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DOE/OR/02-1630&D1

Record of Decision for the Surface Impoundments Operable Unit, Oak Ridge National Laboratory, Oak Ridge, Tennessee

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Record of Decision for the Surface Impoundments Operable Unit, Oak Ridge National Laboratory, Oak Ridge, Tennessee

Date Issued—July 1997

Prepared by
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Oak Ridge, Tennessee
under contract DE-AC05-93OR22028

Prepared for
U.S. Department of Energy
Office of Environmental Management

PREFACE

This *Record of Decision for the Surface Impoundments Operable Unit, Oak Ridge National Laboratory, Oak Ridge, Tennessee* (DOE/OR/02-1630&D1) was prepared in accordance with requirements under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 to present the selected remedy for the Surface Impoundments Operable Unit (SIOU) to the public. This work was performed under Work Breakdown Structure 1.4.12.6.1.01 (Activity Data Sheet 3301, "ORNL WAG 1"). This document provides information about the selected remedy, which includes removal of surface water and sediments within the SIOU; construction of treatment facilities; treatment of the sediments, as required to meet disposal facility waste acceptance criteria; containerization of treated waste; and transport of all treated waste to Envirocare of Utah, the Nevada Test Site, or other appropriate facilities. This document also relies on information from the remedial investigation/feasibility study (DOE/OR/02-1346&D2), the proposed plan (DOE/OR/01-1427&D3/R1), and an engineering support study (X-OE-791).

ACRONYMS AND ABBREVIATIONS

Am	americium
ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	*Code of Federal Regulations*
Ci	curie
Co	cobalt
Cs	cesium
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EIS	environmental impact statement
Envirocare	Envirocare of Utah, Inc.
EPA	U.S. Environmental Protection Agency
FFA	Federal Facility Agreement
FS	feasibility study
ft	foot
ha	hectare
km	kilometer
LDR	land disposal restriction
m	meter
mrem	millirem
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act of 1969
NPDES	National Pollutant Discharge Elimination System
NTS	Nevada Test Site
O&M	operation and maintenance
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
OU	operable unit
PCB	polychlorinated biphenyl
ppm	parts per million
PWTP	Process Waste Treatment Plant
Pu	plutonium
RCRA	Resource Conservation and Recovery Act of 1976
rem	roentgen equivalent man
RI	remedial investigation
ROD	record of decision
SIOU	Surface Impoundments Operable Unit
Sr	strontium
TDEC	Tennessee Department of Environment and Conservation
TSCA	Toxic Substances Control Act of 1976
USC	*United States Code*
WAC	waste acceptance criteria
yd	yard

PART 1. DECLARATION

SITE NAME AND LOCATION

U.S. Department of Energy
Oak Ridge Reservation
Surface Impoundments Operable Unit
Oak Ridge National Laboratory
Oak Ridge, Tennessee

STATEMENT OF BASIS AND PURPOSE

This record of decision (ROD) presents the selected remedial action for the Surface Impoundments Operable Unit (SIOU) on the U.S. Department of Energy (DOE) Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee. The action was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, 42 *United States Code* (USC) 9601 et seq. and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

This decision is based on the administrative record for SIOU, including the remedial investigation (RI)/feasibility study (FS) (DOE 1995), proposed plan (DOE 1997a), the engineering support study (Energy Systems 1996), and other documents for this site.

DOE is the lead agency for this action. The U.S. Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC) are supportive agencies as parties of the Federal Facility Agreement (FFA) for this response action. EPA and TDEC concur with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from SIOU, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

This response action fits into the overall ORR cleanup strategy by addressing treatment and removal of contaminated sediment, water, and incidental soils at SIOU. The selected remedy addresses the principal threats to industrial workers and mitigates the release of contamination to groundwater by (1) removal of the sediments from SIOU and (2) transport off site of all treated waste to an approved disposal facility [e.g., Nevada Test Site (NTS) and Envirocare of Utah, Inc. (Envirocare)]. The selected remedy, which is Alternative 6 in the FS and the proposed plan and is described in Part 2 of this ROD, includes (1) removal of surface waters, sediments, and approximately 0.03 m (0.1 ft) of subimpoundment soil within SIOU; (2) discharge of surface water to the existing Process Waste Treatment Plant (PWTP); (3) treatment of sediments to meet applicable or relevant and appropriate requirements (ARARs) and disposal facility waste acceptance criteria (WAC); (4) containerization of the treated wastes; and (5) transport of treated waste to appropriate waste disposal facilities and disposal therein. The remedy calls for wastes other than those characterized as polychlorinated biphenyl (PCB) waste to be disposed of at NTS which is consistent with SIOU wastes and is most cost effective. Should an on-ORR disposal facility be approved and constructed, waste materials may be diverted instead to the on-ORR facility.

The remedy calls for wastes characterized as PCB waste to be treated to a level equivalent to destruction by incineration (< 2 ppm PCB) before off-site disposal at Envirocare. EPA is promulgating a revision to the Toxic Substances Control Act of 1976 (TSCA) PCB disposal regulations, which may impact the requirements for this action at Impoundments C and D. Should 40 *Code of Federal Regulations* (CFR) 761 be revised to offer other options in the handling, treatment, and disposal of PCB wastes, alternate endpoints in compliance with the new regulation will be documented and used, as appropriate. Concurrence from EPA and TDEC will be obtained before altering the selected remedy to follow the revised regulation, if promulgated.

STATUTORY DETERMINATIONS

The selected remedy protects human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy uses permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practical and satisfies the statutory preference for remedies that reduce toxicity, mobility, or volume as a principal element.

The selected remedy effectively addresses the contaminant sources that are included in the scope of the action for SIOU and, on completion of the remedial action, no additional studies or reviews will be required under this ROD to ensure that the remedy continues to adequately protect human health and the environment. While sources within the scope of the SIOU are addressed, it is recognized that the surface impoundments are within an industrial complex with other sources of contamination and impacted environmental media. The Bethel Valley watershed decision-making process, which includes the surface impoundments area, will address residual contamination at the site.

APPROVALS

Rodney R. Nelson, Assistant Manager U.S. Department of Energy Oak Ridge Operations	Date
Earl C. Leming, Director U.S. Department of Energy Oversight Division Tennessee Department of Environment and Conservation	Date
Richard D. Green, Acting Director Waste Management Division U.S. Environmental Protection Agency—Region 4	Date

PART 2. DECISION SUMMARY

SITE NAME, LOCATION, AND DESCRIPTION

Figure 2.1 shows ORR in Anderson and Roane Counties near the city of Oak Ridge in East Tennessee, approximately 32 km (20 miles) northwest of Knoxville, Tennessee. The reservation comprises 14,300 ha (35,300 acres) of federally owned land and houses three major installations—the Oak Ridge National Laboratory (ORNL), the Oak Ridge Y-12 Plant, and the East Tennessee Technology Park (formerly the Oak Ridge K-25 Site or Oak Ridge Gaseous Diffusion Plant).

ORNL is subdivided into various watersheds. SIOU is in the Bethel Valley watershed and consists of Impoundment A (3524), Impoundment B (3513), and Impoundments C and D (3539 and 3540). SIOU is in the south-central part of ORNL's main plant area, north of White Oak Creek (Fig. 2.2).

SITE HISTORY AND ENFORCEMENT ACTIVITIES

The impoundments were used to manage low-level radioactive liquid wastes generated from experiments and material processing at ORNL. Sediments are radiologically and chemically contaminated. Impoundments A and B are unlined and release contaminants to the environment as a result of groundwater intrusion. Water covering the sediments in these two impoundments provides radiation shielding and prevents airborne release of sediments. Impoundments C and D are clay-lined, not in contact with groundwater, and are not known to be leaking. Other sources in Bethel Valley also contribute to groundwater contamination, which could continue to contaminate surrounding soils after remediation of the impoundments.

The primary chemicals of concern identified in the SIOU sediments are mercury and PCBs. The principal radionuclides of concern and their estimated activity (in curies) are ^{241}Am (3), ^{137}Cs (133), ^{60}Co (1), ^{238}Pu (< 1), ^{239}Pu (7), and ^{90}Sr (36).

IMPOUNDMENT A (3524)

Impoundment A was excavated in natural clay in 1943 and used for short-term storage of wastewater and final precipitation of radioisotopes before discharge to White Oak Creek. This impoundment initially consisted of two unlined impoundments separated by a berm. In the early 1950s, the berm separating the impoundments was removed, forming one impoundment that received process wastewater only. From 1949 to 1957, effluent from Impoundment A was

