analysis from each homogeneous area except where visual observations determined that there was no potential ACM to sample.

The ACM-positive areas, which were identified by the analysis of the bulk samples, were assigned a numeric hazard ranking by the survey. The hazard ranking range was from 1 (low potential for disturbance, ACM in good condition) to 7 (significant damage to ACM, immediate abatement necessary). Table A.4.5 identifies the components investigated.

The following note pertains to Table A.4.5:

a = ACM from these areas was abated during the survey, so these facilities are not among the 56 facilities containing ACM.

TABLE A.4.5 Summary of Site-Wide Asbestos Survey Results

Component	Component Number	Number of Homogeneous Areas Sampled	Number of Areas Positive for ACM	Number of Bulk Samples
Preparation Plant and Plant 1 Storage Shelter	1A and 1B	23	20	62
Ore Refinery Building	2A	76	59	180
Lime Handling Building	2B	15	12	18
Bulk Lime Handling Building	2C	2	2	3
Metal Dissolver Building	2D	11	9	12
NFS Storage Pump House	2E	5	5	11
Maintenance Building	3A	13	10	25
Ozone Building	3B	4	3[a]	5
Control House	3C	13	7	21
NAR Towers	3D	8	5	27
Hot Raffinate Building	3E	33	27	71
Digestion Fume Recovery	3F	4	4	8
Refrigeration Building	3G	4	4	5
Green Salt Plant	4A	107	87	187
Plant 4 Warehouse	4B	0	0	0
Plant 4 Maintenance Building	4C	5	2	4
Metals Production Plant	5A	104	75	215
Metals Fabrication Plant	6A	205	87	421
Plant 7	7A	58	57	108
Recovery Plant	8A	43	31	67
Maintenance Building	8B	4	4	8
Rotary Kiln/Drum Building	8C	0	0	0
Special Products Plant	9A	62	40	114
Boiler Plant	10A	41	30	174
Boiler Plant Maintenance	10B	3	0	5
Service Building	11	55	25	123
Main Maintenance Building	12A	49	40	91
Cylinder Storage Building	12B	0	0	0
Lumber Storage Building	12C	0	0	0
Pilot Plant Wet Side	13A	20	17	30
Pilot Plant Maintenance Building	13B	5	4	11
Administration Building	14	53	53	114
Laboratory	15	141	105	315
Main Electrical Station	16A	2	2	1
General Sump	18B	0	0	0
Main Metal Tank Farm	19A	3	0	5
Valve/Control Building	20A	11	10	16
Filter/Chemical Building	20B	12	7	22

TABLE A.4.5 Summary of Site-Wide Asbestos Survey Results

Component	Component Number	Number of Homogeneous Areas Sampled	Number of Areas Positive for ACM	Number of Bulk Samples
Cooling Towers	20C	1	1	1
Well House 1	20E	2	2	3
Well House 3	20G	2	2	4
Railroad Scale House	24A	0	0	0
Security Building	28A	12	8	21
Human Resources Building	28B	31	19	71
Chemical Warehouse	30A	6	6	12
Engine House/Garage	31	14	13	29
Magnesium Storage Building	32	7	5	9
Pilot Plant Annex	37	10	8	22
Propane Storage	38	4	4	14
Incinerator Building	39A	6	5	8
Rust Building	45	18	9	38
Heavy Equipment Building	46	7	1	9
OS&H Building	53A	3	1	5
UF_6 to UF_4 Reduction Facility 1	54A	54	23	83
Pilot Plant Warehouse	54B	0	0	0
Slag Recycling Building	55A	9	6	17
CP Storage Warehouse	66	4	2	10
Quonset Hut 1	60	0	0	0
Quonset Hut 2	61	1	1[a]	3
Quonset Hut 3	62	2	1[a]	3
KC-2 Warehouse	63	5	0	3
Thorium Warehouse	64	0	0	0
(old) Plant 5 Warehouse	65	0	0	0
Drum Reconditioning Building	66	9	6	15
Plant 1 Thorium Warehouse	67	0	0	0
Pilot Plant Warehouse	68	4	4	2
Decontamination Building	69	5	5	24
General in Process Storage	71	3	1	7
Finished Products Warehouse	77	0	0	0

TABLES A.5.0 and A.5.1

INVENTORY OF NON-RCRA and RCRA DRUMS

Tables A.5.0 and A.5.1 present information on drummed waste at the FEMP. The information presented is a summary of general types of waste that are currently stored in various buildings. This information is a compilation of data from the Material Control and Accountability (MC&A) Department and the Removal Site Evaluation for thorium storage buildings. Sizes of drums are unknown in the existing MC&A database. A new database is being created to track and control drum content, sizes, and locations.

These tables present drum information by storage location and then by enrichment code.* The enrichment codes and their definitions are listed below. Within each code, all quantities of drums have been grouped together. The original quantities for each description are available if requested.

The following notes pertain to Tables A.5.0 and A.5.1:

*Enrichment Codes

A = normal alloy	N = normal waste, 0.710 to 0.712% U-235	3 = enriched 1.10% U-235
B = enriched alloy	P = depleted waste, <0.710% U-235	4 = enriched, 1.25% U-235
C = enriched, 2.1% U-235	T = thorium	5 = enriched, 0.94% U-235
D = depleted	V = enriched waste, >0.712% U-235	7 = enriched sweetener
G = normal	X = enriched	8 = enriched, 0.86% U-235
H = enriched, 0.947% U-235	1 = normal, 0.710 to 0.712% U-235	9 = enriched, 2.10% U-235
L = enriched, 0.947% U-235	2 = enriched, recycle tails	0 = enriched
M = enriched, 1.25% U-235		

**Sizes of drums are not provided in the MCT database. Drum sizes and locations are being placed in a new database to allow tracking of this information.

TABLE A.5.0 Inventory Of Non–RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Metal Dissolver Building	2 D	H	Solid Metal,Not Cores, Embedded Steel	1
Green Salt Plant	4 A	0	Calcium Uranate	250
			Scrap U3O8 Or ThO2, High Fluoride	
			U3O8 Rotexed Plant 8 Furnace Product	
			UF4 Or ThF4	
			Unfired Reduction Charges + MgF2	
		2	Scrap Salts, High Fluoride	3
			Scrap U3O8 Or ThO2, High Fluoride	
		4	U3O8 Rotexed Plant 8 Furnace Product	816
			UF4 From Pilot Plant UF6	
			UO2 Or ThO2 Product	
		7	Off–Spec UF4 Or ThF4	254
			UF4 From Pilot Plant UF6	
			UF4 Or ThF4	
		D	UF4 From Pilot Plant UF6	456
			UF4 Or ThF4	
			UO3 Reactor Recycle Tails	
		M	Scrap U3O8 Or ThO2, High Fluoride	33
Plant 4 Warehouse	4 B	0	UF4 Or ThF4	283
		2	UF4 From Hanford UO3	2,995
		D	Off–Spec UF4 Or ThF4	10,659
			Scrap Salts, High Fluoride	
			Sludges, Oily	
			UF4 From Pilot Plant UF6	
			UF4 Or ThF4	
Metals Production Plant	5 A	0	Contaminated Graphite	370
			Contaminated Magnesium	
			Contaminated Soil, Rocks, Sand...	
			Dust Collector Residues–High Fluoride	
			Metal Spill & Extrusion Ends; High Impurities	
			MgF2 For Milling Or Discard	
			MgF2 Or CaF2	
			MgF2, +20 Mesh, Low U Content	
			Roasted MgF2 (Blended With Other Materials)	
			Rockwell Cleanings	
			Scrap U3O8 Or ThO2, High Fluoride	
			Sludges, Oily, For Oxidation, High Free Metal	
			U3O8 +8 Mesh, Low Fluoride	

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TABLE A.5.0 Inventory Of Non–RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Metals Production Plant (Cont'd)	5 A	0 (Cont'd)	Unfired Reduction Charges + MgF2	
			Zirnlo Product	
		1	Declad Metal, Other Than Zimlo	6
			UO3 Product	
		2	Dust Collector Bags	111
			Scrap Salts, High Fluoride	
		3	Metal Samples For Double Melting	4
		4	Dust Collector Bags	401
			Scrap Salts, High Fluoride	
			Scrap U3O8 Or ThO2, High Fluoride	
			Scrap UO2	
			UO3 Product	
		5	Contaminated Soil, Rocks, Sand...	152
		8	Lead And Lead Contaminated Metal	24
		D	Charged UF4 Pots, Wip	205
			Chemical Reject Solid Remelt Metal	
			Clean Prill For Double Melting	
			Contaminated Magnesium	
			Depleted U Ingot Crops From Primary Ingots	
			Dirty Pril, Code 5 Derbies, High U Content	
			Dry Crushed Slag From Furnace Pot Blowouts	
			Dust Collector Bags	
			Dust Collector Residue, High Fluoride	
			Dust Collector Residues–High Fluoride	
			Ingot Crops And Duds	
			MgF2 For Milling Or Discard	
			MgF2 Or CaF2	
			MgF2, +20 Mesh, Low U Content	
			Non–Briquettable Chips And Turnings	
			Partially Oxidized Metal Oxidation Feed	
			Pickled Arf Remelt Material	
			Pickled Primary Ingo W/O Top Crop Metal	
			Pickled Reject Billets Or Billet Sections	
			Rockwell Cleanings	
			Sludges, Non–Oily, For Oxidation	
			Sr Standard Solid Metal–For Remelt	
			Unfired Reduction Charges + MgF2	
			UO3 Reactor Recycle Tails	
			Wet Crushed Slag From Furnace Pot Blowouts	
		H	Dust Collector Residues, Low Fluoride	422
			Ingot Crops From Primary Ingots	

TABLE A.5.0 Inventory Of Non–RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Metals Production Plant (Cont'd)	5 A	H (Cont'd)	Non–Briquettable Chips And Turnings	
			Partially Oxidized Metal	
			Scrap U3O8 Or ThO2, High Fluoride	
			Solid Metal,Not Cores, Embedded Steel	
			Zirnlo Product	
			Zirnlo: Partially Declad Fuel Elements	
		M	Chemical Reject Solid Metal	144
			Extrusion Butts To Be Pickled	
			Ingot Crops From Primary Ingots	
			Metal Spill & Extrusion Ends; High Impurities	
			Partially Oxidized Metal	
			Pickled Chemical Reject Crops	
			Pickled Crops From Hw Metal	
			Pickled Primary Ingo W/O Top Crop Metal	
			Pickled Primary Ingot Sections	
			Sawed Sect. Req. Piklg. Frm Ingots W/O Top Crops	
			Sawed Sect. Req. Piklg. Frm Ingots W/Top Crops	
			Scrap U3O8 Or ThO2, High Fluoride	
			Solid Metal–Incl. Physical But Not Chem. Reject Ingots	
			Solid Remelt Metal Low Impurities	
			Zirnlo Product	
			Zirnlo: Partially Declad Fuel Elements	
		P	MgF2 For Milling Or Discard	21
			Non–Burnable Metal W/ Uranium Content	
		V	Dust Collector Residues–High Fluoride	24
			MgF2 For Milling Or Discard	
Plant 5 Ingot Storage Shelter	5 G	D	Briquettable Chips And Turnings	304
			Briquettes High In Impurities	
			Depleted U Ingot Crops From Primary Ingots	
			Metal Samples For Double Melting	
			Non–Briquettable Chips And Turnings	
			Sludges, Oily, For Oxidation, High Free Metal	
			Solid Remelt Metal Low Impurities	
		P	Metal Samples For Double Melting	1
Metals Fabrication Plant	6 A	0	Calcium Uranate	14,931
			Dust Collector Residues–High Fluoride	
			MgF2 For Milling Or Discard	
			MgF2 Or CaF2	
			MgF2, Ground	

TABLE A.5.0 Inventory Of Non-RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Metals Fabrication Plant (Cont'd)	6 A	0 (Cont'd)	Off-Site Sump And Filter Cakes After Roasting	
			Roasted Ca-Precipitated Sump And Filter Cakes	
			Roasted, Milled And/Or Screened Calcium	
			U3O8 Rotexed Plant 8 Furnace Product	
			Unroasted But Milled MgF2	
		1	Mark 25 Elements-Inner	41
			Mark 25 Elements-Outer	
		2	Scrap UO2	2
		3	MgF2 For Milling Or Discard	3
		4	MgF2 For Milling Or Discard	133
		7	UF4 From Pilot Plant UF6	419
		D	Chemical Reject Solid Remelt Metal	193
			Depleted U Metal	
			Furnace Salt, Solidified, Non-Chloride	
			Ingot Crops And Duds	
			Metal From Spills For Double Melting	
			Primary Ingot Sec., Not Pickled, 1St Gen. Top Crops	
			Rockwell Spills	
			Solid Metal,Not Cores, Embedded Steel	
		H	Chemical Reject Solid Metal	2
			Solid Metal-Incl. Physical But Not Chem. Reject Ingots	
		M	Chemical Reject Solid Metal	6
			Metal From Spills For Double Melting	
Plant 7	7 A	0	UF4 Or ThF4	36
		1	UF4 From Pilot Plant UF6	2,388
		2	Dust Collector Residues-High Fluoride	253
			UF4 From Hanford UO3	
		D	Dust Collector Residues-High Fluoride	3,259
			Off-Spec UF4 Or ThF4	
			UF4 From Pilot Plant UF6	
			UF4 Or ThF4	
Recovery Plant	8 A	0	Dust Collector Residues-High Fluoride	14
			Sludges, Cleanout, Non-Oily	
		4	Calcium Uranate	1
		P	Discard Process Residues	9
		V	Contaminated Oil, Insoluble	5
			Roasted Ca-Precipitated Sump And Filter Cakes	

TABLE A.5.0 Inventory Of Non-RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Special Products Plant	9 A	0	Calcium Uranate	4,078
			Dirty Pril, Code 5 Derbies, High U Content	
			Dry Crushed Slag From Furnace Pot Blowouts	
			Dust Collector Bags	
			Dust Collector Residues-High Fluoride	
			Metal From Spills For Double Melting	
			Metal Samples For Double Melting	
			MgF2 For Milling Or Discard	
			MgF2 Or CaF2	
			Scrap U3O8 Or ThO2, High Fluoride	
			Sludges, Oily, For Oxidation, High Free Metal	
			Unfired Reduction Charges + MgF2	
			Unroasted But Milled MgF2	
			Wet Sump Or Filter Cake, Non-Oily/Halide	
		2	Unfired Reduction Charges + MgF2	3
		3	Reject Elements-Inner	1
		5	Unfired Reduction Charges + MgF2	4
		B	Zirnlo Product	3
		D	Depleted U Ingot Crops From Primary Ingots	474
			Depleted U Metal	
			Dust Collector Residue, High Fluoride	
			Dust Collector Residues, Low Fluoride	
			Metal From Spills For Double Melting	
			Pickled Extrusion Butts	
			Rockwell Spills	
			Scrap U3O8 Or ThO2, High Fluoride	
			Wet Sump Or Filter Cake, Non-Oily/Halide	
		H	Metal Samples For Double Melting	24
			Scrap U3O8 Or ThO2, High Fluoride	
		M	Extrusion Butts To Be Pickled	2
			Tubular Elements To Be Crushed	
		V	Metal Samples For Double Melting	2
Pilot Plant Wet Side	13 A	0	Zirnlo Ends	1
		B	Zirnlo Ends	1
		H	Zirnlo Ends	82
		M	Scrap U3O8 Or ThO2, High Fluoride	94
Laboratory	15	0	Contam. Tbp/Kerosene Mixtures & Sludges	5
			U3O8 Not Requiring Re-Oxidation	
		D	Contaminated Graphite	18

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TABLE A.5.0 Inventory Of Non-RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Laboratory (Cont'd)	15	D (Cont'd)	Contaminated Soil, Rocks, Sand...	
			Metal Samples For Double Melting	
			Samples, Non-Metallic, Misc.	
			Special Solid Ingots Or Slabs	
		H	Metal Samples For Double Melting	1
		M	Metal Samples For Double Melting	3
			Non-Briquettable Chips And Turnings	
		P	Contaminated Solvent	94
			Non-Recoverable Trash	
		V	Non-Recoverable Trash	6
Old North Tank Farm	19 D	P	Discard Process Residues	761
			Sludges, Cleanout, Non-Oily	
		V	Sump Cake-Copper Contaminated, Low Uranium	137
Pilot Plant Annex	37	H	Zirnlo Ends	12
Six to Four Reduction Facility #1	54 A	1	Metal Samples For Double Melting	3
		D	Contaminated Alumina-Soda Lime	2,744
			Off-Spec UF4 Or ThF4	
			UF4 From Pilot Plant UF6	
		H	Zirnlo Ends	12
		M	Scrap U3O8 Or ThO2, High Fluoride	82
			Zirnlo Ends	
Pilot Plant Shelter	54 B	0	Wet Sump Or Filter Cake, Non-Oily/Halide	2,520
		D	UF4 From Pilot Plant UF6	4,249
Quonset Huts #1, #2, and #3	60	T	Non-Recoverable Trash	1,788
			Scrap U3O8 Or ThO2, Low Fluoride	
			UO2 (Or ThO2) Powder-Refinery Feed	
Thorium Warehouse	64	1	Chemical Reject Solid Metal	230
			Code 2 Derbies For Double Melting Or Shot Cleaning	
			Derbies, Code 1 And Code 3	
			Metal From Spills For Double Melting	
			Metal Samples For Double Melting	
			Partially Oxidized Metal	
			Pickled Chemical Reject Crops	
			Solid Metal-Incl. Physical But Not Chem. Reject Ingots	
			Zirnlo Ends	

TABLE A.5.0 Inventory Of Non-RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Thorium Warehouse (Cont'd)	64	D	Chemical Reject Solid Remelt Metal	184
			Depleted U Metal	
			Ingot Crops And Duds	
			Physical Reject Billets	
			Pickled Primary Ingo W/O Top Crop Metal	
			Primary Ingot Sec., Not Pickled, 1St Gen. Top Crops	
			Reject Billets, Including Sawed Billet Sections	
			Zirnlo Ends	2
		T	Briquettes	420
			Clad Metal For Acid Dissolution	
			Clad Metal For Hno3 Dissolver	
			Clad U Metal	
			First Generation Top Crops From Product Ingots	
			Ingot Crops From Primary Ingots	
			Material Held For Historical Purposes	
			Metal Samples For Double Melting	
			Metal Spill & Extrusion Ends; High Impurities	
			Metal To Be Oxidized	
			Non-Briquettable Chips And Turnings	
			Ox. Clad Or Mix. W/ Any Metal Elem.; Not Al,Zc,Steel	
			Oxides Clad Or Mixed With Aluminum	
			Oxides Clad Or Mixed With Zirconium	
			Partially Oxidized Metal Containing No Metl-X	
			Partially Oxidized Metal Oxidation Feed	
			Samples, Non-Metallic, Misc.	
			Sawdust For Oxidation	
			Scrap U3O8 Or ThO2, High Fluoride	
			Scrap U3O8 Or ThO2, Low Fluoride	
			Solid Metal For Pickling Prior To Remelt	
			Solid Metal To Be Pickled	
			Solid Metal To Be Sawed, Sheared Or Crushed	
			Solid Metal-Incl. Physical But Not Chem. Reject Ingots	
			U3O8 Rotexed Other Than Plt. 8'S Product	
			Wet Thorium Oxalate Cake	
			Zirconium Clad Metal	
			Briquettes	
			Clad U Metal	
			Derbies, Code 1 And Code 3	
			First Generation Top Crops From Product Ingots	
			Metal Samples For Double Melting	
			Metal Spill & Extrusion Ends; High Impurities	

TABLE A.5.0 Inventory Of Non-RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Thorium Warehouse (Cont'd)	64	T (Cont'd)	Metal To Be Oxidized	
			Non-Briquettable Chips And Turnings	
			Oxides Clad Or Mixed With Zirconium	
			Sawdust For Oxidation	
(Old) Plant 5 Warehouse	65	T	Solid Metal For Pickling Prior To Remelt	5,599
			Thorium Hydroxide, Dry	
			UO2(Or ThO2) Pellets-Refinery Feed	
			Wet Sump Or Filter Cake, Halide Contam.	
			Wet Thorium Oxalate Cake	
Plant 1 Thorium Warehouse	67	T	Clad Metal For Hno3 Dissolver	6,004
			Code 4 Or Bottom Burnout Derbies For Dbl. Melt.	
			Contaminated Graphite	
			Contaminated Non-Burnables	
			Contaminated Rags, Etc.	
			Derbies, Code 1 And Code 3	
			Dust Collector Bags	
			Dust Collector Residues-High Fluoride	
			Material Held For Historical Purposes	
			Metal Samples For Double Melting	
			Metal Spill & Extrusion Ends; High Impurities	
			Metal To Be Oxidized	
			Miscellaneous Material	
			Non-Briquettable Chips And Turnings	
			Non-Burnable Metal W/ Uranium Content	
			Off-Spec Th Oxalate, French Source	
			Off-Spec ThO2: French Source	
			Off-Spec UF4 Or ThF4	
			Offsite Sump & Filter Cakes	
			Ore Concentrates-Miscellaneous	
			Ox. Clad Or Mix. W/ Any Metal Elem.; Not Al,Zc,Steel	
			Oxides Clad Or Mixed With Aluminum	
			Oxides Clad Or Mixed With Zirconium	
			Partially Oxidized Metal	
			Samples, Non-Metallic, Misc.	
			Scrap Salts, Low Fluoride	
			Scrap U3O8 Or ThO2, High Fluoride	
			Scrap U3O8 Or ThO2, Low Fluoride	
			Scrap UO2	
			Solid Metal For Pickling Prior To Remelt	

TABLE A.5.0 Inventory Of Non–RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Plant 1 Thorium Warehouse (Cont'd)	67	T (Cont'd)	Solid Metal To Be Pickled	
			ThO2 Produced From Sol–Gel Process	
			ThO2 Produced From Unpurified Hanford Th Nitrate	
			Trailer Cakes, Waste Slurries, Raff., Not To Spec.	
			U Or Th Chloride Salts, Reject	
			UF4 Or ThF4	
			UO2 (Or ThO2) Powder–Refinery Feed	
			UO2 Or ThO2 Product	
			UO2(Or ThO2) Pellets–Refinery Feed	
			Wet Sump Or Filter Cake, Non–Oily/Halide	
			Wet Thorium Oxalate Cake	
Pilot Plant Warehouse	68	T	Scrap U3O8 Or ThO2, Low Fluoride	1,317
			ThO2 Produced From Unpurified Hanford Th Nitrate	
Plant 8 East Pad	74 C	P	Discard Process Residues	2,037
Plant 4 Pad	74 E	0	UO3 Product	5
		2	UF4 Or ThF4	42
		D	UF4 Or ThF4	33
Plant 8 North Pad	74 R	0	Contaminated Rags, Etc.	381
			Drum Decon. Residues:Wet MgF2	
			Dust Collector Residues, Low Fluoride	
			Dust Collector Residues–High Fluoride	
			MgF2, Ground	
			Off–Spec UF4 Or ThF4	
			Sludges, Cleanout, Non–Oily	
			Sludges, For Blending And Screening	
			Sludges, Oily, For Oxidation, High Free Metal	
			U3O8 +8 Mesh, Low Fluoride	
		1	Chips And Turnings Contaminated With Non–U Materials	2
			Sludges, Oily, For Oxidation, High Free Metal	
		5	Rockwell Spills	3
		D	Dust Collector Residues, Low Fluoride	181
			Dust Collector Residues–High Fluoride	
			Scrap Salts, High Fluoride	
			Scrap U3O8 Or ThO2, Low Fluoride	
			U3O8 +8 Mesh, Low Fluoride	
		P	MgF2 For Milling Or Discard	1
		V	Contaminated Soil, Rocks, Sand...	525

TABLE A.5.0 Inventory Of Non-RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Plant 8 North Pad (Cont'd)	74 R	V (Cont'd)	Sludges, Cleanout, Non-Oily	
			Sump Cake-Copper Contaminated, Low Uranium	
			Wet Sump Or Filter Cake, Non-Oily/Halide	
Plant 1 Storage Pad	74 T	0	Calcium Uranate	9,561
			Contam. Filter Elements & Cartridges	
			Contaminated Alumina-Soda Lime	
			Contaminated Carbon Filter Elements	
			Contaminated CaF2-Mgo	
			Contaminated Graphite	
			Contaminated Graphite-Crushed	
			Contaminated Magnesium	
			Contaminated Non-Burnables	
			Contaminated Oil, Insoluble	
			Contaminated Rags, Etc.	
			Contaminated Soil, Rocks, Sand...	
			Contaminated Water Or Sump, Non-Chloride	
			Dirty Pril, Code 5 Derbies, High U Content	
			Discard Process Residues	
			Drum Decon. Residues:Wet MgF2	
			Dry Crushed Slag From Furnace Pot Blowouts	
			Dust Collector Bags	
			Dust Collector Residue, High Fluoride	
			Dust Collector Residues, Low Fluoride	
			Dust Collector Residues, Pyrophoric, High Fluoride	
			Dust Collector Residues-High Fluoride	
			Furnace Salt, Solidified, Chloride	
			Furnace Salt, Solidified, Non-Chloride	
			Incinerator Ashes	
			Incinerator Cinders	
			Lead And Lead Contaminated Metal	
			Material Held For Historical Purposes	
			MgF2 For Milling Or Discard	
			MgF2, +20 Mesh, Low U Content	
			MgF2, Ground	
			Miscellaneous Material	
			MgF2 For Milling Or Discard	
			MgF2, -20 Mesh, High Free Metal For Plt. 8 Roasting	
			Non-Briquettable Chips And Turnings	
			Non-Burnable Metal W/ Uranium Content	
			Non-Recoverable Trash	

TABLE A.5.0 Inventory Of Non-RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Plant 1 Storage Pad (Cont'd)	74 T	0 (Cont'd)	Off-Spec UF4 Or ThF4	
			Oily MgF2	
			Oxides Clad Or Mixed With Stainless Steel	
			Oxides Clad Or Mixed With Zirconium	
			Partially Oxidized Metal	
			Partially Oxidized Metal Containing Metl-X	
			Partially Oxidized Metal Oxidation Feed	
			Roasted MgF2 (Blended With Other Materials)	
			Rockwell Cleanings	
			Rockwell Spills	
			Samples, Non-Metallic, Misc.	
			Scrap Salts, High Fluoride	
			Scrap Salts, Low Fluoride	
			Scrap U3O8 Or ThO2, High Fluoride	
			Scrap U3O8 Or ThO2, Low Fluoride	
			Scrap UO2	
			Sludges, Cleanout, Non-Oily	
			Sludges, Oily	
			Sludges, Oily, For Oxidation, High Free Metal	
			Sludges, Salt, Soft, Chloride	
			Sump Cake-Copper Contaminated, Low Uranium	
			Trailer Cakes, Waste Slurries, Raff., Not To Spec.	
			U Alloyed Or Canned W/ Elements Other Than Al,Mo,Zc	
			U Or Th Nitrate Sol'N, High Impurity	
			U308 For Reoxidation	
			U3O8 +8 Mesh, Low Fluoride	
			Unfired Reduction Charges + MgF2	
			Unroasted But Milled MgF2	
			Wet Crushed Slag From Furnace Pot Blowouts	
			Wet Sump Or Filter Cake, Calide Contam.	
			Wet Sump Or Filter Cake, Non-Oily/Halide	
			Wet Sump Or Filter Cake, Oil Contam.	
			Zirconium Clad Metal	
			Zirnlo Ends	
		1	Chem. Reject Primary Ingots	1,586
			Chemical Reject Solid Metal	
			Clad U Metal	
			Cold Metal Oxides-Non Radium	
			Contaminated Alumina-Soda Lime	
			Contaminated Carbon Filter Elements	
			Contaminated Graphite	

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TABLE A.5.0 Inventory Of Non–RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Plant 1 Storage Pad (Cont'd)	74 T	1 (Cont'd)	Contaminated Magnesium	
			Contaminated Non–Burnables	
			Contaminated Rags, Etc.	
			Declad Metal, Other Than Zimlo	
			Depleted U Ingot Crops From Primary Ingots	
			Derbies, Code 1 And Code 3	
			Dirty Pril, Code 5 Derbies, High U Content	
			Discard Process Residues	
			Dry Crushed Slag From Furnace Pot Blowouts	
			Dust Collector Bags	
			Dust Collector Residues, Low Fluoride	
			Dust Collector Residues–High Fluoride	
			Experimental Shapes	
			Extrusion Butts To Be Pickled	
			Impure Uranyl Or Throium Nitrate Solid	
			Incinerator Cinders	
			Ingot Crops And Duds	
			Ingot Crops From Primary Ingots	
			Ingots From Off–Site To Be Reworked	
			Material Held For Historical Purposes	
			Metal Samples For Double Melting	
			Metal Spill & Extrusion Ends; High Impurities	
			MgF2 For Milling Or Discard	
			MgF2 Or CaF2	
			MgF2, +20 Mesh, Low U Content	
			Miscellaneous Material	
			Non–Recoverable Trash	
			Off–Spec UF4 Or ThF4	
			Ore Concentrates–Miscellaneous	
			Oxides Clad Or Mixed With Aluminum	
			Oxides Clad Or Mixed With Zirconium	
			Partially Oxidized Metal	
			Partially Oxidized Metal Oxidation Feed	
			Pickled Chemical Reject Crops	
			Pickled Crops From Hw Metal	
			Pickled Extrusion Butts	
			Pickled Primary Ingo W/O Top Crop Metal	
			Pickled Primary Ingot Sections	
			Purified Uranyl Or Thorium Nitrate Sol'N	
			Radium–Bearing Materials	
			Reject Elements–Inner	

TABLE A.5.0 Inventory Of Non-RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Plant 1 Storage Pad (Cont'd)	74 T	1 (Cont'd)	Reject Elements-Outer	
			Reject UO3	
			Samples, Non-Metallic, Misc.	
			Sawed Sect. Req. Piklg. Frm Ingots W/O Top Crops	
			Sawed Sect. Req. Piklg. Frm Ingots W/Top Crops	
			Scrap Salts, High Fluoride	
			Scrap Salts, Low Fluoride	
			Scrap U3O8 Or ThO2, High Fluoride	
			Scrap U3O8 Or ThO2, Low Fluoride	
			Scrap UO2	
			Solid Metal To Be Pickled	
			Solid Metal To Be Sawed, Sheared Or Crushed	
			Solid Metal,Not Cores, Embedded Steel	
			Solid Metal-Incl. Physical But Not Chem. Reject Ingots	
			Solid Remelt Metal Low Impurities	
			Sr Standard Solid Metal-For Remelt	
			U Or Th Nitrate Sol'N, High Impurity	
			U308 For Reoxidation	
			U3O8 Not Requiring Re-Oxidation	
			UF4 From Pilot Plant UF6	
			UF4 Or ThF4	
			Unfired Reduction Charges + MgF2	
			Unrecycled Slag+20Mesh,Ball Mill Prod.	
			UO2 (Or ThO2) Powder-Refinery Feed	
			UO2 Or ThO2 Product	
			UO2(Or ThO2) Pellets-Refinery Feed	
			UO3 Product	
			Uranium Carbide, Uc	
			Wet Crushed Slag From Furnace Pot Blowouts	
			Wet Sump Or Filter Cake, Halide Contam.	
			Wet Sump Or Filter Cake, Non-Oily/Halide	
			Zirnlo: Partially Declad Fuel Elements	
		2	Contam. Filter Elements & Cartridges	210
			Contaminated Carbon Filter Elements	
			Contaminated Graphite	
			Contaminated Non-Burnables	
			Contaminated Soil, Rocks, Sand...	
			Dust Collector Bags	
			Dust Collector Residues, Pyrophoric, High Fluoride	
			Dust Collector Residues-High Fluoride	
			Material Held For Historical Purposes	

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TABLE A.5.0 Inventory Of Non-RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Plant 1 Storage Pad (Cont'd)	74 T	2 (Cont'd)	Off-Spec UF4 Or ThF4	
			Scrap Salts, High Fluoride	
			Scrap U3O8 Or ThO2, High Fluoride	
			Scrap U3O8 Or ThO2, Low Fluoride	
			Scrap UO2	
			Unfired Reduction Charges + MgF2	
		3	Contaminated Soil, Rocks, Sand...	3
			Material Held For Historical Purposes	
		4	Calcium Uranate	192
			Contam. Filter Elements & Cartridges	
			Contaminated Rags, Etc.	
			Contaminated Soil, Rocks, Sand...	
			Dirty Pril, Code 5 Derbies, High U Content	
			Discard Process Residues	
			Dust Collector Bags	
			Dust Collector Residues-High Fluoride	
			Off-Spec UF4 Or ThF4	
			Rockwell Spills	
			Scrap Salts, High Fluoride	
			U3O8 +8 Mesh, Low Fluoride	
			Unfired Reduction Charges + MgF2	
		5	Contaminated Rags, Etc.	16
			Contaminated Soil, Rocks, Sand...	
			Rockwell Spills	
		7	Contam. Filter Elements & Cartridges	48
			Contaminated Carbon Filter Elements	
			Dust Collector Residues-High Fluoride	
			Off-Spec UF4 Or ThF4	
			Scrap Salts, High Fluoride	
		8	Non-Recoverable Trash	2
		A	Clad Metal For Acid Dissolution	35
			Oxides Clad Or Mixed With Aluminum	
			Oxides Clad Or Mixed With Stainless Steel	
			Oxides Clad Or Mixed With Zirconium	
			U3O8 Rotexed Plant 8 Furnace Product	
			Uranyl Or Thorium Nitrate Solution	
		B	Material Held For Historical Purposes	4
			Zirconium Clad Metal	
			Zirnlo Ends	
		D	Bad Reduction (No Derby)	18,726
			Chemical Reject Solid Remelt Metal	

TABLE A.5.0 Inventory Of Non-RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Plant 1 Storage Pad (Cont'd)	74 T	D (Cont'd)	Clad U Metal	
			Clean Prill For Double Melting	
			Contam. Filter Elements & Cartridges	
			Contam. Merco-Dri/Hilco Cake	
			Contam. Tbp/Kerosene Mixtures & Sludges	
			Contaminated Alumina-Soda Lime	
			Contaminated Carbon Filter Elements	
			Contaminated CaF2-Mgo	
			Contaminated Graphite	
			Contaminated Graphite-Crushed	
			Contaminated Magnesium	
			Contaminated Non-Burnables	
			Contaminated Oil-Soluble;Coolant	
			Contaminated Rags, Etc.	
			Contaminated Soil, Rocks, Sand...	
			Declad Metal, Other Than Zimlo	
			Depleted U Ingot Crops From Primary Ingots	
			Depleted U Metal	
			Dirty Pril, Code 5 Derbies, High U Content	
			Discard Process Residues	
			Drum Decon. Residues:Wet MgF2	
			Dry Crushed Slag From Furnace Pot Blowouts	
			Dust Collector Bags	
			Dust Collector Residue, High Fluoride	
			Dust Collector Residues, Low Fluoride	
			Dust Collector Residues-High Fluoride	
			Experimental Shapes	
			Extrusion Butts To Be Pickled	
			Furnace Salt, Solidified, Chloride	
			Furnace Salt, Solidified, Non-Chloride	
			Incinerator Cinders	
			Ingot Crops And Duds	
			Ingots From Off-Site To Be Reworked	
			Lead And Lead Contaminated Metal	
			Metal From Spills For Double Melting	
			Metal Samples For Double Melting	
			Metal Spill & Extrusion Ends; High Impurities	
			Metal To Be Oxidized	
			Mg Oxide & Mg Zirconate From Crucible Cleanout	
			MgF2 For Milling Or Discard	
			MgF2 Or CaF2	

TABLE A.5.0 Inventory Of Non-RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Plant 1 Storage Pad (Cont'd)	74 T	D (Cont'd)	MgF2, +20 Mesh, Low U Content	
			MgF2, Ground	
			Miscellaneous Material	
			Non-Briquettable Chips And Turnings	
			Non-Burnable Metal W/ Uranium Content	
			Off-Spec UF4 Or ThF4	
			Oily MgF2	
			Partially Oxidized Metal Containing Metl-X	
			Partially Oxidized Metal Containing No Metl-X	
			Primary Ingot Sec., Not Pickled, 1St Gen. Top Crops	
			Reject UO3	
			Roasted Ca-Precipitated Sump And Filter Cakes	
			Roasted MgF2 (Blended With Other Materials)	
			Roasted, Milled And/Or Screened Ammonium Sump & F.C.	
			Rockwell Cleanings	
			Rockwell Spills	
			Samples, Non-Metallic, Misc.	
			Scrap Salts, High Fluoride	
			Scrap Salts, Low Fluoride	
			Scrap U3O8 Or ThO2, High Fluoride	
			Scrap U3O8 Or ThO2, Low Fluoride	
			Sludges, Cleanout, Non-Oily	
			Sludges, Non-Oily, For Oxidation	
			Sludges, Oily, For Oxidation, High Free Metal	
			Sludges, Salt, Soft, Chloride	
			Sludges, Salt, Soft, Non-Chloride	
			Solid Metal For Pickling Prior To Remelt	
			Solid Metal To Be Pickled	
			Solid Metal, Not Pickled, For Double Melt	
			Solid Metal,Not Cores, Embedded Steel	
			Solid Metal-Incl. Physical But Not Chem. Reject Ingots	
			Solid Remelt Metal Low Impurities	
			Special Solid Ingots Or Slabs	
			Sr Standard Solid Metal-For Remelt	
			U Alloyed Or Canned W/ Elements Other Than Al,Mo,Zc	
			U Or Th Nitrate Sol'N, High Impurity	
			U308 For Reoxidation	
			U3O8 Not Requiring Re-Oxidation	
			U3O8 Rotexed Other Than Plt. 8'S Product	
			U3O8 Rotexed Plant 8 Furnace Product	
			UF4 From Pilot Plant UF6	

TABLE A.5.0 Inventory Of Non-RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Plant 1 Storage Pad (Cont'd)	74 T	D (Cont'd)	UF4 Or ThF4	
			Unfired Reduction Charges + MgF2	
			Unrecycled Slag+20Mesh,Ball Mill Prod.	
			UO3 Product	
			UO3 Reactor Recycle Tails	
			Wet Crushed Slag From Furnace Pot Blowouts	
			Wet Sump Or Filter Cake, Halide Contam.	
			Wet Sump Or Filter Cake, Non-Oily/Halide	
			Wet Sump Or Filter Cake, Oil Contam.	
		G	Material Held For Historical Purposes	34
			Solid Metal,Not Cores, Embedded Steel	
			Zirconium Clad Metal	
			Zirnlo Ends	
		H	Chips Embedded In Concrete-High Calcium	1,188
			Contaminated Graphite	
			Contaminated Rags, Etc.	
			Contaminated Soil, Rocks, Sand...	
			Dust Collector Bags	
			Dust Collector Residue, High Fluoride	
			Ingot Crops From Primary Ingots	
			Material Held For Historical Purposes	
			Metal Spill & Extrusion Ends; High Impurities	
			Mg Oxide & Mg Zirconate From Crucible Cleanout	
			Non-Briquettable Chips And Turnings	
			Partially Oxidized Metal	
			Scrap Salts, Low Fluoride	
			Scrap U3O8 Or ThO2, High Fluoride	
			Solid Metal,Not Cores, Embedded Steel	
			U3O8 +8 Mesh, Low Fluoride	
			Wet Sump Or Filter Cake, Calide Contam.	
			Wet Sump Or Filter Cake, Non-Oily/Halide	
			Zirconium Clad Metal	
			Zirnlo Ends	
		M	Chips Embedded In Concrete-High Calcium	203
			Contaminated Graphite	
			Contaminated Non-Burnables	
			Contaminated Soil, Rocks, Sand...	
			Dust Collector Residue, High Fluoride	
			Dust Collector Residues-High Fluoride	
			Ingot Crops From Primary Ingots	
			Material Held For Historical Purposes	

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TABLE A.5.0 Inventory Of Non-RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Plant 1 Storage Pad (Cont'd)	74 T	M (Cont'd)	Non-Briquettable Chips And Turnings	
			Partially Oxidized Metal	
			Scrap Salts, Low Fluoride	
			Solid Metal,Not Cores, Embedded Steel	
			U308 For Reoxidation	
			Wet Sump Or Filter Cake, Non-Oily/Halide	
			Zirconium Clad Metal	
			Zirnlo Ends	
		N	Non-Recoverable Trash	3
		P	Contam. Filter Elements & Cartridges	5,533
			Contam. Merco-Dri/Hilco Cake	
			Contam. Tbp/Kerosene Mixtures & Sludges	
			Contaminated Copper For Discard	
			Contaminated Graphite	
			Contaminated Graphite-Crushed	
			Contaminated Leather Gloves For Laundry	
			Contaminated Magnesium	
			Contaminated Non-Burnables	
			Contaminated Oil, Insoluble	
			Contaminated Soil, Rocks, Sand...	
			Contaminated Solvent	
			Contaminated Water Or Sump, Non-Chloride	
			Discard Process Residues	
			Drum Decon. Residues:Wet MgF2	
			Dust Collector Residues-High Fluoride	
			Glass And Sample Bottles	
			Grit Blast Residue	
			Incinerator Cinders	
			MgF2 For Milling Or Discard	
			MgF2 Or CaF2	
			Non-Burnable Metal W/ Uranium Content	
			Non-Recoverable Trash	
			Sludges, Cleanout, Non-Oily	
			Sludges, Non-Oily, For Oxidation	
			Sludges, Oily	
			Sludges, Salt, Soft, Chloride	
			Sludges, Solvent	
			UF4 Or ThF4	
		V	Contaminated Non-Burnables	2,110
			Contaminated Soil, Rocks, Sand...	
			Contaminated Steel After Washing/Cleaning	

