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OPERABLE UNIT 3 PROPOSED PLAN/ENVIRONMENTAL ASSESSMENT FOR INTERIM REMEDIAL ACTION DRAFT FINAL NOVEMBER 1993

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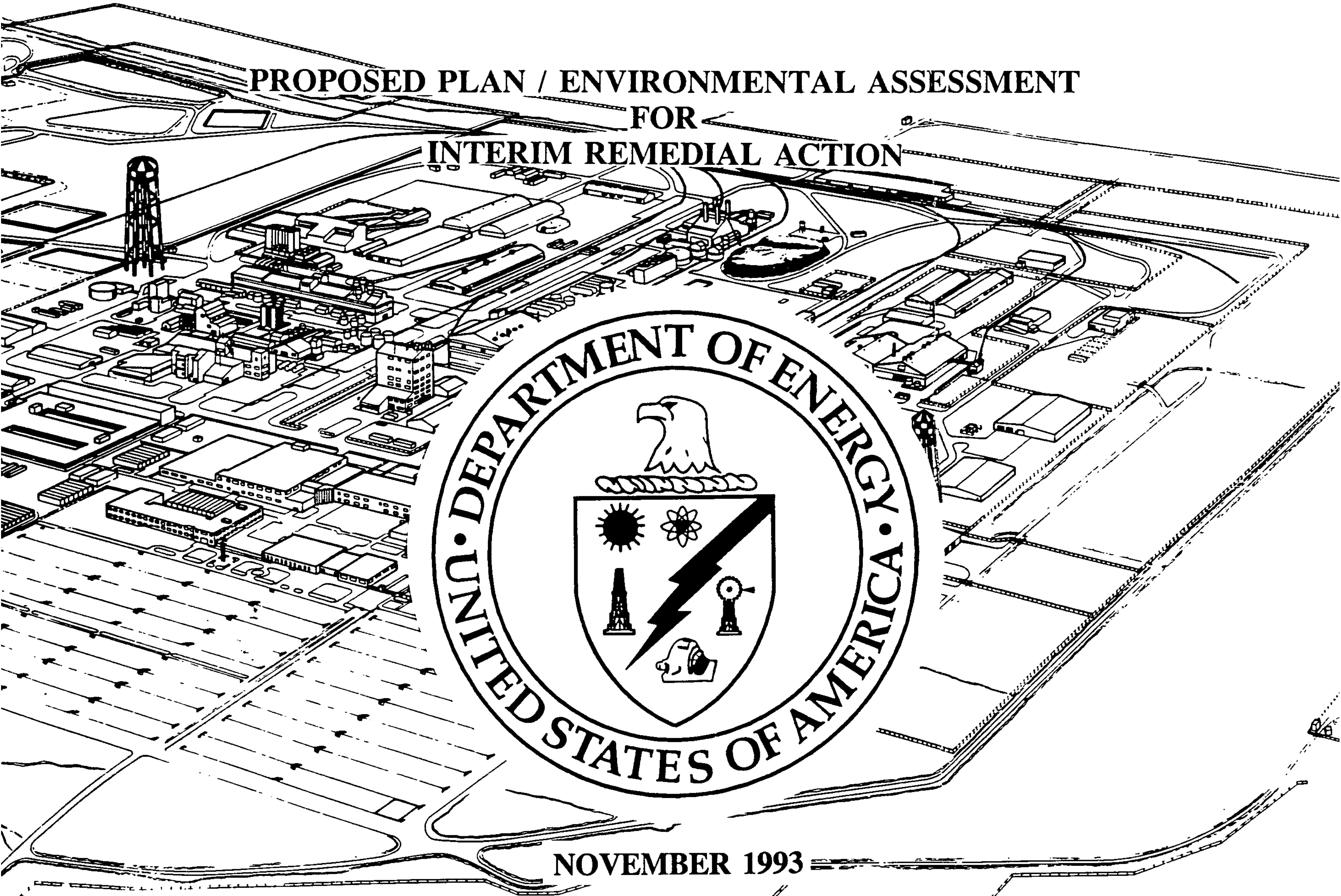
OPERABLE UNIT 3

PROPOSED PLAN / ENVIRONMENTAL ASSESSMENT FOR INTERIM REMEDIAL ACTION



NOVEMBER 1993

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

U.S. DEPARTMENT OF ENERGY
FERNALD FIELD OFFICE

FINAL DRAFT
DOE/EA-0877

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OPERABLE UNIT 3

PROPOSED PLAN / ENVIRONMENTAL ASSESSMENT FOR INTERIM REMEDIAL ACTION

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FERNALD, OHIO

NOVEMBER 1993

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Acknowledgement

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OPERABLE UNIT 3

PROPOSED PLAN FOR INTERIM REMEDIAL ACTION

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Abbreviations, Acronyms, and Initials

ACM	asbestos containing materials
ALARA	as low as reasonably achievable
AMAD	activity median aerodynamic diameter
ARAR(s)	applicable or relevant and appropriate requirement(s)
BRA	baseline risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CPID	Closure Plan Information and Data
CRU3	CERCLA/RCRA Unit 3
CSF	Central Storage Facility
DOE	United States Department of Energy
DOE-FN	United States Department of Energy — Fernald Field Office
DOT	United States Department of Transportation
EA	environmental assessment
EDE	effective dose equivalent
EE/CA	engineering evaluation/cost analysis
EPA	United States Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
FMPC	Feed Materials Production Center
FONSI	finding of no significant impact
FS	feasibility study
HEPA	high-efficiency particulate air filter
HVAC	heating, ventilating, and air conditioning
HWMU	hazardous waste management unit
IROD	Interim Record of Decision
ISF	interim storage facility
LLW	low-level waste
MEPA	medium efficiency particulate air filter
MSL	mean sea level

NCP	National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300
NEPA	National Environmental Policy Act
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
O&M	Operation and Maintenance
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
ORC	Ohio Revised Code
OSHA	Occupational Safety and Health Administration
OU1	Operable Unit 1
OU2	Operable Unit 2
OU3	Operable Unit 3
OU4	Operable Unit 4
OU5	Operable Unit 5
PCB(s)	Polychlorinated biphenyl(s)
PID	photoionization detector
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RI/FS	remedial investigation and feasibility study
ROD	record of decision
S.R.	State Route
SARA	Superfund Amendments and Reauthorization Act of 1986
SVOC(s)	semivolatile organic compound(s)
SWCR	Sitewide Characterization Report
TBC	to be considered
TSI	thermal system insulation
TSS	tension support structure
VOC(s)	volatile organic compounds(s)
WEMCO	Westinghouse Environmental Management Company of Ohio
WPA	OU3 RI/FS Work Plan Addendum
XRF	X-ray Fluorescence

Units of Measure

CF	cubic feet
Ci	Curies
CY	cubic yard(s)
ft^2	square foot (feet)
m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)
mRem	millirem(s)
μCi/ml	microcuries per milliliter
yd^3	cubic yard(s)

1.0 INTRODUCTION

This document presents a Proposed Plan and an Environmental Assessment for an interim remedial action to be undertaken by the U.S. Department of Energy (DOE) within Operable Unit 3 (OU3) at the Fernald Environmental Management Project (FEMP).

1.1 Purpose of the Proposed Plan

The purpose of this Proposed Plan is to solicit input from the public and other interested persons and stakeholders on the proposed interim action to be implemented by the DOE to accelerate the cleanup process within OU3 at the FEMP. This interim action is being proposed as an initiative to remove contaminated buildings and other related facilities located at the FEMP.

1.2 Scope of the Proposed Plan

This Proposed Plan provides site background information, describes the remedial alternatives being considered, presents a comparative evaluation of the alternatives and a rationale for the identification of DOE's preferred alternative, evaluates the potential environmental and public health effects associated with the alternatives, and outlines the public's role in helping DOE and U.S. Environmental Protection Agency (USEPA) to make a final decision on a remedy. This Proposed Plan also provides the necessary evaluation of the environmental consequences of the action to support an informed decision under the National Environmental Policy Act (NEPA). A fact sheet, providing a summary of the proposed action, has also been prepared.

The alternatives considered within this Proposed Plan are:

- Alternative 0 -- No Action
- Alternative 1 -- No Interim Action
- Alternative 2 -- Decontaminate Surfaces Only
- Alternative 3 -- Decontaminate and Dismantle

An Interim Record of Decision (IROD) to be issued following this Proposed Plan will formally document the decisions concerning the proposed interim action. The issuance of an IROD would permit cleanup actions to proceed ahead of the current RI/FS schedule.

1.3 Regulatory Requirements and Governing Agencies

Remedial activity at the FEMP is being conducted in accordance with the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), hereinafter jointly referred to as CERCLA. The lead agency for implementation of the requirements of CERCLA at the FEMP is the DOE, with the USEPA and Ohio EPA (OEPA) acting as support agencies. The DOE, as the lead agency, has the responsibility of drafting this Proposed Plan, soliciting comments from the support agencies and the public, and responding to comments. The responsibility of the USEPA and OEPA as support agencies is to review and to provide comments to DOE in a timely fashion on this Proposed Plan.

For DOE sites such as the FEMP undergoing investigations and cleanup under CERCLA, it is the policy of the DOE to integrate the values of NEPA into the procedural and documentation requirements of the RI/FS process, wherever practical. Consistent with this policy, this Proposed Plan has been written to incorporate NEPA values and additionally represents an Environmental Assessment. The content of this document is not intended to represent a statement on the legal applicability of NEPA to remedial actions conducted under CERCLA.

A separate RI/FS has not been prepared for the proposed interim remedial action; however this Proposed Plan fulfills the requirements of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR 300) for a detailed analysis of alternatives associated with the scope of this action. This Proposed Plan is being issued consistent with Section 117 (a) of CERCLA which requires publication of a notice and brief analysis of the proposed alternatives for site cleanup. Pursuant to CERCLA, the plan must be made available to the public to provide an opportunity for meaningful input into the decision process.

Consideration of state and community input may result in modifications to the interim remedial action selected, so the final decision may differ from the preferred alternative identified in this plan. Therefore, public comment on each alternative in this plan is an important element of the decision-making process for the interim remedial action. Community comments on the preferred alternative and other alternatives will be evaluated and documented as part of the IROD.

1.4 Overview of the FEMP and Operable Unit 3

The FEMP, formerly known as the Feed Materials Production Center[1], is a DOE facility which operated from 1952 to 1989 to provide high purity uranium metal products to support United States defense programs. The FEMP is located in southwestern Ohio about 17 miles northwest of downtown Cincinnati. Production operations were halted in 1989 to focus available resources on environmental restoration activities at the facility. One of these activities, the OU3 RI/FS process, is being conducted pursuant to the terms of an agreement with the USEPA for the purpose of identifying the most promising cleanup actions to be undertaken at the FEMP to address environmental concerns. These environmental concerns have been identified by DOE, USEPA, OEPA, and members of the community living near the facility. They include: (1) the potential impacts on human health and the environment from past releases of hazardous materials from the FEMP to the air, water, and surrounding soils; (2) the on-site accumulation of a large inventory of uranium process materials and low level radioactive and hazardous wastes; and (3) the deteriorated state of, and levels of contamination in, the former uranium processing buildings and support facilities at the site.

To promote a more structured and expeditious cleanup, the FEMP has been divided into five operable units. An operable unit is a term employed under CERCLA to identify a logical grouping of facilities or environmental issues at a cleanup site. Separate RI/FS documentation, including RI and FS Reports and Proposed Plans are being issued for each of the five operable units at the FEMP. The Amended Consent Agreement (EPA 1991) defines the five operable units at the site. The operable units are roughly defined as: Operable Unit 1, the Waste Pit Area; Operable Unit 2, Other Waste Units; Operable Unit 3, the Production Area and associated facilities and equipment; Operable Unit 4, Silos 1-4; and Operable Unit 5, Environmental Media.

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[1] Throughout this report, the acronym "FEMP" is used for this site, even though it was known as the FMPC when in operation.

As previously stated, this document presents a Proposed Plan for an interim remedial action to be undertaken within OU3 at the FEMP. A separate Proposed Plan for final actions will be issued for OU3 following completion of the ongoing RI/FS. Operable Unit 3 consists of the following:

- Production Area and Production-associated facilities and equipment (including all above- and below-grade improvements);
- All other facilities and equipment not specifically included in OUs 1, 2, 4, and 5;
- Drummed Waste Inventories;
- Waste Product Materials, Feedstocks and Thorium;
- Wastewater Treatment Facilities and Effluent Lines;
- Fire Training Facilities;
- Scrap Metal, Coal, and Existing Soil Piles;
- Identified Storage Ponds and Basins; and
- Storage Pads, Roadways, and Railroad Tracks.

1.5 Purpose and Need for the Interim Remedial Action

The buildings, equipment and other facilities contained within OU3 exhibit elevated concentrations of radiological and other hazardous substances at levels which exceed certain standards and guidelines for protecting human health and the environment. The existence of these contaminants results in ongoing exposures to workers and represents, under certain potential circumstances involving releases, an unacceptable threat to neighboring residents.

While DOE maintains an active maintenance program, the former uranium processing support facilities contained within OU3 are, in general, at or beyond their design life and in a state of advancing deterioration. These current conditions present an increasing probability of future releases of hazardous substances to the environment due to structural collapse or other failure mechanisms. While the DOE and USEPA are proceeding toward a decision on the proposed final disposition of these structures as part of the OU3 RI/FS process, the decision resulting from this effort is not scheduled until late 1997.

DOE, as the lead agency for the FEMP, has the responsibility to reduce risks to human health and the environment as quickly as possible. Therefore, DOE is fulfilling its responsibility as the lead agency in accordance with CERCLA and the NCP by proposing to implement an interim remedial action to accelerate the cleanup process within OU3. DOE's preferred alternative is the decontamination and dismantlement of contaminated buildings, equipment, and facilities within OU3 which represent potential sources of releases to the environment. This action could potentially accelerate the clean up process by four years. This proposed action is considered reasonable due to (1) the substantial cost savings to the public from reduced maintenance costs, (2) the resulting reduced exposures to site workers, and (3) the early opportunity to implement cleanup actions to address the advanced state of facility deterioration and continued potential for contaminant release. The DOE has identified no future use for the OU3 facilities, and therefore, considers the removal of these facilities to be a prudent measure to ensure the continued protection of human health and the environment. The proposed interim action is consistent with USEPA guidance (EPA 1989 and 1991b), which allow interim remedial actions to be implemented to respond to an immediate site threat or to take advantage of an opportunity to more promptly reduce site risk.

DOE maintains active custody of the site and restricts access with fences and guards, precluding a member of the public from being exposed to the more heavily contaminated facilities on the site. Additionally, DOE continues an active maintenance program to reduce gross contamination levels within the structures and to implement the necessary corrective actions to minimize the potential for the release of significant quantities of hazardous substances to the environment. While available environmental monitoring data demonstrate that off-site populations are not currently being exposed to risk by OU3 contaminants due to access and administrative controls, the purpose of DOE's environmental restoration program is to eliminate or reduce the potential for such impacts.

1.6 Scope of the Interim Remedial Action

The proposed interim action represents a major component of the OU3 remediation effort. The combination of the interim action and the final action will result in an overall cleanup approach that is consistent with the current leading remedial alternative. The interim action represents an approach to reduce risks to human health and the environment, as well as support a potential acceleration of the OU3 remediation.

Included within the scope of this alternative is the removal of all OU3 facilities, including former uranium processing buildings and equipment, support structures, below-grade and above-grade utilities, and identified ponds and basins. These facilities would be removed and decontaminated to the extent feasible to maximize resource recycling and reduce waste generation, with debris and other waste generated incidental to these actions placed into a safe storage facility at the FEMP and a limited quantity dispositioned to approved off-site disposal facilities. Decisions regarding the location and method of permanent disposition of the removed materials are excluded from the scope of this action and will be made through the ongoing Remedial Investigation/Feasibility Study (RI/FS) process for OU3.

The construction, operation, maintenance, and monitoring of the required interim storage facilities to house the generated debris and waste is within the scope of the action. EPA guidance, Guide to Developing Superfund No Action, Interim Action, and Contingency RODs (EPA 1991b) for interim actions specifically addresses "relocating contaminated material from one area of a site to another area of the site for temporary storage until a decision on how best to manage the site wastes is made." Debris and waste would remain in this storage configuration until issuance of the final ROD on the OU3 RI/FS, which will identify a permanent disposal method. Portions of the contaminated debris and other wastes generated during the period prior to the final ROD would be transported from the site for disposal at an approved off-site disposal facility. The quantity of the material shipped from the site as a consequence of this interim action would not represent greater than 10 percent of the total OU3 waste inventory, including contaminated construction materials and process related waste residues. The shipment of this quantity of material would not bias the final disposal decision in the final ROD. These materials may be shipped off-site due to limitations on available or newly constructed interim storage capacity.

1.7 OU3 RI/FS Integration

The RI/FS process for OU3 is being conducted in accordance with an Amended Consent Agreement (EPA 1991) between USEPA and DOE. One objective of the RI/FS is to develop a detailed understanding of the nature of the contamination on or within the OU3 facilities, their impacts on the surrounding environment, and the threat that the facilities pose to human health and the environment. The OU3 RI/FS Work Plan Addendum (DOE 1993b) detailing proposed investigations to develop this detailed understanding of OU3 was approved by USEPA on August 4, 1993. Following the completion of these investigations, RI and FS Reports will be issued consistent with the milestone schedules defined in the Amended Consent Agreement. Following approval of these RI/FS documents, a draft Record of Decision (ROD) will be submitted to USEPA for approval by April 2, 1997.

The effect of the IROD and the associated proposed interim action would be to separate decontamination and dismantlement activities from the final disposition of wastes and potentially allow decontamination and dismantlement of OU3 components to begin 4 years ahead of the current schedule (see Figure 1-1). The need to address technologies or options for facility removal in the RI/FS documentation for OU3 would be precluded by the issuance of the IROD. The OU3 RI/FS would then be focused upon the evaluation of waste treatment technologies, and methods and locations for the final disposal of the OU3 materials. Through implementation of the interim action and the final RI/FS decision, all of OU3 would be remediated.

Following the IROD, a Remedial Design/Remedial Action (RD/RA) Work Plan would be issued to provide more detailed plans and schedules of how the facilities are to be decontaminated and dismantled, consistent with the alternative selected. Remediation plans associated with current Removal No. 13 (Plant 1 Ore Silos) and Removal No. 19 (Plant 7 Dismantling), will form a basis to develop and support the RD/RA Work Plan design and scheduling. Before

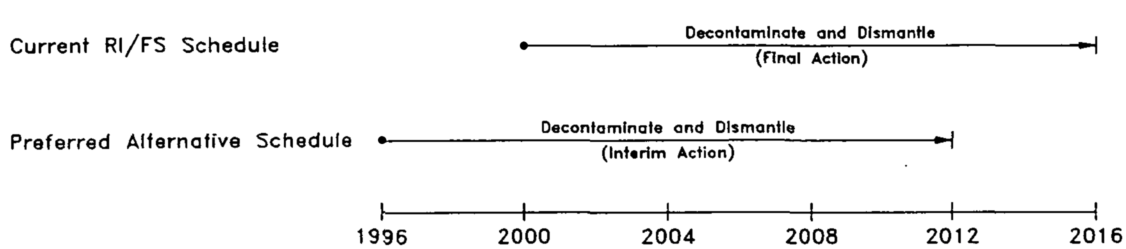

FIGURE 1-1 Schedule Comparison of the Preferred Alternative and the Current RI/FS

implementation of this interim action could begin, it is anticipated that both of these removal actions would be complete or near completion. Therefore, lessons learned from the design and implementation of these removal actions will be incorporated into the RD/RA Work Plan. The RD/RA Work Plan will include a logic flow diagram detailing the evaluation to be performed in assessing a schedule of activities. Some of the factors involved in the schedule process are: attainment of the greatest risk reduction; estimation of funding available; facility and utility requirements during remediation; and coordination of activities with other OUs including soil and groundwater remediation.

The proposed interim remedial action would be coordinated and integrated with ongoing approved removal actions or newly identified removal actions. It is anticipated that most removal actions will be completed before beginning the interim remedial action. The exceptions are Removal of Waste Inventories (Removal No. 9), Safe Shutdown (Removal No. 12), Improved Storage of Soil and Debris (Removal No. 17), and Asbestos Abatement (Removal No. 26). These removal actions are programmatic in nature and represent actions being applied to the site as a whole. Both Safe Shutdown and Improved Storage of Soil and Debris are removal actions connected to the interim remedial action that require coordination of activities. The Removal of Waste Inventories and Asbestos Abatement programs would be completed within buildings and facilities before the decontamination and dismantlement would begin. A discussion of the OU3 removal actions is presented in Section 2.3.

Upon issuance of the final ROD for OU3, the interim action would be integrated with the actions dictated by this RI/FS decision document to provide a unified remediation approach. Once the final ROD has determined the treatment and disposal options to be implemented, materials from the interim action will be controlled and managed to meet the requirements of the final ROD. Discussion of this unified remedial strategy will be provided within the RD/RA Work Plan issued subsequent to the final ROD.

It should be noted that contaminated environmental media, including soils and groundwater in the vicinity of or underlying the OU3 facilities are being addressed under a separate operable unit (Operable Unit 5) which is examining such media on a site-wide basis. Remediation interfaces between OU5 and OU3 will require the highest degree of integration during remedial actions to assure removal of above- and below-grade facilities as coordinated with remediation of environmental media. OU3 interfaces with OUs 1, 2, and 4 are physically minimal; however, remediation activities and waste storage facilities planning are coordinated to maximize available resources and limited space.

1.8 Organization of this Proposed Plan

This Proposed Plan has been prepared to satisfy each of the listed objectives. This Proposed Plan is organized such that:

- Section 2 provides a summary of relevant site background information including a more thorough description of OU3 and its associated radiological and chemical contamination. Section 2 also presents a brief discussion of related site actions.
- Section 3 describes each of the alternatives considered for implementation.
- Section 4 presents a detailed evaluation of the alternatives employing the criteria identified under CERCLA for use in the RI/FS process.
- Section 5 presents the results of the comparative analysis of the alternatives and provides the rationale for selection of DOE's preferred alternative.
- Section 6 summarizes the role of the public in the decision process, solicits public comment on this Proposed Plan, and provides relevant information on how to provide input.
- Section 7 presents a schedule for preparation of CERCLA decision documents for the interim remedial action.
- Finally, a series of appendices provide additional detailed supporting information for topics covered in Sections 2 and 4.

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2.0 BACKGROUND INFORMATION

This section summarizes background information concerning the FEMP and OU3 relevant to this Proposed Plan. Included in this section is a brief summary of the site location and affected environment (Section 2.1), a description of OU3 (Section 2.2), a description of ongoing removal actions in OU3 (Section 2.3), and a summary of information on the nature and extent of contamination within OU3 (Section 2.4).

The background information summarized within this section is based upon the data and information presented in the Sitewide Characterization Report (SWCR) (DOE 1993c), the OU3 RI/FS Work Plan Addendum (DOE 1993b), and other references as noted. The plate map at the back of the document shows the details of the site.

2.1 Site Location and Affected Environment

The FEMP is located on a 1,050-acre site in a rural agricultural area about 17 miles northwest of downtown Cincinnati, Ohio (Figure 2-1). The site is near the villages of Fernald, New Baltimore, New Haven, Ross, and Shandon, Ohio. The nearest resident is located at the property boundary and no individuals reside on the site.

The FEMP is a government-owned, contractor-operated federal facility that produced high-purity uranium metal products for the DOE and its predecessor agency, the Atomic Energy Commission, during the period 1952-1989. Thorium was also processed, but on a smaller scale, and is still stored on the site. Production activities were stopped in 1989, and the production mission of the facility was formally ended in 1991. The FEMP was included on the National Priorities List in 1989. The current mission of the site is environmental restoration in accordance with the requirements of CERCLA, as amended by SARA.

Although not considered part of OU3, environmental media are part of the potential transport and exposure pathways that must be considered. This section presents a description of the environmental media and the characteristics of the FEMP that may be affected by the proposed remedial activities. A brief description of the physical, environmental, and demographic settings of the study area is provided in this section. Topics discussed include

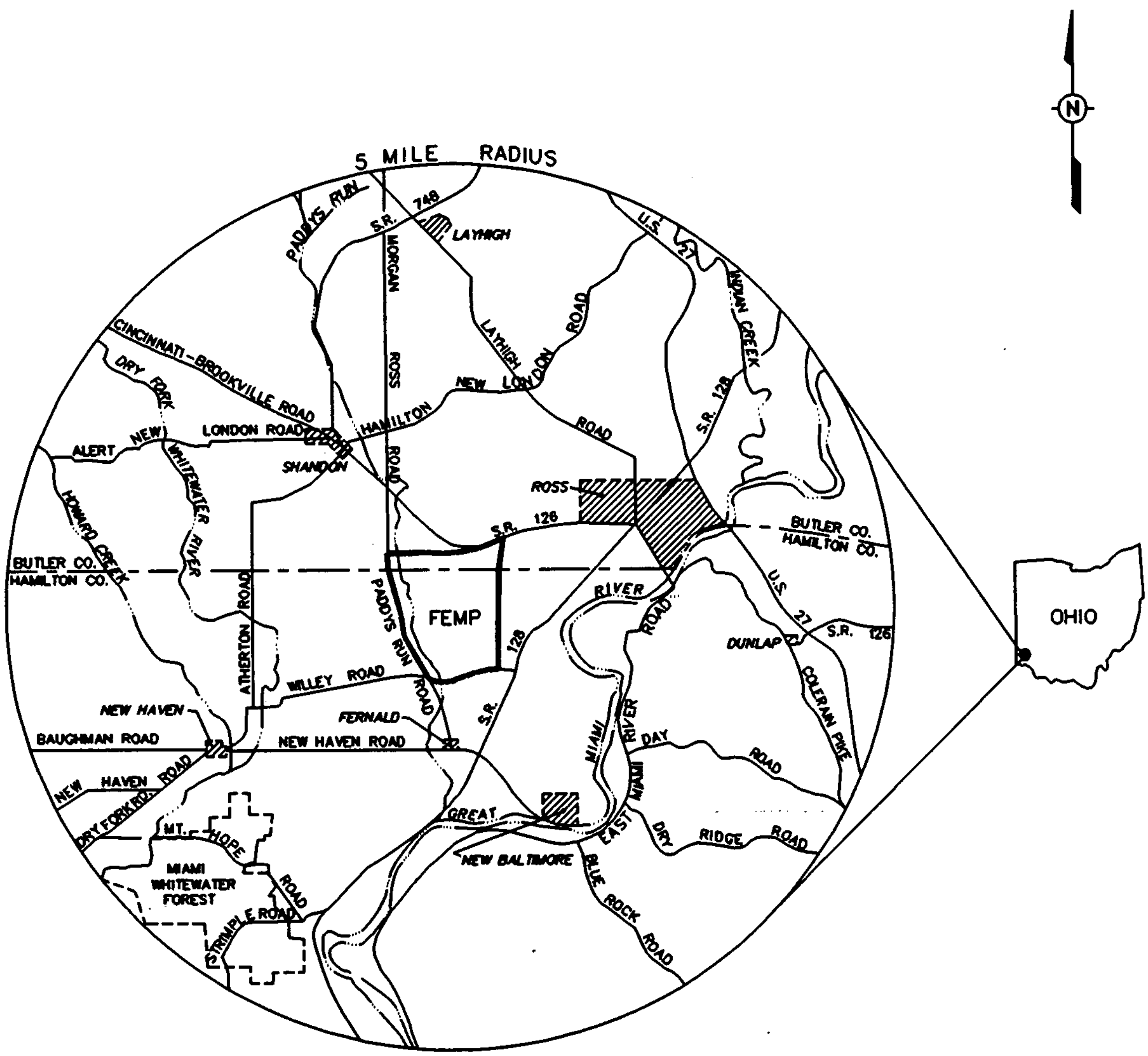

FIGURE 2-1 Location of the FEMP Facility

air quality, meteorology, topography and surface water hydrology, soils and seismology, geology and groundwater hydrology, socioeconomics and land use, biotic resources, and wetlands and floodplains. More extensive discussions of these topics are provided in the SWCR (DOE 1993c) and the OU3 RI/FS Work Plan Addendum (DOE 1993b).

Air Quality

Radioactive and nonradioactive airborne particles are generated by remediation and restoration activities, as well as containerization and packaging of wastes. Airborne particles eventually settle to the ground, creating a potential for resuspension, as well as a potential for introduction to the human food chain through soil, grass, produce, and milk. For these reasons, the air pathway is considered to have the greatest potential for exposure of the public. Through site monitoring programs, engineering controls, and work practices, potential off-site exposures are minimized.

Existing site conditions at the FEMP are in compliance with air quality and health protection standards of the National Ambient Air Quality Standards and the State of Ohio.

Meteorology

Information on the local climate is available from two primary sources: an on-site meteorological system installed at the FEMP in 1986 and the National Weather Service Office at the Greater Cincinnati/Northern Kentucky International Airport.

The average annual precipitation for the Cincinnati area for the period of 1960 through 1989 was 40.56 inches and ranged from 27.99 inches in 1963 to 52.76 inches in 1979. The highest precipitation occurred during the spring and early summer. The maximum 24-hour rainfall event of record occurred in March 1964 when 5.21 inches fell. Precipitation is typically lowest in late summer and fall. The average annual snowfall for the 1960 to 1989 period was 23.5 inches, with the heaviest snowfall usually occurring in January. The maximum monthly snowfall of 31.5 inches occurred in January 1978.

Data from the on-site meteorological system, averaged over 1986 to 1992, were used to obtain the atmospheric dispersion results presented in Appendices D, E, and F.

Topography and Surface Water Hydrology

The maximum elevation on the site is along the northern boundary of the FEMP property and is approximately 700 feet above mean sea level (MSL). The former Production Area and the majority of OU3 components rest on a relatively level plain at about 580 feet above MSL. The plain slopes from 600 feet above MSL along the eastern boundary of the FEMP to 570 feet above MSL at the K-65 silos, and then drops off toward Paddys Run at an elevation of 550 feet above MSL. All drainage, including surface water, on the FEMP is generally from east to west into Paddys Run, with the exception of the extreme northeast corner, which drains east toward the Great Miami River.

Surface waters on and adjacent to the FEMP are the Storm Sewer Outfall Ditch, Paddys Run, and the Great Miami River. The Storm Sewer Outfall Ditch originates within the FEMP and flows toward the southwest where it enters Paddys Run, which flows southward along the western boundary of the facility. Paddys Run, in turn, is a tributary of the Great Miami River. The Great Miami River flows generally toward the southwest; however, locally it flows to the east and south.

Soils

Mineralogy as well as certain soil geochemical parameters influence both the physical characteristics of a soil and its ability to constrain or allow movement of dissolved organic and inorganic constituents. Soil characteristics affect (1) the suitability of a site for agriculture or construction, (2) the likelihood of erosion during remedial actions, and (3) the kinds of habitat (e.g., wetlands) that can develop on a site. Soils in the region of the FEMP were formed from materials deposited during the Wisconsin and Illinoisan glacial periods. These parent materials consist mainly of till, but include sand, gravel, glacial-lake clays, and silt clays. The soil series occurring within the FEMP are Dana, Eden, Fox, Genesee, Hennepin, Henshaw, Markland, Martinsville, Miamian, Radsdale, Raub, Russell, and Uniontown (USDA 1982).

Geology and Groundwater Hydrology of the FEMP

The FEMP lies in the Till Plains section of the Central Lowland physiographic province, characterized by structural and sedimentary basins and domes. The main physiographic features in the area are gently rolling uplands, steep hillsides along the major streams, and the

Great Miami River Valley. This valley is relatively broad, flat-bottomed, and flanked on either side by bluffs that rise to a maximum of 300 feet above the general level of the valley floor.

The Great Miami Aquifer is the principal aquifer within the FEMP Study Area and has been designated a sole source aquifer under the provisions of the Safe Drinking Water Act. The buried valley in which it occurs varies in width from about 0.5 mile to more than 2 miles, having a U-shaped cross section with a broad, relatively flat bottom, and steep valley walls. This valley is filled with extensive deposits of sand and gravel that range in thickness from 120 to 200 feet in the valley to only several feet in scattered silt and clay deposits along the valley walls. Large groundwater supplies occur in the sand and gravel deposits allowing the aquifer to yield a considerable amount of water.

Erratically distributed pockets of sand and gravel within the glacial overburden contain zones of perched groundwater. These zones are located throughout the Production Area and range in depth from 1 to 15 feet below the land surface.

Socioeconomics and Land Use

The FEMP is approximately 17 miles northwest of Cincinnati, Ohio, the focal point of a regional market encompassing the following thirteen counties in Ohio, Kentucky, and Indiana: Brown, Butler, Clermont, Hamilton, and Warren counties in Ohio; Boone, Campbell, Gallatin, Grant, Kenton and Pendleton counties in Kentucky; and Dearborn and Ohio counties in Indiana. These thirteen counties also define the Cincinnati Consolidated Metropolitan Statistical Area. Within a 5-mile radius of the FEMP there are an estimated 23,000 residents. Labor force in the multi-county area was more than 920,000 with unemployment at approximately 5.5 percent in December of 1991 (DOE 1993c).

The transportation network serving the FEMP region are three interstate highways (I-71, I-74 and I-75) providing inter-regional access to locations within the Cincinnati area and two interstate connectors (I-275 and I-471) providing intra-regional highway access. Primary roads providing access to the FEMP include S.R. 128, S.R. 126, New Haven Road, Willey Road and Paddys Run Road. A 1990 traffic count showed Willey Road carrying 800-1000 daily movements.

There are no areas within the FEMP boundaries considered to be prime farmland under the Farmland Policy Protection Act of 1981 (7 CFR 658). The farmland commercial activity adjacent to the FEMP is generally restricted to the village of Ross, approximately 3 miles northeast of the facility, and along State Route 128, south of Ross.

Cultural Resources

The area surrounding the FEMP has a large and diverse archaeological and historical resource base. According to records kept by the Miami Purchase Association for Historic Preservation, an unusually high percentage of the existing 19th century buildings in the area are historically important. Within the vicinity of the FEMP (a 2-mile radius from the boundary), there are three properties listed in the National Register of Historic Places and a number of additional structures that have been judged eligible for inclusion on the listing. Six major archaeological sites lie within 5 miles of the FEMP and five of these are included in the National Register.

Biotic Resources

The FEMP and surrounding areas lie in a transition zone between two distinct regions of the Eastern Deciduous Forest Province (Bailey 1978): the Oak-Hickory and the Beech-Maple forests. The region is characterized by the presence of a mosaic of these forest types. Beech-Maple forests are typically dominated by beech trees in the canopy, the uppermost layer of the forest, with sugar maples dominant in the understory, below the canopy. For the Oak-Hickory forest, the dominant species are oaks, with an abundance of hickories. The fauna vary little between the two forest sections and include white-tailed deer, gray fox, gray squirrel, white-footed mouse, and short-tailed shrew; the cardinal, woodthrush, summer tanager, red-eyed vireo, and the hooded warbler; the box turtle, and common garter snake (Bailey 1978; Shelford 1963).

Potential remedial actions at the FEMP must comply with the substantive requirements of the Endangered Species Act of 1973. To comply with Section 7 (a)(2) of this act, as amended, requiring federal agencies "...in consultation with and with the assistance of..." the Secretaries of the Interior and Commerce, to ensure that their actions are "...not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of the critical habitat of such species...", Miami University performed an Ecological Characterization Study of the FEMP in 1989. Updated surveys have been performed for the Sloan's crayfish and the cave salamander. The following discussions concern threatened and endangered species with potential habitats in the vicinity of the FEMP.

The Indiana bat (*Myotis sodalis*) is listed as both a federal and state endangered species. It is present in Butler and Hamilton counties. Surveys were conducted at the FEMP to determine it's distribution and presence and to identify potential habitat at the FEMP and the immediate vicinity. The Indiana bat has not been identified at the FEMP, but during the summer of 1988, a population was identified approximately 4.8 km (3.0 mi) northeast of the FEMP on Banklick Creek, a tributary of the Great Miami River (Facemire 1990). Potential habitat for the Indiana bat occurs in portions of the riparian woodland associated with Paddys Run. An updated survey will be performed to determine presence of individuals.

The cave salamander (*Eurycea lucifuga*), a state listed endangered species, has not been identified at the FEMP site. During the summer of 1988, a population was identified 1.6 km (1.0 mi) northeast of the FEMP at the Ross Trails Girl Scout Camp. Preliminary data from a 1993 survey has identified excellent habitat in an on-property well, but no individuals.

The Sloan's crayfish (*Orconectes sloanii*) is a state threatened species reported from Paddy's Run by Facemire et al. (Facemire 1990). Current preliminary data from a September 1993 survey shows populations residing in northern sections of Paddy's Run on-site and southern sections of Paddy's Run off-property near New Haven Road.

Several other threatened and endangered species also have the potential to occur in the vicinity of the FEMP. These include the following: Northern waterthrush (*Seiurus noveboracensis*), Northern harrier (*Circus cyaneus*), Red shouldered hawk (*Bueto lineatus*), Slender finger-grass (*Digitaria filiformis*), Mountain bindweed (*Polygonum cilinode*), Dark-eyed junco (*Junco hyemalis*), Running buffalo clover (*Trifolium stoloniferum*), and Cobblestone tiger beetle (*Cicendela margipennis*).

The cobblestone tiger beetle, listed as a Federal 2 (F2) species and statelisted special-interest species, was found in 1988, on a gravel bar in the Great Miami River 2 miles west/southwest of the bridge at New Baltimore, Ohio. As an F2 species, this beetle has been considered by the U.S. Fish and Wildlife Service for possible inclusion on the federal threatened or endangered species list. Special-interest species are listed by the Ohio Department of Natural Resources and are often eligible, with more information, to be listed as state threatened or endangered. This beetle remains on both lists because insufficient information on its past existence and habitat prevents it from being elevated to a threatened or endangered category.

Wetlands and Floodplains

The 100- and 500-year floodplains within the FEMP property are confined to the north-south corridor containing Paddys Run. Outside the boundaries of the FEMP, the 100- and 500-year floodplains of the Great Miami River extends west of the Big Bend area nearly to the eastern boundary of the facility. The 100-year floodplain of the river also extends northward along Paddys Run from the confluence of the two streams to a point about 600 feet from the southern boundary of the FEMP.

A site-wide wetland delineation was conducted in February 1993 in accordance with the 1987 Army Corps of Engineers Wetlands Delineation Manual. The purpose of the delineation was to determine the extent of jurisdictional wetlands and waters of the United States. A jurisdictional determination has been requested from the U.S. Army Corps of Engineers to verify the wetland boundaries and waters of the United States. Preliminary results from the site-wide delineation, subject to the U.S. Army Corps of Engineers approval, indicate a total of 35.9 acres of wetlands which included 26.58 acres of palustrine forested wetlands, 6.95 acres of drainage ditches/swales, and 2.37 acres of isolated emergent and emergent-scrub/shrub wetlands. On-site waters of the United States are confined to Paddys Run and an unnamed tributary and total approximately 8.9 acres. Some wetland areas occur on the perimeter of OU3.

2.2 Description of Operable Unit 3

Operable Unit 3 consists of the former Production Area and production-associated facilities and equipment. The 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. These media are within OU5, but are important as potential pathways between sources of contamination in OU3 and receptors.

Because of the complexity and large number of structures and other improvements included in OU3, the planning process for the OU3 RI/FS required the categorization of these components. The term *component* refers to the smallest physically distinct unit considered separately in the development and implementation of this Proposed Plan. The basis for identifying and categorizing OU3 components was developed in the RI/FS Work Plan Addendum for the operable unit. Table 2-1 provides a comprehensive list of the 227 OU3 components. For each component, the table lists the component name, its alpha-numeric designation, and its component category type. All components listed are within the scope of this Proposed Plan.

The Table 2-1 list includes all elements of OU3 designated as components as of the date of this Proposed Plan. This list, however, may change as the program progresses. For example, components would be taken off the list as the interim actions resulted in their demolition and storage. The list of components will be updated as new information warrants. Components are categorized on the basis of physical similarity or use into 11 separate component categories. Categories 1-4 consist of those OU3 components classified in the general category of structures, facilities, and/or buildings. The four categories are separated by basic function. Within each of these categories, individual components 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. Items not considered to be integral parts of the component are placed in category 9 or 10 (piping/utilities/equipment).

The 11 categories are defined as follows:

Category 1. *Administrative/Support Buildings*

Category 2. *Warehouse/Storage Buildings*

Category 3. *Process Buildings*

Category 4. *Process Support Buildings*

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TABLE 2-1 Operable Unit 3 Component Identification

Component	Component Designation	Category
Preparation Plant	1 A	3
Plant 1 Storage Shelter	1 B	2
Plant 1 Ore Silos	1 C	5
Ore Refinery Plant	2 A	3
General/Refinery Sump Control Bldg.	2 B	4
Bulk Lime Handling Building	2 C	4
Metal Dissolver Building	2 D	3
NFS Storage & Pump House	2 E	5
Cold Side Ore Conveyor	2 F	9
Hot Side Ore Conveyor	2 G	9
Conveyor Tunnel (From Plant 1)	2 H	10
Maintenance Building	3 A	4
Ozone Building	3 B	4
NAR Control House	3 C	1
NAR Towers	3 D	5
Hot Raffinate Building	3 E	3
Harshaw Digestion Fume Recovery	3 F	5
Refrigeration Building	3 G	4
Refinery Sump	3 H	5
Combined Raffinate Tanks	3 J	5
Old Cooling Water Tower	3 K	10
Electrical Power Center Building	3 L	4
Green Salt Plant	4 A	3
Plant 4 Warehouse	4 B	2
Plant 4 Maintenance Building	4 C	4
Metals Production Plant	5 A	3
Plant 5 Ingot Pickling	5 B	4
Plant 5 Electrical Substation	5 C	4
West Derby Breakout/ Slag Milling	5 D	4
Plant 5 Filter Building	5 E	2
Plant 5 Covered Storage Pad	5 F	2
Plant 5 Ingot Storage Shelter	5 G	2
Metals Fabrication Plant	6 A	3
Plant 6 Covered Storage Area	6 B	2
Plant 6 Electrostatic Precipitator (South)	6 C	3
Plant 6 Electrostatic Precipitator (Central)	6 D	9
Plant 6 Electrostatic Precipitator (North)	6 E	3
Plant 6 Salt Oil Heat Treat Building	6 F	3
Plant 6 Sump Building	6 G	3
Plant 7	7 A	2
Plant 7 Overhead Crane	7 B	9
Recovery Plant	8 A	3
Plant 8 Maintenance Building	8 B	4
Rotary Kiln/Drum Reconditioning	8 C	3
Plant 8 Railroad Filter Building	8 D	4
Drum Conveyor Shelter	8 E	9
Plant 8 Old Drum Washer	8 F	9
Special Products Plant	9 A	3
Plant 9 Sump Treatment Facility	9 B	3
Plant 9 Dust Collector	9 C	9
Plant 9 Substation	9 D	4
Plant 9 Cylinder Shed	9 E	4
Electrostatic Precipitator	9 F	3
Boiler Plant	10 A	4
Boiler Plant Maintenance Bldg.	10 B	4
Wet Salt Storage Bin	10 C	4
Cont. Oil/Graphite Burn Pad.	10 D	8
Service Building	11	1
Main Maintenance Building	12 A	4
Cylinder Storage Building	12 B	2
Lumber Storage Building	12 C	2
Pilot Plant Wet Side	13 A	3
Pilot Plant Maintenance Bldg.	13 B	4
Sump Pump House	13 C	3
Pilot Plant Thorium Tank Farm	13 D	5
Administration Building	14 A	1
Building 14 EOC Generator Set	14 B	9
Laboratory	15	3
Main Electrical Station	16 A	9
Electrical Substation	16 B	4
Electrical Panels & Transformer	16 C	9
Main Electrical Switch House	16 D	4
Main Electrical Transformers	16 E	9
Trailer Substation #1	16 F	9
Trailer Substation #2	16 G	9
10-Plex North Substation	16 H	9
10-Plex South Substation	16 J	9
BDN Surge Lagoon	18 A	11
General Sump	18 B	5
Coal Pile Runoff Basin	18 C	11
Biodenitrification Towers	18 D	3
Storm Water Retention Basin	18 E	11
Clearwell Pump House	18 G	3
BDN Effluent Treatment Facility	18 H	3
Methanol Tank	18 J	5
Low Nitrate Tank	18 K	11
High Nitrate Tank	18 L	11
High Nitrate Storage Tank	18 M	5
Main Tank Farm	19 A	5
Pilot Plant Ammonia Tank Farm	19 B	5
Tank Farm Control House	19 C	4
Old North Tank Farm	19 D	5
Pump Station & Power Center	20 A	4
Water Plant	20 B	4
Cooling Towers	20 C	9
Elevated Potable Storage Tank	20 D	5
Well House #1	20 E	4
Well House #2	20 F	4
Well House #3	20 G	4
Process Water Storage Tank	20 H	5
Gas Meter Building	22 A	4
Storm Sewer Lift Station	22 B	4
Truck Scale	22 C	4
Scale House & Weigh Scale	22 D	4
Utility Trench to Pit Area	22 E	10
Meteorological Tower	23	9
Railroad Scale House	24 A	4
Railroad Engine House	24 B	4
Chlorination Building	25 A	4
M.H.#175/Eff. Line/Sampling Bldg.	25 B	4
Sewage Lift Station Building	25 C	4
U.V. Disinfection Building	25 D	4
Digester & Control Building	25 E	4
Sludge Drying Beds	25 F	11

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TABLE 2-1 Operable Unit 3 Component Identification (Cont'd)

Component	Component Designation	Category	Component	Component Designation	Category
Primary Settling Basins	25 G	11	Plant 2 West Pad	74 B	8
Trickling Filters	25 H	5	Plant 8 East Pad	74 C	8
10-Plex Sewage Lift Station	25 J	10	Plant 8 West Pad	74 D	8
Pump House-HP Fire Protection	26 A	4	Plant 4 Pad	74 E	8
Elevated Water Storage Tank	26 B	5	Plant 7 Pad	74 F	8
Main Electrical Strainer House	26 C	4	Plant 5 East Pad	74 G	8
Security Building	28 A	1	Plant 5 South Pad	74 H	8
Human Resources Building	28 B	1	Plant 6 Pads	74 J	8
Guard Post on South End of 'D' St.	28 C	1	Plant 9 Pad	74 K	8
Guard Post on West End of 2nd St.	28 D	4	Building 65 West Pad	74 L	8
Chemical Warehouse	30 A	2	Building 64 East Pad & R.R. Dock	74 M	8
Drum Storage Warehouse	30 B	2	Building 12 North Pad	74 N	8
Old Ten Ton Scale	30 C	8	Decontamination Pad	74 P	8
Engine House/Garage	31 A	3	Plant 8 Old Metal Dissolver Pad	74 Q	8
Old Truck Scale	31 B	8	Plant 8 North Pad	74 R	8
Magnesium Storage Building	32 A	2	Building 63 West Pad	74 S	8
Building 32 Covered Loading Dock	32 B	2	Plant 1 Storage Pad	74 T	8
Pilot Plant Annex	37	3	Pilot Plant Pad	74 U	8
Propane Storage	38 A	4	Laboratory Pad	74 V	8
Cylinder Filling Station	38 B	9	Building 39A Pad	74 W	8
Incinerator Building	39 A	3	Finished Products Warehouse(4A)	77	2
Waste Oil Decant Shelter	39 B	3	*D & D Building (Under Constr.)*	78	4
Incinerator Sprinkler Riser House	39 C	4	Plant 6 Warehouse	79	2
Sewage Treatment Plant Incinerator	39 D	9	Plant 8 Warehouse	80	2
Rust Engineering Building	45 A	1	Plant 9 Warehouse	81	2
Utility Shed East of Rust Trailers	45 B	4	Receiving/Incoming Mat'ls. Insp.	82	2
Heavy Equipment Building	46	4	Clearwell Line	88	10
Six to Four Reduction Facility #2	51	4	Parking Lot	89	8
Health & Safety Building	53 A	1	Skeet Range Building	90	1
In-Vivo Building	53 B	1	Railroad Tracks	G-001	8
Six to Four Reduction Facility #1	54 A	3	Roads	G-002	8
Pilot Plant Shelter	54 B	2	Storm Sewer System	G-003	10
Pilot Plant Dissociator Shelter	54 C	4	Utility Lines	G-004	10
Slag Recycling Building	55 A	3	Underground Storage Tanks	G-005	6
Slag Recycling Pit/Elevator	55 B	3	Process Trailers	G-006	1
CP Storage Warehouse	56 A	2	Non-process Trailers	G-007	1
Storage Shed (West)	56 B	2	Pipe Bridges	G-008	9
Storage Shed (East)	56 C	2	Drums (Non-RCRA)	G-009	5
Quonset Hut #1	60	2	RCRA Drums	G-010	5
Quonset Hut #2	61	2	Inventory	G-011	5
Quonset Hut #3	62	2	Mobile Containers (Sea-Land)	G-012	5
KC-2 Warehouse	63	2	Soil Piles	G-013	7
Thorium Warehouse	64	2	Rock salt pile	P-001	7
(Old) Plant 5 Warehouse	65	2	Sand piles	P-002	7
Drum Reconditioning Building	66	3	*Gravel pile*	P-003	7
Plant 1 Thorium Warehouse	67	2	Copper metal scrap pile	P-004	7
Pilot Plant Warehouse	68	2	Coal pile	P-005	7
Decontamination Building	69	3	*Scrap metal pile*	P-006	7
General In-Process Warehouse	71	2	Outside Equipment Storage Area	P-007	7
Drum Storage Building	72	2	Tension Support Structure #1	TS-001	2
Fire Brigade Training Center Bldg.	73 A	1	Tension Support Structure #2	TS-002	2
Fire Training Pond	73 B	11	Tension Support Structure #3	TS-003	2
Fire Training Tank	73 C	5	Tension Support Structure #4	TS-004	2
Fire Training Burn Trough	73 D	6	Tension Support Structure #5	TS-005	2
Confined Space Burn Tank	73 E	5	Tension Support Structure #6	TS-006	2
Plant 2 East Pad	74 A	8			

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

Category 6. *Containers/Containerized Material, Below-ground* — As for Category 5, except components are below-ground.

Category 7. *Bulk Material* (includes waste piles) — Category 7 includes all existing scrap piles, copper piles, soil piles, and similar items within OU3. It also is intended that this category 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.

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

Category 9. *Piping/Utilities/Equipment, Above-ground* — Category 9 includes all above-ground piping and utility systems, including outside tank and distribution systems.

Category 10. *Piping/Utilities/Equipment, Below-ground* — Category 10 includes all underground piping and utility systems.

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

Table A.2.0 in Appendix A of the OU3 RI/FS Work Plan Addendum (DOE 1993b) summarizes the typical types of construction of the buildings in OU3. To support the evaluation 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 hybrid designs.

Table A.2.1 in the OU3 RI/FS Work Plan Addendum 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 its unique alphanumeric component designator as identified in Table 2-1.

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 41-year history of the site. Table A.2.1 in the OU3 RI/FS Work Plan Addendum 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.

2.3 Description of Removal Actions in Operable Unit 3

Within OU3, several EPA approved removal actions are currently in progress. These removal actions, as defined in the Amended Consent Agreement (EPA 1991), represent the major projects within OU3 and will be coordinated with the proposed interim remedial action. The removal actions are grouped in three categories according to their relationship with the interim action. Each removal action is described in the subsections below.

2.3.1 Removal Actions Completed Before Interim Action

The following removal actions are anticipated to be complete prior to initiation of the interim action. Some of these removal actions will support the RD/RA work plan design and scheduling. Each of the removal actions detailed in this section have previously obtained NEPA approval through categorical exclusions or Environmental Assessments.

2.3.1.1 Removal No. 7 -- Plant 1 Pad Continuing Release

This interim action was initiated to mitigate the continuing release of contaminants from Plant 1 Pad until final remediation. This removal action was approved in 1991 in the Amended Consent Agreement and involves three stages of activity: (1) interim runoff control; (2) soil removal, new pad addition, and covered, controlled storage pad construction; and (3) installation of sealed concrete over existing contaminated concrete.

2.3.1.2 Removal No. 13 -- Plant 1 Ore Silos

This removal action involves the dismantling of the Plant 1 ore silos and their support structures. Deteriorated valves caused the silos to leak material onto a concrete pad in February 1992. Remaining material in the silos will be removed, containerized, and placed in safe storage pending final disposition. All 14 silos and support structures will be dismantled and demolished.