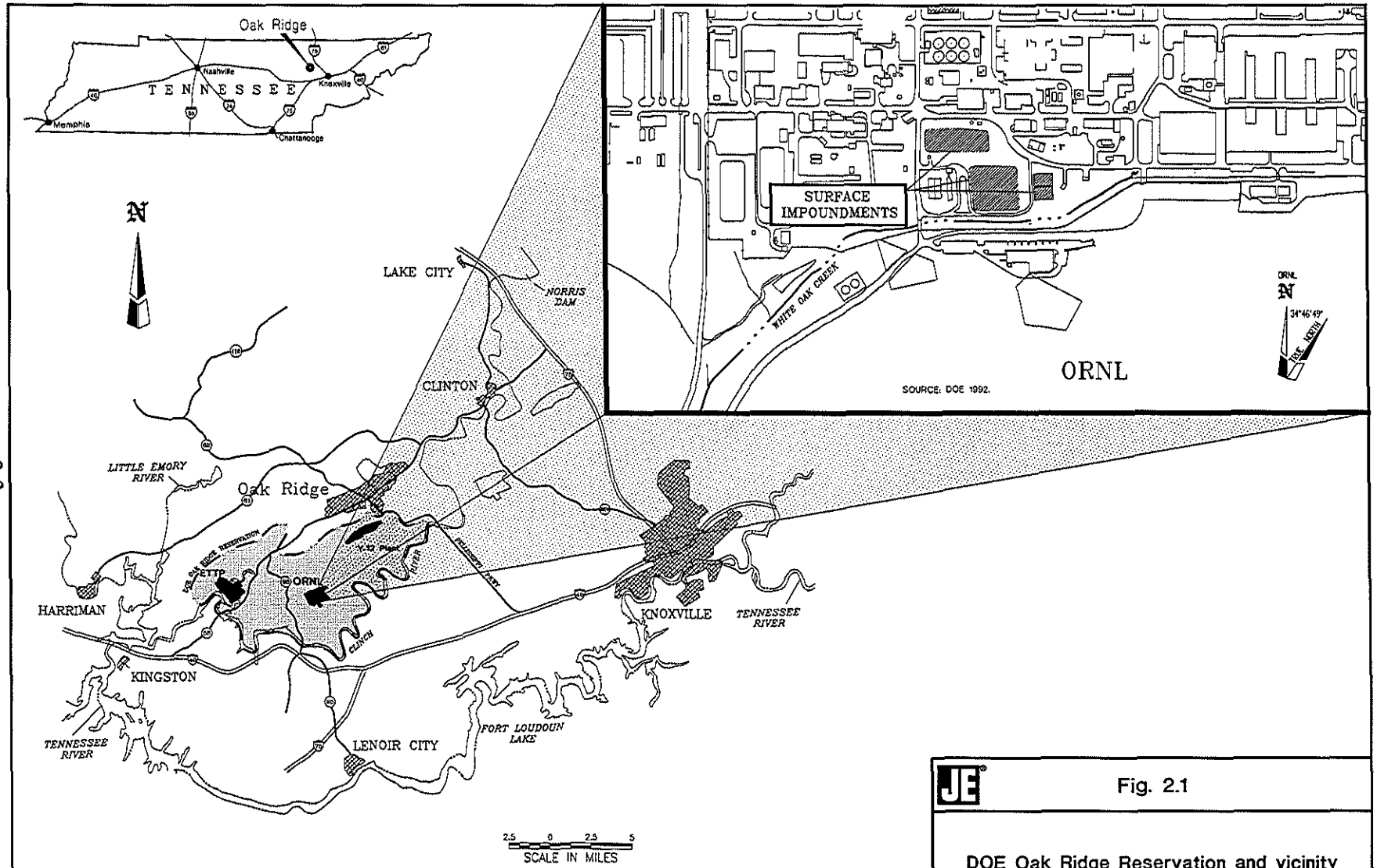

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Fig. 2.1

DOE Oak Ridge Reservation and vicinity

DOE - ORNL, Surface Impoundments - Oak Ridge, Tennessee

DOCUMENT ID: 35H830 0040-20 / ROD	DRAWING ID: 97-14865.DWG	DRAWING DATE: JULY 30, 1997 TG

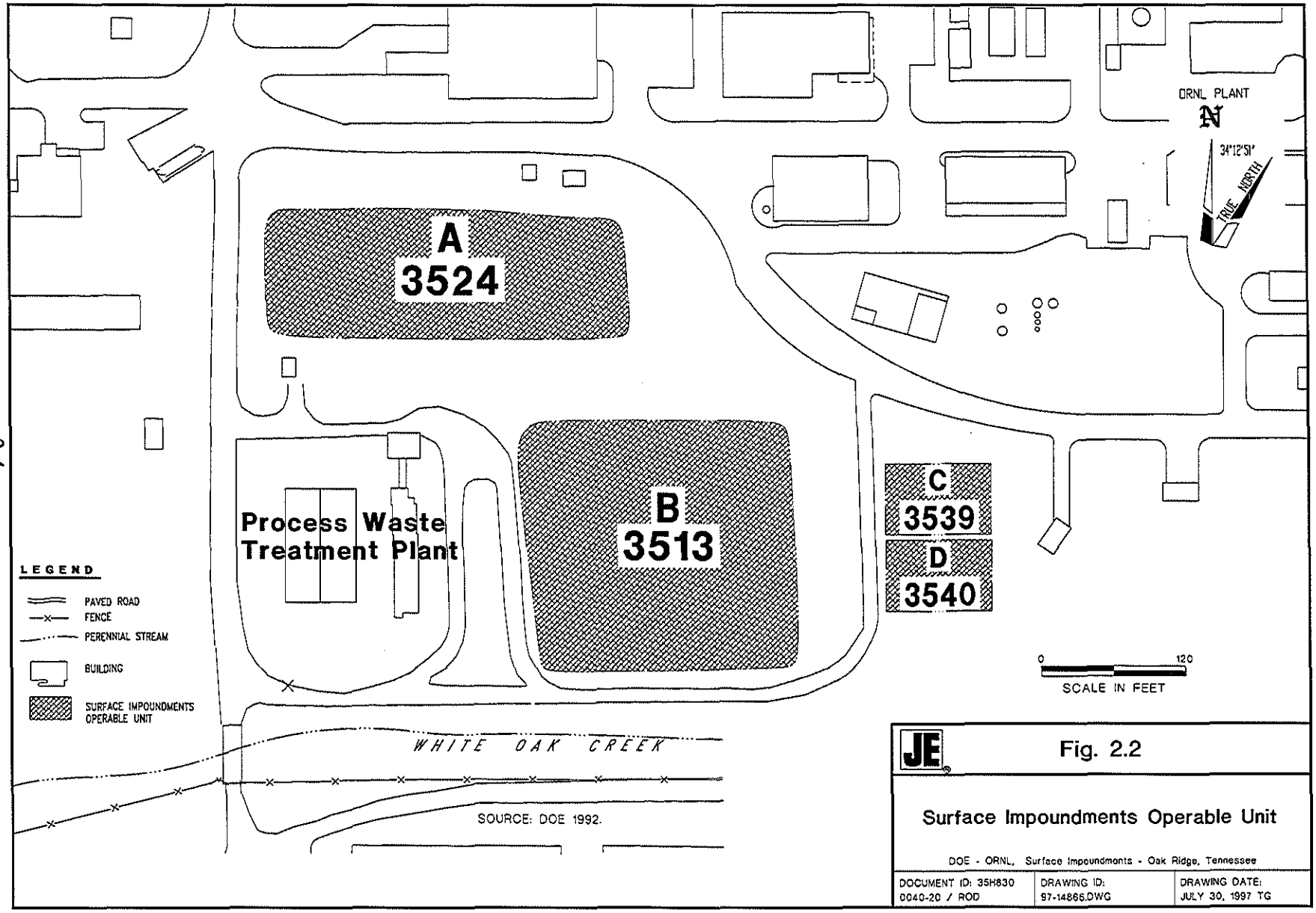
ORNL PLANT
N
34°12'51"
TRUE NORTH
A
3524
B
3513
C
3539
D
3540
Process Waste
Treatment Plant
LEGEND
PAVED ROAD
FENCE
PERENNIAL STREAM
BUILDING
SURFACE IMPOUNDMENTS
OPERABLE UNIT
WHITE OAK CREEK
0
120
SCALE IN FEET
SOURCE: DOE 1992.
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Fig. 2.2
Surface Impoundments Operable Unit
DOE - ORNL, Surface Impoundments - Oak Ridge, Tennessee
DOCUMENT ID: 35H830
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pumped to Impoundment B (3513). In 1957, the PWTP was placed on line; Impoundment A was used as an equalization basin for intermediate storage and collection of process wastewater for the treatment plant until 1989. Impoundment A was used recently as an emergency storage basin for overflow from the process wastewater storage tanks during storms. This impoundment is no longer needed for overflow because a surge tank installed in June 1996 provides adequate storage capacity.

Impoundment A contains approximately 1,100 m^3 (1,400 yd^3) of low-level radioactive sediment. The sediment is not hazardous waste as defined by the Resource Conservation and Recovery Act of 1976 (RCRA), and PCB levels are < 50 ppm.

IMPOUNDMENT B (3513)

Impoundment B was excavated in natural clay in 1944, is unlined, and was used as a settling basin for low-level radioactive waste streams that were diluted with process wastewater. From 1944 to 1947, excess water in the impoundment flowed through pipes on the impoundment's southern berm directly into White Oak Creek. These pipes were plugged in 1947. From 1957 to 1976, Impoundment B received waste that did not require treatment in PWTP. Wastewater from PWTP was also discharged into the impoundment to allow particulate settling. The impoundment has not been used since 1976. Over the past few years, seeps through the southern berm of this impoundment have discharged to White Oak Creek. Temporary corrective actions have been implemented to mitigate this problem until a final remedy for the impoundments is completed.

Impoundment B contains approximately 2,400 m^3 (3,160 yd^3) of low-level radioactive sediment. The sediment is not RCRA-hazardous waste, and PCB levels are < 50 ppm.

IMPOUNDMENTS C AND D (3539 AND 3540)

Impoundments C and D are compacted clay-lined impoundments built in 1964 to receive process wastewater from Building 4500. Historically, if contaminant levels were acceptable, the process waste was discharged into White Oak Creek after verification of radionuclide content and pH adjustments of water in the ponds. Wastewater from Building 4500 exceeding acceptable limits was pumped to Impoundment A (3524) before treatment at PWTP. Impoundments C and D were taken out of service in 1990 but were available for overflow from the process wastewater storage tanks during storms until the new surge tank was installed in June 1996.

Impoundments C and D contain < 30 m^3 (40 yd^3) of sediment with very low levels of radioactive contamination (0.3 Ci). PCB levels are between 50 and 500 ppm. Further characterization is needed to confirm whether the waste meets the definition of RCRA-hazardous waste. Details of the sampling and characterization plan will be approved by TDEC and EPA.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

DOE issued the proposed plan for SIOU June 30, 1997. DOE published a public notice about the project in *The Knoxville News-Sentinel, The Roane County News,* and *The Oak Ridger* June 30, 1997, and set a public comment period from June 30, 1997 to July 30, 1997. DOE held a public meeting March 30, 1995, to provide information about SIOU. A public meeting July 15, 1997, presented the preferred alternative described in the proposed plan and solicited public input. All public comments on the proposed plan are identified and addressed in the "Responsiveness Summary" section of this ROD.

PROJECT SCOPE AND SUMMARY OF SITE CHARACTERISTICS

The purpose of this project is reduction of risk by cleanup and remediation of the four surface impoundments. Media specifically included in the scope of this project are the surface water and sediment in the impoundments that resulted from liquid waste treatment. Incidental soil that may be encountered during sediment and water remediation will be handled appropriately. Groundwater and surface soils within the boundaries of SIOU will be specifically addressed under the Bethel Valley watershed ROD.

For remediation options involving waste removal or relocation on site, DOE anticipates that the impoundments will be excavated to 0.03 m (0.1 ft) below the as-built elevation of the floor of the impoundment excluding bedrock and riprap. Depths of subimpoundment soil removal will be developed in the remedial action work plan. Sediments and surface water are the media of concern at SIOU and account for more than 95 percent of the site contamination. Excavation of the sediment and an additional 0.03 m (0.1 ft) of the natural or compacted subimpoundment clay will ensure that the remedial action objectives have been met, releases from SIOU contaminant sources will be minimized, and risks resulting from these releases will not exceed acceptable levels in nearby surface waters of White Oak Creek.

Table 2.1 provides a summary of contaminant concentrations and sediment volumes in the impoundments. Other site characteristics are provided under "Site History and Enforcement Activities."

SUMMARY OF SITE RISKS

The risk assessment presented in Chapter 3 and Appendix C of the RI/FS contains a detailed discussion of site risks. Ecological and human health risk summaries follow.

ECOLOGICAL RISKS

The ecological risk assessment evaluated risks to aquatic (such as fish) and piscivorous (fish-eating, such as raccoons and birds) wildlife receptors. Risk and hazards were calculated at likely exposure locations using current contaminant concentrations, and contaminant concentrations were modeled for future conditions. Estimated contaminant concentrations were compared to acceptable wildlife exposure levels based upon National Ambient Water Quality Criteria.