TABLE A.5.0 Inventory Of Non-RCRA Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Plant 1 Storage Pad (Cont'd)	74 T	V (Cont'd)	Discard Process Residues	
			MgF2 For Milling Or Discard	
			Non-Recoverable Trash	
			Sump Cake-Copper Contaminated, Low Uranium	
			Wet Sump Or Filter Cake, Non-Oily/Halide	
		X	Contaminated Rags, Etc.	13
			Oxides Clad Or Mixed With Stainless Steel	
			Scrap UO2	
Finished Products Warehouse (4A)	77	D	Chemical Reject Ingots And Other Material	6,960
			Chemical Reject Solid Metal	
			Chemical Reject Solid Remelt Metal	
			Chemical Scrap From Recycle 4A Flat Billets	
			Crushed Tubular Elements	
			First Generation Top Crops From Product Ingots	
			Ingot Crops And Duds	
			Ingots From Off-Site To Be Reworked	
			Metal Samples For Double Melting	
			Physical Reject Billets	
			Physical Scrap From Recycle 4A Flat Billets	
			Pickled Chemical Reject Crops	
			Pickled Reject Billets Or Billet Sections	
			Reject Elements-Inner	
			Reject Elements-Outer	
			Solid Metal To Be Pickled	
			Solid Metal To Be Sawed, Sheared Or Crushed	
			Solid Metal, Not Pickled, For Double Melt	
			Solid Metal,Not Cores, Embedded Steel	
			Solid Metal-Incl. Physical But Not Chem. Reject Ingots	
			Special Machined Shapes	
			Sr Standard Solid Metal-For Remelt	
			Top Crop From Product 4A Flat Billets	
Mobile Containers (Sea-Land)	G-012	P	Contaminated Non-Burnables	922
			Non-Recoverable Trash	
		V	Non-Recoverable Trash	24

Total = 121,177

TABLE A.5.1 Inventory of RCRA Waste Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Metals Production Plant	5 A	4	Contaminated TBP/Kerosene	7
		D	Contam. Merco-Dri & Hilco Cake	6
			Contaminated Solvent	
			Contaminated TBP/Kerosene	
		P	Contam. Merco-Dri & Hilco Cake	173
			Contaminated Oil-Insoluble	
			Contaminated Solvent	
			Contaminated TBP/Kerosene	
			Contaminated Water	
			Non-Recoverable Trash	
		V	Contaminated Solvent	101
			Contaminated TBP/Kerosene	
Metals Fabrication Plant	6 A	0	Contaminated Solvent	17
			Oil Sludges -- High Free Metal	
			Sludges, Solvent	
		D	Contaminated Solvent	6
			Sludges, Solvent	
		N	Contaminated Solvent	4
		P	Contaminated Magnesium	106
			Contaminated Oil-Insoluble	
			Contaminated Solvent	
			Contaminated Water	
			Non-Recoverable Trash	
		V	Contaminated Burnables	52
			Contaminated Oil-Insoluble	
			Contaminated Solvent	
			Non-Recoverable Trash	
Plant 7	7 A	0	Sludges, Solvent	27
			Wet Sump Or Filter Cake	
		P	Contaminated Oil-Insoluble	52
			Contaminated Solvent	
			Contaminated Water	
			Non-Recoverable Trash	
			Sludges, Solvent	
		V	Contaminated Solvent	67
Pilot Plant Thorium Tank Farm	13 D	0	Discard Process Residues	9
			Sludges, Solvent	
			Contaminated Solvent	

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TABLE A.5.1 Inventory of RCRA Waste Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Pilot Plant Thorium Tank Farm (Cont'd)	13 D	0 (Cont'd)	Contaminated TBP/Kerosene	
			Sludges, Solvent	
Plant 1 Thorium Warehouse	67	T	Thorium Nitrate Solution	35
			Unfired Reduction Charges	
			Uranyl Or Thorium	
Pilot Plant Warehouse	68	D	Non-Burnable Metal W/ U	1
		P	Contaminated Soils, Etc.	30
			Non-Recoverable Trash	
Plant 1 Storage Pad	74 T	0	Dust Collector Residues	2
		3	Sludges, Oily	1
Plant 6 Warehouse	79	0	Contaminated Alumina	797
			Contaminated Oil-Insoluble	
			Contaminated Oil-Soluble	
			Contaminated Solvent	
			Discard Process Residues	
			Oily Sludge	
			Samples, Non-Metallic, Misc.	
			Sludges, Oily	
			Sludges, Solvent	
			Wet Sump Or Filter Cake	
		1	Oily Sludge	8
		D	Contam. Merco-Dri & Hilco Cake	627
			Contaminated Alumina	
			Contaminated Oil-Insoluble	
			Furnace Salt	
			Incinerator Cinders	
			Non-Recoverable Trash	
			Oil Sludges - High Free Metal	
			Oily Sludge	
			Sludges, Non-Oily	
			Sump Cake/Cu Contam. Low U	
			Wet Sump Or Filter Cake	
		H	Contam. Merco-Dri & Hilco Cake	62
			Oily Sludge	
		M	Oily Sludge	10
		N	Non-Recoverable Trash	1
		P	Contam. Soil,Bricks&Rocks	630

TABLE A.5.1 Inventory of RCRA Waste Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Plant 6 Warehouse (Cont'd)	79	P (Cont'd)	Contaminated Asbestos Material	
			Contaminated Burnables	
			Contaminated Non-Burnables	
			Contaminated Oil-Insoluble	
			Contaminated Oil-Soluble	
			Contaminated Rags, Etc.	
			Contaminated Soils, Etc.	
			Contaminated Solvent	
			Contaminated TBP/Kerosene	
			Contaminated Water	
			Discard Process Residues	
			Mercury Contaminated Materials	
			Non-Recoverable Trash	
			Oily Cont. Sump Or Filter Cake	
			Oily Sludge	
			PCB Materials/Ballasts	
			PCB/Capacitor	
			PCB/Floor Dry & Chemicals	
			PCB/Lab Pack	
			PCB/Trash	
			PCB/Water	
			Sludges, Non-Oily	
			Sludges, Oily	
			Sludges, Solvent	
		V	Contam. Merco-Dri & Hilco Cake	427
			Contaminated Oil-Insoluble	
			Contaminated Rags, Etc.	
			Contaminated Solvent	
			Contaminated Water	
			Non-Recoverable Trash	
			Oil Sludges - High Free Metal	
			Oily Sludge	
			PCB/Capacitor	
			PCB/Electrical Equipment	
Plant 8 Warehouse	80	0	Contaminated Alumina	38
			Dust Collector Residues	
			Furnace Salt	
			Non-Recoverable Trash	
			Samples, Non-Metallic, Misc.	
			Wet Sump Or Filter Cake	

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TABLE A.5.1 Inventory of RCRA Waste Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Plant 8 Warehouse (Cont'd)	80	1	Dust Collector Residues	5
			Furnace Salt	
			Samples, Non-Metallic, Misc.	
		D	Contam. Merco-Dri & Hilco Cake	516
			Contaminated Alumina	
			Contaminated Burnables	
			Contaminated Rags, Etc.	
			Contaminated Soils, Etc.	
			Dust Collector Residues	
			Furnace Salt	
			Incinerator Cinders	
			Miscellaneous Material	
			Non-Burnable Metal W/ U	
			Samples, Non-Metallic, Misc.	
			Scrap Salts, High Fluoride	
			Scrap Salts, Low Fluoride	
			Sludges, Salt Chloride	
			Sump Cake/Cu Contam. Low U	
			Wet Sump Or Filter Cake	
		P	Contam. Merco-Dri & Hilco Cake	1,262
			Contam. Soil,Bricks&Rocks	
			Contaminated Asbestos Material	
			Contaminated Burnables	
			Contaminated Rags, Etc.	
			Contaminated Soils, Etc.	
			Furnace Salt	
			Lead & Lead Contam. Material	
			Mercury Contaminated Materials	
			Non-Recoverable Trash	
			Scrap Salts, Low Fluoride	
			Soil Contaminated With Oil	
			Wet Sump Or Filter Cake	
		V	Contaminated Burnables	128
			Contaminated Floor Dry	
			Contaminated Rags, Etc.	
			Contaminated Soils, Etc.	
			Discard Process Residues	
			Furnace Salt	
			Non-Recoverable Trash	
Plant 9 Warehouse	81	0	Contaminated Alumina	211

TABLE A.5.1 Inventory of RCRA Waste Drums

Storage Location	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	# of Drums Per Enrichment Class**
Plant 9 Warehouse	81	0 (Cont'd)	Contaminated Solvent	
			Dust Collector Residues	
			Furnace Salt	
			Scrap Salts, High Fluoride	
			Wet Sump Or Filter Cake	
		1	Furnace Salt	2
		D	Dust Collector Residues	160
			Furnace Salt	
			Oil Sludges – High Free Metal	
			Scrap Salts, High Fluoride	
			Sump Cake/Cu Contam. Low U	
		H	Furnace Salt	2
		N	Contaminated Carbon	1
		P	Contam. Merco–Dri & Hilco Cake	109
			Contaminated Alumina–Soda Lime	
			Contaminated Asbestos Material	
			Contaminated Carbon	
			Contaminated Oil–Insoluble	
			Contaminated Rags, Etc.	
			Contaminated Solvent	
			Contaminated TBP/Kerosene	
			Contaminated Water	
			Discard Process Residues	
			Mercury Contaminated Materials	
			Miscellaneous Material	
			Non–Recoverable Trash	
			Sludges, Solvent	
		V	Contaminated Solvent	10
			Contaminated Water	

Total = 5,702

TABLE A.6

INVENTORY OF PRODUCT

Table A.6 presents a general summary of the types of product that are currently stored in various buildings. This information is a compilation of data from the Material Control and Accountability (MC&A) Department. Product is classified as material above the economic discard Limit (EDL). Quantities of metal product in Table A.6 can be related to number of containers and associated drum equivalents as shown in Section 2.5.2.

The information is presented by storage location and then by enrichment code. The enrichment codes and their definitions are listed below. Within each code, all quantities of drums have been grouped together.

The following note applies to Table A.6:

*Enrichment Codes

D = Depleted	M = Enriched, 1.25% U-235	4 = Enriched, 1.25% U-235
H = Enriched, 0.947% U-235	1 = Normal, 0.710 to 0.712% U-235	5 = Enriched, 0.94% U-235

TABLE A.6 Inventory Of Product

Component	Component Designation	Enrichment Class Code*	Material Descriptions Per Enrichment Class	Quantity Per Enrichment Class
Metals Production Plant	5 A	D	Derbies, Grade 2	196
Plant 5 Ingot Storage Shelter	5 G	D	Physical reject billets to be sawed/metal from spills for DBL. melt	14
Metals Fabrication Plant	6 A	D	Cores – mark 31 elements – inner (salvage)	10,774
			Cores – mark 31 elements – outer (samples)	22,324
			Finished cores	27,692
			Ingot crops and duds – skids	2
			Scrap cores	35
			DBL. melt ingots to be sawed, but not pickled prior to remelt	63
			Derbies, Code 1 and Code 3	60
			Derbies, Grade 1	2,702
			Derbies, Grade 2	2
			Metal from spills for DBL. melt/ingot crops & duds	9
		H	DBL. melt ingots to be sawed & pickled prior to remelt	77
			N reactor ingots – finished	204
		M	DBL. melt ingots to be sawed & pickled prior to remelt	25
			N reactor ingots – finished	1
			N reactor ingots – raw	2
		4	Code 2 derbies for DBL. melting or shot cleaning	4
			Derbies, Code 1 and Code 3	706
		5	Derbies, Code 1 and Code 3	52
Special Products Plant	9 A	D	DBL. melt ingots to be sawed, but not pickled prior to remelt	94
Thorium Warehouse	64	D	Chem. reject solid remelt metal (scrap ingots)	14
			Classified shapes for double melting	1
			DBL. melt ingots to be sawed, but not pickled prior to remelt	1,592
			Mark 31 castings – finished – outer (prod. ingots)	1
			Mark 31 castings – raw – inner (prod. ingots)	16
			Mark 31 castings – raw – outer (prod. ingots)	671
			Physical reject billets to be sawed prior to remelt (scrap ingots)	144
			Reject billets, including sawed billet sections (scrap ingots)	6
			Special solid ingots or slabs	2
		1	DBL. melt ingots to be sawed & pickled prior to remelt	89
			N reactor ingots – finished	3
			N reactor ingots – raw	26
			Total =	67,603

TABLE A.7

VOLUMES OF POTENTIALLY CONTAMINATED MATERIALS IN OU3

Table A.7 provides estimates of the volumes of potentially contaminated materials by component. These estimates assume that all materials in OU3 except that in clean draw piles (rock salt, sand, gravel) are potentially contaminated. The components are grouped into major categories, as are the types of materials. The estimates provided are for in-place volumes and, in general, are not equal to the volumes of materials that might require treatment or disposal if such approaches are used. The quantities presented in the table are generally meaningful to only one or two significant figures.

Estimates for volumes of contents of buildings are provided separately from estimates for volumes of structural materials in buildings. The "other" category of material includes, in some cases, combinations of materials that could be distributed to the other categories if additional information were available. Significant contributors to the "other" category include the contents of buildings, coal (P-005), and wood (G-001).

Volumes were estimated using the following approaches:

Buildings. Volumes of structural materials were generally estimated using dimensions taken from as-built drawings. Exterior transite on walls and roofs is assumed to be 5/16-in. thick; transite on interior walls is assumed to be 3/16-in. thick. Steel siding is assumed to be 0.03-in. thick and steel roofs 0.048-in. thick. Estimates for building contents generally assume that the volume of contents equals 10% of the interior volume of the buildings. However, for certain buildings holding only drummed materials the volume of contents is noted as approximately zero (~0).

Containers. Volume estimates are based on available drawings or the volumes of the containers.

Bulk Material. Volume estimates are based on field inspections.

Pads, etc. Volume estimates are based on horizontal dimensions and typical values for thickness and other missing dimensions.

Piping, etc. Volume estimates are based on a review of available drawings.

Ponds and Basins. Volume estimates are generally based on information in Table A.2.1.

A zero entry in Table A.7 means that the component either has no material in that category or has only a small volume in that category compared to other major categories for which estimates are provided. However, as already noted, the "other" category may include volumes that could be placed in one or more of the other categories if more information were available.

The following notes pertain to Table A.7:

a = Volume is included with estimate for 6A.

b = Volume is included with estimate for 5A.

c = Volume is included with estimate for 9A.

d = Volume is not estimated for sea/land containers. The number of these containers varies, and the containers are used for waste being sent off-site.

TABLE A.7 Volumes (ft^3) of Potentially Contaminated Materials in OU3

Component	Concrete	Cement Block	Steel	Transite	Other Metal	Soil/Rubble	Asphalt	Other	Total
Buildings (structure)									
1A	33,534	0	1,783	2,206	0	0	0	0	37,523
1B	9,177	0	215	0	0	0	0	0	9,392
2A	50,195	0	1,104	4,668	0	0	0	0	55,967
2B	1,973	0	73	184	0	0	0	0	2,230
2C	1,104	0	95	55	0	0	0	0	1,254
2D	3,190	0	108	241	0	0	0	0	3,539
3A	3,226	0	205	293	0	0	0	0	3,724
3B	1,112	0	57	103	0	0	0	0	1,272
3C	2,971	0	77	249	0	0	0	0	3,297
3E	21,744	0	278	72	0	0	0	0	22,094
3G	1,009	0	35	82	0	0	0	0	1,126
3L	2,247	0	108	136	0	0	0	0	2,491
4A	97,980	0	1,104	3,040	0	0	0	0	102,124
4B	11,072	0	262	0	0	0	0	0	11,334
4C	3,578	0	77	279	0	0	0	0	3,934
5A	92,351	0	2,155	5,831	0	0	0	0	100,337
5B	1,584	0	37	0	0	0	0	0	1,621
5C	556	0	29	0	0	0	0	0	585
5D	7,521	0	361	0	0	0	0	0	7,882
5E	3,914	0	105	0	0	0	0	0	4,019
5F	9,046	0	545	0	0	0	0	0	9,591
5G	1,420	0	56	0	0	0	0	0	1,476
6A	141,760	0	4,606	6,822	0	0	0	0	153,188
6B	2,266	0	69	0	0	0	0	0	2,335
6C	375	0	25	0	0	0	0	0	400
6E	375	0	25	0	0	0	0	0	400
6F	a	0	a	a	0	0	0	0	a
6G	4,777	0	254	0	0	0	0	0	5,031
7A	36,408	0	720	2,302	0	0	0	0	39,430
8A	48,499	0	990	2,290	0	0	0	0	51,779
8B	1,861	1,383	0	0	0	0	0	0	3,244
8C	21,953	0	631	0	0	0	0	0	22,584
8D	66	0	1	0	0	0	0	0	67
9A	40,695	0	1,040	2,409	0	0	0	0	44,144
9B	647	0	25	48	0	0	0	0	720
9D	940	0	31	77	0	0	0	0	1048
9E	41	0	0	9	0	0	0	0	50
9F	375	0	26	0	0	0	0	0	401
10A	33,466	0	773	1,618	0	0	0	0	35,857
10B	1,784	0	89	0	0	0	0	0	1,873
10C	3,578	0	0	0	0	0	0	0	3,578

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TABLE A.7 Volumes (ft^3) of Potentially Contaminated Materials in OU3

Component	Concrete	Cement Block	Steel	Transite	Other Metal	Soil/Rubble	Asphalt	Other	Total
11-	204,202	54,256	0	0	0	0	0	0	258,458
12A	56,749	5,082	972	2,732	0	0	0	0	65,535
12B	2,509	1,440	0	0	0	0	0	0	3,949
12C	2,111	0	64	0	0	0	0	0	2,175
13A	12,706	5,338	171	0	0	0	0	0	18,215
13B	4,815	2,631	0	0	0	0	0	0	7,446
13C	415	300	0	0	0	0	0	0	715
14A	75,389	35,498	0	0	0	0	0	0	110,887
15-	156,420	63,345	0	0	0	0	0	0	219,765
16B	908	992	0	0	0	0	0	0	1,900
16D	777	815	0	0	0	0	0	0	1,592
18D	7,299	0	524	0	0	0	0	0	7,823
18G	263	0	0	48	0	0	0	0	311
18H	1,301	0	72	0	0	0	0	0	1,373
19C	870	0	41	0	0	0	0	0	911
20A	1,524	0	60	168	0	0	0	0	1,752
20B	3,346	0	87	194	0	0	0	133	3,759
20E	317	418	0	0	0	0	0	0	735
20F	317	418	0	0	0	0	0	0	735
20G	317	418	0	0	0	0	0	0	735
22A	814	575	0	0	0	0	0	0	1,389
22B	2,639	306	0	0	0	0	0	0	2,945
22C	3,457	0	0	0	0	0	0	0	3,457
22D	1,074	0	0	15	0	0	0	0	1,089
24A	414	361	0	0	0	0	0	0	775
24B	2,188	2,370	0	0	0	0	0	0	4,558
25A	257	164	0	0	0	0	0	0	421
25B	216	0	1	0	0	0	0	0	217
25C	2,877	431	0	0	0	0	0	0	3,308
25D	775	0	0	0	0	0	0	0	775
25E	7,591	5,687	30	0	0	0	0	0	13,308
26A	3,765	1,482	0	0	0	0	0	0	5,247
26C	216	244	0	0	0	0	0	0	460
28A/B	28,600	9,528	0	0	0	0	0	0	38,128
28C	79	0	1	0	0	0	0	0	80
28D	29	0	0	0	0	0	0	131	160
30A	22,048	0	524	1,332	0	0	0	0	23,904
30B	744	0	56	68	0	0	0	0	868
31A	12,480	8,082	0	0	0	0	0	0	20,562
32A	8,530	7,787	0	0	0	0	0	0	16,317
32B	1,518	0	14	0	0	0	0	0	1,532
37-	10,012	3,678	71	0	0	0	0	0	13,761
38A	1,537	989	0	0	0	0	0	0	2,526

TABLE A.7 Volumes (ft^3) of Potentially Contaminated Materials in OU3

Component	Concrete	Cement Block	Steel	Transite	Other Metal	Soil/Rubble	Asphalt	Other	Total
39A	5,298	0	166	414	0	0	0	0	5,878
39B	613	0	22	0	0	0	0	0	635
39C	110	133	0	0	0	0	0	0	243
45A	11,687	0	444	0	0	0	0	0	12,131
45B	73	0	0	0	0	0	0	128	201
46-	8,990	0	331	0	0	0	0	0	9,321
51-	23,600	0	1,082	0	0	0	0	0	24,682
53A	75,775	37,460	0	0	0	0	0	0	113,235
53B	3,786	3,685	0	0	0	0	0	0	7,471
54A	15,386	0	323	993	0	0	0	0	16,702
54B	2,899	0	100	0	0	0	0	0	2,999
54C	729	0	92	0	0	0	0	0	821
55A	4,013	0	234	465	0	0	0	0	4,712
55B	979	0	44	88	0	0	0	0	1,111
56A	7,897	0	240	0	0	0	0	0	8,137
56B	724	0	35	0	0	0	0	0	759
56C	1,199	0	70	0	0	0	0	0	1,269
60-	2,475	0	0	0	0	0	0	3,838	6,313
61-	1,244	0	0	0	0	0	0	1,928	3,172
62-	1,244	0	0	0	0	0	0	1,928	3,172
63-	29,920	11,112	39	0	0	0	0	0	41,071
64-	13,690	0	485	0	0	0	0	0	14,175
65-	7,378	0	455	0	0	0	0	0	7,833
66-	3,032	0	116	0	0	0	0	0	3,148
67-	3,199	0	137	0	0	0	0	0	3,336
68-	4,098	0	133	459	0	0	0	0	4,690
69-	7,493	3,468	0	0	0	0	0	0	10,961
71-	40,207	8,551	487	0	0	0	0	0	49,245
72-	1,578	0	34	106	0	0	0	0	1,718
73A	1,405	1,257	0	0	0	0	0	0	2,662
77-	18,370	0	3,724	0	0	0	0	0	22,094
78-	7,298	0	128	0	0	0	0	0	7,426
79-	14,523	0	719	0	0	0	0	0	15,242
80-	8,696	0	217	0	0	0	0	0	8,913
81-	7,407	0	245	0	0	0	0	0	7,652
82-	10,420	0	282	0	0	0	0	0	10,702
90-	175	0	4	0	0	0	0	0	179
G-006	0	3,760	0	0	0	0	0	7,320	11,080
G-007	0	11,844	0	0	0	0	0	23,058	34,902
TS-001	0	0	105	0	0	0	0	442	547
TS-002	0	0	105	0	0	0	0	442	547

TABLE A.7 Volumes (ft^3) of Potentially Contaminated Materials in OU3

Component	Concrete	Cement Block	Steel	Transite	Other Metal	Soil/Rubble	Asphalt	Other	Total
TS-003	0	0	31	0	0	0	0	88	119
Subtotals	1,692,394	295,288	31,493	40,096	0	0	0	39,435	2,098,706
Buildings (contents)									
1A	0	0	0	0	0	0	0	74,742	74,742
1B	0	0	0	0	0	0	0	0	~0
2A	0	0	0	0	0	0	0	133,365	133,365
2B	0	0	0	0	0	0	0	5,303	5,303
2C	0	0	0	0	0	0	0	530	530
2D	0	0	0	0	0	0	0	4,308	4,308
3A	0	0	0	0	0	0	0	5,190	5,190
3B	0	0	0	0	0	0	0	1,316	1,316
3C	0	0	0	0	0	0	0	3,075	3,075
3E	0	0	0	0	0	0	0	11,534	11,534
3G	0	0	0	0	0	0	0	827	827
3L	0	0	0	0	0	0	0	2,383	2,383
4A	0	0	0	0	0	0	0	164,673	164,673
4B	0	0	0	0	0	0	0	0	~0
4C	0	0	0	0	0	0	0	5,096	5,096
5A	0	0	0	0	0	0	0	269,046	269,046
5B	0	0	0	0	0	0	0	b	b
5C	0	0	0	0	0	0	0	b	b
5D	0	0	0	0	0	0	0	b	b
5E	0	0	0	0	0	0	0	b	b
5F	0	0	0	0	0	0	0	0	~0
5G	0	0	0	0	0	0	0	0	~0
6A	0	0	0	0	0	0	0	514,118	514,118
6B	0	0	0	0	0	0	0	2,400	2,400
6C	0	0	0	0	0	0	0	818	818
6E	0	0	0	0	0	0	0	818	818
6F	0	0	0	0	0	0	0	a	a
6G	0	0	0	0	0	0	0	15,109	15,109
7A	0	0	0	0	0	0	0	0	~0
8A	0	0	0	0	0	0	0	72,413	72,413
8B	0	0	0	0	0	0	0	1,648	1,648
8C	0	0	0	0	0	0	0	44,895	44,895
8D	0	0	0	0	0	0	0	80	80
9A	0	0	0	0	0	0	0	104,592	104,592
9B	0	0	0	0	0	0	0	c	c
9D	0	0	0	0	0	0	0	c	c

TABLE A.7 Volumes (ft^3) of Potentially Contaminated Materials in OU3

Component	Concrete	Cement Block	Steel	Transite	Other Metal	Soil/Rubble	Asphalt	Other	Total
9E	0	0	0	0	0	0	0	49	49
9F	0	0	0	0	0	0	0	818	818
10A	0	0	0	0	0	0	0	61,878	61,878
10B	0	0	0	0	0	0	0	3,989	3,989
10C	0	0	0	0	0	0	0	0	0
11-	0	0	0	0	0	0	0	205,223	205,223
12A	0	0	0	0	0	0	0	137,513	137,513
12B	0	0	0	0	0	0	0	1,482	1,482
12C	0	0	0	0	0	0	0	2,834	2,834
13A	0	0	0	0	0	0	0	37,491	37,491
13B	0	0	0	0	0	0	0	2,130	2,130
13C	0	0	0	0	0	0	0	154	154
14A	0	0	0	0	0	0	0	57,619	57,619
15-	0	0	0	0	0	0	0	110,587	110,587
16B	0	0	0	0	0	0	0	1,008	1,008
16D	0	0	0	0	0	0	0	0	~0
18D	0	0	0	0	0	0	0	18,539	18,539
18G	0	0	0	0	0	0	0	363	363
18H	0	0	0	0	0	0	0	2,250	2,250
19C	0	0	0	0	0	0	0	994	994
20A	0	0	0	0	0	0	0	1,867	1,867
20B	0	0	0	0	0	0	0	6,048	6,048
20E	0	0	0	0	0	0	0	154	154
20F	0	0	0	0	0	0	0	154	154
20G	0	0	0	0	0	0	0	154	154
22A	0	0	0	0	0	0	0	391	391
22B	0	0	0	0	0	0	0	143	143
22C	0	0	0	0	0	0	0	0	~0
22D	0	0	0	0	0	0	0	32	32
24A	0	0	0	0	0	0	0	185	185
24B	0	0	0	0	0	0	0	2,072	2,072
25A	0	0	0	0	0	0	0	28	28
25B	0	0	0	0	0	0	0	154	154
25C	0	0	0	0	0	0	0	761	761
25D	0	0	0	0	0	0	0	179	179
25E	0	0	0	0	0	0	0	15,263	15,263
26A	0	0	0	0	0	0	0	2,752	2,752
26C	0	0	0	0	0	0	0	102	102
28A/B	0	0	0	0	0	0	0	17,067	17,067
28C	0	0	0	0	0	0	0	100	100
28D	0	0	0	0	0	0	0	225	225

TABLE A.7 Volumes (ft^3) of Potentially Contaminated Materials in OU3

Component	Concrete	Cement Block	Steel	Transite	Other Metal	Soil/Rubble	Asphalt	Other	Total
30A	0	0	0	0	0	0	0	0	~0
30B	0	0	0	0	0	0	0	0	~0
31A	0	0	0	0	0	0	0	14,447	14,447
32A	0	0	0	0	0	0	0	0	~0
32B	0	0	0	0	0	0	0	1,200	1,200
37-	0	0	0	0	0	0	0	19,351	19,351
38A	0	0	0	0	0	0	0	777	777
39A	0	0	0	0	0	0	0	10,425	10,425
39B	0	0	0	0	0	0	0	615	615
39C	0	0	0	0	0	0	0	59	59
45A	0	0	0	0	0	0	0	18,915	18,915
45B	0	0	0	0	0	0	0	281	281
46-	0	0	0	0	0	0	0	23,884	23,884
51-	0	0	0	0	0	0	0	150,014	150,014
53A	0	0	0	0	0	0	0	72,731	72,731
53B	0	0	0	0	0	0	0	3,989	3,989
54A	0	0	0	0	0	0	0	36,008	36,008
54B	0	0	0	0	0	0	0	0	~0
54C	0	0	0	0	0	0	0	1,824	1,824
55A	0	0	0	0	0	0	0	8,402	8,402
55B	0	0	0	0	0	0	0	637	637
56A	0	0	0	0	0	0	0	0	~0
56B	0	0	0	0	0	0	0	1,210	1,210
56C	0	0	0	0	0	0	0	2,100	2,100
60-	0	0	0	0	0	0	0	0	~0
61-	0	0	0	0	0	0	0	0	~0
62-	0	0	0	0	0	0	0	0	~0
63-	0	0	0	0	0	0	0	0	~0
64-	0	0	0	0	0	0	0	35,495	35,495
65-	0	0	0	0	0	0	0	0	~0
66-	0	0	0	0	0	0	0	5,224	5,224
67-	0	0	0	0	0	0	0	0	~0
68-	0	0	0	0	0	0	0	0	~0
69-	0	0	0	0	0	0	0	6,837	6,837
71-	0	0	0	0	0	0	0	0	~0
72-	0	0	0	0	0	0	0	0	~0
73A	0	0	0	0	0	0	0	915	915
77-	0	0	0	0	0	0	0	0	~0
78-	0	0	0	0	0	0	0	18,720	18,720
79-	0	0	0	0	0	0	0	0	~0
80-	0	0	0	0	0	0	0	0	~0
81-	0	0	0	0	0	0	0	0	~0
82-	0	0	0	0	0	0	0	21,605	21,605

TABLE A.7 Volumes (ft^3) of Potentially Contaminated Materials in OU3

Component	Concrete	Cement Block	Steel	Transite	Other Metal	Soil/Rubble	Asphalt	Other	Total
90-	0	0	0	0	0	0	0	225	225
G-006	0	0	0	0	0	0	0	19,200	19,200
G-007	0	0	0	0	0	0	0	50,480	50,480
TS-001	0	0	0	0	0	0	0	0	~0
TS-002	0	0	0	0	0	0	0	0	~0
TS-003	0	0	0	0	0	0	0	0	~0
Subtotals	0	0	0	0	0	0	0	2,656,597	2,656,597
Containers, etc.									
1C	11,433	0	548	0	0	0	0	3,077	15,058
2E	466	382	183	0	0	0	0	0	1,031
3D	13,183	0	1,255	0	199	0	0	0	14,637
3F	939	0	196	0	0	0	0	0	1,135
3H	2,750	0	0	0	0	0	0	458	3,208
3J	11,870	0	488	0	0	0	0	0	12,358
13D	3,291	0	75	0	0	0	0	750	4,116
18B	25,403	0	598	0	0	0	0	0	26,001
18J	3,197	0	122	0	0	0	0	0	3,319
18M	19,540	0	792	0	0	0	0	0	20,332
19A	14,620	0	547	0	0	0	0	0	15,167
19B	3,332	0	202	0	0	0	0	0	3,534
19D	2,808	0	264	0	0	0	0	0	3,072
20D	4,875	0	535	0	0	0	0	0	5,410
20H	5,024	0	0	0	0	0	0	0	5,024
25H	2,773	0	0	0	0	0	0	0	2,773
26B	4,875	0	860	0	0	0	0	0	5,735
73C	0	0	0	0	0	0	0	0	~0
73D	40	0	10	0	0	0	0	0	50
73E	0	0	25	0	0	0	0	0	25
G-005	0	0	51	0	0	0	0	0	51
G-012	0	0	0	0	0	0	0	0	d
Subtotals	130,419	382	6,751	0	199	0	0	4,286	142,036
Bulk Material									
G-013	0	0	0	0	0	981,000	0	0	981,000
P-004	0	0	0	0	150,000	0	0	0	150,000
P-005	0	0	0	0	0	0	0	189,000	189,000
P-006	0	0	0	0	400,000	0	0	0	400,000

TABLE A.7 Volumes (ft^3) of Potentially Contaminated Materials in OU3

Component	Concrete	Cement Block	Steel	Transite	Other Metal	Soil/Rubble	Asphalt	Other	Total
P-007	0	0	2,000	0	0	0	0	0	2,000
Subtotals	0	0	2,000	0	550,000	981,000	0	189,000	1,722,000
Pads, etc.									
10D	2,381	0	0	0	0	0	0	0	2,381
30C	60	0	0	0	0	0	0	0	60
31B	753	0	0	0	0	0	0	0	753
74A	3,863	0	0	0	0	0	0	0	3,863
74B	7,370	0	0	0	0	0	0	457	7,827
74C	2,591	0	0	0	0	0	0	0	2,591
74D	4,923	0	0	0	0	0	0	0	4,923
74E	8,528	0	0	0	0	0	0	0	8,528
74F	873	0	0	0	0	0	0	0	873
74G	2,347	0	0	0	0	0	0	0	2,347
74H	1,500	0	0	0	0	0	0	0	1,500
74J	1,526	0	0	0	0	0	0	0	1,526
74K	5,104	0	0	0	0	0	0	0	5,104
74L	11,283	0	0	0	0	0	0	0	11,283
74M	12,104	0	0	0	0	0	0	0	12,104
74N	3,270	0	0	0	0	0	0	0	3,270
74P	32,884	0	0	0	0	0	0	0	32,884
74Q	850	0	0	0	0	0	0	71	921
74R	2,054	0	0	0	0	0	0	0	2,054
74S	1,606	0	0	0	0	0	0	0	1,606
74T	181,865	0	0	0	0	0	0	0	181,865
74U	3,136	0	0	0	0	0	0	0	3,136
74V	1,348	0	0	0	0	0	0	0	1,348
74W	2,750	0	0	0	0	0	0	0	2,750
89-east	0	0	0	0	0	0	114,614	0	114,614
89-west	0	0	0	0	0	0	185,169	0	185,169
G-001	0	0	2,059	0	0	0	0	33,264	35,323
G-002	145,926	0	0	0	0	0	145,926	0	291,852
Subtotals	440,890	0	2,059	0	0	0	445,708	33,792	922,449
Piping, etc.									
2F	764	0	251	0	0	0	0	0	1,015
2G	256	0	128	0	0	0	0	0	384

TABLE A.7 Volumes (ft^3) of Potentially Contaminated Materials in OU3

Component	Concrete	Cement Block	Steel	Transite	Other Metal	Soil/Rubble	Asphalt	Other	Total
2H	1,225	0	1,314	0	0	0	0	0	2,539
3K	1,256	0	0	0	0	0	0	0	1,256
6D	868	0	0	0	0	0	0	0	868
7B	21,414	0	370	0	0	0	0	0	21,784
8E	253	0	7	0	0	0	0	0	260
8F	468	0	2	0	0	0	0	0	470
9C	707	0	11	0	0	0	0	0	718
14B	50	0	25	0	0	0	0	0	75
16A	3,554	0	589	0	0	0	0	700	4,843
16C	47	0	76	0	0	0	0	0	123
16E	100	0	87	0	0	0	0	0	187
16F	326	0	0	0	0	0	0	1,212	1,538
16G	326	0	0	0	0	0	0	1,212	1,538
20C	1,828	0	0	0	0	0	0	5,032	6,860
22E	10,289	0	0	0	91	0	0	0	10,380
23-	36	0	156	0	0	0	0	0	192
38B	36	0	1	0	0	0	0	0	37
39D	709	0	37	0	0	0	0	0	746
88-	0	0	65	0	0	0	0	0	65
G-003	3,690	0	171	0	0	0	0	11,390	15,251
G-004	0	0	1,485	0	66	0	0	41	1,592
G-008	8,080	0	7,014	0	0	0	0	0	15,094
Subtotals	56,282	0	11,789	0	157	0	0	19,587	87,815
Ponds and Basins									
18A	0	0	122	0	0	0	0	0	122
18C	1,163	0	10	0	0	0	0	13,373	14,546
18E	0	0	0	0	0	0	0	~0	~0
18K	0	0	90	0	0	0	0	0	90
18L	0	0	90	0	0	0	0	0	90
25F	3,280	0	0	0	0	0	0	0	3,280
25G	696	0	0	0	0	0	0	0	696
73B	0	0	0	0	0	0	0	~0	~0
Subtotals	5,139	0	312	0	0	0	0	13,373	18,824
Miscellaneous									
Sumps	1,345	0	154	0	0	0	0	0	1,499
Dikes	39,417	0	0	0	0	0	0	2,652	42,069

TABLE A.7 Volumes (ft^3) of Potentially Contaminated Materials in OU3

Component	Concrete	Cement Block	Steel	Transite	Other Metal	Soil/Rubble	Asphalt	Other	Total
	0	0	2,688	0	0	0	0	0	2,688
Aboveground tanks	0	0	660	0	0	0	0	0	660
Fences	0	0	0	0	0	0	0	6,359	6,359
Telephone poles									
	40,762	0	3,502	0	0	0	0	9,011	53,275
Subtotals									
	2,365,886	295,670	57,906	40,096	550,356	981,000	445,708	2,965,080	7,701,702
Totals, All Groups									

APPENDIX B

POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

TABLES B.1, B.2, and B.3

Potential location-specific, contaminant-specific, and action-specific applicable or relevant and appropriate requirements (ARARs) and to-be-considered (TBC) requirements are identified and evaluated in Tables B.1 (p. B-4), B.2 (p. B-6), and B.3 (p. B-49), respectively. The preliminary ARAR and TBC determinations for these requirements are also indicated in the tables.

TABLE B.1 Potential Location-Specific Requirements

Potential ARAR	Location	Requirement	Preliminary Determination	Remarks
Antiquity Act; Historic Sites Act (16 USC 431-433; 16 USC 461-467; 40 CFR 6.301(a))	Land	Cultural resources, such as historic buildings and sites and natural landmarks, must be preserved on federal land to avoid adverse impacts.	Potentially applicable	No adverse impacts to such resources are expected to result from the proposed action; however, if these resources were affected, the requirement would be applicable.
National Historic Preservation Act, as amended (16 USC 470 et seq.; 40 CFR 6.301(b); 36 CFR 800)	Land	The effect of any federally assisted undertaking must be taken into account for any district, site, building, structure, or object included in or eligible for the *National Register of Historic Places*.	Potentially applicable	No adverse impacts to such properties are expected to result from the proposed action; however, if these resources were affected, the requirement would be applicable.
Archeological and Historic Preservation Act (16 USC 469; 40 CFR 6.301(c); PL 93-291; 88 Stat. 174)	Land	Prehistorical, historical, and archeological data that might be destroyed as a result of a federal, federally assisted, or federally licensed activity or program must be preserved.	Potentially applicable	No destruction of such data is expected to result from the proposed action. However, if these data were affected, the requirement would be applicable.
Archeological Resources Protection Act (16 USC 470(a))	Land	A permit must be obtained if an action on public or Indian lands could impact archeological resources.	Potentially applicable	No impacts to archeological resources are expected to result from the proposed action. However, if these resources were affected, the requirement would be applicable.
Protection and Enhancement of the Cultural Environment (Executive Order 11593; 40 CFR 6.301)	Land	Historic, architectural, archeological, and cultural resources must be preserved, restored, and maintained, and must be evaluated for inclusion in the *National Register*.	Potentially applicable	No impacts to such resources are expected to result from the proposed action. However, if these resources were affected, the requirement would be applicable.
Endangered Species Act, as amended (16 USC 1531-1543; 50 CFR Subpart B; 40 CFR 6.302(h)); Migratory Bird Treaty Act (16 USC 703 et seq); Bald & Golden Eagle Protection Act (16 USC 668-668(d))	Any	Each federal agency must ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify any critical habitat.	Potentially applicable	No critical habitat exists in the affected area. No adverse impacts to threatened species are expected to result from the proposed action; however, if such species were affected, the requirement would be applicable.
Fish and Wildlife Coordination Act (16 USC 661-666; 40 CFR 6.302(a))	Any	Adequate protection of fish and wildlife resources is required when any federal department or agency proposes or authorizes any modification (e.g., diversion or channeling) of any stream or other water body or any modification of areas affecting any stream or other water body.	Not an ARAR	No modification of streams or stream areas is planned as part of the proposed action.
Conservation of Natural Resources, Ohio Revised Code, Title 15; Department of Natural Resources Regulations, Chapter 1518:18 - Endangered Species and 1518:31 - Endangered Wildlife	Any	No person may willfully root up, injure, destroy, remove, or carry away on or from public highways, public property, or the waters of the state any endangered or threatened plant listed in the regulations. No person shall take, kill, possess, transport, buy, or sell any wild animal contrary to any order or rule of the Division of Wildlife.	Potentially applicable	If critical habitat or endangered species or wildlife were affected by any proposed action, these regulations would be applicable.