2.3.1.3 Removal No. 14 -- Contaminated Soils Adjacent to Sewage Treatment Plant Incinerator

To prevent any potential contaminant migration, this removal action involved the characterization, removal, containerization, storage, and disposal of soils with elevated uranium levels in the vicinity of an out-of-service solid waste incinerator at the sewage treatment plant.

2.3.1.4 Removal No. 15 -- Scrap Metal Piles

This removal action is intended to stabilize and disposition low-level radioactive waste scrap metal currently stockpiled outdoors at the FEMP site. The action is designed to eliminate potential for releases of contaminants to the environment from 1179 metric tons (1300 tons) of scrap copper and approximately 2722 metric tons (3000 tons) of other recoverable scrap metals.

2.3.1.5 Removal No. 19 -- Plant 7 Dismantling

The Plant 7 Dismantling removal action will address the potential for release of contaminants through decontamination and dismantlement of the Plant 7 structure and allow evaluation of decontamination and dismantling methodology for future CRU3 work. Field work is scheduled to begin in fiscal year 1994 and continue into fiscal year 1996. Any beneficial experience gained will be applied in the Remedial Design/Remedial Action Work Plan for the interim remedial action. Some material dismantled from this structure will be utilized in OU3 treatability studies.

2.3.1.6 Removal No. 20 -- Stabilization of Uranyl Nitrate Inventories

This removal action is designed to process uranyl nitrate inventories at the FEMP site to a stable form which can be drummed and stored in warehouses pending final disposition. There are approximately 871 m^3 (230,00 gal.) of acidic uranyl nitrate stored in 21 tanks in or near the Plant 2/3 refinery. A 1991 inspection of the tanks revealed that small leaks had developed in the piping system associated with the tanks.

2.3.1.7 Removal No. 24 -- Pilot Plant Sump

This removal action is concerned with an out-of-service sump at the Pilot Plant. The below-grade sump is a stainless steel cylinder approximately 0.6 m (2 ft) in diameter and 3 m (10 ft) deep which was installed to remove liquids from the floor drains of the Pilot Plant during a 1969 renovation. Sludges and liquids from the sump have high concentrations of lead, copper, chromium, nickel, thorium, and volatile organic compounds. The sump will be removed and its piping disconnected. The drain piping will be checked, the drain system plugged, and adjacent soils cleaned up as required.

2.3.1.8 Removal No. 25 -- Nitric Acid Tank Car and Area

This removal action is intended to remove the residual contents of a nitric acid railroad tank car, decontaminate and dispose of the tank car itself, and address potentially contaminated soils adjacent to the tank car. The tank car, which stored nitric acid from 1952 to 1989, has a capacity of 43,359 kg (100,000 lb) and now contains approximately 0.38 m^3 (100 gal.) of dilute nitric acid.

2.3.1.9 Removal No. 27 -- Management of Contaminated Structures

Removal No. 27 was initiated to minimize the risk from uncontrolled release of contaminants from 25 structures within OU3. This removal action involves the decontamination and dismantlement of 25 of the same components that are included in the scope of this Proposed Plan. Upon approval of the Proposed Plan, this removal action will be incorporated into the scope of the interim remedial action.

2.3.1.10 Removal No. 28 -- Fire Training Facility

This removal action is intended to remove contamination associated with the Fire Training Facility (Building 63) structures, equipment, surficial soils, and surface water. Prior to dismantling and removal activities, all liquids will be removed from the open top tank, the skid tank pond, the sump, and the horizontal pressure vessel end piece. These liquids will be treated prior to disposal. Each of these structures, in addition to the block building and asphalt pad, will be demolished and removed for disposal. Recycling or disposal of the structure materials (debris) will be managed in accordance with Removal No. 17 and Removal No. 9.

2.3.2 Removal Actions Ongoing and Unrelated to the Interim Action

These removal actions are programmatic in nature and represent actions being applied to OU3 as a whole. The Removal of Waste Inventories and Asbestos Abatement programs are unconnected to the interim action because they would occur and be completed within specific components before implementation of the interim action. Both of these programs have received NEPA approval.

2.3.2.1 Removal No. 9 -- Removal of Waste Inventories

Since 1986, low level wastes generated by production, maintenance, and construction activities at the FEMP have been containerized and stored for future disposition. At that time, the FEMP was also the DOE repository for thorium materials, maintaining an inventory of over 15,000 containers. Much of this thorium remains in storage at the FEMP. Removal No. 9 was initiated to establish waste management procedures and to implement packaging, shipment, and disposal of these materials at the Nevada Test Site (NTS). Activities under this removal action comply with all EPA and Department of Transportation (DOT) regulations, DOE Orders, and NTS waste-acceptance criteria. For the interim remedial action, it is assumed that all inventories addressed by this removal action would be previously removed from buildings, facilities, or structures prior to beginning decontamination and dismantlement activities.

2.3.2.2 Removal No. 26 -- Asbestos Abatement Program

The Asbestos removal action documents asbestos abatement activity at the FEMP to mitigate potential asbestos release and migration. Abatement within this program includes in-situ repairs, encasement and encapsulation, and removals. Actions under this removal action are a necessary step prior to initiation of decontamination and dismantlement activities. It is assumed that only transite and other non-friable Asbestos Containing Materials (ACM) will remain within the buildings, facilities, or structures after completion of this removal action. Air monitoring for occupational protection purposes showed no levels as high as the 0.2 fiber/cc limit for occupational exposure. ACM removal under the interim remedial action will be in accordance with this removal action.

2.3.3 Removal Actions Related to the Interim Action

Two actions are directly related to the interim action proposed; these actions are EPA-approved removal actions and impact or are significantly impacted by activities under this Proposed Plan. The two removal actions are Safe Shutdown (Removal No. 12) and Improved Storage of Soil and Debris (Removal No. 17). Safe Shutdown is a related activity because Safe Shutdown activities must occur and be completed before the interim remedial actions can be implemented on a component basis. Improved Storage of Soil and Debris is a related activity, which provides the management structure for interim storage of debris from the proposed action. These two removal actions, their NEPA compliance status, and their impacts on this Proposed Plan are described in the following sections and in Appendices E and F.

2.3.3.1 Removal No. 12 -- Safe Shutdown

This removal action was created to perform the safe shutdown of all process facilities in preparation for final remediation. Safe Shutdown entails the engineering, planning, scheduling and the actual isolation of process equipment, piping systems, and associated utilities and the removal of residual process materials (e.g. equipment hold-up) and other excess materials, supplies, and combustibles to appropriate disposition and approved storage locations. Activities associated with the interim remedial action would be coordinated with the Safe Shutdown schedule to allow scheduled Safe Shutdown activities to precede or be incorporated with activities of the interim remedial action. The NEPA review for Safe Shutdown activities was a categorical exclusion.

2.3.3.2 Removal No. 17 -- Improved Storage of Soil and Debris

Improved Storage of Soil and Debris was initiated to provide controlled storage of excess contaminated soils and debris generated during maintenance, construction, removal, and remedial actions at the FEMP. This removal action includes the implementation of a soil and debris management plan and the installation of a number of tension support structures (TSS). Removal No. 17 would provide a scrap metal pad cover (16,000 ft^2), a decontamination facility pad cover (10,000 ft^2), and a 40,000 ft^2 CSF. Five storage facilities in addition to the CSF would be needed to support interim waste storage from activities under this Proposed Plan. The NEPA review for the scrap metal pad cover and the decontamination facility pad cover was a categorical exclusion. However, additional documentation is needed to complete the NEPA review for the CSF; this documentation is being provided as part of this Proposed Plan. Although EPA has approved Removal No. 17, construction of the CSF cannot begin until the NEPA review by DOE is completed.

To facilitate the NEPA review, construction and operation of the CSF has been included within the scope of Alternative 3 in this Proposed Plan. Appendix E contains details of the CSF and the risks involved in construction and operation.

2.4 Nature and Extent of Contamination

The processes and operations within the former Production Area at the FEMP required the use of a variety of source feed materials and other radioactive and chemical reactants for both production and secondary operations. The production operations also generated a wide variety of waste materials containing both radiological and chemical constituents. During operations at the FEMP, material handling procedures resulted in chemical and radiological contamination within some OU3 components. As a result, these components may serve as current and future sources environmental contamination.

As data becomes available through the OU3 Field Characterization Program, it will be incorporated into the action proposed in this document. Early field sampling results will be available for development of the Remedial Design/Remedial Action Work Plan. The majority of field sampling data will become available for development of bid packages for vendor procurement and final design.

The following subsections, supported by Appendix B, present an overview of existing information on chemical and radiological contamination associated with the OU3 components. This summary is based upon data presented in the OU3 RI/FS Work Plan Addendum wherein additional information is available. The risk assessments and evaluations presented in this document are based on existing data and information available at the time of the document development.

Table 2-2 presents the OU3 RI/FS analyte list as developed in the OU3 RI/FS Work Plan Addendum for the characterization program. This list represents the standard EPA analyte list used for environmental characterizations with the addition of the radionuclides associated with the site. Many of the compounds included on this list have not been identified on this site, and are not expected to be found during the characterization program. Because of the nature of the uranium processing activities at the site, the predominant concerns would normally be radionuclides, inorganics, and solvents/degreasers (volatile organics). Because production ceased nearly three years earlier, the potential presence of volatile organics in the matrices associated with the structures is unlikely.

2.4.1 Radiological Contamination

Historical information and process knowledge, as detailed for each OU3 component in Table B-1, 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), and the associated daughters, including isotopes of lead and polonium. Additional radionuclides within OU3 that have been identified through analysis include isotopes of neptunium, plutonium, technetium, strontium, cesium, and americium. Table 2-2 lists the RI/FS analytes, including radionuclides, as developed for the OU3 RI/FS Work Plan Addendum.

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TABLE 2-2 OU3 RI/FS Analyte List

Radionuclides

Isotopic uranium
Isotopic thorium
Isotopic plutonium and 241
Radium-226 and 228
Neptunium-237
Americium-241
Cesium-137
Strontium-90
Lead-210
Polonium-210
Technetium-99
Alpha/Beta Screening

TAL Inorganics

Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Magnesium
Manganese
Mercury
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Vanadium
Zinc
Cyanide[1]

TCL Semi-Volatile Organics

1,2-Dichlorobenzene
1,2,4-Trichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2-Chloronaphthalene
2-Chlorophenol
2-Methylnaphthalene
2-Methylphenol
2-Nitroanilene
2-Nitrophenol
2,2-Oxybis-(1-chlororpropane)
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,6-Dinitrotoluene
3-Nitroaniline
3,3-Dichlorobenzidine
4-Bromophenyl-phenyl ether
4-Chloro-3-methylphenol
4-Chloroaniline
4-Chlorophenyl-phenyl ether
4-Methylphenol
4-Nitroaniline
4-Nitrophenol
4,6-Dinitro-2-methylphenol
Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
bis(2-Chloroethyl) ether
bis(2-Chloroethoxy) methane
bis(2-Ethylhexyl)phthalate
Butylbenzylphthalate
Carbazole
Chryzene
Dibenzofuran
Dibenzo(a,h)anthracene
Diethylphthalate
Dimethylphthalate
Di-n-butylphthalate
Di-n-octylphthalate
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Ideno(1,2,3-cd)pyrene
Isophorone
Napthalene
Nitrobenzene
N-Nitroso-di-n-dipropylamine
N-Nitrosodiphenylamine
Pentachlorophenol
Phenanthrene
Phenol
Pyrene

TCL PCBs

Arochlor-1016
Arochlor-1221
Arochlor-1232
Arochlor-1242
Arochlor-1248
Arochlor-1254
Arochlor-1260

TCL Volatile Organics

1,1-Dichloroethane
1,1-Dichloroethene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
1,1,2,2-Tetrachloroethane
1,2-Dichloroethane
1,2-Dichloroethene (total)
1,2-Dichloropropane
2-Butanone
2-Hexanone
4-Methyl-2-pentanone
Acetone
Benzene
Bromodichloromethane
Bromoform
Bromomethane
Carbon disulfide
Carbon tetrachloride
Chlorobenzene
Chloroethane
Chloroform
Chloromethane
cis-1,3-Dichloropropene
Dibromochloromethane
Ethylbenzene
Methylene chloride
Styrene
Tetrachloroethene
Toluene
Total Xylenes
trans-1,3-Dichloropropene
Trichloroethene
Vinyl Chloride

TCLP Metals

Arsenic
Barium
Cadmium
Chromium
Lead
Mercury
Selenium
Silver

TCLP Semi-Volatile Organics

1,4-Dichlorobenzene
2,4-Dinitrotoluene
Hexachlorobenzene
Hexachloroethane
Hexachloro-1,3-butadiene
Nitrobenzene
Pentachlorophenol
Pyridine
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
o-Cresol
m-Cresol
p-Cresol

TCLP Volatile Organics

Benzene
Carbon tetrachloride
Chlorobenzene
Chloroform
2-Butanone
1,2-Dichloroethane
1,1-Dichloroethylene
Tetrachloroethylene
Trichloroethylene
Vinyl chloride

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[1] Requested only in components with history of cyanide usage.

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Table B-1 in Appendix B lists potential radiological contaminants for each component within OU3; Tables B-2 presents a summary of radiological smear and direct survey samples by component; and Table B-3 presents airborne alpha and beta concentrations.

Through the ongoing radiation protection program at the FEMP, radiological data on most components is available. As part of this program, the following types of radiological information are collected:

- radiological smear and direct measurements for many individual OU3 components;
- smear and direct survey information on some abandoned in-place equipment;
- radon-222 and radon-220 monitoring; and
- airborne alpha and beta-emitting concentrations.

It should however, be noted that all of these types of information are not available at the current time for every component within OU3.

2.4.2 Chemical Contamination

Data on chemical contamination within OU3 is presented in Appendix B. This information is based on chemical analyses and process knowledge of all operations over a period of 38 years. The following subsections provide further information on chemical contamination within OU3. Additional data will be gathered as part of ongoing RI activities. As available, this data will be integrated with the remedial design activities to implement the interim action.

2.4.2.1 Hazardous Waste Management Units

The Resource Conservation Recovery Act (RCRA) program at the FEMP has identified a total of 53 Hazardous Waste Management Units (HWMUs) of which 48 HWMUs are located within OU3. After further investigation, several of the 48 units have been declared non-HWMUs (i.e., evidence does not support the original declaration as a HWMU). Five of the remaining units have already been through closure or are currently undergoing closure. Closure of interim status HWMUs is currently achieved by submitting a Closure Plan Information and Data (CPID) package to Ohio EPA for review and approval.

At the present time, 32 interim status RCRA HWMUs located in OU3 and listed in Table 2-3 require closure under requirements of Subpart G of 40 CFR 265 (OAC 3745-66-10 through 3745-66-20). Under this Proposed Plan, all substantive requirements of the Applicable or Relevant and Appropriate Requirements (ARARs) for closure of these HWMUs will be addressed under CERCLA interim remedial action. The Remedial Design/Remedial Action Work Plan(s), site procedures, and other documents will be submitted to Ohio EPA for review. Closure Plan Information and Data packages will be submitted to Ohio EPA for review and approval until such time as Ohio EPA approves integrated closure documentation.

Remedial Design/Remedial Action Work Plans, site procedures, and other documents meeting substantive requirements of RCRA ARARs will be submitted to Ohio EPA for review and comment. Closure of the HWMUs will be accomplished as part of the interim remedial action for OU3, and as part of the final remedial actions for OU3 and OU5. Discussions with representatives of OEPA are currently ongoing to successfully integrate RCRA closure activities with CERCLA removal/remediation actions.

Seven active HWMUs (listed in the FEMP 1991 RCRA Part B Permit Application) are a part of OU3. Although these active HWMUs (see Table 2-3) are within OU3, clean-up actions are being deferred from being performed under the interim ROD until closure under RCRA is complete. When these seven "permit pending" active HWMUs are no longer needed to store FEMP mixed waste, they will be closed under requirements of Subpart G of 40 CFR 264 (OAC 3745-55-10 through 3745-55-20). Upon completion of RCRA closure requirements for the seven active HWMUs, they will be remediated under the interim remedial action.

2.4.2.2 Other Chemical Contamination

The available information on potential chemical contaminants associated with individual components within OU3 is presented in Appendix B. The information presented in Appendix B

TABLE 2-3 Operable Unit 3 Hazardous Waste Management Units

HWMU # [a]	HWMU Description
	INTERIM STATUS UNITS
1	Fire Training Facility
3	Waste Oil Storage in Garage
4	Drum Storage Area Near Loading Dock (LAB)
5	Drum Storage Area South of W-26 (LAB)
6	Drummed HF Residue Storage Inside Plant 4
7	Drummed HF Residue Storage NW of Plant 4
8	Drummed HF Residue Storage South of Cooling Tower
9	Nitric Acid Rail Car and Area
10	NAR System Components
11	Tank Farm Sump
12	Wheelabrator - Building 66
13	Wheelabrator Dust Collector - Building 66
14	Box Furnace
15	Oxidation Furnace #1
16	Primary Calciner
17	Plant 8 East Drum Storage Pad
18	Plant 8 West Drum Storage Pad
21	Hilco Oil Recovery
22	Abandoned Sump West of Pilot Plant
25	Plant 1 Storage Building - Building 67
26	Detrex Still
28	Trane Thermal Liquid Incinerator
38	HF Tank Car
40	Bio-Surge Lagoon
41	Sludge Drying Beds
46	UNH Tanks - NFS Storage Area
47	UNH Tanks - North of Plant 2
48	UNH Tanks - Southeast of Plant 2
49	UNH Tanks - Digestion Area (2 Locations)
50	UNH Tanks - Raffinate Building (2 Locations)
52	North and South Solvent Tanks (Pilot Plant)
53	Safe Geometry Digestion Sump (Plant 1)
	PART B PERMIT (Active Units)
19	CP Storage Warehouse - Building 56 (Butler Building)
20	Plant 1 Pad
29	Plant 8 Warehouse (Building 80)
33	Pilot Plant Warehouse (Building 68)
34	KC-2 Warehouse (Building 63)
35	Plant 9 Warehouse (Building 81)
37	Plant 6 Warehouse (Building 79)

[a] HWMU numbers as listed on RCRA Part A Permit Application
HWMUs closed or undergoing closure: HWMU # 27, 30, 31, 32, 36
HWMUs declared non-HWMUs. (Ohio concurrence pending on some units): HWMU # 2, 23, 24, 39, 43, 44
HWMUs contained in other operable units: HWMU # 42, 45, 51

is qualitative in nature and based upon information developed in the OU3 Work Plan Addendum (DOE 1993b). It should be emphasized that the information presented in Appendix B represents potential contamination which may be present in the components.

An examination of the information presented in Table B-1 of Appendix B reveals several classes of chemical or contaminant groups of potential environmental concern in OU3. Principal chemical contaminant groups of concern are trace metals, other inorganics, volatile organic compounds (VOCs), semivolatile organics compounds (SVOCs), polychlorinated biphenyls (PCBs), and other materials such as oils for lubricating and heat treating. Based on the materials used at the site during operations, it is expected that radiological contaminants are a more significant source of carcinogenic risk than chemical contaminants.

Field characterization activities are scheduled to precede the interim remedial action. The results of the field characterization will be evaluated for use during development of the Remedial Design/Remedial Action Work Plan for the interim remedial action. Data will be integrated into health and safety requirements and the design process, consisting of monitoring, decontamination, dismantlement, packaging, transportation, and storage systems. Extensive use of appropriate field monitoring equipment (PID, XRF) will be employed during field implementation of the interim action to prevent exposure of workers to concealed chemical contamination.

In addition to the chemical contaminants discussed above, many of the components have been identified as having asbestos containing material (ACM). The analyses of bulk samples (Diagnostic Engineering Inc., 1992) however, indicate wide variations in the percentages of samples displaying positive ACM analysis results. This data is presented in the OU3 RI/FS Work Plan Addendum.

2.4.3 Mixed Waste

Mixed wastes are hazardous (RCRA) wastes that have been contaminated with radiological wastes. Radiological contamination appears to be relatively widespread throughout many components in OU3. On the basis of the information on materials handling practices and the potential chemical contamination discussed in Section 2.4.2, it is possible that some of the materials and wastes associated with OU3 components may fall into the category of mixed waste. The volumes of material included in this category are currently uncertain.

2.5 Summary of Risks for Operable Unit 3

As discussed in Section 2.2, OU3 consists of a large number of structures, including the process and support facilities at the FEMP, a large quantity of drummed inventory and waste, and various piles of materials. The process facilities, in particular, are complex structures that contain equipment, process lines, outside dust collectors, and various tanks, sumps, and dikes. OU3 contains no environmental media except for previously excavated soil piles; the contaminated media in OU3 are generally the construction materials contained in the structures. Although DOE maintains an active maintenance program, the facilities in OU3 are generally at or beyond their design lives and in a state of advancing deterioration. For example, long-term exposure to nitric acid fumes and splashes from the uranium digestion process contained in Plant 2/3 has eroded the support structure. Additionally, areas of Plant 6 and the thorium storage buildings (64 and 65) are in a deteriorated state and provide insufficient protection of their contents from the elements. Various sumps, such as one west of the former Pilot Plant, contain contaminants that could potentially be released to soils or groundwater. Significant maintenance and renovation would be required in the future simply to maintain the integrity of various structures.

On the basis of process knowledge, the most significant potential contaminants in OU3 are expected to be uranium and thorium and their decay products, along with various trace metals, solvents, PCBs, and asbestos. These contaminants are expected to be located primarily in the former process buildings and in waste residues. Section 2.4 summarizes the nature and extent of contamination in OU3.

Under current conditions, the primary routes by which individuals could be exposed to OU3 contaminants are direct exposure to and direct contact with the contaminants present in the OU3 components. In addition, small quantities of contaminants, such as uranium dust, can be released to the air and contaminants can be discharged to surface water from sources in the operable unit. A potential also exists for releases of contaminants to groundwater from building sumps or other contaminated areas.

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Exposures of on-site workers and site visitors to contaminants are occurring as well as the exposure of any trespassers in OU3. However, because DOE controls access to the site, trespassers are not expected to have access to contaminated areas in OU3. Nearby off-site residents and users of foodstuffs produced near the site are potentially exposed to the small quantities of contaminants that are released from OU3. The major current concern associated with the presence of contamination in OU3 is for the exposure of on-site workers.

Risks associated with exposures to OU3 contaminants are currently low. It is estimated that a hypothetical maximally exposed off-site individual currently receives a total annual radiological dose from the FEMP (exclusive of the dose received from radon, which originates primarily from non-OU3 sources) of about 1 millirem (DOE 1993d). This dose corresponds to a risk of about 6×10^{-7} that such a hypothetical individual will develop cancer as a result of the exposure. This dose is equivalent to that received by an individual flying in an airplane at 39,000 feet for approximately two hours due to natural radiation exposure. Because OU3 contributes only a fraction of the 1 millirem dose from the site as a whole, this estimate provides an upper bound on the carcinogenic risk to an off-site individual that results from radiological contaminants from OU3. This is a small fraction of the dose received by the individual as a result of exposure to natural background radiation. Radiological doses to individuals currently working on-site are limited by DOE's own standards and are relatively low in comparison. They are also within regulatory limits. However, doses and risks to a hypothetical trespasser could be higher if it is assumed that such an individual has frequent and/or prolonged exposure to areas of highest contamination in the operable unit. Carcinogenic risks associated with exposures to chemicals are expected to be less than the risks associated with the exposures to radiological contaminants, on the basis of the materials utilized at the site. Non-carcinogenic effects of exposures to chemical contaminants have not been quantified but are also expected to be low. In its current state, OU3 poses no significant threat to human health as long as access controls of contaminated areas are maintained and facilities and waste storage systems are maintained.

More significant releases of contaminants and resulting exposures could occur in the future if no remediation of OU3 is undertaken. The major concern for OU3 is the potential for increased future risks as components deteriorate, increasing the potential for the release of contaminants. Actual or threatened release of hazardous substances from OU3, if not addressed by the preferred alternative or one of the other active measures considered, may present a current or potential threat to public health, welfare, or the environment.

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3.0 REMEDIAL ACTION ALTERNATIVES

Interim remedial action alternatives were developed in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR 300) and EPA's Guidance for Conducting RI/FS Under CERCLA (EPA 1988). The values of NEPA were incorporated into the alternative-development process. The No Action Alternative (Alternative 0) was included in the document in accordance with the requirements of NEPA (10 CFR 1021.321 (c)). The following subsections identify the remedial action alternatives considered under this Proposed Plan.

3.1 Alternative 0 -- No Action

The "No Action" alternative describes an "as is" condition of all components in OU3 with no further action occurring. Under this alternative, none of the approved removal actions, other future remedial actions, or maintenance activities would be implemented. All components would be abandoned and allowed to further deteriorate, with increased probability for releases of radioactive and other contaminants to the environment.

Therefore, the No Action Alternative would not meet the NCP threshold criterion for overall protection of human health and the environment. Because it does not meet the threshold criterion, the No Action Alternative will receive no further evaluation or discussion in this Proposed Plan.

3.2 Alternative 1 -- No Interim Action

The "No Interim Action" Alternative involves the continuation of all currently approved programs. No acceleration of site remediation would occur under this alternative. This alternative assumes that existing and approved removal actions and site maintenance programs will continue. As required, additional removal actions may be proposed to minimize potential risks. Final remedial action for OU3 components would be determined in the final ROD, presently scheduled for submittal in draft to EPA in April 1997. Analysis of this alternative also satisfies the NEPA "No Action" Alternative analysis requirement.

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3.3 Alternative 2 -- Decontaminate Surfaces Only

Alternative 2 involves in-situ gross decontamination of interior and exterior surfaces of OU3 above-grade components and disposition of generated wastes through existing waste programs. In-situ decontamination of facilities within OU3 would be pursued to minimize releases of contaminants to the environment. This alternative would reduce existing surface contamination levels, thereby reducing direct exposure potential, as well as reducing available sources for wind-born or water-born contamination. All previously approved programs, maintenance activities, and presently approved removal actions would continue under this alternative. As required, additional removal actions might be proposed to further minimize potential risks. No further containment, stabilization, or removal of contamination within components would be included in the scope of this alternative.

Decontamination activities for a component would be initiated after completion of Safe Shutdown activities in the component. Safe Shutdown would carry out necessary actions that must precede the decontamination of the former process facilities. Safe Shutdown for a given facility can, generally, be described as the removal of stored product inventories, de-energization and lock-out of process equipment, and the removal and transfer of salable equipment to off-site vendors.

The methods that would be used for removing gross surface contamination would depend on the type and level of contamination present and the matrix it is found on (for example concrete block, transite, steel, etc). Surface decontamination measures would be used to remove contamination from interior and exterior walls, floors, ceilings, and structural members. Vacuum systems and/or directed air flow would be utilized in order to reduce the potential for contaminant release and migration during the decontamination activities. Table 3-1 lists a variety of proven, potential decontamination technologies that would be effective for use with the implementation of the action. The ultimate selection of decontamination technologies would not be limited to these listed. New and/or innovative technologies developed from the OU3 RI/FS Treatability Studies would be incorporated into the process as appropriate.

TABLE 3-1 Potential Decontamination Technologies

Technology	Media	Secondary Waste Stream
Brushing, scraping, wiping	Any solid	Dry residue
Scrubbing (manual or mechanical)	Concrete, metal, plastic, transite	Residue
Scabbling	Concrete	Concrete residue
Vacuuming	Any	Collected residue
Pressurized steam	Concrete, metal	Wet residue
Strippable coating	Any surface	Coating and contaminants
Water jet (high or low pressure)	Concrete, metal, plastic, transite	Contaminated water
Shot blasting	Metals, concrete	Shot and residue
Grit blasting	Metals, concrete	Grit and residue
CO_2 pellet blasting	Concrete, metals, plastic, painted surfaces	Residue
Chemical foams, gels, pastes	Metals	Foams, gels, pastes, and removed contaminants

Secondary liquid and/or solid waste streams generated during implementation of Alternative 2 would be treated to the extent feasible using existing site systems in a manner fully compliant with identified ARARs and TBCs in order to help facilitate the action in a manner which is timely and protective of human health and the environment. Within HWMU areas, decontamination actions would be separated from actions in non-HWMU areas to minimize generating mixed wastes.

Environmental monitoring would be conducted during all activities associated with Alternative 2. The approach used for monitoring and the contingency measures that would be used if increased concentrations of airborne contaminants were detected during implementation of the alternative would be similar to those discussed below for Alternative 3.

On the basis of projected funding levels, it is estimated that decontamination activities would take about 4 years. Decontamination activities would require approximately 108 full-time workers. It is estimated that about 900,000 person-hours would be required to implement Alternative 2.

3.4 Alternative 3 -- Decontaminate and Dismantle

Alternative 3 primarily involves the decontamination and dismantlement of all OU3 components and the interim storage of the resulting wastes. Implementing Alternative 3 would effectively separate remedial action decisions concerning the decontamination and dismantlement of OU3 components from decisions concerning material and/or waste treatment and disposition. Generally, waste and material treatment and disposition would be addressed by the ongoing RI/FS process with a decision provided in the final ROD for OU3.

The primary scope of Alternative 3 is removal of gross surface contamination from material in components, dismantlement of components, and interim storage of the resulting material/wastes. To the extent practical, the gross surface decontamination effort would maximize recycling and minimize waste generation. In order to facilitate the implementation of Alternative 3 and prevent constraints due to storage space limitations, a limited quantity of wastes would be shipped off-site for disposition.

The interim storage of materials and wastes would be managed under Removal No. 17, Improved Storage of Soil and Debris (DOE 1993a). Related to Alternative 3 is the ongoing Safe Shutdown program (Removal No. 12), which is managing the shutdown of the former process facilities before decontamination and dismantlement actions.

Decontamination and dismantlement activities for a component would be initiated after completion of Safe Shutdown activities in the component. Similar to the case for Alternative 2, Safe Shutdown would carry out necessary actions which must precede the decontamination and dismantlement of the former process facilities. Alternative 3 would include subsequent removal of gross surface contamination, asbestos removal, structural dismantlement and removal, staging of materials, size reduction of materials as necessary, and ending with interim storage and limited off-site disposition.

Figure 3-1 outlines the activities associated with Safe Shutdown and the implementation of

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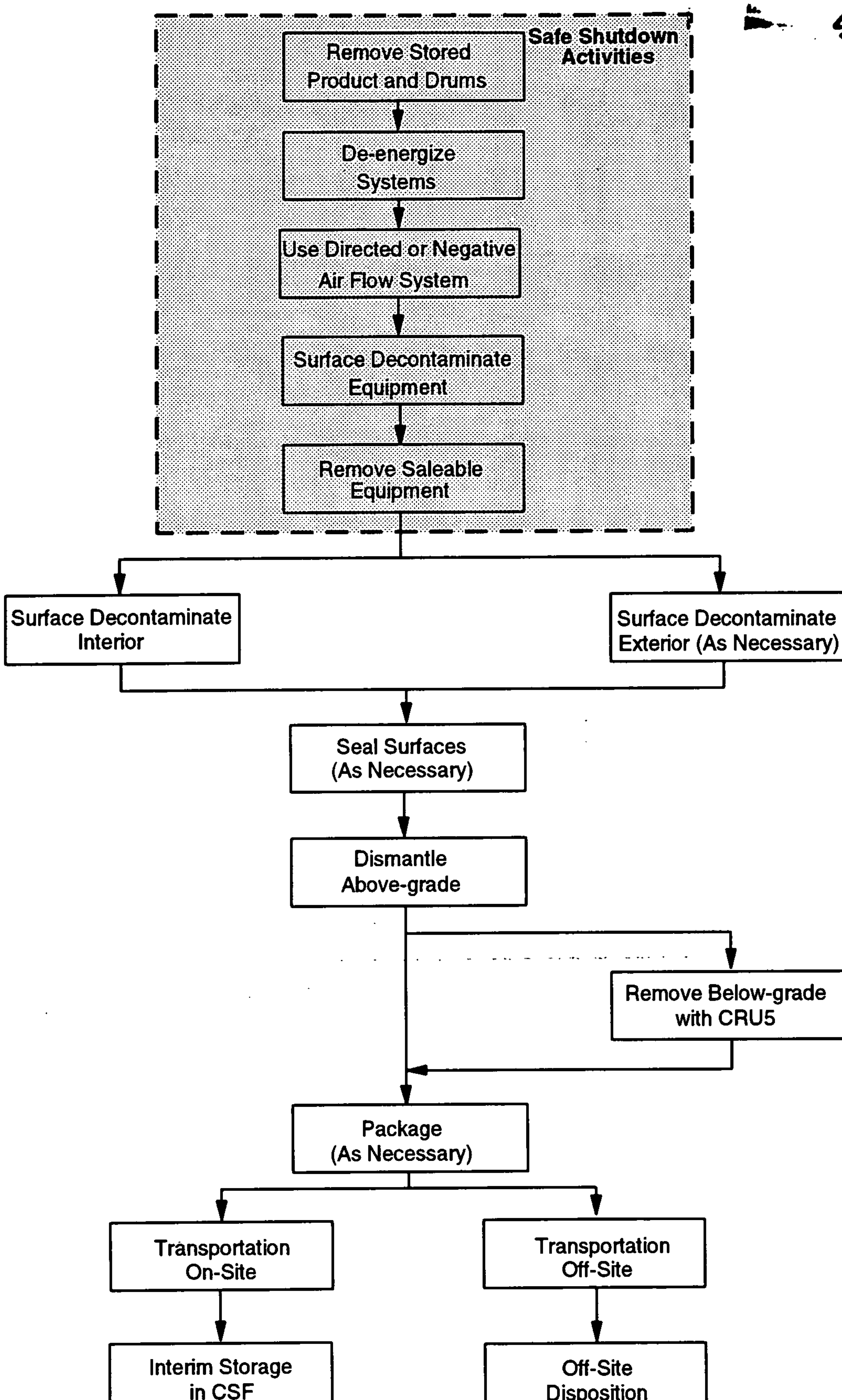

FIGURE 3-1 Safe Shutdown and Alternative 3 Flow Chart

Alternative 3. Environmental monitoring would be conducted during all decontamination and dismantling activities and during the interim storage period. Engineering controls would be utilized throughout implementation of the interim action to control airborne emissions, minimize releases, and maintain a safe work environment.

To address any concern regarding a potential increase in airborne radionuclide concentrations above natural background levels, air would be monitored at both the site perimeter and at nearby locations for the duration of cleanup activities. In addition, mobile air samplers would be used in the work areas to ensure that airborne releases were maintained at low levels. If airborne concentrations were detected at above background levels at nearby receptor locations, contingency measures would be implemented to reduce contaminant emissions. For example, work could be stopped, exposed areas covered or otherwise controlled, and engineering measures could be increased prior to restarting work to ensure that nearby members of the general public would not be adversely impacted. Extensive monitoring would be applied in combination with stringent engineering controls to ensure the safety of workers and the general public.

The implementation of Alternative 3 would, generally, proceed with dismantlement of above-grade components before below-grade components. After above-grade decontamination and dismantlement, foundations, slabs, and pads would be decontaminated or stabilized to minimize further soil contamination. Removal of foundations, slabs, pads, and subsurface utilities would be scheduled to coincide with OU5 remedial actions. Remediation of at grade and below-grade components would be conducted jointly with soil excavation and treatment. Specific component decontamination and dismantling would be scheduled to attain the greatest risk reduction as early as possible. Additional factors to be considered in the development of the schedule are estimation of funding available; facility and utility requirements during remediation; and coordination of activities with other OUs including soil and groundwater remediation.

Based on projected funding levels, preliminary estimates have indicated that the decontamination and dismantlement action would take approximately 16 years to complete. This 16 year estimate is based on an annual contribution from approximately 160 workers performing the decontamination and dismantlement action and other miscellaneous activities along with approximately 16 workers supporting the interim storage efforts. The effort to implement Alternative 3 is estimated at approximately 6 million person-hours, not including efforts related to ongoing site operations and maintenance.

The methods used for removing gross surface contamination would depend on the type and level of contamination present and the matrix it is found on (for example concrete block, transite, steel, etc). Surface decontamination measures would be used to remove contamination from interior and exterior walls, floors, ceilings, and structural members. Vacuum systems and/or directed air flow would be utilized in order to reduce the potential for contaminant release and migration during the decontamination activities. Table 3-1 lists a variety of proven, potential decontamination technologies that would be effective for use with the implementation of the action. The ultimate selection of decontamination technologies would not be limited to these listed. New and/or innovative technologies developed from the OU3 RI/FS Treatability Studies would be incorporated into the process as appropriate.

Secondary liquid and/or solid waste streams generated during implementation of Alternative 3 would be treated to the extent feasible using existing site systems in a manner fully compliant with identified ARARs and TBCs in order to help facilitate the action in a manner which is timely and protective of human health and the environment.

Most of the components associated with this action are buildings. The remaining components include such items as tanks, utilities, storage pads, roads, railroads, ponds and basins. The facilities would be removed and/or dismantled by means of standard engineering procedures and equipment. Following issuance of a decision to proceed with the implementation of this action, a Remedial Design/Remedial Action Work Plan would be issued to provide more detailed plans and schedules for the removal of the contaminated components. The following discussion focuses on procedures that would be used to dismantle the various structures and facilities.

Because many of the buildings and structures are unique in terms of construction type and past use, dismantlement methods would vary with both building type and configuration. Six main building types have been identified as generally representative of buildings at the site:

- Structural steel with transite siding and roofing facilities (for example, Plants 4, 5, 6, and 9);
- Concrete block with built-up or composite roofing (for example, Administration building and Services building);
- Pre-engineered facilities with metal siding and roofing (for example, the newer RCRA storage warehouses);
- Wood frame with wood siding and metal roofing structures (for example, the guard houses);
- Tension support structures; and
- Open structural steel frame structures, (for example, the Harshaw tower and the NAR tower).

Decontamination and dismantlement procedures would be customized to deal with the unique features of these structures, as well as, other structures within the scope of this action.

The following procedure presents an example applicable to the dismantlement of a typical process building. The action would begin by removing yard structures and various exterior equipment and machinery that could restrict heavy equipment mobility and wall-removal operations. The surface decontamination process would typically begin with sealing of the structure or areas of the structure and applying directed air flow or negative pressure filtration to control airborne particles. A variety of surface decontamination techniques would then be employed to reduce the potential for generation of airborne contaminants during structure dismantlement. The dismantlement process of the facilities themselves would typically begin with the removal of asbestos materials followed, generally, with the removal of electrical equipment, piping, water lines, gas lines, tanks, heating, ventilation, and air conditioning (HVAC) duct work, and electrical lines. After these activities are complete, the structural shell of the component would be dismantled. Depending on the component, the specific dismantling activities may vary. For instance, the removal of transite panels would, generally, proceed from within the building outward. The last steps of the dismantling action would be the removal of any air filtration apparatus and the removal of the roof, exterior walls, and internal structural members.

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Materials resulting from dismantlement of the components would be segregated into two groups: one would go to interim storage facilities; the other would be containerized and transported off-site. Most of the dismantled materials would be sorted and transported to the interim storage facilities. Depending on the material type, some packaging might be required. For example, asbestos insulation from ducting would be wrapped or boxed prior to being transported to the interim storage facilities. Structural steel, for example, would probably be transported by crane or flat-bed truck.

Dust resuspension occurring from material and waste movements on site would be minimized by use of the existing paved roadways and the use of dust control measures, as necessary. Loose materials would be packaged and loads would be covered during transport, as necessary, to reduce the potential for contaminant release and migration. Concrete blocks, structural steel, or other materials which do not have high levels of removable contamination would likely be stored without additional packaging. Specific storage requirements for the various types of wastes and materials that would be generated by Alternative 3 are outlined in the Removal Action Work Plan for Removal No. 17, Improved Storage of Soil and Debris (DOE, 1993a).

Small quantities of non-recoverable and non-recyclable materials would be containerized, using white metal boxes (burial volume of 109 cubic feet) and/or SeaLand containers (burial volume of 1,349 cubic feet), and shipped off-site by truck for disposition at the Nevada Test Site (NTS). At this time, NTS is the only facility for which a NEPA review has been completed that can receive wastes from the FEMP. The identification of NTS in this document does not preclude the use of other disposal facilities once NEPA requirements have been met. Following NEPA review, these facilities will be considered as options for receipt of interim action materials.

The shipment of these wastes would be to the extent practical to facilitate the progress of the interim action by ensuring the availability of adequate on-site storage. The quantity of material estimated to be transported off-site before the final ROD is approximately 500,000 cubic feet and represents 648 shipments over a 3,300 kilometer trip to NTS.

Depending on the timing and sequencing of the decontamination and dismantlement, in relation to available interim storage space, only a limited quantity of waste would be dispositioned off-site; a maximum of less than 10 percent of all Alternative 3 wastes generated would potentially be shipped off-site for disposition prior to the final disposition decision being determined by the final ROD for OU3. Appendix G contains estimates of volumes of the construction debris that would be expected to be generated by the interim action, during the period before the final ROD.

As noted in Appendix G, approximately 50% or more of the waste volumes removed in the interim period may be dispositioned off-site. The 10% limitation on waste volumes allowed to be dispositioned off-site refers to 10% of the total OU3 volume of materials. The evaluation in Appendix G further details that the estimated quantity of materials to be dispositioned off-site during the interim period is approximately 4% of the total OU3 volume of materials.

Evaluation factors for the determination of which materials are recoverable, recyclable, or non-recoverable include, but are not limited to the following: economic considerations, available decontamination and/or treatment technologies, volume of secondary waste generated, monitoring capabilities, applicable contamination limits, availability of uses for the materials, and the availability of disposition options. As previously stated, opportunities for employing resource recovery, recycling, and waste minimization would be factored into the planning process for each activity conducted under the interim action.

The scope of Alternative 3 also includes the design, siting, procurement, construction, and operation of a Central Storage Facility (CSF) and additional interim storage facilities (approximately five as presently envisioned) which would be used to store the demolition debris and secondary wastes generated during the decontamination and dismantlement action. The CSF and the additional interim storage facilities would each be approximately 100 feet wide and 400 feet long and provide approximately 30,000 square feet of usable storage space.

Construction of the CSF and the additional interim storage facilities would impact approximately 12 acres. The construction of the additional interim storage facilities would be coordinated with the construction of the CSF and designed in accordance with the requirements of Removal No. 17 (DOE 1993a). The CSF would be constructed in a phased approach in order to support the storage requirements of Alternative 3. Figure 3-2 details the proposed location of the CSF (Removal No. 17 Phase I) and the additional interim storage facilities. For the remainder of the document, the CSF and the five planned interim storage facilities will be referred to collectively as the CSF. Appendices E and G provide additional information on the CSF as well as the anticipated waste volumes which would be generated from the decontamination and dismantlement action.

Under a maximum storage capacity needs, five storage facilities are envisioned. This maximum storage capacity situation would only occur if no waste generated by the interim action was dispositioned off-site. As detailed in Appendix G and illustrated on Figure 3-2, the minimum storage case would require three storage facilities.

The CSF would consist of a group of tension support structures (TSS) built with metallic frames covered by synthetic fabric. These structures would be used to shelter the decontamination wastes and dismantled materials and debris from the elements, control run-on and run-off, control stormwater erosion, and minimize dust particle emissions and resuspensions. The design life of the TSS fabric cover is reported to be at least ten years. The covers could be repaired or replaced, if needed, to extend the life of the structure(s). The durable synthetic fabric is composed of fire retardant material and is translucent, thus maximizing sunlight entry. Large doors would be located at both ends of the structure(s) to facilitate the movement of materials. Sufficient aisle space would be maintained within the structures in order to reduce the possibility of cross-contamination between different wastes or materials. As detailed in the approved Work Plan for Removal No. 17, material storage locations would be closely tracked to maintain the identity of the material sources (DOE 1993a).

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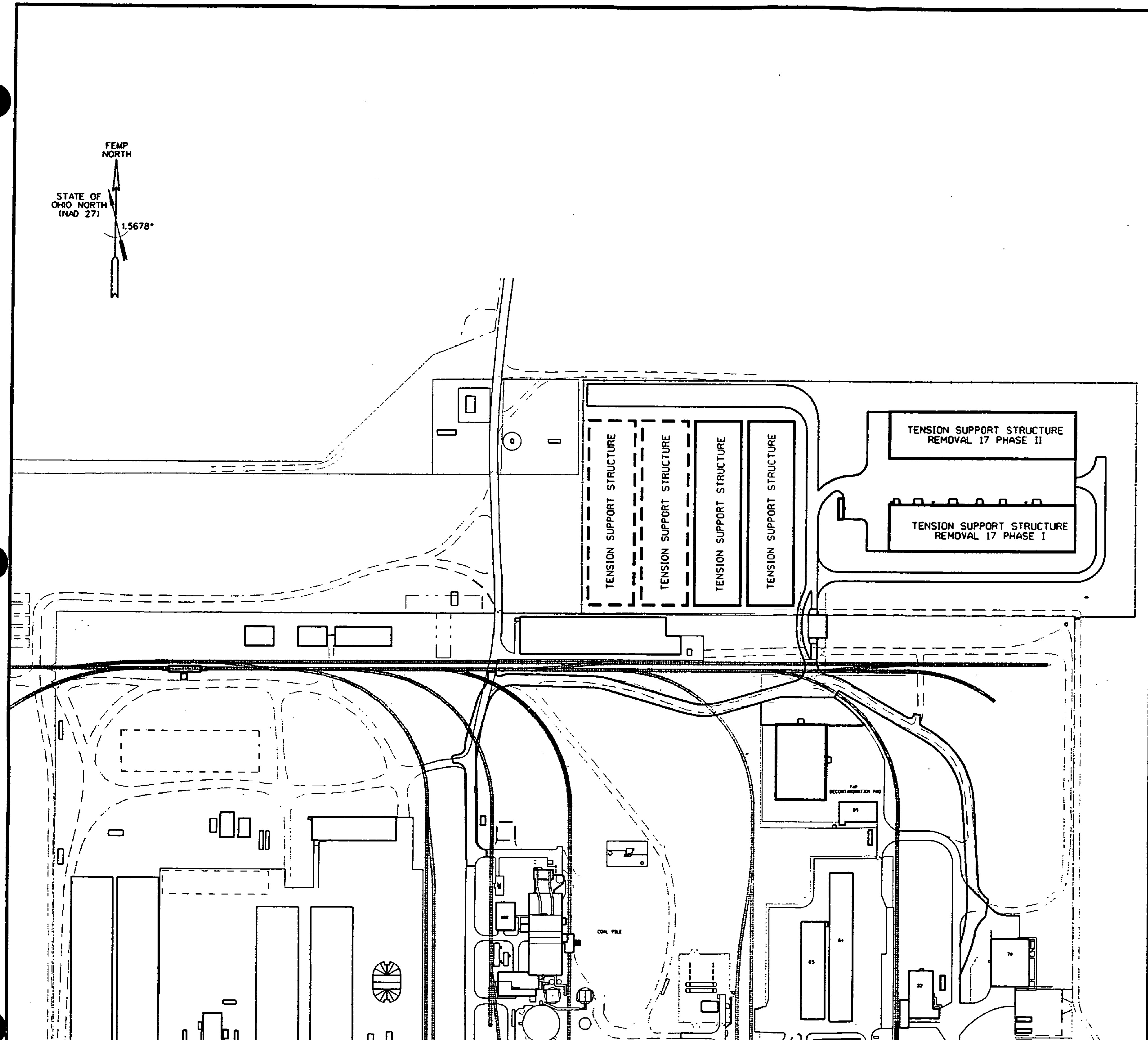

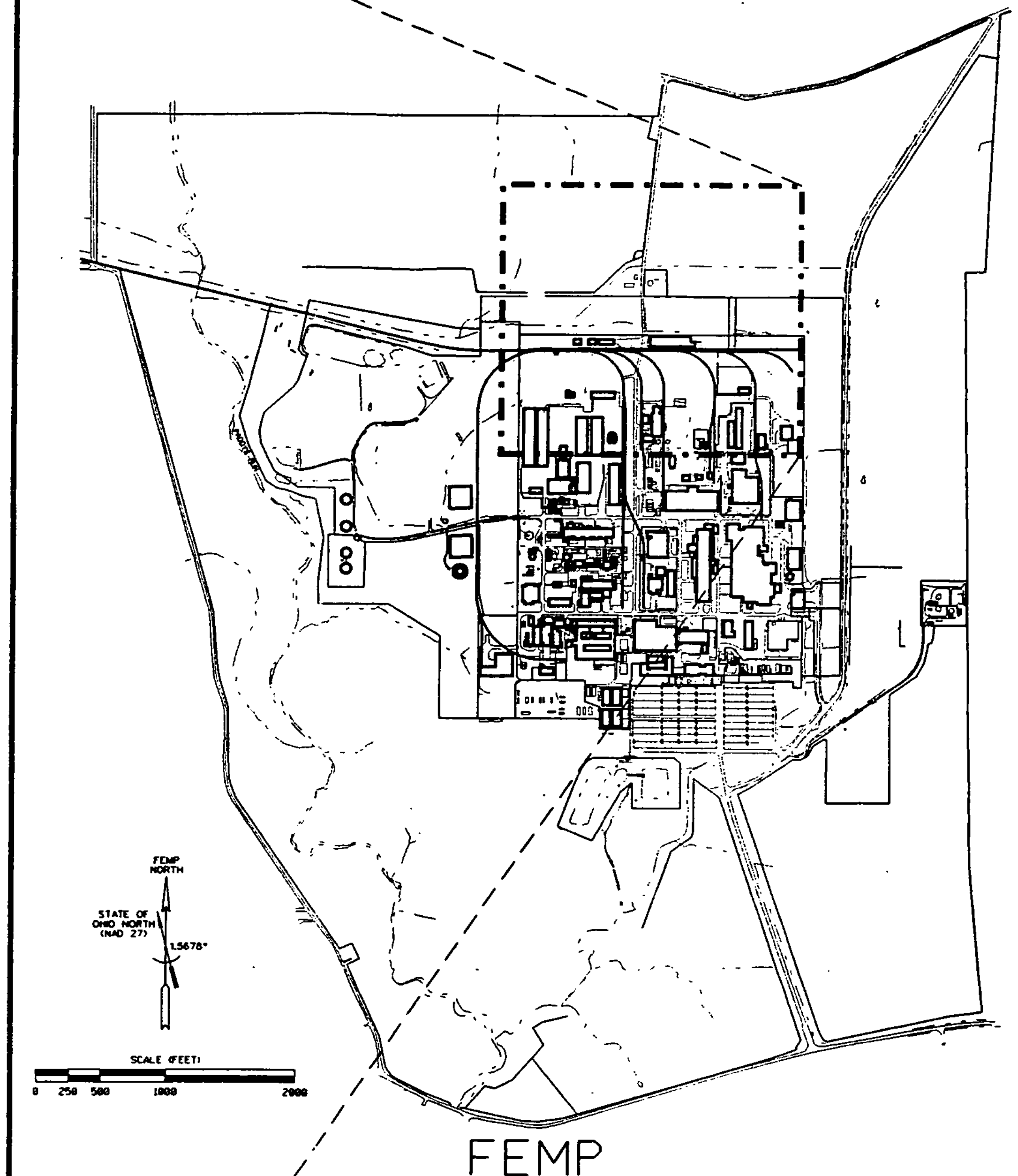

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REQUIRED FOR MINIMUM STORAGE SCENARIO

REQUIRED FOR MAXIMUM STORAGE SCENARIO

Figure 3-2 CSF Location Map

4.0 EVALUATION OF ALTERNATIVES

This section presents an evaluation of the proposed alternatives for interim remedial action. Section 4.1 describes the evaluation criteria used. Sections 4.2, 4.3, and 4.4 present the detailed evaluations of Alternatives 1, 2, and 3, respectively.

4.1 Evaluation Criteria

The detailed evaluation presents relevant information needed for selecting a preferred alternative (Section 5.0). This analysis provides the means by which facts are assembled and evaluated to develop the rationale for a remedy selection. Each alternative is evaluated against the nine criteria from the NCP (40 CFR 300.430) listed below:

- Overall Protection of Human Health and the Environment;
- Compliance with ARARs;
- Long-term Effectiveness and Permanence;
- Short-term Effectiveness;
- Reduction in Toxicity, Mobility, or Volume Through Treatment;
- Implementability;
- Cost;
- State Acceptance; and
- Community Acceptance.

These nine criteria fall within three categories: threshold, balancing, and modifying. The threshold criteria are overall protection of human health and the environment and compliance with ARARs. Unless a specific ARAR is waived, each alternative must meet the threshold criteria in order to be eligible for selection. The five primary balancing criteria are long-term effectiveness and permanence; short-term effectiveness; reduction of toxicity, mobility, or volume through treatment; implementability; and cost. State and community acceptance are modifying criteria that shall be considered in remedy selection. State and community concerns will be incorporated into the Responsiveness Summary document associated with the public comment period and included in the IROD.