In the RI, exposures of wildlife receptors in the impoundments were clearly unacceptable. Exposure levels are exceeded for aquatic receptors in White Oak Creek and White Oak Lake, although exposures are not completely due to contamination originating from SIOU. The SIOU contribution to ecological risk is reduced because leaks are controlled in the Impoundment B berm.

HUMAN HEALTH RADIOLOGICAL RISKS

Radiation levels in the sediments at SIOU are extremely hazardous. Without the water cover on Impoundments A and B providing shielding from radiation, an industrial worker on the bank of an impoundment would receive the maximum allowable annual occupational dose of 5 rem in approximately 100 hours from direct exposure to gamma radiation. In addition, if the sediments dried up and became airborne, inhalation of alpha-emitting radionuclides, including plutonium and americium, would greatly increase the risk of lung cancer over a widespread area.

DOE mandates institutional controls to ensure regulatory compliance for exposures to on-site individuals and to prevent long-term direct contact with the sediments, which would result in a near certain probability of cancer. Radiological risks to future on-site employees and residents were evaluated, assuming 5 days during which the water cover over Impoundment A

Table 2.1. Site characteristics at SIOU, ORR, Oak Ridge, Tennessee

	Impoundment A	Impoundment B	Impoundments C and D
Radioactive COCs	Average (pCi/g dry)	Average (pCi/g dry)	Average (pCi/g dry)
^{241}Am	16,000	4,200	< 270
^{137}Cs	210,000	450,000	54
^{60}Co	3,000	1,300	5
^{238}Pu	1,100	630	0
$^{239,240}Pu$	17,000	19,000	93
^{90}Sr	91,000	73,000	96
Primary chemical COCs	Mean (mg/kg)	Mean (mg/kg)	Mean (mg/kg)
Mercury	396	340	760
PCBs	35	41	180
Sediment volume (yd^3)	1,400	3,163	< 40

Am = americium
Co = cobalt
COC = contaminant of concern
Cs = cesium
g = gram
kg = kilogram
< = less than
mg = milligram
ORR = Oak Ridge Reservation
PCB = polychlorinated biphenyl
pCi = picocurie
Pu = plutonium
SIOU = Surface Impoundments Operable Unit
Sr = strontium
yd = yard

(3524) is lost. Risks to on-site employees and residents, primarily from direct external exposure to gamma radiation from the unshielded sediments, would range up to 8×10^{-2} and 2×10^{-1}, respectively (i.e., 8 in 100 and 2 in 10 additional cases of cancer over those expected under natural conditions). These risks greatly exceed the EPA target risk range of 1×10^{-4} to 1×10^{-6} (i.e., 1 in 10,000 to 1 in 1 million additional cases of cancer over those expected under natural conditions).

Potential future off-site residents would also have unacceptable risks from radioactive contaminants should institutional controls be lost. For these receptors, the main risk is inhalation of windblown particulates derived from the sediments, assuming the sediments dry out for a 5-day period. The risks range up to 7×10^{-3} for receptors at White Oak Creek and 5×10^{-3} for receptors at White Oak Dam and Clinch River (i.e., 7 in 1,000 and 5 in 1,000 additional cases

of cancer over those expected under natural conditions). Sufficiently conservative assumptions were used to estimate these risk levels; it is very unlikely that the risks are underestimated.

If uncontrolled, the principal, short-lived radionuclides of concern (^{90}Sr, ^{137}Cs, and ^{60}Co) would be expected to present unacceptable risks for hundreds of years. The principal long-lived radionuclides of concern (^{238}Pu, ^{239}Pu, and ^{241}Am) would present unacceptable risks for thousands of years or more.

HUMAN HEALTH CHEMICAL RISKS

Risks to current and future on-site employees from heavy metals and organic chemical carcinogens were calculated to be acceptable, as were risks to future residents beyond the current DOE boundary at Clinch River near White Oak Creek.

Based on the results of modeling contaminant migration, unacceptable risks were estimated for future residential use of surface water by receptors at White Oak Creek (2×10^{-3}) and at White Oak Dam (8×10^{-4}) (i.e., 2 in 1,000 and 8 in 10,000 additional cases of cancer over those expected under natural conditions).

Chemical carcinogenic risks calculated for the exposure scenarios were always less significant than radiological risks in all scenarios. For example, the maximum chemical risk calculated was 2×10^{-3} for future on-site residents, compared to a radiological risk of 2×10^{-1} for the same exposure scenario (i.e., 2 in 1,000 and 2 in 10 additional cases of cancer over those expected under natural conditions). Actions taken to reduce radiological risk would effectively reduce chemical risk.

DESCRIPTION OF ALTERNATIVES

Alternatives were developed in Chapters 4 and 5 and Appendix D of the RI/FS to achieve the following remedial action objectives:

- prevent direct exposure to, direct contact with, and inhalation or ingestion of contaminated sediments by humans and animals;
- prevent movement of contaminants to groundwater and surface water;

- control failure of the impoundments' berms and embankments; and

- prevent the bioaccumulation of contaminants in ecological receptors.

The alternatives evaluated in the FS ranged from no action to complete removal of contaminated sediments with off-site disposal. The alternatives were screened, based on effectiveness, implementability, and cost, to develop a shorter list of alternatives for detailed analysis. The final alternatives retained for detailed development and analysis in the FS include the following:

- Alternative 1—no action
- Alternative 2—multilayer cap and institutional controls
- Alternative 3—consolidation cell with simple dewatering
- Alternative 4—consolidation cell with ex situ treatment
- Alternative 5—off-SIOU consolidation cell
- Alternative 6—removal, treatment, and disposal

After the FS for SIOU was issued, an engineering support study (Energy Systems 1996) was performed and additional characterization information was obtained. These data were incorporated into the alternatives discussed in the proposed plan. EPA, TDEC, and DOE agreed that only three alternatives warranted detailed discussion in the proposed plan. They are Alternative 1—no action, Alternative 3—on-site consolidation cell, and Alternative 6—removal, treatment, and disposal.

All alternatives assume that all water removed from the impoundments would be treated at the existing PWTP. Natural disasters such as earthquakes, floods, and tornados are considered in the design for all alternatives except the no action alternative.

The radioactivity levels of the sediment in the impoundments require that remedial design (1) protect workers from exposure to gamma radiation and (2) contain sediment to prevent airborne releases of alpha-emitting radionuclides. Engineering controls (such as radiation shielding, double-contained piping, and remotely operated equipment) and operational controls (such as establishing contamination zones, providing high levels of personal protective equipment, restricting access to only qualified and necessary personnel, monitoring exposures, and monitoring and controlling processes) were included for each alternative to address radiation hazards.

Following are descriptions of the six alternatives considered in the RI/FS. The costs for Alternatives 1, 3, and 6 are revisions to the initial estimates in the RI/FS developed nearly 3 years ago. Detailed cost estimates are available at the Information Resource Center, 105 Broadway Avenue, Oak Ridge, Tennessee, to support the cost shown for these alternatives. Alternatives 2, 4, and 5 were not analyzed in detail in the proposed plan; costs for these alternatives were not updated and are not presented.

ALTERNATIVE 1—NO ACTION

Total capital cost: $0 million
Time to implement: 0 years
Annual operation and maintenance (O&M) cost, years 1–30: $216,000
Present value cost: $2.5 million

Alternative 1 assumes that existing institutional controls are maintained for a reasonable period (e.g., 30 years). These controls include restricting access to contaminated areas with fences and guards, establishing and marking radiation areas, training workers, training or escorting visitors, monitoring radiation levels at the impoundments, monitoring exposure to each employee and visitor, and maintaining water cover on the impoundments for shielding and containment of the sediments. After this period, the site is assumed to be abandoned. This alternative makes no new provisions for containment, removal, treatment, or disposal of wastes. Unacceptable risks are present at all receptor locations considered after loss of institutional controls.

The no action alternative does not meet the remedial action objectives or CERCLA requirements for protection of human health and the environment.

ALTERNATIVE 2—MULTILAYER CAP AND INSTITUTIONAL CONTROLS

Alternative 2 proposes installation of a multilayer cap over the impoundments to prevent airborne contamination and direct exposure. Institutional controls would limit access to groundwater, White Oak Creek, and White Oak Lake to control exposure to contaminants released from SIOU. Surface water in the impoundments, which would be removed during cap installation, would be treated at the PWTP. Releases of contamination to groundwater and eventually to surface water would continue.

This alternative does not meet the remedial action objective of preventing movement of contaminants to groundwater and surface water. It would not meet some ARARs, and waivers for those ARARs would not be justifiable.

ALTERNATIVE 3—ON-SITE CONSOLIDATION CELL

Total capital cost: $18.6 million
Time to implement: 4 years
Annual O&M cost, year 5: $233,000
Annual O&M cost, years 6–30: $91,440
Present value cost: $16.3 million

Alternative 3 includes constructing an engineered consolidation cell at Impoundment A (3524) and consolidating the sediment from all impoundments into the cell. Surface water from the impoundments and leachate collected from the consolidation cell would be discharged to PWTP. Approximately 0.03 m (0.1 ft) of subimpoundment soil would be removed from all impoundments (see "Project Scope and Summary of Site Characteristics") and placed in the consolidation cell. This alternative meets all remedial action objectives and would isolate the wastes sufficiently to protect human health and the environment. Federal institutional controls at the consolidation cell site would be required indefinitely because chemical constituents in the waste would remain hazardous forever and some radioactive constituents (americium and plutonium) have half-lives of thousands or tens of thousands of years.

To develop the consolidation cell, the waste from Impoundments C and D would be transferred to Impoundment B, and Impoundments C and D would be filled to provide a staging area for remediating the large impoundments. The waste in Impoundment A would be transferred to Impoundment B. The bottom liner of the consolidation cell with a leachate collection/detection system would be installed in the empty Impoundment A.

All the sediment in Impoundment B—which would also store waste from Impoundments A, C, and D—would be transferred to the consolidation cell. A temporary cap would be placed over the waste. After the waste is dewatered through the leachate collection system and no further settlement is expected, a final cap would be installed.

The consolidation cell would be inspected and maintained on a regular basis. Institutional controls would permit industrial use of the surface of the consolidation cell. No activities that disturb the cap would be allowed. No institutional controls on the remainder of the site would

be needed for contamination within the scope of SIOU. Residual contamination on the remainder of the site would be addressed in the Bethel Valley watershed ROD.

Additional detail can be found in Section 5.2.3 of the RI/FS. Figure 2.3 is a cross section of the consolidation cell during different phases of construction and operation.

Alternative 3 would require a CERCLA waiver from the TSCA requirement that PCB wastes be disposed of at least 15 m (50 ft) above the high water table [40 CFR 761.75(b)(3)]. TSCA regulations do not specify the permeability of the media between the waste and the water table. The proposed compacted clay liner for Alternative 3 would retard migration of PCBs more effectively than most unconsolidated soils. The proposed combination of a clay liner with a leachate collection/detection system and a geomembrane liner would provide even greater protection. A waiver would be justified based on equivalent protectiveness provided by the liner. Alternative 3 would comply with all other ARARs.