TABLE B.1 Potential Location-Specific Requirements

Potential ARAR	Location	Requirement	Preliminary Determination	Remarks
Floodplain Management (Executive Order 11988; 10 CFR 1022)	Floodplain	Federal agencies must avoid, to the maximum extent possible, any adverse impacts associated with direct and indirect development of a floodplain.	Potentially applicable	OU3 is not located within the 100-year floodplain. However, if a floodplain were affected by the proposed action, the requirement would be applicable.
Protection of Wetlands (Executive Order 11990; 10 CFR 1022)	Wetland	Federal agencies must avoid, to the extent possible, any adverse impacts associated with the destruction or loss of wetlands and the support of new construction in wetlands if a practicable alternative exists.	Potentially applicable	Wetlands exist in the potentially affected areas.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Occupational Safety and Health Administration Standards; Occupational Health and Environmental Control (29 CFR 1910; 1910.96), Subpart G, Ionizing Radiation	Radiation	Any	The dose per calendar quarter resulting from exposure to radiation in a restricted area from sources in that area is limited to the following: Part of Body — Dose (rem) Whole body: head and trunk, active blood-forming organs, lens of eye, or gonads — 1¼ Hands and forearms, feet and ankles — 18¾ Skin of whole body — 7½ The occupational exposure of an individual younger than 18 is restricted to 10% of these limits; the whole-body dose to a worker may not exceed 3 rem in a calendar quarter, and when added to the cumulative occupational dose may not exceed 5(N-18) rem, where N is the age of the exposed individual.	Not an ARAR	The provisions of the OSHA do not apply to working conditions of DOE contractor employees working in government-owned, contractor-operated (GOCO) facilities since DOE exercises statutory authority to prescribe and enforce safety and health standards at its facilities. The DOE exercises this authority pursuant to an agreement between the Secretary of Energy and the Occupational Safety and Health Administration (OSHA).

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Radiation Protection for Occupational Workers (DOE Order 5480.11)	Radiation	Any	The effective dose equivalent received by any member of the public entering a controlled area is limited to 100 mrem/yr. Limiting values for the assessed dose from exposure of workers to radiation are as follows. (These values represent maximum limits; it is DOE policy to maintain radiation exposures as far below these limits as is reasonably achievable.)	To be considered	Although not promulgated standards, these constitute requirements for protection from radionuclide emissions in a controlled area with which the proposed action will comply.

Radiation Effect	Annual Dose Equivalent (rem)
Stochastic effects	5[a]
Nonstochastic effects	
Lens of eye	15
Organ, extremity, or tissue including skin of whole body	50
Unborn child, entire gestation period	0.5

[a] Annual effective dose equivalent.

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TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Standards for Protection against Radiation, 10 CFR 20, Subpart C - Occupational Dose Limits	Radiation	Any	The annual effective dose equivalent received by any adult is limited to 5 rem or the sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue, other than the lens of the eye, is limited to 50 rem. The annual effective dose equivalent to the lens of the eye, to the skin, and to the extremities are limited to: Part of Body — Annual Effective Dose (rem) Lens of eye — 15 Shallow dose to skin or any extremity — 50 In addition, the soluble uranium intake by an individual is limited to 10 milligrams in a week in consideration of chemical toxicity. The annual occupational dose limits for minors are 10% of the annual dose limits specified above. The annual effective dose equivalent for an embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman is limited to 0.5 rem.	Potentially relevant and appropriate	These requirements are not applicable since OU3 is not an NRC-licensed facility; however, they may be relevant and appropriate.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Standards for Protection Against Radiation, 10 CFR 20, Subpart C - Occupational Dose Limits	Radiation	Any	The derived air concentration (DAC) and annual limit on intake (ALI) for occupational dose limits are as follows:	Potentially relevant and appropriate	These requirements are not applicable since OU3 is not an NRC-licensed facility; however, they may be relevant and appropriate.

	Occupational Values		
		Inhalation	
Radionuclide	Oral Ingestion ALI (µCi)	ALI (µCi)	DAC (µCi/mL)
Cobalt-60 W[a]	5E+2	2E+2	7E-8
Y[a]	2E+2	3E+1	1E-8
Strontium-90 D[a]	3E+1	2E+1	8E-9
	Bone surf[b]	Bone surf	
	(4E+1)	(2E+1)	-
Y	-	4E+0	2E-9
Ruthenium-106 D	2E+2	9E+1	4E-8
	LLI wall[b]		
	(2E+2)	-	-
W	-	5E+1	2E-8
Y	-	1E+1	5E-9
Cesium-137 D	1E+2	2E+2	6E-8

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement				Preliminary Determination	Remarks
				Occupational Values				
					Inhalation			
			Radionuclide	Oral Ingestion ALI (µCi)	ALI (µCi)	DAC (µCi/mL)		
			Actinium-227 D	2E-1 Bone surf (4E-1)	4E-4 Bone surf (8E-4)	2E-13 -		
			W	- -	2E-3 Bone surf (3E-3)	7E-13 -		
			Y	-	4E-3	2E-12		
			Actinium-228 D	2E+3	9E+0 Bone surf (2E+1)	4E-9		
			W	-	4E+1 Bone surf (6E+1)	2E-8		
			Y	-	4E+1	2E-8		
			Americium-241 W	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12		
			Bismuth-210 D	8E+2	2E+2 Kidneys (4E+2)	1E-7		
			W	-	3E+1	1E-8		
			Bismuth-212 D	5E+3	2E+2	1E-7		
			W	-	3E+2	1E-7		
			Bismuth-214 D	2E+4 St.wall (2E+4)	8E+2	3E-7		
			W	-	9E-2	4E-7		

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement				Preliminary Determination	Remarks
				Occupational Values				
					Inhalation			
			Radionuclide	Oral Ingestion ALI (µCi)	ALI (µCi)	DAC (µCi/ml.)		
			Europium-152 W	8E+2	2E+1	2E-8		
			Lead-210 D	5E-1 Bone surf (1E+0)	2E-1 Bone surf (4E-1)	1E-10		
			Lead-212 D	8E+1 (Bone surf (1E+2)	3E+1	2E-8		
			Lead-214 D	9E+3	8E+2	3E-7		
			Polonium 210 D	3E+0	6E-1	3E-10		
			W	-	6E-1	3E-10		
			Technetium-99 D	4E+3	5E+3 St. Wall (6E+3)	2E-6		
			W	-	7E+2	3E-7		
			Radon-200 (with daughters removed)	-	2E+4	7E-6		
			Radon-220 (with daughters present)	-	2E+1 (or 12 working level months)	9E-9 (or 1.0 working level)		
			Radon-222 (with daughters removed)	-	1E+4	4E-6		

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement				Preliminary Determination	Remarks
				Occupational Values				
					Inhalation			
			Radionuclide	Oral Ingestion ALI (µCi)	ALI (µCi)	DAC (µCi/ml.)		
			Radon-222 (with daughters present)	-	E+2 (or 4 working level months)	3E-8 (or 0.33 working level)		
			Protac-tinium-231 W	2E-1 Bone surf (5E-1)	2E-3 Bone surf (4E-3)	6E-13		
			Protac-tinium-231 Y	-	4E-3 Bone surf (6E-3)	2E-12		
			Protac-tinium-234 W	2E+3	8E+3	3E-6		
			Y	-	7E+3	3E-6		
			Radium-223 W	5E+0 Bone surf (9E+0)	7E-1	3E-10		
					-	-		
			Radium-224 W	8E+0 Bone surf (2E+1)	2E+0	7E-10		
			Radium-226 W	2E+0 Bone surf (5E+0)	6E-1	3E-10		
			Radium-228 W	2E+0 Bone surf (4E+0)	1E+0	5E-10		
			Thorium-227 W	1E+2	3E-1	1E-10		
			Y	-	3E-1	1E-10		

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement				Preliminary Determination	Remarks
				Occupational Values				
					Inhalation			
			Radionuclide		Oral Ingestion ALI (µCi)	ALI (µCi)	DAC (µCi/mL)	
			Thorium-228	W	6E+0 Bone surf (1E+1)	1E-2 Bone surf (2E-2)	4E-12 -	
				Y	-	2E-2	7E-12	
			Thorium-230	W	4E+0 Bone surf (9E+0)	6E-3 Bone surf (2E-2)	3E-12 -	
				Y	-	2E-2 Bone surf (2E-2)	6E-12 -	
			Thorium-232	W	7E-1 Bone surf (2E+0)	1E-3 Bone surf (3E-3)	5E-13 -	
				Y	-	3E-3 Bone surf (4E-3)	1E-12 -	
			Thorium-234	W	3E+2 LLI wall (4E+2)	2E+2	8E-8	
				Y	-	2E+2	6E-8	
			Uranium-233	D	1E+1 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	5E-10 -	
				W	-	7E-1	3E-10	
				Y	-	4E-2	2E-11	
			Uranium-234	D	1E+1 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	5E-10 -	
				W	-	7E-1	3E-10	
				Y	-	4E-2	2E-11	

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement				Preliminary Determination	Remarks
				Occupational Values				
			Radionuclide		Oral Ingestion ALI (µCi)	Inhalation ALI (µCi)	Inhalation DAC (µCi/mL)	
			Uranium-235	D	1E+1 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	6E-10 -	
				W	-	8E-1	3E-10	
				Y	-	4E-2	2E-11	
			Uranium-236	D	1E+1 Bone surf (2E+1)	1E+8 Bone surf (2E+0)	5E-10 -	
				W	-	8E-1	3E-10	
				Y	-	4E-2	2E-11	
			Uranium-238	D	1E+1 Bone surf (2E+1)	d1E+0 Bone surf (2E+0)	6E-10 -	
				W	-	8E-1	3E-10	
				Y	-	4E-2	2E-11	
			Uranium-natural	D	1E+1 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	5E-10 -	
				W	-	8E-1	3E-10	
				Y	-	5E-2	2E-11	
			Neptunium-237	W	5E-1 Bone surf (1E+0)	4E-3 Bone surf (1E-2)	2E-12 -	
			Plutonium-238	W	9E-1 Bone surf (2E+0)	7E-3 Bone surf (1E-2)	8E-12 -	
				Y	-	2E-2	8E-12	

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks

Radionuclide		Occupational Values: Oral Ingestion ALI (µCi)	Occupational Values: Inhalation ALI (µCi)	Occupational Values: Inhalation DAC (µCi/ml.)
Plutonium-239	W	8E-1	6E-3	3E-12
		Bone surf (1E+0)	Bone surf (1E-2)	-
	Y	-	2E-2	7E-12
		-	Bone surf (2E-2)	-
Plutonium-240	W	8E-1	6E-3	3E-12
		Bone surf (1E+0)	Bone surf (1E-2)	-
	Y	-	2E-2	7E-12
		-	Bone surf (2E-2)	-
Plutonium-241	W	4E+1	3E-1	1E-10
		Bone surf (7E+1)	Bone surf (6E-1)	-
	Y	-	8E-1	8E-10
		-	Bone surf (1E+0)	-
Plutonium-242	W	8E-1	7E-3	3E-12
		Bone surf (1E+0)	Bone surf (1E-2)	-
	Y	-	2E-2	7E-12
		-	Bone surf (2E-2)	-

[a] Daily (D), weekly (W) and yearly (Y) lung retention classes.
[b] ALI is the stochastic dose limit; when an ALI is determined by the nonstochastic dose limit, the organ or tissue designations are LLI wall = lower large intestine wall and Bone surf = bone surface.

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Standards for Protection Against Radiation, 10 CFR 20, Subpart D - Radiation Dose Limits for Individual Members of the Public	Radiation	Any	The total effective dose equivalent to individual members of the public, in an unrestricted or restricted area, is limited to 0.1 rem. The dose in any unrestricted area from external sources is limited to 0.002 rem in any one hour.	Potentially relevant and appropriate	These requirements are not applicable since OU3 is not an NRC-licensed facility; however, they may be relevant and appropriate.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
			The annual average concentrations of radioactive material released in gaseous and liquid effluent at the boundary of the unrestricted area do not exceed:		

Radionuclide	Effluent Concentrations Air (μCi/mL)	Effluent Concentrations Water (μCi/mL)
Cobalt-60 W[a]	2E-10	3E-6
Y[a]	5E-11	-
Strontium-90 D[a]	-	-
	3E-11	5E-7
Y	6E-12	-
Ruthenium-106 D	1E-10	-
	-	3E-6
W	8E-11	-
Y	2E-11	-
Cesium-137 D	2E-10	1E-6
Technetium-99 D	-	6E5
	8E-9	-
W	9E-10	-
Radon-220 (with daughters removed)	2E-8	-
Radon-220 (with daughters present)	3E-11	-
Radon-222 (with daughters removed)	1E-8	-

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement			Preliminary Determination	Remarks
				Effluent Concentrations			
			Radionuclide	Air (µCi/mL)	Water (µCi/mL)		
			Radon-222 (with daughters present)	1E-10	-		
			Radium-223 W	9E-13	-		
			Radium-224 W	2E-12	-		
			Radium-226 W	9E-13	-		
				-	6E-8		
			Radium-228 W	2E-12	-		
				-	6E-8		
			Protactinium-231 W	6E-15	6E-9		
			Y	8E-15	-		
			Protactinium-234 W	1E-8	3E-5		
			Y	9E-9	-		
			Actinium-227 D	-	-		
				1E-15	5E-9		
			W	-	-		
				4E-15	-		
			Y	6E-15	-		
			Actinium-228 D	-	3E-5		
			Y	6E-11	-		
			Bismuth-210 D	-	1E-5		
			W	4E-11	-		
			Bismuth-212 D	3E-10	7E-5		
			W	5E-11	-		
			Bismuth-214 D	1E-9	-		
			W	1E-9	-		
			Europium-152 W	3E-11	1E-5		

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement			Preliminary Determination	Remarks
				Effluent Concentrations			
			Radionuclide	Air (µCi/mL)	Water (µCi/mL)		
			Thorium-227 W	5E-13	2E-6		
			Y	5E-13	1E-4		
			Thorium-228 W	-	-		
				3E-14	2E-7		
			Y	2E-14	-		
			Thorium-230 W	-	-		
				2E-14	1E-7		
			Y	-	-		
				3E-14	-		
			Thorium-232 W	-	-		
				4E-15	3E-8		
			Y	-	-		
				6E-15	-		
			Thorium-234 W	3E-10	-		
			Y	2E-10	-		
			Uranium-233 D	-	-		
				3E-12	3E-7		
			W	1E-12	-		
			Y	5E-14	-		
			Uranium-234 D	-	-		
				3E-12	3E-7		
			W	1E-12	-		
			Y	5E-14	-		
			Uranium-235 D	-	-		
				3E-12	3E-7		
			W	1E-12	-		
			Y	6E-14	-		
			Uranium-236 D	-	-		
				3E-12	3E-7		
			W	1E-12	-		
			Y	6E-14	-		

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement			Preliminary Determination	Remarks
				Effluent Concentrations			
			Radionuclide	Air (µCi/mL)	Water (µCi/mL)		
			Uranium-238 D	-	-		
				3E-12	3E-7		
			W	1E-12	-		
			Y	6E-14	-		
			Uranium-natural D	-	-		
				3E-12	3E-7		
			W	9E-13	-		
			Y	9E-14	-		
			Neptunium-237 W	-	-		
				1E-14	2E-8		
			Polonium-210 D	9E-13	4E-8		
			W	9E-13	-		
			Plutonium-238 W	-	-		
				2E-14	2E-8		
			Y	2E-14			
			Plutonium-239 W	-	-		
				2E-14	2E-8		
			Y	-	-		
				2E-14	-		
			Plutonium-240 W	-	-		
				2E-14	2E-8		
			Y	-	-		
				2E-14	-		
			Plutonium-241 W	-	-		
				8E-13	1E-6		
			Y	-	-		
				1E-12	-		
			Plutonium-242 W	-	-		
				2E-14	2E-8		
			Y	-	-		
				2E-14	-		

[a] Daily (D), weekly (W) and yearly (Y) lung retention classifications.

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TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Radiation Protection Rules, Ohio Administration Code; Chapter 3701-38: General Radiation Protection Standards; Rules 3701-38-13, 3707-38-15 and 3701-38-16	Radiation	Any	No individual in a restricted area shall receive in any one calendar quarter a total occupational dose in excess of: Part of Body — Dose (rem) Whole body; hand and trunk, active blood-forming organs, lens of eyes or gonads — 1-1/4 Hand and forearms, feet and ankles — 18-3/4 Skin of whole body — 7-1/2 Except, exposure to the whole body may exceed the above values provided exposure does not exceed 3 rem/quarter and the dose to the whole body when added to the accumulated dose to the whole body shall not exceed 5(N-18) rem where N = individual's age in years at his last birthday. No person may cause any individual under 18 years of age within a restricted area to receive in any period of one calendar quarter, from all sources of radiation, a dose in excess of 10% of the limits specified above.	Potentially applicable	These requirements may be applicable to the protection of workers at the site during implementation of the corrective action.
			The exposure limit for any member of the public in an unrestricted area is limited to radiation levels which, if an individual were continuously present in the area, could result in his receiving a dose in excess of 2 mrem in any one hour, or in excess of 100 mrem in any 7 consecutive days. Limits in excess of those specified may be approved by the Ohio Department of Health if the limits are not likely to cause any individual to receive a dose to the whole body in any period of one calendar year in excess of 0.5 rem.	Potentially applicable	These requirements would be applicable for the protection of the general public from radionuclide emissions to uncontrolled areas.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
			Radioactive material may not be released to an unrestricted area such that concentrations exceed:		

Radionuclide[a]	Effluent Concentrations Air (µCi/ml)	Effluent Concentrations Water (µCi/mL)
Radium-226 s	3E-12	3E-8
i	2E-12	3E-5
Radium-228 s	2E-12	3E-8
i	1E-12	3E-5
Radon-220	1E-8	-
Radon-222	3E-9	-
Beta and/or gamma emitters not listed with half life < 2 h	3E-8	-
Beta and/or gamma emitters not listed with half life > 2 h	1E-10	3E-6
Alpha emitters not listed above	2E-14	3E-8

[a]Soluble (s) and insoluble (i).

Except higher limits may be allowed upon showing reasonable effort has been made to minimize radioactivity discharged. Concentrations apply at the boundary of the restricted area.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Environmental Radiation Protection Standards for Nuclear Power Operations (40 CFR 190)	Radiation	Any	The annual dose equivalent must not exceed 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ of any member of the public as the result of exposures to the planned discharges of radioactive materials, radon and its daughters excepted.	Potentially relevant and appropriate	These regulations are not applicable because OU3 is not a nuclear power operation associated with the production of electrical power for public use; however, they may be relevant and appropriate to the proposed action.
Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-level and Transuranic Radioactive Wastes (40 CFR 191)	Radiation	Any	The combined annual dose equivalent from the management and storage of spent nuclear fuel or high-level or transuranic radioactive wastes at a disposal facility operated by the Department of Energy and not regulated by the NRC or State of Ohio shall not exceed 25 mrem to the whole body and 75 mrem to any critical organ. Any disposal system shall be designed to not cause the radionuclide concentrations averaged over any year in water withdrawn from any portion of a special source of groundwater to exceed: Radium 226 and -228: 5 pCi/L Alpha-emitting radionuclides: 15 pCi/L or for beta or gamma radiation shall not exceed an annual dose equivalent to the total body or any internal organ of 4 mrem.	Potentially relevant and appropriate	These standards are not applicable because OU3 is not a DOE high-level or transuranic radioactive waste disposal site nor an NRC-licensed disposal site; however, the standards may be relevant and appropriate to the proposed action.
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, 40 CFR 192	Radiation	Any	After closure of a uranium byproduct material disposal site, releases of radon-222 to the atmosphere shall not exceed an average release rate of 20 $pCi/m^2 \cdot s$.	Potentially relevant and appropriate	These standards are not applicable because OU3 is not a disposal site; however, they may be relevant and appropriate to on-site disposal of radionuclide materials.
Disposal or On-Site Storage of Thorium or Uranium Wastes from Past Operations, NRC Branch Technical Position (46 FR 52061, Oct. 23, 1981)	Thorium and uranium	Any	Applications for burial of low-concentration thorium and uranium contaminated wastes or storage thereof will be approved if these guidelines are met, including dose and pCi/g limits and prescribed depth and tiling conditions. Storage on-site pending appropriate disposal requires that radiation doses not exceed those specified in 10 CFR Part 20.	To be considered	These guidelines are for NRC consideration of applications. Other methods of disposal may be proposed but will be evaluated on their own merit.
Radiation Protection of the Public and the Environment (DOE Order 5400.5)	Radiation	Air	The basic dose limit for nonoccupationally exposed individuals is 100 mrem/yr above background, committed effective dose equivalent. Further, all radiation exposures must be reduced to levels as low as reasonably achievable.	To be considered	Although not promulgated standards, these requirements are derived from such standards and they constitute requirements for protection of the public with which the proposed action will comply.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
National Emission Standards for Hazardous Air Pollutants (40 CFR 61), Subpart H, National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities	Radionuclides other than radon-220 and radon-222	Air	Emissions of such radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public in any year an effective dose equivalent of 10 mrem/yr.	Potentially applicable	These requirements may be applicable because Fernald is a DOE facility.
National Emission Standards for Hazardous Air Pollutants (40 CFR 61), Subpart T, National Emission Standards for Radon Emissions from the Disposal of Uranium Mill Tailings	Radon	Air	Radon-222 emissions to ambient air from uranium mill tailings piles that are no longer operational shall not exceed 20 $pCi/m^2 \cdot s$.	Potentially relevant and appropriate	OU3 is not a mill tailings site, so this requirement is not applicable; however, it may be considered relevant and appropriate.
National Emission Standards for Hazardous Air Pollutants (40 CFR 61), Subpart Q, National Emission Standards for Radon Emissions from DOE Facilities	Radon	Air	No source at a DOE facility shall emit more than 20 pCi/m^2 of radon-222 as an average into the air.	Potentially applicable	These regulations are applicable if storage and disposal facilities for radium-containing material are part of the proposed action.
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings (40 CFR 192)	External gamma radiation	Air	The level of external gamma radiation in any occupied or habitable building must not exceed the background level by more than 20 μR/h.	Potentially relevant and appropriate	OU3 is not a mill tailings site, so these requirements are not applicable; they may be relevant and appropriate if habitable buildings would be involved in the proposed action.
	Radon	Air	Releases of radon from tailings disposal piles must not exceed an average rate of 20 $pCi/m^2 \cdot s$ or increase the annual average concentration in air outside the disposal site by more than 0.5 pCi/L.	Potentially relevant and appropriate	OU3 is not a mill tailings site, so these requirements are not applicable; however, they may be considered relevant and appropriate.
	Radon decay products	Air	The annual average (or equivalent) radon decay product concentration, including background, in any habitable building must not exceed 0.02 working level (WL) or a maximum of 0.03 WL – where a WL is any combination of short-lived radon decay products in 1 liter of air, without regard to the degree of equilibrium, that will result in the emission of 1.3×10^5 MeV of alpha energy. (For radon-222 in equilibrium with its decay products, 1 WL = 100 pCi/L.)	Potentially relevant and appropriate	OU3 is not a mill tailings site, so these requirements are not applicable; they may be relevant and appropriate if habitable buildings are involved in the proposed action.

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TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Radiation Protection of the Public and the Environment (DOE Order 5400.5)	See table	Air	Residual concentrations of radionuclides in air in uncontrolled areas are limited to the following. (For known mixtures of radionuclides, the sum of the ratios of the observed concentration of each radionuclide to its corresponding limit must not exceed 1.0.)	To be considered	Although not promulgated standards, these constitute requirements for protection of the public with which the proposed action will comply.

Isotope	Derived Concentration Guide[a] (μCi/mL) D	W	Y
Actinium-227	4×10^{-15}	1×10^{-15}	1×10^{-14}
Actinium-228	4×10^{-11}	1×10^{-10}	1×10^{-10}
Americium-241	-	2×10^{-12}	-
Bismuth-210	9×10^{-10}	6×10^{-11}	-
Bismuth-212	6×10^{-10}	7×10^{-10}	-
Bismuth-214	2×10^{-9}	2×10^{-9}	-
Cesium-137	4×10^{-10}	-[b]	-
Cobalt-60	-	4×10^{-10}	8×10^{-11}
Europium-152	-	5×10^{-11}	-
Lead-210	9×10^{-13}	-	-
Lead-212	8×10^{-11}	-	-
Lead-214	2×10^{-9}	-	-
Neptunium-237	-	2×10^{-14}	-
Plutonium-238[c]	-	3×10^{-14}	4×10^{-14}
Plutonium-239[c]	-	2×10^{-14}	4×10^{-14}
Plutonium-240[c]	-	2×10^{-14}	4×10^{-14}
Plutonium-241[c]	-	1×10^{-14}	2×10^{-12}

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement				Preliminary Determination	Remarks
				Derived Concentration Guide[a] (µCi/mL)				
			Isotope	D	W	Y		
			Plutonium-242[c]	-	1×10^{-12}	2×10^{-12}		
			Polonium-210	1×10^{-12}	1×10^{-12}	-		
			Protactinium-231	-	9×10^{-15}	1×10^{-14}		
			Protactinium-234	-	-	-		
			Radium-223	-	2×10^{-12}	-		
			Radium-224	-	4×10^{-12}	-		
			Radium-226	-	1×10^{-12}	-		
			Radium-228	-	3×10^{-12}	-		
			Radon-220[d]	3×10^{-9}	3×10^{-9}	3×10^{-9}		
			Radon-222[d]	3×10^{-9}	3×10^{-9}	3×10^{-9}		
			Technetium-99	1×10^{-8}	2×10^{-9}	-		
			Ruthenium-106	2×10^{-10}	1×10^{-10}	3×10^{-11}		
			Strontium-90[c]	5×10^{-11}	-	9×10^{-12}		
			Thorium-227	-	8×10^{-13}	7×10^{-13}		
			Thorium-228	-	5×10^{-14}	4×10^{-14}		
			Thorium-229	-	6×10^{-15}	7×10^{-15}		
			Thorium-230	-	4×10^{-14}	5×10^{-14}		
			Thorium-232	-	7×10^{-15}	1×10^{-14}		
			Thorium-natural	-	7×10^{-15}	1×10^{-14}		

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TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement				Preliminary Determination	Remarks
				Derived Concentration Guide[a] (µCi/mL)				
			Isotope	D	W	Y		
			Thorium-234	-	5×10^{-10}	4×10^{-10}		
			Uranium-231[c]	2×10^{-8}	1×10^{-8}	1×10^{-8}		
			Uranium-233[c]	4×10^{-12}	2×10^{-12}	9×10^{-14}		
			Uranium-234[c]	4×10^{-12}	2×10^{-12}	9×10^{-14}		
			Uranium-235[c]	5×10^{-12}	2×10^{-12}	1×10^{-13}		
			Uranium-236[c]	5×10^{-12}	2×10^{-12}	1×10^{-13}		
			Uranium-238[c]	5×10^{-12}	2×10^{-12}	1×10^{-13}		
			Uranium-Natural[c]	5×10^{-12}	2×10^{-12}	1×10^{-13}		

[a]D, W, and Y represent lung retention classes; removal half-times assigned to the compounds with classes D, W, and Y are 0.5, 50, and 500 days, respectively. Exposure conditions assume an inhalation rate of 8,400 m^3 of air per year (based on an exposure over 24 hours per day, 365 days per year).

[b]A hyphen means no limit has been established.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
			[c]The value shown for yearly DCG is for plutonium radionuclides with an absorption factor (f_1) value of 1×10^{-5}. The value shown for weekly DCG is for plutonium radionuclides with a f_1 value of 1×10^{-3}. The value shown for daily and weekly DCG is for Uranium radionuclides with a f_1 value of 5×10^{-2} and for yearly DCG is for uranium radionuclides with a f_1 value of 2×10^{-3}. The value shown for daily DCG is for strontium radionuclides with a f_1 value of 3×10^{-1}. The value shown for yearly DCG is for strontium radionuclides for a f_1 value of 1×10^{-2}. [d]Still being assessed.		
	Radon-222	Air	The above-background concentration of radon-222 in air above an interim storage facility must not exceed 100 pCi/L at any point, an annual average of 30 pCi/L over the facility, or an annual average of 3 pCi/L at or above any location outside the site. (See also the discussion for DOE Order 5820.2A.)	To be considered	Although not promulgated standards, these constitute requirements for protection of the public with which the proposed action will comply.
	Radon-220 and radon-222	Air	The immersion derived concentration guide for both radon-220 and radon-222 in air in an uncontrolled area is 3 pCi/L.	To be considered	Although not promulgated standards, these constitute requirements for protection of the public with which the proposed action will comply.
	External gamma radiation	Air	The level of external gamma radiation in any occupied or habitable building must not exceed the background level by more than 20 μR/h.	To be considered	Pertinent to the proposed action if habitable buildings are involved in the proposed action.
	Radon	Air	Releases of radon-222 from residual radioactive material disposal sites should not exceed an annual average release rate of 20 pCi/m^2·s or increase the annual average radon-222 concentration at or above any location outside the boundary of the contaminated area by more than 0.5 pCi/L.	To be considered	Although not promulgated standards, these constitute requirements for protection of the public with which the proposed action will comply.
	Radon decay products	Air	The annual average (or equivalent) radon decay product concentration, including background, in any habitable building must not exceed 0.02 working level (WL) or a maximum of 0.03 WL.	To be considered	Pertinent to the proposed action if habitable buildings are involved in the proposed action.

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TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Occupational Safety and Health Administration Standards; Occupational Health and Environmental Control (29 CFR 1910; 1910.96), Subpart G, Ionizing Radiation	Uranium, thorium, radium, and radon	Air	Within a restricted area, airborne radioactive material (averaged over a 40-hour work week of seven consecutive days) should not exceed the following limits. (For hours of exposure less than or greater than 40, the limits are proportionately increased or decreased, respectively.)	Not an ARAR	The provisions of the OSHA do not apply to working conditions of DOE contractor employees in government-owned, contractor-operated facilities since DOE exercises statutory authority to prescribe and enforce safety and health standards at its facilities. The DOE exercises this authority pursuant to an agreement between the Secretary of Energy and the Occupational Safety and Health Administration.

Isotope	Solubility Class[a]	Concentration (μCi/mL)	Concentration for Exposure to Minors (μCi/mL)
Actinium-227	S	2×10^{-12}	8×10^{-14}
	I	3×10^{-11}	9×10^{-13}
Actinium-228	S	8×10^{-8}	3×10^{-9}
	I	2×10^{-8}	6×10^{-10}
Americium-241	S	6×10^{-12}	2×10^{-13}
	I	1×10^{-10}	4×10^{-12}
Bismuth-210	S	6×10^{-9}	2×10^{-10}
	I	6×10^{-9}	2×10^{-10}
Bismuth-212	S	1×10^{-7}	3×10^{-9}
	I	2×10^{-7}	7×10^{-9}
Europium-152	S	4×10^{-7}	1×10^{-8}
(T/2 = 9.2 hrs)	I	3×10^{-7}	1×10^{-8}
Europium-152	S	1×10^{-8}	4×10^{-10}
(T/2 = 13 yrs)	I	2×10^{-8}	6×10^{-10}
Lead-210	S	1×10^{-10}	4×10^{-12}
	I	2×10^{-10}	8×10^{-12}
Lead-212	S	2×10^{-8}	6×10^{-10}
	I	2×10^{-8}	7×10^{-10}
Protactinium-231	S	1×10^{-12}	4×10^{-14}
	I	1×10^{-10}	4×10^{-12}
Radium-223	S	2×10^{-9}	6×10^{-11}
	I	2×10^{-10}	8×10^{-12}
Radium-224	S	5×10^{-9}	2×10^{-10}
	I	7×10^{-10}	2×10^{-11}
Radium-226	S	3×10^{-11}	3×10^{-12}
	I	5×10^{-11}	2×10^{-12}
Radium-228	S	7×10^{-11}	2×10^{-12}
	I	4×10^{-11}	1×10^{-12}
Radon-220	S	3×10^{-7}	1×10^{-8}
Radon-222[b]	S	3×10^{-8}	3×10^{-9}
Cesium-137	S	6×10^{-8}	2×10^{-9}
	I	1×10^{-8}	5×10^{-10}

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement				Preliminary Determination	Remarks
			Isotope	Solubility Class	Concentration (μCi/mL)	Concentration for Exposure to Minors (μCi/mL)		
			Cobalt-60	S	3×10^{-7}	1×10^{-8}		
				I	9×10^{-9}	3×10^{-10}		
			Neptunium 237	S	4×10^{-12}	1×10^{-13}		
				I	1×10^{-10}	4×10^{-12}		
			Polonium 210	S	5×10^{-10}	2×10^{-11}		
				I	2×10^{-10}	7×10^{-12}		
			Plutonium-238	S	2×10^{-12}	7×10^{-14}		
				I	3×10^{-11}	1×10^{-12}		
			Plutonium-239	S	2×10^{-12}	6×10^{-14}		
				I	4×10^{-11}	1×10^{-12}		
			Plutonium-240	S	2×10^{-12}	6×10^{-14}		
				I	4×10^{-11}	1×10^{-12}		
			Plutonium-241	S	9×10^{-11}	3×10^{-12}		
				I	4×10^{-8}	1×10^{-9}		
			Plutonium-242	S	2×10^{-12}	6×10^{-14}		
				I	4×10^{-11}	1×10^{-12}		
			Ruthenium-106	S	8×10^{-8}	3×10^{-9}		
				I	6×10^{-9}	2×10^{-10}		
			Strontium-90	S	1×10^{-9}	3×10^{-11}		
				I	5×10^{-9}	2×10^{-10}		
			Technetium-99	S	2×10^{-6}	7×10^{-8}		
				I	6×10^{-8}	2×10^{-9}		
			Thorium-227	S	3×10^{-10}	1×10^{-11}		
				I	2×10^{-10}	6×10^{-12}		
			Thorium-228	S	9×10^{-12}	3×10^{-13}		
				I	6×10^{-12}	2×10^{-13}		
			Thorium-230	S	2×10^{-12}	8×10^{-14}		
				I	1×10^{-11}	3×10^{-13}		
			Thorium-232	S	3×10^{-11}	1×10^{-12}		
				I	3×10^{-11}	1×10^{-12}		
			Thorium - natural	S	6×10^{-11}	2×10^{-12}		
				I	6×10^{-11}	2×10^{-12}		
			Thorium-234	S	6×10^{-8}	6×10^{-10}		
				I	3×10^{-8}	7×10^{-10}		
			Uranium-233	S	5×10^{-10}	2×10^{-11}		
				I	1×10^{-10}	4×10^{-12}		
			Uranium-234	S	6×10^{-10}	2×10^{-11}		
				I	1×10^{-10}	4×10^{-12}		

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TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement				Preliminary Determination	Remarks
			Isotope	Solubility Class	Concentration (μCi/mL)	Concentration for Exposure to Minors (μCi/mL)		
			Uranium-235	S	5×10^{-10}	2×10^{-11}		
				I	1×10^{-10}	4×10^{-12}		
			Uranium-236	S	6×10^{-10}	2×10^{-11}		
				I	1×10^{-10}	4×10^{-12}		
			Uranium-238	S	7×10^{-11}	3×10^{-12}		
				I	1×10^{-10}	5×10^{-12}		
			Uranium-Natural	S	1×10^{-10}	5×10^{-12}		
				I	1×10^{-10}	5×10^{-12}		

[a]Soluble (S); insoluble (I).

[b]These radon concentrations are appropriate for protection from radon-222 combined with its short-lived daughters. Alternatively, the value in Column 1 may be replaced by one-third (1/3) "working level" (A "working level" is defined as any combination of short-lived radon-222 daughters, polonium-218, lead-214, bismuth-214 and polonium-214, in one liter of air without regard to the degree of equilibrium that will result in the ultimate emission of 1.3 10 MeV of alpha particle energy. The value for exposure to minors may be replaced by one-thirtieth (1/30) of a "working level". The limit on radon-222 concentrations in restricted areas may be based on an annual average.

For mixtures of radionuclides see 10 CFR 20, NRC Standards for Protection Against Radiation, Appendix B Note.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Radiation Protection for Occupational Workers (DOE Order 5480.11)	Radiation	Air	Occupational exposure limits for specific radionuclides in air are as follows. (Values for radon isotopes assume 100% equilibrium with the short-lived decay products; these values may be replaced by 1 WL for radon-220 and 1/3 WL for radon-222.)	To be considered	Although not promulgated standards, these constitute requirements for worker protection with which the proposed action will comply.

Isotope	Derived Concentration Guide[a] (μCi/mL) D	W	Y
Ru-106	4×10^{-8}	2×10^{-8}	5×10^{-9}
Np-237	-[b]	2×10^{-12}	-
Sr-90	8×10^{-9}	-	2×10^{-9}
Te-99	2×10^{-6}	3×10^{-7}	-
Pa-321	-	7×10^{-13}	2×10^{-12}
Pa-234	-	3×10^{-6}	3×10^{-6}
Po-210	3×10^{-10}	3×10^{-10}	-
Ra-223	-	3×10^{-10}	-
Ra-224	-	7×10^{-10}	-
Ra-226	-	3×10^{-10}	-
Ra-228	-	5×10^{-10}	-
Rn-220[c]	8×10^{-9}	-	-
Rn-222[c]	3×10^{-8}	-	-
Ce-137	7×10^{-8}		
Ac-227	2×10^{-13}	7×10^{-13}	2×10^{12}
Ac-228	4×10^{-9}	2×10^{-8}	-
Am-241	-	2×10^{-2}	-
Bi-210	1×10^{-7}	1×10^{-8}	-
Bi-212	1×10^{-7}	1×10^{-7}	-
Bi-214	3×10^{-7}	4×10^{-7}	-
Eu-152	-	1×10^{-8}	-
Th-227	-	1×10^{-10}	1×10^{-10}
Th-228	-	4×10^{-12}	7×10^{-12}
Th-230	-	3×10^{-12}	7×10^{-12}
Th-232	-	5×10^{-13}	1×10^{-12}
Th-234	-	9×10^{-8}	6×10^{-8}
U-233	5×10^{-10}	3×10^{-10}	2×10^{-11}
U-234	5×10^{-10}	3×10^{-10}	2×10^{11}
U-235	6×10^{-10}	3×10^{-10}	2×10^{-11}
U-236	6×10^{-10}	3×10^{-10}	2×10^{-11}
U-237	1×10^{-6}	7×10^{-7}	6×10^{-7}
Pu-238	-	3×10^{-12}	7×10^{12}
Pu-239	-	2×10^{-12}	6×10^{-12}

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks

Isotope	Derived Concentration Guide[a] (μCi/mL) D	W	Y
Pu-240	-	2×10^{-12}	6×10^{-12}
Pu-241	-	1×10^{-10}	3×10^{-10}
Pu-242	-	2×10^{-12}	6×10^{-12}
Co-60	-	7×10^{-8}	1×10^{-8}

[a]D, W, and Y represent lung retention classes; removal half times assigned to the compounds with classes D, W, and Y are 0.5, 50, and 500 days, respectively. Exposure conditions assume an inhalation rate of 2,400 m^3 of air per year (based on an exposure over 40 hours per week, 50 weeks per year).

[b]A hyphen means no limit has been established.

[c]These values are appropriate for protection from radon combined with its short-lived daughters and are based on information given in ICRP Publication 32: *Limits for Inhalation of Radon Daughters by Workers* and Federal Guidance Report No. 11: *Limiting Values of Radionuclide Intake and Air Concentrations, and Dose Conversion Factors for Inhalation, Submersion, and Ingestion* (EPA 520/1-88-020). The values given are for 100% equilibrium concentration conditions of the radon daughters with the parent. To allow for an actual measured equilibrium concentration or a demonstrated equilibrium concentration, the values given in this table should be multiplied by the ratio (100% actual %) or 100%/demonstrated %), respectively. Alternatively, the DAC values for Rn-220 and Rn-222 may be replaced by 1 WL and 1/3 WL, and 1/3 WL, respectively, for appropriate limiting of daughter concentrations. Because of the dosimetric considerations for radon, no f_1 or lung clearance values are listed. A "Working Level" (WL) is any combination of short-lived radon daughters, in one liter of air without regard to the degree of equilibrium, that will result in the ultimate emission of 1.3 E+0.5 MeV of alpha energy.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Radiation Protection Rules, Ohio Administration Code; Chapter 3701-38: General Radiation Protection Standards; Rules 3701-38-13, 3701-38-15 and 3701-38-16.	Radiation	Air	Individuals in restricted areas may not be exposed to airborne radioactive material in average concentrations in excess of the following:	Potentially applicable	These requirements may be applicable to the protection of workers at the site during implementation of the remedial action.

	Concentration Levels			
	General (μCi/mL)		Minors (μCi/mL)	
Radionuclide[a]	Air	Water	Air	Water
Radium-226 s	3E-11	4E-7	3E-12	3E-8
i	5E-11	9E-4	2E-12	3E-5
Radium-228 s	7E-11	8E-7	2E-12	3E-8
i	4E-11	7E-4	1E-12	3E-5
Radon-220	3E-7	-	1E-8	-
Radon-222	1E-7	-	3E-9	-
Beta and/or gamma emitters not listed with half-life <2 h	1E-6	-	3E-8	-
Beta and/or gamma emitters not listed with half-life >2 h	3E-9	9E-5	1E-10	3E-6
Alpha emitters not listed above	6E-13	4E-7	2E-14	3E-8

[a]Soluble (s) and Insoluble (i).

No allowance shall be made for the use of protective clothing or equipment, or particle size except as authorized by the Ohio Department of Health. Concentrations may be averaged over no longer than one week.