4.1.1 Overall Protection of Human Health and the Environment

Alternatives are assessed to determine whether they can adequately protect human health and the environment, in both the short- and long-term, from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site by eliminating, reducing, or controlling exposures to levels established during development of remediation goals consistent with 40 CFR 300.430(e)(2)(i). Overall protection of human health and the environment draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs (40 CFR 300).

4.1.2 Compliance with ARARs

The NCP (40 CFR 300) identifies two categories of requirements which must be identified for a remedial action, applicable and relevant and appropriate requirements (ARARs), and to be considered criteria (TBCs). Applicable requirements are those which upon an objective determination specifically address a hazardous substance, pollutant, or other contaminants found at a CERCLA site. Relevant and appropriate requirements are those which, while not applicable, still address problems or situations sufficiently similar to the circumstances of the release or remedial action contemplated. A waiver of a requirement may be made by the lead agency provided that one of the six criteria listed under 40 CFR 300.430(f)(1)(ii)(C) is met.

In certain cases standards may not exist in promulgated regulations that address the proposed action or constituents of concern. In these cases, nonpromulgated advisories, criteria or guidance that were developed by the USEPA, other federal agencies, or states, are to be considered (TBC) in establishing remedial action objectives that are protective of human health and the environment and thus useful in developing CERCLA remedies.

The NCP provides that the lead agency (DOE) is responsible for ensuring that all federal and state requirements that are identified in the ROD as ARARs for the remedial action are met. If waivers from any ARARs are involved, the DOE, as lead agency, is responsible for ensuring that the conditions of the waivers are met. This will achieve a level of cleanup, or standard

Costs for final waste disposition are not generally considered because they are not within the scope of the interim action. However, for Alternative 3, the cost associated with the disposition of the non-recyclable and non-recoverable materials to NTS is included.

Cost analysis is included to eliminate any remedial action alternative with a cost disproportionately high to its ability to meet remedial action objectives. Cost analysis specifics including additional detailed explanation of cost categories and assumptions are provided in Appendix C.

4.1.8 State Acceptance

This criterion is a modifying criteria that may not be completed until comments are received. State concerns will be incorporated into the IROD and included into the final version of this Proposed Plan upon approval of the document by EPA.

4.1.9 Community Acceptance

This criterion is a modifying criteria that includes determining which components of the alternatives interested persons in the community support, have reservations about, or oppose. This assessment will not be completed until comments on this Proposed Plan are received (40 CFR 300). This criteria will be addressed in the IROD after public comments on this Proposed Plan are received.

4.2 Alternative 1 -- No Interim Action

The "No Interim Action" Alternative represents continuation of current approved actions within OU3, without acceleration until the final ROD. This alternative does not include any activity designed to destroy, isolate, or reduce the toxicity of any of the contaminants in the contaminated structures in advance of the remedy selected in the final ROD. During this period, the structures are left to take the natural course of weathering with further deterioration expected. This alternative assumes that existing and approved removal actions and site maintenance programs would continue.

4.2.1 Overall Protection of Human Health and the Environment

The No Interim Action Alternative would offer no increased protection of human health and the environment. Existing programs would continue unchanged with the structures remaining in place. Most of these facilities have generally exceeded their intended design life and, with the progression of the natural ageing process, are potential sources of contaminant releases to the environment.

Particulate and gaseous material could potentially contaminate the air and/or particulate and liquid material could potentially reach soils, surface water, and groundwater. Under this alternative, on-site personnel would be subject to direct exposure to radionuclides, potential internal exposure to inhaled airborne radioactive material, internal exposure to inhaled asbestos fibers, internal exposure to inhaled pathogenic organisms from avian fecal material, and the potential for direct contact with hazardous materials.

4.2.2 Compliance with ARARs

Under the No Interim Action Alternative, existing site programs would continue in accordance with site requirements to control potential occupational exposure to hazardous materials. Compliance with contaminant-specific ARARs and DOE radiation dose limits, including TBCs, would be achieved through continued application of access restrictions and radiation controls. During the period before the final remediation, potential exposures to the public and contaminant releases to groundwater may occur due to deterioration of structures in OU3.

4.2.3 Long-term Effectiveness and Permanence

Under this alternative, no change in overall site conditions would occur until the final ROD was implemented. The evaluation of long-term effectiveness and permanence will be carried out for the No Action Alternative in the final OU3 Feasibility Study.

of control, for radiological and hazardous substances, pollutants or contaminants that, at a minimum, assures the protection of human health and the environment.

The approach taken in development of the requirements for this Proposed Plan was to invoke the most stringent requirement or the prevailing standard affecting this action. This meant that duplicate standards were eliminated, yielding to the more stringent standard and reliance on the use of DOE Orders such as DOE Order 5400.5, a TBC, in lieu of overlapping or duplicate ARARs. The rationale for this method of identification is that the use of single standards allows a clear line of compliance with the most stringent standard. DOE Orders, although not promulgated standards, do represent contractual obligations for DOE contractors and subcontractors, and therefore constitute requirements with which the FEMP and its contractors must comply. Requirements in DOE Orders are derived from promulgated standards generated by the USEPA, NRC, OSHA and other regulatory authorities. Compliance with these orders in lieu of the similar regulations results in a level of protectiveness equal to or greater than that required by the regulations.

Each alternative is evaluated against attainment of Federal and State ARARs as proposed in Appendix A. The evaluation is based on contaminant-specific, location-specific, and action-specific ARARs. The ARARs in Appendix A represent only those ARARs and TBCs that apply to the proposed interim remedial action. As such, the action proposed may not attain final ARARs for this operable unit. Under the final ROD, all ARARs would be achieved, but if waivers become necessary for some ARARs, they will be addressed under the final ROD.

4.1.3 Long-term Effectiveness and Permanence

This criterion addresses the results of a remedial action in terms of the risk remaining at the site after response objectives have been met (EPA 1988). It assesses the level of risk remaining at the site and how well human health and the environment will be protected from treatment residues and untreated materials. This criterion assesses the affects after remediation is complete.

For an interim action, no actions are intended to represent final remediation. For this reason, long-term effectiveness is not meaningful in context of an interim action. The evaluation for this criterion will be performed for the No Action and other alternatives in the OU3 Feasibility Study to be completed in support of the final ROD.

4.1.4 Short-term Effectiveness

This criterion assesses the effects of each alternative during remediation until remedial response objectives are achieved. This criterion has been divided into separate evaluations for health and environmental protection to further develop the evaluation.

4.1.5 Reduction in Toxicity, Mobility, or Volume Through Treatment

This criterion evaluates the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site (40 CFR 300). Because this interim remedial action does not perform final treatment of the OU3 media, this criterion will be fully evaluated as part of the FS for the final OU3 remedial action.

4.1.6 Implementability

This criterion evaluates the ease or difficulty of implementing each alternative and considers factors such as technical and administrative feasibility. It also judges the availability of necessary services and materials required for implementation (EPA 1988). Technical feasibility considers construction and operation, reliability of technology, ease of undertaking additional remedial action, and monitoring considerations. Administrative feasibility is based on the coordination among agencies, offices, and contractors necessary to implement the alternative. Availability of services and materials is based on the availability of treatment and storage services, necessary equipment and specialists, and prospective technologies.

4.1.7 Cost

This criterion evaluates the cost of an alternative. The cost analysis includes direct costs, indirect costs, and operation and maintenance (O&M) costs. These include such items as management, engineering, characterization, mobilization, demobilization, and interim storage.

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4.2.4 Short-term Effectiveness

For this alternative, short-term effectiveness is evaluated from the present until the final ROD is issued in 1997. During this time the No Interim Action Alternative would maintain site activities and programs. Measures would be taken to protect human health and the environment through monitoring and spill prevention/maintenance. Because removal actions, site maintenance programs, and other ongoing activities would continue, workers would continue to be exposed to contaminants. This alternative would not reduce the time until remedial objectives for OU3 are met.

4.2.4.1 Health Protection

The No Interim Action Alternative would involve no changes in health protection. Risks would be consistent with details provided in Section 2.5. Exposures to individuals associated with the operation and maintenance of the buildings would continue. Existing site programs to minimize health risks would proceed. These risks are anticipated to be less than the occupational health risks associated with implementing an interim action.

4.2.4.2 Environmental Protection

Because the No Interim Action Alternative does not remove the source of contamination, releases to the environment could potentially occur before the final ROD.

Soil

Under the No Interim Action Alternative, contaminant concentrations in the soil in and around the buildings would remain at existing levels or potentially increase.

Water Quality and Hydrology

Continued deterioration of OU3 components due to ageing could potentially increase the adverse effects on water quality and hydrology. The potential release of particulate material from OU3 components could migrate to surface water and groundwater, contributing to documented groundwater contamination (DOE 1993c). Past operations have affected groundwater and future releases may further degrade water quality.

Air Quality

Potential radioactive and hazardous emissions from deteriorating OU3 components could adversely effect air quality.

Noise Levels

Under the No Interim Action Alternative, noise levels would be negligible to off-site residents.

Biotic Resources

If contaminated facilities associated with OU3 are left in their current condition, contaminants could potentially migrate to aquatic habitats on-site, affecting aquatic biota over time.

No threatened and endangered species or critical habitat for threatened and endangered species has been identified within OU3. However, some of the Federal or State listed species have been sighted off the FEMP site, and could be exposed to contaminants in the sediment and surface water in Paddys Run. They could also be exposed to contaminants through food transfer or direct contact with contaminated media.

Wetlands and Floodplains

A site-wide wetland delineation was conducted in February 1993 (Ebasco 1993), as discussed in Section 2.1. Under the No Interim Action Alternative, there would be no activity to impact these wetlands.

The 100- and 500-year floodplains within the FEMP property are confined to the north-south corridor containing Paddys Run. Under the No Interim Action Alternative, no activity would take place within these floodplains.

Socioeconomics & Land Use

The delay of actions until the final ROD would have no impact on population, economy, land use patterns and traffic movements near the site.

Cultural Resources

Under this alternative, there would be no impact to cultural resources.

4.2.5 Reduction in Toxicity, Mobility, or Volume Through Treatment

Under the No Interim Action Alternative, there would be no reduction of toxicity, mobility, or volume through treatment because no remedial activity would be implemented. Additionally, through weathering and deterioration of buildings exceeding intended design lives, the mobility and the volume of contaminated media would potentially increase.

4.2.6 Implementability

The No Interim Action Alternative would be highly implementable and would require no changes from current work patterns, scope, and requirements. It also poses no technical or administrative limitations, and services and materials are available. However, continuing under the existing system of using removal actions to proceed with cleanup would require multiple studies, documents, regulatory reviews, and public comment periods for similar actions.

4.2.7 Cost

The No Interim Action Alternative would not cost anything additional. Costs associated with current projects or future removal actions are not included. Additional details concerning the cost estimate for the alternative are contained in Appendix C.

4.2.8 State Acceptance

State concerns with or acceptance of this alternative will be incorporated into the IROD and included into the final version of this Proposed Plan upon approval of the document by EPA.

4.2.9 Community Acceptance

As stated in Section 4.1.9 above, this criterion may not be addressed until public comments on this Proposed Plan are received. The public comments will be incorporated into the IROD and the responsiveness summary.

4.3 Alternative 2 -- Decontaminate Surfaces Only

This alternative includes decontaminating surfaces in addition to currently approved actions and maintenance programs. No further containment, stabilization, or removal of media would be performed.

4.3.1 Overall Protection of Human Health and the Environment

This alternative would reduce risks to human health and the environment. Through removal of loose surface contamination, this alternative would minimize subsequent worker contact with contaminated materials and reduce the quantity of materials releasable to the environment. Reduction of contaminants within the structures would not be complete because fixed contamination would remain in place. In the short-term, this alternative could slightly increase health risks to the public and would involve exposure of workers associated with the decontamination activities (see Section 4.3.4.1). Exposure to workers associated with the action would be controlled to health-protective levels.

During decontamination, radioactive and/or toxic materials might be released to the air or soils, but such releases would be managed through appropriate engineering controls, procedures, containment measures, and radiation and contaminant monitoring. Heavily contaminated structures and equipment would be appropriately contained at all times. Negative pressure ventilation and HEPA filters, as well as other containment measures, would reduce contaminant releases. Residual contaminated materials and other wastes generated by the decontamination process would be treated to the extent feasible using existing site systems. On- and off-site monitoring would detect significant increases in airborne contaminants, and appropriate measures would be promptly implemented to reduce releases.

4.3.2 Compliance with ARARs

This alternative would meet all action-specific ARARs referenced in Appendix A. Although this alternative would reduce potential exposure to hazardous substances, continued application of existing site controls would be required in order to comply with ARARs. Engineering controls used during the interim action would comply with ARARs to control and minimize potential release of contaminants to the environment. During the period before the final ROD, potential exposures to the public and contaminant releases to the groundwater may potentially occur.

4.3.3 Long-term Effectiveness and Permanence

Under this alternative only a limited improvement of site conditions would be achieved. This alternative would not accelerate or advance remediation of the site. This alternative would not contribute beneficially to the long-term improvement of the site. The evaluation of long-term effectiveness will be conducted in the OU3 Feasibility Study as part of the final ROD.

4.3.4 Short-term Effectiveness

This alternative would be effective in reducing removable contamination and related worker exposures. During decontamination, commonly practiced engineering controls would be used to minimize worker exposures and prevent contaminant releases. Site monitoring programs would detect increases in on-site airborne activity which could lead to potential airborne exposures to off-site residents. Appropriate measures would be promptly implemented to reduce releases. After decontamination, the potential exists for components to become contaminated again due to ongoing maintenance and storage operations. This alternative would be effective in protecting human health during its implementation. This alternative would not reduce the time needed to achieve remedial objectives for OU3.

4.3.4.1 Health Protection

This section presents the short-term impacts to human health associated with Alternative 2 decontamination activities. The action is anticipated to occur over four years and quantitative risk calculations developed for the NEPA review are summarized in Appendix J. This section includes a qualitative assessment of the chemical and radiological risks associated with the implementation of Alternative 2.

The qualitative assessment begins with consideration of the expected nature of the risks and the approach and assumptions used for the assessment. The risk is further defined through consideration of the hazardous substances that may be present and the relative quantities and availability of contaminants that are sources of risk. The extent of exposures and risks are diminished by the application of engineered controls. Monitoring of the occupational and off-site environments assures awareness to potentially hazardous substances and the effectiveness of control measures. The qualitative risks are summarized and are related to the more detailed assessments described in Appendices D and J.

Overview of Risk

Dose and risk assessment pathways are evaluated for three population groups, or receptors, as they exist in three different exposure environments; in-plant operations; other on-site operations; or off-site residence. The in-plant worker is used to represent a worker who is involved with the remediation activities. Some of the work performed by this worker may be done outdoors. Pathways of exposure for the in-plant worker are inhalation of, and immersion in, airborne radiological and chemical contaminants and exposure from external contaminant sources. For other on-site and off-site receptors, assessments are based upon estimated airborne contaminant releases from major plants and facilities due to various operations.

Other on-site worker exposure is received from inhalation of, immersion in, and external exposure due to accumulated ground deposition from released and dispersed airborne radiological and chemical contaminants. Off-site resident dose and risk, from the further dispersed airborne effluent plume, is received from inhalation and immersion; external exposure due to ground deposition; and, ingestion of locally produced vegetables, meat, and milk due to downwind deposition on soil and vegetation. Figure 4-1 is a schematic summarizing the receptors, the exposure environment, and the exposure pathways.

Risk Assessment Assumptions

The following major assumptions were used in the risk assessments detailed in Appendices D and J:

- The assessment of risks using process knowledge as a basis to utilize the limited existing analytical data is adequate for decision-making purposes in this assessment.

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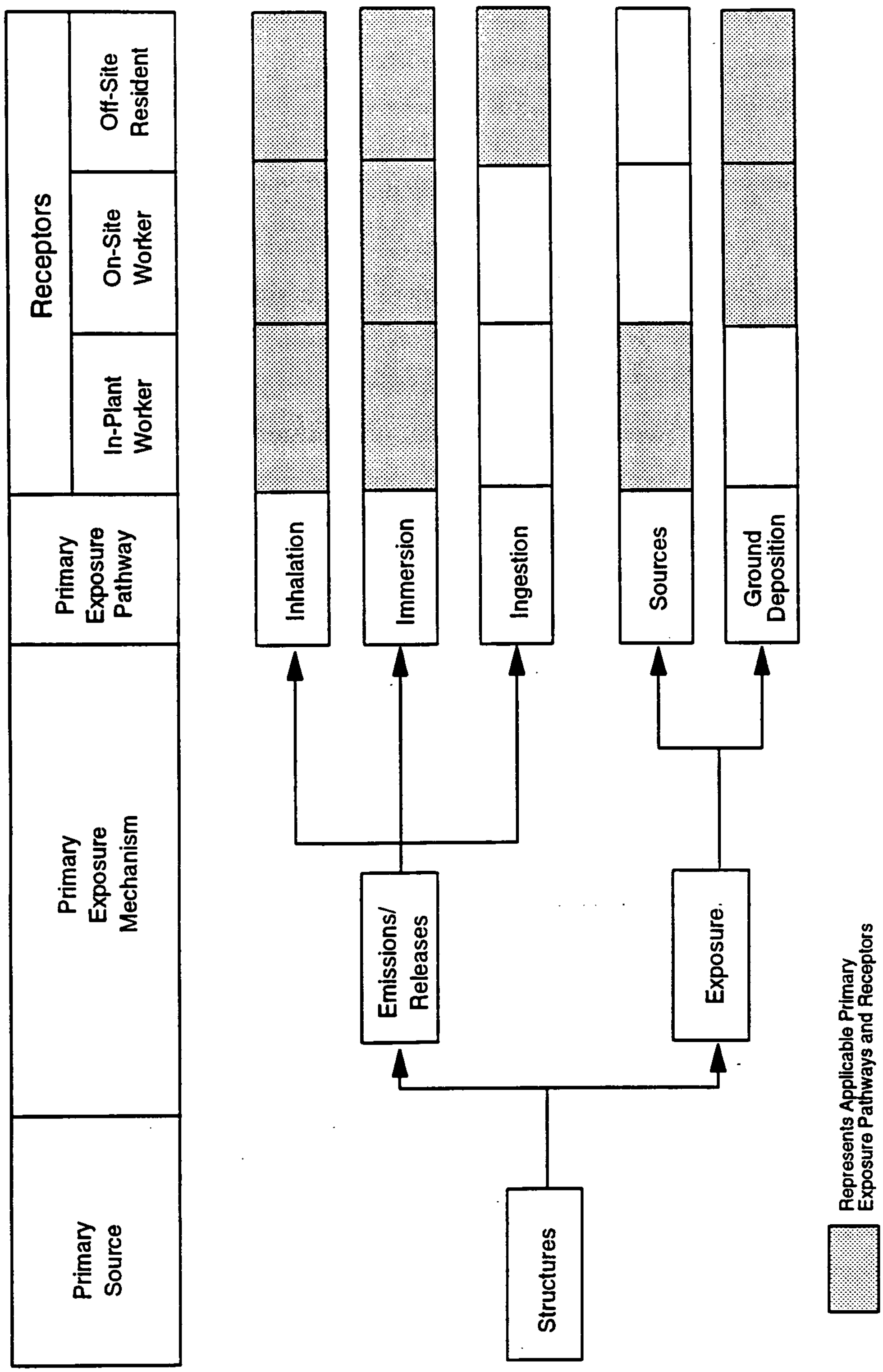

FIGURE 4-1 Risk Assessment Conceptual Model

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It is assumed that risks to on-site workers not directly involved with the remediation and to the off-site public are the result of airborne releases of contaminants during remedial actions. Engineering controls would be used to minimize releases during remediation activities.

- In-plant occupational exposure to the remediation worker has two components: direct radiation from fixed external sources and inhalation of airborne contaminants. External exposure is assumed to be equivalent to that observed historically during production operations and airborne concentrations of contaminants, on the average, are assumed to increase by a factor of ten due to remedial action.
- Dermal contact was excluded from the assessment for workers performing the remediation on the assumption that personal protective equipment would be used to prevent direct contact with contaminated media.Particulate and gaseous material could potentially contaminate the air.

<u>Comparison of Chemical and Radiological Risk Factors</u>

Following shutdown of production operations, and completion of removal actions, the production quantities of hazardous materials will have been removed. Remaining chemical risks are due to small quantities of hazardous materials remaining as residues. Factors bearing upon the availability, mobility, toxicity, and potential threat from these materials are considered below.

Potentially hazardous metals were present in trace concentrations in uranium feed concentrates and in subsequent production processes. Quality control for production processes required monitoring and minimization of the trace metals concentrations. Therefore, only trace concentrations of lead, chromium, silver, arsenic, and barium known to accompany the uranium processes, are expected to reside in the contamination within OU3 process plants. Because of these controls, the low concentrations of trace metals are expected to contribute relatively low risks compared to those presented by the uranium contamination.

Lead as metal has been used extensively in building materials and for radiation shielding. However, these items have retained their integrity and no significant releases are expected which would expose workers or the public to lead from OU3 facilities as a result of remedial

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action. There would be virtually no lead exposure anticipated, from these materials, to others on-site and off-site.

Liquid metal mercury was used in pressure measurement devices for laboratory and production processes. Controls were in place for worker protection however spills may have occurred. Because years have passed, and given the relatively high vapor pressure of liquid mercury at standard temperature and pressure, it is anticipated that any trace quantities have evaporated and would no longer be present to expose in-plant workers, others on-site, and off-site residents.

Toxicity is a consideration with contaminants, such as lead, mercury, and arsenic. Control of exposure to such metals are guided by their toxicity which is related to the reference dose or threshold for toxic effects. Occupational exposure to uranium may require control based upon its toxicity rather than the attendant radiation dose, as well. For public exposure, the acceptable risk and associated radiation dose standard is lower than for occupational exposure. Therefore, radiation exposure to the public is always more limiting than the potential toxicity effect standards for uranium.

Inorganic compounds were used in production and support operations. Major quantities of compounds such as hydrofluoric acid, nitric acid, ammonia, and sodium hydroxide were used or produced in the plants. With the cessation of production, the bulk quantities of these materials have been (and are being) removed as a part of safe shutdown activities. The trace quantities that may remain, after normal housekeeping maintenance, are expected to be so low and immobile that they would not constitute significant occupational or environmental exposures during the action.

A broad variety of hazardous organic compounds have been used in production and maintenance activities. With the passage of time, the small quantities of volatile organic compounds, that may have been spilled or that might have remained in process vessels, have evaporated and would not be present as sources of exposure. Small quantities of other semi-volatile organic compounds may remain and the OU3 field investigation will characterize the concentrations, mobility, and toxicity of any remaining compounds. Their semi-volatile nature would indicate minimal airborne concentrations are to be expected. Airborne releases should be negligible.

A potential for histoplasmosis exists due to avian fecal materials within the structures. Asbestos containing materials (ACM) and Thermal System Insulation (TSI) have been identified within OU3 and removal and repair have been in progress for over four years; only transite and other relatively non-friable ACM will remain within components when decontamination begins. No assessment of exposure to ACM has been made here; however the potential to encounter newly characterized ACM is acknowledged and will remain within the scope of occupational safety assessments.

Since the primary mission of the site was production of uranium metal and thorium compounds, the quantities of uranium and thorium processed in the production area far exceeded the quantities of other hazardous materials. Uranium and thorium are the most prevalent elements within the contaminants of concern and are expected to be the major contributor to occupational and environmental exposure and risk. The radiological exposures and risks are believed to be far greater than those due to non-radiological contaminants.

Considering the relative quantities and mobility of the contaminants, assessment of the exposure and risk due to the proposed remedial actions is focused on uranium and thorium contaminants. Airborne releases, which could effect other on-site workers and off-site residents, are expected to be acceptably low. This is particularly true given the engineered controls and the industrial hygiene and health physics programs which would control exposures to in-plant workers.

Engineering Controls

Engineered controls and fail safe designs would be used to limit airborne and liquid-borne releases. In addition to the engineered controls, the method and sequence of decontamination activities are designed to best control contaminants. These actions would entail the removal of loose contamination; after decontamination any remaining contaminants would be immobile and fixed within the component media. The absence of removable contamination minimizes subsequent worker exposure and environmental releases. Decontamination processes, methods, sequences, and hardware are chosen for the most effective contamination control.

Absolute filtered exhausters and enclosures would be used for decontamination operations that might generate airborne contaminants. Controls would be as local and as focused as possible to limit elevated airborne concentrations to a minimum volume. This reduces the probability and consequence of a potential release and optimizes the extent of air handling facilities. Curbing, dams, sumps, holding tanks, and absorbents would be used to control contaminated liquids.

<u>Monitoring</u>

Monitoring for continuing assessment of potential hazards during the on-site activities include occupational health physics and industrial hygiene; characterization of contaminants; and routine environmental monitoring.

Occupational monitoring and exposure controls reduce worker exposures and additionally control potential releases of hazardous materials to the environment. FERMCO radiation control technicians and technologists assess potential sources of radiation exposure, specify control requirements, and then provide monitoring through radiation detection instrument measurements, air sampling, and personnel dosimetry. Industrial hygiene assessments, procedures, and monitoring are provided by industrial hygiene technicians and technologists. Prompt recognition of a potential problem, at the source, permits prompt control.

The occupational safety measures help assure acceptable risks to workers performing the decontamination. They will not be exposed to hazardous materials in excess of OSHA regulatory limits. Radiation exposures are expected to result in doses well below the limit of five rem per year prescribed in DOE Order 5480.11.

Sampling technicians and technologists provide both facilities characterization and routine environmental monitoring. Facilities are assessed for potentially hazardous substances that could pose an environmental threat. Routine environmental monitoring would show the consequence of any significant release from OU3 remedial actions. The airborne pathway is monitored through the sampling of air, soil, produce, forage, and milk. Nine continuous air samplers are located within the FEMP site boundary. Soil and vegetation samples are also collected at the air sampling locations. Surface water, sediment, and numerous groundwater samples are collected and analyzed. Liquid effluent pathways through OU3 are continuously monitored at Manhole 175.

Risk Summary

Estimates of potential radiation exposure and associated risks were made for in-plant workers, for other on-site workers, and for off-site residents. The in-plant workers are those workers performing decontamination within the OU3 components. The other on-site worker represents the average worker who would have no association with the proposed action. The analysis is for the maximally exposed individual within each of the three receptor groups. The risk reported is for probability of additional cancer incidence.

For calculation of exposures/risks, four major process buildings were assumed to be decontaminated simultaneously. This situation represents a reasonable maximum decontamination effort and represents the conservative maximum exposure for any given year of the project. The project is estimated to last four years. The basis and results for this analysis are provided in Appendices D and J. Dose and risk for the in-plant worker are calculated for direct exposure to contaminated materials, inhalation of airborne concentrations released during decontamination, and immersion in the contaminated "airborne cloud." The risk to the other on-site workers, and the off-site public, who are not directly involved in decontamination operations is assessed through the effect of airborne releases from the plants undergoing decontamination.

The majority of the radiological risk to the in-plant worker would be the result of external radiation exposure; inhalation of radiological contaminants are estimated to contribute only about 10-20% of the total radiological risk (see Appendix D). Because of industrial hygiene monitoring, occupational exposures to chemical contaminants would be properly controlled during decontamination operations. All doses would be controlled to not exceed the DOE radiation dose limit of 5 rem/year and additionally keep all exposures as low as reasonably achievable (ALARA). Based upon risk assessment calculations contained in Appendices D and J, risks to the in-plant workers would remain well below this level.

Because of worker protection that would be utilized during implementation of the alternative, any exposures to chemical contaminants would be primarily due to inhalation. Because it is expected that carcinogenic risks associated with exposure to chemical contaminants would be less than those from exposure to radiological contaminants, it is anticipated that the chemical risks would be considerably less than the radiological risks. If the carcinogenic risks due to chemical contaminants were as high as the risks due to inhalation of radiological contaminants, then the total annual risk to an in-plant worker due to exposure to chemical contaminants would be about 10^{-4}, which represents one incidence of cancer in ten thousand.

An estimate of the risk to the other on-site workers was made based upon potential airborne releases from the four plants that might be undergoing simultaneous decontamination. The total estimated risk to the maximally exposed other on-site worker is on the order of 10^{-8}. This is a small fractional contribution to the expected risk due to normal duties for that worker. The exposure due to the decontamination action contribution is well below regulatory limits and also the lower ALARA limits attained through administrative controls.

Based on the radiological and chemical assessment combined with the approach to implement the action, it has been estimated in Appendix J that total annual risks to off-site individual receptors, from both radiological and chemical contaminants, are expected to be less than 10^{-7} (one in ten million). This risk for the general public is less than the EPA suggested risk range of 10^{-4} to 10^{-6} (one in ten thousand to one in one million). Because the estimated risk to the maximally exposed off-site resident is less than the EPA risk range, the risks from implementation of Alternative 2 are considered acceptable. As a means for comparison, an average individual in the United States receives an annual radiation dose of about 300 millirem from natural background and other sources, or about 17,000 times larger than that estimated for the proposed action. In addition, the annual dose to the public from the proposed action is well below the applicable DOE standard of 100 millirem.

Injuries and Fatalities

Based on data from the U.S. Department of Labor for the period 1985 through 1988 and assuming a four year effort with approximately 110 workers, no fatalities are anticipated and approximately 60 injuries are estimated. This assessment is contained in Appendix J.

4.3.4.2 Environmental Protection

During gross surface decontamination, some release of contaminants may occur from the process of extracting removable contamination. Although the levels of contamination would be greatly reduced, Alternative 2 would not completely remove the source of contamination, leaving fixed contamination, and, therefore, releases to the environment may potentially occur before final remediation.

<u>Soil</u>

Some potential would exist for contaminants to be released from a structure during decontamination and reach soils beneath the structure. However, good engineering practices would minimize the potential for releases. Because not all contaminants would be removed, some potential would exist for contaminants to be released to soils before final remediation.

<u>Water Quality and Hydrology</u>

If a liquid agent is used for decontaminating OU3 components, contaminants could migrate through runoff to surface waters and groundwater. However, the potential for such migration to surface water and groundwater would be minimized through the control, collection, and treatment of liquids. Since components would not be removed, some potential would exist for remaining contaminants to eventually migrate to surface water or groundwater before final remediation.

<u>Air Quality</u>

This alternative would minimize worker contact with contaminated materials after decontamination has occurred and reduce the quantity of materials available for release to the environment. In the process of decontamination, ambient air quality could be impacted from the release of radioactive particulates present in the structures. These potential releases would be managed through appropriate engineering controls, procedures, containment measures, and radiation and containment monitoring during all decontamination activities. Negative pressure ventilation or directed air flow systems fitted with HEPA filters, and other containment measures would be used to reduce contaminant releases from work areas and contaminated components during decontamination activities.

Radiation monitoring would detect significant increases in levels of airborne contaminants that might reach other on-site workers and the public so that appropriate actions could be taken to reduce releases.

Noise Levels

The use of mechanical decontamination equipment would produce negligible noise levels and would not adversely affect nearby residents.

Biotic Resources

Utilization of best management practices such as HEPA filtration, would minimize the potential for impacts to biotic resources during remediation. With facilities remaining in their current condition, contaminants could potentially migrate to aquatic or terrestrial habitats before final remediation effecting populations over time. Off-site wildlife and threatened and endangered species could potentially be exposed to contaminants through food transfer or direct contact with contaminated media.

Wetlands and Floodplains

Wetlands and floodplains would not be impacted by this alternative.

Socioeconomics & Land Use

Actions under this alternative would have no significant impact on population, economy, land use patterns, or traffic movement near the site.

Cultural Resources

Under this alternative, there would be no impact to cultural resources.

4.3.5 Reduction in Toxicity, Mobility, or Volume Through Treatment

This alternative would decontaminate materials by removing gross contamination from surfaces such as floors, walls, ceilings, structural members, equipment, and materials. Through decontamination, the mobility of contaminants would be reduced. After decontamination, only fixed contamination, which is less mobile, would remain within the facilities. Decontamination is a form of physical treatment, which does not fix the contaminants in the host media, but merely transfers them to a secondary medium. The collected secondary medium with removed contaminants would be managed resulting in storage or treatment, thereby reducing contaminant mobility. Waste residues from the decontamination process would be treated using existing on-site facilities. This alternative may result in a net increase in the total volume of contaminated media for OU3 through creation of contaminated decontamination residues, in addition to the unremoved contaminated source term.

4.3.6 Implementability

Alternative 2 would employ commonly used techniques and would pose no unusual technical difficulties. The necessary materials, equipment, and services are readily available. Decontamination processes are being implemented on a similar scale at the DOE site near Weldon Spring, Missouri, and have been completed on projects such as the decommissioning of the Shippingport Atomic Power Station (large scale) and the Apollo, Pennsylvania remediation project (small scale). Equipment and systems needed to prevent the spread of contamination and to monitor containment during decontamination are readily available and have been demonstrated at projects such as the chromium plant operated by Allied Signal in Baltimore, Maryland.

Known and existing decontamination technologies would be selected during remedial design. Potential decontamination technologies that are proven and effective include, but are not limited to, wiping, vacuuming, manual or mechanical scrubbing, low or high pressure washing, grit blasting or pelletized CO_2 blasting, as well as other demonstrated effective technologies. Secondary liquid and/or solid waste streams would be treated as required to meet disposal restrictions and to minimize waste volume. Anticipated secondary waste streams may be water, chemicals, or solid grit materials. Final waste streams would be characterized and disposed through FEMP waste management programs. If mixed wastes are produced, they would be managed in accordance with Removal No. 17 (DOE 1993a).

4.3.7 Cost

An estimated cost for Alternative 2 of $82 million (in current year dollars) reflects a four year program to surface decontaminate the structures in OU3. This cost represents only the decontamination effort. The equivalent present worth cost for Alternative 2 applying a 4.4% real interest rate, would be approximately $71 million. The basis for the cost estimate is presented in Appendix C.

4.3.8 State Acceptance

State concerns with or acceptance of this alternative will be incorporated into the IROD and included into the final version of this Proposed Plan upon approval of the document by EPA.

4.3.9 Community Acceptance

As stated in Section 4.1.9 above, this criterion will not be addressed until public comments on this Proposed Plan are received. The public comments will be incorporated into the IROD and the responsiveness summary.

4.4 Alternative 3 -- Decontaminate and Dismantle

This alternative includes component and material decontamination, dismantlement, interim storage, and disposition of a limited amount of non-recoverable and non-recyclable materials. This alternative represents in-situ surface decontamination followed immediately by dismantlement of the components. Section 3.4 presents a detailed discussion of the alternative.

4.4.1 Overall Protection of Human Health and the Environment

Alternative 3 would reduce overall risks to human health and the environment. This alternative would remove contaminated components, which are potential sources of environmental releases, and would reduce worker contact with contaminated materials following the remedial action. In the short-term, this alternative could increase health and safety risks to workers associated with the decontamination and dismantlement activities. The extent of increased risk is presented in section 4.4.4.1.

In the process of decontamination and dismantlement, it is possible that relatively small quantities of radioactive and/or toxic materials may be released to the air, water, or soils. These releases would be managed through appropriate engineering controls, decontamination procedures, dismantlement procedures, containment measures, and radiation and contaminant monitoring during all site activities. Heavily contaminated structures and equipment would be appropriately contained at all times. Negative pressure ventilation or directed air flow systems fitted with HEPA filters, as well as other containment measures, would reduce contaminant releases from work areas and contaminated components during demolition activities. Appropriate contaminated materials and other wastes would be placed in containers, as necessary, for interim storage. On- and off-site radiation monitoring would be used to detect increases in potential airborne exposures to the public, and appropriate measures would be promptly implemented to reduce releases.

Proper controls would be implemented to prevent potential runoff to surface water bodies. The decontamination and dismantlement process is not likely to result in significant releases of contaminants to groundwater. Appropriate measures (site security and radiation safety) would be taken to prevent direct contact exposures to the general public during the interim action. The implementation of Alternative 3 could result in a potential acceleration of the time required to achieve remedial objectives for OU3. This alternative is protective of human health and the environment.

4.4.2 Compliance with ARARs

Appendix A preliminarily identifies ARARs and TBCs which are potentially pertinent to activities under this Proposed Plan. The approach taken in development of the requirements for this alternative was to invoke the most stringent requirement or the prevailing standard affecting this action. As such, the ARARs and TBCs proposed in Appendix A would be protective of human health and the environment during the interim action. The implementation of Alternative 3 would result in compliance with ARARs as identified in Appendix A.

4.4.3 Long-term Effectiveness and Permanence

Under this alternative, DOE proposes the decontamination and dismantlement of all OU3 components. This alternative would achieve progress toward site remediation and would accelerate the cleanup process. The evaluation of long-term effectiveness for final treatment and disposition will be conducted in the OU3 Feasibility Study as part of the final ROD.

4.4.4 Short-term Effectiveness

Alternative 3 would be efficient in reducing the sources of contamination; however, the combined decontamination and dismantlement actions would increase short-term risks to human health and the environment. Engineering controls would be used during the action to minimize worker exposures and prevent off-site releases of contamination. Site monitoring would detect increases in potential airborne exposures to the public so that activities could be stopped or other measures taken to reduce releases. These measures would minimize the increase in short-term risks.

Placing materials into interim storage facilities at the CSF would reduce risks to human health and the environment by confining them in a more manageable configuration, generally removed from exposure to the environment. This would further reduce the risk of contaminant releases until the final ROD is implemented.

Environmental effects would be minimized through engineering controls to prevent airborne releases or spills. Runoff and run-on engineering controls would control storm water and prevent additional contamination of perched water and groundwater. Foundations, slabs, and pads would be decontaminated, repaired, and/or sealed to minimize any movement of contaminants by storm water to the vadose zone and the glacial till. Below-grade remediation would be a coordinated effort with OU3 and OU5. Pads, roads, foundations, and underground utilities excavated would be integration with environmental media remediation (soils and groundwater). Under Alternative 3, these actions would occur through joint excavation of below-grade components for OU3 simultaneously with OU5 soil excavation. It is anticipated that resulting "clean" soils from soil washing would be used as backfill material. This alternative is protective of human health and the environment. The implementation of this action could result in the acceleration of the time required to achieve remedial objectives.

4.4.4.1 Health Protection

Estimates of radiological risks associated with implementation of Alternative 3 were made for in-plant workers, for other on-site workers, and for off-site residents. The in-plant workers are those performing decontamination within the OU3 components. The other on-site worker represents the average worker who has no association with the proposed action. The analysis includes the maximally exposed individual within each of these three groups.

The qualitative risk assessment contained in this section for the short-term impacts associated with implementing the Alternative 3 decontamination and dismantlement activities is based upon the details presented in Section 4.3.4.1 above. This section contains additions to the methodology of the risk assessment base on the addition of dismantlement to the scope of Alternative 3. The risks associated with this alternative are acceptable.

<u>Risk Assessment Assumptions</u>

For Alternative 3, it is assumed that the annual in-plant worker exposures remain the same and that airborne releases, affecting other workers and off-site residents remain the same as those estimated for Alternative 2. The annual exposures and airborne releases estimated for Alternative 2 remain the same for Alternative 3 because it is assumed that the maximum exposure or release to a receptor occurs during decontamination activities. Once decontamination has occurred, limited quantities of loose contamination exist to become airborne. Therefore, the highest risks to each receptor group occurs during decontamination.

The time duration of worker and public exposure increases by a factor of four for Alternative 3 compared to Alternative 2 because a 16 year remedial action period is anticipated compared for four years to perform decontamination only. Given these assumptions, the estimated risks increase by a factor of four.

Engineering Controls and Monitoring

The principles and nature of engineering controls and monitoring described for Alternative 2 are the same for Alternative 3. Methods to control airborne and liquid-borne contaminant releases are identical in concept and in most applications. Decontamination activities within a component would remain the same for both alternatives. Following the decontamination phase, dismantlement activities would require larger enclosures and more extensive air handling equipment.

Procedural controls will supplement engineered controls. For example, penetrations into contaminated pipes and HVAC ducting would require enclosures around the cutting operations. Upon exposure, ends would be capped and sealed to prevent the release of contaminants. Dismantlement of the building shell would follow removal of all other elements. Dismantlement would proceed using the best procedures and equipment to minimize occupational and environmental exposure.

Risk Summary

Estimates of the potential radiation exposure and associated risks were made for the same population groups: in-plant and other on-site workers, and off-site residents. The analysis included risk estimates for the maximally exposed individual within each of the three groups and the collective exposures and risks for each population group. The risk basis is the probability for induction of cancer.

For this assessment it was assumed that four major process buildings undergo decontamination and dismantlement simultaneously. This yielded maximum annual exposures and risks. It was assumed that this condition would continue for a 16 year period; the time estimated for completion of Alternative 3. The risk estimate basis and results are provided in Appendices D, E, and F and are summarized in Appendix J. The estimated risk to the in-plant worker was on the order of 10^{-3}, less than 10^{-8} for other on-site workers, and less than 10^{-6} for off-site residents.

As discussed for Alternative 2, worker doses would be controlled to not exceed the DOE radiation dose limit of 5 rem/year. Based upon the risk summary in Appendix J, the risks to the in-plant and other on-site workers would remain well below this level. Similarly, the risk to the general public is less than the EPA suggested risk range of 10^{-4} to 10^{-6} (one in ten thousand to one in one million). Because the estimated risk to the maximally exposed off-site resident is less than the EPA risk range, the risks from Alternative 3 are acceptable. As a means for comparison, an average individual in the United States receives an annual radiation dose of about 300 millirem from natural background and other sources, or about 5,000 times larger than that estimated for the proposed action. In addition, the annual dose to the public from the proposed action is well below the applicable DOE standard of 100 millirem.

Injuries and Fatalities

Based on data from the U.S. Department of Labor for the period 1985 through 1988 and assuming a 16 year effort with approximately 200 workers, no fatalities are anticipated and approximately 420 injuries are estimated. This assessment is contained in Appendix J.

4.4.4.2 Environmental Protection

Soil

Under this alternative, above- and below-grade components would be removed, causing disturbance of Production Area soils which were previously disturbed during initial construction. Erosion control would be used during remediation. Soil remaining after component removal would be remediated as part of OU5 activities. The below-grade components are of insufficient depth to impact the site geology during removal.

Grading operations for the construction of the CSF would cause soil disturbance of approximately 12 acres, which could increase the potential for erosion and soil runoff (Appendix E). However, engineering controls and best management practices such as revegetation and silt fences would minimize the potential impacts to soil and surface water. Upon completion of construction activities, all unpaved disturbed areas would be regraded and revegetated to their original condition and erosion rates would return to current levels.

Soil at NTS would be permanently disturbed for the disposal of Alternative 3 materials. The geology of NTS has been determined to be suitable for disposal of low level radioactive waste (DOE 1991). NTS is characterized by great depths to the groundwater table, from 155m (515 ft) to more than 600m (2000 ft) (DOE 1991). Groundwater movement in the saturated and unsaturated zones is slow, with low potential for radioactivity transport of radionuclides to off-site areas. These parameters make the geology of NTS suitable for disposal activities.

Water Quality and Hydrology

Removal of below-grade structures could affect perched groundwater and the Great Miami Aquifer. However, stormwater collection and treatment would minimize the potential for such effects. Existing monitoring wells within the Production Area would detect releases to the perched groundwater and the aquifer during remediation. If releases are detected, appropriate response actions would be implemented. Overall, removal of contaminant sources associated with OU3 components would minimize the potential for future impacts to surface water and groundwater.

Erosion control measures such as silt fences would be applied during removal of below-grade improvements and construction of the storage facilities. These measures should minimize contaminant increases in surface water and movement of contaminated sediments to drainage ways and other surface waters.

Excavation and construction activities associated with the CSF would have only minor impacts to water quality. Engineering controls and best management practices would limit impacts to local drainage areas. Construction of the CSF would not substantially change local hydrologic conditions and a storm water collection system would minimize impacts to water quality.

The implementation of Alternative 3 is expected to have minimal impacts to surface water at NTS, since NTS lies within an arid region. Groundwater would not be impacted directly by disposal of waste materials. Engineering controls would be incorporated into the design of the disposal facilities at NTS. Groundwater beneath NTS ranges from 155m (515 ft) to more than 600m (2000 ft) (DOE 1991). Ongoing monitoring and maintenance activities would minimize risk of contaminant releases to groundwater. In the case of an accident (e.g. facility failure), contaminants could be released to groundwater at NTS. However, monitoring systems would detect the release, and appropriate response actions would be initiated.

Air Quality

Potential airborne releases from decontamination, dismantlement, and storage activities would be managed using appropriate engineering controls, procedures, containment measures, and radiation and containment monitoring. Negative pressure ventilation or directed air flow systems fitted with HEPA filters, and other containment measures would be used to reduce contaminant releases from work areas and contaminated components during decontamination activities.

Excavation activities could result in minor increases in fugitive dust emissions, which would be minimized through engineering controls and best management practices (e.g., dust suppressants, and revegetation). Emissions from the operation of the CSF would be controlled through Medium Efficiency Particulate Air (MEPA) filtration.

Disposal of waste material at NTS would not result in substantial air quality impacts. Minor increases in fugitive dust from equipment operation and excavation activities may occur. Standard engineering practices and ongoing monitoring activities would be used to control air quality impacts.

Noise Levels

Noise levels during the construction and operation of the CSF would be typical of any industrial setting and would not be noticeable to off-site residents due to the buffer zones of the site. Dismantlement activities would follow a deconstruction approach, limiting the resulting noise levels. Disposal of Alternative 3 waste would have minimal noise impacts at NTS.

Biotic Resources

Impacts to biotic resources associated with Alternative 3 would generally be minimal. Removal of contaminants and utilization of best management practices such as HEPA filtration, would minimize potential impacts to biotic resources. Approximately 12 acres of ungrazed managed pasture which currently provides minimal habitat or food source for terrestrial wildlife would be disturbed by construction of the CSF. No other terrestrial community displacement or disturbance is anticipated. The location for the CSF is shown in Figure 3-2.

Disposal activities associated with Alternative 3 would disturb portions of NTS. Habitat at NTS in the disposal area is limited (DOE 1991) and minimal displacement of species would occur.

Wetlands and Floodplains

Wetland areas on the perimeter of OU3 may be impacted by the interim action. A wetland assessment was prepared in accordance with 10 CFR 1022 and is presented in Appendix H. A wetland area of less than 0.5 acres is located north of the CSF area, but would not be affected by CSF construction. No activity would take place within the 100- and 500-year floodplains on the FEMP property.

Alternative 3 would result in the permanent filling of approximately 1.2 acres of wetlands on the east and west sides of OU3 from operating heavy equipment near drainageways and stockpiling soil from subgrade removal and decontamination and dismantlement activities. The impacted wetland areas consist of man-made drainageways with minimal quality habitat. Best management practices would minimize the amount of wetland area impacted. The wetland area north of the proposed CSF locations would not be impacted by Alternative 3.

No wetland or floodplain areas would be impacted at NTS by disposal of waste material.

Socioeconomics & Land Use

The implementation of this alternative would result in no change in the number of employees. It is anticipated that the shift in site activities from environmental investigation and design to construction and remediation would result in approximately the same number of workers.

Construction activity associated with the CSF, the decontamination and dismantlement activities, and off-site transportation would occur in a phased approach, thus minimizing impacts to existing traffic. The designated CSF site is located in the north buffer zone and is not currently used for FEMP remedial activities. Therefore, the structure would not impact current land use and the removal of the components is consistent with remediation of the site.

Disposal of Alternative 3 waste at NTS would have minimal impacts on socioeconomics and land use at NTS.

Cultural Resources

The National Historic Preservation Act (36 CFR 800, Section 106) requires Federal agencies to protect properties on or eligible for inclusion on the National Register of Historic Places. This list includes undiscovered resources, districts, sites, buildings, structures, or objects that may be eligible for inclusion on the National Register.

The Ohio State Historical Preservation Officer has determined that no cultural resources occur within the fenced Production Area (Luce 1987). An archeological survey of the area outside the fenced Production Area will be performed. If possible, impact area boundaries would be designed to avoid cultural resources. However, if this is not feasible and cultural resources would be affected, they would be evaluated to determine the appropriate treatment. Preservation of in-situ cultural resources would be accomplished through consultation with the Ohio Historic Preservation Office. Should it be agreed that cultural resources are to be removed, the following steps would be followed: 1) archaeological excavation, 2) laboratory treatment of cultural resources recovered at the site, and 3) curation of any recovered artifacts. If final in-situ preservation of on-property artifact(s) is chosen, the plan must be compatible with remedial alternatives selected for the area. No adverse effects to archaeological or cultural resources would occur under this alternative.

Disposal of wastes at NTS would not impact cultural resources.

4.4.5 Reduction in Toxicity, Mobility, or Volume Through Treatment

Alternative 3 includes decontamination of materials by removal of gross surface contamination to minimize the mobility of contaminants. The surface decontamination measures would clean contaminants off surfaces such as floors, walls, ceilings, structural members, and miscellaneous equipment and materials. Known and existing decontamination technologies would be selected during remedial design. Decontamination is a form of physical treatment, which does not fix the contaminants in the host media, but merely transfers them to a secondary medium. The collected secondary medium with removed contaminants would be managed resulting in storage or treatment, thereby reducing contaminant mobility. Waste residues from the decontamination process would be treated using existing on-site facilities. Dismantlement would prevent eventual exposure of contaminated media to weathering and allow its placement within the interim storage facilities. A small quantity of contaminated non-recoverable and non-recyclable debris may receive final disposition under the provisions of Removal No. 17. Additionally, any materials that could be recycled would be. This alternative would reduce the mobility of contaminants. The volume of contaminated media would likely increase due to generation of decontamination residues as well as the bulking of debris from dismantlement activities.

4.4.6 Implementability

The decontamination and dismantlement of contaminated structures would use commonly practiced engineering and de-construction techniques and pose no unusual technical difficulties. The necessary materials, equipment, and services are readily available. Decontamination and dismantlement is being performed at a similar site in Weldon Spring, Missouri, and has been completed on projects such as the decommissioning of the Shippingport Atomic Power Station and the Apollo, Pennsylvania remediation project. Decontamination and dismantlement has also been implemented on projects involving significant alpha contamination, i.e., the Radium Chemical Company facility in Queens, New York. Equipment and systems needed to prevent the spread of contamination and monitor containment during decontamination are readily available and have been demonstrated at projects such as the chromium plant operated by Allied Signal in Baltimore, Maryland.

Potential decontamination technologies that are proven and effective include, but are not limited to, wiping, vacuuming, manual or mechanical scrubbing, low or high pressure washing, grit blasting or pelletized CO_2 blasting, as well as other demonstrated effective technologies. Secondary waste streams would be treated as required to meet disposal restrictions and to minimize waste volume. Anticipated secondary waste streams may be water, chemicals, and solid grit materials. Final waste streams would be characterized and disposed through FEMP waste management programs. Materials from the decontamination process would be managed under Removal No. 17. If mixed wastes are obtained, these wastes would also be managed in accordance with Removal No. 17.

4.4.7 Cost

The cost of this alternative, in FY94 dollars, is estimated at $1,076 million, and includes the decontamination and dismantlement of the OU3 components, interim storage of debris, containers, and transportation, and disposition of a limited quantity of material at NTS. The equivalent present worth cost for Alternative 3 applying a 4.4% real interest rate, would be approximately $725 million. Details of the estimate are presented in Appendix C.

4.4.8 State Acceptance

State concerns with or acceptance of this alternative will be incorporated into the IROD and included into the final version of this Proposed Plan upon approval of the document by EPA.

4.4.9 Community Acceptance

As stated above in Section 4.1.9, this criterion may not be addressed until comments on this Proposed Plan are received from the public. The public comments will be incorporated into the IROD and the responsiveness summary.

5.0 SELECTION OF PREFERRED ALTERNATIVE

In this section, Alternatives 1, 2, and 3 are compared to allow selection of a preferred alternative. This comparative evaluation is performed based on EPA's standard evaluation criterion, which are defined in Section 4.1. The comparative evaluation is summarized in Section 5.1. DOE's preferred alternative is selected in Section 5.2.

OU3 components have generally exceeded their design life and no use has been identified for them other than support for remedial activities at the site. In time, the components will pose a safety hazard. Therefore, DOE will propose eventual decontamination and dismantlement of the components independent of the interim remedial action implemented. As a consequence, the comparison of Alternatives 1, 2, and 3 presented here assumes eventual decontamination and dismantlement of OU3 components. This assumes that if Alternative 3 is not implemented, then decontamination and dismantlement is assumed to be selected under the final ROD.