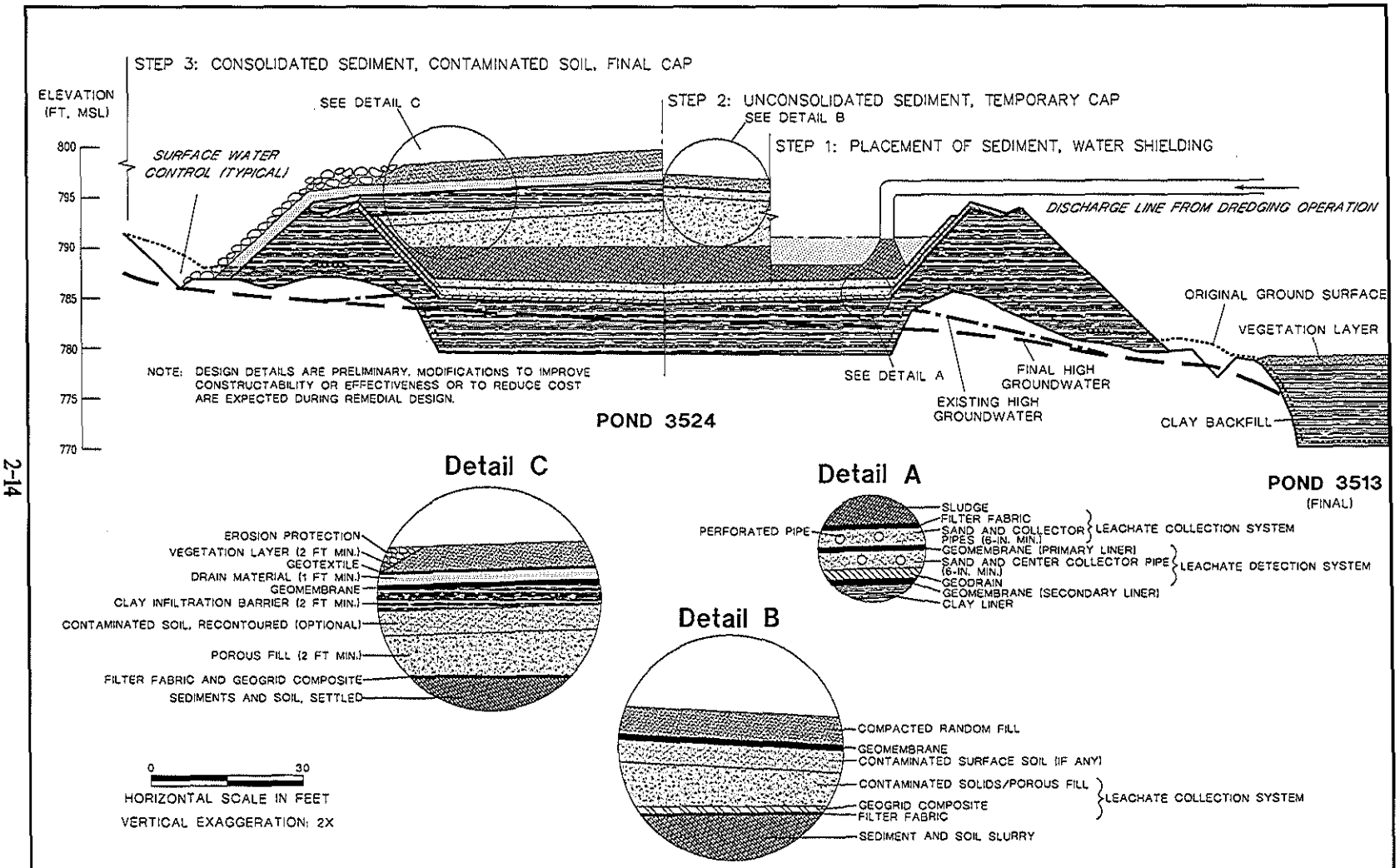
ALTERNATIVE 4—CONSOLIDATION CELL WITH EX SITU TREATMENT

Alternative 4 would add an ex situ treatment step to the operations proposed for Alternative 3. After transfer of all sediment into Impoundment B and construction of the consolidation cell liner in the empty Impoundment A, waste would be solidified in a new treatment facility similar to the facility described in Alternative 6. After curing in forms, the solidified waste would be moved into the consolidation cell and the cell would be capped.

Alternative 4 was not addressed in detail in the proposed plan because it increases cost, provides no additional risk reduction compared to Alternative 3, and would increase waste volume and the size of the consolidation cell. As for Alternative 3, Alternative 4 would need a waiver from TSCA siting criteria. If wastes from Impoundments C and D are determined to be hazardous under RCRA regulations, additional waivers could also be needed depending on the results of engineering support studies regarding the effectiveness of the treatment process.

ALTERNATIVE 5—OFF-SIOU CONSOLIDATION CELL

Alternative 5 is the same as Alternative 3, except that the disposal cell would not be at the SIOU site in the main area of ORNL. The location assumed in the FS is at ORNL near the Process Waste Sludge Basin, one of several small impoundments with similar wastes that could



JE	Fig. 2.3	**Alternative 3 section - liner, placement of wastes, temporary cap, and final cap** DOE - ORNL, Surface Impoundments - Oak Ridge, Tennessee	DOCUMENT ID: 35H830 0040-20 / ROD	DRAWING ID: 97-14867.DWG	DRAWING DATE: July 15, 1997 TG

also be consolidated in the cell. Sediment would be removed from the impoundments, transported by tanker truck or pipeline to the newly constructed disposal cell, and dewatered in the cell as described for Alternative 3. The cap and institutional controls would also be as described for Alternative 3.

Alternative 5 was not addressed in detail in the proposed plan because no additional long-term risk reduction would result but waste transfer cost and potential worker risk would increase in comparison to Alternative 3. Alternative 5 would need the same waiver from TSCA siting criteria as Alternative 3.

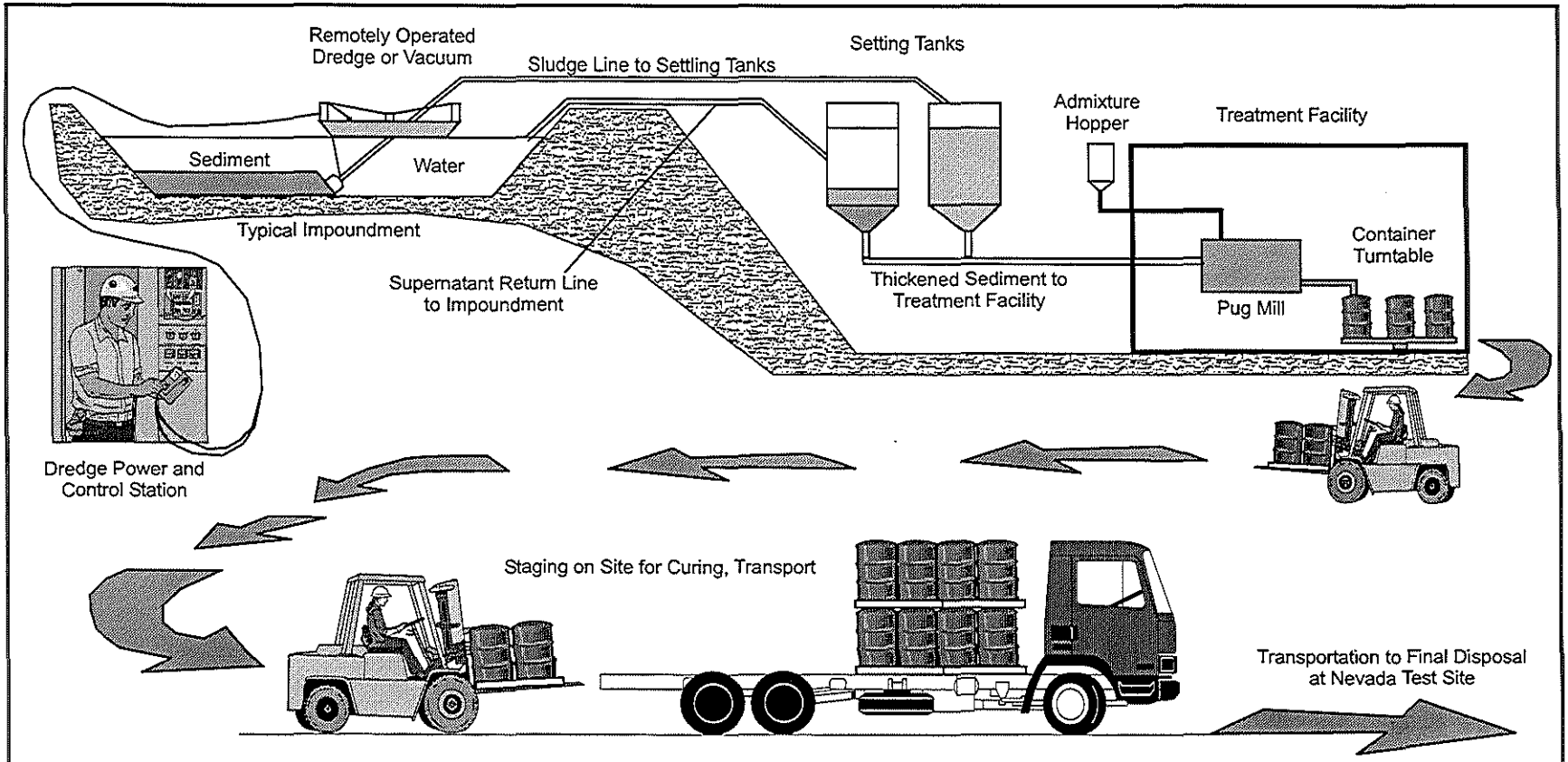
ALTERNATIVE 6—REMOVAL, TREATMENT, AND DISPOSAL

Total capital cost: $64.3 million
Time to implement: 4 years
Annual O&M cost, year 5: $212,000
Annual O&M cost, years 6–9: $70,500
Present value cost: $53.1 million

Alternative 6 is a two-stage process that includes removal of all sediments within SIOU, treatment of sediments to meet ARARs and disposal facility WAC, containerization of treated wastes, and transport of all treated waste to appropriate waste disposal facilities. The process for addressing Impoundments A and B is shown in Figure 2.4.

The first stage, remediation of Impoundments C and D, will be a stand-alone project. Impoundments C and D will be resampled using an approved sampling plan. The sediments in Impoundments C and D will be removed by manual pumping or dredging as described for Alternative 3 or by other appropriate methods. Approximately 0.03 m (0.1 ft) of clay liner below the sediment will be excavated to ensure that the sediment has been removed. Based on the sampling results, the waste removed from the small impoundments will be treated as needed to meet WAC at Envirocare.