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TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Occupational Safety and Health Administration Standards (29 CFR 1910; 1910.1000), Subpart Z, Toxic and Hazardous Substances; 1910.1025, Lead; 1910.1028, Benzene; 1910.1101, Asbestos; 1910-1018, Inorganic arsenic	Specific substances	Air	Permissible occupational exposure limits (time weighted average) for various airborne substances have recently been revised to the following final rule limits; they may be achieved by any reasonable combination of engineering controls, work practices, and personal protective equipment.	Not an ARAR	The provisions of OSHA do not apply to working conditions of DOE contractor employees working in government-owned, contractor-operated facilities since DOE exercises statutory authority to prescribe and enforce safety and health standards at its facilities. The DOE exercises this authority pursuant to an agreement between the Secretary of Energy and the Occupational Safety and Health Administration.

Substance	Limit[a] (mg/m^3)	Condition
Acetone	1800	750 ppm,[c] STEL[b] is 1000 ppm, 2400 mg/m^3
Aluminum		
Total dust	15	
Respirable fraction	5	
Pyro powders	5	
Soluble salts	2	
Alkyls	2	
Aroclor 1254 (PCB)	0.5	Skin notation for potential contribution to overall exposure by cutaneous route (airborne or direct contact)
Lead	0.05	For metallic lead and inorganic compounds, as lead
Asbestos	2 fibers/m^3	Ceiling 10 fibers/m^3
Arsenic, organic compounds	0.5	-
Arsenic, inorganic compounds	0.01	-
Cadmium fumes	0.1	Ceiling is 0.3 mg/m^3
Carbon tetrachloride	12.6	2 ppm
Chlordane	0.5	
Chloroform (Trichloromethane)	9.78	2 ppm
Chromium metal	1.0	
1,1-Dichloroethane	400	100 ppm
1,2-Dichloroethyene	790	200 ppm
Ethyl benzene	435.0	100 ppm, STEL is 125 ppm and 545 mg/m^3
Gasoline	900	300 ppm, STEL is 1500 mg/m^3 or 500 ppm

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement			Preliminary Determination	Remarks
			Substance	Limit[a] (mg/m^3)	Condition		
			Magnesium oxide fume (total particulate)	10.0			
			Mercury (organo) alkyl compounds	0.01	STEL is 0.03 mg/m^3; skin notation for potential contribution to overall exposure by cutaneous route (airborne or direct contact).		
			Mercury vapor	0.05	Skin notation for potential contribution to overall exposure by cutaneous route (airborne or direct contact).		
			Nickel carbonyl (as Ni)	0.007	0.001 ppm		
			Nickel, soluble compounds	0.1			
			Pentachlorophenol	0.5	Skin notation for potential contribution to overall exposure by cutaneous route (airborne or direct contact).		
			Perchloroethylene (tetrachloroethylene)	170.0	25 ppm		
			Phenol	19.0	5 ppm; Skin notation for potential contribution to overall exposure by cutaneous route (airborne or direct contact).		
			Tetrachloroethylene; see Perchloroethylene				
			Tetrachloromethane (carbon tetrachloride)	12.6	2 ppm		
			Toluene	375.0	100 ppm; STEL 150 ppm and 560 mg/m^3		
			Tributyl phosphate	2.5	0.2 ppm		
			1,1,1-Trichloroethane	1900	350 ppm; STEL is 2450 mg/m^3 and 450 ppm		

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement			Preliminary Determination	Remarks
			Substance	Limit[a] (mg/m^3)	Condition		
			Xylenes (o-, m-, p-isomers)	435.0	100 ppm; STEL is 150 ppm and 655 mg/m^3		
			Zirconium compounds	5.0	STEL is 10 mg/m^3		
			Barium, soluble compounds	0.5			
			Benzene	1 ppm	5 ppm averaged for 15 min.		
			Cadmium dust	0.2	Ceiling 0.6 mg/m^3		
			Chromium II compounds	0.5			
			Chromium III compounds	0.5			
			Copper				
			Fume (Cu)	0.1			
			Dust (Cu)	1.0			
			Fluorides (F)	2.5			
			Mercury (aryl and inorganic) (Hg)	-	0.1 mg/m^3 ceiling; skin notation for potential contribution to overall exposure by cutaneous maximum duration route (airborne or direct contact)		
			Nickel (metal and insoluble compounds)	1.0			
			Silver, metal and soluble compounds	0.01			
			Trichloroethylene	270.0	50 ppm; for short-term exposure 1080 mg/m^3 or 200 ppm		
			Uranium				
			Soluble compounds	0.05			
			Insoluble compounds	0.2	STEL 0.6 mg/m^3		
			Yttrium	1.0			
			Particulates:				
			Total dust	15	For particulates not otherwise regulated (i.e., nuisance dust)		
			Respirable fraction	5			

See next page for footnotes.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
			[a]Permissible exposure limit expressed as the 8-hour time-weighted average. [b]Short-term exposure limit. [c]Parts of vapor or gas per million parts of contaminated air by volume at 25° and 760 torr.		
Clean Air Act, as amended (42 USC 7401-7642); National Primary and Secondary Ambient Air Quality Standards (40 CFR 50)	Particulate matter	Air	For a majority stationary source (see 40 CFR 52.2(b)(1)(i)(a)) that emits >250 tons/year of any regulated pollutant or >100 tons/year of a regulated pollutant for which the area is designated as nonattainment, particulate matter less than 10 μm in diameter (PM-10) should not exceed a 24-hour average concentration of 150 $\mu g/m^3$ or an annual arithmetic mean of 50 $\mu g/m^3$.	Potentially applicable	These requirements do not apply directly to source-specific emissions; rather, they are national limitations on ambient concentrations. However, they will be addressed in controlling particulate emissions that could result from implementation of the remedial action.
	Lead	Air	As for the above conditions, the standard for lead and its compounds, as elemental lead, is 1.5 $\mu g/m^3$ maximum arithmetic mean averaged over one calendar quarter.	Potentially applicable	These requirements do not apply directly to source-specific emissions; rather, they are national limitations on ambient concentrations. However, they will be addressed in controlling lead emissions that could result from implementation of the remedial action.
Ohio Air Pollution Control Regulations, Ohio Administrative Code, 3745-17-02	Particulate matter	Air	For total suspended particulates, the 24-hour primary and secondary ambient air quality standards are identical, and the annual primary and secondary ambient air quality standards are identical. Total suspended particulates shall be measured in the ambient air as particles with an aerodynamic diameter less than or equal to a nominal 10 μm. The level of 24-hour ambient air quality standards for total suspended particulates is 150 $\mu g/m^3$, 24-hour average concentration. The level of the primary and secondary annual standards for total suspended particulates is 50 $\mu g/m^3$, annual arithmetic mean.	Potentially applicable	These regulations do not apply directly to source-specific emissions, rather they are limits on ambient concentrations in the air. However, they would be applicable to controlling particulate emissions during implementation of the remedial action.
Ohio Air Pollution Regulations, Ohio Administrative Code 3745-20-04 and -05 Demolition and Renovation Procedures for Asbestos Emission Control	Asbestos	Air	Remove friable asbestos materials from a facility being demolished or renovated before any wrecking or dismantling that would break up materials or preclude access to the materials for subsequent removal. Wet and encase friable materials with a suitable leak-tight container.	Potentially Applicable	These regulations are applicable to the demolition or renovation of any building in which asbestos is present.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Ohio Air Pollution Lead Control Regulations Ohio Administrative Code, 5745-71-02, Lead Emissions Limits	Lead	Air	Exposure to lead shall not exceed the arithmetic mean of 1.5 $\mu g/m^3$ during any calendar quarter.	Potentially applicable	These regulations would be applicable to any proposed action which would put lead into the air.
Toxic Substances Control Act, as amended (15 USC 2607-2629; PL 94-469 et seq.); Polychlorinated Biphenyls (PCBs) Manufacturing Processing, Distribution in Commerce and Use Prohibitions (40 CFR 761), Subpart A, General;	PCBs	Air	The release of inadvertently generated PCBs at the vent point for emissions must be <10 ppm.	Potentially relevant and appropriate	This requirement is not applicable because no PCBs would be generated and vented from manufacturing/processing activities as part of the proposed action; however, portions of this requirement may be relevant and appropriate because PCB emissions could occur during implementation.
Occupational Safety and Health Administration Standards; Occupational Health and Environmental Control (29 CFR 1910; 1910.95), Subpart G, Occupational Noise Exposure	Noise	Air	The permissible occupational exposure level for noise is 90 dBA (slow response) for an 8-hour day; with decreasing times of exposure, the levels increase to 115 dBA per 15-minute day.	Not an ARAR	The provisions of the OSHA do not apply to working conditions of DOE contractor employees working in government-owned, contractor-operated facilities since DOE exercises statutory authority to prescribe and enforce safety and health standards at its facilities. The DOE exercises this authority pursuant to an agreement between the Secretary of Energy and the Occupational Safety and Health Administration.
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings (40 CFR 192)	Radium and thorium	Soil	Average concentrations of residual radioactive materials in soil over an area of 100 m^2 may not exceed background by more than 5 pCi/g in the top 15 cm of soil or 15 pCi/g in each 15-cm layer below the top layer.	Potentially relevant and appropriate	OU3 is not a mill tailings site, so these requirements are not applicable; however, they may be considered relevant and appropriate to the proposed action.
Radiation Protection of the Public and the Environment (DOE Order 5400.5)	Radium and thorium	Soil	Average concentrations of radium-226, radium-228, thorium-230, and thorium-232 averaged over an area of 100 m^2 may not exceed 5 pCi/g in the top 15 cm of soil and 15 pCi/g in each 15-cm layer below the top layer. These guidelines taken into account ingrowth of radium-226 from thorium-230 and of radium-228 from thorium-230, 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.	To be considered	Although not promulgated standards, these constitute requirements for protection of the public with which the proposed action will comply.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Toxic Substances Control Act, as amended (15 USC 2607-2629; PL 94-469 et seq.); Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions (40 CFR 761), Subpart G, PCB Spill Cleanup Policy.	PCBs	Soil	For spills of materials contaminated with >50 ppm PCBs in unrestricted access areas (e.g., residential areas), soil within the spill area must be excavated and backfilled with soil containing <1 ppm PCBs. Contaminated soil may be decontaminated to 10 ppm by weight by excavating a minimum of 10 inches and backfilling with soil containing <1 ppm PCBs. For spills at outdoor electrical substations, the soil must be cleaned to 25 ppm by weight (as for other restricted access areas) or to 50 ppm by weight with posting of a visible notice.	Potentially applicable	If a spill of materials contaminated with PCBs should occur during implementation of the remedial action, these regulations would be applicable.
Safe Drinking Water Act (42 USC 300G; PL 93-523); National Primary Drinking Water Regulations (40 CFR 141), Subpart B, Maximum Contaminant Levels; Subpart G, National Revised Primary Drinking Water Regulations; Maximum Contaminant Levels; National Secondary Drinking Water Regulations (40 CFR 143), Secondary Maximum Contaminant Levels.	See table	Water	Maximum contaminant levels (MCLs) and secondary maximum contaminant levels (SMCLs) for drinking water delivered directly to the ultimate user of a public water system are as follows:	Potentially relevant and appropriate	These requirements are not applicable because OU3 is not a public water system; however, if water supplies would be impacted by actions at the site, these requirements would be relevant and appropriate to protect drinking water sources from the contamination due to the remedial action.

Parameter	Unit	MCL	SMCL
Aluminum	mg/L	-	0.05 to 0.2
Asbestos	million fibers/L	7.0	-
Arsenic	mg/L	0.05	-
Barium	mg/L	1	-
Lead	µg/L	50	-
Cadmium	mg/L	0.005	
Chromium	mg/L	0.05	
Fluoride	mg/L	4.0	2.0
Mercury	mg/L	0.002	
Silver	mg/L	0.05	0.1
Benzene	mg/L	0.005	-
Trichloroethylene	mg/L	0.005	-
Copper	mg/L	-	1
Manganese	mg/L	-	0.05
Nitrate	mg/L	10	-
Chloroform	mg/L	0.1	-
Ethyl-benzene	mg/L	0.7	-

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement				Preliminary Determination	Remarks
			Parameter	Unit	MCL	SMCL		
			Selenium	mg/L	0.05	-		
			Iron	mg/L	-	0.3		
			Carbon tetrachloride	mg/L	0.005	-		
			1,2-Dichloroethane	mg/L	0.005	-		
			1,1-Dichloroethylene	mg/L	0.007	-		
			1,1,1-Trichloroethane	mg/L	0.2			
			Pentachlorophenol	mg/L	0.2	-		
			PCBs	mg/L	0.0005	-		
			Toluene	mg/L	1.0	-		
			Tetrachloroethylene	mg/L	0.005	-		
			Xylene (total)	mg/L	10.0	-		
			Radionuclides:					
			Gross alpha[a]	pCi/L	15	-		
			Gross beta[b]	mrem/yr	4	-		
			Radium-226 and radium-228	pCi/L	5	-		
			Others:					
			pH	units	-	6.5-8.5		
			TDS	mg/L	-	500		

[a]Including radium but excluding radon and uranium.

[b]As mrem/yr, annual dose equivalent; if gross beta activity exceeds 50 pCi/L, isotopic analysis and organ-specific dose calculations should be made to insure that this total dose limit is met. Also, for strontium-90 the average annual concentration assumed to produce a total body or organ dose of 4 mrem/yr for bone marrow is 8 pCi/L.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
National Primary and Secondary Drinking Water Regulations (54 FR 97, May 22, 1989, Proposed Rule); Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper (53 FR 150, August 18, 1988, Proposed Rule); National Primary Water Regulations (56 FR 33050, July 18, 1991, Proposed Rule)	See table	Water	Proposed maximum contaminant levels (PMCLs) and proposed secondary maximum contaminant levels (PSMCLs) for drinking water delivered directly to the ultimate user of a public water system are as follows:	To be considered	These requirements are not promulgated standards; however, they may be considered if water impacted by the site would be directly used as a drinking water supply.

Parameter	Unit	PMCL	PSMCL
Metals:			
Lead	µg/L	5	-
Radionuclides:			
Radon-222	pCi/L	300	-
Radium-226	pCi/L	20	-
Radium-228	pCi/L	20	-
Uranium	µg/L	20	-
Adjusted gross Alpha	pCi/L	15	-
Beta particle and photon emitters	ede/yr	4	-
Others:			
PCBs	µg/L	0.5	-

NOTE: 20 µg/L uranium is approximately equal to 30 pCi/L using an activity-to-mass conversion of 1.3 pCi/µg. The activity-to-mass ratio can vary depending on the relative amounts of uranium-234, -235, and -238 that are present in a sample. The MCL applies to the total mass of uranium in the sample. The unit mrem ede/yr refers to the dose committed over a period of 50 years to reference man (ICRP 1975) from an annual intake at the rate of 2 liters of drinking water per day.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
National Primary Drinking Water Regulations; Maximum Contaminant Level Goals, Subpart F (40 CFR 141.50-141.52)	See table	Water	Maximum contaminant level goals, the maximum level of contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, are as follows: Contaminant — Limit Ethylbenzene — 0.7 mg/L Xylenes (totals) — 10.0 mg/L Toluene — 1.0 mg/L Asbestos — 7 million fibers/L Cadmium — 0.005 mg/L Chromium — 0.1 mg/L Mercury — 0.002 mg/L Nitrate — 10 (as Nitrogen) mg/L PCBs — 0 mg/L Benzene — 0 mg/L Trichloroethylene — 0 mg/L Fluoride — 4 mg/L Copper — 1.3 mg/L Fluoride — 4.0 mg/L Lead — 0 mg/L Barium — 2 mg/L	Potentially relevant and appropriate	These regulations are not applicable because OU3 is not a public water system; however, if drinking water supplies would be impacted by actions at the site, these requirements could be relevant and appropriate. MCLGs may be relevant and appropriate where they meet all the standards set forth in 40 CFR 300.400(g). However, MCLGs of zero are not considered ARARs under CERCLA.
Ore Mining and Dressing Point Source Category (40 CFR 440), Subpart C, Uranium, Radium, and Vanadium Ores Subcategory	Radium and uranium	Water	Limits for surface-water discharges from mines that produce uranium ore are as follows: uranium, 2 mg/L as a 30-day average and 4 mg/L as a 24-hour maximum; radium-226 (dissolved and total), 3 and 10 pCi/L as a 30-day average and 10 and 30 pCi/L as a 24-hour maximum, respectively.	Potentially relevant and appropriate	These requirements are neither applicable nor relevant and appropriate because surface water discharged from the site is not mine drainage. However, they may be considered relevant and appropriate in establishing remediation goals.
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings (40 CFR 192)	Uranium	Water	Surface impoundments for the disposal of uranium by-product wastes shall conform to the groundwater protection standards of 40 CFR 264.92, and in addition concentration limits for combined radium-226 and radium-228 shall not exceed 5 pCi/L and gross alpha-particle activity (excluding radon and uranium) shall not exceed 15 pCi/L.	Potentially applicable	These requirements may be applicable if water impacted by the site would be directly used as a drinking water supply.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Federal Water Pollution Control Act, Clean Water Act (33 USC 1251-1376); Water Quality Criteria (40 CFR 122)	See table	Water	The concentration of contaminants in surface water should be limited to the following for the protection of human health and aquatic life:	To be considered	Federal WQC are nonenforceable guidelines used by states to set water quality standards for surface water; however, they may be considered if the waters concerned are a public water supply or if fishing is also included in the state's designated use of the waters concerned. If a state has promulgated a numerical water quality standard for a given contaminant, the state standard would be relevant and appropriate rather than a federal WQC.

Water Quality Criteria for Protection of Human Health

Contaminant	Unit	Water and Fish Ingestion	Fish Consumption
Metals			
Lead	µg/L	50	-
PCB	µg/L	7.9E-05[b]	7.9E-05[b]

Ambient Water Quality Criteria for Protection of Aquatic Life

Contaminant	Unit	Freshwater Acute	Freshwater Chronic
Metals			
Lead	µg/L	82[a]	3.2[a]
Others			
PCBs	µg/L	2.0	0.014

[a] Water-hardness dependent criterion (based on 100 mg/L).

[b] Human health criteria reported for three risk levels; reported value is for the 1×10^{-6} level.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Ohio Water Quality Standards, Ohio Administrative Code 3745-1-01, 3745-1-07; Ohio NPDES Permits, Ohio Administrative Code 3745-33	Any	Water	All surface waters shall be free of suspended solids or other substances that will settle and form putrescent or otherwise objectionable sludge deposits or that will adversely affect aquatic life; free of floating debris, oil, scum or other floating materials in amounts sufficient to be unsightly or cause degradation; free from materials producing color, odor, or other conditions in such a degree as to create a nuisance; free of substances in concentrations that are toxic or harmful to human, animal, or aquatic life and/or are rapidly lethal in the mixing zone; and free from nutrients in concentrations that create nuisance growths of aquatic weeds and algae. Water use designations and chemical specific criteria are presented in Tables 7-1 through 7-16 of the Ohio Water Quality Standard regulations. Such criteria apply as outside mixing zone or inside mixing zone maximums for the designated use of the affected body of water.	Potentially applicable	It is not anticipated the actions at OU3 will result in discharges directly from a point source into any waters of the State of Ohio, so these regulations would not be applicable. However, if wastewater may be indirectly discharged to a POTW, applicable pretreatment standards and requirements apply. Fernald holds a NPDES permit for its treatment works, and any discharge of waste water must comply with such permit. All such discharges would have to meet the pretreatment standards and requirements and not cause any violation of the NPDES permit conditions.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Ohio Drinking Water Regulations, Ohio Administrative Code, Title 3745, Chapter 81-Public Water System Primary Contaminant Control	See table	Water	Maximum contaminant levels for inorganic chemicals are:	Potentially relevant and appropriate	These requirements may be relevant and appropriate if water impacted by the site would be used directly as a drinking water supply.

Contaminant	Maximum Level (mg/L)
Arsenic	0.05
Cadmium	0.010
Chromium	0.05
Fluoride	4.0
Lead	0.05
Mercury	0.002
Nitrate	10.0
Silver	0.05
Selenium	0.01

Maximum contaminant levels for organic chemicals are:

Contaminant	Maximum Level (mg/L)
Trihalo-methanes	0.10
Benzene	0.005
Carbon tetrachloride	0.005
Trichloroethylene	0.005
1,2-Dichloroethane	0.005
1,1-Dichloroethylene	0.007
1,1,1-Trichloroethane	0.20

Maximum contaminant levels for radionuclides are:

Isotope	Maximum Level (pCi/L)
Radium-226 and -228 combined	5.0
Gross alpha particle activity (including radium-226, but excluding radon and uranium	15.0

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
			Maximum contaminant levels for beta particle and photon radioactivity from man-made radionuclides shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 mrem/yr, based on 2-L per day drinking water intake using the 168-hour data listed in NBS Handbook 69, as amended August 1963, U.S. Department of Commerce. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 mrem/yr. Also, for strontium-90, the average annual concentration assumed to produce a total body or organ dose of 4 mrem/yr for bone marrow is 8 pCi/L.		
Ohio Drinking Water Regulations Ohio Administrative Code, Title 3745, Chapter 82 - Public Water System Secondary Contaminant Control	See chart	Water	Secondary Maximum Contaminant levels are: Copper 1.0 mg/L Fluoride 2.0 mg/L Iron 0.3 mg/L	Potentially relevant and appropriate	These regulations may be relevant and appropriate if water impacted by the site would be used directly as a drinking water supply.
Radiation Protection of the Public and the Environment (DOE Order 5400.5)	Radiation	Water	Residual concentrations of radionuclides in water in uncontrolled areas are limited to the following. (For known mixtures of radionuclides, the sum of the ratios of the observed concentration of each radionuclide to its corresponding limit must not exceed 1.0.) Actinium-227 1×10^{-8} µCi/mL Actinium-228 6×10^{-5} µCi/mL Americium-241 3×10^{-8} µCi/mL Bismuth-210 2×10^{-5} µCi/mL Bismuth-212 1×10^{-4} µCi/mL Bismuth-214 6×10^{-4} µCi/mL Europium-152 2×10^{-5} µCi/mL Lead-210 3×10^{-8} µCi/mL Lead-212 3×10^{-6} µCi/mL Lead-214 2×10^{-4} µCi/mL Protactinium-231 1×10^{-8} µCi/mL Protactinium-234 7×10^{-5} µCi/mL	To be considered	Although not promulgated standards, these constitute requirements for protection of the public with which the proposed action will comply.

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement		Preliminary Determination	Remarks
			Isotope	Concentration[a] (µCi/mL)		
			Thorium-228	4×10^{-7}		
			Thorium-230	3×10^{-7}		
			Thorium-232	5×10^{-8}		
			Thorium-227	4×10^{-6}		
			Thorium-234	1×10^{-5}		
			Radium-223	3×10^{-7}		
			Radium-224	4×10^{-7}		
			Radium-226	1×10^{-7}		
			Radium-228	1×10^{-7}		
			Radon-220[b]	3×10^{-9}		
			Radon-222[b]	3×10^{-9}		
			Technetium-99	1×10^{-4}		
			Neptunium-237	3×10^{-8}		
			Ruthenium-106	6×10^{-6}		
			Cesium-137	3×10^{-6}		
			Cobalt-60[c]	1×10^{-5}		
				5×10^{-6}		
			Polonium-210	8×10^{-8}		
			Plutonium-238[c]	4×10^{-8}		
				3×10^{-6}		
			Plutonium-239[c]	3×10^{-8}		
				2×10^{-6}		
			Plutonium-240[c]	3×10^{-8}		
				2×10^{-6}		
			Plutonium-241[c]	1×10^{-6}		
				1×10^{-4}		
			Plutonium-242[c]	3×10^{-8}		
				2×10^{-6}		
			Strontium-90[c]	1×10^{-6}		
				1×10^{-5}		
			Uranium-233[c]	5×10^{-7}		
				5×10^{-6}		
			Uranium-234[c]	5×10^{-7}		
				5×10^{-6}		
			Uranium-235[c]	6×10^{-7}		
				5×10^{-6}		
			Uranium-236[c]	5×10^{-7}		
				6×10^{-6}		

TABLE B.2 Potential Contaminant-Specific Requirements

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
			Isotope: Uranium-238[c]; Concentration[a] (μCi/mL): 6×10^{-7}, 6×10^{-6} Isotope: U-natural[c]; Concentration[a] (μCi/mL): 6×10^{-7}, 6×10^{-6} [a]Exposure conditions assume an ingestion rate of 730 L/yr of water (based on exposure during 365 d/yr). [b]Still being assessed. [c]All other concentration levels are for plutonium radionuclides with a f^1 value of 1×10^{-3}. For uranium radionuclides with a f^1 value of 2×10^{-3}. All other concentration levels are for uranium radionuclides with a f^1 value of 5×10^{-2}. For cobalt radionuclides the f_1 values are 5×10^{-2} and 3×10^{-1} consecutively. For strontium radionuclides the f_1 values are 3×10^{-0} and 1×10^{-2} consecutively.		

TABLE B.3 Potential Action-Specific Requirements

Potential ARAR	Action	Requirement	Preliminary Determination	Remarks
Hazardous Material Transportation Act, as amended (49 USC 1801-1812); Solid Wastes (40 CFR 263), Standards Applicable to Transportation of Hazardous Waste	Transportation	Generic requirements are established for minimizing the environmental impacts of spills or releases of hazardous materials, as are procedures for transporting hazardous waste.	Potentially applicable	These requirements are not part of an environmental law and hence are not subject to evaluation for attainment or waiver as part of the ARAR process. However, they could be pertinent to the proposed action if hazardous waste is transported off-site. In this case, the pertinent requirements (e.g., for spill response) would be addressed during implementation.
Hazardous Materials Regulations; Shippers – General Requirements for Shipments and Packagings (49 CFR 173), Subpart I, Radioactive Materials	Transportation	Low-specific-activity radioactivity materials must be packaged in strong, tight containers to prevent leakage of radioactivity under conditions normally incident to transportation, and the vehicles must be placarded. In exclusive-use vehicles, external radiation levels on packages must be <200 mrem/h, or <1,000 mrem/h if secured in a closed transport vehicle with no intermediate loading or unloading; external radiation levels on the outer surface of the vehicle are limited to <200 mrem/h at any point and <10 mrem/h at 2 m from the surface of the vehicle; and levels in any normally occupied space are limited to <2 mrem/h.	Potentially applicable	These requirements are not part of an environmental law and hence are not subject to evaluation for attainment or waiver as part of the ARAR process. However, they could be pertinent to the proposed action if the waste is transported off-site, because the average concentration of radionuclides in certain waste could meet the criteria for classification as low-specific-activity material.
Noise Control Act, as Amended; Noise Pollution and Abatement Act	Decontamination	The public must be protected from noises (e.g., that could result from remedial action activities) that jeopardize health or welfare.	Potentially applicable	Because equipment and vehicles would be involved in certain aspects of the proposed action, all pertinent requirements of the act would be followed.
Termination of Operating Licenses for Nuclear Reactors (U.S. Nuclear Regulatory Commission Regulatory Guide 1.86)	Decontamination	Structural debris associated with licensed reactors that is released for reuse without radiological restrictions shall be decontaminated to the specified levels.	Potentially relevant and appropriate	These requirements are not applicable because OU3 is not a nuclear reactor licensed by the U.S. Nuclear Regulatory Commission. Furthermore, they have been incorporated into DOE Order 5400.5, with which the proposed action will comply. However, this order does not include the requirements shown here. These requirements may be relevant and appropriate to the release of structural material for reuse without radiological restrictions.
Radiation Protection of the Public and the Environment (DOE Order 5400.5)	Decontamination	Structural debris that is released from DOE facilities for reuse without radiological restrictions shall be decontaminated to specified levels.	To be considered	These requirements may be pertinent if structural debris decontamination is part of a proposed action.

TABLE B.3 Potential Action-Specific Requirements

Potential ARAR	Action	Requirement	Preliminary Determination	Remarks
Occupational Safety and Health Administration Standards for Hazardous Waste Operations and Emergency Response (29 CFR 1910)	Waste management	General worker protection requirements are established, as are requirements for worker training and the development of an emergency response plan and a safety and health program for employees. In addition, procedures are established for hazardous waste operations – including decontamination and drum/container handling (e.g., for radioactive waste, asbestos, and PCBs).	Not an ARAR	The provisions of the OSHA do not apply to working conditions of DOE contractor employees working in government-owned, contractor-operated facilities since DOE exercises statutory authority to prescribe and enforce safety and health standards at its facilities. The DOE exercises this authority pursuant to an agreement between the Secretary of Energy and the Occupational Safety and Health Administration.
Radioactive Waste Management (DOE Order 5820.2A)	Waste management	External exposure to radioactive waste (including releases) should not result in an effective dose equivalent of >25 mrem/yr to any member of the public; releases to the atmosphere are to meet the requirements of 40 CFR 61 (see related discussion above for contaminant-specific requirements); and an environmental monitoring program must be implemented to address compliance with performance standards.	To be considered	Although not promulgated standards, these constitute requirements with which the proposed action will comply.
Radiation Protection of the Public and the Environment (DOE Order 5400.5)	Interim waste storage and management	The control and stabilization features of a storage facility for waste containing uranium, thorium, and their decay products should be designed to ensure an effective life of 50 years, with a minimum life of at least 25 years, to the extent reasonably achievable; site access controls should be designed to ensure an effective life of at least 25 years, to the extent reasonable; and periodic monitoring, shielding, access restrictions, and safety measures must be implemented to control the migration of radioactive material, as appropriate.	To be considered	Although not promulgated standards, these constitute requirements for storage and management of wastes with which this action will comply.
Licensing Requirements for Disposal of Radioactive Waste, 10 CFR 61, Subpart C and D	Radioactive waste disposal	Land disposal facilities must be sited, designed, operated, closed, and controlled after closure so that reasonable assurance exists that exposures to humans are less than an annual dose equivalent of 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ of any member of the public. Also, operations of such facilities must comply with 10 CFR 20 radiation protection standards.	Potentially relevant and appropriate	These regulations are not applicable if the radioactive waste is disposed of at disposal facilities operated by DOE except to the extent DOE is required to obtain a license from the NRC. These regulations may be relevant and appropriate if there will be permanent disposal of radioactive materials.

TABLE B.3 Potential Action-Specific Requirements

Potential ARAR	Action	Requirement	Preliminary Determination	Remarks
Domestic Licensing of Source Material, 10 CFR 40, Appendix A	Radioactive waste disposal	The siting and design of uranium mill tailings disposal sites must meet certain technical criteria including geology, topography, hydrology, and meteorology, and monitoring capability including maximum values for groundwater protection as follows:	Potentially relevant and appropriate	These regulations are not applicable if the radioactive waste is disposed of at disposal facilities operated by DOE except to the extent DOE is required to obtain a license from the NRC. These regulations may be relevant and appropriate if there will be disposal of radioactive materials.
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings (40 CFR 192)	Radioactive waste disposal	Uranium mill tailings shall be disposed of in a manner to ensure effective control for up to 1,000 years to the extent reasonably achievable, and in any case for up to 200 years; controls must provide that radon-222 releases from disposal facilities to the atmosphere will not exceed an annual release rate of 20 $pCi/m^2 \cdot s$ or increase the annual average concentration of radon-222 in air at or above any location outside the disposal site by more than 0.5 pCi/L.	Potentially relevant and appropriate	Fernald is not a mill tailings site, so these requirements are not applicable; however, they may be relevant and appropriate if a disposal facility is part of the proposed action.
Atomic Energy Act, as amended (42 USC 2112)	Radioactive waste disposal	The DOE can distribute by-product material only to individuals or organizations who are licensed by the NRC to receive such material.	Potentially applicable	These requirements may be applicable to the disposal of radioactively contaminated material (which is by-product material) from the Fernald OU3 site at commercial facilities.

Constituent	Concentration
Arsenic	0.05 mg/L
Barium	1.0 mg/L
Cadmium	0.01 mg/L
Chromium	0.05 mg/L
Lead	0.05 mg/L
Mercury	0.002 mg/L
Silver	0.05 mg/L
Combined radium-226 and radium-228	5 pCi/L
Gross alpha-particle activity	15 pCi/L

TABLE B.3 Potential Action-Specific Requirements

Potential ARAR	Action	Requirement	Preliminary Determination	Remarks
Radioactive Waste Management (DOE Order 5820.2A)	Waste disposal	Large quantities of 11e(2) by-product material waste shall be managed according to the requirements of 40 CFR 192 and disposed of at specially designated DOE sites. These disposal sites should be identified and developed as needed to support DOE remedial action and should normally be located in the state in which the wastes are generated. Control and stabilization features for long-term management facilities should provide, to the extent reasonably achievable, an effective life of 1,000 years with a minimum life of at least 200 years. Emanation of radon-222 should be limited to an annual average release rate of 20 $pCi/m^2 \cdot s$, and the annual average concentration of radon-222 outside the site boundary should not be increased by more than 0.5 pCi/L. Potentially biodegradable wastes should be conditioned to limit biogenic gas generation; groundwater should be protected; and access should be controlled, with controls designed to be effective to the extent reasonable for at least 200 years.	To be considered	Although not promulgated standards, these constitute requirements with which the proposed action will comply.
Toxic Substances Control Act, as amended (15 USC 2607-2629; PL 94-469 et seq.); Poly-chlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions (40 CFR 761), Subpart A, General	PCB testing	Inspection and testing are required for material contaminated with PCBs.	Potentially applicable	This requirement may be applicable to characterization of site waste for PCBs.
Toxic Substances Control Act, as amended (15 USC 2607-2629; PL 94-499, et seq.); Poly-chlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions (40 CFR 761), Subpart D, Storage and Disposal	PCB storage	Material contaminated with PCBs >50 ppm must be stored for disposal (within one year) in a facility that is marked for storage and is not located in a 100-year floodplain. The facility should have a roof and walls to prevent rain from reaching the stored PCBs and an impervious floor with 6-inch curbing to provide a double containment volume. Stored articles or containers should be checked monthly for leaks.	Potentially applicable	Storage of articles or containers with PCB concentrations in excess of 50 ppm is expected to be part of the remedial action.
Toxic Substances Control Act, as amended (15 USC 2607-2629; PL 94-499, et seq.); Poly-chlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions (40 CFR 761), Subpart D, Storage and Disposal	PCB incineration	Liquid PCBs should be incinerated in an EPA-approved facility either for 2 seconds at 1200°C with 3% excess oxygen in the stack gas or for 3 seconds at 1600°C with 2% excess oxygen; the combustion efficiency should be 99.9%, and water scrubbers should be used to control hydrochloric acid (HCl). Nonliquid PCBs should be incinerated in an EPA-approved facility with the same combustion efficiency, and mass emissions should not exceed 0.001 g/kg PCB introduced.	Potentially applicable	Should the proposed action include the treatment of material that is contaminated with PCBs, these requirements would be applicable.

TABLE B.3 Potential Action-Specific Requirements

Potential ARAR	Action	Requirement	Preliminary Determination	Remarks
Toxic Substances Control Act, as amended (15 USC 26070-2629; PL 94-499, et seq.); Poly-chlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions (40 CFR 761), Subpart D, Storage and Disposal	PCB disposal	Material contaminated with PCBs >50 ppm must be incinerated or disposed of in a chemical waste landfill. PCB containers for PCBs <500 ppm may be disposed of as municipal solid waste after draining the free liquids; liquids containing <500 ppm PCB can be disposed of in a chemical waste landfill if it is not an ignitable waste. PCB articles with ≥500 ppm PCBs and nonliquid material with >50 ppm PCBs (e.g., contaminated soil, rags, or other debris) should be disposed of by incinerating (or using an alternative treatment) or landfilling. The chemical waste landfill should be located in an area with an in-place soil thickness of 4 ft or compacted thickness of 3 ft and a soil permeability of $\leq 10^{-7}$ cm/s, >30% passing through a No. 200 sieve, a liquid limit >30, and a plasticity index >15; a synthetic liner can be used to achieve an equivalent permeability. The landfill should also contain a leachate collection system, which can be a simple gravity-flow drainfield, a compound system (where a double liner is present), or a suction lysimeter network. The bottom of the landfill should be ≥50 ft above the historical high groundwater table, and the site should not be hydrologically connected to standing or flowing water. Structures should be in place to divert runoff from a 24-hour, 25-year storm. If located below the 100-year floodwater elevation, 2-ft surface water diversion dikes should surround the landfill. The landfill should be located in an area of low to moderate relief to minimize erosion, landslides, and slumping. Surface water and the leachate collection system should be monitored (monthly during operations, then twice a year for surface water), as should groundwater.	Potentially applicable	If such material is disposed of on-site, the requirement may be applicable.

TABLE B.3 Potential Action-Specific Requirements

Potential ARAR	Action	Requirement	Preliminary Determination	Remarks
Toxic Substances Control Act, as amended (15 USC 26070-2629; PL 94-499, et seq.); Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions (40 CFR 761), Subpart G, PCB Spill Cleanup Policy	PCB spill cleanup	For decontamination for spills of less than 270 gal of untested mineral oil, low-concentration PCBs which involves less than 1 lb of PCBs by weight: Solid surfaces: double washed/rinsed; All indoor, residential surfaces: 10 μg/100 cm^2;* Soil: excavated and the ground restored to its original configuration. For decontamination of low-concentration spills involving 1 lb or more PCBs by weight and all spills of materials other than low-concentration materials at an outdoor electrical substation: Contaminated solid surfaces: 100 μg/100 cm^2;* or, at the option of the responsible party: 25 ppm PCBs by weight or 50 ppm PCBs by weight provided that a label or notice is visibly placed in the area. For spills in other restricted access areas: High-contact solid surfaces: 10 μg/100 cm^2;* Low-contact, indoor, impervious solid surfaces: 10 μg/100 cm^2; or, at the option of the responsible party, low-contact, indoor, nonimpervious surfaces: 10 μg/100 cm^2; or 100 μg/100 cm^2 if encapsulated, if EPA approved; Low-contact, outdoor surfaces (both impervious and nonimpervious): 100 μg/100 cm^2; Soil: 25 ppm PCBs by weight. For spills in a nonrestricted access area, or if a previously contaminated restricted access area is to be converted: Indoor solid surfaces and high-contact outdoor solid surfaces:** 10 μg/100 cm^2;* Indoor vault areas and low-contact, outdoor, impervious solid surfaces: 10 μg/100 cm^2;* At the option of the responsible party, low-contact, outdoor, nonimpervious solid surfaces: 10 μg/100 cm^2;* or 100 μg/100 cm^2; if encapsulated, with EPA approval; Soil: 10 ppm PCBs by weight*** Post cleanup sampling is required to verify the level of cleanup.	Potentially applicable	Spills which occurred prior to May 4, 1987, are excluded from the provisions of these regulations. Such old spills are to be decontaminated to requirements established at the discretion of EPA. Generally, new spills will be covered by these regulations; however, more stringent cleanup levels may apply where EPA determines additional cleanup is required.

* Verified by standard wipe tests.
** Defined as high contact residential/commercial surfaces
*** Provided that it is excavated to a minimum depth of 10 in. and replaced by clean soil (less than 1 ppm PCBs).

TABLE B.3 Potential Action-Specific Requirements

Potential ARAR	Action	Requirement	Preliminary Determination	Remarks
Solid Waste Disposal Act, as amended (42 USC 6901, et seq.); Solid Wastes (40 CFR 261), Subpart C, Characteristics of Hazardous Waste; Subpart D, List of Hazardous Wastes; Ohio Hazardous Waste Management Regulations; Ohio Administrative Code 3745-51.	Waste characterization and management	A waste must be evaluated to determine if it is a hazardous waste, i.e., either a waste listed in this requirement or a characteristic waste. A characteristic waste is determined by its (1) ignitability (defined by flash point, oxidizer, and other); (2) corrosivity (defined by pH ≤2 or ≥12.5, rate of steel corrosion, and other); (3) reactivity (defined by instability, violent reaction with water, explosivity, cyanide- or sulfide-bearing nature and vapor generation potential, and other); or (4) leachability, as defined by an established toxic characteristic leaching procedure (TCLP); the following are maximum contaminant concentrations in leachate for this factor.	Potentially applicable	These requirements are applicable to the characterization and management of site waste. Evaluation is complete or underway for existing stored waste inventories.
Solid Waste Disposal Act, as amended (42 USC 6901, et seq.); Solid Wastes (40 CFR 264), Subpart B, General Facility Standards, Subpart C, Preparedness and Prevention; Subpart D, Contingency Plan and Emergency Procedures; Subpart E, Manifest System, Recordkeeping and Reporting; Ohio Hazardous Waste Management Regulations, Ohio Administrative Code 3745-52.	Waste treatment, storage, and disposal	General requirements are established for storage, treatment and disposal facility location, design and inspection, waste compatibility determination, emergency contingency plans, preparedness plans, recordkeeping, reporting and worker training. Location requirements include (1) facilities must not be located within 61 m (200 ft) of a fault in which displacement has occurred in Holocene time (i.e., since the end of the Pleistocene) and (2) facilities located in a 100-year floodplain must be constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood.	Potentially applicable	These requirements would be applicable if the storage, treatment or disposal of hazardous waste on-site will be within the scope of the proposed action, i.e., if RCRA waste is "placed" on-site and capped for the purpose of leaving it in place without remediation.