5.1 Summary of Comparative Analysis of Alternatives

The comparative evaluation of the alternatives for interim remedial action is summarized in Sections 5.1.1 through 5.1.9 and Table 5-1.

5.1.1 Overall Protection of Human Health and the Environment

As discussed in Section 4, each alternative is protective of human health and the environment. Engineering and administrative measures would be used during the remedial action periods for Alternatives 2 and 3 such that no significant adverse impacts would occur to the general public, on-site workers not directly involved in remediation, or the environment. Remediation worker exposures would be similarly controlled to levels that would be health protective.

Because it is assumed that decontamination and dismantlement of OU3 components would eventually occur independent of which alternative is implemented, similar overall protection of human health and the environment would eventually be provided by each alternative.

TABLE 5-1 Alternative Evaluation Summary

Evaluation Criteria	Alternative 1 No Interim Action	Alternative 2 Decontaminate Surfaces Only	Alternative 3 Decontaminate and Dismantle
Overall protection of human health and the environment	This alternative would be protective of human health and the environment following final remediation. However, before final remediation, migration of contaminants into soils and groundwater and releases to the atmosphere could occur.	Same as Alternative 1, although most removable contamination would be removed during the interim action.	This alternative would be most protective of human health and the environment. Acceleration of the remediation would provide increased protection to human health and the environment compared to Alternatives 1 and 2.
Compliance with ARARs	Before the final ROD, deteriorating conditions of the buildings may result in potential exposures to the public and contaminant releases to the groundwater.	This alternative would comply with ARARs during the action, but before the final ROD, deteriorating conditions of the buildings may result in potential exposures to the public and contaminant releases to the groundwater.	This alternative would comply with ARARs.
Long-term Effectiveness and Permanence	Because this alternative is an interim action, this criterion was not evaluated.	Same as Alternative 1.	Same as Alternative 1.
Short-term Effectiveness	This alternative would allow final remediation of OU3 in a manner protective of human health and the environment. However, this alternative would not accelerate the remediation, and the time until remedial objectives are reached would be longer than for Alternative 3.	Same as Alternative 1. Additionally, this alternative would be protective of human health and the environment during implementation.	This alternative would be protective of human health and the environment during implementation. Engineering and administrative controls would be used to maintain worker and public protection. This alternative would allow acceleration of remediation and would achieve remedial action objectives and protection against threats earlier than for Alternatives 1 and 2 and would accelerate OU5 remediation of environmental media.

TABLE 5-1 Alternative Evaluation Summary (Cont'd)

Evaluation Criteria	Alternative 1 No Interim Action	Alternative 2 Decontaminate Surfaces Only	Alternative 3 Decontaminate and Dismantle
Reduction in toxicity, mobility, or volume through treatment	This alternative provides no treatment before the final ROD. In the interim before final remediation, releases to the environment might occur increasing the volume of contaminated material.	This alternative would reduce contaminant mobility through removal of gross surface contamination, but uses only physical treatment. In the interim before final remediation, releases to the environment might occur increasing the volume of contaminated material.	This alternative would reduce the mobility of contaminants by removing contaminants to an improved storage configuration and would minimize waste generation as compared to Alternatives 1 and 2.
Implementability	Easier and more direct to implement in the short-term than Alternatives 2 or 3. However, requires duplication of multiple studies, documents, regulatory reviews, and public comment periods.	Easier and more direct to implement in the short-term than Alternative 3.	Technically and administratively feasible to implement. In the long-term, similar to Alternatives 1 and 2.
Cost (Millions) Current year (FY94)	$2,520	$2,602	$2,164
Present worth	$1,548	$1,619	$1,476
State acceptance	State concerns will be incorporated into the IROD and included into the final version of this Proposed Plan.	State concerns will be incorporated into the IROD and included into the final version of this Proposed Plan.	State concerns will be incorporated into the IROD and included into the final version of this Proposed Plan.
Community acceptance	This criterion cannot be addressed until comments on this Proposed Plan are received from the public.	This criterion cannot be addressed until comments on this Proposed Plan are received from the public.	This criterion cannot be addressed until comments on this Proposed Plan are received from the public.

However, under Alternative 1, potential sources of contamination would remain in place for an additional four years prior to the commencement of remedial activities. Before remediation of components, releases of contaminants to the environment could potentially occur through floors into soils and groundwater and through airborne releases to the atmosphere and could result in the exposure of on-site and off-site receptors to contaminants.

For Alternative 2, the components would undergo a gross surface decontamination to remove significant levels of removable contamination. Without removal of the interior equipment and utilities, a full decontamination could not occur, and some removable contamination would still remain in place. Leaving some contamination in place could potentially lead to releases to the environment and subsequent exposures of receptors before final remediation.

For Alternative 3, dismantlement of components would be accelerated. This alternative would substantially reduce the time before remedial actions would begin for OU3. Figure 5-1 illustrates schedule comparisons between the three alternatives and details the potential for early remediation offered by Alternative 3. Overall, Alternative 3 would provide the greatest protection for human health and the environment as a result of the acceleration of remedial action.

5.1.2 Compliance with ARARs

Assuming that components are eventually decontaminated and dismantled, each alternative would comply with the ARARs as proposed in Appendix A during the decontamination and dismantlement activities. During the period before the final ROD, Alternatives 1 and 2 would allow the buildings to continue to age, weather, and deteriorate, resulting in the potential for public exposure to contaminants and contaminant releases to groundwater. Alternative 3 would be protective of human health and the environment during the interim action and would comply with ARARs as developed in Appendix A.

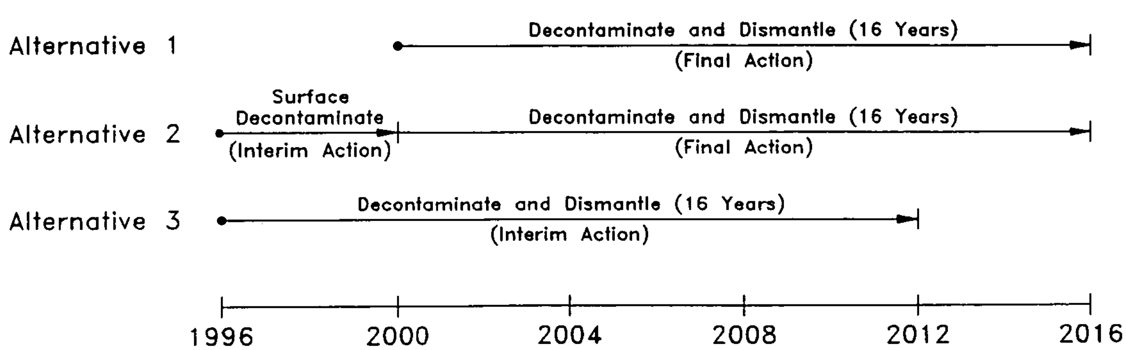

FIGURE 5-1 Comparison of Schedules for the Alternatives

5.1.3 Long-term Effectiveness and Permanence

Because the action proposed in this document is an interim action, long-term effectiveness and permanence were not evaluated.

5.1.4 Short-term Effectiveness

Alternatives 2 and 3 would be effective in protecting human health and the environment during implementation of the alternatives through the use of engineering and administrative controls. Assuming that decontamination and dismantlement of OU3 components would eventually occur, all of the alternatives are equally protective of human health and the environment, with the exception of possible incremental risks associated with the delays for Alternatives 1 and 2. However, accelerating the decontamination and dismantling activities using Alternative 3 would allow remedial action objectives to be achieved sooner and would provide protection against threats earlier than Alternatives 1 or 2. It is estimated that the implementation of Alternative 3 would allow completion of remediation in the year 2012, in comparison to completion under the final ROD in the year 2016. Additionally, acceleration of the remediation within the Production Area may allow the advancement of the remediation of OU5 soils and perched groundwater.

5.1.5 Reduction in Toxicity, Mobility, or Volume Through Treatment

Assuming the eventual decontamination and dismantlement of components independent of which alternative is selected, all three alternatives would result in implementation of gross surface decontamination. Decontamination is a form of physical treatment, which does not fix the contaminants in the host media, but merely transfers them to a secondary medium. The collected secondary medium with removed contaminants would be managed resulting in storage or treatment, thereby reducing contaminant mobility. Waste residues from the decontamination process would be treated using existing on-site facilities. This reduction would be attained through gross surface decontamination and placement of decontamination and dismantlement wastes in controlled storage or through disposition of wastes. Therefore, a comparison of alternatives requires an evaluation of the impacts of timing. In the period before final remediation, Alternative 1 and 2 could potentially result in additional contamination of soil and groundwater, increasing the volume of contaminated material. In addition, under Alternative 2, two surface decontamination efforts would ultimately be required and would result in an increased volume of decontamination waste compared to Alternative 3.

Alternative 3 would reduce the potential of an increase in volume of contaminated material due to migration of contaminants during the period before remediation is complete and would minimize the volume of decontamination residues and other wastes.

5.1.6 Implementability

Alternative 1 would be the easiest and most direct to implement because it would require no additional action. However, continuing under the existing system of using removal actions to proceed with cleanup requires duplication of multiple studies, documents, regulatory reviews, and public comment periods for similar actions.

Alternative 2 and 3 would use proven and reliable technologies, although the scope for Alternative 3 would be considerably larger than the scope of Alternative 2. In the long term, assuming eventual decontamination and dismantlement of OU3 components, implementability issues associated with the action would be similar for all alternatives.

5.1.7 Cost

Two methods are used to present costs associated with implementing each of the alternatives. As shown in Table 5-1, the first method illustrates the costs in current fiscal year (1994) dollars. In other words, if the entire cost of the alternative was paid during the 1994 fiscal year, then that cost would be considered to be in current year dollars. However, because of inflation, work performed in the future would undoubtably cost more than work performed today.

To account for this, a second cost estimating approach is used, called present worth analysis. Present worth analysis calculates the amount of money that would have to be invested today in order to pay for the cleanup over the years of implementation. The real interest rate applied in the present worth analysis is determined by the Federal Government's Office of Management and Budget to be 4.4 percent based on an investment interest rate minus the rate of inflation.

The costs for each alternative reflect the costs for performing the alternative itself plus the eventual decontamination, dismantlement, and interim site maintenance and monitoring. The differences in overall costs for the alternatives are mainly the result of the four-year difference in implementation schedules. The difference results from four additional years of costs associated with the maintenance and monitoring of the structures and related facilities while they remain in place (including security forces, utilities, etc.).

In the short term, Alternative 1 would be the least costly of the alternatives and Alternative 3 would be the most costly. However, assuming, eventual decontamination and dismantlement of OU3 components, Alternative 3 would result in the lowest overall cost. Alternatives 1 and 2 would be more costly due to costs associated with the continuing operation and maintenance of the site for an additional number of years. Additionally, for Alternative 2, the costs also increase due to the assumption that the decontamination effort would be repeated prior to the dismantlement of the components under the final ROD. This effort is likely to be required to support the health and safety requirements of the remediation. It is anticipated that substantial removable contamination will be present in, under, and around equipment, corners, roofs, utilities, and piping. The estimated costs for each alternative are presented in Table 5-1.

5.1.8 State Acceptance

State concerns with or acceptance of this alternative will be incorporated into the IROD and included into the final version of this Proposed Plan upon approval of the document by EPA.

5.1.9 Community Acceptance

As stated in Section 4.1.9, this criterion may not be addressed until comments on this Proposed Plan are received from the public. Therefore, a comparative evaluation cannot be performed for this criterion.

5.2 Preferred Alternative

Alternative 3 is DOE's preferred alternative because it accelerates the remediation process by nearly four years and provides protection against potential threats sooner. The overall costs associated with this alternative are also expected to be less than for Alternatives 1 or 2.

On the basis of currently available information, the preferred alternative provides the best balance of trade-offs among the alternatives with respect to the evaluation criteria. DOE and EPA believe the preferred alternative would protect human health and the environment. It would also be cost-effective and would comply with Federal, State, and local ARARs.

Because this proposal pertains to an interim action instead of a final action, the preferred alternative does not utilize permanent solutions or consider alternative technologies. It does not satisfy the statutory preference for remedial actions that employ treatment to reduce toxicity, mobility, or volume as a principal element of the action. However, permanent solutions will be utilized in the final remedial action and alternative treatment (or resource recovery) will be utilized to the maximum extent possible. The final remedial action will satisfy the statutory preference for treatment as a principal element or will provide justification for not meeting the preference.

6.0 COMMUNITY PARTICIPATION

This Proposed Plan identifies DOE's preferred alternative, based on current information, from a list of possible alternatives for remediation of former production buildings and structures within OU3. After this Proposed Plan is approved by EPA, a notice of availability will be released in local metropolitan newspapers announcing a 30-day public comment period and a public meeting. Public comments by area residents and other interested parties will be accepted on all of the alternatives being considered. A modification to, or complete change in, the preferred alternative may be made if public comments or additional data warrant consideration of a more suitable or appropriate solution. The public comment period will begin on December 8, 1993 and continue through January 7, 1994.

The public meeting conducted during the public comment period will allow interested parties to question this Proposed Plan. At the public meeting, DOE and EPA will present this Proposed Plan, answer questions, and accept both oral and written comments. The public meeting is scheduled:

Wednesday, January 5, 1994 at 7:00 PM
The Plantation
9660 Dry Fork Road; Harrison, Ohio 45030

Written comments may be submitted to the following addresses before the close of the public comment period:

Mr. Ken Morgan
Director, Public Information
U.S. Department of Energy Fernald Field Office
P.O. Box 398705
Cincinnati, Ohio 45239-8705
(513) 648-3131

Mr. Jim Saric
U.S. Environmental Protection Agency
77 West Jackson Boulevard
5HRE 8J
Chicago, Illinois 60604
(312) 886-0992

A copy of this Proposed Plan is available in the Administrative Record, located at the public Environmental Information Center, Jamtek Building, 10845 Hamilton-Cleves Highway, Harrison, Ohio 45030, (513) 738-0164 or 738-0165.

PUBLIC ENVIRONMENTAL INFORMATION CENTER HOURS

Monday and Thursday, 9 a.m. to 8 p.m.

Tuesday, Wednesday, and Friday, 9 a.m. to 9:30 p.m.

Saturday, 9 a.m. to 1 p.m.

7.0 SCHEDULE

The schedule provided in this section addresses preparation of CERCLA decision documents for the interim remedial action. Following approval of this Proposed Plan by EPA, a 30 day public comment period will be initiated to evaluate public acceptance of the proposed interim action. Comments and responses will be incorporated into a Responsiveness Summary document for inclusion into the Interim Record of Decision for OU3. A draft schedule for these activities is shown in Figure 7-1. During development of the IROD, DOE will complete the NEPA review for the proposed action and, if appropriate, will issue a Finding of No Significant Impacts (FONSI) for the action, documenting NEPA authorization.

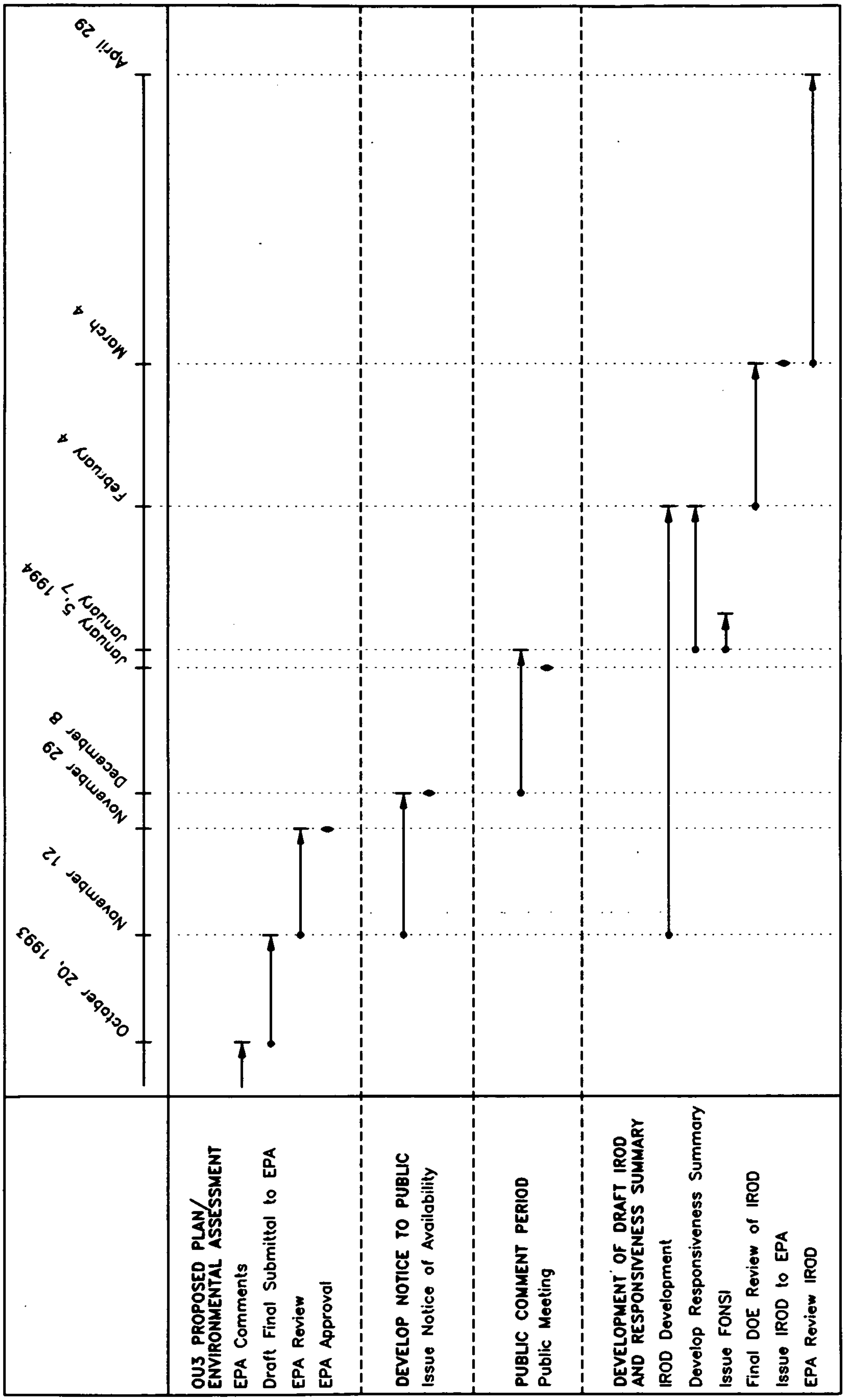

FIGURE 7-1 Schedule of OU3 Proposed Interim Action Decision

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8.0 REFERENCES AND AGENCIES AND PERSONS CONSULTED

The publications/organizations detailed below constitute the documents referenced and the agencies and organizations contacted to support the information presented in this Proposed Plan.

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APPENDIX A

POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs); OTHER CRITERIA TO BE CONSIDERED (TBCs); AND OTHER REQUIREMENTS

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APPENDIX A -- POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs); OTHER CRITERIA TO BE CONSIDERED (TBCs); AND OTHER REQUIREMENTS

A.1 Introduction

The regulatory requirements discussed by this section are those requirements that have been identified for the OU3 interim remedial action. This section includes a discussion of CERCLA provisions affecting this action and a list of the ARARs and other criteria to be considered as well as the regulatory requirements that specifically address the alternatives discussed. The approach taken in development of the requirements for this Proposed Plan was to invoke the most stringent requirement or the prevailing standard affecting this action.

A.2 ARARs and Interim Actions

The alternatives considered by this plan for OU3 are interim measures taken under DOEs authority as lead agency, and were developed to address the more immediate threats in OU3. CERCLA Section 104 establishes the frame work for the lead agency to undertake response actions at CERCLA sites. Response actions by definition include both remedial and removal actions. Remedial actions are generally long term actions that must attain ARARs identified for that action or waive those requirements. Removal actions are responses to immediate releases or threats of release. The preamble to the NCP discusses interim measures which it defines as a means to control or prevent the further spread of contamination while the final remedy is decided upon. Interim actions must, according the NCP, be consistent with the final remediation likely to be selected. From an ARARs perspective, an interim action should be protective of human health and the environment, but need not comply with all of the ARARs identified for the remedial action; however, those ARARs must be complied with at final remediation. The tables included in this appendix list those ARARs that have been identified to specifically address the preferred alternative.

A.3 CERCLA Statutory Provisions

An interim remedial action, as proposed by this document, is a remedial activity as defined by CERCLA and is therefore conducted in support of the final remedial action, and is consequently part of the ongoing RI/FS for OU3. Consequently the statutory waiver for permits in CERCLA Section 121(e) applies. This section states the following:

> "(e) Permits and enforcement-
>
> 1) No Federal, State or local permit shall be required for the portion of any removal or remedial action conducted entirely on site, where such remedial action is selected and carried out in compliance with this section."

Although according to the CERCLA statutes, no permits are required for this action since it is conducted on site, CERCLA and a similar requirement in the USEPA-DOE Amended Consent Agreement make it clear that the substantive requirements of the appropriate permits, that would otherwise be required, must be submitted. These permits and the integration of their substantive requirements are discussed elsewhere in this plan. There are specific requirements that will be addressed for waste that are shipped off-site. A later section will address this issue.

A.4 Amended Consent Agreement Provisions

The Amended Consent Agreement, Section XIII states:

"A. U.S.EPA and U.S.DOE recognize, under Section 121(d) and 121(e)(1) of CERCLA, 42 U.S.C. 9621(d) and 9621(e)(1) and the NCP, that portions of the response actions under this Agreement and conducted entirely on the Site are exempt from the procedural requirement to obtain Federal, State or local permits. U.S.DOE must satisfy the Federal and State standards, requirements, criteria, or limitations that would have been included in any such permit to the extent required by CERCLA and the NCP."

"B. When U.S.DOE proposes a response action to be conducted entirely on the Site, which in the absence of Section 121(e)(1) of CERCLA and the NCP would require a Federal or State permit, U.S.DOE shall include in its submittal to U.S.EPA:

1. Identification of each permit that would otherwise be required;

2. Identification of the standards, requirements, criteria or limitations that would have had to have been met to obtain each such permit; and

3. Explanation of how the response action will meet the standards, requirements, criteria, or limitations identified in item 2 above."

Consequently, supporting documentation, containing the information discussed and the substantive or technical requirements will be integrated into the RD/RA Work Plan.

<u>OU3 Interim Remedial Action ARARs</u>

Table A-1, A-2 and A-3 of this Appendix are lists of ARARs and TBCs identified as pertinent to the OU3 interim remedial action. These requirements were identified from the ARARs table being developed for the OU3 Remedial Action. The tables, identified as chemical-specific, action-specific and location-specific, include the regulatory citation, contaminant or medium in question, a synopsis of the requirement, the ARARs determination and a remarks section.

The approach taken in development of the requirements for this Proposed Plan was to invoke the most stringent requirement or the prevailing standard affecting this action. This meant that duplicate standards were eliminated, yielding to the more stringent standard and reliance on the use of DOE Orders such as DOE Order 5400.5, a TBC, in lieu of overlapping or duplicate ARARs. The rationale for this method of identification is that the use of single standards allows a clear line of compliance with the most stringent standard. DOE Orders, although not promulgated standards, do represent contractual obligations for DOE contractors and subcontractors, and therefore constitute requirements with which the FEMP and its contractors must comply. Requirements in DOE Orders are derived from promulgated standards generated by the USEPA, NRC, OSHA and other regulatory authorities. Compliance with these orders in lieu of the similar regulations results in at least as equal a level of protectiveness. Additionally, compliance with alternate standards during an interim action is, according to the NCP, an acceptable demonstration of compliance if those standards are protective of human health and the environment.

The ARARs identified for the OU3 interim remedial action include regulations resulting from implementation of the Clean Air Act (CAA). The CAA's objective is to protect and enhance the quality of the nation's air resources in order to promote and maintain public health and welfare and the productive capacity of the population. ARARs for this action include standards from the National Emission Standards for Hazardous Air Pollutants (NESHAPs) for radionuclides and for asbestos. The DOE and USEPA have entered into a legal agreement to implement 40 CFR 61, Subpart Q, on a site specific basis (Federal Facilities Agreement: Control and Abatement of Radon-222 Emissions, dated November 14, 1991). Because it is a requirement and is not waivable, it is not included as an ARAR.

Regulations implemented by the Clean Water Act (CWA) also are ARARs for this action. The CWA's objective is to restore and maintain the physical, chemical and biological integrity of the nation's waters. ARARs for the OU3 interim remedial action include compliance with the NPDES Permit and Federal Water Quality Criteria. The MCLs from the Safe Drinking Water Act (SDWA) are also included as ARARs for this action.

The Resource Conservation and Recovery Act (RCRA) also has resulted in implementation of regulations that have been identified as ARARs for the management of residues and waste generated by the this action. The goals of RCRA are protection of human health and the environment, reduction of waste and conservation of energy, and reduction or elimination of generation of hazardous waste. Promulgated requirements under RCRA were identified as ARARs for this action for waste characterization, container management, generator standards, treatment, tank storage and closure. Additional standards from RCRA evaluated and considered as applicable, or as relevant and appropriate, or as to be considered, include the Corrective Managemant Unit (CAMU) Rule and the proposed standards for corrective action.

The Toxic Substances Control Act (TSCA) also has resulted in implementation of regulations identified as ARARs for this action. The objective of TSCA is to provide for the management, handling and disposal of toxic substances, including PCBs. PCBs are a potential contaminant in OU3.

The ARARs for this plan identified from the State of Ohio's regulations include regulations to control fugitive dust emissions, asbestos, lead and air quality non-degradation. Other standards identified as ARARs or criteria to be considered (TBCs) include standards for radiation exposure, endangered species protection, solid waste management, radioactive waste management and stormwater management.

Other Requirements

Table A-4 is a list of requirements with which this action must comply. The requirements included in that table are from OSHA, DOT and DOE Orders. This table is included to identify standards, in addition to the ARARs, which this action will comply with. The requirements identified here include standards for worker protection, off-site actions and other standards which the USEPA has determined are not standards for environmental protection and therefore are not ARARs. In the case of worker protection, particularly OSHA's 29 CFR 1910.120, EPA has determined that this standard is a requirement and is not an ARAR because it cannot be waived. Also, this particular standard is not an environmental standard, so it for this reason also cannot be an ARAR.

Table A-4 is not an all inclusive table of requirements. There are additional requirements which could result from off-site actions and would be required under CERCLA Section 121(d)(3). Under this requirement, the CERCLA Off-Site Policy, activities that occur off-site shall be at facilities that are in compliance with RCRA, TSCA and other environmental laws and applicable state requirements. Determinations under this policy will be made during the remedial action.

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TABLE A-1 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 Radio-nuclides 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 relevant and appropriate	These requirements may potentially be relevant and appropriate because this action results in activities that are regulated. Each source shall be limited to 0.1 mrem/yr with dosages to the public not exceeding 10 mrem/yr from the facility.
Radiation Protection of the Public and the Environment (DOE Order 5400.5)	Radiation	Any	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, DOE Orders represent contractual obligations for DOE contractors and subcontractors, and therefore constitute requirements that the facility and its contractors must comply with. Requirements in DOE Orders are derived from promulgated standards generated by the USEPA, NRC, OSHA and other regulatory authorities. Compliance with these orders in lieu of the similar regulations results in an equal level of protectiveness. Additionally, compliance with alternate standards during an interim action is, according to the NCP, an acceptable demonstration of compliance if those standards are protective of human health and the environment.

TABLE A-1 Potential Contaminant-Specific Requirements (Cont'd)

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Radiation Protection of the Public and the Environment (DOE Order 5400.5, Chapter III)	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, DOE Orders represent contractual obligations for DOE contractors and subcontractors, and therefore constitute requirements that the facility and its contractors must comply with. Requirements in DOE Orders are derived from promulgated standards generated by the USEPA, NRC, OSHA and other regulatory authorities. Compliance with these orders in lieu of the similar regulations results in an equal level of protectiveness. Additionally, compliance with alternate standards during an interim action is, according to the NCP, an acceptable demonstration of compliance if those standards are protective of human health and the environment.

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 A-1 Potential Contaminant-Specific Requirements (Cont'd)

Potential ARAR	Contaminant	Medium	Requirement				Preliminary Determination	Remarks
DOE Order 5400.5, Chapter III (Cont'd)			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}		

TABLE A-1 Potential Contaminant-Specific Requirements (Cont'd)

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
DOE Order 5400.5, Chapter III (Cont'd)			See DCG table below		

Isotope	Derived Concentration Guide[a] (µCi/mL) 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.

[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.

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TABLE A-1 Potential Contaminant-Specific Requirements (Cont'd)

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
DOE Order 5400.5, Chapter III (Cont'd)	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, DOE Orders represent contractual obligations for DOE contractors and subcontractors, and therefore constitute requirements that the facility and its contractors must comply with. Requirements in DOE Orders are derived from promulgated standards generated by the USEPA, NRC, OSHA and other regulatory authorities. Compliance with these orders in lieu of the similar regulations results in an equal level of protectiveness. Additionally, compliance with alternate standards during an interim action is, according to the NCP, an acceptable demonstration of compliance if those standards are protective of human health and the environment.
	Radon 220, 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	
	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	

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TABLE A-1 Potential Contaminant-Specific Requirements (Cont'd)

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Ohio Air Pollution Control Regulations, Ohio Administrative Code, 3745-17-08, Restriction of emission of fugitive dust	Particulate matter	Air	No person shall cause or permit any fugitive dust source to be operated; or any materials to be handled, transported or stored; or a building or its appurtenances or a road to be used constructed, altered, repaired or demolished without taking or installing reasonably available control measures to prevent fugitive dust from becoming airborne. Such reasonably available control measures shall include, but not be limited to, one or more of the following which are appropriate to minimize or eliminate visible particulate emissions of fugitive dust: ● the use of water or other suitable dust suppression chemicals for the control of fugitive dust from the demolition of existing buildings or structures, construction operations, the grading of roads, or the clearing of land. ● the periodic application of asphalt, oil, water, or other suitable dust suppression chemicals on dirt or gravel roads and parking lots, and any other surfaces which cause emissions of fugitive dust. ● the installation and use of hoods, fans, and other equipment to adequately enclose, contain, capture, vent, and control the fugitive dust. Such equipment shall meet the following requirements: - collection efficiency is sufficient to minimize or eliminate visible particulate emissions of fugitive dust at the point(s) of capture to the extent possible with good engineering design.	Potentially relevant and appropriate	Applicable in Butler County to cities of Hamilton, Middletown, and New Miami, and Fairfield, Lemon, Madison and St. Clair Townships.
Ohio Air Pollution Lead Control Regulations Ohio, Administrative Code, 3745-71-02, 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.
Ohio Air Pollution Regulations, Ohio Administrative Code 3745-20-02;03;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 friable asbestos is present.

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TABLE A-1 Potential Contaminant-Specific Requirements (Cont'd)

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
National Emissions Standard for Hazardous Air Pollutants (40 CFR 61, Subpart M, Sections 145, 149, 150 and 153), National Emissions Standard for Asbestos	Asbestos	Air	Standards for demolition and renovation, asbestos waste disposal	Potentially Applicable	These regulations are applicable to the demolition or renovation of any building in which friable asbestos is present.
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 such PCB contaminated materials should occur during implementation of the remedial action, these regulations would be applicable.

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TABLE A-1 Potential Contaminant-Specific Requirements (Cont'd)

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Safe Drinking Water Act (42 USC 300G; PL 93-523), National Primary Drinking Water Regulations (40 CFR 141), Subpart B, Maximum Contaminant Levels (40 CFR 141.11 through .16); Subpart F, Maximum Contaminant Level Goals, (40 CFR 141.50 through .52); Subpart G, National Revised Primary Drinking Water Regulations (40 CFR 141.60 through .63); Ohio Drinking Water Regulations, Public Water System Primary Contaminant Control, OAC 3745-81.	See table	Water	Maximum contaminant levels (MCLs) for drinking water delivered directly to the ultimate user of a public water system are given.	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. Maximum contaminant level goals (MCLGs), the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, 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. In all instances the identified MCLG was equal to the MCL, and so no MCLGs are listed. The most protective standard (amongst Federal MCL, Federal MCLG, and State MCL) is identified.

Parameter	Unit	MCL
Inorganics:		
Asbestos (> 10μm)	million fibers/L	7
Arsenic	mg/L	0.05
Barium	mg/L	1 (Ohio MCL)
Cadmium	mg/L	0.005
Chromium	mg/L	0.05 (Ohio MCL)
Copper	mg/L	1.3 (56 FR 26460, 6/7/91)
Fluoride	mg/L	4.0
Lead	μg/L	15 (56 FR 26460, 6/7/91)
Mercury	mg/L	0.002
Nitrate (as Nitrogen)	mg/L	10
Selenium	mg/L	0.01 (Ohio MCL)
Silver	mg/L	0.05 (Ohio MCL)
Organics:		
Benzene	mg/L	0.005
Carbon tetrachloride	mg/L	0.005
1,2-Dichloroethane	mg/L	0.005
1,1-Dichloroethylene	mg/L	0.007
Ethylbenzene	mg/L	0.7
PCBs	mg/L	0.0005
Pentachlorophenol	mg/L	0.001
Tetrachloroethylene	mg/L	0.005
Toluene	mg/L	1.0
1,1,1-Trichloroethane	mg/L	0.2
Trichloroethylene	mg/L	0.005
Xylenes (total)	mg/L	10.0
Radionuclides:		
Gross alpha[1]	pCi/L	15
Gross beta[2]	mrem/yr	4
Radium-226 and Radium-228 (combined)	pCi/L	5 (Ohio MCL)

Footnotes for Requirements Table:

[1] Including radium but excluding radon and uranium.

[2] As mrem/yr, annual dose equivalent; if gross beta activity exceeds 50 pCi/L, isotopic analysis and organ-specific dose calcultions 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 9 pCi/L.

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TABLE A-1 Potential Contaminant-Specific Requirements (Cont'd)

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
National Primary Drinking Water Regulations, Radionuclides (56 FR 33050, July 18, 1991, Proposed Rule).	See table	Water	Proposed maximum contaminant levels (MCLs) for drinking water delivered directly to the ultimate user of a public water system are given. (See parameter table below.)	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	MCL
Radionuclides:		
Adjusted gross Alpha	pCi/L	15
Beta particle and photon emitters (excluding Radium-228)	mrem ede/yr	4
Radium-226	pCi/L	20
Radium-228	pCi/L	20
Radon-222	pCi/L	300
Uranium	μg/L	20*

* 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.

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TABLE A-1 Potential Contaminant-Specific Requirements (Cont'd)

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 limits on the concentration of contaminants in surface water for the protection of human health and aquatic life are given.	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.

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TABLE A-1 Potential Contaminant-Specific Requirements (Cont'd)

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
Ohio Water Quality Standards, Ohio Administrative Code (OAC) 3745-1-01, 3745-1-07; Ohio NPDES Permits, OAC 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 is 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 A-1 Potential Contaminant-Specific Requirements (Cont'd)

Potential ARAR	Contaminant	Medium	Requirement	Preliminary Determination	Remarks
[1] Radiation Protection of the Public and the Environment (DOE Order 5400.5, Chapter III)	Radiation	Water	Residual concentrations of radionuclides in water in uncontrolled areas are given. (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, DOE Orders represent contractual obligations for DOE contractors and subcontractors, and therefore constitute requirements that the facility and its contractors must comply with. Requirements in DOE Orders are derived from promulgated standards generated by the USEPA, NRC, OSHA and other regulatory authorities. Compliance with these orders in lieu of the similar regulations results in an equal level of protectiveness. Additionally, compliance with alternate standards during an interim action is, according to the NCP, an acceptable demonstration of compliance if those standards are protective of human health and the environment.

Isotope	Ingested Water Derived Concentration Guide (μCi/mL)
Actinium-227	1×10^{-8}
Actinium-228	6×10^{-6}
Americium-241	3×10^{-8}
Bismuth-210	2×10^{-5}
Bismuth-212	1×10^{-4}
Bismuth-214	6×10^{-4}
Cesium-137	3×10^{-6}
Cobalt-60	1×10^{-5}
Europium-152	2×10^{-5}
Lead-210	3×10^{-8}
Lead-212	3×10^{-6}
Lead-214	2×10^{-4}
Neptunium-237[1]	3×10^{-8}
Plutonium-238[1]	3×10^{-6}
Plutonium-239[1]	2×10^{-6}
Plutonium-240[1]	2×10^{-8}
Plutonium-241[1]	1×10^{-4}

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TABLE A-1 Potential Contaminant-Specific Requirements (Cont'd)

Potential ARAR	Contaminant	Medium	Requirement: Isotope	Requirement: Ingested Water Derived Concentration Guide (μCi/mL)	Preliminary Determination	Remarks
DOE Order 5400.5, Chapter III (Cont'd)			Plutonium-242[1]	2×10^{-6}		
			Polonium-210	8×10^{-8}		
			Protactinium-231	1×10^{-8}		
			Protactinium-234	7×10^{-5}		
			Radium-223	3×10^{-7}		
			Radium-224	4×10^{-7}		
			Radium-226	1×10^{-7}		
			Radium-228	1×10^{-7}		
			Radon-220[2]	-		
			Radon-222[3]	-		
			Technetium-99	1×10^{-4}		
			Ruthenium-106	6×10^{-6}		
			Strontium-90	1×10^{-6}		
			Thorium-227	4×10^{-6}		
			Thorium-228	4×10^{-7}		
			Thorium-229	4×10^{-8}		
			Thorium-230	3×10^{-7}		
			Thorium-232	5×10^{-8}		
			Thorium-natural	5×10^{-8}		

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TABLE A-1 Potential Contaminant-Specific Requirements (Cont'd)

Potential ARAR	Contaminant	Medium	Requirement		Preliminary Determination	Remarks
DOE Order 5400.5, Chapter III (Cont'd)			Isotope	Ingested Water Derived Concentration Guide (μCi/mL)		
			Thorium-234	1×10^{-5}		
			Uranium-231	1×10^{-4}		
			Uranium-233	5×10^{-6}		
			Uranium-234	5×10^{-6}		
			Uranium-235	5×10^{-6}		
			Uranium-236	6×10^{-6}		
			Uranium-238	6×10^{-6}		
			Uranium-Natural	6×10^{-6}		

[1] Based on the listed f_1 value. It is assumed that individual organ doses, except for the gastrointestinal tract, change in proportion to f_1 for all organs, including the "Remainder." Gastrointestinal doses are unchanged because very little material is absorbed in the upper portions of the tract.

[2] DCGs for Rn-220 are being assessed by DOE. Until the review has been completed and new values issued, the value of 3×10^{-9} μCi/mL given in Figure III-3 shall be used.

[3] DCGs for Rn-222 are being assessed by DOE. Until the review has been completed and new values issued, the value of 3×10^{-9} μCi/mL given in Figure III-3 shall be used for Rn-222 releases from DOE facilities. In addition, the requirements of Chapter IV, Sections 4b, 6b, and 6d, shall be used when they are applicable.

TABLE A-2 Potential Location-Specific Requirements

Potential ARAR	Location	Requirement	Preliminary Determination	Remarks
Protection of Wetlands (Executive Order 11990; 10 CFR 1022, 40 CFR Part 6)	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	Best management practices will be utilized to minimize impact on wetlands through consultation with the Corps of Army Engineers.
Nationwide Permit Program (33 CFR 330)	Wetland	The U.S. Corps of Engineers can issue a Nationwide Permit (NWP) as a general permit for certain classes of actions that involve dredge or fill activities in wetlands of navigable waters. Discharge into wetlands may require a wetland delineation.	Potentially applicable	On-site alternatives might require dredge or fill activities in jurisdictional wetlands in order to have sufficient ground areas for remedial activities. Nationwide Permit #38 applies to the class of dredge and fill activities associated with cleanup of Hazardous and Toxic Waste. If remedial activities exceed the limitations for a NWP, an individual permit for the dredge and fill activities must be sought. (33 CFR 323 and OAC 3745-32 (Section 401 Water Quality Certifications))

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TABLE A-3 Potential Action-Specific Requirements

Potential ARAR	Action	Requirement	Preliminary Determination	Remarks
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.
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	Although not promulgated standards, DOE Orders represent contractual obligations for DOE contractors and subcontractors, and therefore constitute requirements that the facility and its contractors must comply with. Requirements in DOE Orders are derived from promulgated standards generated by the USEPA, NRC, OSHA and other regulatory authorities. Compliance with these orders in lieu of the similar regulations results in an equal level of protectiveness. Additionally, compliance with alternate standards during an interim action is, according to the NCP, an acceptable demonstration of compliance if those standards are protective of human health and the environment.
Radioactive Waste Management (DOE Order 5820.2A, Chapter III)	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, DOE Orders represent contractual obligations for DOE contractors and subcontractors, and therefore constitute requirements that the facility and its contractors must comply with. Requirements in DOE Orders are derived from promulgated standards generated by the USEPA, NRC, OSHA and other regulatory authorities. Compliance with these orders in lieu of the similar regulations results in an equal level of protectiveness. Additionally, compliance with alternate standards during an interim action is, according to the NCP, an acceptable demonstration of compliance if those standards are protective of human health and the environment.

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TABLE A-3 Potential Action-Specific Requirements (Cont'd)

Potential ARAR	Action	Requirement	Preliminary Determination	Remarks
Radiation Protection of the Public and the Environment (DOE Order 5400.5, Chapter IV, Section 6)	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, DOE Orders represent contractual obligations for DOE contractors and subcontractors, and therefore constitute requirements that the facility and its contractors must comply with. Requirements in DOE Orders are derived from promulgated standards generated by the USEPA, NRC, OSHA and other regulatory authorities. Compliance with these orders in lieu of the similar regulations results in an equal level of protectiveness. Additionally, compliance with alternate standards during an interim action is, according to the NCP, an acceptable demonstration of compliance if those standards are protective of human health and the environment.
DOE Order 6430.1A, Section 1324-7	Solid Waste Airborne Effluent Control	Exhaust outlets that may contain fission products shall be provided with two monitoring systems. These monitoring systems shall comply with Section 1589-99.0.1, Radioactive Airborne Effluents.	TBC	Although not promulgated standards, DOE Orders represent contractual obligations for DOE contractors and subcontractors, and therefore constitute requirements that the facility and its contractors must comply with. Requirements in DOE Orders are derived from promulgated standards generated by the USEPA, NRC, OSHA and other regulatory authorities. Compliance with these orders in lieu of the similar regulations results in an equal level of protectiveness. Additionally, compliance with alternate standards during an interim action is, according to the NCP, an acceptable demonstration of compliance if those standards are protective of human health and the environment.

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TABLE A-3 Potential Action-Specific Requirements (Cont'd)

Potential ARAR	Action	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 A, General	PCB testing	Inspection and testing are required for material contaminated with PCBs.	Relevant and appropriate	This requirement may be relevant and appropriate for characterization of site waste for PCBs.
Solid Waste Disposal Act, as amended (42 USC 6901, et seq.), Solid Wastes (40 CFR 262.11); Ohio Hazardous Waste Management Regulations, Ohio Administrative Code 3745-52-11.	Waste characterization and management	A waste must be evaluated to determine if it is a hazardous waste, i.e., either a waste listed in 40 CFR 261 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 40 CFR 261.24 for the constituents identified by the established toxic characteristic leaching procedure (TCLP).	Potentially applicable	These requirements are applicable to the characterization and management of waste generated by this action. 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 (Ohio Hazardous Waste Management Regulations, Ohio Administrative Code (OAC) 3745-54-10 through -18); Subpart C, Preparedness and Prevention (OAC 3745-54-30 through -37); Subpart D, Contingency Plan and Emergency Procedures (OAC 3745-54-50 through -56); Subpart E, Manifest System, Recordkeeping and Reporting (OAC 3745-54-70 through -77).	Waste treatment, storage, and disposal	General requirements are established for storage and treatment facility location, design and inspection, waste compatibility determination, emergency contingency plans, preparedness plans, 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	The substantive requirements in this requirement could be applicable for storage or treatment of hazardous waste on-site. As an example, if RCRA hazardous waste is stored on-site, interim storage areas must meet substantive requirements of this section.

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TABLE A-3 Potential Action-Specific Requirements (Cont'd)

Potential ARAR	Action	Requirement	Preliminary Determination	Remarks
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 X for miscellaneous units; Ohio Hazardous Waste Management Regulations, Ohio Administrative Code 3745-57.	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 the substantive requirements in these regulations would be applicable.
Solid Waste Disposal Act, as amended (42 USC 6901, et seq.); Solid Wastes (40 CFR 264), Subpart I, Use and Management of Containers (Ohio Hazardous Waste Management Regulations, Ohio Administrative Code (OAC) 3745-55-70); Subpart J, Tank Systems (OAC 3745-55-90); Subpart L, Waste Piles (OAC 3745-56-50 through 3745-56-60).	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. Waste piles must be designed 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.	Potentially applicable	The substantive requirements may be applicable to the proposed action, if a part of the proposed action will be on-site storage or treatment of waste that meets the prerequisites for definition as hazardous waste.
Solid Waste Disposal Act, as amended (42 USC 6905, et seq.), Solid Wastes (40 CFR 264 Subpart S), Corrective Action Management Unit.	Waste treatment storage disposal	Allows waste treatment storage and disposal within a corrective action management unit which can encompass one or more units or areas where RCRA contaminates are found.	Potentially relevant and appropriate	The ability to manage waste from various units within one CAMU or containment building, as allowed under the CAMU Rule provides a more efficient and effective means of management of waste generated from the various units within Operable Unit 3 which will be addressed by this action.
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, respectively.	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 for waste that meets the prerequisites for definition as characteristic or listed hazardous waste. It would be applicable to those situations where hazardous waste is generated, or when it is transported off-site.

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TABLE A-3 Potential Action-Specific Requirements (Cont'd)

Potential ARAR	Action	Requirement	Preliminary Determination	Remarks
Solid Waste Disposal Act, as amended (42 USC 6901, et seq.), Standards for Owners and Operators of Interim Status Hazardous Waste Treatment, Storage and Disposal Facilities (40 CFR 265), Subpart G, Closure and Post-Closure; Ohio Hazardous Waste Management Regulations, Ohio Administrative Code 3745-66.	RCRA closures	These regulations set forth general requirements for closure of interim status hazardous waste management units.	Potentially applicable	These requirements may be applicable to the proposed remedial action if any waste materials are generated from units meeting the definition of a RCRA HWMU, subject to the interim status standards in 40 CFR 265.
Solid Waste Disposal Act, as amended (42 USC 6901, et seq.), Solid Waste, (40 CFR 264 subpart S), Corrective Action Rule (proposed at 55 FR 30797)	Waste management storage and disposal	Establishes cleanup criteria for RCRA solid waste management units	To be considered	These proposed requirements may provide criteria or cleanup levels for remediation of units which meet the definition of a Solid Waste Management Unit (SWMU).
Solid Waste Disposal Act, as amended (42 USC 6901, et seq.), Containment Buildings, (40 CFR 264), Subpart DD	Waste storage	Hazardous waste and debris may be placed in units known as containment buildings for the purose of interim storage or treatment.	Applicable	These requirements may be applicable to the proposed remedial action if any waste materials are generated and stored in temporary structures.

TABLE A-4 Requirements Identified

<table>
<tr><th>Requirement Citation or Reference</th><th>Contaminant/ Action</th><th>Medium</th><th>Requirement</th><th>Remarks</th></tr>
<tr><td>Radiation Protection for Occupational Workers (DOE Order 5480.11, Chapter 9)</td><td>Radiation</td><td>Any</td><td>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.)
<table>
<tr><th>Radiation Effect</th><th>Annual Dose Equivalent (rem)</th></tr>
<tr><td>Stochastic effects</td><td>5[a]</td></tr>
<tr><td>Nonstochastic effects</td><td></td></tr>
<tr><td>Lens of eye</td><td>15</td></tr>
<tr><td>Organ, extremity, or tissue including skin of whole body</td><td>50</td></tr>
<tr><td>Unborn child, entire gestation period</td><td>0.5</td></tr>
</table>
[a] Annual effective dose equivalent.</td><td>These requirements are not part of environmental law and hence are not subject to the evaluation for attainment or waier as part of the ARAR process. Although not promulgated standards, DOE Orders represent contractual obligations for DOE contractors and subcontractors, and therefore constitute requirements that the facility and its contractors must comply with. Requirements in DOE Orders are derived from promulgated standards generated by the USEPA, NRC, OSHA and other regulatory authorities. Compliance with these orders in lieu of the similar regulations results in an equal level of protectiveness. Additionally, compliance with alternate standards during an interim action is, according to the NCP, an acceptable demonstration of compliance if those standards are protective of human health and the environment.</td></tr>
<tr><td>Radiation Protection for Occupational Workers (DOE Order 5480.11, Chapter 9)</td><td>Radiation</td><td>Air</td><td>Occupational exposure limits for specific radionuclides in air are given. Values for radon isotopes assume 100% equilibrium with the short-lived decay products; these values may be replaced by 1 working level for radon-220 and 1/3 working level for radon-222.</td><td>These requirements are not part of environmental law and hence are not subject to the evaluation for attainment or wavier as part of the ARAR process. Although not promulgated standards, DOE Orders represent contractual obligations for DOE contractors and subcontractors, and therefore constitute requirements that the facility and its contractors must comply with. Requirements in DOE Orders are derived from promulgated standards generated by the USEPA, NRC, OSHA and other regulatory authorities. Compliance with these orders in lieu of the similar regulations results in an equal level of protectiveness. Additionally, compliance with alternate standards during an interim action is, according to the NCP, an acceptable demonstration of compliance if those standards are protective of human health and the environment.</td></tr>
</table>

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TABLE A-4 Requirements Identified (Cont'd)

Requirement Citation or Reference	Contaminant/ Action	Medium	Requirement	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 those listed. 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.	These requirements are not part of environmental law and hence are not subject to the evaluation for attainment or wavier as part of the ARAR process.
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; they may be achieved by any reasonable combination of engineering controls, work practices, and personal protective equipment. The list includes, but is not limited to, aluminum, asbestos, lead, arsenic, cadmium, ethyl benzene, gasoline, mercury, phenol, 1,1,1-trichloroethane, toluene, tributyl phosphate, copper, nickel, uranium and particulates.	These requirements are not part of environmental law and hence are not subject to the evaluation for attainment or wavier as part of the ARAR process. The provisions of 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
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.	These requirements are not part of environmental law and hence are not subject to the evaluation for attainment or wavier as part of the ARAR process. The provisions of 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
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 were established for minimizing the environmental impacts of spills or releases of hazardous materials, as are procedures for transporting hazardous waste.	These requirements 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 as requirements.

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TABLE A-4 Requirements Identified (Cont'd)

Requirement Citation or Reference	Contaminant/ Action	Medium	Requirement	Remarks
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.	These requirements 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.
Occupational Safety and Health Administration Standards for Hazardous Waste Operations and Emergency Response (29 CFR 1910.120)	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).	Pursuant to 40 CFR 300.150, 29 CFR 1910.120 is a requirement not subject to evaluation for attainment or waiver as part of the ARAR process, for all facilities undergoing remediation under the NCP.

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APPENDIX B

SUMMARY TABLES

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TABLE B-1

POTENTIAL CONTAMINANTS FOR OU3 COMPONENTS

Table B-1 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, known significant quantities of use, spill logs, history of the FMPC (unpublished manuscript), 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 B-1. 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 B-1:

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 (e.g., 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 compounds	Material which originated as natural thorium 232. May include metal compounds 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), and ammonium diuranate (ADU).
Low grade residues	Residual material from magnesium fluoride (MgF_2), sump cakes, and 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, selinium, silver, sodium, thallium, vanadium, and zinc.
--	No suspected contaminants other than those common to all components.