Current data suggest that PCB concentrations are > 50 ppm and, consequently, the wastes would require either disposal by incineration or in a permitted chemical waste landfill. Incineration requires destruction of PCBs to < 2 ppm. If concentrations > 50 ppm are verified during resampling, an alternate method of destruction for PCBs (rather than incineration or disposal in a PCB landfill) would be required because there are no chemical waste landfills also permitted for radiological wastes. At present, there are no known commercial vendors who have



Note:
Conceptual design for removal, treatment, and transportation of Surface Impoundments Operable Unit sediment from Impoundments A and B. Details of design are likely to change during remedial design.

Steps:
1. Sediment is pumped from impoundments to settling tank.
2. After settling, supernatant is decanted from tank and returned to impoundment.
3. Thickened sediment is pumped to treatment facility.
4. Cement, fly ash admixture is combined with sediment in pug mill.
5. Wet concrete-like mixture is extruded from pug mill into containers.
6. Containers are moved to staging, curing area and held until mixture solidifies.
7. Containers of solidified waste are transported to disposal site.

JE	Fig. 2.4	Alternative 6 - Removal, Treatment, and Off-site Disposal DOE - ORNL, Surface Impoundments - Oak Ridge, Tennessee	DOCUMENT ID: 35H830 0040-30 / ROD	DRAWING ID: 97-14821.CDR	DRAWING DATE: JULY 15, 1997 TG

treated PCBs to < 2 ppm in a radioactive matrix containing transuranic elements. DOE will solicit proposals from vendors of various PCB destruction technologies. DOE will evaluate the vendors and technologies and select the safest and most cost-effective technology. Chemical dechlorination is the proposed PCB destruction technology considered in the cost estimate. If chemical dechlorination is not used, changes will be documented in the ROD, as appropriate.

EPA has proposed revisions to the regulations concerning treatment of PCB-contaminated waste that may alter the destruction requirements. If these revisions are promulgated, DOE will incorporate the modified requirements into remedial design and remedial action planning documents for Impoundments C and D, as required.

Costs for removal, treatment, packaging, and transportation according to U.S. Department of Transportation (DOT) requirements and disposal at Envirocare are estimated at $5 million–$10 million for < 61 m^3 (80 yd^3) of sediment and incidental soil removed.

Impoundments C and D would be backfilled with stone and gravel to provide an area for construction of a facility to treat the sediment from Impoundments A and B.

The second stage, remediation of Impoundments A and B, assumes that an appropriate disposal facility will be available before waste removal activities begin. If no facility is available, DOE will present an alternate approach to the public. Remediation of Impoundments A and B relies on stabilization/solidification as the representative treatment method. A 1996 treatability study developed a recipe of dry cement, dry fly ash, and sediment with enough water to produce a waste form that meets DOT transport requirements and NTS WAC. The treatment facility could include settling tanks, dewatering equipment, a pug mill for mixing dry ingredients with the sediment, a packaging station, and auxiliary equipment. The facility would have provisions for remote operation, shielding, high-efficiency particulate air filtration, and other provisions necessary to control worker exposure to radiation.

After construction and testing of the treatment facility, approximately 3,500 m^3 (4,600 yd^3) of sediment would be transferred from Impoundments A and B to the facility with a remotely operated hydraulic dredge or other appropriate equipment. Excess water at the treatment facility would be returned to the impoundments or would be treated at PWTP. Incidental soil below the sediment will be removed to 0.03 m (0.1 ft) below the as-built elevation of the impoundment excluding bedrock and riprap. Waste would be solidified into containers meeting DOT requirements and staged on the SIOU site for curing and transport.

After curing, waste would be shipped immediately to the disposal facility. Disposal fees are estimated based on current charges at NTS for disposal of contact-handled low-level waste in standard containers. Development of an on-ORR mixed waste disposal facility is under consideration in a separate CERCLA decision-making process. A decision on the on-ORR facility is expected in late 1998 and, if approved, the facility is scheduled to be operational in 2000. If the facility is approved and constructed, and if SIOU wastes meet the facility's WAC, then DOE may choose to send the waste there, rather than to NTS.

When all waste is removed and shipped, the treatment facility and equipment would be decontaminated to the extent practical. Contaminated material that is not reusable would be cut up, placed in containers, and shipped for disposal at NTS. Uncontaminated material, including the treatment building, would be released for other use. Surface water in the impoundments would be discharged to PWTP, the impoundments would be backfilled with clean soil, and the site would be restored.

Institutional controls would not be needed at the site for SIOU contaminants but could be needed because of other contaminant sources. Appropriate institutional controls for residual contamination would remain in place unless and until superseded as appropriate by the Bethel Valley watershed ROD. The cost estimate assumes 5 years of monitoring and controls after remediation. Institutional controls at NTS (or other final disposal location) would be needed indefinitely. The cost for these controls is assumed to be included in the disposal fee.

This alternative meets all remedial action objectives and ARARs.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Table 2.2 summarizes the performance of the three alternatives discussed in detail in the proposed plan against the nine CERCLA criteria. The first two criteria must be met in initial screening by any alternative considered for selection in the ROD. The next five criteria are the primary balancing criteria upon which the analysis is based. The remaining two criteria (state and community acceptance) are based on regulatory agency review and public comment. Following is a discussion of the evaluation of the alternatives.

Overall Protection of Human Health and the Environment. Alternatives 3 and 6 would result in protection of human health and the environment; however, Alternative 6 offers greater protection because the waste is transferred from SIOU at ORNL to an engineered disposal facility. Alternative 1 (no action) is not protective.

Table 2.2. Evaluation of alternatives for CERCLA criteria, SIOU, ORNL, Oak Ridge, Tennessee

CERCLA criteria	Alternative 1 No action	Alternative 3 On-site consolidation cell	Alternative 6 Removal, treatment, and off-site disposal
1. Overall protection of human health and the environment			
Future RME Risk	**Total risk**	**Total risk**	**Total risk**
Employee on site	8×10^{-2}	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$
Resident Clinch River	5×10^{-3}	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$
Resident White Oak Dam	5×10^{-3}	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$
Resident White Oak Creek	7×10^{-2}	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$
Resident on site	2×10^{-1}	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$
Human health risk	Risk to human health from migration of contamination to groundwater and White Oak Creek. If water cover over sediment is lost, airborne contamination resulting in widespread human health risk is possible. Very high external gamma exposures to on-site receptors	Protective to employees and to residential receptors at White Oak Dam and at White Oak Creek. Protective at the site while DOE maintains institutional controls	Protective to all receptors because of removal of source material
Ecological risk	Risk to environmental receptors from consumption of fish in impoundments. Small risk from consumption of fish in White Oak Creek	No risk to environmental receptors	No risk to environmental receptors
2. Compliance with ARARs	No ARARs under CERCLA. Not protective as required by CERCLA	One waiver required	Meets all ARARs
3. Long-term effectiveness	Not effective	Effective for period of institutional control	Very effective
4. Reduction of toxicity, mobility, or volume through treatment	None	Small reduction in volume	Increase in volume. Some decrease in mobility of most contaminants
5. Short-term effectiveness	No increase or reduction in short-term effects on human health and environment	Potential for adverse short-term effects	Potential for adverse short-term effects

Table 2.2. (continued)

CERCLA criteria	Alternative 1 No action	Alternative 3 On-site consolidation cell	Alternative 6 Removal, treatment, and off-site disposal
6. Implementability	Very easy to implement	Somewhat difficult to implement	Difficult to implement, technically and administratively
7. Cost effectiveness	$2.5 million (present value)	$16.3 million (present value)	$53.1 million (present value)
8. State acceptance	Not acceptable	Not supported at this time	Preferred alternative
9. Community acceptance	Little support	Significant support	Significant support

ARAR = applicable or relevant and appropriate requirement
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
$ = dollar
DOE = U.S. Department of Energy
< = less than
ORNL = Oak Ridge National Laboratory
RME = reasonable maximum exposure
SIOU = Surface Impoundments Operable Unit

Compliance with ARARs. Alternative 6 meets all ARARs. Alternative 3 requires one waiver, and Alternative 1 does not meet the intent of CERCLA.

Long-Term Effectiveness. Alternative 6 provides the best long-term effectiveness because waste is removed from SIOU and disposed of in an engineered disposal facility. Waste is treated to reduce toxicity and mobility before disposal. The engineered disposal facilities under consideration offer superior containment and better protection from inadvertent intrusion than the consolidation cell proposed for Alternative 3. The hydrogeology of the proposed disposal facilities for Alternative 6 is more suitable than the on-site consolidation cell for Alternative 3, which is about 100 m (330 ft) from White Oak Creek and where fractured bedrock is near the base of the liner.

Alternative 3 would effectively prevent direct contact, direct exposure, airborne exposure, and contact of waste with groundwater. However, the engineered cell may not effectively contain the contaminants for the duration needed for long-lived radioisotopes (half-lives > 10,000 years) to become safe. Institutional controls to prohibit unacceptable uses and to maintain the cap would be needed to ensure long-term protection.

Alternative 1 would not provide long-term protectiveness.

Reduction of Toxicity, Mobility, and Volume Through Treatment. Alternative 6 would reduce toxicity of the sediment in Impoundments C and D by treating PCBs. PCB treatment would not significantly affect sediment volumes, but a large liquid waste stream could result depending on the chosen PCB treatment process. The liquid waste would be treated at ORNL before discharge at an existing permitted outfall. Stabilization/solidification of the sediment from Impoundments A and B in Alternative 6 would increase volume but would greatly reduce mobility of contaminants in the sediment from Impoundments A and B. Toxicity would not be affected.

Alternative 3 would dewater the sediments and treat the surface water and leachate. This would provide a small volume reduction through treatment. No contaminants would be destroyed, and toxicity and mobility would not be affected through treatment.

Alternative 1 would not provide treatment of the sediments.

Short-Term Effectiveness. Alternatives 3 and 6 pose the potential for short-term risk. Alternative 3 is effective in the short term because it reduces the time to meet the remedial action objectives and poses a lower risk to remediation workers because handling of radioactive

materials would be limited. Safety measures taken would protect workers during handling. Environmental risks would be eliminated when the temporary cap is placed on the disposal cell approximately 2 years after construction begins.

For Alternative 6, short-term risks to remediation workers and the public along the transportation route would be controlled to acceptable levels through compliance with Occupational Safety and Health Administration and DOT requirements, DOE as-low-as-reasonably-achievable principles, and project-specific health and safety plans as for Alternative 3. However, much greater control would be needed than for Alternative 3; more intensive handling of radioactive waste during treatment would significantly increase worker exposure to radiation and the potential for spills or other releases. Transportation of waste would increase the likelihood of accidents.

Alternative 1, the no action alternative, proposes minimal maintenance actions only and therefore would pose little risk to remediation workers. Existing environmental risks would continue.

Implementability. The maintenance actions proposed for Alternative 1, the no action alternative, are already in place, and continued implementation would be very easy.