Contaminant	Concentration (mg/L)
Arsenic	5.0
Barium	100.0
Cadmium	1.0
Chromium	5.0
Lead	5.0
Mercury	0.2
Silver	5.0

TABLE B.3 Potential Action-Specific Requirements

Potential ARAR	Action	Requirement	Preliminary Determination	Remarks
Solid Waste Disposal Act, as amended (42 USC 6901, et seq.); Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (40 CFR 265) Subpart P - Thermal Treatment and Subpart Q - Chemical, Physical, and Biological Treatment; Ohio Hazardous Waste Management Regulations, Ohio Administrative Code 3745-69.	Waste treatment and disposal.	A waste analysis must be performed prior to thermal treatment. Monitoring and inspection of temperature and emission controls must be performed. At closure, all hazardous waste residues must be removed. Chemical, physical or biological treatment must comply with the requirements for ignitable, reactive or incompatible wastes (40 CFR 264.17). A waste analysis must be performed prior to treatment. Inspection of all discharge controls and safety and monitoring equipment must be performed. At closure, all hazardous waste residues must be removed.	Potentially applicable	If thermal, chemical, physical, or biological treatment is part of the proposed action these regulations would be applicable.
Solid Waste Disposal Act, as amended (42 USC 6901, et seq.); Solid Wastes (40 CFR 264), Subpart F, Releases from Solid Waste Management Units; Ohio Hazardous Waste Management Regulations, 3745-55-92.	Waste disposal	A groundwater monitoring system must be maintained for a solid waste management unit such as a surface impoundment, waste pile, land treatment unit, or landfill. An exemption to continued maintenance of this system during the post-closure period of the unit may be appropriate if the unit is an engineered structure; does not receive or contain liquid waste or waste containing free liquid; is designed and operated to exclude liquid, precipitation, and other run-on and runoff; has both an inner and outer containment layer with a leak detection system; is maintained to disallow migration beyond the outer containment layer before the post-closure care period; and monitoring results do not identify a statistically significant increase in hazardous constituents in the upper aquifer during the operational life of the impoundment. Where multiple regulated units are present at a facility, the point of compliance for this monitoring can be taken as the circumscription of all of these units. The concentration of a hazardous constituent in the uppermost aquifer beneath a regulated unit is not to exceed the existing background concentration or the maximum concentration listed in the following table if higher than the background level, or an alternate concentration limit, unless an exemption is granted.	Potentially applicable	These requirements would be applicable to the proposed action if the remedial action results in new on-site disposal sites.

Constituent	Concentration (µg/L)
Metals:	
Arsenic	50
Barium	1,000
Cadmium	10
Chromium	50
Lead	50
Mercury	2
Silver	50

TABLE B.3 Potential Action-Specific Requirements

Potential ARAR	Action	Requirement	Preliminary Determination	Remarks
Solid Waste Disposal Act, as amended (42 USC 6901, et seq.); Solid Wastes (40 CFR 264), Subpart I, Use and Management of Containers; Subpart J, Tank Systems; Subpart K, Surface Impoundments; Subpart L, Waste Piles; Subpart M, Land Treatment; Subpart N, Landfills: Ohio Hazardous Waste Management Regulations, Ohio Administrative Code 3745-55-70, 3745-55-90, 3745-56, 3745-57, 3745-59, 3745-66, 3745-67 and 3745-68.	Waste storage and disposal	Containers used to store hazardous waste must be closed and in good condition. Tank systems must be adequately designed and have sufficient structural strength and compatibility with the wastes to be stored or treated to ensure that it will not collapse, rupture, or fail, including secondary containment. Each new surface impoundment must have two or more liners and a leachate collection system between such liners, and must be designed, constructed, maintained and operated to prevent overtopping, overfilling, wind and wave action, rainfall, run-on, malfunctions of detection equipment and human error. Waste piles must have a liner designed, constructed and installed to prevent any migration of wastes out of the pile into adjacent subsurface soil or groundwater or surface water at any time during its active life. No ignitable or reactive waste may be placed in a waste pile unless it has been treated or is managed in such a way that it's protected from conditions which may cause it to ignite or react. Land treatment facilities must be designed to ensure that the hazardous constituents to be placed therein can be degraded, transformed or immobilized within the treatment zone, and must have an unsaturated zone monitoring system that includes soil monitoring using soil cores and soil pore liquid monitoring devices such as lysimeters. Each new landfill must have two or more liners and a leachate collection system above and between the liners, to protect human health and the environment. The landfill must be designed, constructed, operated and maintained to prevent run-off, run-on, and wind dispersal of particulate matter. Placement of liquid waste or waste containing free liquids in a landfill is prohibited.	Potentially applicable	These requirements may be applicable to the proposed action, if there will be on-site storage or disposal of site waste that meets the prerequisites for definition as hazardous waste are a part of the proposed action.
Solid Waste Disposal Act, as amended (42 USC 6901, et seq.); Land Disposal Restrictions (40 CFR 268), Subpart C, Prohibition on Land Disposal; Obtaining a Soil and Debris Treatability Variance for Remedial Actions, Superfund LDR Guide #6A, OSWER 9347.3-06FS; Ohio Hazardous Waste Management Regulations; Ohio Administrative Code, 3745-59.	Waste disposal	The land disposal of certain hazardous waste (e.g., contaminated soil and debris) without proper treatment is restricted, unless a treatability variance is appropriate. Such treatment must attain levels achievable by the best demonstrated available technologies (BDAT) for each hazardous constituent in the listed waste. For most types of debris (e.g., concrete, steel pipes), which generally cannot be treated, site manager should use best management practices, including decontamination or destruction. Once it is determined that the debris must comply with LDR (i.e., placement will occur), site managers must request a variance, setting forth the specific treatment level range to be achieved (see, Highlight 2, LDR Guide #6A).	Potentially applicable	These requirements would be applicable to the proposed action if permanent, permitted disposal sites are a part of the proposed remedial action. These requirements would be applicable if there will be land disposal of contaminated soil or debris or the consolidation of site wastes into a disposal or storage area which would trigger RCRA land disposal requirements.

TABLE B.3 Potential Action-Specific Requirements

Potential ARAR	Action	Requirement	Preliminary Determination	Remarks
Solid Waste Disposal Act, as amended (42 USC 6901, et seq.); Standards for Hazardous Waste Generators (40 CFR 262) and Standards for Hazardous Waste Transporters (40 CFR 263); Ohio Solid Waste Management Regulations, Ohio Administrative Code 3745-52 and 53.	Waste generation and transportation	General requirements for packaging, labeling, and marking hazardous wastes for temporary storage and transportation.	Potentially applicable	These requirements would be applicable to the proposed remedial action if any site waste meets the prerequisites for definition as characteristic or listed hazardous waste.
Solid Waste Disposal Act, as amended (42 USC 6901, et seq.); Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities (40 CFR 264), Subpart G, Closure and Post-Closure; Ohio Hazardous Waste Management Regulations, Ohio Administrative Code 3745-55.	Waste disposal	These regulations set forth general requirements for closure of hazardous waste disposal facilities, waste piles, surface impoundments, and tank systems.	Potentially applicable	These requirements would be applicable should hazardous waste disposal facilities, waste piles, surface impoundments, and tank systems be closed as a part of the proposed action.
Ohio Administrative Code, Chapter 119; Rule 1301:7-7 Article 39: Corrective Actions and Cost Recovery Standards for Petroleum Underground Storage Tank Releases.	Removal of underground storage tanks	When there is evidence of the presence of free product, the owner must remove free floating product to the maximum extent practicable while continuing corrective action steps, including conducting investigations to determine the full extent and location of any contamination.	Potentially applicable	These regulations would be applicable if contamination remained after removal of underground storage tanks.

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TABLE B.3 Potential Action-Specific Requirements

Potential ARAR	Action	Requirement	Preliminary Determination	Remarks
Criteria for Classification of Solid Waste Disposal Facilities and Practices, 40 CFR 257; Solid Waste Disposal Facilities, Ohio Administrative Code, 3745-27.	Solid waste disposal	Solid wastes shall be disposed of by sanitary landfill, incineration, or composting. No open dumping shall be allowed. The Ohio Environmental Protection Agency must approve all plans and specifications. Plans shall not be approved for siting a sanitary landfill in a regulatory floodplain outside of a floodway, in a sand or gravel pit, in a limestone or sandstone quarry, within 1,000 ft of a water well, within 200 ft of a stream or lake, so that the seasonal high ground water table and the lowest level of waste materials will be separated by less than 5 ft of soil or low permeability; in an area surrounding a public water supply well, above a designated sole source aquifer, or so that the seasonal high ground water table will be less than 5 ft below the surface of the site. Operation of the site shall prevent erosion and dust, scavenging and salvaging, litter, noise, odors, insects, rodents and other vectors. No sewage solids, semisolids or liquids, other semisolids or liquids or hazardous waste shall be accepted. All wastes will be covered within 24 hours. Monitoring wells shall be installed to measure any effect upon the quality of the ground water. Within 60 days of closure, the landfill shall be covered and seeded, land surface shall be graded, gas migration shall be controlled by ventilation. Monitoring wells shall be maintained for three years and leachate shall be inspected for at least three years.	Potentially applicable	These regulations would be applicable if the proposed action includes siting a new solid waste facility.

APPENDIX C

SITE MAPS

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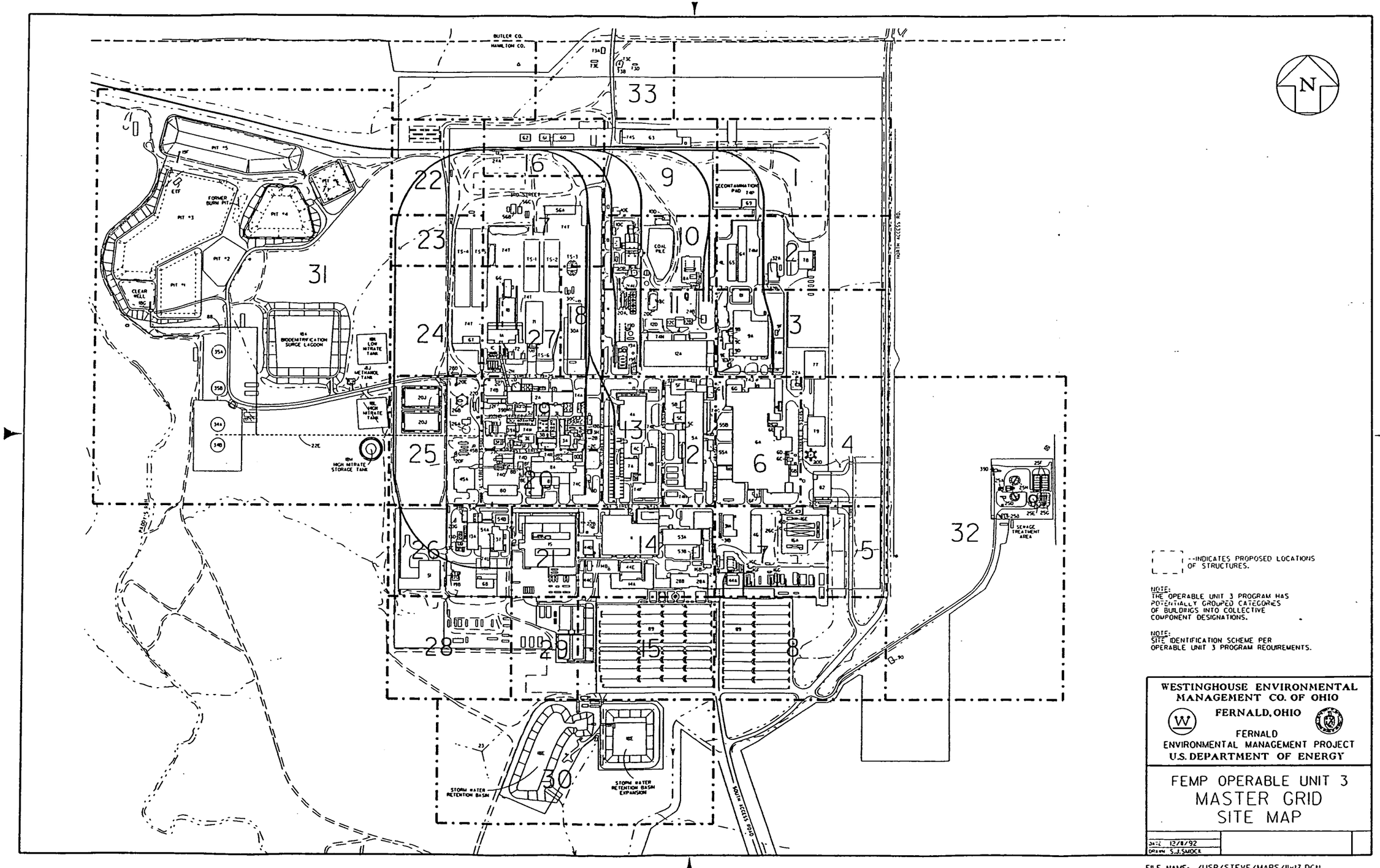
TABLE C.1 Operable Unit 3 Component Identification

Component	Component Designation	Grid	Component	Component Designation	Grid
Preparation Plant	1 A	27	Electrical Panels & Transformer	16 C	7
Plant 1 Storage Shelter	1 B	27	Main Electrical Switch House	16 D	7
Plant 1 Ore Silos	1 C	27	Main Electrical Transformers	16 E	7
Ore Refinery Plant	2 A	19	Trailer Substation #1	16 F	7
General/Refinery Sump Control Building	2 B	19	Trailer Substation #2	16 G	7
Bulk Lime Handling Building	2 C	19	BDN Surge Lagoon	18 A	31
Metal Dissolver Building	2 D	19	General Sump	18 B	19
NFS Storage & Pump House	2 E	27	Coal Pile Runoff Basin	18 C	11
Cold Side Ore Conveyor	2 F	19	Biodenitrification Towers	18 D	19
Hot Side Ore Conveyor	2 G	19	Storm Water Retention Basin	18 E	30
Conveyor Tunnel (From Plant 1)	2 H	19	Clearwell Pump House	18 G	31
Maintenance Building	3 A	19	BDN Effluent Treatment Facility	18 H	20
Ozone Building	3 B	19	Methanol Tank	18 J	31
NAR Control House	3 C	19	Low Nitrate Tank	18 K	31
NAR Towers	3 D	19	High Nitrate Tank	18 L	31
Hot Raffinate Building	3 E	19	High Nitrate Storage Tank	18 M	31
Harshaw Digestion Fume Recovery	3 F	19	Main Tank Farm	19 A	11
Refrigeration Building	3 G	19	Pilot Plant Ammonia Tank Farm	19 B	26
Refinery Sump	3 H	19	Tank Farm Control House	19 C	11
Combined Raffinate Tanks	3 J	19	Old North Tank Farm	19 D	11
Old Cooling Water Tower	3 K	19	Pump Station & Power Center	20 A	11
Electrical Power Center Building	3 L	19	Water Plant	20 B	10
Green Salt Plant	4 A	13	Cooling Towers	20 C	11
Plant 4 Warehouse	4 B	13	Elevated Potable Storage Tank	20 D	4
Plant 4 Maintenance Building	4 C	13	Well House #1	20 E	25
Metals Production Plant	5 A	12	Well House #2	20 F	25
Plant 5 Ingot Pickling	5 B	12	Well House #3	20 G	26
Plant 5 Electrical Substation	5 C	12	Process Water Storage Tank	20 H	10
West Derby Breakout/ Slag Milling	5 D	12	Gas Meter Building	22 A	6
Plant 5 Filter Building	5 E	12	Storm Sewer Lift Station	22 B	14
Plant 5 Covered Storage Pad	5 F	12	Truck Scale	22 C	4
Plant 5 Ingot Storage Shelter	5 G	12	Scale House & Weigh Scale	22 D	25
Metals Fabrication Plant	6 A	6	Utility Trench to Pit Area	22 E	25/31
Plant 6 Covered Storage Area	6 B	6	Meteorological Tower	23	30
Plant 6 Electrostatic Precipitator (South)	6 C	6	Railroad Scale House	24 A	16
Plant 6 Electrostatic Precipitator (Central)	6 D	6	Railroad Engine House	24 B	11
Plant 6 Electrostatic Precipitator (North)	6 E	6	Chlorination Building	25 A	32
Plant 6 Salt Oil Heat Treat Building	6 F	6	M.H.#175/Eff. Line/Sampling Bldg.	25 B	32
Plant 6 Sump Building	6 G	6	Sewage Lift Station Building	25 C	7
Plant 7	7 A	13	U.V. Disinfection Building	25 D	32
Plant 7 Overhead Crane	7 B	13	Digester & Control Building	25 E	32
Recovery Plant	8 A	20	Sludge Drying Beds	25 F	32
Plant 8 Maintenance Building	8 B	20	Primary Settling Basins	25 G	32
Rotary Kiln/Drum Reconditioning	8 C	20	Trickling Filters	25 H	32
Plant 8 Railroad Filter Building	8 D	20	Pump House-HP Fire Protection	26 A	25
Drum Conveyor Shelter	8 E	20	Elevated Water Storage Tank	26 B	25
Plant 8 Old Drum Washer	8 F	20	Main Electrical Strainer House	26 C	7
Special Products Plant	9 A	3	Security Building	28 A	14
Plant 9 Sump Treatment Facility	9 B	3	Human Resources Building	28 B	14
Plant 9 Dust Collector	9 C	3	Guard Post on South End of 'D' St.	28 C	7
Plant 9 Substation	9 D	3	Guard Post on West End of 2nd St.	28 D	24
Plant 9 Cylinder Shed	9 E	3	Chemical Warehouse	30 A	18
Electrostatic Precipitator	9 F	3	Drum Storage Warehouse	30 B	27
Boiler Plant	10 A	10	Old Ten Ton Scale	30 C	18
Boiler Plant Maintenance Bldg.	10 B	10	Engine House/Garage	31 A	7
Wet Salt Storage Bin	10 C	10	Old Truck Scale	31 B	7
Cont. Oil/Graphite Burn Pad	10 D	10	Magnesium Storage Building	32 A	2
Service Building	11	14	Building 32 Covered Loading Dock	32 B	2
Main Maintenance Building	12 A	11	Pilot Plant Annex	37	26
Cylinder Storage Building	12 B	11	Propane Storage	38 A	10
Lumber Storage Building	12 C	11	Cylinder Filling Station	38 B	10
Pilot Plant Wet Side	13 A	26	Incinerator Building	39 A	19
Pilot Plant Maintenance Bldg.	13 B	26	Waste Oil Decant Shelter	39 B	19
Sump Pump House	13 C	26	Incinerator Sprinkler Riser House	39 C	19
Pilot Plant Thorium Tank Farm	13 D	26	Sewage Treatment Plant Incinerator	39 D	32
Administration Building	14 A	14	Rust Engineering Building	45 A	25
Building 14 EOC Generator Set	14 B	14	Utility Shed East of Rust Trailers	45 B	25
Laboratory	15	21	Heavy Equipment Building	46	7
Main Electrical Station	16 A	7	Six to Four Reduction Facility #2	51	26
Electrical Substation	16 B	14	Health & Safety Building	53 A	14

TABLE C.1 Operable Unit 3 Component Identification

Component	Component Designation	Grid	Component	Component Designation	Grid
In-Vivo Building	53 B	14	Decontamination Pad	74 P	1
Six to Four Reduction Facility #1	54 A	26	Plant 8 Old Metal Dissolver Pad	74 Q	20
Pilot Plant Shelter	54 B	26	Plant 8 North Pad	74 R	20
Pilot Plant Dissociator Shelter	54 C	26	Building 63 West Pad	74 S	9
Slag Recycling Building	55 A	12	Plant 1 Storage Pad	74 T	27
Slag Recycling Pit/Elevator	55 B	12	Pilot Plant Pad	74 U	26
CP Storage Warehouse	56 A	17	Laboratory Pad	74 V	21
Storage Shed (West)	56 B	17	Building 39A Pad	74 W	19
Storage Shed (East)	56 C	17	Finished Products Warehouse(4A)	77	3
Quonset Hut #1	60	16	D & D Building(Under Constr.)	78	2
Quonset Hut #2	61	16	Plant 6 Warehouse	79	4
Quonset Hut #3	62	16	Plant 8 Warehouse	80	20
KC-2 Warehouse	63	9	Plant 9 Warehouse	81	3
Thorium Warehouse	64	2	Receiving/Incoming Mat'ls. Insp.	82	4
(Old) Plant 5 Warehouse	65	2	Clearwell Line	88	31
Drum Reconditioning Building	66	27	Parking Lot	89	15,8
Plant 1 Thorium Warehouse	67	24	Skeet Range Building	90	8
Pilot Plant Warehouse	68	26	Railroad Tracks	G-001	NA
Decontamination Building	69	1	Roads	G-002	NA
General In-Process Warehouse	71	27	Storm Sewer System	G-003	NA
Drum Storage Building	72	27	Utility Lines	G-004	NA
Fire Brigade Training Center Bldg.	73 A	33	Underground Storage Tanks	G-005	NA
Fire Training Pond	73 B	33	Process Trailers	G-006	NA
Fire Training Tank	73 C	33	Non-process Trailers	G-007	NA
Fire Training Burn Trough	73 D	33	Pipe Bridges	G-008	NA
Confined Space Burn Tank	73 E	33	Drums (Non-RCRA)	G-009	NA
Plant 2 East Pad	74 A	19	RCRA Drums	G-010	NA
Plant 2 West Pad	74 B	19	Inventory	G-011	NA
Plant 8 East Pad	74 C	20	Mobile Containers (Sea-Land)	G-012	NA
Plant 8 West Pad	74 D	20	Soil Piles	G-013	NA
Plant 4 Pad	74 E	13	Rock salt pile	P-001	16
Plant 7 Pad	74 F	13	Sand piles	P-002	16
Plant 5 East Pad	74 G	12	Gravel pile	P-003	17
Plant 5 South Pad	74 H	12	Copper metal scrap pile	P-004	17
Plant 6 Pads	74 J	6	Coal pile	P-005	10
Plant 9 Pad	74 K	3	Scrap metal pile	P-006	1
Building 65 West Pad	74 L	2	Outside Equipment Storage Area	P-007	9
Building 64 East Pad & R.R. Dock	74 M	2	Tension Support Structure #1	TS-001	17
Building 12 North Pad	74 N	11	Tension Support Structure #2	TS-002	17
			Tension Support Structure #3	TS-003	17



--INDICATES PROPOSED LOCATIONS OF STRUCTURES.

NOTE:
THE OPERABLE UNIT 3 PROGRAM HAS POTENTIALLY GROUPED CATEGORIES OF BUILDINGS INTO COLLECTIVE COMPONENT DESIGNATIONS.

NOTE:
SITE IDENTIFICATION SCHEME PER OPERABLE UNIT 3 PROGRAM REQUIREMENTS.

WESTINGHOUSE ENVIRONMENTAL MANAGEMENT CO. OF OHIO
FERNALD, OHIO
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
U.S. DEPARTMENT OF ENERGY

FEMP OPERABLE UNIT 3
MASTER GRID
SITE MAP

DATE 12/8/92
DRAWN S.J.SMOCK

FILE NAME: /USR/STEVE/MAPS/11x17.DGN

FIGURE C.1 Master Site Grid Map

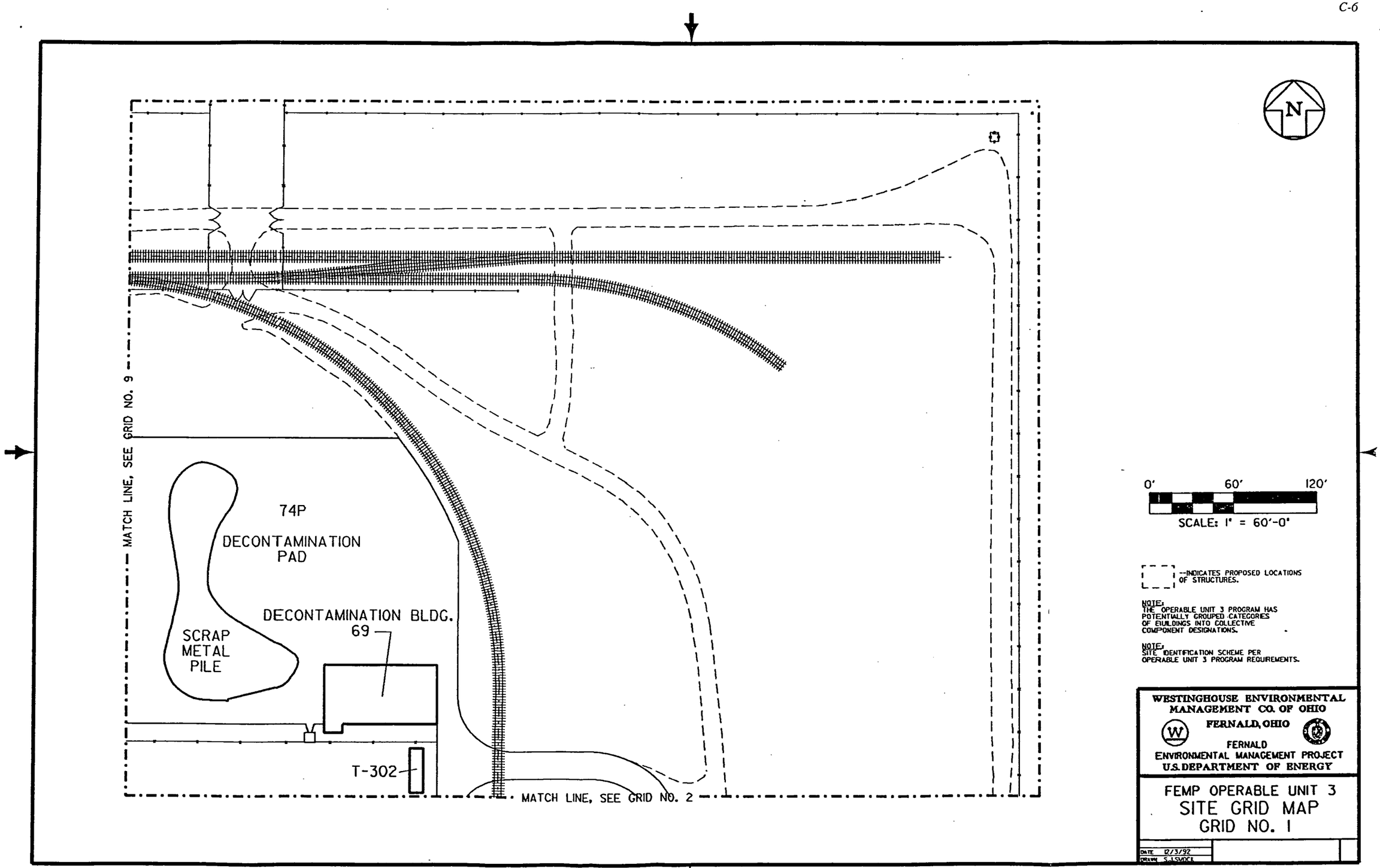
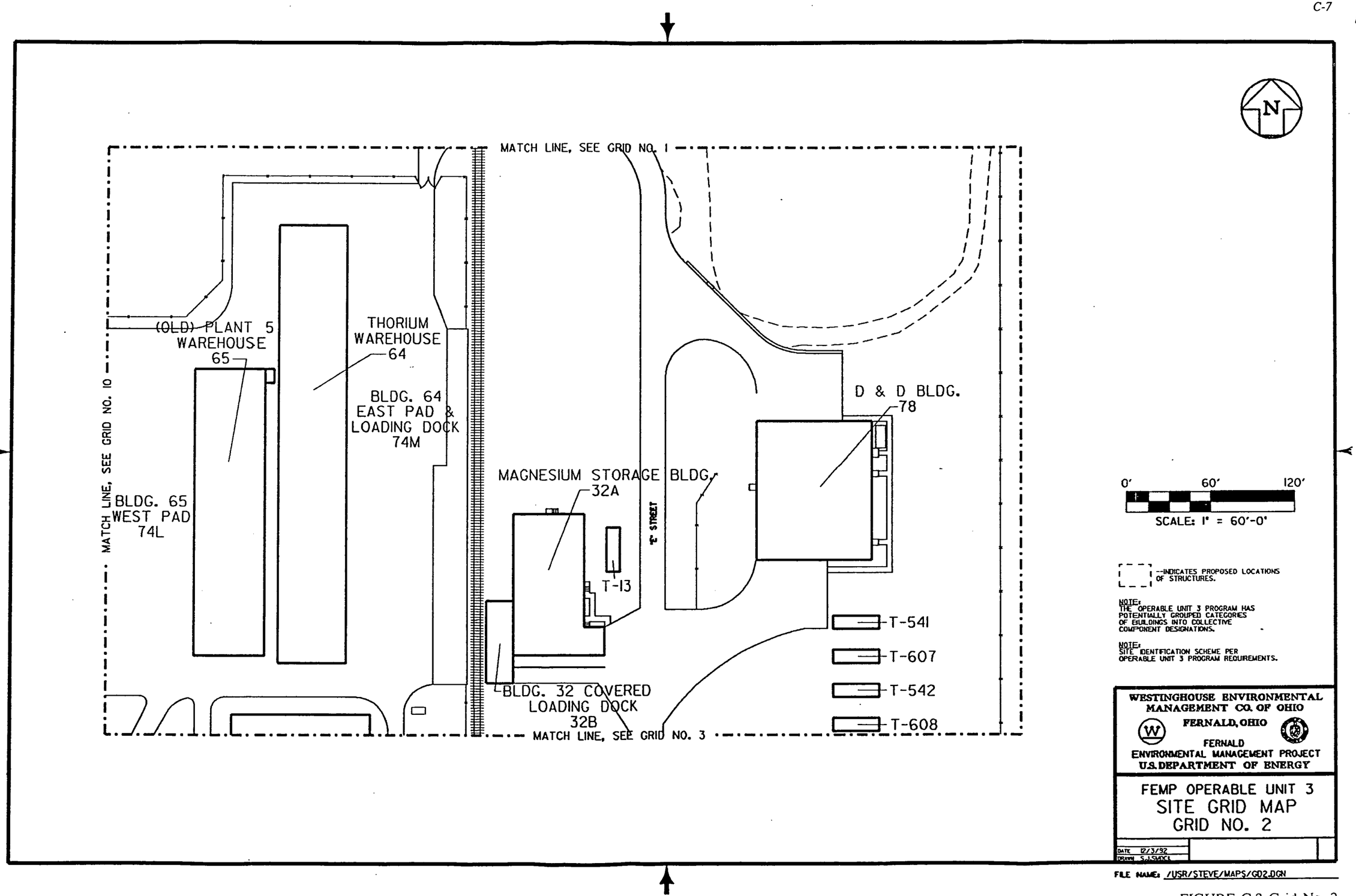


FIGURE C.2 Grid No. 1



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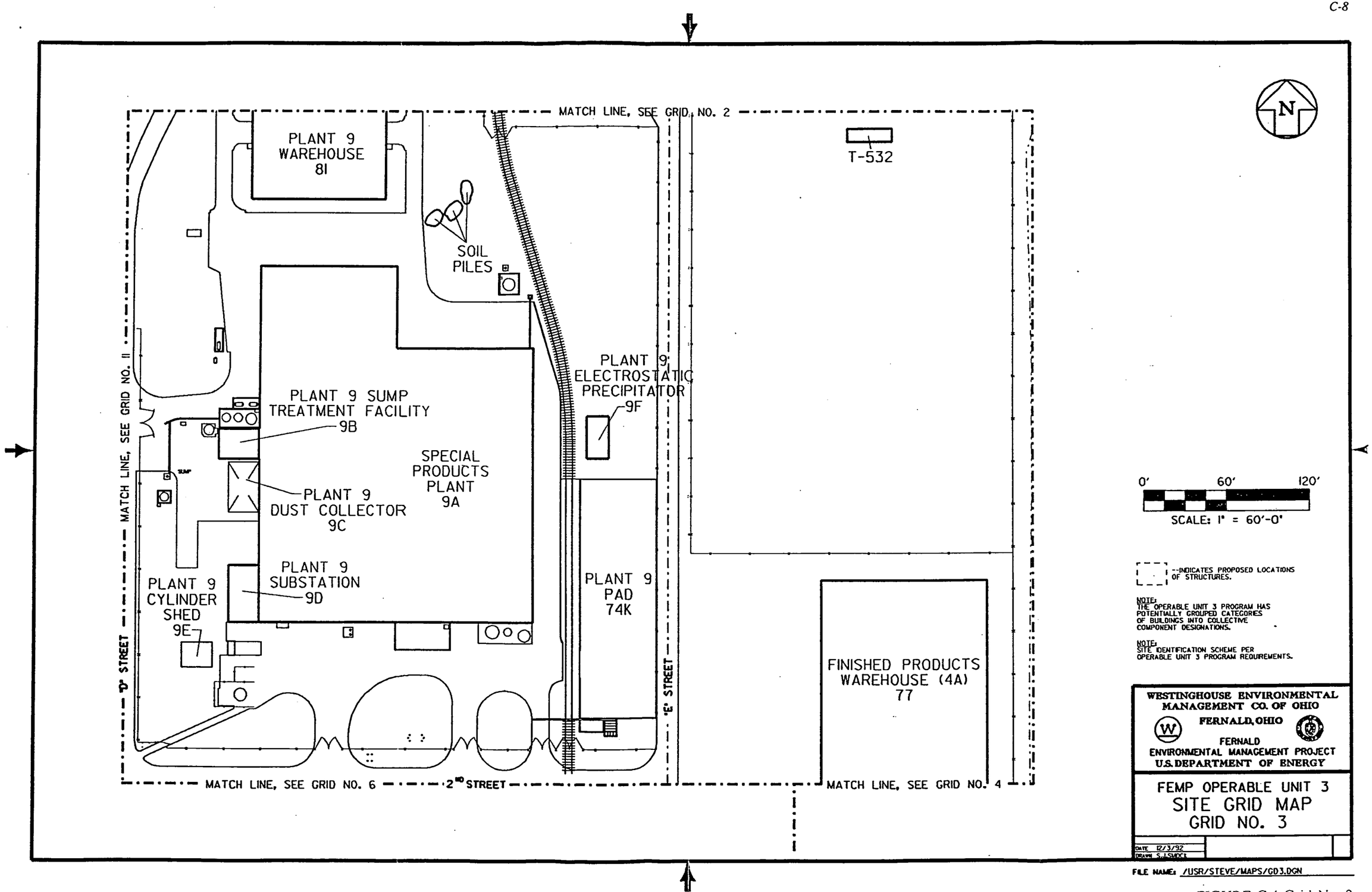

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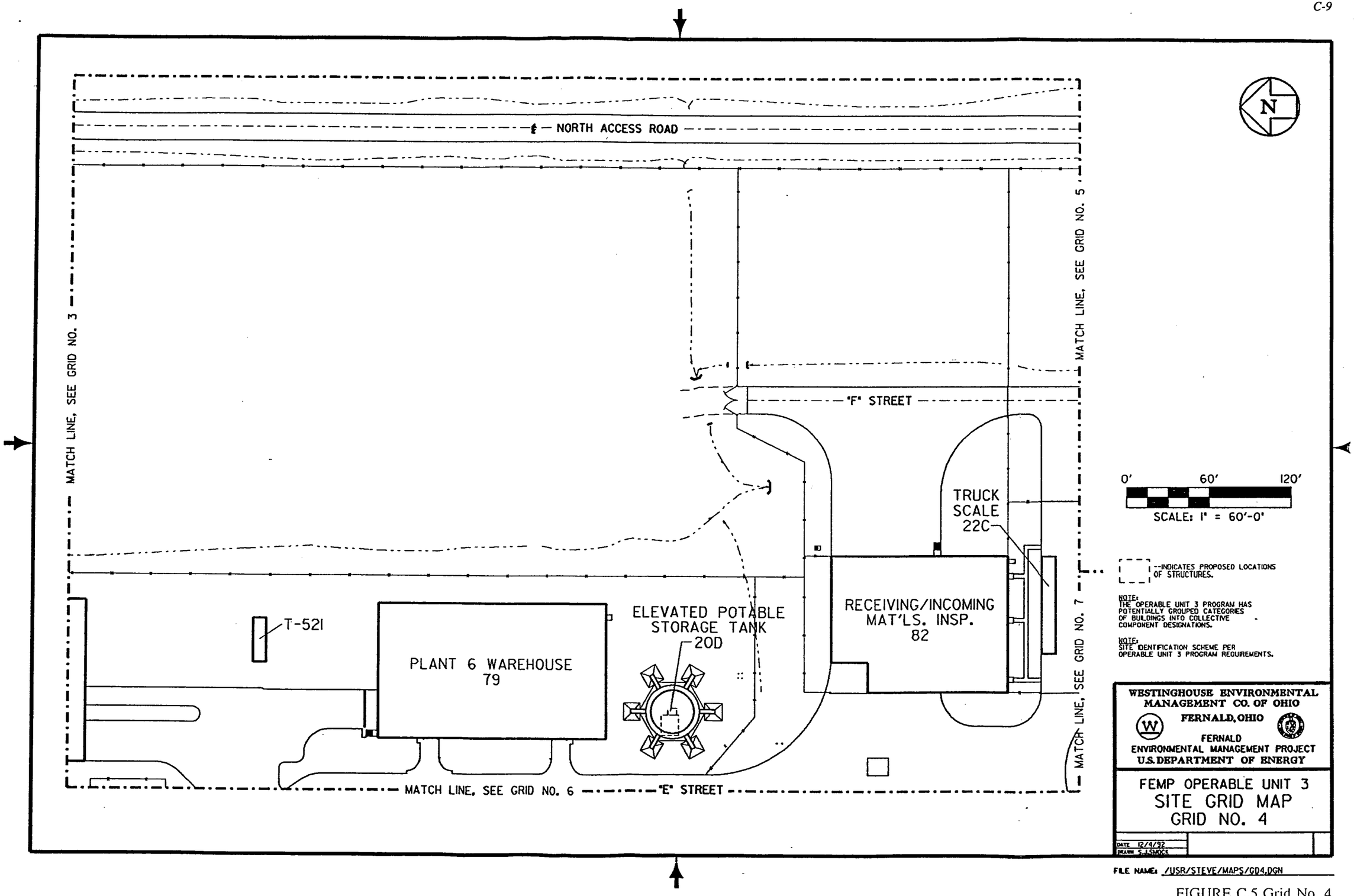

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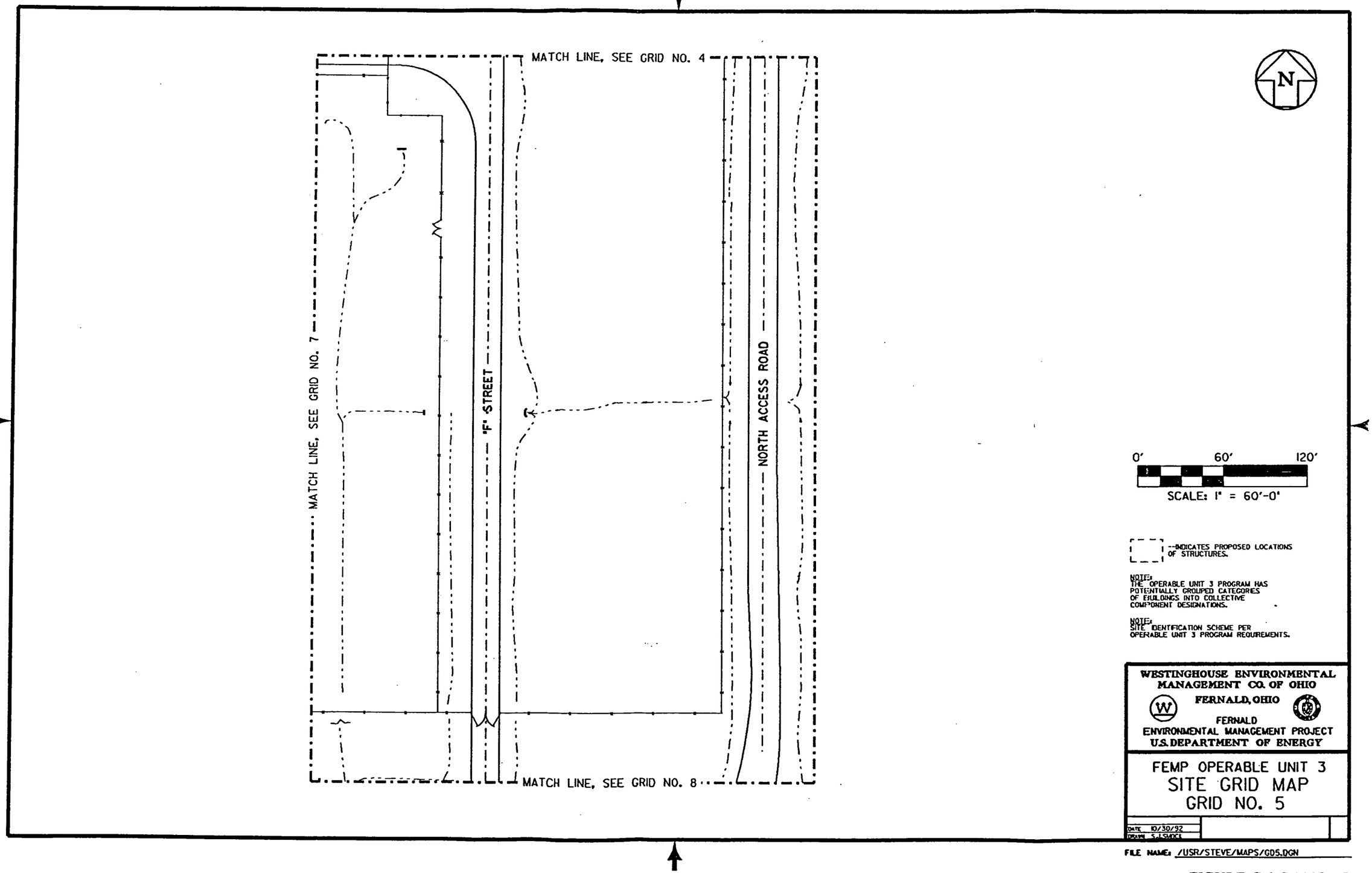