TABLE B-1 Potential Contaminants for OU3 Components

Structure/Facility	Potential Contaminants
Preparation Plant (1A)	Uranium (up to 20% E), UO_3, UF_4, U_3O_8, thorium, thorium oxalate, MgF_2, HF, Halon 1301, MgF_2, ore, ore concentrates, ammonia, cesium-137, radium-226, americium-241, arsenic, cadmium, chromium, lead, uranyl nitrate, nitric acid, NaOH, solvent residues, still bottoms, 1,1,1-trichloroethane, trichloroethylene, perchloroethylene, carbon tetrachloride, chlordane, chloroform, 1,2-dichloroethane, 1,1-dichloroethylene, vinyl chloride, sump cakes
Plant 1 Storage Building (1B)	Ores, ore concentrates, 1,1,1-trichloroethane, trichloroethylene, perchloroethylene, uncharacterized low-level radioactive and RCRA drummed wastes, copper, asbestos, sump cake
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
Ore Refinery Plant (2A)	Uranium (up to 10% E), uranyl nitrate, Al_2O_3, ore concentrates, ores, high & low grade residues, ammonia, silver, lead, chromium, arsenic, tetrachloroethylene, kerosene, tributyl phosphate, NaOH, soda ash, nitric acid, extraction impurities, UO_3, H_2SO_4, thorium nitrate
General/Refinery Sump Control Building (2B)	Barium oxide, magnesium oxides, magnesium hydroxide, barium hydroxide
Bulk Lime Handling Building (2C)	CaO, $Ca(OH)_2$
Metal Dissolver Building (2D)	Uranium metal and oxides (up to 1.25% E), ammonia, tetrachloroethane, nitric acid, uranyl nitrate, chromium, barium, kerosene, tributyl phosphate
NFS Storage and Pump House (2E)	Uranium (up to 5% E), uranyl nitrate, plutonium/neptunium, nitric acid, barium, chromium
Cold Side Ore Conveyor (2F)	Ore concentrates, high & low grade residues
Hot Side Ore Conveyor (2G)	Uranium (up to 1.25% E), ore, ore concentrates, high & low grade residues
Conveyor Tunnel from Plant 1 (2H)	Ores
Maintenance Building (3A)	Uranium (up to 5% E), 1,1,1-trichloroethane
Ozone Building (3B)	Nitric acid
NAR Control House (3C)	--
NAR Towers (3D)	Nitric acid, urea

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TABLE B-1 Potential Contaminants for OU3 Components (Cont'd)

Structure/Facility	Potential Contaminants
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
Harshaw Digestion Fume Recovery (3F)	Ammonia, nitric acid
Refrigeration Building (3G)	Refrigerant
Refinery Sump (3H)	Uranyl nitrate, MgO, tributyl phosphate, kerosene, magnesium uranate, nitric acid, chromium, barium
Combined Raffinate Tanks (3J)	Barium carbonate, alum, uranyl nitrate, ore raffinates, perchloroethylene, lubricating & cutting oil, trichloroethylene, 1,1,1-trichloroethane
Old Cooling Water Tower (3K)	--
Electrical Power Center Building (3L)	PCB oils
Green Salt Plant (4A)	Anhydrous ammonia, ammonia, catalyst (nickel), U_3O_8, UO_3, UO_2, mercury, KOH, KF, UF_4 (depleted and enriched up to 1.25% E), HF (anhydrous and aqueous), thorium oxide, thorium tetrafluoride
Plant 4 Warehouse (4B)	UF_4, UO_3
Plant 4 Maintenance Building (4C)	UF_4, trichloroethylene, 1,1,1-trichloroethane, hydraulic oil
Metal Production Plant (5A)	UF_4, UO_3, magnesium, MgF_2, mercury, lead, chromium, cadmium, U_3O_8, lubricating oil, MgO, zirconium, yttria, uranium metal (up to 1.25% E), lubricating oil, zirconium oxide, uranium, cooling oil, (Shell Turbo 68 oil) perchloroethylene, benzene, hydraulic oil, trichloroethylene, 1,1,1-trichloroethane
Plant 5 Ingot Pickling (5B)	--
Plant 5 Electrical Substation (5C)	PCB oils
West Derby Breakout/Slag Milling (5D)	--
Plant 5 Filter Building (5E)	--
Plant 5 Covered Storage (5F)	Uranium (up to 1.25% E)
Plant 5 Ingot Storage Shelter (5G)	Uranium (depleted)

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TABLE B-1 Potential Contaminants for OU3 Components (Cont'd)

Structure/Facility	Potential Contaminants
Metals Fabrication Plant (6A)	Uranium metal, lithium carbonate, potassium carbonate, U_3O_8, water-soluble oils, cooling and hydraulic oils, lubricating oil, ammonia, uranyl nitrate, cadmium, chromium, lead, benzene, chlorobenzene, toluene, trichloroethylene, sodium chloride, potassium chloride, sodium sulfide, NaOH, lead, uranyl nitrate, chromium, MgO, lithium chloride, trichloroethylene, 1,1,1-trichloroethane, carbon tetrachloride, barium, copper, tin
Plant 6 Covered Storage Area (6B)	Uranium metal, low & high grade residues
Plant 6 Electrostatic Precipitator South (6C)	U_3O_8, cooling oils
Plant 6 Electrostatic Precipitator Central (6D)	U_3O_8, cooling oils
Plant 6 Electrostatic Precipitator North (6E)	U_3O_8, cooling oils
Plant 6 Salt-Oil Heat Treat Building (6F)	Uranium metal, sodium chloride, potassium chloride, cooling oil (quench oil)
Plant 6 Sump (New) (6G)	--
Plant 7 (7A)	UF_6, UF_4, UO_2, UO_2F_2, HF (aqueous and anhydrous), ammonia, catalyst (nickel), UO_3
Plant 7 Overhead Crane (7B)	UF_6, UF_4, UO_3, UO_2F_2
Recovery Plant (8A)	UF_4, NaOH, high grade/low grade residues, tributyl phosphate, lubricating, hydraulic, cooling oil sludges, MgF_2, U_3O_8, uranium metal (up to 1.25% E), ammonium diuranate cakes, mercury, calcium uranate, calcium fluoride, uranyl ammonium, wet low grade scrap cake, solvents (1,1,1-trichloroethane, trichloroethylene, perchloroethylene), magnesium, arsenic, lead, prill, lithium & potassium carbonate, graphite, HCl, HF (aqueous & anhydrous), KOH, calcium carbonates, copper, phosphoric acid, ammonium hydroxide, uranyl ammonium phosphate cake, ammonia, $CuSO_4$, SO2, diatomaceous earth, carbon tetrachloride, tetrachloroethylene, acetone, ethylbenzene, methyl ethyl ketone, toluene, xylene, thorium tetrafluoride, thorium oxalate, thorium oxides, H_3PO_4
Plant 8 Maintenance Building (8B)	Lubricating, cooling and hydraulic oils; degreasing solvents
Rotary Kiln/Drum Reconditioner (8C)	--
Plant 8 Railroad Filter Building (8D)	U_3O_8, uranium (up to 1.25% E), MgF_2
Plant 8 Old Drum Washer (8F)	Uranium metal, thorium, NaOH

TABLE B-1 Potential Contaminants for OU3 Components (Cont'd)

Structure/Facility	Potential Contaminants
Special Products Plant (9A)	Uranium (up to 2.1% E), NaOH, aqueous HF, ammonia, copper, zirconium, nickel, aluminum, U_3O_8, lubricating oil, lithium & potassium carbonate, magnesium, MgF_2, NaCl, KCl, thorium tetrafluoride, zinc fluoride, UF_4, dolomite, prill, hydraulic oil, cooling oil, uranyl nitrate
Plant 9 Sump Treatment Facility (9B)	Uranium (up to 2.1% E), uranyl nitrate, trichlorethylene, copper, zirconium, nickel, aluminum, NaOH, HF
Plant 9 Dust Collector (9C)	UF_4, MgF_2, dolomite
Plant 9 Substation (9D)	PCB oils
Plant 9 Cylinder Shed (9E)	--
Electrostatic Precipitator House (9F)	U_3O_8, uranium metal (up to 2.1% E)
Boiler Plant (10A)	Sulfur, fly ash, mercury, 1,1,1-trichloroethane, lead, oil
Boiler Plant Maintenance Building (10B)	Degreasing solvents (1,1,1-trichloroethane), lubricating oils
Wet Salt Storage Bin (10C)	--
Contaminated Oil/Graphite Burn Pad (10D)	Uranium (up to 1.25% E), tributyl phosphate, kerosene, lubricating, hydraulic, machine oils, spent solvents (1,1,1-trichloroethane, perchloroethylene, trichloroethylene)
Service Building (11)	Uranium, perchloroethylene, trichloroethylene, lead, magnesium, vinyl chloride
Main Maintenance Building (12A)	Uranium, thorium, solvents, (1,1,1-trichloroethane, perchloroethylene), motor oils, lubricating oils, hydraulic oil, paint, mercury, silver
Cylinder Storage Building (12B)	--
Lumber Storage Building (12C)	--
Pilot Plant Wet Side (13A)	Tributyl phosphate, kerosene, diamyl amyl phosphonate, radium, naphtha mineral spirits, thorium, NaOH, ammonia, MgF_2, lead, 1,1,1-trichloroethane, NaCl, mercury, copper, nickel, chromium, ammonia, MgO, barium, cadmium, benzene, thorium oxalate, thorium nitrate, oxalic acid, thorium hydroxide, thorium tetrafluoride, HCl, zinc fluoride, HF (aqueous), calcium fluoride, aluminum, ammonia, nickel, Uranium (up to 2.5% E), U_3O_8, Barium chloride, barium sulfate
Pilot Plant Maintenance Building (13B)	Hydraulic, lubricating oils, mercury
Sump Pump House (13C)	Uranium, thorium, NaOH, magnesium oxide

TABLE B-1 Potential Contaminants for OU3 Components (Cont'd) 4900

Structure/Facility	Potential Contaminants
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
Administration Building (14A)	--
Building 14 EOC Generator Set (14B)	Diesel fuel
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
Main Electrical Station (16A)	PCB oils
Electrical Substation (16B)	PCB oils
Electrical Panels & Transformer (16C)	PCB oils
Main Electrical Switch House (16D)	--
Main Electrical Transformers (16E)	PCB oils
Trailer Substation #1 (16F)	PCB oils
Trailer Substation #2 (16G)	PCB oils
10-Plex North Substation (16H)	--
10-Plex South Substation (16J)	--
Biodenitrification Surge Lagoon (18A)	Uranium, 1,1,1-trichloroethane, nitrates
General Sump (18B)	Uranium, thorium, spent solvents (1,1,1-trichloroethane, trichloroethylene, perchloroethylene)
Coal Pile Runoff Basin (18C)	Uranium, 1,1,1-trichloroethane
Biodenitrification Towers (18D)	Phosphoric acid, sulfuric acid, methanol
Storm Water Retention Basin (18E)	Uranium
Clearwell Pump House (18G)	Uranium, 1,1,1-trichloroethane
BDN Effluent Treatment Facility (18H)	Uranium, oil
Methanol Tank (18J)	Methanol
Low Nitrate Tank (18K)	Uranium, nitrates, 1,1,1-trichloroethane

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TABLE B-1 Potential Contaminants for OU3 Components (Cont'd)

Structure/Facility	Potential Contaminants
High Nitrate Tank (18L)	Uranium, nitrates, 1,1,1-trichloroethane
High Nitrate Storage Tank (18M)	--
Main Tank Farm (19A)	Ammonia, HF (anhydrous & aqueous), KF, tributyl phosphate, kerosene, HCl, oil
Pilot Plant Ammonia Tank Farm (19B)	Anhydrous ammonia
Tank Farm Control House (19C)	--
Old North Tank Farm (19D)	Anhydrous ammonia, HF, KF, HCl, residues
Pump Station & Power Center (20A)	Chlorine (as hypochlorite)
Water Plant (20B)	Alum, lime, sulfuric acid
Cooling Towers (20C)	Chromium, pentachlorophenol (wood preservative)
Elevated Potable Storage Tank (20D)	--
Well House #1 (20E)	--
Well House #2 (20F)	--
Well House #3 (20G)	--
Process Water Storage Tank (20H)	--
Gas Meter Building (22A)	--
Storm Sewer Lift Station (22B)	Uranium
Truck Scale (22C)	--
Scale House and Weigh Scale (22D)	--
Utility Trench to Pit Area (22E)	Uranium (up to 0.71% E), MgF_2, raffinates, ore raffinates
Meteorological Tower (23)	--
Railroad Scale House (24A)	--
Railroad Engine House (24B)	Ethylene glycol & lubricating oils
Chlorination Building (25A)	Chlorine
Manhole #175/Effluent Line/Sampling Building (25B)	Uranium, trace contaminants in site effluents
Sewage Lift Station Building (25C)	Hydrogen sulfide

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TABLE B-1 Potential Contaminants for OU3 Components (Cont'd)

Structure/Facility	Potential Contaminants
UV Disinfection Building (25D)	--
Digester and Control Building (25E)	--
Sludge Drying Beds (25F)	1,1,1-trichloroethane, uranium, perchloroethylene, vinyl chloride, trichloroethylene
Primary Settling Basins (25G)	--
Trickling Filters (25H)	--
10-Plex Sewage Lift Station (25J)	--
Pump House-HP Fire Protection (26A)	Lubricating oils
Elevated Water Storage Tank (26B)	--
Main Electrical Strainer House (26C)	Halon
Security Building (28A)	--
Human Resources Building (28B)	--
Guard Post on South End of "D" Street (28C)	--
Guard Post on West End of 2nd Street (28D)	--
Chemical Warehouse (30A)	Paint, lime, MgO, diatomaceous earth, lithium carbonate, potassium carbonate
Drum Storage Warehouse (30B)	--
Old Ten Ton Scale (30C)	--
Engine House/Garage (31A)	Waste oil, solvents, 1,1,1-trichloroethane, asbestos, gasoline, H_2SO_4, mercury, ethylene glycol
Old Truck Scale (31B)	--
Magnesium Storage Building (32A)	Magnesium
Building 32 Covered Loading Dock (32B)	Uranium, thorium, magnesium
Pilot Plant Annex (37)	U_3O_8, zirconia, MgO, thorium, lubricating oils, zinc, UF_4, magnesium, MgF_2, ThF_4, ZnF_2, calcium, quench oil, sodium & potassium chloride, uranium metal (up to 5% E)
Propane Storage (38A)	Propane

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TABLE B-1 Potential Contaminants for OU3 Components (Cont'd)

Structure/Facility	Potential Contaminants
Cylinder Filling Station (38B)	--
Incinerator Building (39A)	Uranium, UO_3, ammonia, raffinates, 1,1,1-trichloroethane, trichloroethylene, perchloroethylene, spent lubricating/hydraulic oils, acetone
Waste Oil Decant Shelter (39B)	Spent solvents (1,1,1-trichloroethane, trichloroethylene, perchloroethylene), spent lubricating and hydraulic oils
Incinerator Sprinkler Riser House (39C)	--
Sewage Treatment Plant Incinerator (39D)	Uranium, hydraulic and lubricating oil
Rust Engineering Building (45A)	Uranium metal, uranium carbide, ammonium sulfate, U_3O_8, cutting oil
Utility Shed East of Rust Trailers (45B)	--
Heavy Equipment Building (46)	Oil
Six to Four Reduction Facility #2 (51)	--
Health and Safety Building (53A)	Mercury, silver
In-Vivo Building (53B)	Germanium
Six to Four Reduction Facility #1 (54A)	UF_6, UF_4, ammonia, anhydrous and aqueous HF, UO_2F_2, calcium fluoride, magnesium, ThF_4, calcium, MgF_2, thorium, water soluble oil, coolant, zinc, uranium metal (up to 1.25% E), perchloroethylene
Pilot Plant Shelter (54B)	Uranium, UF_4, ThF_4, thorium oxalate, thorium hydroxide, kerosene
Pilot Plant Dissociator Shelter (54C)	Ammonia, nickel
Slag Recycling Building (55A)	MgF_2, prill, magnesium, uranium
Slag Recycling Pit/Elevator (55B)	MgF_2, prill, magnesium, uranium
CP Storage Warehouse (56A)	KOH, acetic acid, silver nitrate, oil
Storage Shed West (56B)	--
Storage Shed East (56C)	--
Quonset Hut #1 (60)	Thorium oxide, thorium hydroxide, thorium oxalate
Quonset Hut #2 (61)	Thorium
Quonset Hut #3 (62)	--

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TABLE B-1 Potential Contaminants for OU3 Components (Cont'd)

Structure/Facility	Potential Contaminants
KC-2 Warehouse (63)	1,1,1-trichloroethane, perchloroethylene, fuel oil, acetone, kerosene, PCBs
Thorium Warehouse (64)	Uranium metal (up to 1.25% E), U_3O_8, uranyl nitrate, thorium compounds and metal, hydraulic oil, thorium oxide
Old Plant 5 Warehouse (65)	Thorium hydroxide, thorium oxalate
Drum Reconditioning Building (66)	Cadmium, xylene
Plant 1 Thorium Warehouse (67)	Uranium compounds, thorium oxides, silver, cadmium, lead
Pilot Plant Warehouse (68)	Uranium compounds & metal, thorium compounds & metals
Decontamination Building (69)	NaOH, ammonia, sodium silicate, lead, methyl ethyl ketone, used oils and lubricants, nitric acid
General In-Process Warehouse (71)	Uranium (up to 20% E), U_3O_8, thorium oxides, oil,
Drum Storage Building (72)	Uranium (up to 1.25% E)
Fire Brigade Training Center Building (73A)	Uranium, waste solvents and oils
Fire Training Pond and Tank (73B & 73C)	Uranium, used oils (hydraulic, lubricating), toluene, waste paint solvents & thinners
Fire Training Burn Trough (73D)	Uranium, PCB, waste solvents and oils (hydraulic, lubricating), magnesium
Confined Space Burn Tank (73E)	HF
Plant 2 East Pad (74A)	Uranyl nitrate, UO_3 (up to 3% E), uranium (up to 5% E)
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
Plant 8 East Pad (74C)	Uranium metal (up to 1.25% E), thorium compounds, 1,1,1-trichloroethane, MgF_2, oil
Plant 8 West Pad (74D)	Uranium, 1,1,1-trichloroethane, copper, thorium, oil residues, NaOH
Plant 4 Pad (74E)	Uranium, UF_4, UO_3, UO_2, U_3O_8
Plant 7 Pad (74F)	UF_4, UO_3, UF_6, UO_2F_2
Plant 5 East Pad (74G)	Uranium (up to 1.25% E), UF_4, magnesium
Plant 5 South Pad (74H)	UF_4, MgF_2

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TABLE B-1 Potential Contaminants for OU3 Components (Cont'd)

Structure/Facility	Potential Contaminants
Plant 6 Pads (74J)	Uranium metal (up to 1.25% E)
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
Building 65 West Pad (74L)	Uranium and thorium metal, thorium compounds
Building 64 East Pad and Railroad Dock (74M)	Uranium and thorium compounds, magnesium
Building 12 North Pad (74N)	Diesel fuel, ethylene glycol, solvents (1,1,1-trichloroethane, trichloroethylene), lubricating and hydraulic oils
Decontamination Pad (74P)	Uranium, thorium, oil
Plant 8 Old Metal Dissolver Pad (74Q)	HCl, magnesium, prill
Plant 8 North Pad (74R)	U_3O_8, uranium metal (up to 1.25% E), thorium metal, magnesium, SO_2, ammonium hydroxide
Building 63 West Pad (74S)	--
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
Pilot Plant Pad (74U)	Uranium and thorium compounds, UF_6, aqueous HF, ammonia, oil
Laboratory Pad (74V)	Uranium and thorium samples, ammonia, HF, tributyl phosphate, kerosene, diamyl amyl phosphonate
Building 39A Pad (74W)	Uranium, UO_3, ammonia, raffinate, 1,1,1-trichloroethane, lead, trichloroethylene, perchloroethylene, spent lubricating/hydraulic oils
Finished Product/4A Warehouse (77)	Uranium metal
Future D&D Facility (78)	--
Plant 6 Warehouse (79)	Drummed uranium & RCRA wastes, hazardous waste
Plant 8 Warehouse (80)	Drummed RCRA wastes & uranium, hazardous waste
Plant 9 Warehouse (81)	Drummed RCRA wastes & uranium, hazardous waste

TABLE B-1 Potential Contaminants for OU3 Components (Cont'd) 4900

Structure/Facility	Potential Contaminants
Receiving & Incoming Material Inspection Building (82)	--
Clearwell Line (88)	--
Parking Lots (89)	Motor oils, ethylene glycol, gasoline
Skeet Range Building (90)	Lead
Railroad Tracks (G-001)	Uranium ore, creosote, MgF_2, ammonia
Roads (G-002)	Motor oils, hydraulic fluids, ethylene glycol, gasoline, uranium compounds
Storm Sewer System (G-003)	Uranium, lead, barium, solvent wastes
Utility Lines (G-004)	Asbestos, uranium (ores, raffinates, and compounds)
Underground Storage Tanks (G-005)	Petroleum compounds, waste oils, solvents
Process Trailers (G-006)	--
Non-Process Trailers (G-007)	--
Pipe Bridges (G-008)	Uranium, asbestos, lead
Non-RCRA Drums (G-009)	Uranium, thorium, etc.
RCRA Drums (G-010)	Hazardous wastes
Inventory (G-011)	Uranium, thorium
Mobile Containers (G-012)	--
Soil Piles (G-013)	--
Rock Salt Pile (P-001)	--
Sand Piles (P-002)	--
Gravel Pile (P-003)	--
Copper Metal Scrap Piles (P-004)	Copper, asbestos
Coal Pile (P-005)	--
Scrap Metal Pile (P-006)	Uranium
Outside Equipment Storage Areas (P-007)	Uranium, H_2SO_4, ethylene glycol, lead, motor oil, asbestos, motor fuels

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TABLE B-1 Potential Contaminants for OU3 Components (Cont'd)

Structure/Facility	Potential Contaminants
Tension Support Structure #1 (TS-001)	--
Tension Support Structure #2 (TS-002)	--
Tension Support Structure #3 (TS-003)	--
Tension Support Structure #4 (TS-004)	--
Tension Support Structure #5 (TS-005)	--
Tension Support Structure #6 (TS-006)	--

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TABLE B-2

OPERABLE UNIT 3 RADIOLOGICAL COMPONENT SURVEYS

This table details, by component, results obtained from on-site radiological surveys during the period from 1989 to July 1992. 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. 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 within the time period of the data set.

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TABLE B-2 Operable Unit 3 Component Radiological Surveys

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	454	31,000	1,356	5,376	200,000	1,094	1,113	490,000	1419	42,314	1,400,000	1,096
Plant 1 Storage Shelter	1 B	42	54	10	N/A	N/A	N/A	72	138	10	N/A	N/A	N/A
Plant 1 Ore Silos	1 C	3,128	23,054	194	100,000	140,000	6	1,589	14,434	194	N/A	N/A	N/A
Ore Refinery Plant	2 A	261	42,184	1,017	8,010	100,000	839	658	114,477	1027	115,220	1,599,000	874
General/Refinery Sump Control Bldg.	2 B	112	433	208	578	7,000	160	171	1,393	227	16,379	219,500	161
Bulk Lime Handling Building	2 C	142	1,249	149	90	400	26	319	6,958	149	5,260	52,000	26
Metal Dissolver Building	2 D	218	1,893	213	7,320	70,000	66	446	6,433	229	60,750	398,600	65
NFS Storage & Pump House	2 E	441	1,594	10	N/A	N/A	N/A	881	5,151	10	N/A	N/A	N/A
Hot Side Ore Conveyor	2 G	52	77	27	N/A	N/A	N/A	45	126	27	N/A	N/A	N/A
Maintenance Building	3 A	60	2,597	192	18,885	1,800,000	114	368	8,043	195	47,405	3,000,000	119
Ozone Building	3 B	204	501	132	1,740	16,000	40	344	1,039	132	17,540	199,500	40
NAR Control House	3 C	52	273	107	60	1,000	137	93	402	119	2,650	47,400	137
NAR Towers	3 D	225	3,896	163	N/A	N/A	N/A	354	7,400	163	5,458	15,000	48
Hot Raffinate Building	3 E	190	2,409	138	6,910	31,000	117	369	4,363	138	62,860	379,000	117
Harshaw Digestion Fume Recovery	3 F	218	241	24	410	1,100	25	303	673	26	13,300	69,500	25
Refrigeration Building	3 G	167	2,300	162	780	4,100	18	270	1,200	162	55,080	900,000	19
Refinery Sump	3 H	45	593	60	N/A	N/A	N/A	75	1,177	60	N/A	N/A	N/A
Combined Raffinate Tanks	3 J	237	2,402	56	N/A	N/A	N/A	616	7,521	67	N/A	N/A	N/A
Old Cooling Water Tower	3 K	62	125	59	N/A	N/A	N/A	50	304	59	N/A	N/A	N/A
Electrical Power Center Building	3 L	63	1,065	119	500	1600	212	89	2,089	179	4980	36,400	42
Green Salt Plant	4 A	1,049	31,866	1,321	N/A	N/A	N/A	4,069	176,040	1,323	N/A	N/A	N/A
Plant 4 Warehouse	4 B	237	1,680	42	N/A	N/A	N/A	801	3,359	73	N/A	N/A	N/A
Plant 4 Maintenance Building	4 C	48	54	35	N/A	N/A	N/A	40	77	56	N/A	N/A	N/A
Metals Production Plant	5 A	400	12,496	3,794	4,839	200,000	3,277	2,832	187,233	3,883	160,806	4,000,000	3,124

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TABLE B-2 Operable Unit 3 Component Radiological Surveys (Cont'd)

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
Plant 5 Ingot Pickling	5 B	282	5,186	81	2,120	34,000	76	1,841	32,017	81	40,690	700,000	76
Plant 5 Electrical Substation	5 C	91	481	50	840	2,100	50	277	1,552	50	3,270	28,700	50
West Derby Breakout/ Slag Milling	5 D	54	60	43	520	5,000	42	63	84	43	3,000	21,000	42
Plant 5 Filter Building	5 E	743	7,870	37	6,280	64,000	40	8,438	139,655	37	84,470	800,000	40
Plant 5 Covered Storage Pad	5 F	180	222	64	130	9,000	409	316	400	64	2,650	160,000	409
Plant 5 Ingot Storage Shelter	5 G	405	3,389	31	N/A	N/A	N/A	4,263	52,541	46	1,000	1,000	14
Metals Fabrication Plant	6 A	762	34,145	3,557	N/A	N/A	N/A	11,113	807,781	3,885	146,515	2,595,000	2,295
Plant 6 Salt Oil Heat Treat Building	6 F	1,434	11,259	26	N/A	N/A	N/A	32,390	295,873	26	282,270	1,090,000	26
Plant 6 Sump Building	6 G	35	136	38	N/A	N/A	N/A	123	473	39	1,050	2,000	40
Plant 7	7 A	366	26,282	414	N/A	N/A	N/A	1,262	31,714	413	N/A	N/A	N/A
Recovery Plant	8 A	400	26,000	2,501	3,468	250,000	1,945	849	60,000	2,636	57,445	1,400,000	2,019
Plant 8 Maintenance Building	8 B	97	136	15	230	500	12	104	177	15	3,880	9,000	12
Rotary Kiln/Drum Reconditioning	8 C	272	641	70	390	60,000	695	822	31,000	71	2,440	180,000	695
Special Products Plant	9 A	1,643	46,308	1,236	N/A	N/A	N/A	12,491	705,506	1,457	189,534	2,000,000	1,076
Plant 9 Sump Treatment Facility	9 B	66	546	10	N/A	N/A	N/A	190	1,448	10	45,600	360,000	10
Plant 9 Dust Collector	9 C	529	4,299	29	N/A	N/A	N/A	4,790	78,526	29	157,900	700,000	20
Plant 9 Substation	9 D	473	3,994	21	N/A	N/A	N/A	1,581	10,883	21	11,010	100,000	21
Boiler Plant	10A	49	200	263	200	200	8	29	220	166	3,458	11,000	12
Boiler Plant Maintenance Bldg.	10B	43	392	110	N/A	N/A	N/A	91	2,354	75	N/A	N/A	N/A
Service Building	11	29	235	663	30	1,800	2,945	25	404	618	344	100,000	2,976
Main Maintenance Building	12A	61	5,508	1,517	350	20,000	1,836	127	17,992	1,557	4,564	319,000	1,953
Cylinder Storage Building	12B	10	50	113	N/A	N/A	N/A	19	86	113	2,757	10,000	113
Lumber Storage Building	12C	8	24	67	N/A	N/A	N/A	14	156	67	3,246	12,000	67
Pilot Plant Wet Side	13A	1,024	17,400	247	46,201	699,000	176	1,326	23,000	263	158,276	1,600,000	161
Pilot Plant Maintenance Bldg.	13B	130	408	18	N/A	N/A	N/A	261	931	18	N/A	N/A	N/A

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TABLE B-2 Operable Unit 3 Component Radiological Surveys (Cont'd)

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
Sump Pump House	13C	875	4,638	16	176,375	1,000,000	16	1,439	11,236	16	158,880	500,000	16
Pilot Plant Thorium Tank Farm	13D	103	1,106	91	N/A	N/A	N/A	131	1,658	91	N/A	N/A	N/A
Administration Building	14A	21	58	234	10	2,500	3,074	22	162	238	100	25,400	3,074
Laboratory	15	86	30,358	3,682	1,820	80,000	402	161	23,694	3,909	10,559	1,000,000	1,743
General Sump	18B	206	3,784	200	N/A	N/A	N/A	380	7,757	190	N/A	N/A	N/A
Biodenitrification Towers	18D	56	169	140	N/A	N/A	N/A	65	905	214	2,836	89,000	94
BDN Effluent Treatment Facility	18H	27	27	20	N/A	N/A	N/A	31	31	20	N/A	N/A	N/A
Main Metal Tank Farm	19A	20	20	10	N/A	N/A	N/A	15	15	10	N/A	N/A	N/A
Tank Farm Control House	19C	5	5	1	N/A	N/A	N/A	21	21	1	N/A	N/A	N/A
Pump Station & Power Center	20A	225	230	20	207	500	88	360	360	88	1,338	7,500	88
Water Plant	20B	42	200	115	N/A	N/A	N/A	64	400	116	400	400	1
Cooling Towers	20C	42	42	20	N/A	N/A	N/A	43	82	21	N/A	N/A	N/A
Elevated Potable Storage Tank	20D	232	240	4	N/A	N/A	N/A	407	429	10	1,225	2,400	8
Well House #1	20E	25	36	21	N/A	N/A	N/A	25	74	21	1,000	1,000	21
Well House #2	20F	22	36	21	N/A	N/A	N/A	103	385	113	1,147	4,000	113
Well House #3	20G	23	102	34	N/A	N/A	N/A	38	177	34	4,235	80,000	34
Process Water Storage Tank	20H	42	42	10	N/A	N/A	N/A	36	36	10	N/A	N/A	N/A
Gas Meter Building	22A	14	20	46	N/A	N/A	N/A	21	68	46	1,435	8,000	46
Storm Sewer Lift Station	22B	43	63	30	N/A	N/A	N/A	56	242	30	N/A	N/A	N/A
Scale House & Weigh Scale	22D	250	250	11	N/A	N/A	N/A	402	402	60	1,180	2,800	60
Railroad Scale House	24A	32	403	21	N/A	N/A	N/A	99	1,365	21	7,667	100,000	21
Railroad Engine House	24B	19	67	117	N/A	N/A	N/A	40	220	117	3,647	30,000	92
M.H.#175/Eff. Line/Sampling Bldg.	25B	N/A	N/A	N/A	N/A	N/A	N/A	400	400	10	1,000	1,000	2
Sewage Lift Station Building	25C	24	86	32	N/A	N/A	N/A	68	831	32	2,938	30,000	32
U.V. Disinfection Building	25D	173	173	1	N/A	N/A	N/A	388	400	19	1,940	8,500	8

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TABLE B-2 Operable Unit 3 Component Radiological Surveys (Cont'd)

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
Digester & Control Building	25E	22	57	22	N/A	N/A	N/A	38	190	25	3,200	25,000	25
Sludge Drying Beds	25F	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17,670	26,000	6
Pump House-HP Fire Protection	26A	225	225	4	N/A	N/A	N/A	385	385	114	2,467	160,000	114
Elevated Water Storage Tank	26B	N/A	N/A	N/A	N/A	N/A	N/A	385	385	145	1,015	2,000	145
Security Building	28A	39	40	47	100	500	76	42	47	47	810	7,500	76
Human Resources Building	28B	20	49	196	10	1,000	503	19	78	196	60	2,300	503
Chemical Warehouse	30A	139	294	797	213	900	304	188	712	798	3,838	49,200	304
Drum Storage Warehouse	30B	61	172	64	N/A	N/A	N/A	80	500	64	N/A	N/A	N/A
Engine House/Garage	31A	126	200	182	N/A	N/A	N/A	230	400	182	10,920	150,000	91
Building 32 Covered Loading Dock	32B	247	259	50	343	5,900	81	422	652	148	22,754	1,500,000	148
Pilot Plant Annex	37	134	5,194	282	1,488	10,000	41	398	31,400	285	92,393	1,000,000	41
Propane Storage	38A	28	119	97	N/A	N/A	N/A	60	389	97	2,284	30,000	97
Incinerator Building	39A	186	482	105	1,220	25,000	35	257	584	116	38,750	799,500	35
Incinerator Sprinkler Riser House	39C	62	128	27	N/A	N/A	N/A	71	233	28	N/A	N/A	N/A
Sewage Treatment Plant Incinerator	39D	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	288,750	1,000,000	16
Rust Engineering Building	45A	52	250	631	60	500	16	80	2,307	943	2,771	250,000	542
Heavy Equipment Building	46	74	200	321	N/A	N/A	N/A	83	400	321	7,370	100,000	289
Six to Four Reduction Facility #2	51	19	20	127	N/A	N/A	N/A	16	17	128	1,000	1,000	34
Health & Safety Building	53A	48	523	89	40	1,500	2,530	48	751	87	230	3,500	2,530
In-Vivo Building	53B	19	19	55	N/A	N/A	N/A	17	17	55	1,000	1,000	55
Six to Four Reduction Facility #1	54A	311	12,000	928	1,193	28,000	893	885	73,000	1,106	22,853	1,100,000	895
Pilot Plant Shelter	54B	42	42	10	N/A	N/A	N/A	39	68	10	N/A	N/A	N/A
Slag Recycling Building	55A	137	662	98	N/A	N/A	N/A	1,056	10,665	98	71,550	700,000	68
Slag Recycling Pit/Elevator	55B	216	3,120	86	N/A	N/A	N/A	1,761	28,927	86	67,570	950,000	66
CP Storage Warehouse	56A	40	41	70	N/A	N/A	N/A	48	206	60	N/A	N/A	N/A

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TABLE B-2 Operable Unit 3 Component Radiological Surveys (Cont'd)

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 #1	60	49	49	20	N/A	N/A	N/A	40	40	20	N/A	N/A	N/A
Quonset Hut #2	61	1,093	32,168	34	N/A	N/A	N/A	735	21,647	34	N/A	N/A	N/A
Quonset Hut #3	62	39	39	25	N/A	N/A	N/A	43	155	25	N/A	N/A	N/A
KC-2 Warehouse	63	42	115	83	N/A	N/A	N/A	48	521	85	986	1,000	22
Thorium Warehouse	64	157	2,378	85	N/A	N/A	N/A	699	9,927	55	N/A	N/A	N/A
(Old) Plant 5 Warehouse	65	145	966	15	N/A	N/A	N/A	373	4,424	15	N/A	N/A	N/A
Drum Reconditioning Building	66	145	2,146	115	N/A	N/A	N/A	527	7,100	115	N/A	N/A	N/A
Plant 1 Thorium Warehouse	67	1,531	31,506	45	N/A	N/A	N/A	1,582	28,882	45	N/A	N/A	N/A
Pilot Plant Warehouse	68	203	1,096	46	N/A	N/A	N/A	281	922	46	N/A	N/A	N/A
Decontamination Building	69	170	1,700	101	1,654	110,000	87	283	1,400	127	16,143	280,000	87
General In-Process Warehouse	71	276	17,900	590	1,429	140,000	528	390	21,000	627	16,766	799,000	528
Plant 2 East Pad	74A	202	1,558	484	N/A	N/A	N/A	348	15,400	485	7,200	30,800	51
Plant 2 West Pad	74B	129	843	227	1,510	25,000	118	195	1,300	247	18,710	196,000	119
Plant 8 East Pad	74C	60	3,224	111	N/A	N/A	N/A	358	15,495	132	1,150	3,500	20
Plant 8 West Pad	74D	73	712	194	N/A	N/A	N/A	101	2,000	194	186,216	400,000	37
Plant 4 Pad	74E	72	429	118	630	15,000	219	94	150	120	14,660	700,000	219
Plant 7 Pad	74F	72	296	50	N/A	N/A	N/A	221	1,118	50	N/A	N/A	N/A
Plant 5 East Pad	74G	245	2,500	368	1,370	32,000	547	405	6,400	367	20,470	450,000	635
Plant 5 South Pad	74H	200	1,400	120	260	4,000	650	216	1,100	120	4,210	160,000	650
Plant 6 Pads	74J	68	1,831	386	200	200	6	170	4,276	392	54,563	1,000,000	236
Plant 9 Pad	74K	77	897	325	1,943	6,000	35	158	2,257	649	69,163	750,000	298
Building 65 West Pad	74L	318	7,370	127	208	400	63	1,843	81,976	180	1,619	32,000	63
Building 64 East Pad & R.R. Dock	74M	234	250	117	211	500	117	377	400	117	3,718	14,000	117
Building 12 North Pad	74N	9	78	215	N/A	N/A	N/A	22	188	215	19,030	300,000	215
Decontamination Pad	74P	130	1,384	31	N/A	N/A	N/A	264	2,397	31	15,260	60,000	31

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TABLE B-2 Operable Unit 3 Component Radiological Surveys (Cont'd)

		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)		
Component	Component Designation	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 8 North Pad	74R	21	134	50	N/A	N/A	N/A	29	171	50	N/A	N/A	N/A
Plant 1 Storage Pad	74T	41	41	6	N/A	N/A	N/A	37	37	6	N/A	N/A	N/A
Pilot Plant Pad	74U	32	64	125	N/A	N/A	N/A	39	166	126	N/A	N/A	N/A
Finished Products Warehouse (4A)	77	59	762	180	N/A	N/A	N/A	91	2,177	181	N/A	N/A	N/A
Plant 6 Warehouse	79	70	240	248	N/A	N/A	N/A	79	657	249	6,970	65,000	34
Plant 8 Warehouse	80	33	135	62	N/A	N/A	N/A	38	159	62	N/A	N/A	N/A
Plant 9 Warehouse	81	55	134	661	N/A	N/A	N/A	61	340	662	3,070	10,000	29
Receiving/Incoming Mat'ls. Insp.	82	38	200	84	N/A	N/A	N/A	57	400	84	N/A	N/A	N/A
Parking Lot	89	1	19	105	10	200	355	1	18	105	170	1,800	464
Railroad Tracks	G-001	82	259	148	N/A	N/A	N/A	110	434	202	4,578	100,000	74
Roads	G-002	179	554	565	263	5,900	179	300	1,057	845	2,989	98,000	263
Process Trailers	G-006	64	200	256	N/A	N/A	N/A	95	400	261	1,000	1,000	58
Non-process Trailers	G-007	30	200	228	140	2,200	1,201	37	400	234	308	9,700	1,378
Copper Metal Scrap Pile	P-004	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	34,370	100,000	6

TABLE B-3

OPERABLE UNIT 3 AIR QUALITY DATA

Table B-3 includes November 1991 air quality data for several buildings throughout the site. A number of readings were taken from each location using a 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 percent 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 percent of the DAC, or 5.00E-12 μCi/mL (based on a time-weighted average).

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TABLE B-3 Operable Unit 3 Air Quality Data

Component Name	Component Designation	Air Quality Data (Total activity in µCi/ml)		
Preparation Plant	1 A	Location:	1A-585-7C-2B	Center Bay Redrumming
		Number of Samples:		15
			Alpha (µCi/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 (µCi/ml)	Beta (µCi/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 (µCi/ml)	Beta (µCi/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 (µCi/ml)	Beta (µCi/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

TABLE B-3 Operable Unit 3 Air Quality Data (Cont'd)

Component Name	Component Designation	Air Quality Data (Total activity in μCi/ml)		
Ore Refinery Plant	2 A	Location:	2A-580-4C-3C	Dig. S. of Tank DI-10
		Number of Samples:		14
			Alpha (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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
		Location:	2A-580-4B-3C	
		Number of Samples:		14
			Alpha (μCi/ml)	Beta (μCi/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

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TABLE B-3 Operable Unit 3 Air Quality Data (Cont'd)

Component Name	Component Designation	Air Quality Data (Total activity in μCi/ml)		
Ore Refinery Plant	2 A	Location:	2A-580-4C-3C	Dig. S. of Tank DI-10
Metal Dissolver Building	2 D	Location:	2D-580-3A-1B	Metal Dissolver Bldg.
		Number of Samples:		12
			Alpha (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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

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TABLE B-3 Operable Unit 3 Air Quality Data (Cont'd)

Component Name	Component Designation	Air Quality Data (Total activity in μCi/ml)		
Ore Refinery Plant	2 A	Location:	2A-580-4C-3C	Dig. S. of Tank DI-10
Metals Production Plant	5 A	Location:	5-580-2D-1	Flat Scale
		Number of Samples:		13
			Alpha (μCi/ml)	Beta (μCi/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
		Location:	5-592-26E-1	South End of Plant 2nd Fl.
		Number of Samples:		15
			Alpha (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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

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TABLE B-3 Operable Unit 3 Air Quality Data (Cont'd)

Component Name	Component Designation	Air Quality Data (Total activity in μCi/ml)		
Ore Refinery Plant	2 A	Location:	2A-580-4C-3C	Dig. S. of Tank DI-10
Metals Fabrication Plant	6 A	Location:	*6-580-4C3-2	N. End of Inspection Office
		Number of Samples:		15
			Alpha (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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

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TABLE B-3 Operable Unit 3 Air Quality Data (Cont'd)

Component Name	Component Designation	Air Quality Data (Total activity in µCi/ml)		
Ore Refinery Plant	2 A	Location:	2A-580-4C-3C	Dig. S. of Tank DI-10
Recovery Plant	8 A	Location:	8-580-4C-2B	
		Number of Samples:		15
			Alpha (µCi/ml)	Beta (µCi/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 (µCi/ml)	Beta (µCi/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 (µCi/ml)	Beta (µCi/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 (µCi/ml)	Beta (µCi/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

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TABLE B-3 Operable Unit 3 Air Quality Data (Cont'd)

Component Name	Component Designation	Air Quality Data (Total activity in μCi/ml)		
Ore Refinery Plant	2 A	Location:	2A-580-4C-3C	Dig. S. of Tank DI-10
Recovery Plant (Cont'd)		Location:	8-580-1B-2B	EIMCO Drumming Station
		Number of Samples:		15
			Alpha (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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 B-3 Operable Unit 3 Air Quality Data (Cont'd)

Component Name	Component Designation	Air Quality Data (Total activity in μCi/ml)		
Ore Refinery Plant	2 A	Location:	2A-580-4C-3C	Dig. S. of Tank DI-10
Special Products Plant	9 A	Location:	9-583-10D-4	South of Door on SE Side
		Number of Samples:		8
			Alpha (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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

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TABLE B-3 Operable Unit 3 Air Quality Data (Cont'd)

Component Name	Component Designation	Air Quality Data (Total activity in μCi/ml)		
Ore Refinery Plant	2 A	Location:	2A-580-4C-3C	Dig. S. of Tank DI-10
Pilot Plant Annex	37	Location:	37-579-7A-1B	P-2 Furnace
		Number of Samples:		15
			Alpha (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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
Six to Four Reduction Facility #1	54 A	Location:	*54-579-4D-2C	West Autoclave Area
		Number of Samples:		15
			Alpha (μCi/ml)	Beta (μCi/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 (μCi/ml)	Beta (μCi/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

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TABLE B-3 Operable Unit 3 Air Quality Data (Cont'd)

Component Name	Component Designation	Air Quality Data (Total activity in µCi/ml)		
Ore Refinery Plant	2 A	Location:	2A-580-4C-3C	Dig. S. of Tank DI-10
Drum Reconditioning Building	66	Location:	66-585-5B-2B	Bldg 66 South End
		Number of Samples:		15
			Alpha (µCi/ml)	Beta (µCi/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 (µCi/ml)	Beta (µCi/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 (µCi/ml)	Beta (µCi/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 (µCi/ml)	Beta (µCi/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

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TABLE B-3 Operable Unit 3 Air Quality Data (Cont'd)

Component Name	Component Designation	Air Quality Data (Total activity in µCi/ml)		
Ore Refinery Plant	2 A	Location:	2A-580-4C-3C	Dig. S. of Tank DI-10
General In-Process Warehouse	71	Location:	71-585-2C-1A	N. End Package Prep.
		Number of Samples:	19	22
			Alpha (µCi/ml)	Beta (µCi/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
		Location:	71-585-10A-2B	SW Scale Area
		Number of Samples:	16	21
			Alpha (µCi/ml)	Beta (µCi/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 (µCi/ml)	Beta (µCi/ml)
		Minimum Reading		8.90E-15
		Maximum Reading		8.90E-15
		Average Reading		8.90E-15

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APPENDIX C

COST ASSESSMENT

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APPENDIX C -- COST ASSESSMENT

C.1 Introduction

Based on the interim remedial action alternatives defined in Section 3, an assessment of costs has been performed. Costs associated with the implementation of each of the evaluated alternatives have been assessed for comparison in the Section 4 evaluation and in the Section 5 selection of the preferred alternative. In addition to the cost of implementing each alternative, an assessment of costs associated with the schedule in which these alternatives would be implemented has been prepared to support a more thorough evaluation of the use of public funds.

The alternative definitions, as stated below, establish the baseline assumptions in order to assess the implementation costs for each.

Alternative 1 -- No Interim Action: No interim actions are implemented as part of this alternative. The final OU3 ROD addresses the entire scope of the operable unit, including any removal, treatment, and disposition. Implementation of this alternative requires no additional funding beyond costs associated with on-going site activities (which have been included as part of the operation and maintenance [O&M] cost estimate).

Alternative 2 -- Decontaminate Surfaces Only: This alternative includes in situ decontamination of all inner and some outer surfaces of above-grade structures. For purposes of cost assessment, the probable duration and period for Alternative 2 has been identified as four years beginning in FY-96 and completing by the beginning of FY-2000. The action would require approximately 900,000 manhours to complete and would utilize an estimated 108 workers.

Alternative 3 -- Decontaminate and Dismantle: Alternative 3 includes in situ surface decontamination, as in Alternative 2, but also includes dismantlement of all OU3 structures. The resultant debris would be placed in interim storage in the Central Storage Facility (CSF), as described in Section 3, prior to dispositioning under the final ROD. A quantity of the debris generated before the final ROD would be dispositioned off-site as described in Section 3.4. This quantity represents less than ten percent of the total volume of OU3 materials. For purposes of the cost assessment, the probable duration and period for Alternative 3 has been identified as 16 years, beginning in FY-1996 and ending by the beginning of FY-2012. The action would require approximately 6,000,000 manhours to complete and utilize an estimated worker force of 160 decontamination and dismantlement workers and 16 workers to operate the CSF.

With each of the alternatives, the anticipated schedule represents a current rough estimate. The actual availability of funding for implementation will significantly effect actual implementation durations.

C.2 Approach to Determining Costs Related to Implementing the Alternatives

In order to develop an implementation cost for each of the alternatives evaluated by the Proposed Plan, additional simplifying assumptions were required. Key assumptions are summarized in the following sections.

<u>Alternative 1 Assumptions</u>

The alternative represents no additional actions to be taken and, therefore, there are no associated implementation costs.

<u>Alternative 2 Assumptions</u>

The assumptions used in developing the Alternative 2 cost estimate were as follows:

- Buildings and structures located within the former production area and within the sewage treatment plant area were assumed to be significantly contaminated and requiring some level of decontamination prior to dismantlement. Surface decontamination was not assumed for other buildings or structures.

- All structural surfaces (ceilings, floors, interior and exterior walls) of contaminated buildings and structures, as defined above, would be decontaminated.

- All ground level floors and storage pads were considered to be constructed of concrete or a comparable material for development of estimates associated with application of surface decontamination technologies. Similarly, elevated floors were assumed to be constructed either of concrete or steel deck plate, with appropriate technology assumptions applied.

- Decontamination of concrete surfaces was assumed to include dry vacuuming, high pressure water washing, and scabbling. Decontamination of steel surfaces was assumed to include dry vacuuming, water washing, and mechanical brushing techniques. Costs associated with the application of these technologies were based on unit cost data available in the *Oak Ridge K-25 Site Technology Logic Diagram* (DOE 1993a).

- Gross surface decontamination performed under the scope of Alternative 2 would be expected to result in a reduction of risk to workers, the public, and the environment. However, it is anticipated that additional surface decontamination would be required at the time of eventual structure dismantlement to adequately abate airborne contaminants.

Alternative 3 Assumptions

The cost estimate for Alternative 3 includes: the removal of stored drums and materials to an on-site storage pad or warehouse; appropriate containment measures (from glove bags for asbestos work to large vacuum filtration systems for entire buildings); gross decontamination (water washing, vacuum cleaning, etc.); removal of asbestos-containing materials; building dismantlement; debris characterization; environmental monitoring; and interim on-site storage of containers and bulk debris. Additional assumptions employed in the cost estimate for the action include:

- worker crews would be required to wear full anti-contamination clothing for decontamination activities;
- worker crews would work four 10-hour days per week;
- because of the time required to dress, undress, take scheduled breaks, eat lunch, and decontaminate tools, as well as the reduction of productivity that results from wearing full anti-contamination clothing, workers would average four hours of "actual" work per day;
- debris would be placed in on-site interim storage; and
- a small portion of the total debris to be generated from the action would be transported off site for disposal and recycling prior to the final ROD.

In order to complete the estimate, an assessment of material volumes was also completed. The method categorized OU3 buildings according to six general building types:

- Type A - structural steel with transite siding and roofing;
- Type B - concrete block with composite roofing;
- Type C - pre-engineered steel;
- Type D - wood frame;
- Type E - tension support structures; and
- Type F - open steel platforms and/or equipment.

One representative structure was defined for each of the six categories and utilized as a basis for developing a cost estimate for all of the buildings in the category. For example, Plant 7 (7A) was identified as representative for the Type A building category.

For each of the representative buildings, detailed volume estimates were developed for the varieties of media and equipment contained in the structure and contents. The resulting knowledge was then applied to other buildings in the category, based on known similarities and/or differences between the buildings. Additionally, for the Type A buildings, Building 4A and Building 2A (both well documented for materials content) were used as additional representatives for medium and extreme examples of equipment contents respectively (for HVAC ductwork, dust collection equipment, electrical systems, and process piping).

Additional material take-offs from the detailed Plant 7 estimate were performed for exterior transite siding/roofing, batt insulation, interior walls, and structural steel members. Resulting quantity information for individual structures was compared to previous estimates from other sources to verify the methodology (including *Interim Record of Decision Proposed Plan Support*, Parsons 1993). A similar approach was employed for the structures in each building category.

The overall approach to the implementation of the alternative has been evaluated to be best accomplished in a grid-by-grid manner, with thirteen areal groupings (packages) of structures representing the operable unit. For example, one of the areas is comprised roughly of a city block of structures related to the Refinery complex. A fourteenth package contains the remainder of the structures not defined by the thirteen areal packages, such as underground tanks and piping, parking lots, fences, storage pads, site roads, impoundments, etc. The costs for removal of these structures in the Alternative 3 analysis does not include excavation costs, since the Operable Unit 5 (OU5) scope includes soils and since the excavation action would be coordinated with OU5 remediation plans.

Alternative 3 also includes the construction, operation, and maintenance of five Tension Support Structures (TSSs) as part of the CSF. The cost estimate includes the construction, operation, and maintenance of five 100-foot x 400-foot TSSs as part of the CSF. Also included in the CSF scope and estimate are costs associated with replacing the TSS outer skins every ten years and provisions for all required capital equipment and material handling, transport, and staging actions necessary to temporarily store dismantled waste materials.

General Assumptions

Throughout the scope of the three alternatives, all activities related to waste treatment (e.g., fixative application, vitrification, cementation, and the Advanced Waste Water Treatment facility) and final disposition previously identified in long-term planning were omitted and will be addressed under the final ROD documentation. However, as indicated by Appendix G, a small quantity of nonrecoverable waste and recyclable materials would be dispositioned off-site during the interval period between the interim ROD and the final ROD. Therefore, the related transportation and disposal costs are included in the Alternative 3 estimate. Additionally, all costs associated with soil excavation, soil washing, and backfill are considered within the scope of Operable Unit 5 and therefore have not been included in this estimate.

The cost estimates are considered to be conceptual with an overall level of accuracy of +50 percent/-30 percent, with contingencies as high as 20% in those areas where factored building material quantities, undefined waste volumes, assumed support requirements, and preliminary design strategies serve as the only data source to the estimate. As a result, parametric costing analyses were employed and estimate assumptions made based on project duration and estimating experience. Applicable assumptions used in developing the direct, indirect, and O&M costs associated with the alternatives are included in supporting documentation (Parsons 1993).