Alternative 3 would be the easier of the two action alternatives to implement. The sediment and water handling and cell construction equipment, material, and techniques are readily available. Engineered cells are routinely designed and built throughout the country. The proposed in-cell dewatering method has not been widely used, but it is expected to be reliable based on results of the treatability study and alternate available methods. If this alternative were selected through the CERCLA process, there would be no administrative impediments (e.g., licenses or permits) to implementation.

Technical implementability of Alternative 6 would be more difficult because of the safety requirements necessary to ensure adequate containment and shielding of the highly radioactive waste and the complexity of the two treatment systems. Treatment of mixed radioactive and hazardous waste to reduce PCB concentrations has been done in the laboratory, but no full-scale field demonstrations are known to have been completed. Containment of potential airborne releases of alpha-emitting radionuclides increases the complexity of the treatment process. After treatment for PCBs, the waste from Impoundments C and D is expected to meet Envirocare WAC.

Although complex, the proposed stabilization/solidification of sediment from Impoundments A and B for Alternative 6 is implementable. The solidified, containerized waste form could be safely transported according to DOT requirements and disposed of without airborne releases of contamination. Samples of the final waste form would be taken to ensure that the waste to be disposed of is not RCRA-characteristic hazardous waste and does not contain PCBs at levels > 50 ppm.

The availability of NTS for disposal of solid low-level radioactive waste is likely, but administrative considerations may impede or delay shipments of waste. Although there are no laws prohibiting shipment of low-level waste, DOE Headquarters Office of the General Council has recommended suspension of waste shipments from new generators to NTS pending resolution of issues associated with National Environmental Policy Act of 1969 (NEPA) review of the facility at a programmatic level. An environmental impact statement (EIS) has been prepared under NEPA for NTS and for some generators on project-specific bases; however, not all possible generators and their actions have been addressed. A programmatic EIS has been released (DOE 1997b). Once approved, a ROD for the programmatic EIS will set forth terms and conditions under which shipments may resume. Administrative approval for shipment and disposal is considered difficult, but achievable.

DOE is currently evaluating various waste disposal alternatives for environmental restoration wastes from the entire ORR under a separate decision-making process. This evaluation includes consideration of a large-scale engineered disposal facility on ORR for most low-level radioactive, hazardous, TSCA, or mixed wastes generated from cleanup activities. If the result of this separate project is the construction of a disposal facility for the entire reservation and the treated SIOU wastes meet the new facility's WAC, SIOU wastes may be sent to the ORR disposal facility rather than to NTS.

Cost. Alternative 6 is the most costly of all the alternatives at an estimated $53.1 million (present value). However, the greater cost is justified because of the greater long-term effectiveness and protection offered by Alternative 6. It does not require long-term annual surveillance and maintenance expenditures. Its cost is primarily attributed to the amount of handling necessary to achieve full compliance with ARARs. Removal and disposal of the SIOU waste does allow beneficial reuse of the site and, given its location, reuse of the site should offset some of the cost. If an ORR disposal facility for low-level waste becomes available for SIOU waste, cost savings of up to $5.5 million compared to disposal at NTS may result from reductions in transportation costs and disposal fees. There may be additional savings of $5 million to $10 million if treatment for PCBs is not required. DOE considers that these benefits make Alternative 6 cost effective.

Alternative 3 is a less costly solution to remediation of the impoundments at a present value cost of $16.3 million. It does, however, require limitations on use of roughly a third of the 2.4-ha (6-acre) site and requires long-term maintenance and institutional controls. According to EPA guidance, the cost for maintenance and institutional controls is estimated only until year 30 because costs beyond that time frame are not considered accurate. However, because of the long half-lives of some of the radioactive constituents, maintenance and controls would be needed forever.

The present value cost of Alternative 1 is lowest at $2.5 million. This is also based on 30 years of institutional control, although controls would be needed forever.

State Acceptance. Alternative 6 meets all TDEC recommendations; Alternative 3 does not. In a letter to DOE dated September 20, 1996, TDEC stated that Alternative 3 is unacceptable because the long-term effectiveness of the cell is not protective for the life of the defined risk. In addition, costly, indefinite institutional controls would be required. Alternative 3 also promotes a strategy of maintaining small pockets of contaminated media throughout ORR that the state will not support.

Community Acceptance. Community acceptance addresses the issues and concerns the public may have about each alternative. The proposed plan (DOE 1997a) presented Alternative 6 as the preferred alternative. The "Highlights of Community Participation" section summarizes community participation. The selected remedy is the same as the preferred alternative in the proposed plan. The Responsiveness Summary, Part 3 of this ROD, provides comments submitted during the public comment period and responses to these comments.

The proposed plan has also been reviewed by the EPA National Remedy Review Board. This review organization was established as part of the EPA Superfund Administrative Reforms in January 1996 and is comprised of technical experts and senior managers from EPA regional offices and headquarters. The board promotes cost-effectiveness and national consistency in remedy selection at Superfund sites. Specific comments from the board are included in the responsiveness summary of this ROD.

SELECTED REMEDY

DOE, with the concurrence of EPA and the state of Tennessee, has determined that the preferred alternative (Alternative 6) presented in the proposed plan is the most appropriate remedy for protection of industrial workers and eliminating the primary source of groundwater

contamination at the SIOU. This selection is based on the comparative analysis of the alternatives presented in this ROD. This alternative satisfies the two threshold criteria and provides the best balance of trade-offs with respect to the CERCLA criteria used to evaluate remedial alternatives.

Alternative 6 satisfies the statutory preference for remedial actions that use treatment to reduce toxicity, mobility, and volume. The preferred alternative provides long-term effectiveness and permanence over other alternatives. Specific details on the selected remedy follow.

Alternative 6, the selected remedy, offers the greatest overall protection of human health and the environment because the waste is removed from the site. Alternative 6 meets all ARARs, has the greatest long-term effectiveness, and meets the statutory preference for treatment of wastes by reducing toxicity (of PCBs) and mobility (of radioactive and heavy metal contaminants) and is preferred by the state of Tennessee. Alternative 6 does not depend on institutional controls for long-term effectiveness (except for those already in place at NTS and Envirocare, the representative off-site disposal facilities). Alternative 6 is acceptable in meeting short-term effectiveness, implementability, and cost effectiveness criteria.

The selected remedy meets the end-use criteria recommended by the citizens group site-specific advisory board for ORNL, the expressed recommendations of TDEC, EPA requirements and statutory preferences, and the goals and objectives of the DOE Accelerated Cleanup Plan.

The availability of NTS for disposal of solid low-level radioactive waste is likely; however, a contingency plan would be required should administrative considerations impede or delay shipments of waste. If an ORR disposal facility with WAC compatible with SIOU wastes is developed through a separate decision-making process, it would serve as the contingency disposal facility for this alternative. If the new ORR disposal facility is available, it will likely be chosen because of reduced transportation costs and disposal fees. If no facility is available, DOE will present an alternate approach to the public.

The final ROD is scheduled for approval on September 30, 1997. Remedial action must begin within 15 months or by December 31, 1998. DOE will issue a request for proposals for removal, treatment, and disposal of the sediment, water, and incidental soil in Impoundments C and D. DOE will submit the recommended methodology to EPA and TDEC. A contract will be awarded by December 1, 1998, and substantial remedial actions will begin by December 31, 1998.

In fiscal year 1998, administrative issues regarding the final disposal location for waste from Impoundments A and B will be resolved. If no disposal facility is available, DOE will present an alternate approach to the public. If a facility is available, DOE will issue a request for proposals for removal, treatment, and disposal of sediment, water, and incidental soil in Impoundments A and B. DOE will submit the recommended proposal to EPA and TDEC.

STATUTORY DETERMINATIONS

Under CERCLA Section 121, selected remedies must be protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified and granted), be cost-effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. CERCLA includes a preference for remedies that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element.

PROTECTION OF HUMAN HEALTH AND ENVIRONMENT

The selected remedy protects human health and the environment by removing the source sediment contaminants at the SIOU; preventing the continued migration of contaminants from the SIOU; and designating the Bethel Valley watershed decision-making process to appropriately address any residual contamination remaining at the site.

COMPLIANCE WITH ARARS

The selected remedy will meet all ARARs, which are summarized here and listed in Table 2.3.

Chemical-specific requirements set health- or risk-based concentration limits or discharge limitations in various environmental media for specific hazardous substances, pollutants, or contaminants. These requirements generally set protective cleanup levels for the chemicals of concern in the designated media or indicate a safe level of discharge that may be incorporated when considering a specific remedial activity. There are no specified cleanup levels for SIOU because the scope of the action is limited to source removal of contaminated sediments; residual contamination of surrounding media will be addressed as part of the Bethel Valley watershed project.

Table 2.3. ARARs and TBCs for remedial action at SIOU, ORR, Oak Ridge, Tennessee

Action	Requirement	Prerequisites	Citation
	Location-specific		
	Action(s) that will affect such resources must adhere to the DOE/ORO Programmatic Agreement (May 6, 1994). When alteration or destruction of the resource is unavoidable, steps must be taken to minimize or mitigate the impacts and to preserve data and records of the resource	Any action that will impact historic or archaeologic resources—**applicable**	National Historic Preservation Act (16 USC 470a-w) EO 11593; 36 CFR 800 DOE/ORO Programmatic Agreement (May 6, 1994) (TBC)
	Chemical-specific		
Control of radionuclide emissions	Exposures to members of the public from all radiation sources released into the atmosphere shall not cause an EDE to be > 10 mrem (0.1 mSv)/year	Point source discharge of radionuclides into the ambient air from a DOE facility—**applicable**	40 CFR 61.92 Rules of the TDEC 1200-3-11-.08
	Radiological emission measurements must be performed at all release points with a potential to discharge radionuclides into the air in quantities that could cause an EDE in excess of 1% of the standard (0.1 mrem/year). All radionuclides that could contribute > 10% of the standard (1 mrem/year) for the release point shall be measured		40 CFR 61.93 Rules of the TDEC 1200-3-11-.08
Protection of the public	DOE will carry out all DOE activities to ensure that radiation doses to individuals are ALARA	Release of radionuclides into the environment—**TBC**	DOE Order 5400.5(I.4) 10 CFR 834 (proposed)
	Exposures to members of the public from all radiation sources shall not cause an EDE to be > 100 mrem (1 mSv)/year		DOE Order 5400.5(II.1a) 10 CFR 834 (proposed)
	Action-specific		
Surface water control	Implement good site planning and best management practices to control stormwater discharges including: • documentation of best management practices in a stormwater control plan or equivalent	Control of stormwater discharges associated with construction activities at industrial sites that result in a disturbance of > 5 acres of total land area. For those sites with < 5 acres affected—**relevant and appropriate**	40 CFR 122 Rules of the TDEC 1200-4-10-.05

Table 2.3. (continued)