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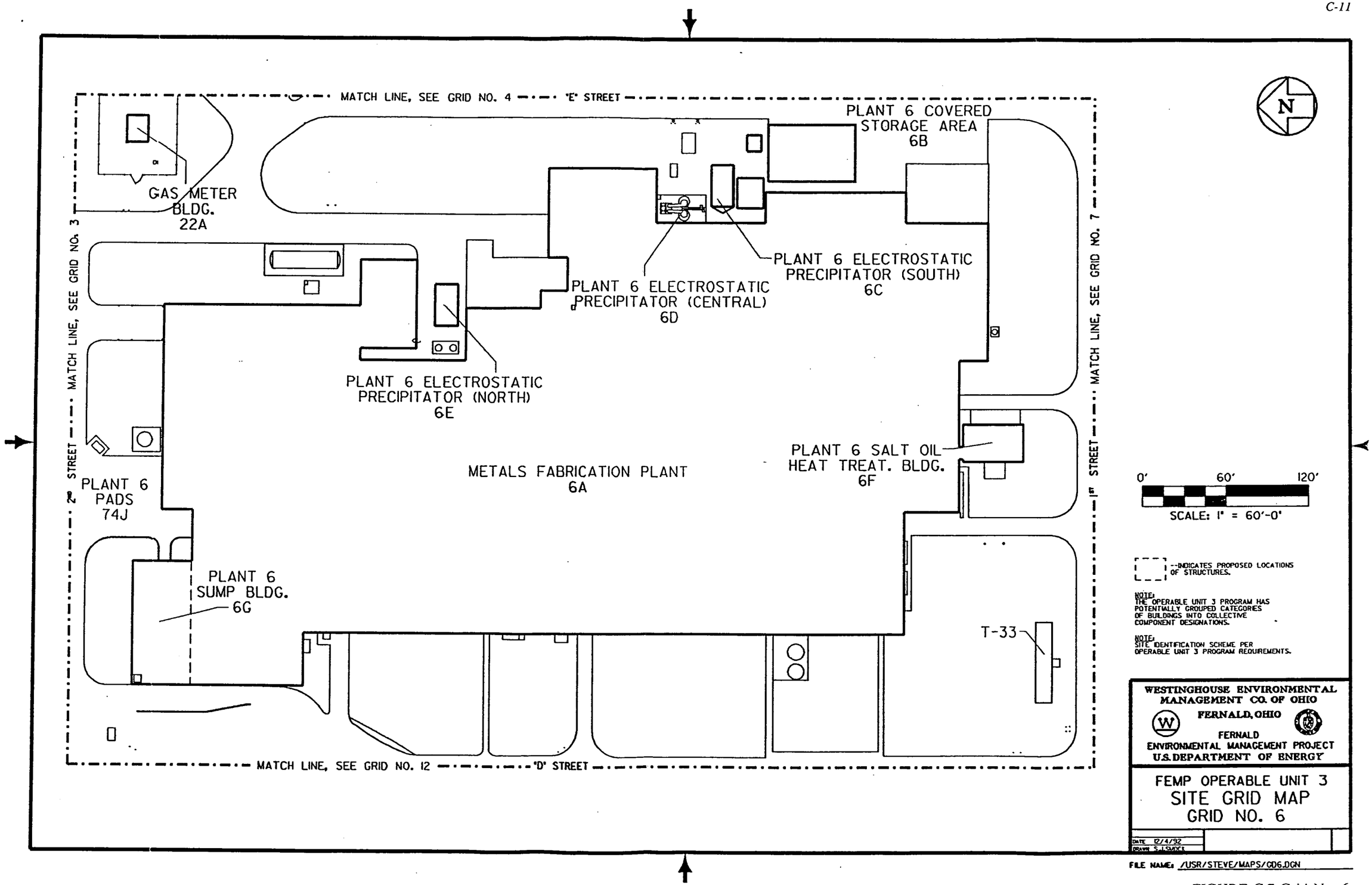

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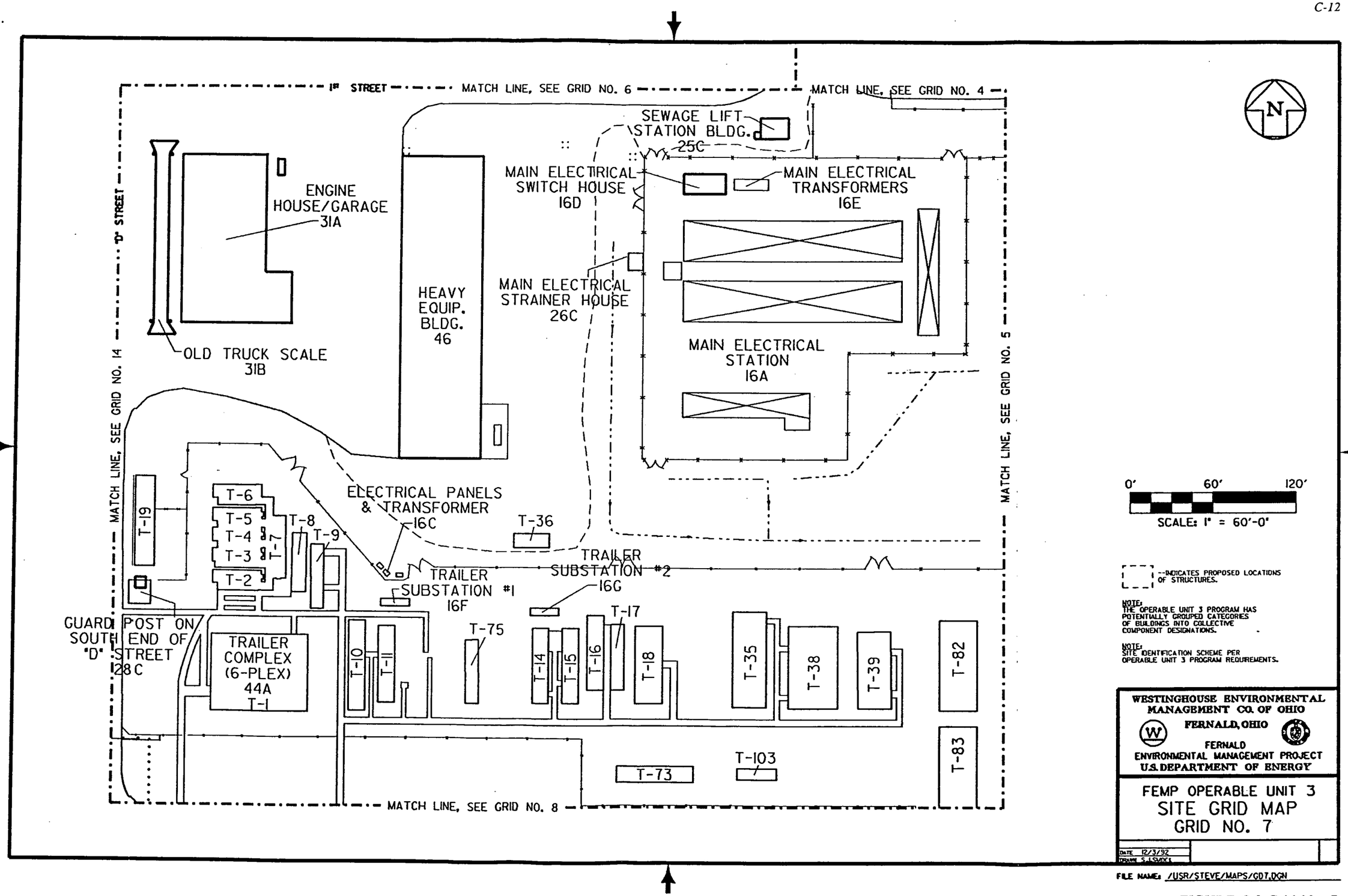


FIGURE C.8 Grid No. 7

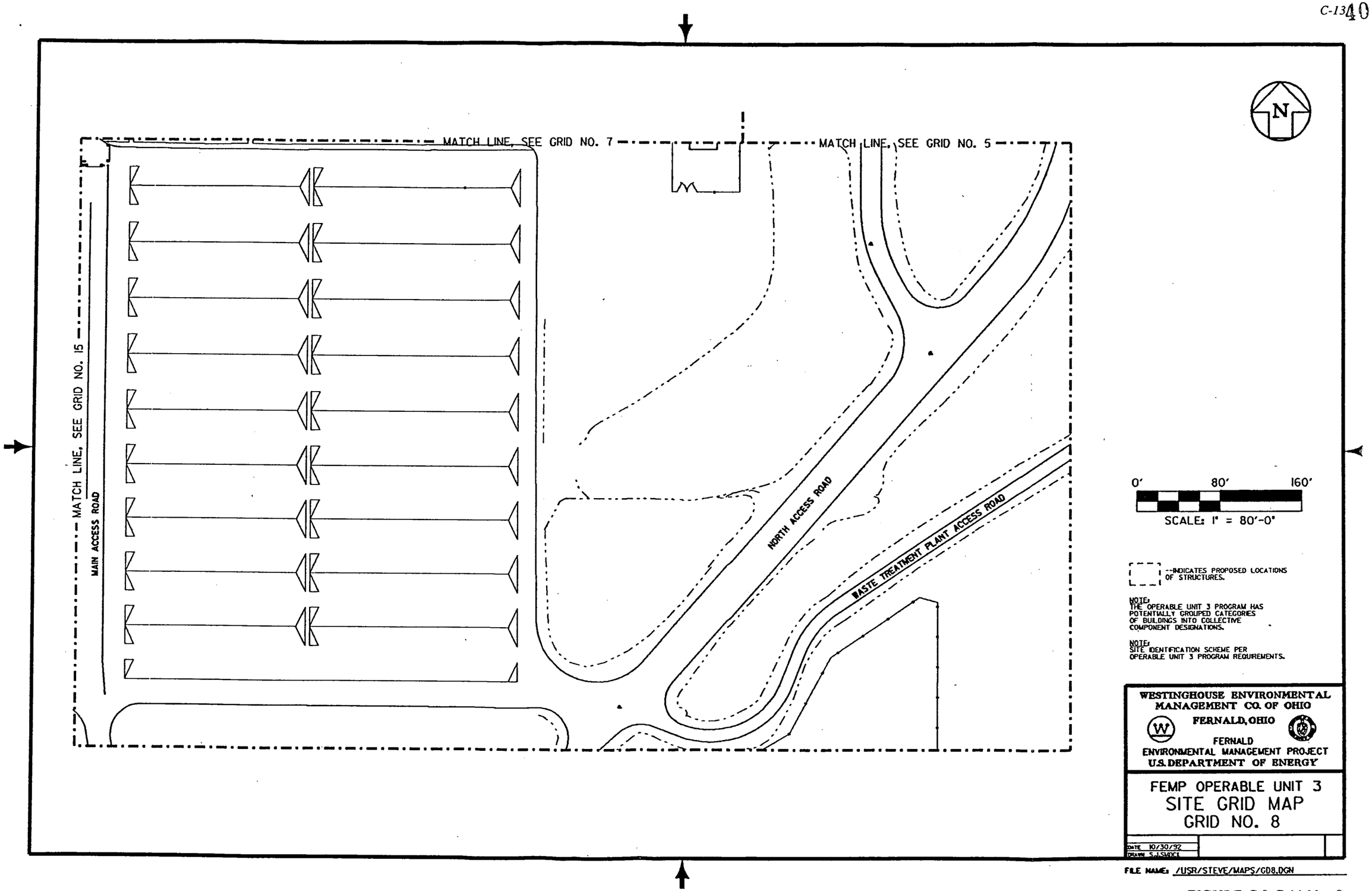
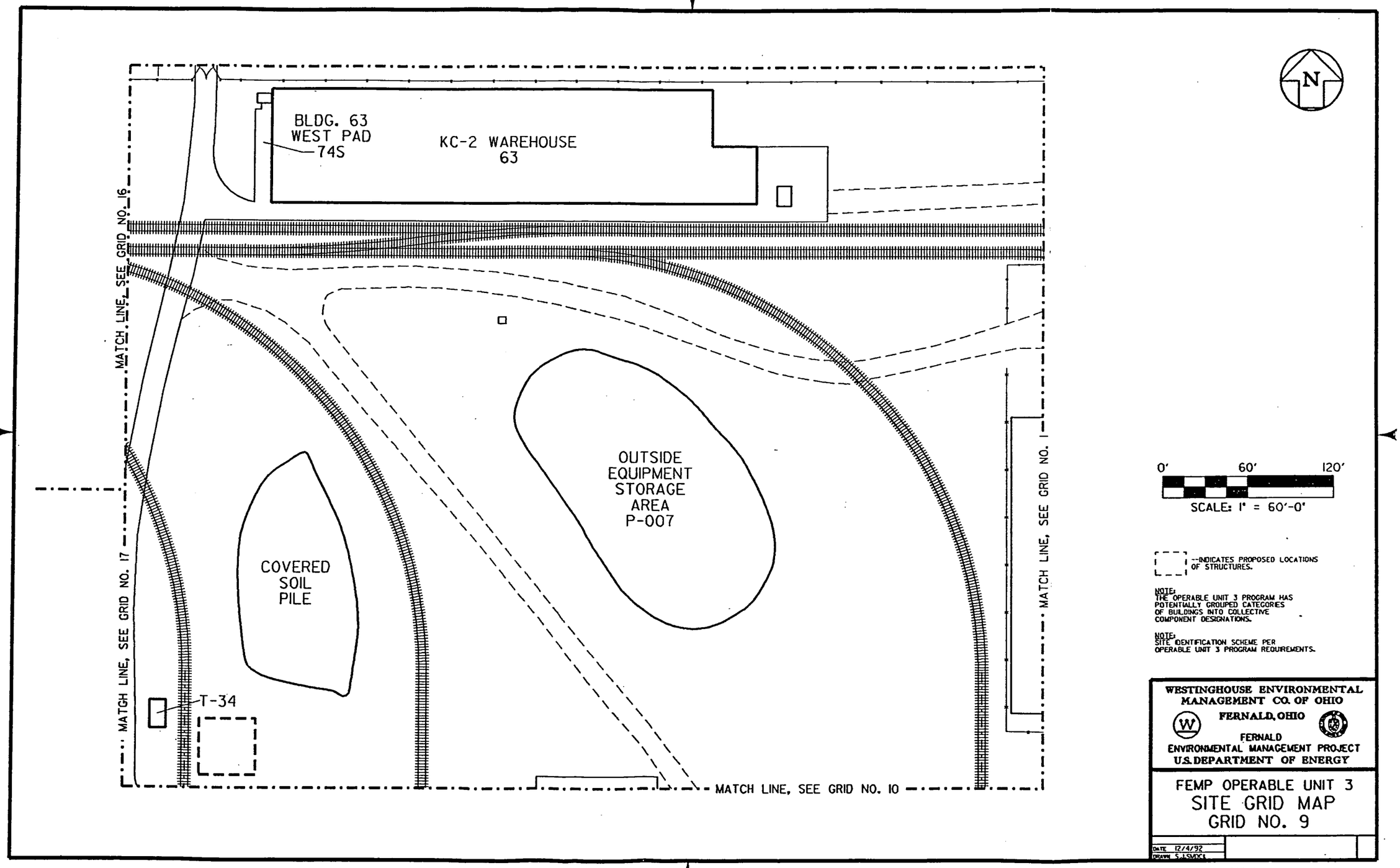


FIGURE C.9 Grid No. 8



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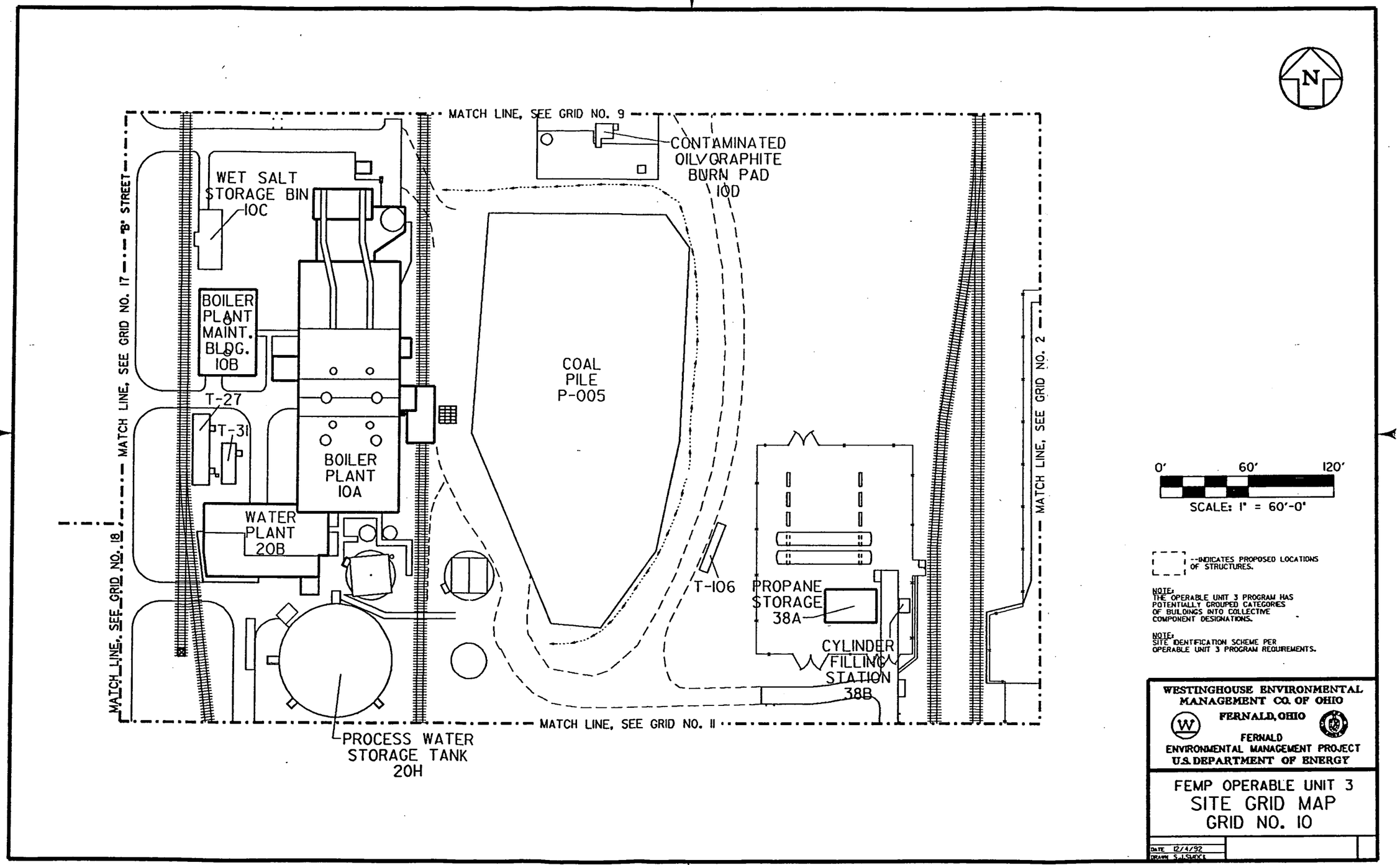
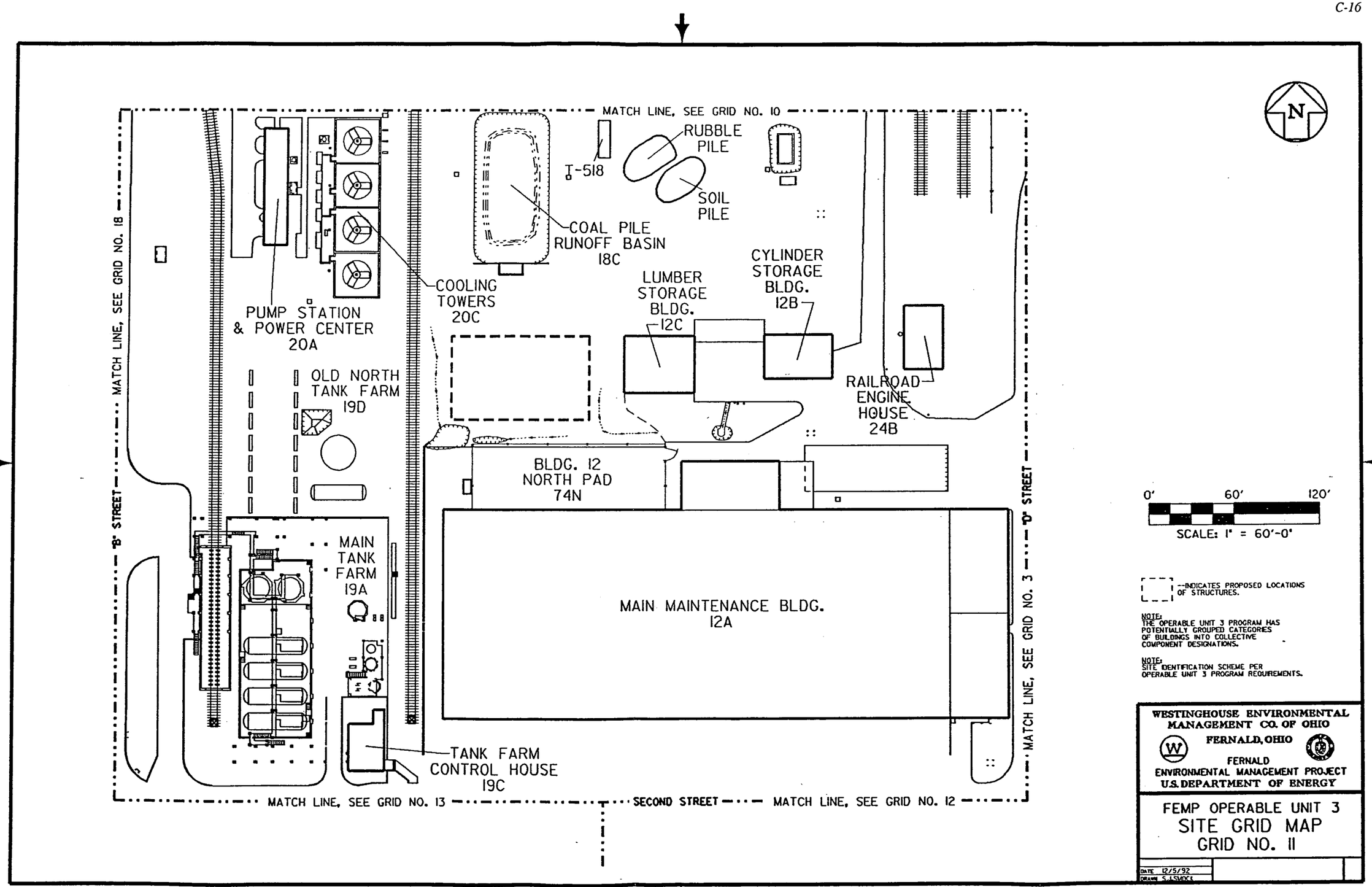


FIGURE C.11 Grid No. 10



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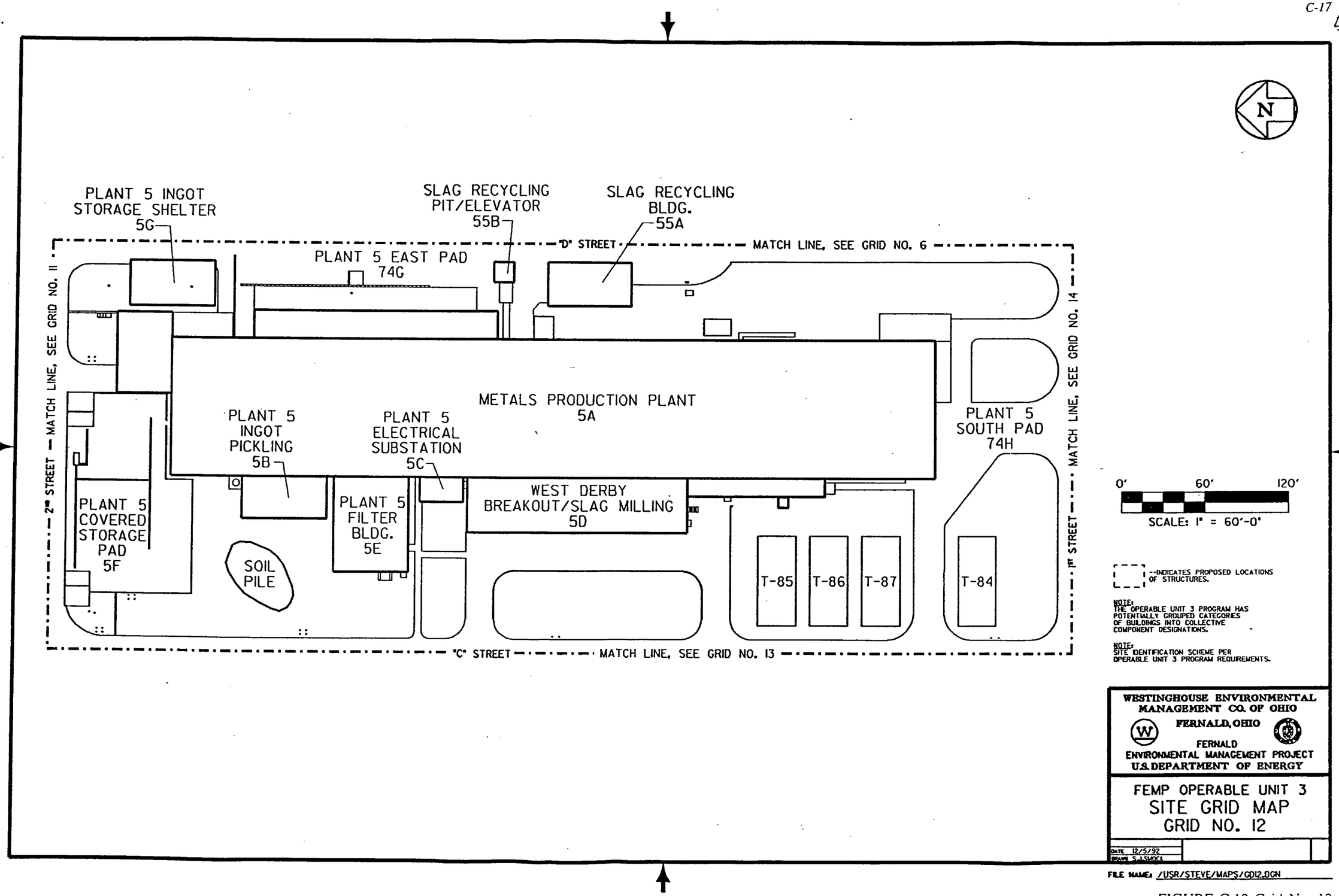

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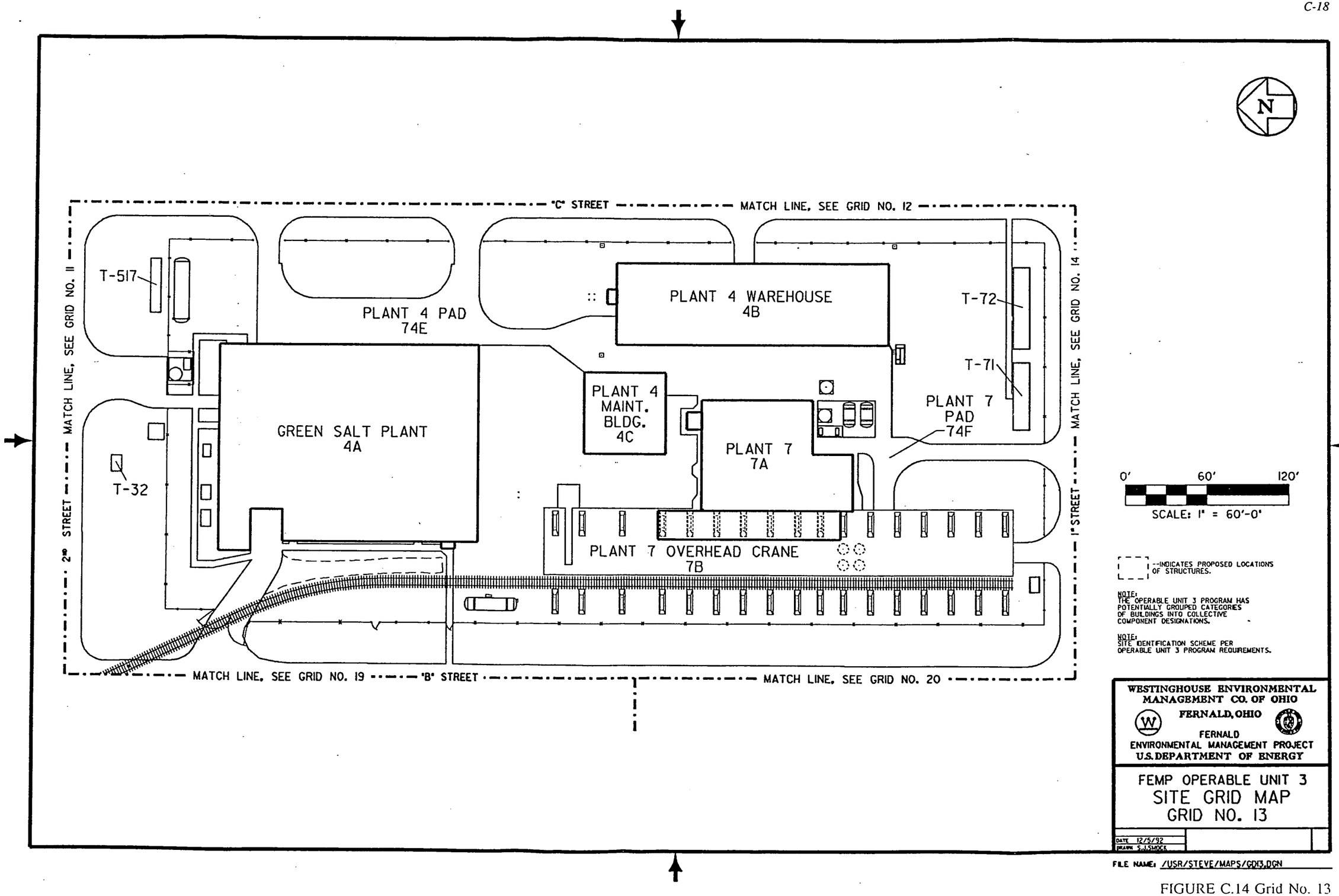

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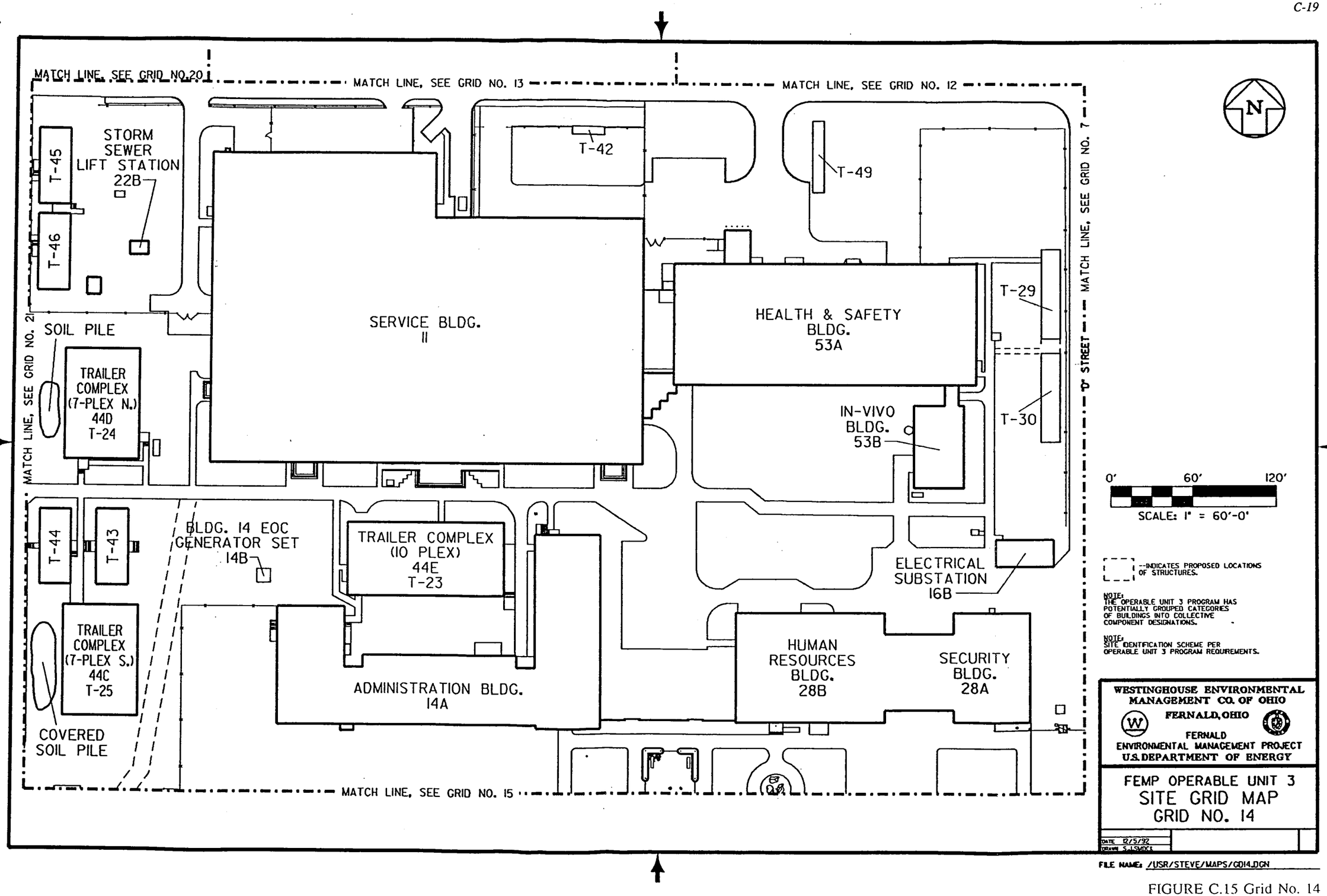
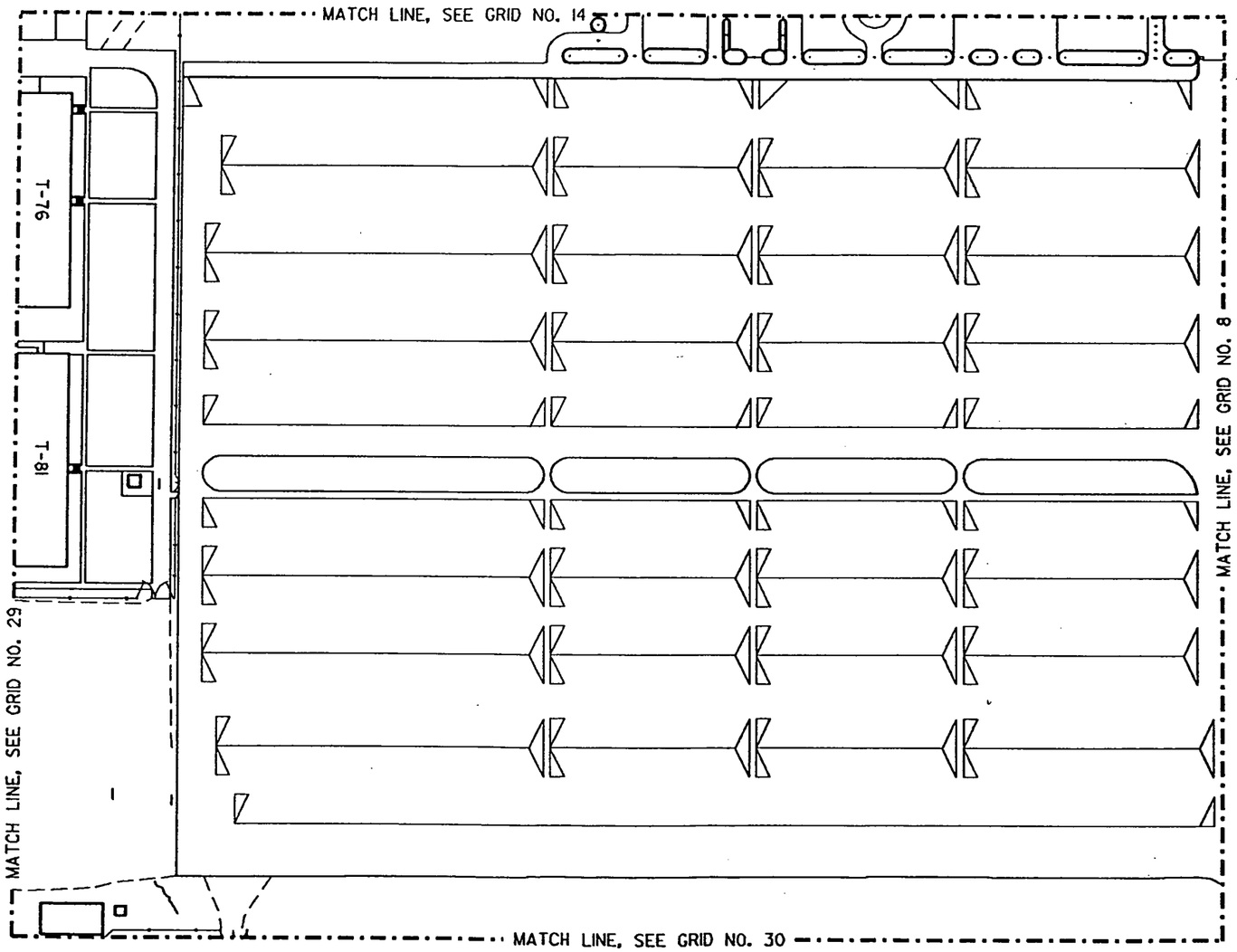


FIGURE C.15 Grid No. 14

4002



N

0' 80' 160'

SCALE: 1" = 80'-0"

--INDICATES PROPOSED LOCATIONS OF STRUCTURES.

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SITE IDENTIFICATION SCHEME PER OPERABLE UNIT 3 PROGRAM REQUIREMENTS.

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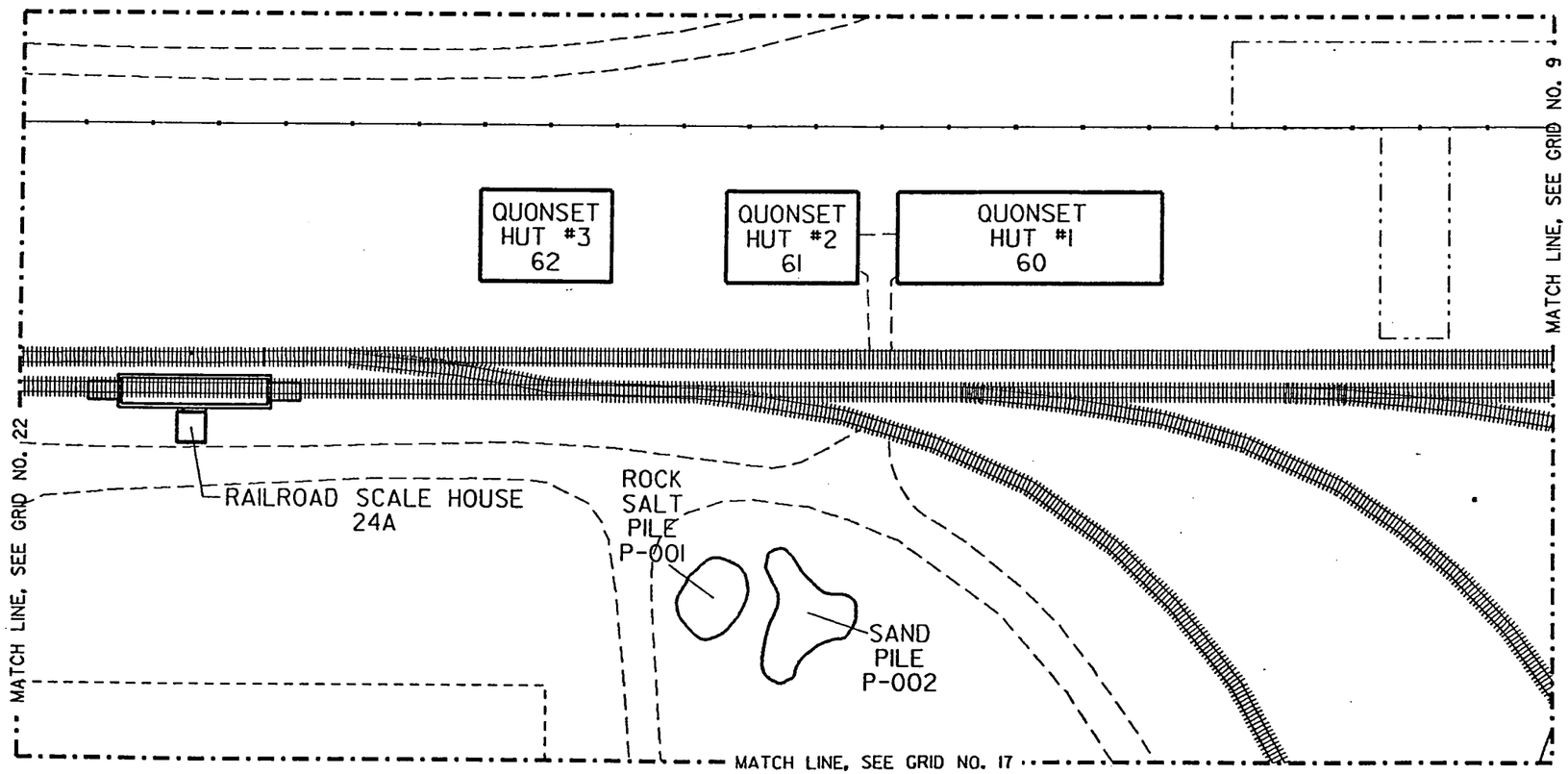
FERNALD, OHIO
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
U.S. DEPARTMENT OF ENERGY

FEMP OPERABLE UNIT 3
SITE GRID MAP
GRID NO. 15

DATE 10/30/92
DRAWN S.J.SMOCK

FILE NAME: /USR/STEVE/MAPS/GD15.DGN

FIGURE C.16 Grid No. 15



0' 60' 120'
SCALE: 1" = 60'-0"

--INDICATES PROPOSED LOCATIONS OF STRUCTURES.