Direct costs associated with decontamination and dismantlement include characterization of contaminants, containment of potential airborne contaminants, surface decontamination, disassembly and dismantling, wrapping and containerizing as necessary, and transporting waste materials to staging areas adjacent to and within the CSF. Job conditions, health physics, and other indirect costs were objectively developed and applied as percentages against direct labor. Included in the job condition factors were costs attributed to radiological, chemical, or biological contamination considerations, radiation safety surveys, inaccessible work areas, work space congestion, work interferences and interruptions, etc. Costs associated with time involved in clothing changes, showers, and frisking and monitoring requirements when entering or leaving a contaminated area were considered within health physics. Indirect costs were represented as expenditures for engineering and design, construction management, and overall project management required by the decontamination and dismantlement activities but not included in their direct costs. All mark-ups comply with existing FEMP protocols and procedures for preparing cost estimates.

Because of the detailed nature of the current estimate for the engineering and related activities for the dismantling of Plant 7 (Removal No. 19), Plant 7 was used as the cost basis for estimating indirect costs for each of the packages. Engineering costs, which also include project support for completion of administrative requirements, were applied as a percentage of the direct costs for the estimate.

All costs associated with the surface decontamination of Alternative 2 and the decontamination and dismantlement costs of Alternative 3 were subject to overall contingency factors of 20 percent. All purchased materials for these alternatives were also subject to a 6% state sales tax.

Excluded from the estimate for all of the alternatives are costs associated with site regulatory oversight, on-going litigations, long-term monitoring, remediation support facilities, and Operable Units 1, 2, 4, and 5. Additionally, costs related to the treatment of wastes (other than the small quantity of nonrecoverable and recyclable materials that will be dispositioned off-site during the interval period), material handling, and transport from interim storage to treatment, or ultimate waste disposition are excluded from this estimate and should be addressed during the preparation of the final ROD Feasibility Study and Proposed Plan.

Table C-1 represents the estimated costs associated with the implementation of each of the three alternatives. For Alternative 3, the operation and maintenance costs associated with the CSF are included. The values shown in the table are provided in current fiscal year 1994 (FY-94) dollars, without account for escalation (inflation).

Table C-1 OU3 Alternative Implementation Cost in FY-94 dollars (Millions of $)

Alternative	Direct Costs	Indirect Costs	Total Costs
1 -- No Interim Action	$0	$0	$0
2 -- Surface Decontaminate Only	$16	$66	$82
3 -- Decontaminate and Dismantle	$222	$854	$1,076

C.3 Determining Total Project Costs

In order to examine the overall impacts of implementing each of the alternatives, a general assumption about the long-term course of actions in OU3 has been made. Although the interim action scope is limited to the selection and implementation of one of the three alternatives proposed, it is reasonable to assume that the selection of Alternative 1 or Alternative 2 would eventually require that they be followed in the final ROD by the selection of an alternative equivalent to Alternative 3 in this document. On this basis, costs associated with the later implementation of the scope can be compared with the near-term implementation of Alternative 3. This section addresses these costs and provides support for the comparative analysis presented in Section 5.

By utilizing current and out-year planning documents at the FEMP, such as activity data sheets for establishing budgets, an average yearly cost was determined for the O&M and General and Administrative (G&A) activities for the OU3 facilities. By implementing the scope of Alternative 3 beginning in FY-96, versus implementation in FY-2000 under the final ROD, and assuming that the action takes the same course and duration in each case, the net result is a difference of approximately four years of costs for the facilities. Table C-2 presents the costs, shown in FY-94 dollars, associated with the O&M of facilities and related G&A for the 20 year period for each of the alternatives; this 20 year period is comprised of the 16 year period for the alternative implementation plus the anticipated four year difference between the interim action and the final action start dates.

Table C-2 Operation and Maintenance Costs Over the Project Life in FY-94 dollars (Millions of $)

Alternative	Total Costs
1 -- No Interim Action	$1,445
2 -- Surface Decontaminate Only	$1,445
3 -- Decontaminate and Dismantle	$1,088

The major assumptions employed in this analysis include:

- Implementation of Alternative 3 results in declining O&M and G&A costs associated with OU3 facilities over the expected 16 year duration of the action. A direct relationship between the number of components remaining at any point in time with the annual cost of plant operations has been incorporated.

- Activity Data Sheets (ADSs) 8B1, 64D1, 68D1, and 69D1 represent the total of site O&M budgets, with an approximated 70% associated with OU3 activities. The projected budgets for these ADSs for the next five years were averaged; the 70% share for OU3 activities, which is approximately $89 million per year, is used as the starting point in the O&M calculations.

- It is assumed that even after final remediation has been completed, a small amount of O&M costs for the site will still remain. These costs, calculated to be roughly $6 million per year, encompass such items as a security force, maintenance of the boundary fence, residual environmental monitoring, and lab tests to ensure long-term permanence, etc. This amount could conceivably be much larger if the disposition of wastes under the final ROD encompasses any amount of on-site storage. Since it is not known how many years beyond site

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remediation that these costs will need to continue, the O&M costs in Table C-2 include a $140 million investment in the final year of remediation. This amount, when invested at 4.4%, will yield an annual return of $6 million to cover the residual site activities.

Table C-3 summarizes the total costs of implementing each alternative over the 20 year period identified above. For Alternatives 1 and 2, this cost represents the total to implement the alternative (Table C-1), the cost of eventually implementing Alternative 3 after the final ROD, and the associated O&M costs incurred until OU3 remediation is finished (Table C-2).

Table C-3 OU3 Total Remediation Cost Comparison in FY-94 dollars (Millions of $)

Alternative	Direct Costs	Indirect Costs	O&M Costs	Total Costs
1 -- No Interim Action	$222	$853	$1,445	$2,520
2 -- Surface Decontaminate Only	$237	$920	$1,445	$2,602
3 -- Decontaminate and Dismantle	$222	$854	$1,088	$2,164

The present worth cost estimates shown Table C-4 represent the result of applying a present worth analysis to the FY-94 cost estimate shown in Table C-3. The present worth analysis assumes a discount rate of 4.4 percent.

Table C-4 OU3 Total Remediation Cost Comparison Using Present Worth Analysis (Millions of $)

Alternative	Direct Costs	Indirect Costs	O&M Costs	Total Costs
1 -- No Interim Action	$127	$483	$938	$1,548
2 -- Surface Decontaminate Only	$141	$540	$938	$1,619
3 -- Decontaminate and Dismantle	$151	$574	$751	$1,476

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The present worth analysis demonstrates that Alternative 3 is less expensive from an overall perspective than Alternative 1 or Alternative 2. The primary reason is the early implementation schedule for the Alternative 3 solution, which eliminates an estimated four years of O&M and G&A costs from the total project. As defined, Alternative 2 represents the most expensive interim remedial action because it incurs all costs associated with Alternative 1 plus additional costs to perform gross surface decontamination from FY-96 through the beginning of FY-2000.

C.4 References

Parsons, 1993, *Interim Record of Decision Proposed Plan Support*, Revision No. 0, Parsons, Fairfield, Ohio.

U. S. Department of Energy, 1993a, *Oak Ridge K-25 Site Technology Logic Diagram*, Final, prepared by Martin Marietta Energy Systems, Inc., Oak Ridge, Tennessee.

U. S. Department of Energy, 1993b, *Plant 7 Dismantling Removal Action 19 Work Plan*, Revision No. 0, prepared by Fernald Environmental Restoration Management Corporation, Cincinnati, Ohio.

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APPENDIX D

DECONTAMINATE AND DISMANTLE RISK SUMMARY

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APPENDIX D -- DECONTAMINATE AND DISMANTLE RISK SUMMARY

D.1 Introduction

The scope of the interim Proposed Plan for Operable Unit 3 (OU3) is to remediate all above- and below-grade components within OU3. The purpose of the interim action is to reduce risks and accelerate OU3 remedial actions. Because this is an interim action, no Remedial Investigation, Feasibility Study, or formal risk assessment has been prepared. However, the following risk evaluation is presented to provide the reader an overall understanding of the potential risks involved with the action and to demonstrate that the action will be consistent with worker and public health standards. To support this goal, this appendix will present the risks associated with the decontamination and dismantlement of the OU3 components (Alternative 3) and Decontaminate Surfaces Only (Alternative 2).

D.2 Conceptual Model

Dose and risk assessment pathways are evaluated for three population groups, or receptors, as they exist in three different exposure environments. The receptors exist in one of three environments:

- in-plant operations;
- other on-site operations; or
- off-site residence.

The in-plant worker is used to represent a worker who is involved in the proposed action. Some of the work performed by this worker may be done outdoors. Radiation dose is received through the following pathways:

- inhalation of, and immersion in, airborne radioactivity; and
- exposure from external contaminant sources.

For other on-site and off-site receptors, assessments are based upon estimated airborne contaminant releases from major plants and facilities due to various operations.

Other on-site worker exposure is computed for:

- inhalation of, and immersion in, released and dispersed airborne radioactivity; and
- external exposure due to accumulated ground deposition from released and dispersed airborne radioactivity.

Off-site resident dose and risk, from the further dispersed airborne effluent plume, is calculated for:

- inhalation and immersion;
- external exposure due to ground deposition; and
- ingestion of locally produced vegetables, meat, and milk due to downwind deposition on soil and vegetation.

Figure D-1 is a schematic summarizing the receptors, the exposure environment, and the exposure pathways.

The assessments include evaluation of individual exposure and risk as well as the collective impact upon the group. The estimates are provided for in-plant workers, other on-site workers, and off-site residents. The calculations, and their bases, are given for:

In-Plant Worker

- the maximally exposed individual Effective Dose Equivalent (EDE) (rem);
- the risk associated with that EDE;
- the collective EDE for all in-plant workers (person-rem); and
- population groups range from 16 to 160 workers depending upon the projects.

Other On-Site Workers

- the maximally exposed individual EDE (rem);
- the risk associated with that EDE;

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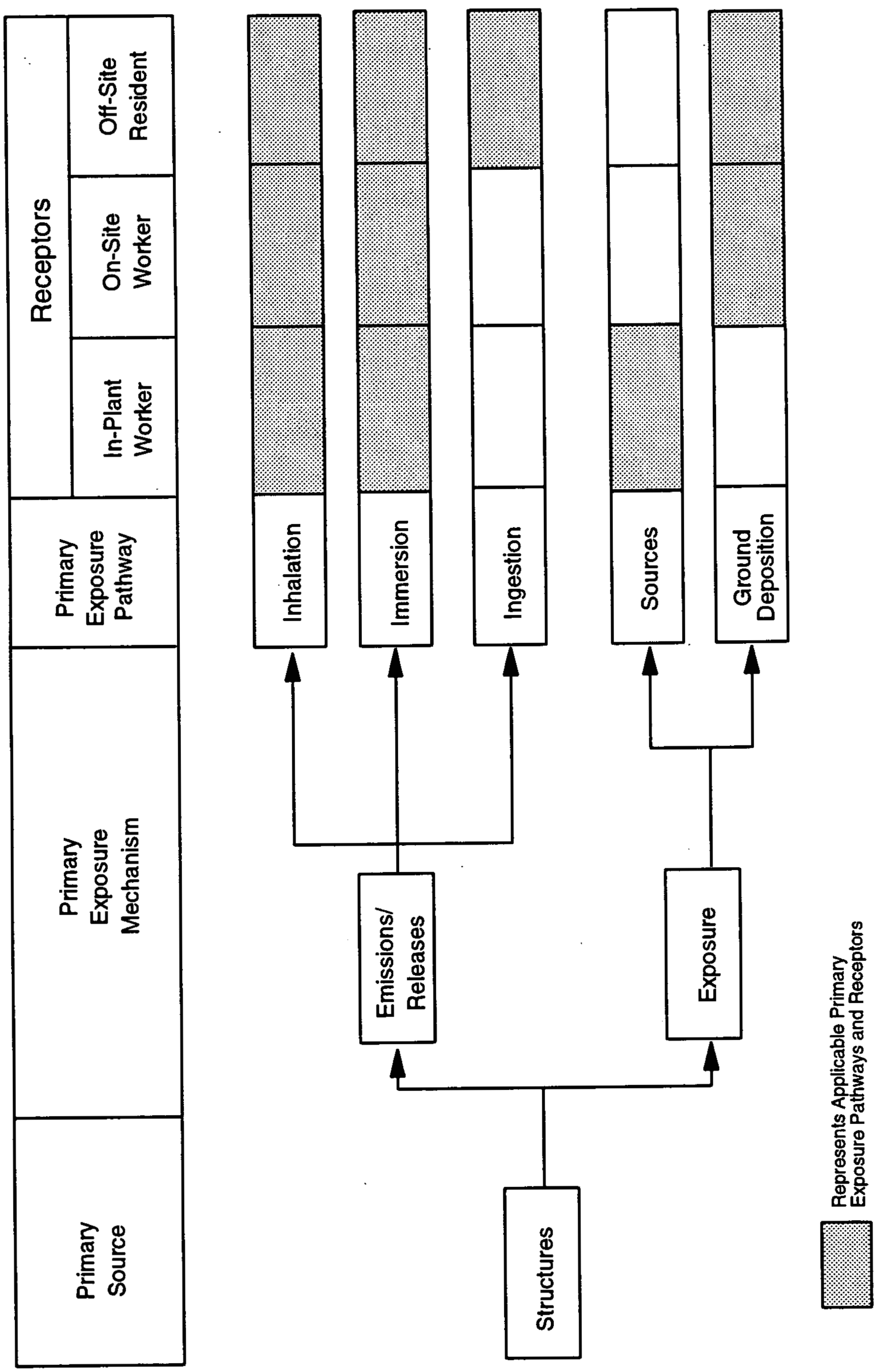

FIGURE D-1 Conceptual Model for Routine Operations

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- the collective EDE for all on-site workers (person-rem); and
- the population is 1600 workers.

Off-Site Residents

- the maximally exposed individual EDE (rem);
- the risk associated with that EDE;
- the collective EDE for off-site residents out to a five mile radius (person-rem); and
- the population is 27,500 residents.

The radiation dose and risk to other on-site workers and to off-site residents is based upon estimated airborne releases. The EPA CAP88-PC computer code (EPA 1992) was used to compute the radiation dose due to atmospheric dispersion. Additional occupational and public exposures are analyzed in the following Appendices:

Appendix E - Central Storage Facility Summary

Airborne releases from interim storage of contaminated waste soils and from decontamination wastes are used to estimate the impact on other on-site workers and to off-site residents.

Appendix F - Safe Shutdown Risk Summary

Concurrent operations to remove production materials, equipment, and wastes are assessed for the cumulative impact on occupational and public exposures.

Appendix I - Off-Site Transportation

The RADTRAN code was used to assess dose and risk for occupational and public exposures due to the shipment of radioactive wastes for disposal.

The cumulative impact is provided in Section 6.0 of this document.

The best available information is used to estimate specific EDE's. This encompasses a broad scope of information and parameters ranging from analytical data for contaminants to forecasted work schedules. Each of these information items is described in detail in the following sections. A separate report (EDI 1993) gives greater detail concerning the relationship of these factors to specific features within the CAP88-PC and RADTRAN codes.

D.3 Sources and Exposure Pathways

In-plant airborne radionuclide concentrations were estimated for each of the nine major production plants within the Production Area. These plants were selected because they contain the highest levels of contamination. The other facilities covered by this action are far less contaminated and would contribute negligible risks compared to these plants. This permits calculation of the EDE to in-plant workers due to airborne radioactivity. Those concentrations were then used to predict airborne releases from each plant for the impact on other on-site workers and to off-site residents. The sources assessed are the nine principal plants in OU3:

- Preparation Plant (Plant 1);
- Ore Refinery Plant (Plant 2/3);
- Green Salt Plant (Plant 4);
- Metals Production Plant (Plant 5);
- Metals Fabrication Plant (Plant 6);
- Plant 7;
- Recovery Plant (Plant 8);
- Special Products Plant (Plant 9); and
- Pilot Plant.

The airborne concentrations for each of the three exposed groups for that pathway are estimated through the steps described below.

1. Review and use of existing air sample concentrations within each of the plants with the assumption that the work activities will increase airborne levels, on the average, by a factor of ten.

2. Existing air sample data consist primarily of gross alpha and gross beta concentrations. Dose assessment requires use of specific isotopic airborne concentrations. An extensive set of isotopic analytical data (DOE 1987) are available through analyses of airborne materials from various dust collectors in Plants 1, 4, 5, 8, 9, and the Pilot Plant (Table D-1). The isotopic ratios have been applied to the air sample data to yield specific isotopic airborne concentrations. These form the basis for airborne exposure to the in-plant worker and also for releases which would expose the down wind on-site worker and the off-site resident.

3. In accordance with current planning, HEPA filtered enclosures will be used to control potentially released airborne contaminants within each plant. Ventilation flow rates, through the HEPA filters, are estimated based upon five volume air exchanges per hour. While HEPA filters are rated at greater collection efficiency, the EPA guidance of 99% efficiency (0.01 penetration) is used. An accident scenario is postulated wherein the HEPA filtration systems fail completely for one 24 hour day; 100% release during that period.

4. Planning schedules and time lines were consulted to determine the time duration of activities associated with each plant.

An extensive set of data, previously referenced dust-collector data (DOE 1987), for airborne particle size distributions is available through cascade impactor sampling. An overall weighted average among the plants yields 8.5 μm Activity Median Aerodynamic Diameter (AMAD). Because of model constraints, the analysis was limited to a more conservative upper limit of 3.0 μm AMAD. Use of the 3μm AMAD is more conservative, relative to 8μm AMAD particle size distribution due to a higher dose conversion factor. Inhalation of the smaller particle size distribution results in deposition in deeper respiratory passages with slower clearance mechanisms. The dose to the lung increases with the protracted clearance. Any translocation to other organs tends to increase with the increased residence time.

External radiation exposure to in-plant workers is primarily based upon historical experience. Two relatively small EDE components are provided by the CAP88-PC code. Airborne

TABLE D-1 Average Radionuclide Concentrations in Dust Collector Samples (μCi/g)

Isotope	Plant 1	Plant 4	Plant 5	Plant 8	Plant 9	Pilot Plant
U-238	1.2E-01	2.4E-01	5.9E-02	1.5E-01	1.9E-01	1.7E-01
U-234[(1)]	1.2E-01	2.4E-01	5.9E-02	1.5E-01	1.9E-01	1.7E-01
Th-230	3.3E-03	2.0E-04	8.5E-05	4.2E-03	1.5E-04	2.1E-04
Ra-226	1.5E-03	1.8E-05	3.1E-06	1.6E-05	2.4E-04	5.0E-06
U-236	5.1E-03	2.2E-02	6.6E-04	1.1E-02	1.8E-02	<3.3E-03
U-235	1.4E-02	1.3E-02	9.6E-04	6.9E-03	1.1E-02	8.3E-03
Tc-99	2.7E-02	3.9E-02	1.8E-04	1.1E-02	3.8E-02	8.4E-05
Th-232	1.1E-03	8.0E-05	4.0E-05	1.4E-04	3.3E-05	1.4E-04
Ra-228	6.2E-04	5.2E-06	5.3E-06	2.7E-05	7.0E-06	5.5E-05
Th-228	7.3E-04	1.4E-04	1.3E-04	3.0E-04	1.0E-03	1.4E-04
U-233[(2)]	<3.4E-02	7.0E-02	<1.7E-02	4.3E-02	5.4E-02	<4.9E-02
Pu-239, 240	7.2E-03	1.3E-04	1.6E-05	3.5E-04	9.3E-04	6.0E-06
Np-237	4.2E-04	7.5E-05	1.0E-05	1.2E-04	2.5E-04	5.1E-06
Pu-238	3.1E-04	1.3E-05	2.7E-06	3.4E-05	7.3E-05	4.1E-05
Cs-137	6.0E-04	1.8E-04	1.5E-04	1.5E-04	4.0E-04	1.5E-04
Sr-90[(2)]	4.1E-04	1.9E-04	4.9E-04	2.4E-05	1.2E-04	<6.3E-06

(1) U-234 analyses were all below analytical sensitivity; it is assumed that concentrations are equal to U-238.

(2) Values represented by < mean results were below the analytical sensitivity.

immersion dose and external exposure due to downwind surface deposition of contaminants are automatically computed for other on-site workers and for off-site residents.

D.4 Specific Exposure Groups and Pathways

Information from Section D.3 above is further developed to estimate the EDE and risk, to in-plant workers, other on-site workers, and off-site residents. In-plant airborne radionuclide concentrations result in inhalation and immersion doses to those workers. Additional information was assessed to estimate external exposure to in-plant workers due to radionuclide inventories within the plants. The highest in-plant condition was then conservatively applied as though all workers could experience that EDE for the duration of each of the project.

The EDE, and risk, to other on-site workers was calculated by assuming that operations could be carried out on as many as four plants simultaneously. The total releases from those four plants were used to determine the maximum exposure to an individual on-site worker. Then, an additional assessment was performed to determine the distributed collective EDE to all on-site workers. The worker population was distributed to zones which accounted for their positions relative to the release points. Figure D-2 shows the grid which was overlaid on the Production Area and the number of workers within each grid. Then, the average meteorological data with the CAP88-PC atmospheric diffusion calculations was used to compute the collective EDE.

A similar approach was used for off-site residents. The potential maximally exposed off-site individual resident was determined with the use of CAP88-PC. The same code was used to determine the collective EDE to off-site residents out to a five mile radius.

D.4.1 The In-Plant Worker

This section summarizes the airborne and external exposure dose and risk to the in-plant worker.

Figure D-2 On-Site Worker Population Distribution

Production Area Northwest 40 Workers	Production Area North Central 30 Workers	Production Area Northeast 20 Workers
Production Area West Central 200 Workers	Production Area Central 150 Workers	Production Area East Central 40 Workers
Production Area Southwest 50 Workers	Production Area South Central 40 Workers	Production Area Southeast 30 Workers
Admin. Area West 400 Workers	Admin. Area Central 400 Workers	Admin. Area East 200 Workers

D.4.1.1 Airborne Radionuclides within the Plants

Average gross alpha and gross beta airborne concentrations, within each of the plants, are presented in Table B-3, Air Quality Data, Appendix B of this Plan. Isotopic ratios, for airborne materials within each of the plants, were based upon analyses of samples from dust collectors within each of the plants.

Table D-1 summarizes the average concentrations of isotopes in particulate material from dust collectors in each of the indicated plants. This kind of information was not available for Plant 2; the Plant 4 ratios were applied because of the similarity of materials processed. For the same reason, the ratios from the Pilot Plant were used to calculate concentrations in Plant 7. Similarly, averages of Plant 5 and Plant 4 isotopic ratios were used as an analog for Plant 6.

Analytical instruments used to gross alpha count the air sample filters have approximately the same counting efficiency, or calibration, for the various alpha emitting isotopes present. Gross beta counting efficiencies among the beta emitting isotopes present are highly variable. The counting efficiency is low for low-energy beta emitters such as technetium-99, and high for higher-energy beta emitters such as protactinium-234m. The sum of only the alpha emitters present was ratioed to the gross alpha airborne concentrations from Table B-3 in Appendix B. For the beta (and gamma) emitters, a ratio was established to the average uranium-238 concentrations. The latter is generally the most abundant radionuclide and provides a consistent basis for the calculations.

Tables D-1 and D-2 show the longer lived primary radionuclides. For radiation dosimetry and for fractionation of gross alpha concentrations to alpha emitting radionuclides, the following daughters were assumed to be present in equilibrium with the parent.

Parent	Daughter
U-238	Th-234 and Pa-234m
U-235	Th-231
Ra-226	Po-218, Pb-214, Bi-214, and Po-214
Ra-228	Ac-228
Th-228	Ra-224, Po-216, Pb-212, Bi-212, Po-212 (0.64), and Tl-208 (0.36)
Np-237	Pa-233
Cs-137	Ba-137m
Sr-90	Y-90

It is assumed that remedial activities will increase current airborne concentrations, within each plant by a factor of ten. This estimate is an attempt to scope a number of factors. The level of airborne concentrations will depend upon the work activities occurring within the plant; concentrations can be expected to vary by an order of magnitude. Airborne concentrations will, at times, be less than the current average concentrations as well as significantly above those levels. The assumed increase by a factor of ten is a best estimate, at this time, for the average condition.

Site health physics procedures mandate the use of respiratory protective equipment under conditions anticipated in the decontamination and dismantlement work. Protection factors for various respiratory protection devices have been estimated by OSHA, DOE, and others. The most current ANSI Standard for Respiratory Protection (ANSI Z88.2-1992) recognizes different protection factors based upon the characteristics of the aerosols present. In many cases, a respirator or half-face mask, affords a protection factor of ten (90% efficient). For

TABLE D-2 Calculated In-Plant Isotopic Airborne Concentrations (μCi/ml)

Isotope	Plant 1	Plant 2	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant
Gross Alpha	2.9E-13	1.2E-13	1.1E-13	1.2E-13	1.3E-13	2.1E-13	2.9E-13	1.3E-13	1.7E-13
U-238	1.1E-13	5.0E-14	4.4E-14	5.0E-14	5.2E-14	9.9E-14	1.2E-13	5.2E-14	7.9E-14
U-234	1.1E-13	5.0E-14	4.4E-14	5.0E-14	5.2E-14	9.9E-14	1.2E-13	5.2E-14	7.9E-14
Th-230	3.1E-15	4.1E-17	3.7E-17	7.2E-17	6.0E-17	1.2E-16	3.3E-15	4.2E-17	9.6E-17
Ra-226	1.4E-15	3.7E-18	3.3E-18	2.6E-18	3.3E-18	2.9E-18	1.3E-17	6.7E-17	2.3E-18
U-236	4.8E-15	4.6E-15	4.0E-15	5.5E-16	2.6E-15	1.9E-15	8.6E-15	5.1E-15	1.5E-15
U-235	1.3E-14	2.7E-15	2.4E-15	8.1E-16	1.8E-15	4.9E-15	5.4E-15	3.1E-15	3.9E-15
Tc-99	2.6E-14	8.2E-15	7.2E-15	1.5E-16	4.3E-15	4.9E-17	8.8E-15	1.1E-14	3.9E-17
Th-232	1.1E-15	1.6E-17	1.5E-17	3.4E-17	2.7E-17	8.0E-17	1.1E-16	9.3E-18	6.4E-17
Ra-228	6.2E-16	1.1E-18	9.7E-19	4.5E-18	2.9E-18	3.2E-17	2.2E-17	2.0E-18	2.5E-17
Th-228	7.0E-16	2.9E-17	2.6E-17	1.1E-16	7.2E-17	7.9E-17	2.4E-16	2.8E-16	6.3E-17
U-233	3.2E-14	1.5E-14	1.3E-14	1.4E-14	1.5E-14	1.4E-15	3.4E-14	1.5E-14	1.1E-15
Pu-239,40	6.8E-15	2.7E-17	2.4E-17	1.3E-17	2.1E-17	8.7E-18	2.7E-16	2.6E-16	7.0E-18
Np-237	4.0E-16	1.6E-17	1.4E-17	8.8E-18	1.3E-17	2.5E-18	9.4E-17	7.0E-17	2.0E-18
Pu-238	3.0E-16	2.7E-18	2.4E-18	2.3E-18	2.6E-18	7.0E-17	2.7E-17	2.1E-17	5.6E-17
Cs-137	5.7E-16	3.8E-17	3.3E-17	1.3E-16	8.6E-17	8.9E-17	1.2E-16	1.1E-16	7.1E-17
Sr-90	3.9E-16	4.0E-17	3.5E-17	4.2E-16	2.4E-16	3.7E-18	1.9E-17	3.4E-17	2.9E-18

greater challenges, use of a full-face mask is required and the worst-case protection factor is ten. It is assumed that the proper respiratory protection will be used. The net effect is a compensation. The factor of ten increase in airborne concentrations will be reduced by a factor of ten, relative to worker inhalation, by the appropriate respiratory protection. For this reason, the estimate of dose and risk to the in-plant worker will utilize the current airborne concentrations within each of the plants.

The dose conversion factors and risk calculations use the same basis as the EPA CAP88-PC computer program (EPA 1992). This code is used to calculate dose to the other on-site worker and the off-site resident (EDI 1993). The cited reference, for CAP88-PC, in turn cites a number of additional references which describe the EPA methodology in detail.

Table D-2 summarizes the calculated specific airborne radionuclide concentrations within each plant. These are based upon gross alpha airborne concentrations from periods of production compared to the ratios derived from Table D-1 using the methodology described above.

The airborne pathway dose was then calculated to the in-plant worker. The same dose conversion factors, from CAP88-PC, were used to compute the inhalation and immersion EDE due to airborne radioactivity. The annual EDE rate, based upon 40 hours/week, was determined. The EDE was then extended, based upon the expected work period (years) at each of the Plants. Plant 8 was found to have the highest EDE. That rate was summarized and used to estimate the conservative maximum EDE rate for <u>every</u> individual in-plant worker and also for the collective EDE for the in-plant worker population. For Alternative 2, a four year project life was then applied. For Alternative 3, a 16 year project life was assumed.

D.4.1.2 External Radiation Exposure

The external exposure rates within each plant can be expected to be quite variable depending upon the distribution and quantities of contaminants and the extent and time duration of worker proximity. Historical worker exposures were reviewed with focus on the later years of production operations: 1986 and 1987. Summaries were not defined for these specific plants however the average external exposure to workers, during these two years, was 166 mrem/yr (Neton 1993). While reflective of production operations, they include both higher and lower dose biases that would tend to support the average. Toward the higher end, they include work in the proximity of Silos 1 and 2, in Operable Unit 4, which contain relatively large quantities of radium-226. Also, work with thorium storage activities have higher exposure rates. The lower bias to exposures is represented by workers who wore dosimeters, but whose duties did not entail significant radiation exposures.

The probability of an average exposure as high as 166 mrem/yr is low because of the establishment of more conservative radiation protection practices since 1987. Improvements are specifically defined in DOE Order 5480.11 and the supplemental DOE Radiological Control Manual. These practices are in place (Neton 1993) and use of 166 mrem/yr is reasonably conservative. An estimate is that the actual range, relative to 166 mrem/yr, is plus 0% and minus 50%.

As with the airborne exposure pathway, the external EDE rates were applied to the expected work period at each plant. The combination showed Plant 8 the highest annual rate. Again, this annual rate was then applied to the four year and 16 year project lives for Alternative 2 and Alternative 3 respectively.

D.4.1.3 Summary of Dose and Risk to the In-Plant Worker

A summary of the annual doses and risks to the workers within the plants is provided in Table D-3.

These represent the estimated dose to a worker performing decontamination activities within a component for both Alternative 2 and 3. The significant difference is that Alternative 2 requires a 4 year work period and Alternative 3 requires 16 years. The process plants listed above represent the highest contamination on-site and, therefore, represent the highest exposure to the in-plant workers. Given the schedule, budget constraints, and available space within the process area for decontamination and dismantlement work, a maximum of four teams could be functioning within the Production Area. It is anticipated that each team will remediate components simultaneously. For these reasons, only four components could reasonably be decontaminated at the same time and the doses represented in Table D-3 above are the maximum doses accrued from work in each plant. Therefore, the maximum exposure

TABLE D-3 In-Plant Worker EDE and Risk

Plant	Work Period (Years)	Estimated EDE				Risk/yr
		Airborne (mrem)	External (mrem)	Total (mrem)	Annual (mrem/yr)	
Plant 1	1.08	50	179	229	212	1.0E-04
Plant 2	2.67	49	443	492	184	8.9E-05
Plant 4	1.83	29	304	333	182	8.8E-05
Plant 5	4.00	65	664	729	182	8.8E-05
Plant 6	4.00	71	664	735	184	8.9E-05
Plant 7	2.67	93	443	536	201	9.6E-05
Plant 8	2.42	102	402	504	208	1.0E-04
Plant 9	1.67	31	277	308	184	8.9E-05
Pilot Plant	2.42	51	402	453	187	9.0E-05

possible in a given year of the project for both Alternative 2 and 3 could be represented by the decontamination of Plant 1.

For decontamination and dismantlement, the resulting maximum individual EDE rate for the in-plant worker is 212 mrem per year in Plant 1. It is anticipated that the decontamination and dismantlement of any other component or series of components in one year would obtain a lesser individual EDE rate than Plant 1. Because the in-plant worker would work only in one plant at a time, the workers maximum EDE would be achieved through remaining in Plant 1 for the duration of the project.

The probability for cancer incidence in adult workers is 4.8E-04 per rem (NCRP 1993). This is the sum of the probabilities of 4.0E-04 fatal cancers per rem and 0.8E-04 non-fatal cancers per rem. While CAP88-PC was used to calculate the effective dose equivalent, the risk was calculated separately with the probability given above. CAP88-PC calculates risk; however, the algorithm assumes a continuous lifetime exposure period of 70 years and a probability of 4.0E-04 per rem: neither is appropriate here.

Therefore, the assessment for the Alternative 2 in-plant worker with 108 workers over a 4 year period is:

Individual Worker

212 mrem/yr x 4 yr = 848 mrem EDE

848 mrem x 4.8E-07/mrem = 4.1E-04 risk

Collective Workers

848 mrem/worker X 108 workers = 9.2E+01 person-rem

9.2E+01 person-rem X 4.8E-04/rem = 4.4E-02 risk

Using the same methods for Alternative 3, with 160 workers over a 16 year period:

Individual Worker

212 mrem/yr X 16 yr = 3.4 rem EDE

3.4 rem X 4.8E-04/rem = 1.7E-03 risk

Collective Workers

3.4 rem X 160 workers = 5.4E+02 person-rem

5.4E+02 person-rem X 4.8E-04/rem = 2.6E-01 risk

D.4.2 The Other On-Site Worker

The risk to the on-site worker, who is not directly involved in activities associated with either Alternative 2 or 3, is assessed through the effect of airborne releases from the plants undergoing decontamination and, ultimately, due to other concurrent activities in the Production Area. Based upon current planning, the most active period would include simultaneous activities at four Plants: 1, 2, 8, and the Pilot Plant.

It is planned that HEPA filters will be placed at the plants to control airborne releases to the Production Area and to off-site residents. The ventilation flow rates were determined by assuming five air exchanges per hour and then relating that criteria to the interior building volume.

Existing airborne concentrations were assumed to increase by a factor of ten, for entrainment of contaminants during decontamination operations, and multiplied by the volume flow rates. The factor of ten is assumed as an anticipated increase to airborne levels due to decontamination activities. One percent penetration of the effluent through the HEPA filters was assumed. Table D-4, summarizes that information for the four selected plants and provides the annual releases from each plant, which were then used to compute exposure to the maximum individual on-site worker.

TABLE D-4 Annualized Source Term Releases (μCi/Yr)

Isotope	Plant 1	Plant 2	Plant 8	Pilot Plant
U-238	1.5E+01	7.3E+00	3.6E+01	3.6E+00
U-234	1.5E+01	7.3E+00	3.6E+01	3.6E+00
Th-230	4.1E-01	6.0E-03	1.0E+00	4.4E-03
Ra-226	1.9E-01	5.4E-04	3.9E-03	1.1E-04
U-236	6.3E-01	6.6E-01	2.6E+00	7.1E-02
U-235	1.7E+00	3.9E-01	1.7E+00	1.8E-01
Tc-99	3.3E+00	1.2E+00	2.7E+00	1.8E-03
Th-232	1.4E-01	2.4E-03	3.5E-02	2.9E-03
Ra-228	7.8E-02	1.6E-04	6.8E-03	1.2E-03
Th-228	9.1E-02	4.2E-03	7.3E-02	2.9E-03
U-233	4.2E+00	2.1E+00	1.0E+01	5.0E-02
Pu-239,40	8.9E-01	3.9E-03	8.3E-02	3.2E-04
Np-237	5.2E-02	2.3E-03	2.9E-02	9.2E-05
Pu-238	3.9E-02	3.9E-04	8.3E-03	2.6E-03
Cs-137	7.5E-02	5.5E-03	3.7E-02	3.3E-03
Sr-90	5.1E-02	5.8E-03	5.9E-03	1.3E-04

The impact of airborne releases to the maximum individual on-site worker was evaluated and then the collective EDE was determined. First, the dose to the maximally exposed down wind individual on-site worker was determined through individual CAP88-PC runs for each plant.

The maximum exposure, to an other on-site worker, associated with an individual plant was found to be 300 meters NE of Plant 8. The plant height affects the downwind distance of the maximum airborne concentrations. Then, the contribution of effluents from the other three plants, to that location, was added to provide the total dose to the maximum other on-site worker. Table D-5 shows the individual and total contributions from the four plants. This results in an individual maximum EDE rate of 7.6E-03 mrem/yr. Any duties away from that location would reduce the exposure. On that basis:

Alternative 2 - Individual On-Site Worker
7.6E-03 mrem/yr X 4 yr = 3.0E-02 mrem EDE
3.0E-02 mrem X 4.8E-07/mrem = 1.4E-08 risk

Alternative 3 - Individual On-Site Worker
7.6E-03 mrem/yr X 16 yr = 1.2E-01 mrem EDE
1.2E-01 mrem X 4.8E-07/mrem = 5.8E-08 risk

TABLE D-5 On-Site Worker Maximum Annual EDE and Risk

Plant	Distance (meters)	Direction	EDE (mrem/yr)	Annual Risk
Plant 1	309	EEESE	1.3E-03	6.2E-10
Plant 2	232	ENE	3.8E-04	1.8E-10
Plant 8	300	NE	5.6E-03	2.7E-09
Pilot Plant	480	NE	2.9E-04	1.4E-10
Total			7.6E-03	3.7E-09

For the collective dose equivalent a separate CAP88-PC run was used. In this case, the total release from the four plants was used to calculate the EDE within each of the worker distribution grids shown in Figure D-2. These were then extended and totalled to yield the collective EDE. This allows for the varying population distribution with the statistical representation of the various wind direction probabilities and atmospheric stability classes. The results for Alternatives 2 and 3 are summarized in Table D-6.

TABLE D-6 Collective On-Site Worker EDE (person-mrem)

Location	West	Central	East
Production Area - North	40 Workers	30 Workers	20 Workers
Alternative 2	2.0E-01	2.3E-01	4.4E-01
Alternative 3	8.2E-01	9.3E-01	1.8E+00
Production Area - Central	200 Workers	150 Workers	40 Workers
Alternative 2	1.7E+00	2.0E+00	5.6E-01
Alternative 3	6.9E+00	8.0E+00	2.2E+00
Production Area - South	50 Workers	40 Workers	30 Workers
Alternative 2	5.2E-01	2.6E-01	3.2E-01
Alternative 3	2.1E+00	1.0E+00	1.3E+00
Administrative Area	400 Workers	400 Workers	200 Workers
Alternative 2	3.0E+00	2.9E+00	1.8E+00
Alternative 3	1.2E+01	1.2E+01	7.4E+00

	Alternative 2	Alternative 3
Total Collective Person-rem	1.4E-02	5.6E-02
Total Collective Risk	6.7E-06	2.7E-05

Meteorological data used for the CAP88-PC computations included averages of observations from the on-site meteorological tower during the years from 1987 through 1992.

D.4.3 The Off-Site Resident

The impact of airborne effluent releases was assessed for the maximally exposed off-site individual and also for the collective EDE for the population out to five miles. A conservative feature is that effluent releases are assumed to be continuous for 168 hours per week. It is likely that any elevated releases would accompany 40 hour per week work activities. The closest downwind resident is 915 meters NE of the center of the Production Area. This is approximately at the site boundary where the North Access Road reaches the highway. The four plant source term was used with CAP88-PC. The code was used to calculate the EDE due to inhalation, immersion, and ingestion. The ingestion path was set to assume that all vegetables, milk, and meat are locally produced.

The probability for cancer incidence in the whole population is 6.0E-04 per rem (NCRP 1993). This is the sum of the probabilities of 5.0E-04 fatal cancers per rem and 1.0E-04 non-fatal cancers per rem. Again, risks were directly converted from EDE.

The EDE rate for the maximally exposed off-site resident is 1.8E-02 mrem/yr.

Alternative 2 - Individual Off-Site Resident
1.8E-02 mrem/yr X 4 yr = 7.2E-02 mrem EDE
7.2E-02 mrem X 6.0E-07/mrem = 4.3E-08 risk

Alternative 3 - Individual Off-Site Resident
1.8E-02 mrem/yr X 16 yr = 2.9E-01 mrem EDE
2.9E-01 mrem X 6.0E-07/mrem = 1.7E-07 risk

The assessment for the collective EDE for off-site residents out to five miles was determined by using the four plant source term with CAP88-PC. The annual EDE rate was applied to the 1990 population distribution (DOE 1993) and those results are provided in Table D-7. The collective EDEs are:

Alternative 2:	1.3E-01 person-rem
	7.8E-05 risk
Alternative 3:	5.1E-01 person-rem
	3.1E-04 risk

D.5 An Accident Scenario

A scenario is proposed wherein the absolute filtered (HEPA) exhausts from Plant 8, the source of the largest potential release, loses containment integrity for a 24 hour day. There is 100% release during the 24 hours before remedies can be implemented. No attempt has been made to analyze the probabilities of the various occurrences that might lead to the release; these could include:

- fire or explosion;
- high or tornadic winds;

- an earthquake; and/or
- other failure of the filters or filter banks.

TABLE D-7 Annual Population Collective EDE for Routine Releases from Four Plants

Direction	Distance: 0-1 Mile EDE (Person-mrem/yr)	1-2 Miles EDE (Person-mrem/yr)	2-3 Miles EDE (Person-mrem/yr)	3-4 Miles EDE (Person-mrem/yr)	4-5 Miles EDE (Person-mrem/yr)
N	1.5E-01	2.8E-02	8.4E-02	7.1E-02	6.2E-02
NNW	6.9E-02	2.8E-02	1.4E-01	1.4E-01	6.8E-02
NW	---	3.1E-02	1.3E-01	1.3E-01	1.1E-01
WNW	1.6E-02	1.1E-02	1.0E-01	8.7E-02	7.3E-02
W	---	3.4E-02	1.8E-01	1.8E-01	2.0E-01
WSW	4.4E-02	3.0E-02	1.2E-01	9.5E-02	4.7E-01
SW	5.6E-02	1.1E-01	1.3E-01	2.3E-01	2.9E-01
SSW	7.8E-02	1.2E-01	9.1E-02	1.9E-02	1.4E-02
S	4.3E-02	1.4E-02	1.0E-01	4.4E-01	3.5E-01
SSE	---	2.8E-02	1.5E-01	7.4E-01	6.1E-01
SE	6.0E-02	1.6E+00	2.3E-01	1.3E+00	1.1E+00
ESE	3.0E-02	---	7.4E-01	1.7E+00	1.4E+00
E	---	6.5E-02	8.1E-01	1.8E+00	1.6E+00
ENE	6.0E-02	1.2E+00	2.9E+00	2.6E+00	1.5E-01
NE	---	2.1E+00	3.1E+00	1.9E-01	1.7E-01
NNE	1.8E-01	---	1.5E-01	1.2E-01	1.3E-01

Total Collective Person-mrem/Yr = 32.0
Total Collective Risk/yr = 1.9E-05
Total Population = 27,500 persons

Plant 8 is estimated to have the largest source term among the nine plants. The 24 hour 100% release represented in Table D-8 provides the source term for the Plant 8 accident scenario. Exposures and risks to the in-plant worker are not estimated because the maximum exposure for this worker occurs on a day-to-day basis.

TABLE D-8 Source Term for the Accident Scenario

Isotope	μCi	Isotope	μCi
U-238	9.9E+00	Th-228	2.0E-02
U-234	9.9E+00	Ra-228	1.9E-03
Th-230	2.7E-01	U-233	2.7E+00
Ra-226	1.1E-03	Pu-239,240	2.3E-02
U-236	7.1E-01	Np-237	7.9E-03
U-235	4.7E-01	Pu-238	2.3E-03
Tc-99	7.4E-01	Cs-137	1.0E-02
Th-232	9.6E-03	Sr-90	1.6E-03

Assessment of the accident impact to on-site workers was accomplished using CAP88-PC in the same way as that for routine releases but with the accident scenario source term. The maximally exposed individual on-site worker is located 300 meters NE of Plant 8 and receives 1.6E-03 mrem with an attendant risk of 7.7E-10. For the collective EDE, CAP88-PC was used along with the worker population distribution (Figure D-2) relative to the Plant 8 location. The result was 1.3E-03 person-rem collective EDE as is shown in Table D-9.

TABLE D-9 Collective On-Site Worker EDE (person-mrem) for the Accident Scenario.

Location	West	Central	East
Production Area - North	40 Workers 1.7E-02	30 Workers 2.7E-02	20 Workers 1.9E-02
Production Area - Central	200 Workers 8.6E-02	150 Workers 1.7E-01	40 Workers 5.2E-02
Production Area - South	50 Workers 9.5E-03	40 Workers 4.0E-02	30 Workers 3.6E-02
Administrative Area	400 Workers 4.0E-01	400 Workers 2.8E-01	200 Workers 1.7E-01

Total Collective Dose (Person-rem)	1.3E-03
Total Collective Risk	6.2E-07

Because of the location of Plant 8, the maximally exposed off-site resident is 1200 meters downwind. Again, CAP88-PC was run in the same way as that for routine releases. The individual off-site resident would receive 2.6E-03 mrem EDE with an attendant risk of 1.6E-09 The results for the collective EDE are shown in Table D-10. This rounds to a total of 2.5E-03 person-rem.

TABLE D-10 Population Collective EDE for the Accident Scenario

	Distance & Collective EDE				
Direction	0-1 Mile (person-mrem)	1-2 miles (person-mrem)	2-3 miles (person-mrem)	3-4 miles (person-mrem)	4-5 miles (person-mrem)
N	2.9E-02	4.6E-03	1.3E-02	1.1E-02	9.6E-03
NNW	1.3E-02	4.6E-03	2.2E-02	2.2E-02	1.0E-02
NW	-------	5.2E-03	2.0E-02	2.0E-02	1.6E-02
WNW	3.3E-03	1.8E-03	1.6E-02	1.4E-02	1.2E-02
W	-------	5.6E-03	3.0E-02	2.9E-02	3.1E-02
WSW	8.8E-03	4.8E-03	1.8E-02	1.5E-02	7.3E-02
SW	1.1E-02	1.9E-02	2.2E-02	3.6E-02	4.5E-02
SSW	1.5E-02	1.9E-02	1.4E-02	3.0E-03	2.2E-03
S	8.0E-03	2.4E-03	1.6E-02	6.9E-02	5.4E-02
SSE	-------	4.6E-03	2.4E-02	1.1E-01	9.4E-02
SE	1.3E-02	2.7E-01	3.7E-02	2.1E-01	1.6E-01
ESE	6.6E-03	-------	1.2E-01	2.7E-01	2.1E-01
E	-------	1.1E-02	1.3E-01	2.9E-01	2.5E-01
ENE	1.2E-02	2.0E-01	4.7E-01	4.3E-01	2.4E-02
NE	-------	3.4E-01	4.9E-01	3.1E-02	2.7E-02
NNE	3.6E-02	-------	2.4E-02	2.0E-02	2.0E-02

Total Collective Person-mrem = 2.5E+00
Total Collective Risk = 1.5E-06

It is emphasized that the accident scenario assessment used average on-site meteorological conditions from 1987 through 1992. One cannot forecast what meteorological conditions might exist at the time of the theoretical accident. With the exception of one case, it is reasonable to use average weather data. That exception is that the accident might occur as a result of, or be accompanied by, high or tornadic winds. High and directed winds result in a narrower down wind trajectory of the contaminated plume resulting in much less dilution at a given distance. The down wind individual, or population group, within the narrow trajectory are maximally exposed. The accompanying condition is reduced exposure to other off-site residents who would be exposed to airborne effluent during normal meteorological conditions.

Risks from the impact of expected routine releases can be compared to the accident scenario risks (See Table D-11).

TABLE D-11 Comparison of Alternative 3 and the Accident Scenario

	Alternative 3		Accident Scenario	
Receptor Group	mrem	Risk	mrem	Risk
Individual On-Site Worker	1.2E-01	5.8E-08	1.6E-03	7.7E-10
Individual Off-Site Resident	2.9E-01	1.7E-07	2.6E-03	1.6E-09

D.6 References

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APPENDIX E

CENTRAL STORAGE FACILITY SUMMARY

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APPENDIX E -- CENTRAL STORAGE FACILITY SUMMARY

E.1 Introduction

To support the storage requirements associated with the interim remedial action, Removal No. 17 Work Plan provides the management structure. Under Removal No. 17, Improved Storage of Soil and Debris, the Central Storage Facility (CSF) will provide interim storage for soil and debris from the interim remedial action.

This appendix addresses the construction and operation of six Tension Support Structures (TSS) to be identified as the CSF for interim storage of soil and debris. In accordance with Removal Action 17 Work Plan, soil and debris meeting the following criteria would be transported to the CSF for storage:

1) Soil or debris that is contaminated with hazardous wastes, petroleum products, asbestos-bearing material, and PCB-contamination that cannot be decontaminated or shipped off site.

2) Soils that contain greater than 100 pCi/g total Uranium and/or greater than 5 pCi/g total Radium and/or greater than 50 pCi/g total Thorium.

Additionally, containerized soils which contain hazardous or mixed waste may be transported and stored in bulk in the CSF. The Removal No. 17 Work Plan identifies two categories of radiologically contaminated debris: recoverable and non-recoverable. It is the intent of Removal No. 17 that non-recoverable debris be containerized and shipped for disposal. During the interval period for the interim action (prior to the final ROD) this approach would apply. Following the final ROD, the treatments and dispositions specified by the ROD would apply. Recoverable debris would be stored in additional interim storage facilities located adjacent to the CSF identified in the Work Plan.

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E.2 Site Selection

Four site-specific selection criteria were considered for determining the location of the CSF.

1) It was preferred that the facility be located in a relatively uncontaminated area. The CSF would store hazardous and mixed (radiological/hazardous) contaminated soil and debris. The Removal Action Work Plan requires that the CSF be assessed for hazardous, PCB, or petroleum product contaminants. A CSF would not be constructed at a location with these contaminants.

2) Construction of the facility cannot interfere with other planned uses for the site. Numerous vacant areas at the FEMP have been selected for the construction of other remediation facilities. These sites were therefore unavailable for construction of the CSF.

3) The site must be of sufficient size to accommodate construction of a minimum of six CSF structures.

4) The facility would not be located in environmentally sensitive areas such as floodplains, wetlands, and habitats of threatened and endangered species.

The CSFs would be located on 12 acres of ungrazed, managed field located on the northeast corner of the site, south of the access road and pine plantation (Figure 3-1; Section 3.0).

E.3 Central Storage Facility Action

The CSF action includes the design, procurement, construction and operation of the necessary storage facilities (approximately 6) to contain the demolition debris and secondary waste streams generated under the interim remedial action. The CSFs will be constructed in a phased approach to support storage requirements of the interim remedial action. The first CSF will initially contain soils, but can be used for storage of debris and wastes.

Activities related to the CSF would consist of the following:

1) Constructing TSSs to house soil and debris. Tension-support structures are built with metallic arch frames covered by PVC-coated polyester fabric. A large TSS would require a strip foundation in order to resist wind loads. These structures can shelter the waste piles and control the runoff erosion and the migration of dust particles. The durable fabric cover of the TSS is fire retardant and translucent which would maximize the entry of sunlight. The design life of the cover is a minimum of ten years, and the cover can be repaired or replaced if needed to extend life. The structure can be erected relatively quickly for both existing or future waste piles. Tension-support structures could easily be expanded for enhanced storage capacity by erecting an additional length to an end of an existing structure.

   For each building, a subsurface liner system would be constructed to provide containment. Each building would also be equipped with Medium Efficiency Particulate Air (MEPA) filters to prevent the visible emission of particulates from the structure; to remove exhaust particulates from diesel-powered equipment operating within the facilities; and to minimize the accumulation of heat during the summer. Large doors would be located along the side of the structure to facilitate the movement of waste material. A method of segregating and containing specific types of materials would be required with sufficient aisle space for loading/unloading. The CSF structure would cover an area of approximately 40,000 square feet and approximately 90 percent of this space will provide improved storage.

2) Relocating some of the existing soil and debris piles to the CSF.

3) Transferring newly generated excess soil and debris that cannot be used as backfill to the CSF location.

Additional detail as to the design and construction of the CSF will be provided within a Remedial Design/Remedial Action Work Plan submitted following the IROD.