Action	Requirement	Prerequisites	Citation
	• minimal clearing for grading • removal of vegetation cover only within 20 days of construction • weekly erosion control inspections and maintenance • control measures to detain runoff • discharges that do not cause erosion		
Fugitive emissions from excavation activities	Take reasonable precautions to prevent particulate matter from becoming airborne; no visible emissions are permitted beyond property boundary lines for more than 5 minutes/hour or 20 minutes/day. Potential nonpoint sources of fugitive emissions are included in the plant-wide fugitive emissions plan	Nonpoint source air emissions—**applicable**	Rules of the TDEC 1200-3-8-.01
Characterization/management of excavated wastes, PPE and other secondary wastes streams generated during remediation	A person who generates solid waste must determine whether that waste is hazardous using various methods, including application of knowledge of hazardous characteristics of the waste based on information about the materials or processes used	Wastes generated during activities potentially contaminated with RCRA-characteristic waste—**applicable to secondary wastes from remediation of Impoundments C and D if further sampling indicates the wastes are RCRA-characteristic**	40 CFR 262.11 Rules of the TDEC 1200-1-11-.03(1)(b)
	All RCRA-restricted waste generated during remedial activities must be treated to meet LDR before land disposal		40 CFR 268.40 Rules of the TDEC 1200-1-11-.10(3)(a)
	LLW generators must characterize and segregate LLW from uncontaminated waste and otherwise minimize the amount of LLW generated. Subsequent management of LLW must be accordance with DOE Order 5820.2A	Generators of LLW—**TBC**	DOE Order 5820.2A(III.3)

Table 2.3. (continued)

Action	Requirement	Prerequisites	Citation
Treatment of RCRA-characteristic waste	Must treat to meet LDRs for those RCRA-characteristic wastes	Wastes that are determined to be RCRA-characteristic wastes—**applicable to remediation of Impoundments C and D if further sampling indicates the wastes are RCRA-characteristic**	40 CFR 268
	Where a treatment technology specified in 40 CFR 268 is not appropriate to the waste, the generator may apply for a treatability variance to comply with LDRs	Hazardous wastes (soils) for which the technology specified in 40 CFR 268 is inappropriate—**applicable to remediation of Impoundments C and D if further sampling indicates the wastes are RCRA-characteristic**	40 CFR 268.44
Treatment of contaminated soil and sediment to meet the disposal requirements of 40 CFR 761.60(a)(4)	The regional administrator may approve an alternate disposal method that can achieve a level of performance equivalent to incineration or high-efficiency boilers	Disposal of PCB-contaminated soil and sediment—**applicable to remediation of Impoundments C and D** if further sampling indicates the wastes contain PCBs above 50 ppm	40 CFR 761.60(e)
Tank requirements for treatment	Ensure that existing and new tanks have sufficient structural strength and are compatible with the waste to prevent collapse or rupture	Storage or treatment of RCRA-characteristic waste in a tank—**applicable to treatment of Impoundments C and D wastes if further sampling indicates the wastes are RCRA-characteristic**	40 CFR 264.191-192 Rules of the TDEC 1200-1-11-.06(10)(b)-(c)
	Ensure that waste is compatible with the tank material unless the tank is protected by a liner or by other means		40 CFR 264.191 Rules of the TDEC 1200-1-11-.06(10)(b)
	Provide tanks with secondary containment and controls to prevent overfilling and maintain sufficient freeboard in open tanks to prevent overtopping by wave action or precipitation		40 CFR 264.193–194 Rules of the TDEC 1200-1-11-.06(10)(d)-(e)
	Inspect the following: overfilling control, control equipment, monitoring data, waste level (for uncovered tanks), tank condition, above-ground portions of tanks (to assess their structural integrity), and the area surrounding the tank (to identify signs of leakage)		40 CFR 264.195 Rules of the TDEC 1200-1-11-.06(10)(f)

Table 2.3. (continued)

Action	Requirement	Prerequisites	Citation
	Repair any corrosion, crack, or leak		40 CFR 264.196 Rules of the TDEC 1200-1-11-.06(10)(g)
	At closure, remove all hazardous waste and hazardous waste residues from tanks, discharge control equipment, and discharge confinement structures		40 CFR 264.197(a) Rules of the TDEC 1200-1-11-.06(10)(h)
Closure of impoundments	Remove or decontaminate all waste residues, contaminated containment system components (liners, etc.), contaminated subsoils, and structures and manage them as hazardous wastes	Closure of surface impoundments—**relevant and appropriate to closure of Impoundments C and D if further sampling indicates the wastes are RCRA-characteristic**	40 CFR 264.228(a)(2)(1) Rules of the TDEC 1200-1-11-.06(11)
Transportation to disposal facility	The waste must meet packaging, labeling, marking, placarding, and pretransport requirements in accordance with DOT regulations	Transportation of hazardous and radioactive materials above exempt quantities—**applicable**	49 CFR 171, 172, 173, 174, 177, 178, and 179; DOE Order 460.1 (TBC)
	Waste must meet packaging requirements based on the maximum activity of radioactive material in a package	Packaging of radioactive materials above exempt quantities for public transport—**applicable**	49 CFR 173.431; 49 CFR 173.433; 49 CFR 173.435; 49 CFR 173.411
	Waste must be marked with hazardous waste marking, generator's name and address, and the manifest docket number	Transportation of hazardous waste in containers of 110 gal or less—**applicable to transport of Impoundments C and D wastes if further sampling indicates the wastes are RCRA-characteristic**	40 CFR 262.32(b) Rules of the TDEC 1200-1-11-.03(4)
	Shipment must be manifested according to 40 CFR 262 and 263	Transportation of hazardous waste for off-site treatment, storage, or disposal—**applicable to transport of Impoundments C and D wastes if further sampling indicates the wastes are RCRA-characteristic**	40 CFR 262 Subpart B 40 CFR 263 Subpart B Rules of the TDEC 1200-1-11-.03 Rules of the TDEC 1200-1-11-.04
	Generators must certify before shipment that the waste meets the waste acceptance criteria of the receiving facility	Waste shipped from one field organization to another for disposal—**TBC**	DOE Order 5820.2A(III)

Table 2.3. (continued)

Action	Requirement	Prerequisites	Citation
	LLW must be disposed of on site; if off-site disposal is required due to lack of capacity, disposal must be to a DOE facility	Shipments of LLW—TBC	DOE Order 5820.2A
	Off-site disposal of LLW to a commercial facility requires an exemption from the on-site disposal requirements of DOE Order 5820.2A; requests for exemption must be approved by the DOE ORO. Must meet DOE Order and implementing procedural requirements for off-site shipments	Shipments of LLW—TBC	DOE Order 5820.2A

ALARA = as low as reasonably achievable
ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
DOE = U.S. Department of Energy
DOT = U.S. Department of Transportation
EDE = effective dose equivalent
EO = Executive Order
> = greater than
gal = gallon
< = less than
LDR = land disposal restriction
LLW = low-level (radioactive) waste
mrem = millirem
mSv = millisievert
ORO = Oak Ridge Operations
ORR = Oak Ridge Reservation
% = percent
PCB = polychlorinated biphenyl
PPE = personal protective equipment
ppm = parts per million
RCRA = Resource Conservation and Recovery Act of 1976
SIOU = Surface Impoundments Operable Unit
TBC = to be considered
TDEC = Tennessee Department of Environment and Conservation
USC = *United States Code*

Chemical-specific ARARs for SIOU consist of limits on radionuclide emissions. Subpart H of 40 CFR 61 addresses atmospheric radionuclide emissions from DOE facilities and will be applicable to airborne emissions during remedial activities. EPA has issued a final National Emission Standards for Hazardous Air Pollutants rule that limits emissions of radionuclides to the ambient air from DOE facilities to amounts that would not cause any member of the public to receive an effective dose equivalent of 10 mrem/year or more (40 CFR 61.92). 40 CFR 61.93(b)(4)(i) requires radiological emission measurements at all release points with a potential to discharge radionuclides into the air in quantities that could cause an effective dose equivalent in excess of 1 percent of the standard (0.1 mrem/year). All radionuclides that could contribute > 10 percent of the standard (1 mrem/year) for a release point shall be measured. TDEC has proposed an equivalent rule in *Rules of the Tennessee Department of Environment and Conservation*, Chapter 1200-3-11. Containment and filtration of emissions as needed during treatment will be required, and dust control measures discussed under the "Fugitive Emissions" heading will prevent unacceptable emissions of radionuclides during remedial action at SIOU.

To-be-considered guidance from DOE Order 5400.5, "Radiation Protection of the Public and the Environment," of February 8, 1990, limits exposures to an effective dose equivalent of 100 mrem/year from all exposure pathways and all DOE sources of radiation. The overriding principle of the DOE Order is that all releases of radioactive material shall be as low as reasonably achievable.

Location-specific requirements set restrictions on the concentration of hazardous substances or the conduct of activities solely because they are in special locations. Based on current information for SIOU, the only condition or resource present on or near SIOU that would trigger location-specific ARARs is that SIOU is located within an historic district. The mitigation requirements associated with cultural resources and consultation with the State Historic Preservation Office have already been satisfied.

Performance, design, or other action-specific requirements set controls or restrictions on particular kinds of activities related to the management of hazardous waste. Selection of a particular remedial action at a site will invoke action-specific ARARs that may specify particular performance standards or technologies, as well as environmental levels for discharged or residual chemicals. The following text summarizes the action-specific ARARs triggered by various types of activities anticipated during implementation of the remedial action.

Stormwater Runoff

Stormwater discharges from industrial site activities involving construction operations that result in the disturbance of 2 ha (5 acres) of land or more have been included in the final rule for the National Pollutant Discharge Elimination System (NPDES) permits for stormwater discharges and incorporated into the TDEC permitting regulations [40 CFR 122; Rules of the TDEC 1200-4-10-.05]. Stormwater discharge requirements are applicable if 2 ha (5 acres) or more are disturbed; otherwise, they are relevant and appropriate requirements. Compliance with the substantive requirements of the NPDES permitting process for stormwater discharges during construction activities (Rules of the TDEC 1200-4-10-.05) will be required. In particular, implementation of good site planning and best management practices to control stormwater discharges will be required. Stormwater flow controls such as berms, silt fences, hay bales, and other best management practices will be followed during implementation of the selected remedy to comply with stormwater runoff ARARs.

Fugitive Emissions

Elevation of airborne particulate concentrations could result if excavation at SIOU were not controlled. The TDEC Air Pollution Commission has promulgated applicable requirements in Rules of the TDEC 1200-5-8-.010, for the control of fugitive dust. An operator must take reasonable precautions to prevent particulate matter from becoming airborne. In addition, fugitive dust may not be released as a visible emission beyond property boundary lines for more than 5 minutes/hour or 20 minutes/day. To ensure compliance with the ORNL site air permit and to meet the substantive requirements of fugitive dust emissions, dust suppression measures (such as water, organic agents, or foams sprayed over the area of concern to prevent dust generation) combined with ambient air monitoring stations shall be used as a best management approach for activities during SIOU remediation.