NOTE:
THE OPERABLE UNIT 3 PROGRAM HAS POTENTIALLY GROUPED CATEGORIES OF BUILDINGS INTO COLLECTIVE COMPONENT DESIGNATIONS.

NOTE:
SITE IDENTIFICATION SCHEME PER OPERABLE UNIT 3 PROGRAM REQUIREMENTS.

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FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
U.S. DEPARTMENT OF ENERGY

FEMP OPERABLE UNIT 3
SITE GRID MAP
GRID NO. 16

DATE 12/5/92
DRAWN S. LESMOCK

FILE NAME: /USR/STEVE/MAPS/GD16.DGN

FIGURE C.17 Grid No. 16

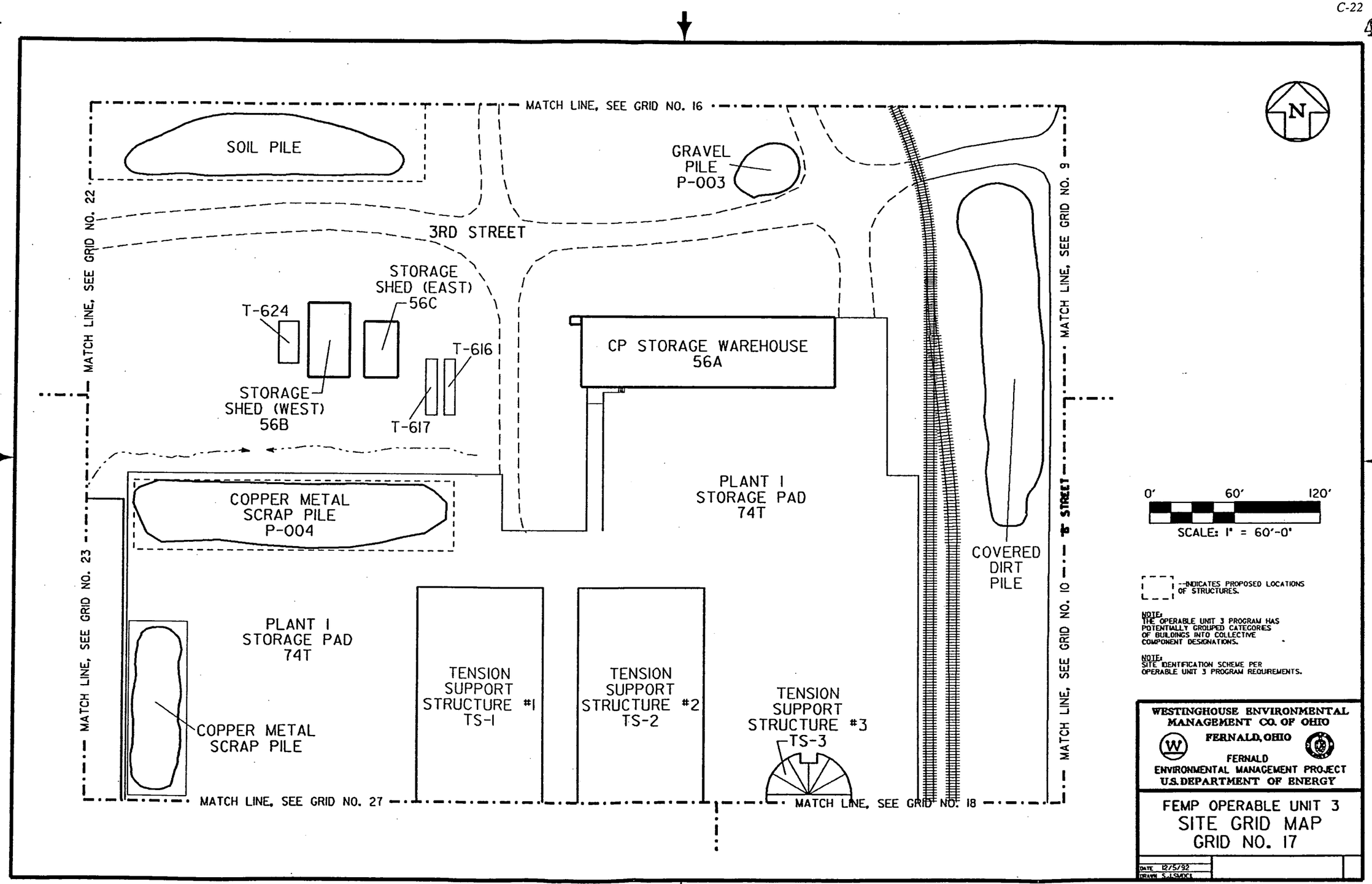
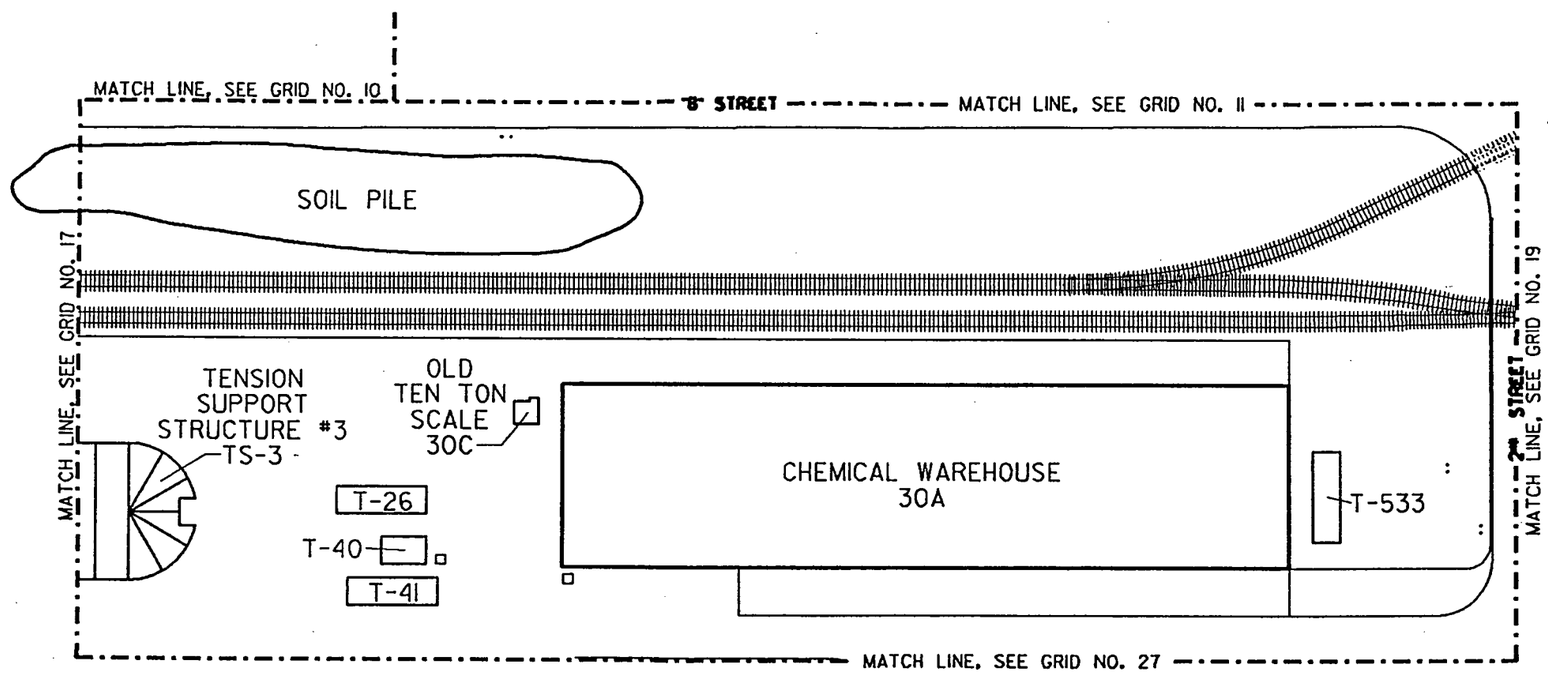


FIGURE C.18 Grid No. 17



0' 60' 120'

SCALE: 1" = 60'-0"

--INDICATES PROPOSED LOCATIONS OF STRUCTURES.

NOTE:
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ENVIRONMENTAL MANAGEMENT PROJECT
U.S. DEPARTMENT OF ENERGY

FEMP OPERABLE UNIT 3
SITE GRID MAP
GRID NO. 18

DATE 12/5/92
DRAWN S.L.SHOCK

FILE NAME: /USR/STEVE/MAPS/GD18.DGN

FIGURE C.19 Grid No. 18

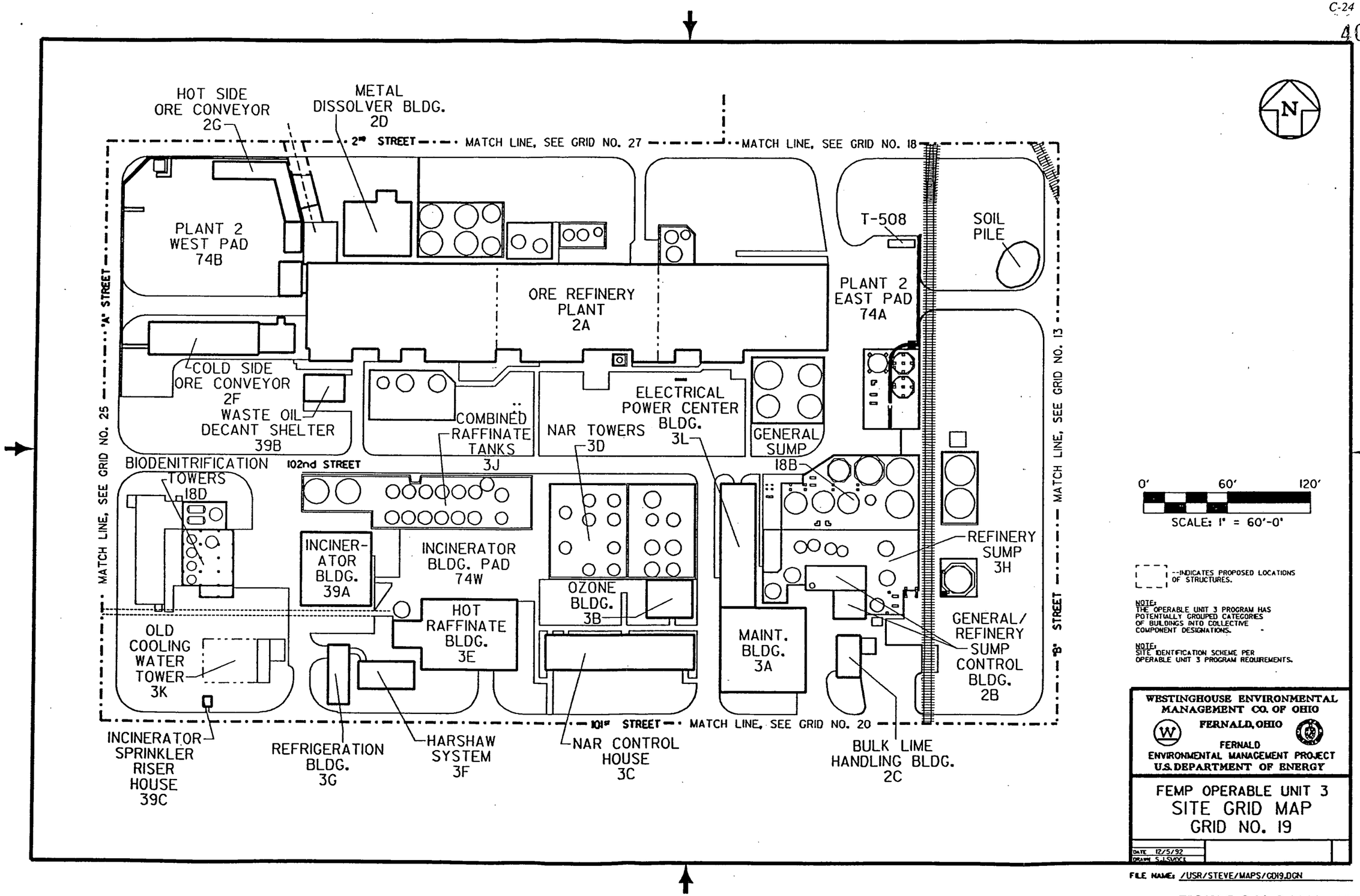
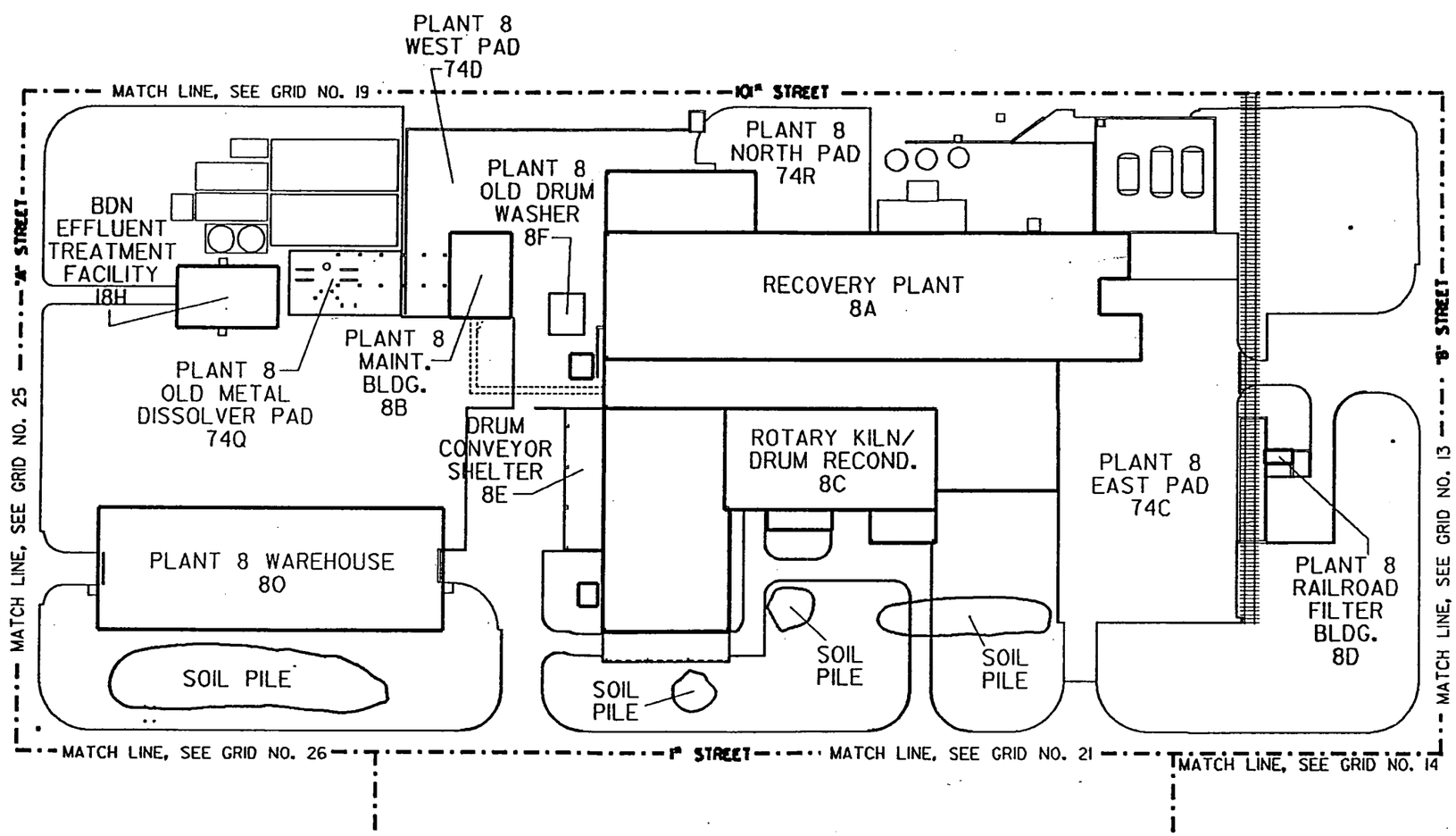


FIGURE C.20 Grid No. 19

4002



0′ 60′ 120′

SCALE: 1" = 60′-0′

—INDICATES PROPOSED LOCATIONS OF STRUCTURES.

NOTE:
THE OPERABLE UNIT 3 PROGRAM HAS POTENTIALLY GROUPED CATEGORIES OF BUILDINGS INTO COLLECTIVE COMPONENT DESIGNATIONS.

NOTE:
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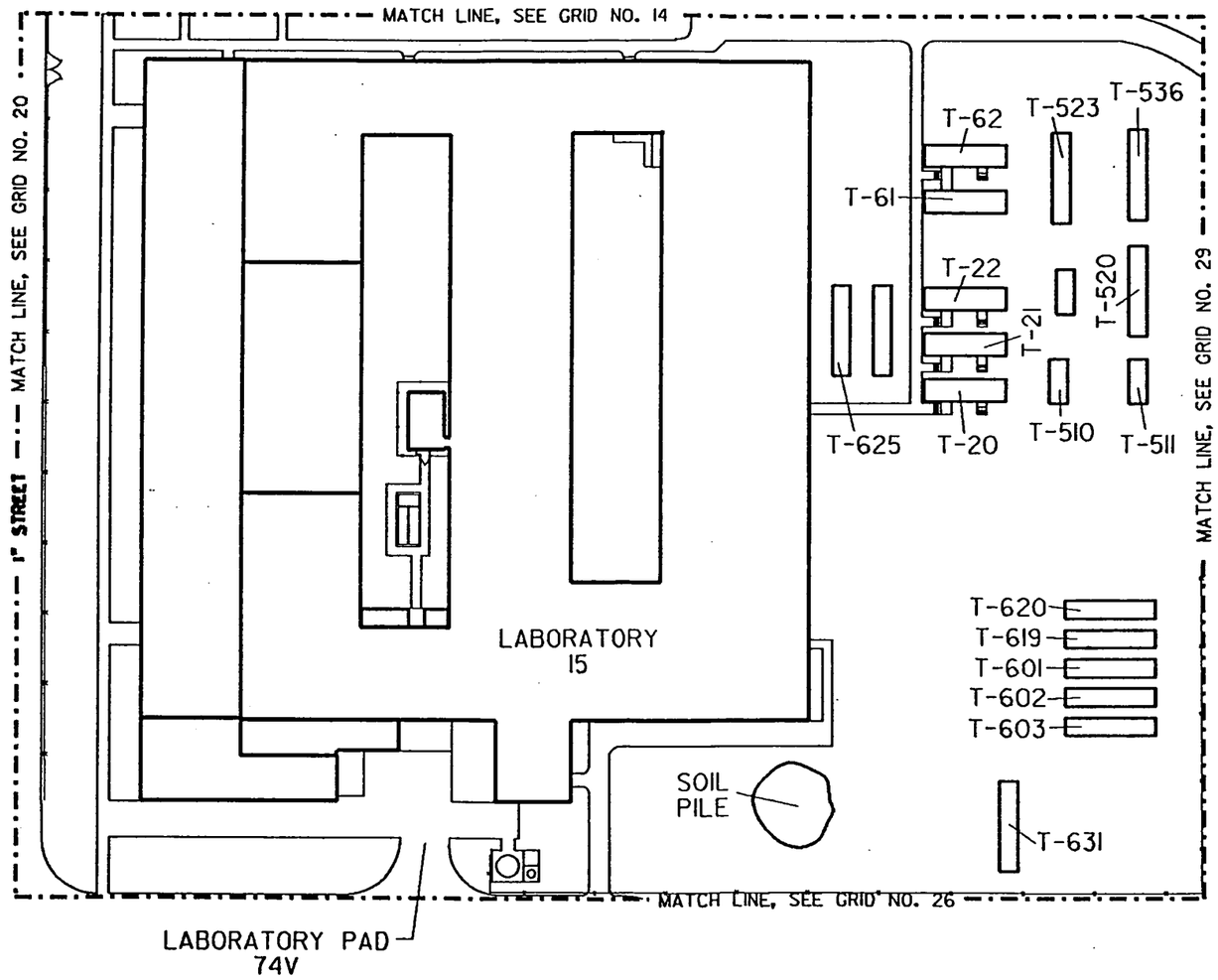
FEMP OPERABLE UNIT 3
SITE GRID MAP
GRID NO. 20

DATE 12/6/92
DRAWN S. J. SHOCK

FILE NAME: /USR/STEVE/MAPS/G020.DGN

FIGURE C.21 Grid No. 20



0' 60' 120'

SCALE: 1" = 60'-0"

--INDICATES PROPOSED LOCATIONS OF STRUCTURES.

NOTE:
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NOTE:
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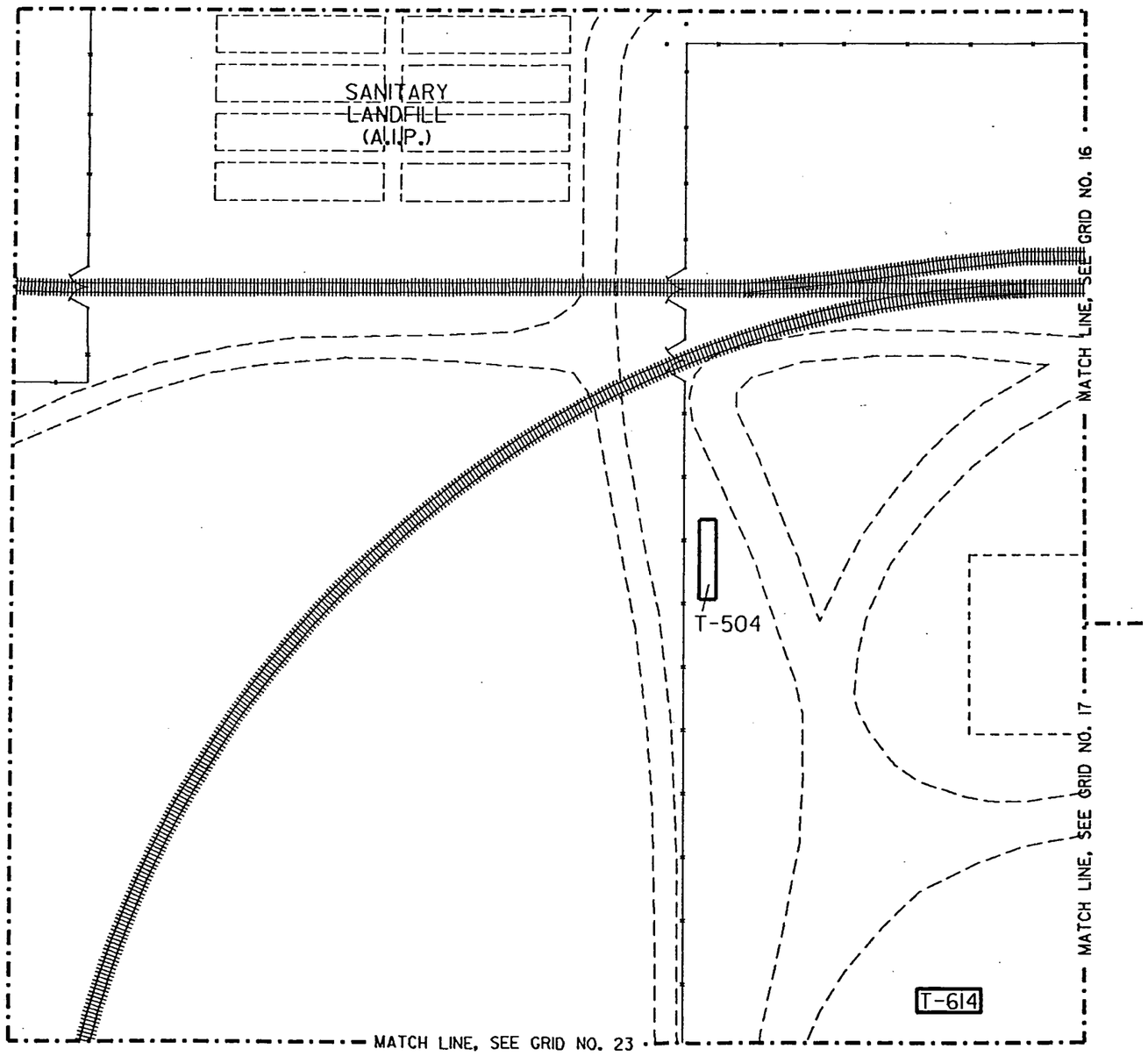
FEMP OPERABLE UNIT 3
SITE GRID MAP
GRID NO. 21

DATE 12/6/92
DRAWN S.J.SMOCK

FILE NAME: /USR/STEVE/MAPS/GD2LDGN

FIGURE C.22 Grid No. 21



N

0' 60' 120'

SCALE: 1" = 60'-0"

--INDICATES PROPOSED LOCATIONS OF STRUCTURES.

NOTE:
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NOTE:
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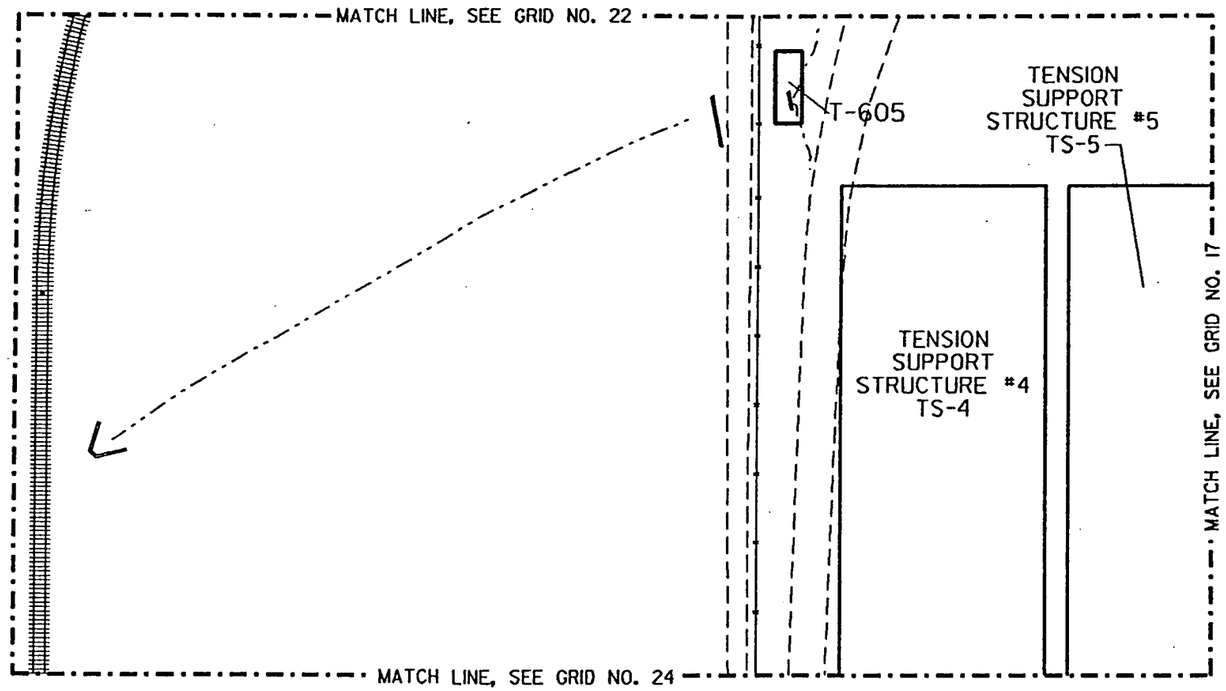
FEMP OPERABLE UNIT 3
SITE GRID MAP
GRID NO. 22

DATE 11/2/92
DRAWN S.J.SMOCK

FILE NAME: /USR/STEVE/MAPS/GD22.DGN

FIGURE C.23 Grid No. 22



N

0' 60' 120'

SCALE: 1" = 60'-0"

--INDICATES PROPOSED LOCATIONS OF STRUCTURES.

NOTE:
THE OPERABLE UNIT 3 PROGRAM HAS POTENTIALLY GROUPED CATEGORIES OF BUILDINGS INTO COLLECTIVE COMPONENT DESIGNATIONS.

NOTE:
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U.S. DEPARTMENT OF ENERGY