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E.4 Hazard Assessment and Accident Scenario

The Risk Assessment and Management (RAM) System (DOE 1992) was used to identify the potential hazards and concerns associated with construction and operation of the CSF. The major concerns and hazards associated with the preferred alternative can be summarized according to the following general categories:

1) Hazards related to the operation of vehicles and equipment. Vehicles would be used to bring materials into the CSF and for moving stored soil/debris within the facility. Vehicles and equipment would also be used during construction. The primary concerns with vehicle use are fire and accidents. The cause of most of these occurrences would likely be operator error or equipment failure.

2) Hazards associated with the storage of hazardous/mixed soil, debris, and liquid wastes. The primary concerns associated with the storage of these materials are inhalation of dust by workers and the escape of waste leachate or decontamination wastewater into the environment. The risks associated with the inhalation concerns/hazards would be minimized by a ventilation system (MEPA) and personal protective equipment.

E.5 Potential Environmental Impacts

The proposed containment structures, associated facilities, and access areas would occupy an area of approximately 12 acres. The existing grade of the site is approximately 4 to 5 percent and falls primarily to the south and west. In order to provide a level surface for the proposed structure, some alteration of the existing topography would be required.

The containment structure would have an aboveground concrete foundation to reduce surface water run-on and runoff. Within the containment structure, any water or other liquid spills that come in contact with the floor slab including the truck wheel washing areas would be channelled to a collection area and containerized for proper treatment/disposal. Prior to treatment, liquids will be sampled and analyzed. All surface run-on and runoff would be diverted away from the containment structure and to existing drains and ditches. The runoff would be discharged into storm sewers or drainage ditches that lead to the storm sewer outfall ditch.

During construction, erosion control would be maintained through the use of silt fences and hay bales around erosion-prone areas. These areas would be seeded with native grasses upon completion of the project.

In the vicinity of the removal areas, changes in topography caused by excavation of contaminated soils would be replaced with clean fill, regraded to natural gradient, and seeded with natural grasses where practical to minimize erosion and sediment deposition into Paddys Run. Removal would take place during periods of dry weather to minimize any contaminant runoff.

Soils contaminated with uranium, radium, thorium, hazardous and/or mixed wastes, petroleum-based substances, and PCBs would be placed in the proposed CSF. Most of the wastes would come from the vicinity of the OU3 process area.

Prior to any construction or removal activities, the native soils at the proposed CSF location would be sampled for background readings of organics, inorganics, and radionuclides. This data would be used as a baseline to establish whether further contamination of the area is being caused by the CSF.

Grading operations during the construction of this facility would cause disturbance to the site soils. Soils would not be removed from the site; however, the soil profiles would be altered somewhat during grading operations. Soil properties would not be substantially altered during construction operations, nor is it likely that enhanced paths of migration between the saturated zones would be created.

Since the proposed containment structures would be built on a concrete slab with interior drainage and collection systems, it is unlikely that any contaminants would impact the soils beneath or surrounding the buildings.

A leak detection system would be installed beneath the building floor slab to warn of any potentially escaping contaminants.

Wheel washing of the transport trucks prior to entry and upon leaving the interior of the containment structure would minimize the risk of spreading contamination to soils on other areas of the site. Wastewaters from wheel washing of any transport trucks would be collected, analyzed, and treated to prevent contact with the soil.

The drainage ditch south of the proposed CSF would be modified to divert surface water to the east along the northern edge of the OU3 process area. At the northeast corner of the process area, surface water would be directed south along the east border of OU3. The natural gradient of this area would then cause surface water to flow southeast toward the storm sewer outfall ditch and ultimately to Paddys Run.

All wastewaters generated by maintenance and cleaning operations at the CSF would be diverted to a collection sump and then removed for treatment and/or storage at an appropriate waste management facility. The CSF would not be a processing plant and (with the exception of domestic wastewater and truck wheel water) would not generate an effluent stream. Domestic wastewater would be discharged to the FEMP sewage treatment plant.

Impacts to groundwater during the construction phase would be negligible. The grading and foundation work would be a "clean" operation with no contaminated media on location until construction is completed. Surface waters and drainage courses would be protected from any incidental spills of fuels or potentially toxic substances; therefore, the groundwater would not be impacted.

Initially, impacts to both the perched and the Great Miami aquifers would be beneficial. By containerizing or covering contaminated soil and debris, the effects of precipitation and infiltration would be minimized. Contaminants from these areas would not be eroded into Paddys Run where they would infiltrate into the aquifer, nor would they percolate through the soils and ultimately into the groundwater. No water would be allowed to enter the containment facility and no water would be allowed to escape from within.

The site designated for the CSFs is located within the fenced site boundary. The site is currently not utilized for FEMP activities; therefore, the containment structure would not impact current land use.

Since secondary containment for the buildings would be provided, no contaminant migration into area soils is expected from the operation of the central storage containment structure. Therefore, impact on any potential future land use (including agricultural uses) should not occur as a result of construction and operation of this facility. Operation of the CSF would result in minimal addition of new employees; therefore, no impact to the socioeconomic structure in the communities surrounding the FEMP is expected.

The transport of materials for the TSS should have minimal impact on the transportation system at the FEMP or the surrounding community.

The construction of the TSS or the pre-engineered building may have an aesthetic impact to the surrounding community since the height of these structures (approximately 40 feet) would permit visibility from off site. However, because the location of the CSF containment structures would be within the FEMP fence line adjacent to other areas undergoing remedial activity, the aesthetic impact should be minor.

The Ohio State Historical Preservation Officer has determined that no cultural resources occur within the fenced Production Area. Archaeological surveys are being conducted outside of the fenced Production Area within the FEMP boundary. The archaeological survey to be performed would address the CSF location.

E.6 Conceptual Model

The assessment of potential exposure and risk uses the same approach as described in Appendix D for comparison of Alternative impacts.

Radiation dose estimates are made for the :

- in-plant workers;
- other on-site workers; and
- off-site residents.

Individual dose and risk are calculated. In addition, the collective dose equivalents and associated collective risks are also calculated. The materials that are expected to be the sources of the exposures are different. The first phase of the CSF is intended to provide interim storage for contaminated soils. The additional phases will provide storage for materials from OU3 buildings. Therefore, one assessment is made considering wastes from buildings and another for contaminated soil wastes.

E.6.1 Building Contaminants

Appendix D explains the basis for estimating airborne radionuclide concentrations within the nine major production plants in OU3. Airborne concentrations within the additional phases of the CSF are assumed to be the current average among those nine plants. Except for brief intermittent waste movements into and out of the CSF, there will be no activities to cause significant increases in airborne contaminant concentrations.

For air volume flow rates, leading to releases from the facilities, the same assumption of five facility volume air exchanges per hour is made. It is assumed that 10 percent of the airborne contaminants will be released because somewhat less efficient Medium Efficiency Air Particulate Filters are planned for use. The empty volume of a CSF is used. It is known that space will become occupied with wastes, but it is not presently reasonable to estimate the rate of waste accumulation. The releases used assume that the total of five facilities are sources of airborne effluent even though those releases will be less until higher waste inventories accumulate. The maximum release case is estimated to occur throughout remedial operations.

The annual release source term for building contaminants from the CSF was then used with CAP88-PC to calculate estimated exposures to other on-site workers and to off-site residents. This data is presented in Table E-1.

TABLE E-1 CSF Annual Releases from Decontamination Wastes

Isotope	Release (μCi/yr)	Isotope	Release (μCi/yr)
U-238	3.6E+01	Th-228	8.9E-02
U-234	3.6E+01	Ra-228	3.9E-02
Th-230	3.8E-01	U-233	7.9E-01
Ra-226	8.4E-02	Pu-239,40	4.1E-01
U-236	1.8E-02	Np-237	3.4E-02
U-235	2.1E+00	Pu-238	2.7E-02
Tc-99	3.6E+00	Cs-137	6.9E-02
Th-232	7.9E-02	Sr-90	6.4E-02

E.6.2 Soil Contaminants

Soil contaminant quantities and concentrations were estimated based upon RI/FS soil sample data down to 18 inches (Zimmerman, 1993). Uranium isotopes are predominant; however, the relative abundance and nature of specific radionuclides is different. The source term for the first phase of the CSF based on soil data is presented in Table E-2.

TABLE E-2 CSF Soil Source Term

Isotope	Upper 95% Confidence of the Mean	Isotope	Upper 95% Confidence of the Mean
U-238	136 pCi/g	Th-228	6.40 pCi/g
U-234	104 pCi/g	Ra-228	12.9 pCi/g
Th-230	83.9 pCi/g	Pu-239,40	0.33 pCi/g
Ra-226	40.0 pCi/g	Pu-238	0.37 pCi/g
U-235	4.84 pCi/g	Cs-137	0.53 pCi/g
Tc-99	0.80 pCi/g	Sr-90	0.97 pCi/g
Th-232	7.13 pCi/g		

EPA Guidance (EPA 1989) was used to estimate an emission flux of 4.3E-07 g/m^2-sec over an effective surface area of 256 m^2.

The annual release source term for contaminated soils was then used with CAP88-PC to calculate estimated exposure to other on-site workers and to off-site residents. This data is presented in Table E-3.

TABLE E-3 Estimated Annual CSF Releases from Soil Wastes

Isotope	Release (μCi/yr)	Isotope	Release (μCi/yr)
U-238	4.7E-01	Th-228	2.2E-02
U-234	3.6E-01	Ra-228	4.5E-02
Th-230	2.9E-01	Pu-239,40	1.2E-03
Ra-226	1.4E-01	Pu-238	1.3E-03
U-235	1.7E-02	Cs-137	1.9E-03
Tc-99	2.8E-03	Sr-90	3.4E-03
Th-232	2.5E-02		

E.7 Dose and Risk Summary

This is a two phase assessment. The first phase evaluates the dose and risk associated with the single CSF with soil as the waste form. The additional CSF phases are the proposed five additional storage facilities with building materials and debris as the waste form. Eight workers are associated with the initial facility. An additional eight workers are required for all operations at the five additional facilities.

E.7.1 First Phase CSF

<u>In-Plant Workers</u>

The estimated annual EDE (Effective Dose Equivalent) rate to the individual workers during the first phase of the CSF is 215 mrem/yr (Zimmerman, 1993).

For the Alternative 3 individual in-plant worker:

215 mrem/yr X 16 yr = 3.4+00 rem EDE

3.4 rem X 4.8E-04/rem = 1.6E-03 risk

For the Alternative 3 collective EDE and risk:

3.4 rem X 8 workers = 2.7E+01 person-rem

2.7E+01 person-rem X 4.8E-04/rem = 1.3E-02 risk

Other On-Site Workers

The individual on-site worker with the highest exposure would be located 213 meters NE of the CSF and is estimated to receive 3.0E-04 mrem/yr.

For the Alternative 3 individual on-site worker:

3.0E-04 mrem/yr X 16 yr = 4.8E-03 mrem EDE

4.8E-03 mrem X 4.8E-07/mrem = 2.3E-09 risk

Calculation of the collective EDE, to the on-site worker population used the same approach described in Appendix D. The single facility airborne soil release was used with CAP88-PC to compute the EDE to the 12 grid matrix of the distributed worker population. The point of release is north of the worker grid (285 ft.) and west (620 ft.) of the eastern edge of the grid. Table E-4 summarizes the results.

For the Alternative 3 collective EDE and risk:

4.7E-05 person-rem/yr X 16 yr = 7.5E-04 person-rem

7.5E-04 person-rem X 4.8E-04/rem = 3.6E-07 risk

Off-Site Resident

The maximum potential exposure to a theoretical off-site resident, at 500 meters NE of the facility, was computed to be 7.4E-04 mrem/yr.

For the Alternative 3 individual off-site resident:

7.4E-04 mrem/yr X 16 yr = 1.2E-02 mrem EDE

1.2E-02 mrem X 6.0E-07/mrem = 7.2E-09 risk

TABLE E-4 First Phase CSF Annual Collective On-Site Worker Dose Equivalent Rate

	Collective Dose Rate (Person-mrem/yr)		
Location	West	Central	East
Production Area - North	3.1E-03 40 Workers	2.9E-03 30 Workers	2.3E-03 20 Workers
Production Area - Central	7.6E-03 200 Workers	6.4E-03 150 Workers	3.0E-03 40 Workers
Production Area - South	1.2E-03 50 Workers	1.0E-03 40 Workers	1.1E-03 30 Workers
Administrative Areas	6.4E-03 400 Workers	7.1E-03 400 Workers	4.7E-03 200 Workers

Total Collective Dose Rate (Person-rem/yr) = 4.7E-05
Total Collective Dose (Person-rem) = 7.5E-04 (16 yr)
Total Collective Risk = 3.6E-07

The collective EDE rate was determined by applying the soil release source term, with CAP88-PC, to distributed off-site residents out to a five mile radius. Table E-5 shows the EDE rates for the distances and directions indicated.

For the Alternative 3 collective EDE and risk for the off-site population:

3.5E-04 person-rem/yr X 16 yr = 5.6E-03 person-rem

5.6E-03 person-rem X 6.0E-04/rem = 3.4E-06 risk

Table E-6 presents a summary of the individual and collective EDE and risks to each receptor group from the first phase CSF.

E.7.2 Additional CSF Phases

<u>In-Plant Workers</u>

The EDE rate for this phase was assumed to be equal to the maximum EDE rate from Plant 8 operations (212 mrem/yr). This value is conservative because it assumes an airborne concentration during decontamination activities versus storage of materials. During storage, limited actions are applied that could cause contaminants to be released to the air from materials previously decontaminated.

Table E-5 Annual Population Collective EDE Rate for First Phase CSF

	Distance				
	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles
Direction	EDE (Person-mrem/yr)	EDE (Person-mrem/yr)	EDE (Person-mrem/yr)	EDE (Person-mrem/yr)	EDE (Person-mrem/yr)
N	2.7E-03	3.2E-04	8.9E-04	7.4E-04	6.2E-04
NNW	1.2E-03	3.2E-04	1.5E-03	1.5E-03	6.8E-04
NW	---	3.6E-04	1.3E-03	1.3E-03	1.1E-03
WNW	3.0E-04	1.3E-04	1.1E-03	8.9E-04	7.3E-04
W	---	3.9E-04	2.0E-03	1.8E-03	2.0E-03
WSW	7.6E-04	3.4E-04	1.2E-03	9.8E-04	4.8E-03
SW	8.9E-04	1.3E-03	1.4E-03	2.4E-03	3.0E-03
SSW	1.3E-03	1.4E-03	9.5E-04	2.0E-04	1.5E-04
S	7.3E-04	1.7E-04	1.1E-03	4.6E-03	3.5E-03
SSE	---	3.2E-04	1.7E-03	7.7E-03	6.1E-03
SE	1.3E-03	1.9E-02	2.5E-03	1.3E-02	1.1E-02
ESE	6.6E-04	---	7.8E-03	1.7E-02	1.4E-02
E	---	7.6E-04	8.7E-03	2.0E-02	1.6E-02
ENE	1.2E-03	1.4E-02	3.1E-02	2.8E-02	1.5E-03
NE	---	2.4E-02	3.3E-02	2.1E-03	1.9E-03
NNE	3.3E-03	---	1.6E-03	1.4E-03	1.3E-03

Total Collective Person-rem/Yr = 3.5E-04
Total Collective Person-rem = 5.6E-03 (16 yr)
Total Collective Risk = 3.4E-06

TABLE E-6 EDE and Risk from the First Phase CSF

Receptor Group	Individual EDE (rem)	Individual Risk	Collective EDE (Person-rem)	Collective Risk
In-Plant Worker	3.4E+00	1.6E-03	2.7E+01	1.3E-02
Other On-Site Worker	2.1E-05	1.0E-08	7.5E-04	3.6E-07
Off-Site Resident	1.2E-05	7.2E-09	5.6E-03	3.4E-06

For the Alternative 3 individual in-plant worker:

212 mrem/yr X 16 yr = 3.4E+00 rem EDE

3.4E+00 rem X 4.8E-04/rem = 1.6E-03 risk

The collective worker population dose equivalent is calculated assuming there are eight workers for the additional CSF phases.

For Alternative 3 collective EDE and risk:

3.4 rem X 8 workers = 2.7E+01 person-rem

2.7E+01 person-rem X 4.8E-04/rem = 1.3E-02 risk

<u>Other On-Site Workers</u>

The interior airborne concentrations in each of these facilities was assumed to be equal to the average of the current airborne concentrations among the nine major plants. Except for brief intermittent waste movements, there will be no activities to cause significant increases in airborne contaminant concentrations. The air movement rate leading to releases from each facility was assumed to be five volume air exchanges per hour. It was assumed that ten percent of the airborne contaminants will be released because somewhat less efficient medium efficiency air particulate filters are planned for use. This source term was used with CAP88-PC. The highest exposed individual on-site worker, at 213 meters NE of the center of the five facilities, is estimated to receive 1.5E-02 mrem/yr.

For Alternative 3, the individual on-site worker:

1.5E-02 mrem/yr X 16 yr = 2.4E-01 mrem EDE

2.4E-01 mrem X 4.8E-07/mrem = 1.2E-07 risk

The calculation of the collective EDE to on-site workers used the same method described in Appendix D; This method was also applied for the first phase CSF analysis earlier in this Appendix. Table E-7 summarizes those results for each of the distributed grids.

The collective EDE for Alternative 3 is:

2.4E-03 person-rem/yr X 16 yr = 3.8E-02 person-rem

3.8E-02 person-rem X 4.8E-04/rem = 1.8E-05 risk

TABLE E-7 Additional CSF Phases Annual Collective On-Site Worker Dose Equivalent Rate

	Collective Dose Rate (Person-mrem/yr)		
Location	West	Central	East
Production Area - North	1.6E-01 40 Workers	1.4E-01 30 Workers	1.4E-01 20 Workers
Production Area - Central	3.8E-00 200 Workers	3.3E-01 150 Workers	1.5E-01 40 Workers
Production Area - South	5.8E-02 50 Workers	5.1E-02 40 Workers	5.7E-02 30 Workers
Administrative Areas	3.3E-01 400 Workers	3.6E-01 400 Workers	2.3E-01 200 Workers

Total Collective Dose Rate (Person-rem/yr) = 2.4E-03
Total Collective Dose (Person-rem) = 3.8E-02 (16 yr)
Total Collective Risk = 1.8E-05

<u>Off-Site Resident</u>

The maximum potential exposure to a hypothetical off-site resident, at 500 meters NE of the facilities, was computed to result in a EDE rate of 3.9E-02 mrem/yr.

For Alternative 3 individual off-site resident:

3.9E-02 mrem/yr X 16 yr = 6.2E-01 mrem

6.2E-01 mrem X 6.0E-07/mrem = 3.7E-07 risk

The collective EDE was determined by applying the estimated releases with CAP88-PC to off-site residents out to a five mile radius. Table E-8 summarizes those results and the collective EDE is 1.8E-02 person-rem/yr.

For the collective EDE for the off-site population from Alternative 3:

1.8E-02 person-rem/yr. X 16 yr. = 2.9E-01 person-rem

2.9E-01 person-rem X 6.0E-04/rem = 1.7E-04 risk

Table E-9 presents a summary of the individual and collective EDE and risks to each receptor group from the additional CSF phases.

Table E-8 Annual Population Collective EDE for Additional CSF Phases

	Distance				
	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles
Direction	EDE (Person-mrem/yr)	EDE (Person-mrem/yr)	EDE (Person-mrem/yr)	EDE (Person-mrem/yr)	EDE (Person-mrem/yr)
N	1.4E-01	1.7E-02	4.7E-02	3.8E-02	3.4E-02
NNW	6.2E-02	1.7E-02	7.7E-02	7.8E-02	3.7E-02
NW	---	1.9E-02	7.0E-02	7.0E-02	5.5E-02
WNW	1.7E-02	6.4E-03	5.7E-02	4.6E-02	3.9E-02
W	---	2.1E-02	1.0E-01	9.7E-02	1.1E-01
WSW	3.9E-02	1.8E-02	6.2E-02	5.2E-02	2.5E-01
SW	4.7E-02	6.7E-02	7.3E-02	1.3E-01	1.6E-01
SSW	6.9E-02	6.8E-02	5.0E-02	1.0E-02	7.5E-03
S	3.8E-02	8.8E-03	5.6E-02	2.4E-01	1.9E-01
SSE	---	1.7E-02	8.5E-02	4.1E-01	3.2E-01
SE	7.0E-02	1.0E+00	1.3E-01	7.2E-01	5.8E-01
ESE	3.4E-02	---	4.2E-01	9.1E-01	7.5E-01
E	---	4.0E-02	4.5E-01	1.0E+00	8.5E-01
ENE	6.3E-02	7.5E-01	1.6E+00	1.5E+00	7.0E-02
NE	---	1.2E+00	1.7E+00	1.1E-01	9.4E-02
NNE	1.7E-01	---	8.5E-02	7.1E-02	6.9E-02

Total Collective Person-rem/Yr = 1.8E-02
Total Collective Person-rem = 2.9E-01 (16 yr)
Total Collective Risk = 1.7E-04

TABLE E-9 EDE and Risk from the Additional CSF Phases

Receptor Group	Individual EDE (rem)	Individual Risk	Collective EDE (Person-rem)	Collective Risk
In-Plant Worker	3.4E+00	1.6E-03	2.7E+01	1.3E-02
Other On-Site Worker	2.4E-04	1.4E-07	3.8E-02	1.8E-05
Off-Site Resident	6.2E-04	3.7E-07	2.9E-01	1.7E-04

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E.7.3 Summary

The summarized dose and risks from all phases of the CSF are presented in Table E-10. These values represent the summation of doses and risks in Tables E-6 and E-9. For the in-plant workers, this number is not additive. The dose to individual in-plant workers is location specific and assumes the worker is at the point of highest exposure at all times. Therefore, this value represents the in-plant worker maximum individual exposure.

TABLE E-10 EDE and Risk from the CSF

Receptor Group	Individual EDE (rem)	Individual Risk	Collective EDE (Person-rem)	Collective Risk
In-Plant Worker	3.4E+00	1.6E-03	5.4E+01	2.6E-02
Other On-Site Worker	2.4E-04	1.2E-07	3.9E-02	1.9E-05
Off-Site Resident	6.3E-04	3.8E-07	3.0E-01	1.8E-04

E.8 References

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APPENDIX F

SAFE SHUTDOWN RISK SUMMARY

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APPENDIX F -- SAFE SHUTDOWN RISK SUMMARY

F.1 Introduction

The U.S. Department of Energy (DOE) has proposed and received EPA approval to proceed with a Removal Action for the Safe Shutdown at the Fernald Environmental Management Project (FEMP) in Fernald, Ohio.

Placing the FEMP in a safe shutdown mode is defined as follows: Documented concurrence/verification that OU3 activities, operations, and facilities not currently in operation comply with applicable DOE and regulatory environmental, safety, and health requirements and statutes and do not pose unacceptable environmental, safety, or health risks to workers, the public, or the environment. It is envisioned that Safe Shutdown activities represent the first step toward component decontamination and dismantlement and site remediation.

Pursuant to the requirements of DOE Order 5820.2A, the DOE Program Offices are responsible for placing facilities in a safe storage condition prior to decommissioning when the facilities become excess to programmatic needs. The FEMP Safe Shutdown Program is designed to ensure that the process facilities are in a physical state of compliance with all applicable regulations and requirements and are ready for further decontamination and dismantlement.

F.2 Safe Shutdown Action

The Safe Shutdown Removal Action will be carried out utilizing five teams of approximately 25 people each. Each of the five teams would be working on a separate production facility. Therefore, Safe Shutdown activities would be on-going in five of the production facilities simultaneously. The five facilities targeted for the initial Safe Shutdown activities include Plants 1, 4, 7, 8, and 9.

The 13 Hazardous Waste Managements Units (HWMUs) within the scope of the Safe Shutdown Removal Action currently contain approximately 15,000 pounds of solid material

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(e.g., paint chips, dried filtrate, dried uranyl nitrate); 40,000 gallons of liquid RCRA waste (e.g., nitric acid, 1,1,1, Trichloromethane) would be generated from the cleanout of HWMUs during the Safe Shutdown Removal Action.

This material would be removed and handled as RCRA waste pursuant to existing RCRA requirements, applicable health and safety requirements, DOE Orders, and existing Site Operations Procedures. Upon removal, the material would be stored on site in approved RCRA storage areas until final disposition.

An estimated 55,000 containers of inventory (process materials and residues) are stored in the production plants. These inventories would be removed from each of the production plants before Safe Shutdown activities. These materials would be consolidated on site in space made available by the removal and off-site shipment of waste inventories under Removal No. 9. Again, it is anticipated that enough waste would be removed from the Plant 1 Pad and Plant 6 to create adequate storage capacity for the product inventories currently stored in the production facilities targeted for Safe Shutdown. The final disposition of stored waste in the production facilities is being evaluated. Safe Shutdown would only remove the inventories from the production plants and consolidate them on site.

An additional 73,000 containers hold waste materials to be shipped off site for disposal as required by Removal No. 9 negotiated in the 1991 Amended Consent Agreement. Waste inventories are scheduled to be removed from facilities and would not be a factor in the FEMP Safe Shutdown activities.

Process materials and residues would be handled and packaged pursuant to all applicable health and safety requirements. These materials would be consolidated on site in space made available by the removal and off-site shipment of waste inventories under Removal No. 9. It is anticipated that enough waste would be removed from the Plant 1 Pad and Plant 6 to create adequate storage capacity for the process materials and residues that would be generated during the cleanout of idle process equipment.

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The proposed action may require supplying power to equipment in surges in order to remove any hold-up material contained on or within. In no case would the proposed action require the complete start-up of process equipment.

HEPA filters and personal protective equipment would be used to minimize risks to worker's health and safety and releases to the natural and human environments. Isolation barriers would also be employed in work areas to preclude releases to the environment.

Safe Shutdown would ensure that process equipment has been isolated from all energy sources; hazardous materials have been characterized and removed from process equipment; and loose, gross radiological contamination has been removed from the production facilities.

The current schedule has Safe Shutdown activities phased over a 5.25 year period with nine major Plants involved. The work periods associated with each plant are detailed in Table F-1.

TABLE F-1 Safe Shutdown Work Durations

Plant	Work Period (months)
2/3	62
Pilot Plant	41
6	32
1	31
9	22 (2 periods)
8	21 (2 periods)
5	20
4	18
7	8

F.3 Potential Environmental Impacts

The proposed action would take place within the previously disturbed FEMP Plant area and would not result in the development of any new areas at the FEMP. However, some minor impacts to the FEMP could occur.

The protection of human health and safety (on site and off site) during the Safe Shutdown Removal Action would be addressed through several processes. The protection of the workers directly involved in the Safe Shutdown Removal Action would be addressed by identifying hazards and specifying safety requirements (e.g., personal protective equipment, monitoring, and decontamination) that must be followed to minimize health and safety risks.

The potential exists that groundwater and surface water on and adjacent to the FEMP could be impacted by an accidental release of contaminated material from a container or piece of equipment being handled as part of the Safe Shutdown Removal Action. Accidental releases are unlikely because of procedural steps to be taken during the implementation of Safe Shutdown activities such as the erection of containment barriers around drains. Specific information regarding spill prevention and control can be found in the FEMP Best Management Plan (BMP), FEMP Spill Prevention Control and Countermeasure Plan, and the RCRA Contingency Plan.

The implementation of the Safe Shutdown Removal Action would not result in any disturbance of soils in the FEMP Plant Area. Only an accidental release to the soil directly adjacent to a pad or roadway would cause any adverse impact to FEMP soils during the Safe Shutdown Removal Action. Emergency response procedures would be followed if a release of a hazardous material should occur.

Routine and potential accidental airborne releases have been estimated, and resultant radiation dose and risk to other on-site workers and to nearby residents have been calculated. The potential risks are very low and within an acceptable range.

The proposed Safe Shutdown Removal Action would require the addition of approximately 150 new employees during Fiscal Year (FY) 1993 and FY 1994. The additional personnel are expected to have a minor impact on the socioeconomic structure around the FEMP.

The proposed action would not result in any development within the floodplain areas of the FEMP. In addition, there would be no impact to wetlands resulting from the Safe Shutdown Removal Action.

A Biological and Ecological Characterization study performed at the FEMP in 1986 and 1987 did not identify any federal or stated listed endangered or threatened species residing on the FEMP. The proposed action would take place within the FEMP Plant area and therefore, would not result in the destruction of any habitat on or adjacent to the FEMP.

The Safe Shutdown Removal Action is not expected to result in any adverse cumulative impacts. The Safe Shutdown activities would be performed pursuant to all applicable health and safety requirements (e.g., use of HEPA filtration and containment around drainage systems).

Upon completion of the Removal Action, potential sources of contamination that could potentially be released to the environment would be removed and the FEMP Production Plants would be placed in a safe condition until decontamination and dismantlement activities.

F.4 Risk Summary

An estimate of the radiation exposures and risks associated with Safe Shutdown activities is performed to support the estimation of cumulative impacts in Section 6.0 of this Proposed Plan. This assessment is made using the same approach as presented in Appendix D.. Separate decontamination and dismantling activities would be conducted concurrently with Safe Shutdown operations; however, the two would not be conducted simultaneously within a given plant. Safe Shutdown would precede any cleanup operations in any plant.

F.4.1 Population Groups at Risk

Risks related to Safe Shutdown operations are estimated for three groups of receptors:

- A Safe Shutdown worker,
- An on-site worker not involved in Safe Shutdown, and
- An off-site resident.

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Safe Shutdown Worker

The Safe Shutdown worker exposure is assessed through two pathways:

- Whole body external exposure from external sources within the plants, and
- Inhalation and immersion due to airborne radioactivity within the plants.

On-Site Worker

The on-site worker is assumed to be down wind of airborne effluents from a plant undergoing Safe Shutdown operations and exposure due to inhalation and immersion is estimated.

Off-Site Resident

The resident is exposed through the release of airborne effluents from the plants during Safe Shutdown. In addition to inhalation and immersion dose, the ingestion pathway is also included with the conservative assumption that all vegetables, milk, and meat are produced on the local property.

F.4.2 Estimation of Airborne Concentration

Airborne concentrations leading to exposure of each of the three groups are estimated through the following steps.

1. Current average air sample concentrations within each plant are assumed to be elevated by a factor of 10 due to Safe Shutdown activities.

2. Current air sample data are limited to gross alpha and gross beta concentrations. The relative quantities of specific isotopes are determined from analytical results of dust collector samples (DOE 1987). The isotopic distribution is then applied to the various gross alpha airborne concentrations to estimate specific isotopic airborne concentrations. Those values are then used to calculate effective dose equivalents for all three exposure groups.

3. Routine airborne releases are based upon the increased in-plant concentrations. Ventilation is estimated by assuming five building volume air exchanges per hour. A release fraction of one percent is used.

4. The forecast work periods are multiplied by the estimated dose rates to yield total dose for all operations.

F.4.3 Specific Exposure Groups and Pathways

F.4.3.1 The Safe Shutdown Worker

F.4.3.1.1 Airborne Radionuclides within the Plants

The relative distributions of specific airborne isotopes within the plants were determined using analytical data from samples of dust collector media for each plant. This approach is described in Appendix D. Table D-1 lists the dust collector averages. Table D-2 provides the in-plant airborne concentrations that are used to estimate in-plant worker dose equivalent. These concentrations are also used to estimate airborne releases leading to exposure of down wind on-site workers and off-site residents.

FEMP health physics procedures mandate the use of respiratory protection for actions which could suspend airborne contaminants. The most current ANSI Standard for Respiratory Protection (ANSI Z88.2-1992) recognizes that protection factors depend upon characteristics of aerosols and/or vapors. A respirator, or half face mask, usually provides a protection factor of ten. For more challenging airborne contaminants, a full face mask is required with minimum protection factor of ten. Inhalation doses are estimated assuming a protection factor of ten.

The dose conversion factors (effective dose equivalent or EDE) are those used for the EPA CAP88-PC computer program (EPA 1992). This code is also used to calculate EDE to the on-site worker and the off-site resident (EDI 1993). Within the CAP88-PC Users Manual, there are a number of references which describe many features of the EPA code.

Using the airborne concentrations shown in Table D-2, the airborne pathway EDE was calculated to the in-plant worker. A 40 hour work week was assumed.

F.4.3.1.2 External Radiation Exposure

Exposure rates within each plant are difficult to predict because of the distribution and quantities of the contaminants and the unknown extent and time duration of worker proximity. Historical worker dose summaries were reviewed with focus on the later years of production activities: 1986 and 1987. Plant-by-plant dose summaries were not available; however, the average for all workers during those years was 166 mrem/yr (Neton 1993). Reasons for both higher and lower biases among the population tend to support the average for those two years.

It is not likely that future average doses will be as high as 166 mrem/yr due to more conservative radiation protection practices since 1987. The improved practices are demonstrated in DOE Order 5480.11 and the supplemental DOE Radiological Control Manual. These newer practices are in place, and use of 166 mrem/yr is relatively conservative. A forecast is that the 166 mrem/yr will range from plus 0 percent to minus 50 percent.

As with the airborne pathway, the work schedules are applied to yield total EDE and risk.

F.4.3.1.3 Summary of Dose and Risk to the Safe Shutdown Worker

A summary of the EDEs and risks to the in-plant workers is provided in Table F-2. These values represent the total dose and risk to workers involved in the project. The total individual maximum exposure is 952 mrem. With 125 Safe Shutdown workers, the collective EDE is 1.2E+02 person-rem with a collective risk of 5.8E-02.

TABLE F-2 Safe Shutdown Worker EDE and Risk

Plant	Work Period (Years)	Estimated EDE (mrem)			Risk
		Airborne	External	Total	
Plant 1	2.58	119	428	547	2.6E-04
Plant 2	5.17	94	858	952	4.6E-04
Plant 4	1.50	24	249	273	1.3E-04
Plant 5	1.67	27	277	304	1.5E-04
Plant 6	2.67	47	443	490	2.4E-04
Plant 7	0.67	23	111	134	6.4E-05
Plant 8	1.75	74	291	365	1.8E-04
Plant 9	0.92	17	153	170	8.2E-05
Pilot Plant	3.42	72	568	640	3.1E-04

The probability for cancer incidence in adult workers is 4.8E-04 per rem (NCRP 1993). This is the sum of the probabilities of 4.0E-04 fatal cancers per rem and 0.8E-04 non-fatal cancers per rem. While CAP88-PC was used to calculate the effective dose equivalent, the risk was calculated separately with the probability given above. CAP88-PC calculates risk, however the algorithm assumes a continuous lifetime exposure period of 70 years and a probability of 4.0E-04 per rem; neither is appropriate here.

F.4.3.2 The Other On-Site Worker

This risk to the on-site worker who is not directly involved in Safe Shutdown activities is assessed through the effect of airborne releases from the plants undergoing safe shutdown operations. The development of the source terms from each plant was described earlier and the annualized summary is given in Table D-4 of Appendix D. The results are summarized in Table F-3.

The on-site worker, subject to the maximum exposure, would be 447 meters NE of the center of the Production Area. The EDE at that location for the duration of Safe Shutdown activities is 3.5E-02 mrem and an attendant risk of 1.7E-08.

TABLE F-3 Other On-Site Worker EDE and Risk from Safe Shutdown

Plant	Work Period (Years)	Maximum Exposure			Risk
		Distance	Direction	EDE (mrem)	
Plant 1	2.58	350	NE	4.7E-03	2.3E-09
Plant 2	5.17	450	NE	2.8E-03	1.3E-09
Plant 4	1.50	450	NE	1.2E-03	5.8E-10
Plant 5	1.67	300	NE	2.5E-03	1.2E-09
Plant 6	2.67	200	NE	1.4E-02	6.7E-09
Plant 7	0.67	500	NE	1.1E-04	5.3E-11
Plant 8	1.75	300	NE	9.9E-03	4.8E-09
Plant 9	0.92	200	NE	1.6E-03	7.7E-10
Pilot Plant	3.42	350	NE	1.1E-03	5.3E-10

The collective dose to the on-site worker population was represented in each of 12 sectors covering the entire Production and Administrative Areas. A CAP88-PC analysis assessed doses to each of the sectors, which was then used to obtain a collective dose equivalent for each of the 12 sectors. A better representation of the collective dose equivalent to on-site workers requires analysis of the number of workers at locations relative to airborne release points. To accomplish this, nine grid sectors were established over the Production Area: central, northeast, east, southeast, south, southwest, west, northwest, and north. The worker population located in each of the grids was estimated.

Similarly, adjacent non-Production Areas to the south were defined as Administration Areas west, central, and east, and the worker population within each grid was estimated. CAP88-PC runs for the four plant aggregate source term estimated dose and collective dose equivalents were calculated. Table F-4 summarizes that information. The total collective dose for the on-site worker population from this activity is 5.5E-02 person-rem.

F.4.3.3 The Off-Site Resident

Dose and risk to the off-site resident were obtained using the same method applied to other on-site workers. The source term is the sum of releases from all nine plants during safe shutdown operations. It is conservatively assumed that all vegetables, milk, and meat is locally produced on the local property. A theoretical off-site resident is assumed to be 915 meters down wind (Northeast) of the center point of the nine plants. This results in a maximum individual EDE of 1.1E-01 mrem and a risk of 6.6E-08 at that location. These values cover the entire 62 month period and include all Safe Shutdown tasks. The total collective EDE for off-site residents (Table F-5), within a five mile radius is 1.9E-01 person-rem.

TABLE F-4 Collective Other On-Site Worker Dose Equivalents (person-mrem)

Location	West	Central	East
Production Area - North	40 Workers 3.1E-01	30 Workers 3.5E-01	20 Workers 7.1E-01
Production Area - Central	200 Workers 2.6E+00	150 Workers 3.1E+00	40 Workers 9.0E-01
Production Area - South	50 Workers 7.9E-01	40 Workers 3.9E-01	30 Workers 4.9E-01
Administrative Area	400 Workers 3.9E+00	400 Workers 4.1E+00	200 Workers 2.6E+00

Total Collective Dose (Person-rem)	5.5E-02
Total Collective Risk	2.6E-05

TABLE F-5 Collective Off-Site Resident EDE for Safe Shutdown

	Distance				
	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles
Direction	EDE (Person-mrem)	EDE (Person-mrem)	EDE (Person-mrem)	EDE (Person-mrem)	EDE (Person-mrem)
N	8.9E-01	1.7E-01	5.1E-01	4.3E-01	3.7E-01
NNW	4.2E-01	1.7E-01	8.4E-01	8.6E-01	3.9E-01
NW	---	2.0E-01	7.6E-01	7.8E-01	6.4E-01
WNW	9.6E-02	6.4E-02	6.2E-01	5.3E-01	4.5E-01
W	---	2.1E-01	1.1E+00	1.1E+00	1.2E+00
WSW	2.7E-01	1.8E-01	6.8E-01	5.7E-01	2.8E+00
SW	3.4E-01	6.9E-01	7.9E-01	1.4E+00	1.7E+00
SSW	4.7E-01	7.0E-01	5.4E-01	1.1E-01	8.7E-02
S	2.6E-01	8.9E-02	6.1E-01	2.6E+00	2.0E+00
SSE	---	1.7E-01	9.2E-01	4.5E+00	3.6E+00
SE	3.6E-01	9.6E+00	1.4E-01	8.1E+00	6.6E+00
ESE	1.8E-01	---	4.5E+00	1.0E+01	8.4E+00
E	---	3.8E-01	4.8E+00	1.1E+01	9.8E+00
ENE	3.6E-01	7.5E+00	1.7E+01	1.6E+01	9.2E-01
NE	---	1.3E+01	1.8E+01	1.2E+00	1.1E+00
NNE	1.1E+00	---	8.9E-01	7.8E-01	7.6E-01

Total Collective Dose (Person-mrem) = 193
Total Collective Risk = 7.6E-05

F.5 References

Environmental Dimensions, Inc. (EDI), 1993, *Dose and Risk Assessments in Support of the Operable Unit 3 Proposed Plan for Interim Remedial Action.*

U. S. Department of Energy, 1987, *History of FMPC Radionuclide Discharges, FMPC-2082,* (Tables 52-87), prepared by Westinghouse Materials Company of Ohio.

U. S. Environmental Protection Agency, 1989, *Risk Assessment Methodology: Draft Environmental Impact Statement for Proposed NESHAPS for Radionuclides*, Volume I, Background Information Document, Office of Radiation Programs.

U. S. Environmental Protection Agency, 1992, *Users Guide for CAP88-PC Version 1.0, 402-B-92-001.*

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APPENDIX G

EVALUATION OF WASTE VOLUMES AND STORAGE FACILITY REQUIREMENTS FOR THE PREFERRED ALTERNATIVE

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APPENDIX G -- EVALUATION OF WASTE VOLUMES AND STORAGE FACILITY REQUIREMENTS FOR THE PREFERRED ALTERNATIVE

G.1 Introduction

During the implementation of the interim action preferred alternative, large amounts of waste construction materials (debris), equipment, piping/conduit, structural metals, and decontamination wastes would be generated. Since a portion of the implementation phase of the action would occur prior to the final OU3 ROD (addressing treatment and material disposition), much of the resulting materials would be held in interim storage on-site during this interval (called the "interval period" in this discussion), awaiting the final decision. Once the final ROD identifies treatment requirements and disposition options, these materials would be dispositioned. In the following text, the required capacity for on-site interim storage is estimated based on a series of detailed assumptions about the action and the wastes associated with the action.

G.2 Base Assumptions

The development of estimates for volumes associated with the storage and/or transportation of action-generated wastes requires that assumptions regarding schedule and volume calculation be stated. The following base assumptions have been made in support of the analysis.

<u>Schedule</u>

- The implementation of the action requires approximately 16 years to complete.
- The schedule is constrained by funding levels.
- The interim action Record of Decision (IROD) would be achieved in mid-FY-94.
- The interim action would be in full field implementation by FY-96.
- The final Record of Decision would be achieved in late FY-97.
- The final action would be in full implementation by FY-2000.
- Facilities dismantled during the IROD implementation period prior to the full implementation of the final ROD (interval period) would require on-site interim storage capacity.

- Storage capacity need would cease to increase once the final action is in full implementation.

The following structures have been identified for probable dismantlement (above-grade portions) during the four to five year interval period prior to the full implementation of the final ROD:

- Refinery Complex, including 2A, 2D, 2F, 2G, 3B, 3C, 3D, 3E, 3F, 3G, 3J, 39A, 39B, and 39C;
- Plant 4 (4A) and 4C.

The list is based on current anticipated funding levels and current priorities associated with structure removal. For each major structure, all minor structures in the immediate vicinity would also be included in the dismantlement plan, however, several structures in the vicinity of the Refinery Complex must remain in operation during the interval period to support other site operations.

Volume

In order to assess the storage and disposal requirements for the wastes resulting from the decontamination and dismantlement of the identified structures, a series of assessments have been applied. Tables G-1 through G-3 summarize calculations performed to estimate the storage volume requirements for a Central Storage Facility (CSF) and volumes for off-site disposal, supported by additional detailed assumptions included as footnotes to each table. Table G-1 develops bulk volume estimates from in-place volume estimates for materials associated with decontamination and dismantlement of the identified structures in the interval period. Table G-2 estimates the volumes of materials to be shipped from the site (as non-recoverable and non-treatable or for recycling), and those materials to be retained on-site during the interval period, and container requirements. Table G-3 estimates interim storage facility needs associated with the materials identified to remain in on-site interim storage during the interval period.

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Table G-1 Interval Period Debris Bulk Volume Estimates*

Media Description	Volume (CY)	Bulking Percent (%)	Bulk Volume (CY)
Concrete/Cement Block	1,238	130	1,609
Structural Steel	200	300	600
Miscellaneous Metal	1,424	200	2,848
Equipment	10,551	350	21,102
Transite	341	120	409
Other	2,826	200	5,652
Decontamination Residues	2,600	N/A	2,600
TOTAL	19,180		34,820

* Assumptions Employed in Preparation of the Table:

1. During the 4-5 year period, no at grade or below-grade structure(s) will be removed. This work will occur later in conjunction with Operable Unit 5 activities, therefore no at grade or below-grade materials are included in the volume estimates for the interval period.
2. Media definitions: Concrete/Cement Block includes floor slabs (above grade level), cement block used in wall construction, and acid brick; Structural Steel includes medium and heavy grades of steel used in structural applications and does not include floor plate under 1/4 inch, siding, or roofing; Miscellaneous Metal includes lighter gauge metals, metal with configuration making radiological survey impossible, conduit, piping, wiring, ductwork, but does not include tankage; Equipment includes all tankage and other processing units; Transite includes asbestos-containing corrugated and flat sheeting used in wall and roof construction; Other includes those construction materials not included above, not limited to glass, plaster, wood, insulation, plastic, and shingles; Decontamination Residues includes vacuumed dusts, used personal protective equipment, spent consumable equipment, etc. The miscellaneous metal and equipment categories may include significant quantities of non-ferrous and exotic metals with notable recovery values.
3. Media volumes are estimated based on OU3 RI/FS Work Plan Addendum Table A.7 and table source information.
4. Media waste bulking factors assumed: Concrete/Cement Block = 1.3, Structural Steel = 3, Miscellaneous Metal = 2, Equipment = 3.5 (includes conversion from metal density to bulk density), Transite = 1.2, Other = 2, Decontamination Residues = N/A.
5. Decontamination Residues have been estimated to result in approximately 10,000 drums (55 gal.) during the course of the project (@ 7 CF per drum).

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Table G-2 Estimates of Media Storage Volume and Container Requirements*

Media Description	Shipped Volume (CY)	Stored Volume (CY)	Containers for Stored Volume
Concrete/Cement Block	0	1,609	N/A (Piles)
Structural Steel	600	0	----
Miscellaneous Metal	1,994	854	285 B-25s
Equipment	8,440	12,661	215 SLs
Transite	409	0	----
Other	5,652	0	----
Decontamination Residues	1,300	1,300	5,000 Drums
TOTAL	18,395	16,424	

* Assumptions Employed in Preparation of the Table:

1. Media storage/shipping assumptions: Concrete/Cement Block will be stored in bulk piles of cut slabs or shipped in SeaLand containers. Structural Steel will be stored in bulk piles or shipped in SeaLand containers. Miscellaneous metal will be stored in B-25 boxes. Equipment will be stored in SeaLand containers. Transite will be stored or shipped in SeaLand containers. Other will be stored or shipped in B-25 boxes. Decontamination Residues will be stored in drums on pallets.
2. Bulk piles inside of storage structures will be limited to maximum 10 feet in height.
3. SeaLand containers accommodate ~80% of 2000 cubic feet, or ~1600 cubic feet (~59 CY) of interior storage.
4. B-25 boxes accommodate ~80% of 100 cubic feet, or ~80 cubic feet (~3 CY) of interior storage.
5. Containers represents the anticipated need for interim storage. For all containers, volume rather than weight has been assumed to be the limiting parameter.
6. Portions of materials determined to be non-recoverable and either contaminated or non-contaminated may be identified for off-site shipment for disposition. The estimated volume fraction by category: Concrete/Cement Block = none, Structural Steel = none, Miscellaneous Metal = 0.5, Equipment = 0.2, Transite = all, Other = all, and Decontamination Residues = 0.5. These values have been represented in the shipped volume category and removed from the stored volume category.
7. Recycle/beneficial reuse of materials of value may result in off-site transport of additional materials. The following volume fractions have been used as an estimate: Concrete/Cement Block = none; Structural Steel = all; Miscellaneous Metal = 0.2; Equipment = 0.2; Transite = none; Other = none; Decontamination Residues = none. These values have also been represented in the shipped volume category and removed from the stored volume category.
8. Off-site shipment volumes, based on the volume and container assumptions above: Structural Steel = 11 SeaLands; Miscellaneous Metal = 665 B-25s; Equipment = 143 SeaLands; Transite = 7 SeaLands; Other = 1884 B-25s; and Decontamination Residues = 5000 drums.

Table G-3 Estimate of Interim Storage Capacity Needs for the Preferred Alternative

Media Description	Minimum Storage Footprint (SF)	Maximum Storage Footprint (SF)
Concrete/Cement Block	4,344	4,344
Structural Steel	N/A	1,620
Miscellaneous Metal	2,280	7,690
Equipment	51,500	85,835
Transite	N/A	1,664
Other	N/A	15,072
Decontamination Residues	10,000	20,000
TOTAL	68,124	136,225
Number of TSSs Required	~3	~5

• Assumptions Employed in Preparation of the Table:

1. Tension Support Structures (TSSs) will be constructed similar to the structures identified in Removal No. 17 (approximately 40,000 square feet of floor area) to become part of an expanded Central Storage Facility (CSF).
2. Usable storage floor space in TSSs is estimated to be approximately 75% (~30,000 square feet) of total floor space, due to the need to maintain aisles, corridors, media/contamination segregation, and multiple ingress/egress points.
3. Each medium would be stored segregated from non-similar media and segregated by types and levels of contamination. Media contamination type (radiological only, mixed hazardous and radiological, and non-contaminated) has significant impact on segregation needs, although a general assumption has been made that all hazardous materials will also exhibit radiological contamination. Additionally, segregation is a means to assure that cross-contamination is minimized (waste minimization), that the value of field investigation data is preserved, and that media-specific management practices can be employed effectively.
4. SeaLand containers are not stacked and have a 8 foot x 30 foot (240 square foot) footprint per 59 CY stored.
5. B-25 boxes are stacked three high for storage and have a 4 foot x 6 foot (24 square foot) footprint per 9 CY stored.
6. Drum storage is assumed at two sets in height and requiring a 16 square foot footprint per 8 drums (56 CF or 0.13 CY per square foot footprint).
7. Storage Footprint (Min) represents the storage needs associated with assumptions of off-site disposition and recycle/reuse. Storage Footprint (Min) corresponds to Stored Volume (CY) from Table G-2.
8. Storage Footprint (Max) is a calculation provided on the same storage bases, but representing a condition in which all dismantlement debris, equipment, and decontamination residues are retained in interim storage on site. Storage Footprint (Max) corresponds to Non-Stored Volume (CY) from Table G-2.

G.3 Results

As a result of the analyses, storage capacity to accommodate wastes generated during the interval period is identified as three tension support structures of 40,000 ft^2 each, in addition to the capacity requirements specified in the Removal No. 17 Work Plan. If all generated wastes and recyclable materials were retained on-site during the period, then an additional two tension support structures would be required.

The materials identified for off-site disposition during the interval period represent those materials for which neither recovery nor recycling is a reasonable possibility during the interval period. The impact of the planned disposal of such material is relatively small in comparison to the overall waste volumes anticipated to be generated by the project. Materials expected to receive off-site disposition during the interval period is approximately 18,000 cubic yards, versus a total anticipated bulk volume of debris for the interim action of 590,000 cubic yards (less than 4 percent of the total). Such an insignificant portion of the total will not result in biasing the ultimate treatment and disposal decisions for the final ROD, but will facilitate handling of an increased volume of structural debris during the interval period.

Following the interval period, the structures would be retained primarily for staging of materials before treatment or final packaging. The TSSs have an expected design life of 10 to 15 years for the fabric covering and significantly longer for the metal support structure, and therefore may require replacement of the fabric covering prior to the end of the action.

G.4 References

U. S. Department of Energy, 1993b, *Operable Unit 3 Remedial Investigation and Feasibility Study Work Plan Addendum*, Final, prepared by the Fernald Environmental Restoration Management Corporation, Cincinnati, Ohio.

APPENDIX H

WETLANDS ASSESSMENT FOR

INTERIM REMEDIAL ACTION

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APPENDIX H -- WETLANDS ASSESSMENT FOR INTERIM REMEDIAL ACTION

H.1 Introduction

The FEMP is divided into five separate operable units. The subject of the proposed plan is Operable Unit 3 (OU3). There are a limited number of alternatives available to mitigate the threat of release from the former production facilities and above- and below-grade improvements within OU3. In addition, there are major concerns with regard to potential exposures to human health and the environment associated with the facilities remaining in their current condition under the existing restoration schedule. The proposed action involves component and gross material decontamination and dismantlement and interim storage of generated waste materials.

The primary objective of the Proposed Plan is to protect public health and the natural environment by mitigating the threat of releases associated with OU3 facilities.

Executive Order 11990 (Protection of Wetlands), and DOE regulation "Compliance with Floodplain/Wetlands Environmental Review Requirements" (10 CFR 1022) specify the requirements for a floodplain/wetland assessment where DOE is responsible for providing federally undertaken, financed, or assisted construction and improvements. A floodplain assessment will not be performed since the proposed action will not impact flood plains. Pursuant to 10 CFR 1022.5 and 1022.11, the DOE has determined a wetlands assessment is applicable to the proposed action. DOE issued a Wetlands Notice of Involvement concerning the proposed plan in Hamilton and Butler Counties, Ohio to satisfy public notice requirements of 10 CFR 1022.14. DOE has determined, the appropriate NEPA documentation for the proposed action is an Environmental Assessment.