Treatment of Surface Water Removed from SIOU

All waters removed from the impoundments during remedial activities will be sent to PWTP. The water must first be tested to ensure it meets the WAC for PWTP, and if necessary, treated before being sent to the facility. PWTP is a part of a permitted NPDES. If PWTP cannot accept any of the water, a contingency is to use a package treatment plant consisting of zeolite ion exchange canisters and from there transferring the water to the Nonradiological Waste Treatment Plant. Any spent zeolite packs must be characterized, and if necessary, managed and disposed of as a hazardous waste in accordance with 40 CFR 261, 262, and 263 or as a mixed waste under the Commissioner's Order for the site treatment plan, Section 105 of the FFA, and DOE Order 5820.2A, "Radioactive Waste Management."

Treatment of Sediments from Impoundments C and D

Sediments and incidental soils from Impoundments C and D will be treated using an alternate method of disposal per 40 CFR 761.60(e). An alternate method of disposal is required because no TSCA-permitted incinerators or permitted chemical-waste landfills are currently available that can also accept the radiological and potentially RCRA-contaminated sediments. The alternate method of disposal has not yet been finalized; however, chemical dechlorination is the method used in the cost estimate for the selected remedy. Treatment systems must be evaluated to determine the destruction efficiency for PCBs in the sediments. If a method other than chemical dechlorination is used, it will be reviewed and approved by EPA and TDEC with appropriate documentation. Protectiveness of human health and the environment will be paramount in selection of the alternate method of disposal. EPA guidance requires that PCBs be destroyed to a level of < 2 ppm to demonstrate equivalency of performance with a TSCA-permitted incinerator. Once destruction requirements for PCBs have been met, the sediments will exit TSCA regulatory authority and be eligible for disposal at Envirocare as a mixed waste, if all other WAC are met.

Proposed revisions to the TSCA rules, if finalized before implementation of the remedial action, would allow destruction to risk-based level [proposed Sect. 761.61(c)] or disposal in a landfill that has been deemed protective (proposed Sect. 761.62). Should methodology capable of the required efficiency be unavailable for environmental media such as the sediments, the remaining wastes would of necessity be stored until suitable treatment and disposal facilities are developed.

The sediments from Impoundments C and D may also be RCRA-characteristic waste. The sediments and incidental soils must be properly characterized per 40 CFR 261. If the sediments are a RCRA-hazardous waste, land disposal restrictions (LDRs) (40 CFR 268) will be legally applicable for disposal of the wastes at an off-site facility. The sediments will then be treated to meet LDRs and any other disposal facility WAC. Treatability variances may be required for some of the potential RCRA constituents. If so, the EPA guidance for obtaining and complying with treatability variances for soil contaminated with RCRA-hazardous wastes for which treatment standards have already been set will be followed (Office of Solid Waste and Emergency Response Directive 9347.3-06FS, July 1989). Tanks associated with treatment of the RCRA wastes must comply with RCRA tank requirements in 40 CFR, Subpart J. Requirements such as secondary containment and closure of a tank system are included here.

Stabilization of Sediments from Impoundments A and B

Stabilization of sediments and incidental soils from Impoundments A and B will involve requirements for physically stabilizing the wastes such that the waste can pass the paint filter test per RCRA, Subtitle D, and can meet WAC of NTS or other disposal facilities. In addition, sufficient shielding of the radiological activity must be provided that all other requirements for transportation, worker safety, public exposure limits, and disposal facility WAC are met.

Closure of Impoundments

The SIOU scope includes removal and treatment of the sediments and surface water of the impoundments. Remediation of incidental soils is included only as necessary to support remediation of the sediments. Contaminated subsoils surrounding the impoundments will be addressed as part of the Bethel Valley watershed operable unit (OU) and will be included with actions for other subsoils. Thus, requirements for closure with waste in place, while relevant, are not appropriate.

Transportation of Waste to Off-Site Disposal

Mixed or low-level wastes will be generated during the SIOU remediation. In accordance with DOE Order 5820.2A, radioactive waste is to be disposed of on the site where it is generated if possible; if off-site disposal is necessary because of lack of on-site capacity, disposal must be at another DOE facility. Disposal capabilities for the SIOU sediments do not exist on ORR. Thus, the selected remedy provides for off-site disposal of the sediments.

DOT requirements for shipping and packaging (49 CFR 172 and 175) and for transport on a public highway (49 CFR 177) of hazardous materials will be applicable to remedial actions at SIOU. General requirements for shipping hazardous materials are defined in 49 CFR 172, with specific marking, labeling, and placarding regulations for radioactive materials in 49 CFR 172.510, 172.405, and 172.556, respectively.

Regulations governing transportation of hazardous materials by public highway are found in 49 CFR 177, and specific loading and unloading requirements for radioactive materials are in 49 CFR 177.842. The number of packages in any one motor vehicle must be limited so that the total transport index number does not exceed 50. The total transport index is the sum of the numbers expressing the maximum radiation level in millirems per hour at 1 m (3.3 ft) from the external surface of each package (49 CFR 173.403bb).

EPA and TDEC regulations governing generators and transporters of hazardous waste found in 40 CFR 262-263 and Rules of the TDEC 1200-1-11-.03 to .04, are also ARAR for

remedial activities at the SIOU. Rules of the TDEC 1200-1-11-.03 (40 CFR 262) requires generators to ensure and document that the hazardous waste they generate is properly identified and transported to a treatment, storage, and disposal facility.

Requirements for manifesting [Rules of the TDEC 1200-1-11-.03(3); 40 CFR 262.20–23], packaging, labeling, marking, and placarding [Rules of the TDEC 1200-1-11-.03(4); 40 CFR 262.30–33] will be followed. In addition, there are record-keeping and reporting requirements [Rules of the TDEC 1200-1-11-.03(5); 40 CFR 262.40–43]. Pretransport requirements referenced under DOT regulations 49 CFR 172, 173, 178, and 179 are also applicable.

Off-Site Disposal of Low-Level Wastes

CERCLA Section 121(d)(3) requires that the off-site transfer of any hazardous substance, pollutant, or contaminant generated during CERCLA response actions be to a facility that is in compliance with RCRA and applicable state laws. EPA has established procedures and criteria at 40 CFR 300.440 for determining whether facilities are acceptable for the receipt of off-site waste. Once wastes generated from a CERCLA response action are transferred off site, all administrative as well as substantive provisions of all applicable requirements must be met.

An off-site disposal facility holding a Nuclear Regulatory Commission agreement state permit will be used for disposal of sediments from Impoundments A and B. The wastes must also meet the acceptance criteria of the off-site disposal facility. If the sediments from Impoundments C and D are RCRA hazardous, they would be treated to meet LDRs before disposal. After destruction of PCBs and treatment to remove RCRA characteristics, the sediments would be disposed of as low-level waste.

Decontamination of Equipment

Decontamination activities will include washing equipment and collecting the decontamination water with temporary sumps connected to PWTP. The decontamination water must meet WAC for this facility before treatment.

Institutional Controls

Institutional controls will remain in place for SIOU until superseded by the Bethel Valley watershed ROD. No regulatory requirements specify institutional controls for CERCLA units.

For the containment and long-term management of residual contamination at inactive hazardous waste sites, Rules of the TDEC 1200-1-12-.08(3)(a)4.(iv) controls are to include, at a minimum, deed restrictions for sale and use of the property and securing the area to prevent

human contact with hazardous substances. Also, RCRA contains general requirements for institutional controls following closure of RCRA units (40 CFR 264.14), which are relevant and appropriate for any RCRA waste left on site. Although residual contamination will remain in the surrounding media, these requirements have not been included as ARARs for SIOU because removal of the sediments will not leave waste in place as defined by the scope of this action.

DOE Order 5400.5, Chapter IV, requires administrative (institutional) controls for long-term management in areas containing residual radioactivity above guidance levels based on basic dose limits in the DOE Order.

These and other measures mandated by health and safety standards will continue to protect workers and the public after remedial action at SIOU is completed and pending remedial action on the Bethel Valley watershed OU.

COST EFFECTIVENESS

Actions taken under CERCLA must consider the estimated total present-worth cost of alternatives. Alternative 6 costs more than Alternative 3 but meets regulatory requirements and reduces risk to human health and the environment to acceptable levels. Removal and disposal of the waste per Alternative 6 will allow beneficial reuse of the site and offset some of the cost. Alternative 6 is considered a cost-effective remedy for the protection of human health and the environment.

USE OF PERMANENT SOLUTIONS TO THE MAXIMUM EXTENT PRACTICABLE

The selected remedy represents the maximum extent to which permanent solutions can be used in a cost-effective manner for the SIOU sources at this time. Of the remediation alternatives, the selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. The impact of any residual contamination will be assessed in the Bethel Valley ROD; additional action could be taken pursuant to that decision.

PREFERENCE FOR TREATMENT

CERCLA Section 121 establishes a preference for alternatives that use treatment to permanently reduce toxicity, mobility, or volume of hazardous substances. The selected remedy will use stabilization/solidification to reduce mobility of the contamination in the waste removed

from Impoundments A and B. If sampling results indicate that treatment of waste removed from Impoundments C and D is needed to meet TSCA regulations or disposal facility WAC, permanent reductions of toxicity or mobility could result from implementation of the selected remedy.

The selected remedy, therefore, meets the CERCLA preference for treatment.

EXPLANATION OF SIGNIFICANT CHANGES

The proposed plan, which was released for public comment on June 30, 1997, identified Alternative 6 as the preferred alternative. DOE received oral comments during the public meeting on July 15, 1997, and written comments as documented in the "Responsiveness Summary." DOE, EPA, and TDEC reviewed the comments and determined that no significant changes to the remedy, as originally identified in the proposed plan, were necessary.

REFERENCES

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PART 3. RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

This responsiveness summary serves three major purposes. First, it informs DOE, EPA, and TDEC of community concerns about the site and the community's preferences regarding the proposed remedial alternative. Second, it demonstrates how public comments are integrated into the decision-making process. Finally, it allows DOE to formally respond to public comments.

This responsiveness summary documents all public comments on the *Proposed Plan for the Surface Impoundments Operable Unit, Oak Ridge, Tennessee* (DOE 1997a). The proposed plan was issued in June 1997; the public comment period was June 30–July 30, 1997. DOE announced the availability of the proposed plan in *The Knoxville News-Sentinel, The Roane County News,* and *The Oak Ridger* June 30, 1997. A public meeting was held July 15, 1997. Comments made during the public meeting and those received in writing during the public comment period are addressed here.

This summary is prepared pursuant to the terms of the 1992 FFA among DOE, EPA, and TDEC, as well as other requirements, including:

- CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986; 42 USC, Section 9601, et seq.;
- NCP, 40 CFR 300.430; and
- *Community Relations in Superfund, A Handbook* (Yu et al. 1993).

COMMENTS AND RESPONSES

This section will be prepared following the July 30, 1997, close of the public comment period.