FEMP OPERABLE UNIT 3
SITE GRID MAP
GRID NO. 23

DATE 10/30/92
DRAWN S.J. SMOCK

FILE NAME: /USR/STEVE/MAPS/GD23.DGN

FIGURE C.24 Grid No. 23

4002

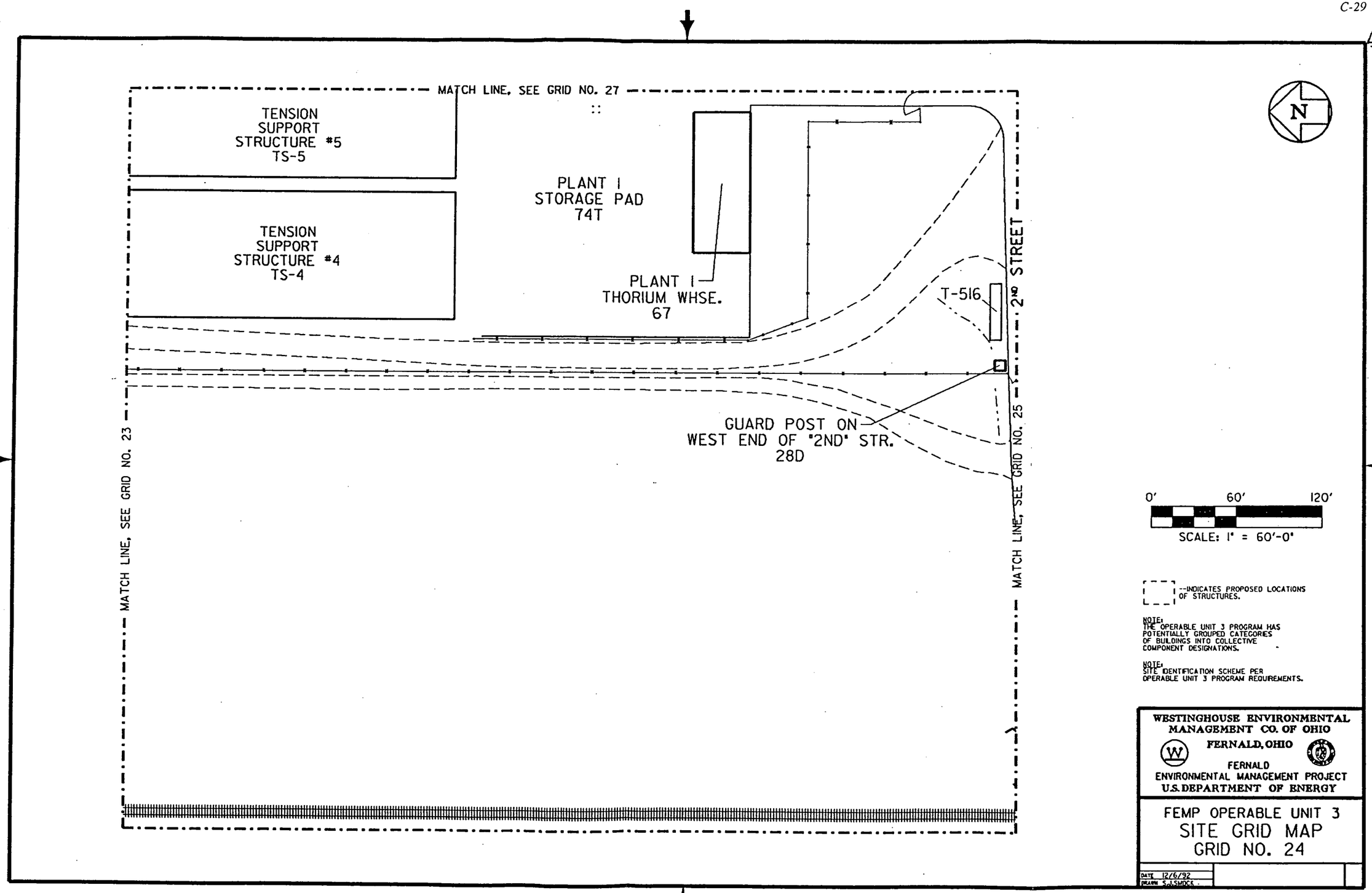


FIGURE C.25 Grid No. 24

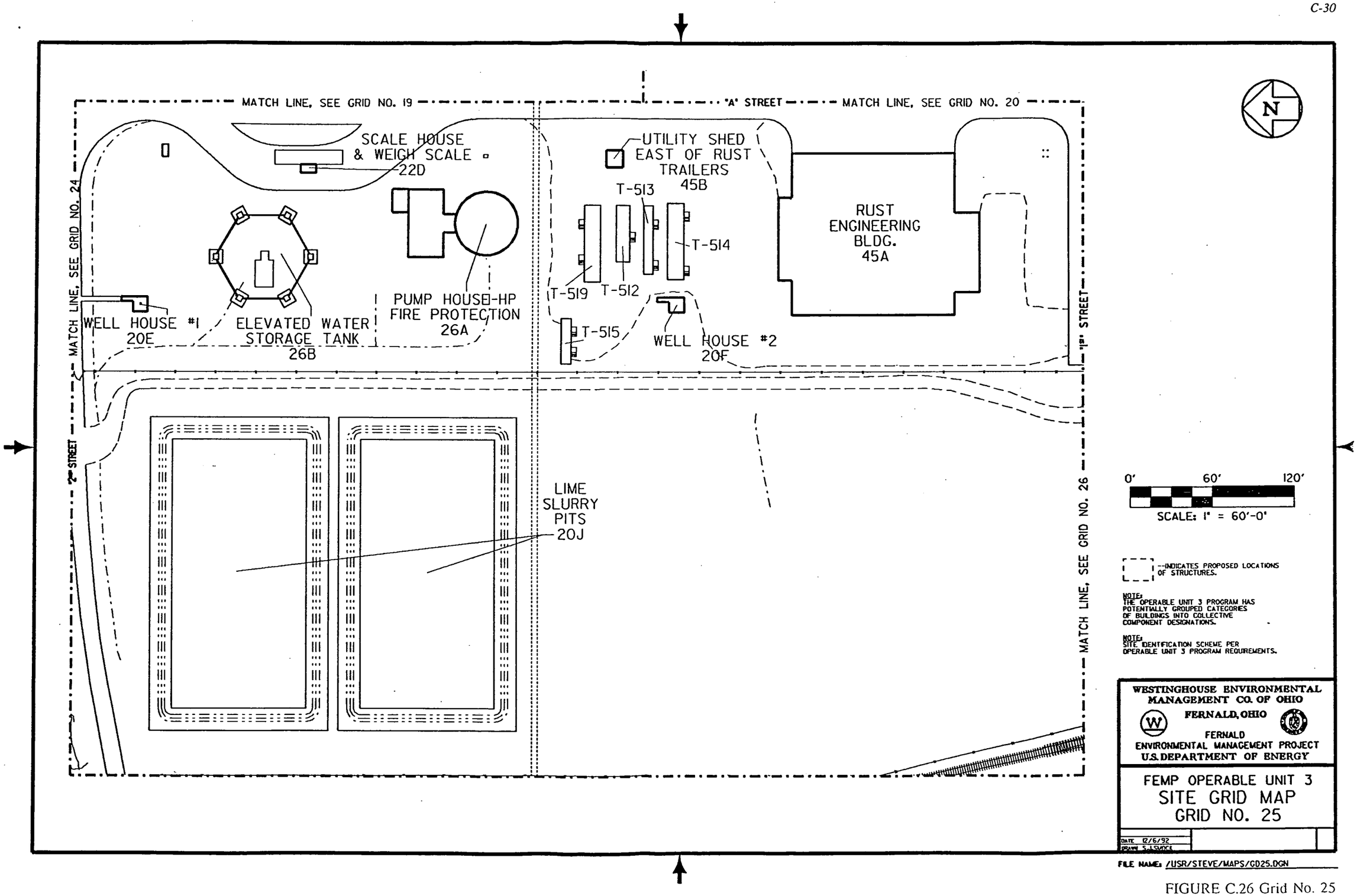


FIGURE C.26 Grid No. 25

4002

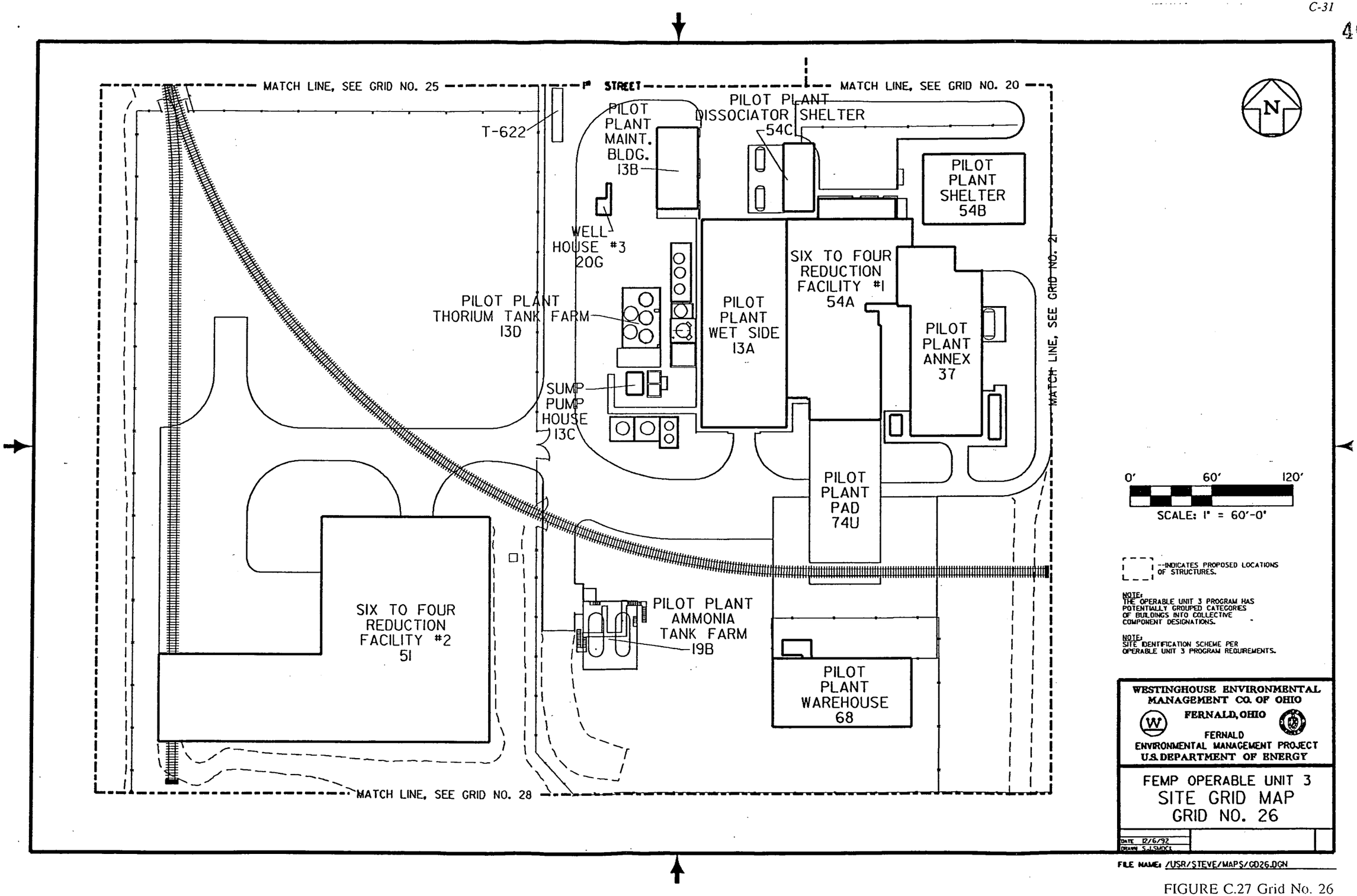


FIGURE C.27 Grid No. 26

4002

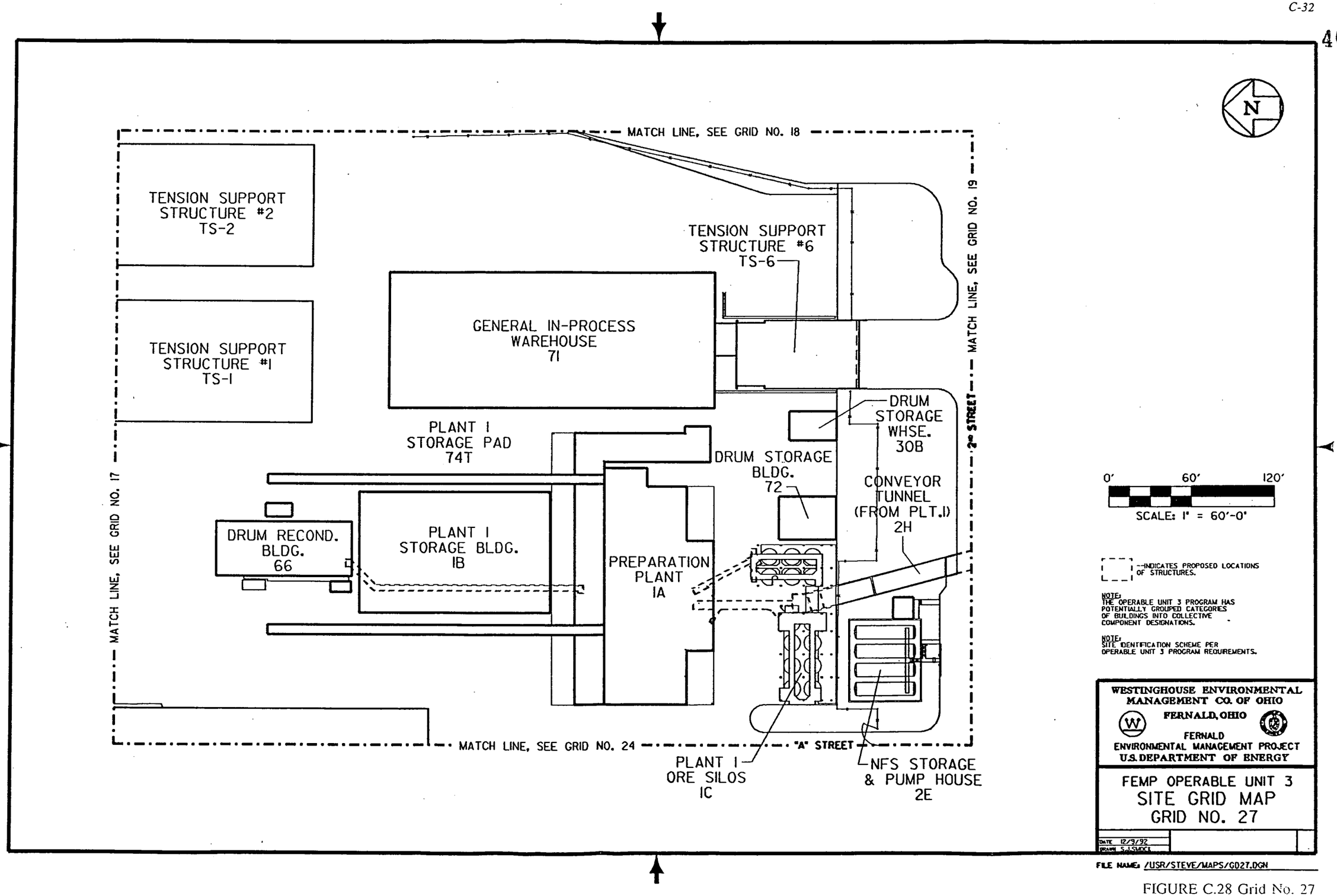
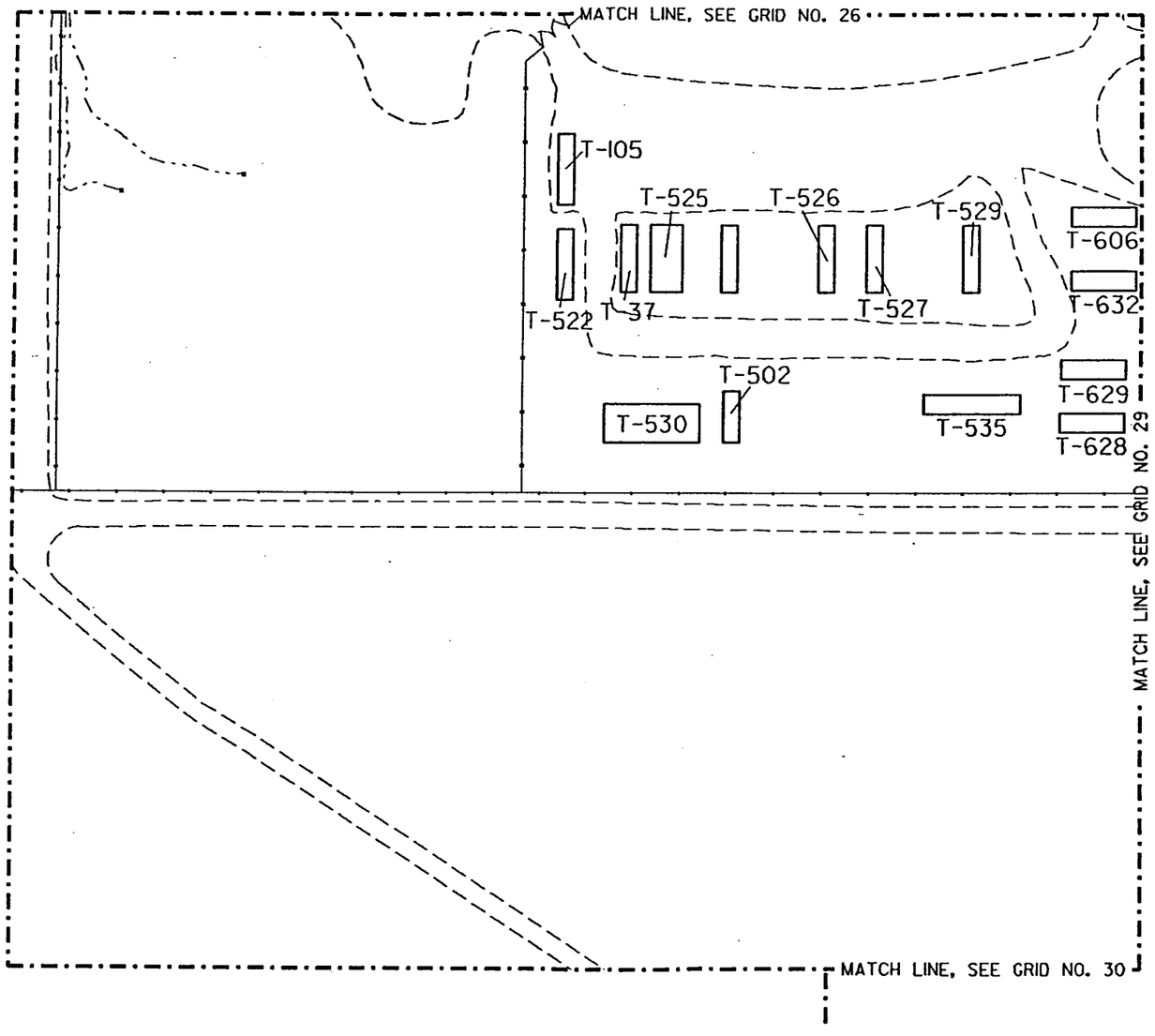


FIGURE C.28 Grid No. 27



0' 80' 160'

SCALE: 1" = 80'-0"

--INDICATES PROPOSED LOCATIONS OF STRUCTURES.

NOTE:
THE OPERABLE UNIT 3 PROGRAM HAS POTENTIALLY GROUPED CATEGORIES OF BUILDINGS INTO COLLECTIVE COMPONENT DESIGNATIONS.

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FEMP OPERABLE UNIT 3
SITE GRID MAP
GRID NO. 28

DATE 11/2/92
DRAWN S.J.SWICK

FILE NAME: /USR/STEVE/MAPS/GD28.DGN

FIGURE C.29 Grid No. 28

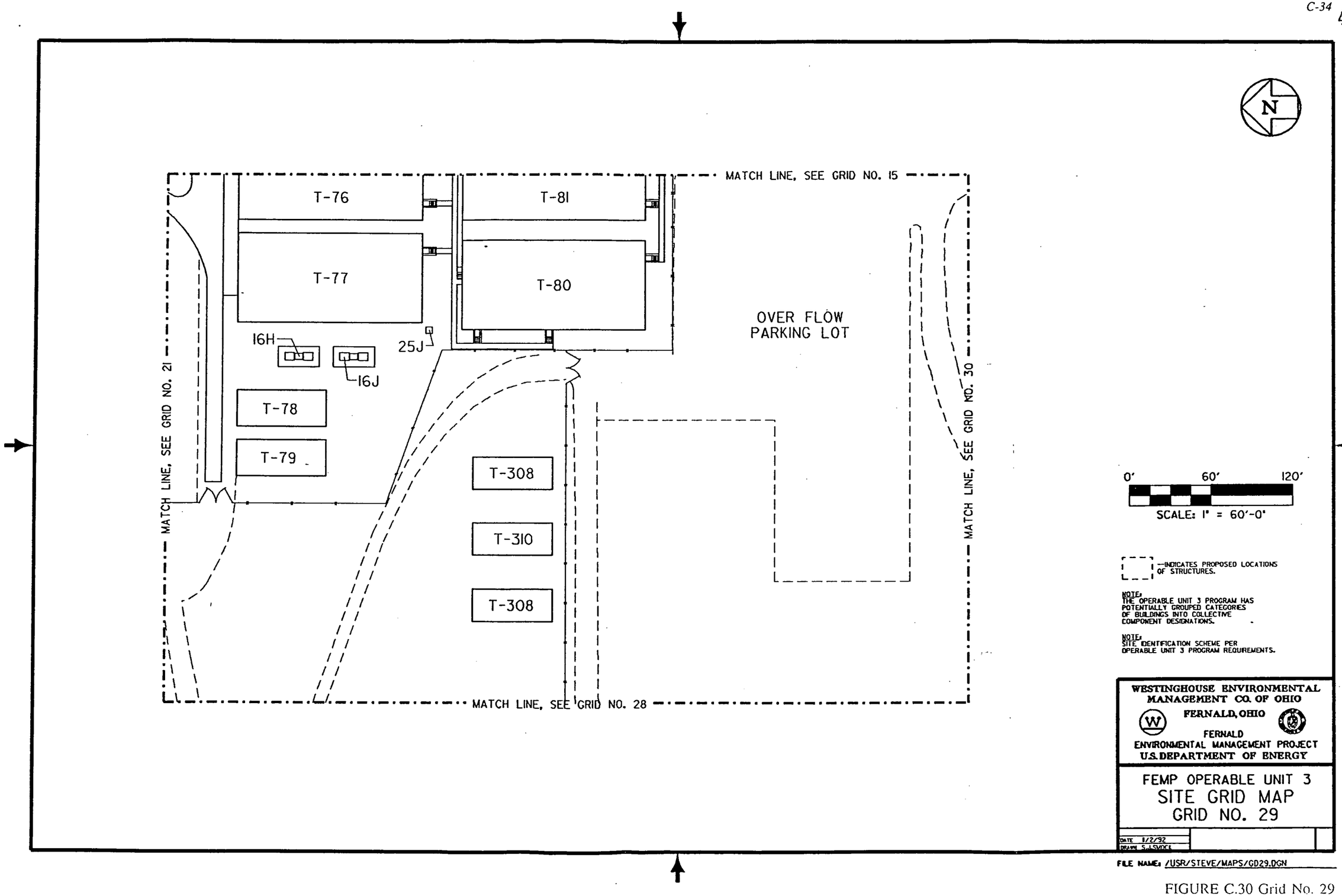


FIGURE C.30 Grid No. 29

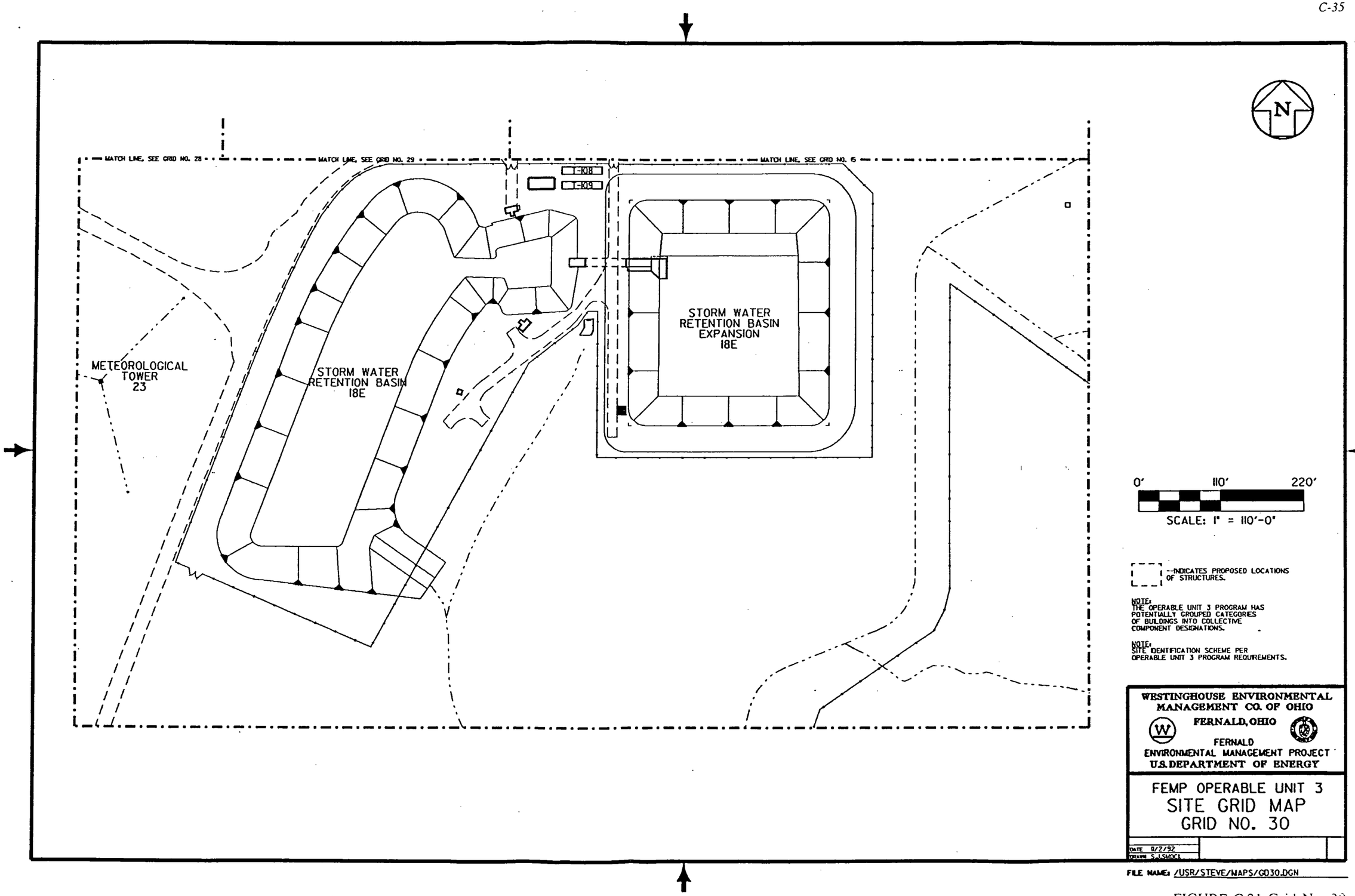


FIGURE C.31 Grid No. 30

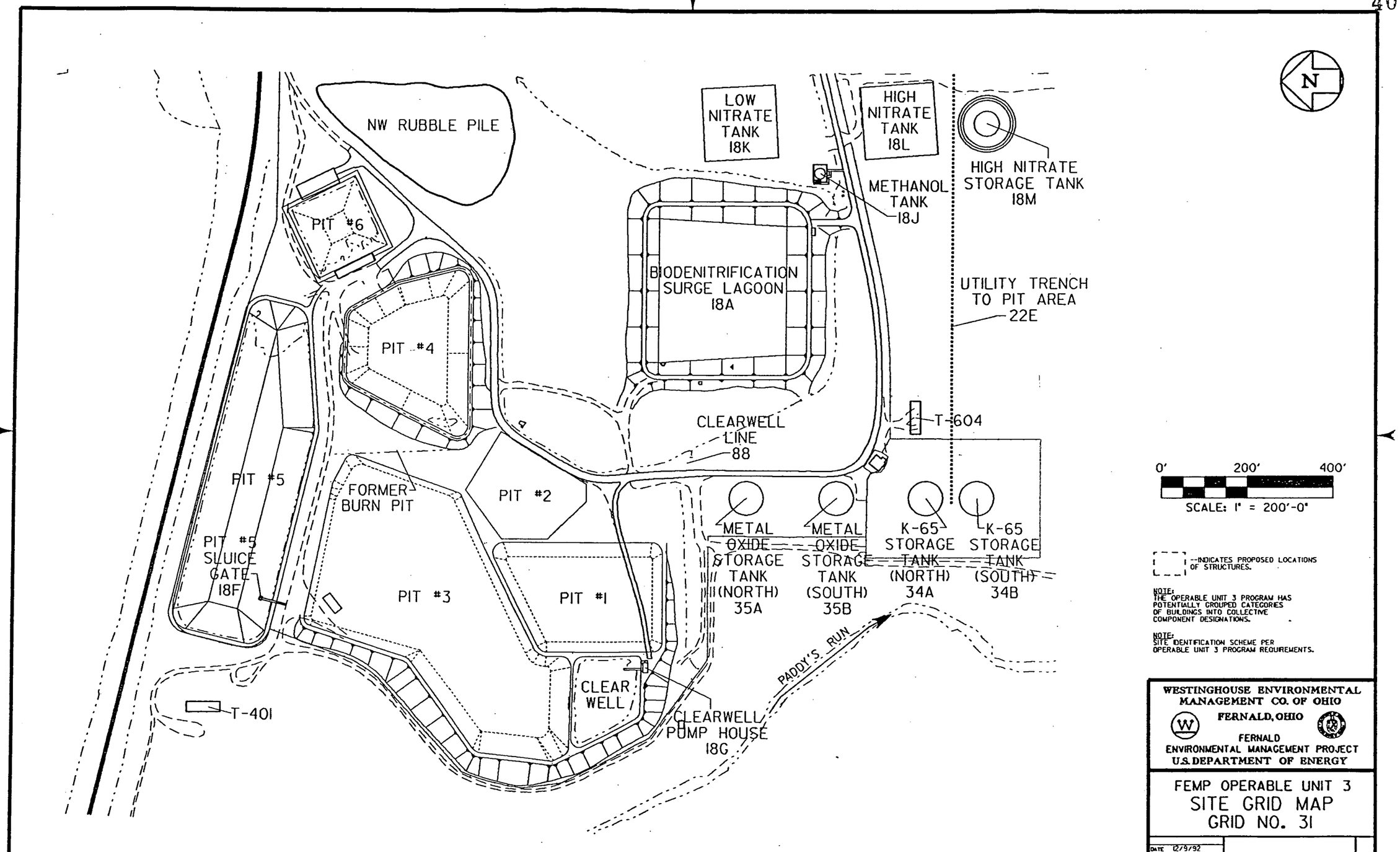


FIGURE C.32 Grid No. 31

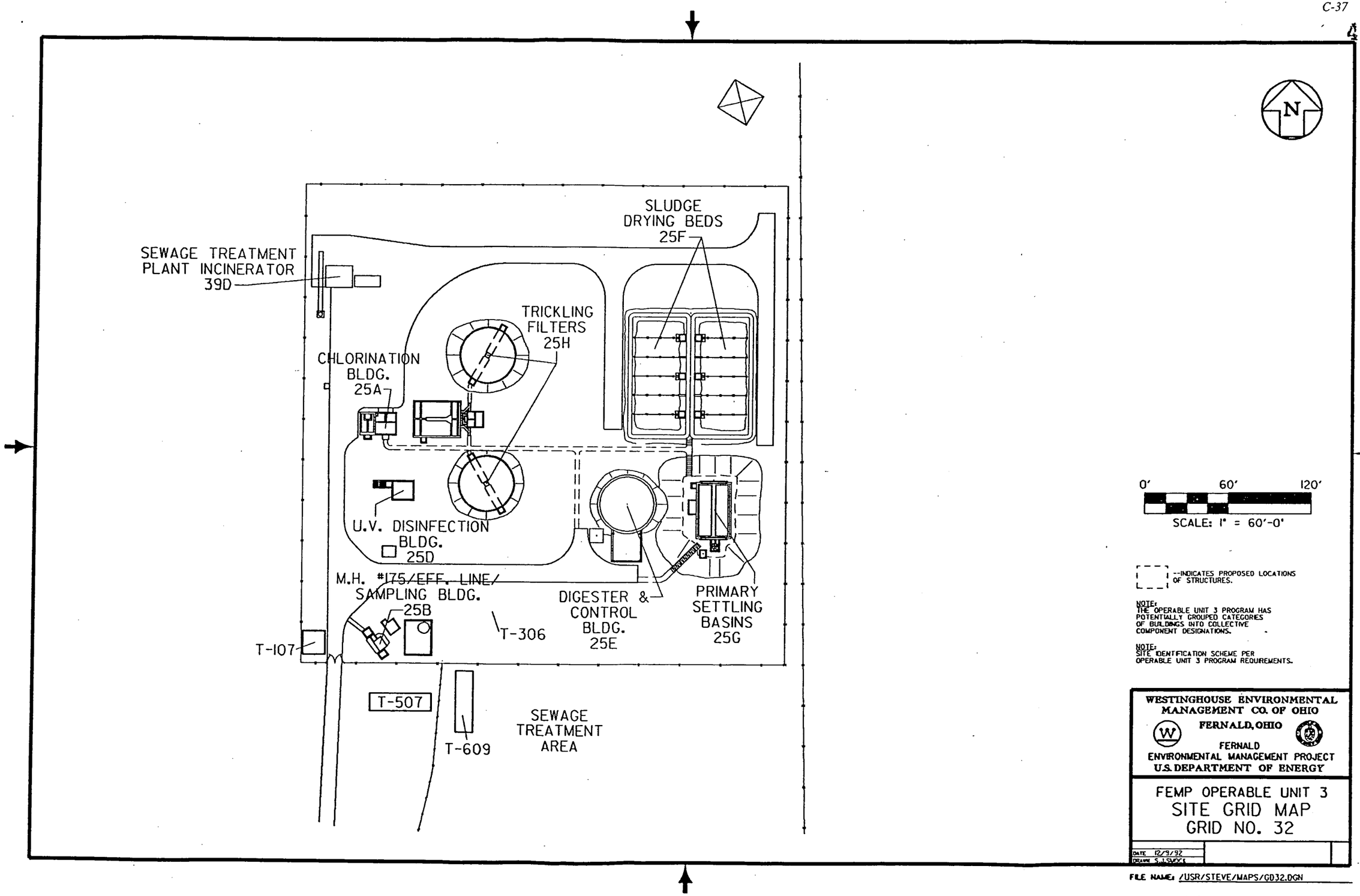


FIGURE C.33 Grid No. 32

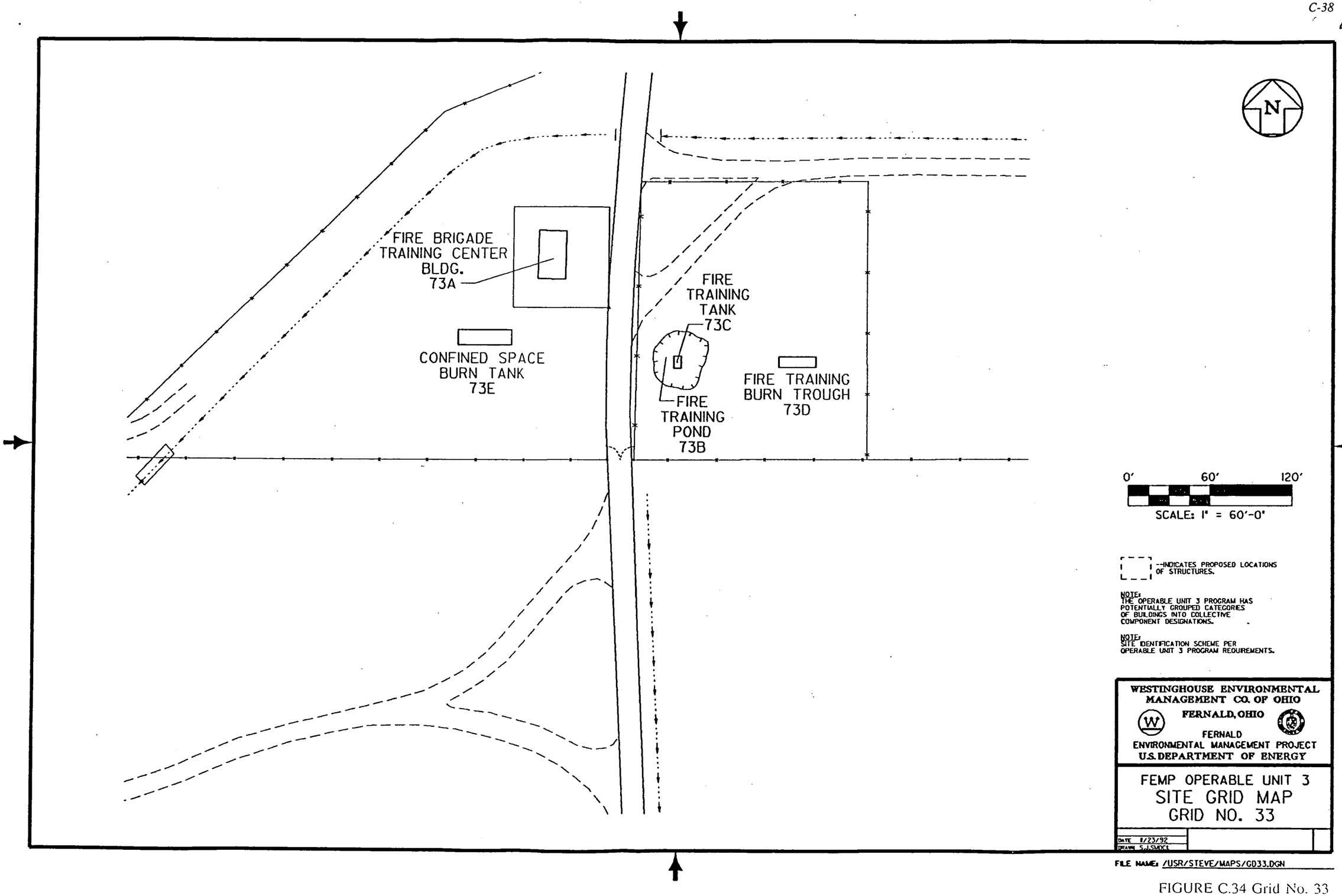
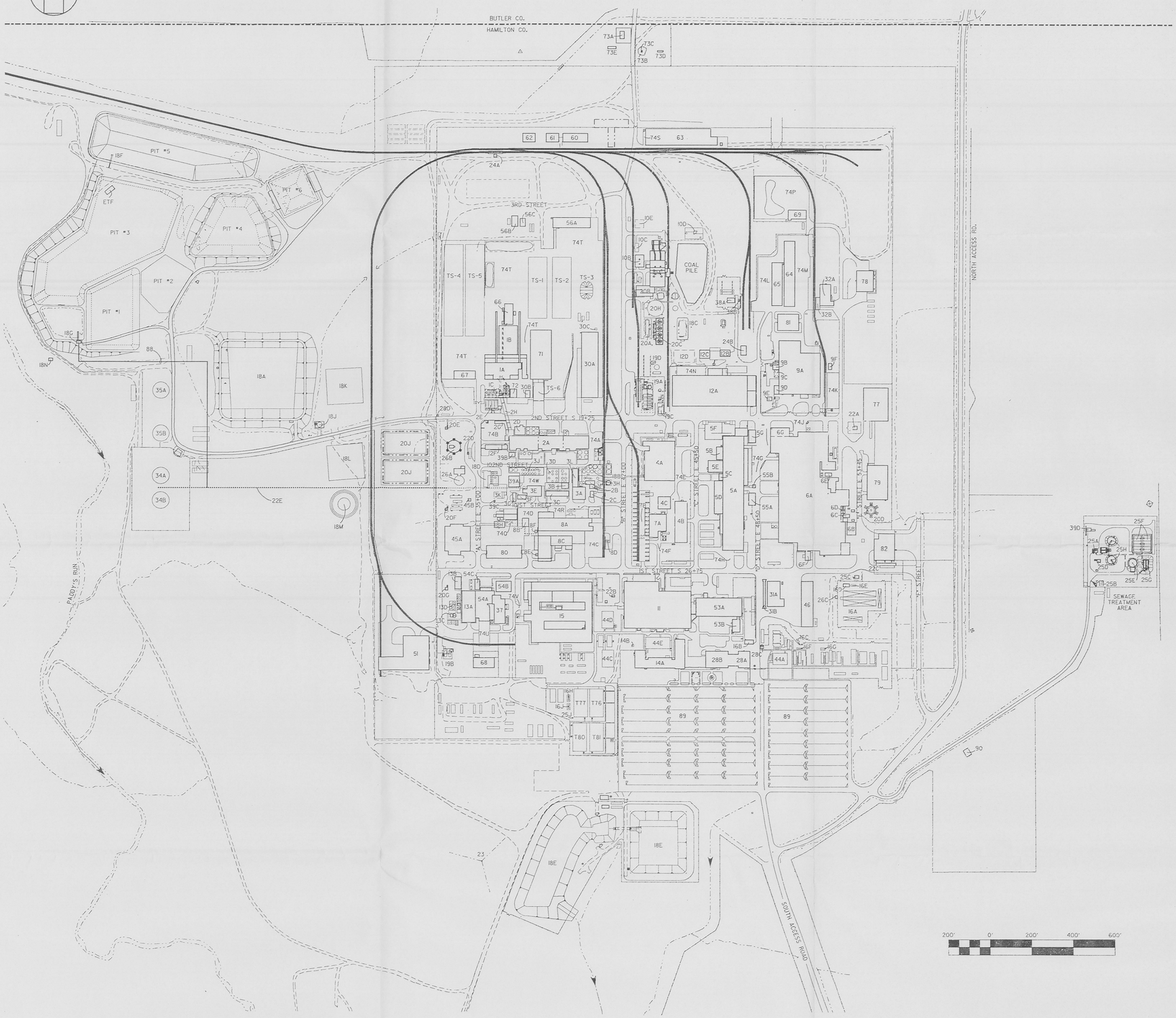


FIGURE C.34 Grid No. 33



FEMP SITE IDENTIFICATION

TS-1	TENSION SUPPORT STRUCTURE #1
TS-2	TENSION SUPPORT STRUCTURE #2
TS-3	TENSION SUPPORT STRUCTURE #3
TS-4	TENSION SUPPORT STRUCTURE #4
TS-5	TENSION SUPPORT STRUCTURE #5
TS-6	TENSION SUPPORT STRUCTURE #6
1A	PREPARATION PLANT
1B	PLANT 1 STORAGE BLDG.
1C	PLANT 1 ORE SILOS
2A	ORE REFINERY PLANT
2B	GENERAL/REFINERY SUMP CONTROL BLDG.
2C	BULK LIME HANDLING BLDG.
2D	METAL DISSOLVER BLDG.
2E	NFS STORAGE & PUMP HOUSE
2F	COLD SIDE ORE CONVEYOR
2G	HOT SIDE ORE CONVEYOR
2H	CONVEYOR TUNNEL (FROM PLANT 1)
3A	MAINTENANCE BLDG.
3B	OZONE BLDG.
3C	NAR CONTROL HOUSE
3D	NAR TOWERS
3E	HOT RAFFINATE BLDG.
3F	HARSHAW SYSTEM
3G	REFRIGERATION BLDG.
3H	REFINERY SUMP
3J	COMBINED RAFFINATE TANKS
3K	OLD COOLING WATER TOWER
3L	ELECTRICAL POWER CENTER BLDG.
4A	GREEN SALT PLANT
4B	PLANT 4 WAREHOUSE
4C	PLANT 4 MAINTENANCE BLDG.
5A	METALS PRODUCTION PLANT
5B	PLANT 5 INGOT PICKLING
5C	PLANT 5 ELECTRICAL SUBSTATION
5D	WEST DERBY BREAKOUT/SLAG MILLING
5E	PLANT 5 FILTER BLDG.
5F	PLANT 5 COVERED STORAGE PAD
5G	PLANT 5 INGOT STORAGE SHELTER
5A	METALS FABRICATION PLANT
6B	PLANT 6 COVERED STORAGE AREA
6C	PLANT 6 ELECTROSTATIC PRECIPITATOR (SOUTH)
6D	PLANT 6 ELECTROSTATIC PRECIPITATOR (CENTRAL)
6E	PLANT 6 ELECTROSTATIC PRECIPITATOR (NORTH)
6F	PLANT 6 SALT OIL HEAT TREAT BLDG.
6G	PLANT 6 SUMP BLDG.
7A	PLANT 7
7B	PLANT 7 OVERHEAD CRANE
8A	RECOVERY PLANT
8B	PLANT 8 MAINTENANCE BLDG.
8C	ROTARY KILN/DRUM RECONDITIONING
8D	PLANT 8 RAILROAD FILTER BLDG.
8E	DRUM CONVEYOR SHELTER
8F	PLANT 3 OLD DRUM WASHER
9A	SPECIAL PRODUCTS PLANT
9B	PLANT 9 SUMP TREATMENT FACILITY
9C	PLANT 9 DUST COLLECTOR
9D	PLANT 9 SUBSTATION
9E	PLANT 9 CYLINDER SHED
9F	PLANT 9 ELECTROSTATIC PRECIPITATOR
10A	BOILER PLANT
10B	BOILER PLANT MAINTENANCE BLDG.
10C	WET SALT STORAGE BIN
10D	CONTAMINATED OIL/GRAPHITE BURN PAD
10E	UTILITIES HEAVY EQUIP. BLDG. (PROPOSED)
11	SERVICE BLDG.
12A	MAIN MAINTENANCE BLDG.
12B	CYLINDER STORAGE BLDG.
12C	LUMBER STORAGE BLDG.
12D	MAINTENANCE BLDG. WAREHOUSE (PROPOSED)
13A	PILOT PLANT WET SIDE
13B	PILOT PLANT MAINTENANCE BLDG.
13C	SUMP PUMP HOUSE
13D	PILOT PLANT THORIUM TANK FARM
14A	ADMINISTRATION BLDG.
14B	BLDG. 14 EOC GENERATOR SET
15	LABORATORY
16A	MAIN ELECTRICAL STATION
16B	ELECTRICAL SUBSTATION
16C	ELECTRICAL PANELS & TRANSFORMER
16D	MAIN ELECTRICAL SWITCH HOUSE
16E	MAIN ELECTRICAL TRANSFORMERS
16F	TRAILER SUBSTATION #1
16G	TRAILER SUBSTATION #2
16H	10 PLEXS NORTH SUBSTATION
16J	10 PLEXS SOUTH SUBSTATION
18A	BDN SURGE LAGOON
18B	GENERAL SUMP
18C	COAL PILE RUNOFF BASIN
18D	BIODENITRIFICATION TOWERS
18E	STORM WATER RETENTION BASINS
18F	PIT #5 SLUICE GATE
18G	CLEARWELL PUMP HOUSE
18H	BDN EFFLUENT TREATMENT FACILITY
18J	METHANOL TANK
18K	LOW NITRATE TANK
18L	HIGH NITRATE TANK
18M	HIGH NITRATE STORAGE TANK
18N	WASTE PIT AREA STORM WATER RUNOFF CONTROL
19A	MAIN TANK FARM
19B	PILOT PLANT AMMONIA TANK FARM
19C	TANK FARM CONTROL HOUSE
19D	OLD NORTH TANK FARM
20A	PUMP STATION & POWER CENTER
20B	WATER PLANT
20C	COOLING TOWERS
20D	ELEVATED POTABLE STORAGE TANK
20E	WELL HOUSE #1
20F	WELL HOUSE #2
20G	WELL HOUSE #3
20H	PROCESS WATER STORAGE TANK
20J	LIME SLURRY PITS
22A	GAS METER BLDG.
22B	STORM SEWER LIFT STATION
22C	TRUCK SCALE
22D	SCALE HOUSE & WEIGH SCALE
22E	UTILITY TRENCH TO PIT AREA
23	METEOROLOGICAL TOWER
24A	RAILROAD SCALE HOUSE
24B	RAILROAD ENGINE HOUSE
25A	CHLORINATION BLDG.
25B	M.H. #175/EFF. LINE/SAMPLING BLDG.
25C	SEWAGE LIFT STATION BLDG.
25D	U.V. DISINFECTION BLDG.
25E	DIGESTER & CONTROL BLDG.
25F	SLUDGE DRYING BEDS
25G	PRIMARY SETTLING BASINS
25H	TRICKLING FILTERS
25J	10 PLEXS SEWAGE LIFT STATION
26A	PUMP HOUSE-HP FIRE PROTECTION
26B	ELEVATED WATER STORAGE TANK
26C	MAIN ELECTRICAL STRAINER HOUSE
26A	SECURITY BLDG.
28B	HUMAN RESOURCES BLDG.
28C	GUARD POST ON SOUTH END OF "D" STR.
28D	GUARD POST ON WEST END OF "2ND" STR.
30A	CHEMICAL WAREHOUSE
30B	DRUM STORAGE WAREHOUSE
30C	OLD TON TON SCALE
31A	ENGINE HOUSE/GARAGE
35	OLD TRUCK SCALE
32A	MAGNESIUM STORAGE BLDG.
32B	BLDG. 32 COVERED LOADING DOCK
34A	A-65 STORAGE TANK (NORTH)
34B	A-65 STORAGE TANK (SOUTH)
35A	METAL OXIDE STORAGE TANK (NORTH)
35B	METAL OXIDE STORAGE TANK (SOUTH)
37	PILOT PLANT ANNEX
38A	PROPANE STORAGE
38B	CYLINDER FILLING STATION
39A	INCINERATOR BLDG.
39B	WASTE OIL DECANT SHELTER
39C	INCINERATOR SPRINKLER RISER HOUSE
39D	SEWAGE TREATMENT PLANT INCINERATOR
44A	TRAILER COMPLEX (6-PLEX)
44C	TRAILER COMPLEX (7-PLEX SJ)
44D	TRAILER COMPLEX (7-PLEX NJ)
44E	TRAILER COMPLEX (10 PLEX)
45A	RUST ENGINEERING BLDG.
45B	UTILITY SHED EAST OF RUST TRAILERS
45	HEAVY EQUIPMENT BLDG.
51	SIX TO FOUR REDUCTION FACILITY #2
53A	HEALTH & SAFETY BLDG.
53B	N-NWD BLDG.
54A	SIX TO FOUR REDUCTION FACILITY #1
54B	PILOT PLANT SHELTER
54C	PILOT PLANT DISSOCIATOR SHELTER
55A	SLAG RECYCLING BLDG.
55B	SLAG RECYCLING PIT/ELEVATOR
56A	CP STORAGE WAREHOUSE
56B	STORAGE SHED (WEST)
56C	STORAGE SHED (EAST)
60	QUONSET HUT #1
61	QUONSET HUT #2
62	QUONSET HUT #3
63	KC-2 WAREHOUSE
64	THORIUM WAREHOUSE
65	(OLD) PLANT 5 WAREHOUSE
66	DRUM RECONDITIONING BLDG.
67	PLANT 1 THORIUM WAREHOUSE
68	PILOT PLANT WAREHOUSE
69	DECONTAMINATION BLDG.
71	GENERAL IN-PROCESS WAREHOUSE
72	DRUM STORAGE BUILDING
73A	FIRE BRIGADE TRAINING CENTER BLDG.
73B	FIRE TRAINING POND
73C	FIRE TRAINING TANK
73D	FIRE TRAINING BURN TROUGH
73E	CONFINED SPACE BURN TANK
74A	PLANT 2 EAST PAD
74B	PLANT 2 WEST PAD
74C	PLANT 8 EAST PAD
74D	PLANT 8 WEST PAD
74E	PLANT 4 PAD
74F	PLANT 7 PAD
74G	PLANT 5 EAST PAD
74H	PLANT 5 SOUTH PAD
74J	PLANT 6 PADS
74K	PLANT 9 PAD
74L	BUILDING 65 WEST PAD
74M	BUILDING 64 EAST PAD & R.R. DOCK
74N	BUILDING 12 NORTH PAD
74P	DECONTAMINATION PAD
74Q	PLANT 8 OLD METAL DISSOLVER PAD
74R	PLANT 8 NORTH PAD
74S	BUILDING 63 WEST PAD
74T	PLANT 1 STORAGE PAD
74U	PILOT PLANT PAD
74V	LABORATORY PAD
74W	BUILDING 39A PAD
77	FINISHED PRODUCTS WAREHOUSE (4A)
78	D & D BUILDING
79	PLANT 6 WAREHOUSE
80	PLANT 8 WAREHOUSE
81	PLANT 9 WAREHOUSE
82	RECEIVING/INCOMING MAT'LS. INSP.
88	CLEARWELL LINE
89	PARKING LOTS
90	SKEET RANGE BLDG.
T76	INTERIM OFFICE SPACE
T77	INTERIM OFFICE SPACE
T80	INTERIM OFFICE SPACE
T81	INTERIM OFFICE SPACE

--INDICATES PROPOSED LOCATIONS OF STRUCTURES.

NOTE:
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NOTE:
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4092

WESTINGHOUSE ENVIRONMENTAL MANAGEMENT CO. OF OHIO
FERNALD, OHIO
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
U.S. DEPARTMENT OF ENERGY

FEMP OPERABLE UNIT 3
SITE MAP - PLATE I
SCALE: 1" = 200'

DATE 12/9/92
DRAWN S.J.SMOCK

560

FILE NAME: /USR/STEVE/MAPS/42X30.DGN