H.2 Purpose and Need for the Proposed Action

The purpose of this action is to reduce risks to human health and the environment through the accelerated decontamination and dismantlement of all above- and below-grade components within OU3. There are major concerns with regard to potential exposures to human health and the environment associated with the facilities remaining in their current condition.

Therefore, DOE has negotiated with the EPA and received approval to pursue a proposed plan and interim ROD to address concerns related to the OU3 facilities and improvements prior to the issuance of the final ROD. The proposed action is expected to impact wetland areas around the perimeter of the OU3 Production Area.

H.3 Alternatives

H.3.1 Alternative 1 -- No Interim Action

The No Interim Action Alternative represents the continuation of all currently approved programs. No acceleration of site remediation will occur under this alternative. This alternative assumes that existing and approved removal actions and site maintenance programs will continue to be implemented. This alternative would not impact wetland areas, but in the short-term would not be protective of human health and the environment as a result of contaminants from buildings and structures potentially migrating to wetland areas and perched groundwater. Therefore, this alternative was not selected.

H.3.2 Alternative 2 -- Decontaminate Surfaces Only

This alternative includes accelerated in-situ gross decontamination of interior and exterior surfaces of OU3 components and interim storage of decontamination waste materials. This alternative would reduce existing levels of surface contamination within components. A variety of surface decontamination techniques may be employed depending on the surface to be cleaned. This alternative would not impact wetland areas, but in the short-term would not be protective of human health and the environment as a result of contaminants from buildings and structures potentially migrating to wetland areas and perched groundwater. Therefore, this alternative was not selected.

H.3.3 Alternative 3 -- Decontaminate and Dismantle (Proposed Action)

Alternative 3 includes above- and below-grade component decontamination and dismantlement and interim storage of waste materials. Above-grade components will be addressed prior to below-grade portions of components. The activities involved for above-grade components are removal of equipment and materials, surface decontamination, dismantlement, and interim storage. After above-grade decontamination and dismantlement, foundations, slabs, and pads will be decontaminated to minimize further contamination of soils. Removal of foundations, slabs, pads, and subsurface utilities will be scheduled to coincide with OU5 remedial actions.

Methods to be used for decontaminating and dismantling the structures depend on the contamination expected and type of construction (e.g., concrete block, transite, steel, etc.). Surface decontamination measures (in situ and/or post demolition) would be used to remove contamination from surfaces such as floors, walls, ceilings, structural members, and miscellaneous equipment and materials. Known and existing surface decontamination technologies would be selected during remedial design for application. Secondary liquid and/or solid waste streams may be treated to meet disposal and/or storage requirements and minimize waste volume.

Materials generated during decontamination and dismantlement activities, including decontamination residues and demolition debris, would be managed in accordance with Removal No. 17, Improved Storage of Soil and Debris. Materials requiring treatment prior to disposition would be stored on-site. Non-recoverable and non-recyclable materials (miscellaneous building materials) that cannot be effectively treated may be dispositioned at an approved disposal facility.

H.4 Wetland Effects

Wetlands on the perimeter of OU3 were delineated using the Routine Determination On-site Inspection method in accordance with the 1987 Corps of Engineers Wetlands Delineation Manual. The wetlands delineation was conducted to demonstrate compliance with 10 CFR 1022, and Executive Order 11990. Persistent emergent wetlands (≈ 1.2 acres) were located on the east and west perimeters of the OU3 Production Area (Ebasco 1993). Another wetland area (≈ 0.5 acres) is located north of the proposed site for the CSF. Vegetation common to these wetland areas include the broad-leaf cattail (Typha latifolia), yellow nutgrass (Cyperus esculentus), green bulrush (Scirpus atrovirens), and swamp milkweed (Asclepias incarnata). Figure H-1 shows wetland areas on the perimeter of the OU3 Production Area.

The proposed action may result in long-term and direct impacts from the permanent filling of approximately 1.2 acres of wetlands on the east and west sides of OU3. Continuous equipment traffic and stockpiling of building and structure contents will alter the topography, resulting in sediment deposition into wetland areas. Additionally, removal of roads, utilities, trenches, and piping may impact wetlands through excavation and soil stockpiling activities, resulting in possible sediment deposition into wetland areas. Impacts to wetland areas, however, would be positive due to the removal of contaminant sources.

The impacted wetland areas consist of man-made drainageways with minimal quality habitat. Best management practices will be utilized to minimize the amount of wetland area impacted. The area north of the proposed CSF locations will not be impacted by the proposed action.

H. 5 References

Ebasco Environmental, 1993, *Wetlands Delineation Report of the FEMP*, Draft, prepared by Fernald Environmental Restoration Management Corporation, Cincinnati, Ohio.

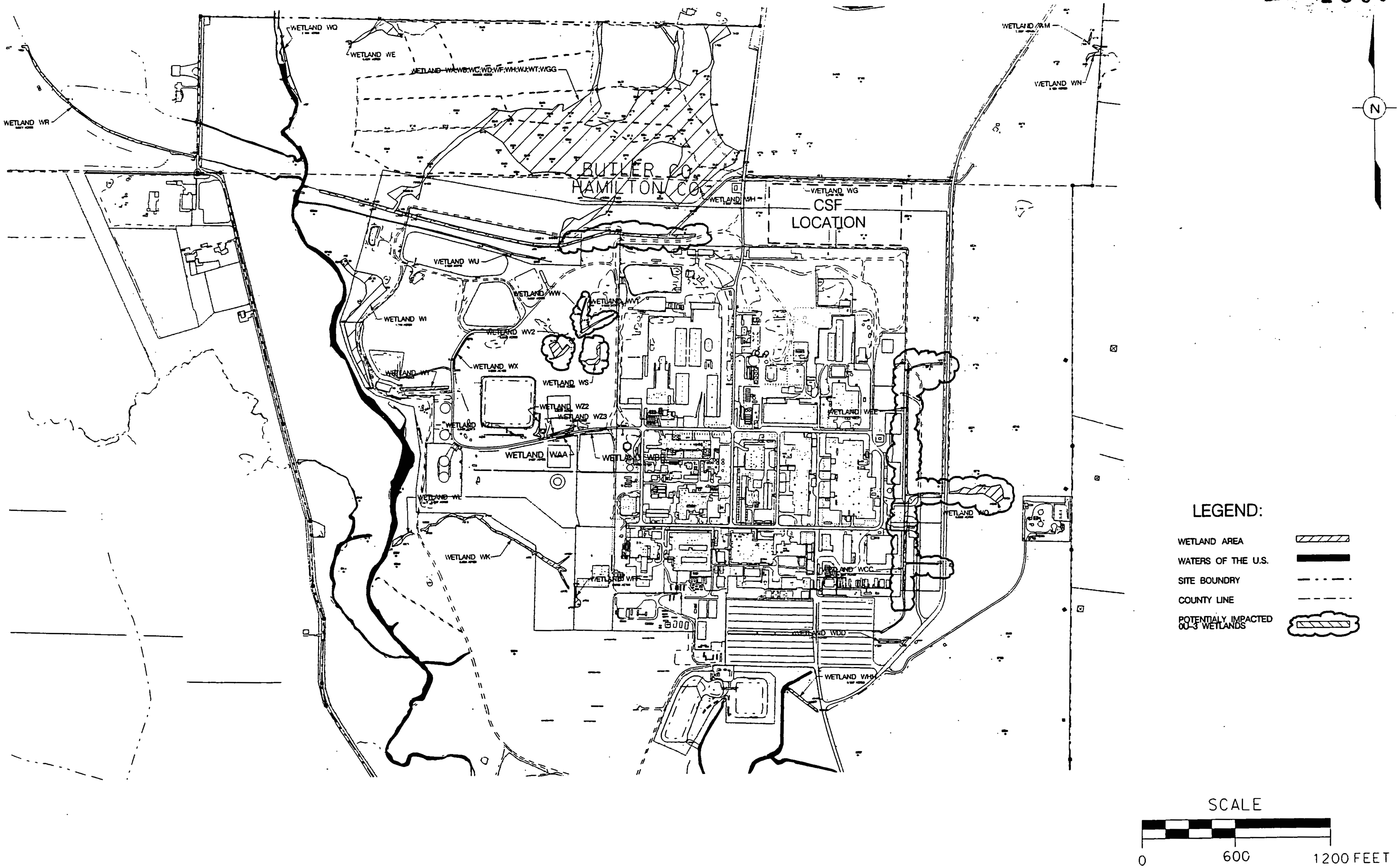

FIGURE H-1 Wetland Areas Adjacent to OU3

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APPENDIX I -- OFF-SITE TRANSPORTATION

I.1 Introduction

Analysis of the potential impacts in this Proposed Plan includes consideration of the radiation dose and risk to truck drivers and to the en-route public due to shipment of radioactive wastes for disposal to the Nevada Test Site (NTS). Alternatives 1 and 2 would not require waste transportation. Only Alternative 3 would involve waste shipments.

This analysis includes two distinct cases; the incident-free transport and then the transportation accident scenario. Two different waste configurations were used with the models contained within the Sandia National Laboratories (SNL) RADTRAN 4 Computer Code (SNL 1986 and 1992).

The occupational and public radiation doses, during incident free transport, is only due to external gamma ray (and other photon) exposure. Because of the linear extent of the source, the incident-free analysis was based upon shipments of two SeaLand containers. These are typically double trailer shipments with each container being 9.1 meters long.

For the accident analysis, more highly concentrated and dispersable residues, in 55 gallon containers was used.

I.2 Incident Free Transport

I.2.1 Conceptual Model

Empirical external dose rate measurements were input to RADTRAN 4 which combines code specific algorithms parameters with user determined parameters, as described later in this Appendix.

This assessment for normal accident free transport, estimates exposure to four population groups or receptors:

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1. Truck drivers including loading, en-route, and unloading operations;
2. Public drivers and passengers who share the road with the waste transport vehicles;
3. Members of the public who live, work, or are otherwise adjacent to the road; and
4. Members of the public in the vicinity of the waste transport vehicle during stops.

I.2.2 User Input Parameters

The FERMCO specified parameters and analysis flags included:

Incident free transport
Consider no building shielding
Package size: 2 each 9.1 m (SeaLand Container)
Transport Mode: Truck only
Truck Drivers: 2 per trip (no other crew)
Number of shipments: 645
Package Dose Rate at one meter: 0.018 mrem/hr.
Number of persons exposed during stops: 4
Average distance to persons during stops: 20 meters
One way trip distance: 3300 km

Package Size and Number

Waste containers are expected to be 55 gallon drums, B-25 boxes and SeaLand containers. The maximum external exposure case is expected to be a double trailer shipment with a total of two 9.1 meter long SeaLand containers. This single case was used to estimate the impact of 645 shipments. The latter was calculated based upon waste volume estimates given in Table G-1 of Appendix G.

Package Dose Rate at One Meter

A tissue equivalent plastic scintillation detector was used to take measurements, at one meter, from a SeaLand container currently loaded with representative wastes. New measurements, at the locations around the container ranged from 6μR/hr to 18 μR/hr, with an average of 9.6 ± 4.0μR/hr. To be conservative, the maximum value of 18 μR/hr was used for the analysis.

Number of Persons and Distances During Stops

The RADTRAN default values of 50 persons at a distance of 20 meters was judged to be a high estimate. That distribution approximates a population density of 39,790 persons/km^2. For comparison, the population distribution at a busy urban truck stop, along the planned route, was assessed.

The following information was obtained (Maupin, 1993) for a standard truck stop along the expected route to compare reasonableness:

Equilibrium number of parked trucks: 120
Number of drivers per truck: 1.3 (156 total)
Truck stop area: 10 acres

The default distance of 20 meters was used and a conservative closer-in distribution was used. This also allowed for exposure to truck stop workers. Use of four persons at 20 meters approximates a population density of 3183 persons/km^2. This in turn can be compared to the RADTRAN default value for an urban population distribution of 3861 persons/km^2.

I.2.3 Radtran Values

The significant default values provided by RADTRAN that were used are:

Distance Fraction of Travel:
- 90 percent rural
- 5 percent suburban
- 5 percent urban

Truck Speed:

Rural	55 mph
Suburban	25 mph
Urban	15 mph

Stop Time:
- 0.011 hr/km

Urban Conditions:

Fraction during rush hours	8 percent
Fraction on city streets	6 percent
Fraction on urban highway	85 percent

Public Traffic One-Way Sharing of Route:

Rural	470 vehicles/hr
Suburban	780 vehicles/hr
Urban	2800 vehicles/hr

Population Densities:

Rural	6 persons/km^2
Suburban	719 persons/km^2
Urban	3861 persons/km^2

Large package size flags for heavy equipment handling and for driver loading and unloading.

Information that is derived includes:

Travel time	40.5 hr
Stop time	36.3 hr

The RADTRAN urban population density was used. However, an analysis of the expected route, with populations and city sizes, showed that those city population densities were better approximated by the default suburban population density.

I.2.4 Incident Free Dose and Risk Summary

Truck Drivers

The results yielded a calculated 2.2E-01 mrem per trip per driver including travel and handling. If two drivers were dedicated to the 648 trips, there would be 1.4E-01 rem/driver or 2.5E-01 person-rem for the entire project. This collective dose equivalent corresponds to a collective risk of 1.2E-04. As in other analyses within this Plan, risk is based on cancer incidence.

It is planned that six two-man driving crews would share driving duties. This corresponds to an individual dose equivalent of 2.4E-02 rem with a corresponding individual risk of 9.6E-06.

En-Route Public

The maximum individual member of the public resides adjacent to the route and receives an effective dose equivalent of 1.7E-06 rem with an associated risk of 1.0E-09.

The collective effective dose equivalents are:

Public drivers sharing the route:	1.05E-01 person-rem
Residents and others along the route:	2.40E-01 person-rem
Truck stops public:	1.60E-01 person-rem
Collective Total:	5.05E-01 person-rem
Collective Risk:	3.0E-04

I.3 Transportation Accident

I.3.1 Conceptual Model

The RADTRAN 4 computer code was also used to perform the transportation accident assessment for moving debris and wastes from the FEMP to NTS. Generally, the RADTRAN 4 model computes the probabilities of each of eight accident categories given the total distance traveled in urban, suburban, and rural settings. These categories are termed "severity categories" to represent the increasing severity of the accident. Figure I-1 presents the classification of each category with respect to accident crush force and fire duration. The dose equivalents of various accidents are computed by RADTRAN 4 based on a large number of factors. These include, but are not limited to:

- The amount, isotopes, and characteristics of radioactive materials involved;
- the rural, suburban, and urban population densities;
- the fraction of time for each Pasquill stability category at the accident site;
- the amount of radioactive material released for each accident severity category;
- the fraction of released radioactivity which becomes airborne and that which is respirable.

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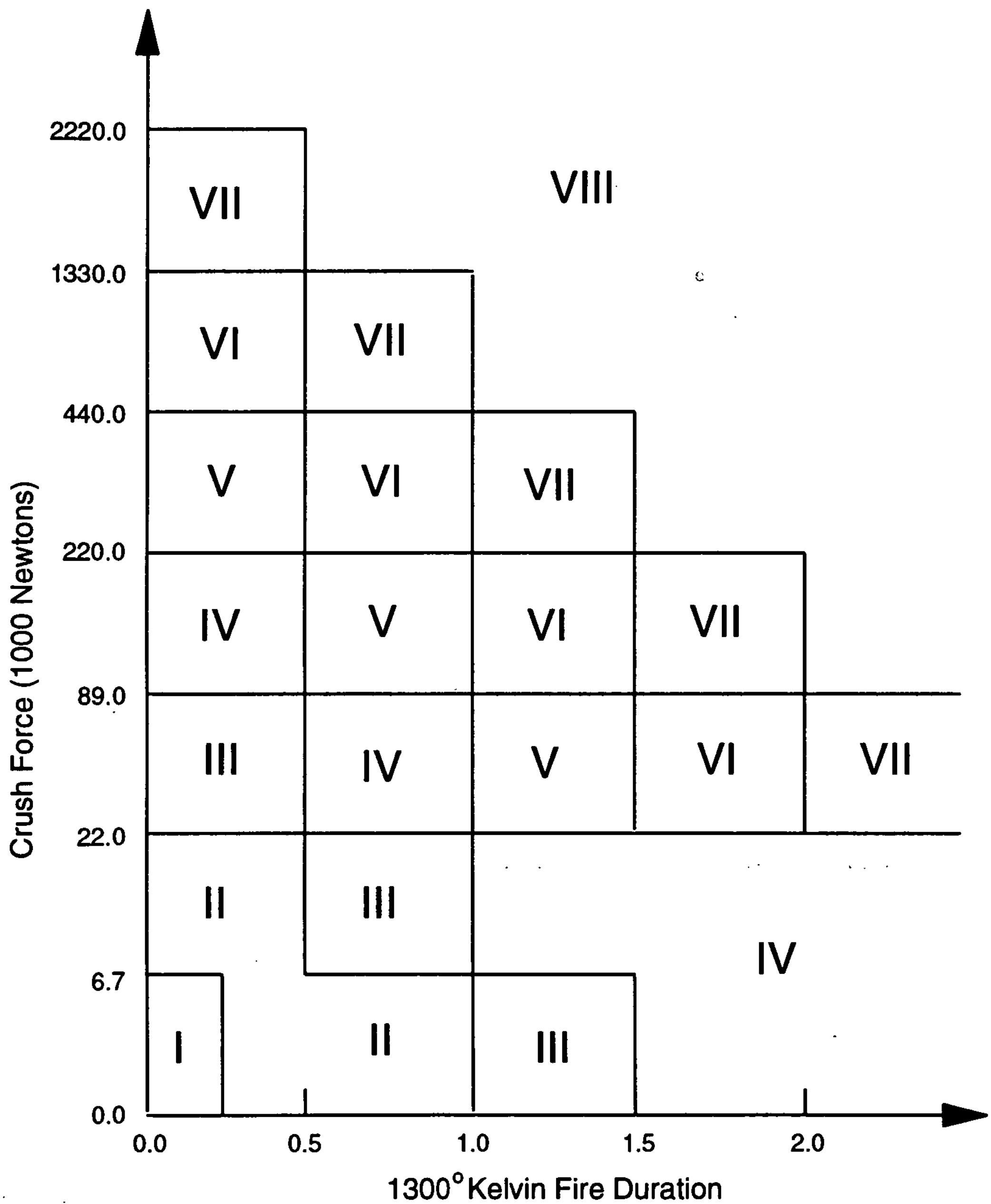

Figure I-1 Accident Severity Category Classification (SNL 1986)

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For this accident assessment the ingestion pathway was excluded. This is because the ingestion pathway analysis done by RADTRAN 4 is not highly sophisticated. Inclusion of the ingestion pathway amounts to assuming that fallout contaminated crops are harvested and consumed by people and livestock for 50 years. It is more reasonable to assume that contaminated crops are withheld from the food supply.

I.3.2 Shipment Configuration for the Accident Scenario

I.3.2.1 Waste Containers and Waste Forms

Three types of containers used for waste shipments are 55 Gallon drums, B-25 boxes, and SeaLand containers. The waste forms and related factors are assessed below to justify the selected configuration for the accident scenario.

<u>55 Gallon Drums</u>

Physical Characteristics:

> Standard DOT Specification 17H 55 gallon drums contain a nominal seven cubic feet of waste.

Waste Forms:

> The drums will contain residues including dusts, powders, granules, grindings, and similar media from the decontamination processes. In addition, wastes from the operations will include contaminated personal protective equipment, spent consumables, and small equipment items. Compacting and other waste minimization procedures, have resulted in most drums approaching 1,000 lb. each (REECO 1993). The estimated total quantity to be shipped is 5,000 drums (Appendix G, Table G-2). The quantity per shipment is 38 drums (REECO 1993).

B-25 Boxes

Physical Characteristics:

The B-25 boxes are 4 ft. by 6 ft. by 4 ft. high. Each is expected to contain 80 cubic feet of wastes.

Waste Forms:

1. Miscellaneous Metals: Lighter gauge metals, conduit, piping, wiring, ductwork, and smaller process and construction metallic objects. The estimated total quantity to be shipped is 665 boxes (Appendix G, Table G-2).

2. Other Materials: Construction and process materials and scrap including glass, plaster, wood, insulation, roofing, and various plastic-based materials. The estimated total quantity to be shipped is 1884 boxes (Appendix G, Table G-2). The quantity per shipment is 6 boxes (REECO 1993).

SeaLand Containers

Physical Characteristics:

The SeaLand containers are 8 ft. by 30 ft. by 8 ft. high. They are expected to contain 1600 cubic feet of wastes.

Waste Forms:

1. Structural Steel: Medium to heavy grade steel from structural applications such as girders and beams. The estimated quantity to be shipped is 11 containers (Appendix G, Table G-2).

2. Transite: Transite panels from interior and exterior building walls. The estimated quantity to be shipped is 7 containers (Appendix G, Table G-2). The quantity per shipment is 2 containers (REECO 1993).

I.3.2.2 Selection for the Accident Scenario

The waste forms to be shipped in B-25 boxes and SeaLand containers will typically have only surface contamination with relatively low radionuclide concentrations per weight of wastes.

Loose surface contaminants will have been removed from a large fraction of those materials. A minimum fraction of the activity would be dispersed during an accident. While the 55 gallon drums meet required Department of Transportation Specifications, the B-25 boxes and SeaLand containers are more ruggedly constructed and less likely to lose containment integrity as the result of the forces and fire that might attend a severe accident.

A portion of the wastes will have the highest radionuclide concentrations and contain wastes that would be more readily dispersed as the result of a severe accident. These wastes will be transported in 55 gallon drums. Therefore, the shipment configuration used to assess the accident scenario is for a load consisting of 38 each 55 gallon drums. It is assumed that 19 drums contain highest concentration residues and that the other 19 drums contain lower concentration waste forms. Each drum is estimated to have 1,000 lb of waste.

An estimate of the highest concentration waste forms is obtained by using the average concentrations of the various radionuclides present in the dust collectors from Plants 1, 4, 8, 9, and the Pilot Plant. The other 19 drums, of lower activity, are estimated to be five percent of the high concentration residues. Table I-1 summarizes the waste concentrations for each drum and for the total shipment for use with the transportation accident scenario.

I.3.3 Accident Parameters

The most significant parameters used in the accident assessment are summarized in Tables I-1, I-2, and I-3. Many parameters such as distance traveled, number of trips, and population densities are identical to those used in Section I.3. Ingestion, inhalation, and immersion dose conversion factors used in the model were taken from data files contained in the CAP88-PC computer code (EPA 1992). Average gamma energy per transformation data used by RADTRAN 4 were derived from radioactive decay tables (DOE 1981).

TABLE I-2 Accident Scenario Parameters

Parameter	Value
Number of "High Activity" drums per trip	19
Number of "Low Activity" drums per trip	19
Pasquill Stability Class	F
Accident Rate	
Rural	1.4E-07 km^{-1}
Suburban	2.7E-06 km^{-1}
Urban	1.6E-05 km^{-1}
Release fractions by severity category	
1	0.00
2	0.01
3	0.02
4	0.04
5	0.08
6	0.16
7	0.32
8	0.64

TABLE I-3 Transportation Accident Severity Fractions

Severity Group	Rural	Suburban	Urban
1	4.6E-01	4.4E-01	5.8E-01
2	3.0E-01	2.9E-01	3.8E-01
3	1.8E-01	2.2E-01	2.8E-02
4	4.0E-02	5.1E-02	6.4E-03
5	1.2E-02	6.6E-03	7.4E-04
6	6.5E-03	1.7E-03	1.5E-04
7	5.7E-04	6.7E-05	1.1E-05
8	1.1E-04	5.9E-06	9.9E-07

I.3.4 Dose and Risk Summary

Table I-4 summarizes the expected probability of accidents of each severity category. No immediate fatalities are estimated from any of the severity categories. Table I-5 summarizes the population dose in person-rem for each severity category.

Depending on severity and location of a transportation accident, population dose estimates range from 0 to 834 person-rem. For the severity categories considered, the expected number of accidents vary from 0.1 for the least severe accident category to 3.0E-05 for the most severe accident category.

TABLE I-4 Expected Probability of Transportation Accidents

Severity Group	Rural	Suburban	Urban
1	1.3E-01	1.3E-01	9.9E-01
2	8.2E-02	8.2E-02	6.5E-01
3	4.8E-02	6.3E-02	4.8E-02
4	1.1E-02	1.5E-02	1.1E-02
5	3.2E-03	1.9E-03	1.3E-03
6	1.8E-03	5.0E-04	2.5E-04
7	1.5E-04	1.9E-05	1.9E-05
8	3.1E-05	1.7E-06	1.7E-06

TABLE I-5 Population Dose Resulting from Transportation Accidents (Person-rem)

Severity Group	Rural	Suburban	Urban
1	0.0	0.0	0.0
2	3.4E-02	4.0E+00	1.3E+01
3	6.7E-02	8.0E+00	2.6E+01
4	1.3E-01	1.6E+01	5.2E+01
5	2.7E-01	3.2E+01	1.0E+02
6	5.4E-01	6.4E+01	2.1E+02
7	1.1E+00	1.3E+02	4.2E+02
8	2.1E+00	2.6E+02	8.3E+02

A combination and sum of the expected accident incidence (Table I-4) with the population dose (Table I-5) yields a collective 11.7 person-rem.

I.4 References

Maupin, 1993, *Personal Communication with Dennis Maupin*, General Manager, Albuquerque Auto Truck Plaza, Albuquerque, New Mexico.

REECO, 1993, *Personal Communication with REECO Area 5 Waste Management*, Nevada Test Site, Nevada.

Sandia National Laboratories (SNL), 1986, *RADTRAN 3, SAND 84-0036*, Madsen, MM, Taylor, JM, Ostmeyer, RM, and Reardon, PC, Albuquerque, New Mexico.

Sandia National laboratories (SNL), 1992, *RADTRAN 4, Volume 3, User Guide, SAND 89-2370*, Neuhauser, KS, Albuquerque, New Mexico.

United States Department of Energy, 1981, *Radioactive Decay Data Tables, DOE-TIC-11026*, Technology Information Center.

United States Environmental Protection Agency, 1992, *User's Guide for CAP88-PC, Version 1.0*, Office of Radiation Programs.

APPENDIX J

RISK SUMMARY FOR ALTERNATIVES 2 AND 3

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APPENDIX J -- RISK SUMMARY FOR ALTERNATIVES 2 AND 3

J.1 Introduction

This appendix presents the summary of risk associated with Alternative 2, Surface Decontamination Only, and Alternative 3, Decontamination and Dismantlement. The risk evaluations summarized in this appendix are extracted from Appendices D, E, F, and I. The cumulative impact assessment presented in Section J.4 is associated with the preferred alternative, Alternative 3, and the Safe Shutdown Removal Action.

J.2 Human Health Impacts from Alternative 2

Alternative 2 would be effective in reducing removable contamination and related worker exposures. During decontamination, commonly practiced engineering controls would be used to minimize worker exposures and prevent contaminant releases. Site monitoring programs would detect increases in on-site airborne activity which could lead to potential airborne exposures to off-site residents. Appropriate measures would be promptly implemented to reduce releases. This alternative would be effective in protecting human health during its implementation. This alternative would not reduce the time needed to achieve remedial objectives for OU3.

Estimates of potential radiation exposure and associated risks were made for in-plant workers, for other on-site workers, and for off-site residents. The in-plant workers are those workers performing decontamination within the OU3 components. The other on-site worker represents the average worker who would have no association with the proposed action. The analysis is for the maximally exposed individual within each of the three receptor groups. The risk estimates provided are the probability that a cancer will be induced as a result of the estimated doses received.

For calculation of exposures/risks, four major process buildings were assumed to be decontaminated simultaneously. This situation represents a reasonable maximum decontamination effort and represents the conservative maximum exposure for any given year of the project. The project is estimated to last four years. The basis and results for this analysis are provided in Appendix D. Dose and risk are calculated for direct exposure to contaminated materials, inhalation of airborne concentrations released during decontamination, and immersion in the contaminated "airborne cloud." Table J-1 summarizes dose and risk for the maximally exposed individual on an annual basis and for the estimated four years of the project.

TABLE J-1 Summary of Individual Doses and Risks from Alternative 2

	Annual		Project (4 Years)	
Receptor	EDE* (rem/yr)	Risk/yr	EDE (rem)	Risk
In-Plant Worker	2.1E-01	1.0E-04	8.5E-01	4.0E-04
Other On-Site Worker	7.6E-06	3.6-09	3.0E-05	1.5E-08
Off-Site Resident	1.8E-05	1.1E-08	7.2E-05	4.3E-08

* Effective Dose Equivalent (EDE) includes radiation doses due to penetrating radiation from sources external to the body as well as doses resulting from internal deposition of radionuclides.

The dose presented above for an in-plant worker represents the maximum that would be received by a worker for the four year project (1996-2000) while performing decontamination activities within a component. For Alternative 2, the resulting maximum EDE rate for the in-plant worker is about 2.1E-01 rem per year, with a project total of 8.5E-01 rem. The total associated risk for the four year project is about 4.0E-04, based on a dose-to-risk conversion factor of 4.8E-04 latent cancers per rem.

The risk to the other on-site worker who is not directly involved in decontamination operations is assessed through the effect of airborne releases from the plants undergoing decontamination. The conservative maximum annual EDE for this worker would be about 7.6E-06 rem per year and 3.2E-05 rem for the project total. This value represents a conservative maximum exposure to an other on-site worker because it assumes a worker continuously present at the point of maximum exposure. CAP88-PC (EPA 1992) was used to calculate the EDE to the hypothetical nearest downwind other on-site worker and the EDE was converted to risk. The total risk associated with implementing Alternative 2 would be about 1.5E-08 to the individual other on-site worker.

The maximum annual EDE from the project to an off-site resident would be about 1.8E-05 rem per year. For the expected four year duration for Alternative 2, this corresponds to a project total EDE of 7.2E-05 rem. These values are greater than the estimated dose and risk to the on-site worker because a resident is assumed to be continually exposed (168 hours/week) at the point of maximum concentration versus 40 hours per week for the other on-site workers.

The estimated risk (4.3E-08) to the maximally exposed off-site resident compares favorably to the EPA suggested risk range of 1.0E-04 to 1.0E-06 (one in ten thousand to one in one million). In comparison, the average natural background annual EDE to individuals in the United States is 300 mrem per year (NCRP 1987). An individual exposure to natural radiation would total 1.2 rem EDE for the same four year period, with a risk of 7.2E-04. The exposure associated with the natural radiation background, unrelated to this action, presents a risk nearly 17,000 times greater than that associated with the decontamination action.

Exposures associated with this proposed action do not exceed DOE limits for occupational workers and result in a risk to the public lower than EPA risk guidance of 1.0E-06. Because the exposures are acceptable, this action is effective in protecting human health in the short-term.

A potential also exists for receptors to be exposed to chemical contaminants during the implementation of Alternative 2. For all receptors, the major pathway for exposure to such contaminants is expected to be inhalation. On the basis of the types of materials utilized at the FEMP during its operation, it is expected that radiological contaminants are more significant sources of carcinogenic risk than chemical contaminants. The chemical contaminants for which risks are likely to be highest are metals and other inorganics, which are expected to have the widest distribution in OU3 structures.

For an individual in-plant worker, the annual radiological risk associated with the implementation of Alternative 2 would be less than about 10^{-4}, as noted in Table J-1. The majority of that risk would be the result of external radiation exposure; inhalation of radiological contaminants would contribute only about 10-20% of the total radiological risk (see Appendix D). Because of worker protection that would be utilized during implementation of the alternative, any exposures to chemical contaminants would be primarily due to

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inhalation. Because it is expected that carcinogenic risks associated with inhalation of chemical contaminants would be less than those due to inhalation of radiological contaminants, and because the radiological risk to in-plant workers would be dominated by risk due to external radiation exposure, it is anticipated that the total carcinogenic risks due to exposure to chemical contaminants would be considerably less than the total risk due to exposure to radiological contaminants. If the carcinogenic risks due to chemical contaminants were as high as the risks due to inhalation of radiological contaminants, then the total annual risk to an in-plant worker due to exposure to chemicals contaminants would also be about 10^{-4}. The total chemical carcinogenic risk to an in-plant worker associated with implementation of Alternative 2 would be four times larger because the alternative would require four years to complete.

For other on-site workers and off-site residents, radiological risks associated with Alternative 2 would be largely due to inhalation, although some contribution would be provided by other pathways. Total annual radiological risks to individual receptors would be approximately 10^{-8}, as noted in Table J-1. Total annual maximum individual radiological risk would be 3.6E-09 to the on-site worker and 1.1E-08 to the off-site resident. Again, it would be expected that carcinogenic risks associated with inhalation of chemical contaminants (the anticipated dominant exposure route) would be less than those associated with inhalation of radiological contaminants. However, if the total carcinogenic risks to receptors due to chemical contaminants were as large as the total risks due to exposure to radiological contaminants, then the annual carcinogenic risk to individual receptors from exposure to chemical contaminants would still be less than 10^{-7}. The total chemical carcinogenic risk to an other on-site worker or an off-site resident associated with implementation of Alternative 2 would be four times as large (but well below 10^{-7}), because the alternative would require four years to complete.

The estimated number of injuries and fatalities for remediation workers implementing Alternative 2 were obtained using average incident rates for injuries and fatalities for construction workers. This estimate is based on data from the U.S. Department of Labor (DOL 1988 and DOL 1990) for the period 1985 through 1988. The average incident rates are 7.35E-05 injuries per person-hour and 1.26E-07 fatalities per person-hour.

Based on an estimate of the effort required to decontaminate the structures (108 remediation workers working 216,750 PH/year for 4 years), the number of injuries and fatalities were estimated for Alternative 2 as shown in Table J-2.

TABLE J-2 Estimated Injuries and Fatalities Associated with Alternative 2

Activity	No. of Workers	Duration (Years)	Total Person-Hours	Total Injuries	Total Fatalities
Decontamination	108	4	864,000	64	0.11

J.3 Human Health Impacts from Alternative 3

Alternative 3 would be efficient in reducing the sources of contamination; however, the combined decontamination and dismantlement actions would increase short-term risks to human health and the environment. Engineering controls would be used during the action to minimize worker exposures and prevent off-site releases of contamination. Site monitoring would detect increases in potential airborne exposures to the public so that activities could be stopped or other measures taken to reduce releases. These measures would minimize the increase in short-term risks.

Placing materials into interim storage facilities at the CSF would reduce risks to human health and the environment by confining them in a more manageable configuration. This would further reduce the risk of contaminant releases until the final ROD is implemented.

Environmental effects would be minimized through engineering controls to prevent airborne releases or spills. Runoff and run-on engineering controls would control storm water and prevent additional contamination of perched water and groundwater. Foundations, slabs, and pads would be decontaminated, repaired, and/or sealed to minimize any movement of contaminants by storm water to the vadose zone and the glacial till. Removal would be coordinated with OU5 soil and perched groundwater remediation. This alternative is protective of human health and the environment. The implementation of this action could result in the acceleration of the time required to achieve remedial objectives.

Health risks for this alternative are analyzed in four assessments: decontamination and dismantlement; off-site transportation of non-recoverable and non-recyclable materials; storage; and construction injuries and fatalities.

Estimates of radiological risks associated with implementation of Alternative 3 were made for in-plant workers, for other on-site workers, and for off-site residents. The in-plant workers are those performing decontamination within the OU3 components. The other on-site worker represents the average worker who has no association with the proposed action. The analysis includes both the maximally exposed individual within each of those three groups, and the effect based upon the total populations exposed. For transportation, risks to truck drivers and the en-route public are assessed.

As discussed for Alternative 2, carcinogenic risks associated with exposures to chemical contaminants are expected to be less than those associated with exposures to radiological contaminants. Because the annual radiological risks to an in-plant worker, to an other on-site worker, and to an off-site resident are approximately the same for both Alternatives 2 and 3, the discussion of annual risks provided for Alternative 2 applies to Alternative 3 also. In the case of incident-free off-site transportation, there would be no exposures to chemical contaminants.

Decontamination and Dismantlement

For calculation of exposures/risks, four major process buildings were assumed to be decontaminated and dismantled simultaneously. This represents a reasonable maximum remediation effort with a conservative maximum exposure for any given year of the project. The project is estimated to last 16 years. The basis and results for this analysis are provided in Appendix D. The approach used is the same as that discussed for Alternative 2. Decontamination and dismantlement workers and on-site waste transport drivers are assessed as in-plant workers for implementation of this alternative.

The EDE and risk are calculated for direct exposure to, and airborne concentrations of, contaminated materials released during remediation. Dose is calculated for both inhalation and immersion in the "airborne cloud" and also for accumulation on the floor (external). Table J-3 summarizes the estimated doses and risks to the maximally exposed individual on an annual basis and for the project duration (16 years).

TABLE J-3 Summary of Individual Doses and Risks from Alternative 3

Receptors	Annual		Project (16 Years)	
	EDE (rem/yr)	Risk/yr	EDE (rem)	Risk
In-Plant Worker	2.1E-01	1.0E-04	3.4E+00	1.6E-03
Other On-Site Worker	7.6E-06	3.6E-09	1.2E-04	5.8E-08
Off-Site Resident	1.8E-05	1.1E-08	2.9E-04	1.7E-07

The estimated dose and risk presented above for the in-plant workers represents the maximum dose that would be received by a worker while performing decontamination and dismantlement activities within a component. For decontamination and dismantlement, the maximum individual EDE rate for the in-plant worker would be about 2.1E-01 rem per year. This value is well below allowable occupational exposures (5 rem per year) mandated under DOE Order 5480.11 and 29 CFR 1910. Site health and safety procedures, administrative controls, and engineering controls would maintain exposures As Low As Reasonably Achievable (ALARA). With remediation beginning in 1996 and ending in 2012, the total individual in-plant worker EDE would be about 3.4E+00 rem, while the associated risk would be about 1.6E-03.

The risk to the other on-site worker who is not directly involved in the operations is assessed through the effect of airborne releases from the plants undergoing decontamination and dismantlement. The conservative maximum individual annual EDE to the other on-site worker is estimated to be about 7.6E-06 rem per year with a project total of 1.2E-04 rem. It is unlikely that a person would be permanently located at the point of maximum exposure. The risk to such an individual would be 5.8E-08.

The maximum annual EDE to the off-site individual from the decontamination and dismantlement action is estimated to be about 1.8E-05 rem per year. For the expected 16

4900

year duration for Alternative 3, the total dose would be about 2.9E-04 rem. These values are greater than the estimated dose and risk to the on-site worker because a resident is assumed to be at the point of continuous exposure (168 hours/week) maximum concentration versus 40 hours per week for the other on-site worker. In addition, the off-site resident is assumed to consume locally produced milk, meat, and vegetables. The total risk to the off-site resident would be 1.7E-07.

The total individual risk for the project to the maximally exposed off-site resident compares favorably to the EPA suggested risk range of 1.0E-04 to 1.0E-06 (one in ten thousand to one in one million). In comparison, the average annual EDE to individuals in the United States is 300 mrem per year (NCRP 1987). Exposure from natural radiation sources to an individual would total approximately 4.8 rem EDE for the same 16 year period, with an associated risk of 2.9E-03. The risk associated with the natural radiation background, unrelated to this action, roughly 17,000 times greater than that associated with the 16 year decontamination and dismantlement action.

The total carcinogenic risks associated with the implementation of Alternative 3 for 16 years would be approximately 3.0E-03 for an in-plant worker and about 3.5E-07 for an off-site resident.

Off-Site Transportation

The limited quantity of materials anticipated to be shipped off-site for disposition constitutes less than 10 percent of the total volume of material estimated in OU3 (DOE 1993b) after bulking factors are applied (see Appendix G for media bulking factors). This quantity represents the estimated maximum amount to be transported off-site to the Nevada Test Site (NTS) before the final ROD. Without the availability of limited off-site disposition, implementation of the interim action would be constrained by storage space limitations until the final ROD determined the final disposition options. It is anticipated that structural steel would be transported off-site for recycling.

B-25 boxes or SeaLand containers would be used for shipments. A B-25 box has a 24 ft^2 footprint and approximately 80 ft^3 of interior storage space. The SeaLand container has a 240 ft^2 footprint with approximately 1,600 ft^3 of interior storage space. Table G-2 of Appendix G estimates the quantity of materials to be dispositioned during the interim action. A total of approximately 486,000 cubic feet of material are estimated to be transported off-site. This volume results in approximately 160 SeaLand containers and 3,400 B-25 boxes.

Depending on the weight of each container, a truck can transport seven to nine B-25 boxes or one to two SeaLand containers. Using a conservative estimate that assumes the lowest number of containers per shipment, the number of shipments is 648. Over an anticipated three year period, an average of 216 shipments would occur yearly.

Appendix I provides a summary of the waste shipment assessment for exposures to truck drivers and en-route public. The Sandia National Laboratories RADTRAN code (SNL 1986 and 1992) was used for the dose and risk estimates. It was assumed that six pairs of truck drivers would share the 648 trips. Dose equivalents to the crew include the dose received while loading and unloading as well as those received while driving. The individual dose equivalent for the truck drivers is estimated to be about 4.8E-02 rem.

Dose and risk is assessed for the en-route public. The individual maximum exposure to a member of the en-route public is estimated to be 1.7E-06 rem.

Non-recoverable and non-recyclable materials would be placed in an appropriate disposal facility at NTS; NTS would be responsible for the monitoring and maintenance activities at their facility. NTS is located in an arid environment with much lower precipitation than at the FEMP site, so the potential for migration of contaminants to surface water or groundwater would be minimal. Disposal of materials at NTS is expected to be health protective.

Storage

The CSF would be used to store wastes prior to final disposition. The estimated volume of materials to be stored is approximately 16,500 cubic yards (Appendix G). An assessment of risks to the CSF workers is contained in Appendix E. A summary of doses and risks from the storage of materials is presented in Table J-4. These values assume a total of 6 storage facilities with 16 associated workers.

On the basis of the same assumptions used to estimate chemical risk for Alternative 2, the total chemical carcinogenic risks associated with interim storage for 16 years would be at most approximately 10^{-4} for an in-plant worker and about 10^{-7} or less for the other individual receptors.

TABLE J-4 Individual Dose and Risk from Storage

	Annual		Project (16 years)	
Receptor Groups	EDE (rem/yr)	Risk/yr	EDE (rem)	Risk
In-Plant Worker	2.2E-01	1.1E-04	3.5E+00	1.7E-03
Other On-Site Worker	1.5E-05	7.2E-09	2.4E-04	1.2E-07
Off-Site Resident	3.9E-05	2.3E-08	6.3E-04	3.8E-07

Alternative 3 Injuries and Fatalities

The probabilities of injuries and fatalities for Alternative 3 were calculated using the approach described in Sec. 4.3.4.1. Table J-5 presents estimates of injuries and fatalities associated with implementation of Alternative 3.

TABLE J-5 Estimated Injuries and Fatalities Associated with Alternative 3

Activity	Average No. of Workers	Duration (Years)	Total Person-Hours	Total Injuries	Total Fatalities
Decontaminate and Dismantle	160	16	5,100,000	375	0.64
Build CSF (6 TSS)	15.23	3	91,000	7	0.01
Operate CSF (6 TSS)	16	16	512,000	38	0.06
TOTAL				420	0.71

Decontamination and Dismantlement Accident

An accident scenario was developed for the decontamination and dismantlement action. For this assessment, a plant representing the largest source of airborne emissions was selected based on estimated airborne concentrations and volume or size of the structure. This scenario assumes that there would be a complete loss of controls for a 24 hour period. Ventilation would continue but all airborne activity would be released. It is estimated (Appendix D) that the maximally exposed on-site worker would be located 300 meters NE of the structure. The results of the 24 hour release are presented in Table J-6.

Table J-6 Decontaminate and Dismantle Accident Scenario

Receptor	Individual EDE (rem)	Individual Risk
Other On-Site Worker	1.6E-06	7.7E-10
Off-Site Resident	2.6E-06	1.6E-09

Transportation Accident

An accident scenario was also developed for the transportation of wastes for disposition to NTS. The accident assumes a potential shipment configuration, representing a conservative combination of high concentration residues in the most vulnerable containers. The analysis is presented in Appendix I.

A number of potential accidents were assessed including numerous levels of accident severity in specific settings (rural, suburban, and urban). The most probable accident would be the least severe accident in the most densely populated area (urban). The resulting dose to the surrounding population would be 1.0E-03 person-rem. Combining the accident probability with the resulting potential exposure from an accident, gives an estimated collective population dose of about 11.7 person-rem.

Summary

Table J-7 summarizes estimated doses and risks for all population groups for Alternative 3. Estimates for individuals given in this table represent total doses and risks to the maximally exposed individual for the 16 year duration of the project. Totals are not summed for workers because the in-plant exposed workers would not be in more than one group; they have only one assigned occupational activity. Therefore, it is not appropriate to sum individual worker EDE and risk. The total for public exposure in Table J-7 provides the total exposure to an individual off-site resident.

Exposures associated with this proposed action do not exceed DOE limits for occupational workers and result in a risk to the public lower than EPA risk guidance of 1.0E-06. Because the exposures are acceptable, this action is effective in protecting human health in the short-term.

TABLE J-7 Summary Results For The Alternative 3 Project (16 years)

Activity and Receptor Group	Individual EDE (rem)	Individual Risk
Decontaminate and Dismantle		
In-Plant Workers	3.4E+00	1.6E-03
Other On-Site Workers	1.2E-04	5.8E-08
Off-Site Residents	2.9E-04	1.7E-07
Transportation		
Truck Drivers	4.8E-02	2.3E-05
En-Route Public	1.7E-06	1.0E-9
Central Storage Facility		
In-Plant Workers	3.5E+00	1.7E-03
Other On-Site Workers	2.4E-04	1.2E-07
Off-Site Residents	6.3E-04	3.8E-07
TOTAL		
Workers	N/A	N/A
Public	9.2E-04	5.5E-07

J.4 Cumulative Impacts Associated with Alternative 3

The potential cumulative impacts associated with implementation of the preferred alternative (Alternative 3) and the Safe Shutdown removal action are discussed in this section. The safe shutdown of the production area components would be concurrent with the implementation of Alternative 3. Section J.4.1 considers cumulative health impacts and Section J.4.2 considers cumulative environmental impacts.

J.4.1 Health Impacts

Evaluation of Alternative 3 required an assessment of the potential radiation doses and risks associated with the alternative. The following summarizes those assessments. Details for the assessment are available in Appendices D, E, and I. Table J-7 provides a summary of doses and risks by receptor group, namely occupational workers, other on-site workers, and off-site residents. An analysis of Safe Shutdown activities is presented in Appendix F of this Proposed Plan, where doses and risks are provided by receptor group.

Table J-8 summarizes radiological doses and associated risks of fatal cancer induction from exposure to radioactive contaminants by receptor group. Individual doses and risks are for the maximally exposed individual. Cumulative doses and risks associated with Alternative 3 and Safe Shutdown are indicated as subtotals and totals.

Totals are not given for individuals for the occupational exposure groups in Table J-8 because the occupationally exposed workers would not be in more than one group; they have only one assigned occupational activity. Therefore, it is not appropriate to sum individual EDE and risk. Individual cumulative risk for an occupational worker would be the same as the risk for an individual in-plant worker participating in implementation of Alternative 3, namely 1.6E-03. Total collective risk to all occupational workers (313) due to the two connected actions would be 3.5E-01.

TABLE J-8 Radiological Doses and Risks by Receptor Group

Receptor Group	Individual EDE (rem)	Individual Risk	Collective Risk
Workers			
Alternative 3: In-Plant Worker	3.4E+00	1.6E-03	2.6E-01
Truck Drivers	4.8E-02	2.3E-05	2.8E-04
CSF In-Plant Worker	3.5E+00	1.7E-03	2.7E-02
Safe Shutdown In-Plant Worker	9.5E-01	4.6E-04	5.8E-02
Subtotal (Occupational)	N/A	N/A	3.5E-01
Alternative 3: On-Site Worker	1.2E-04	5.8E-08	2.7E-05
CSF On-Site Worker	2.4E-04	1.2E-07	2.0E-05
Safe Shutdown On-Site Worker	3.5E-05	1.7E-08	2.7E-05
Subtotal (Other On-Site)	4.0E-04	2.0E-07	7.4E-05
TOTAL FOR WORKERS	N/A	N/A	3.5E-01
Public Exposures (Off-Site)			
Alternative 3: Decontaminate and Dismantle	2.9E-04	1.7E-07	3.0E-04
Off-Site Transportation	1.7E-06	1.0E-9	3.0E-04
CSF	6.3E-04	3.8E-07	1.8E-04
Safe Shutdown	1.1E-04	6.6E-08	1.1E-04
TOTAL FOR PUBLIC	1.0E-03	6.2E-07	8.9E-04

Exposures resulting in the risks presented above are estimated to be well below the DOE administrative control level of 2,000 millirems per year and the limit for occupational workers of 5,000 millirems per year specified in DOE Order 5480.11. Therefore, the risks to the occupational worker from the proposed action are acceptable.

For the individual other on-site worker, cumulative results are presented in Table J-8. However, these results are overly conservative because the individual maximally exposed worker cannot be directly downwind from all activities (Alternative 3, Safe Shutdown, and CSF) at the location of maximum exposure. Collective risk for other on-site workers is based on expected worker locations within the FEMP. The individual risk is estimated to be 2.0E-07 and collective risk is estimated to be 7.4E-05 for the other on-site workers. The collective risk is estimated from exposures to 1,600 workers located throughout the FEMP. As with the in-plant workers, the dose to the other on-site workers are estimated to be well below the DOE administrative limit of 1,000 millirems per year and the limit for occupational workers of 5,000 millirems per year specified in DOE Order 5480.11. Therefore, the risks to the other on-site worker from the proposed action are acceptable.

The totals for public exposures in Table J-8 provide the cumulative results for the connected actions for both individual and collective effects. The individual risk to the off-site resident is 6.2E-07 and the collective risk is 8.9E-04. The collective risk is estimated from exposures to approximately 23,000 residents within a five mile radius around the FEMP. The risks presented above for the individual member of general public compare favorably to the EPA suggested risk range of 1.0E-04 to 1.0E-06 (one in ten thousand to one in one million). Because the estimated risk to the maximally exposed off-site resident is less than the EPA risk range, the risks from the proposed action are acceptable.

As discussed in Section J.3, it is expected that radiological contaminants are more significant sources of carcinogenic risks than chemical contaminants for remedial activities in OU3. For the in-plant workers for Alternative 3 or Safe Shutdown, radiological risks would be primarily due to external radiation exposure, while chemical risks would result primarily from inhalation. For truck drivers no exposure to chemical contaminants are expected in the absence of accidents. Therefore, for in-plant workers, cumulative individual and collective carcinogenic risks due to chemical contaminants are expected to be well below cumulative radiological risks. For other on-site workers and for the general public, both radiological and chemical risks are expected to be largely due to inhalation. Because radiological risks are expected to be larger than chemical carcinogenic risks, cumulative radiological impacts provide an upper bound on cumulative carcinogenic effects due to exposure to chemical contaminants for these receptors.

J.4.2 Environmental Impacts

Activities related to Safe Shutdown would take place within structures and would not involve disruption of areas outside the structures. Cumulative environmental impacts associated with Alternative 3 and Safe Shutdown would generally be the same as those impacts related to Alternative 3.

All areas that would be affected by the implementation of Alternative 3 have been disturbed by previous construction and operation at the site. No unique wildlife habitat or species occur within areas of the proposed activity. In the long term, the impact of the proposed action would be positive because removal of contaminated structures and other sources of contamination would reduce the potential for future environmental exposures, and associated restoration activities would facilitate future beneficial use of the site. Decontamination and dismantlement of building structures would also reduce the potential for impacts to surface water, groundwater, and air quality because contaminant sources would be removed to better storage configurations.

The construction of the CSF would disturb approximately 12 acres of ungrazed, managed field, which currently provides minor habitat or food source for terrestrial wildlife. Implementation of Alternative 3 would result in the disruption of about 1.2 acres of wetlands (Appendix H).

Concurrent Safe Shutdown, decontamination and dismantlement, and storage facility activities are not expected to result in any adverse cumulative impacts on the site's workforce, which is anticipated to remain relatively constant.

Disposition activities at NTS are expected to have no impacts on soils, air quality, water quality and hydrology, habitat or threatened and endangered species, wetlands, floodplains, local population, land use patterns, or cultural resources.

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