United States Department of Energy
Environmental Restoration Program

DOE/OR/02-1427&D2

Proposed Plan for Surface Impoundments Operable Unit, Waste Area Grouping 1, Oak Ridge National Laboratory, Oak Ridge, Tennessee

August 1996

This Proposed Plan Describes:

- The Surface Impoundments Operable Unit
- Current and future risks to human health and the environment
- Remedial action alternatives considered
- The U.S. Department of Energy preferred alternative
- How to participate in the selection/modification of the preferred alternative
- Where to get more information

Your opinion is invited

The U.S. Department of Energy invites you to express your opinion of its preferred alternative for environmental restoration of the Surface Impoundments Operable Unit. This report tells how to obtain further information. Interested citizens are encouraged to read the remedial investigation and feasibility study reports for additional background, more detailed technical information, and regulatory history. A form has been attached for comments, but you are not restricted to the form. Any written comments will be considered by the decision makers.

The reports and other documents are available at the Information Resource Center, 105 Broadway Avenue, Oak Ridge, Tennessee.

Hours: Monday–Friday
7:30 a.m.–5:30 p.m.
Telephone: (423) 241-4582

Public Comment Period

(Date) to (Date)

Public Meeting

(Date)
(Time)
(Location)

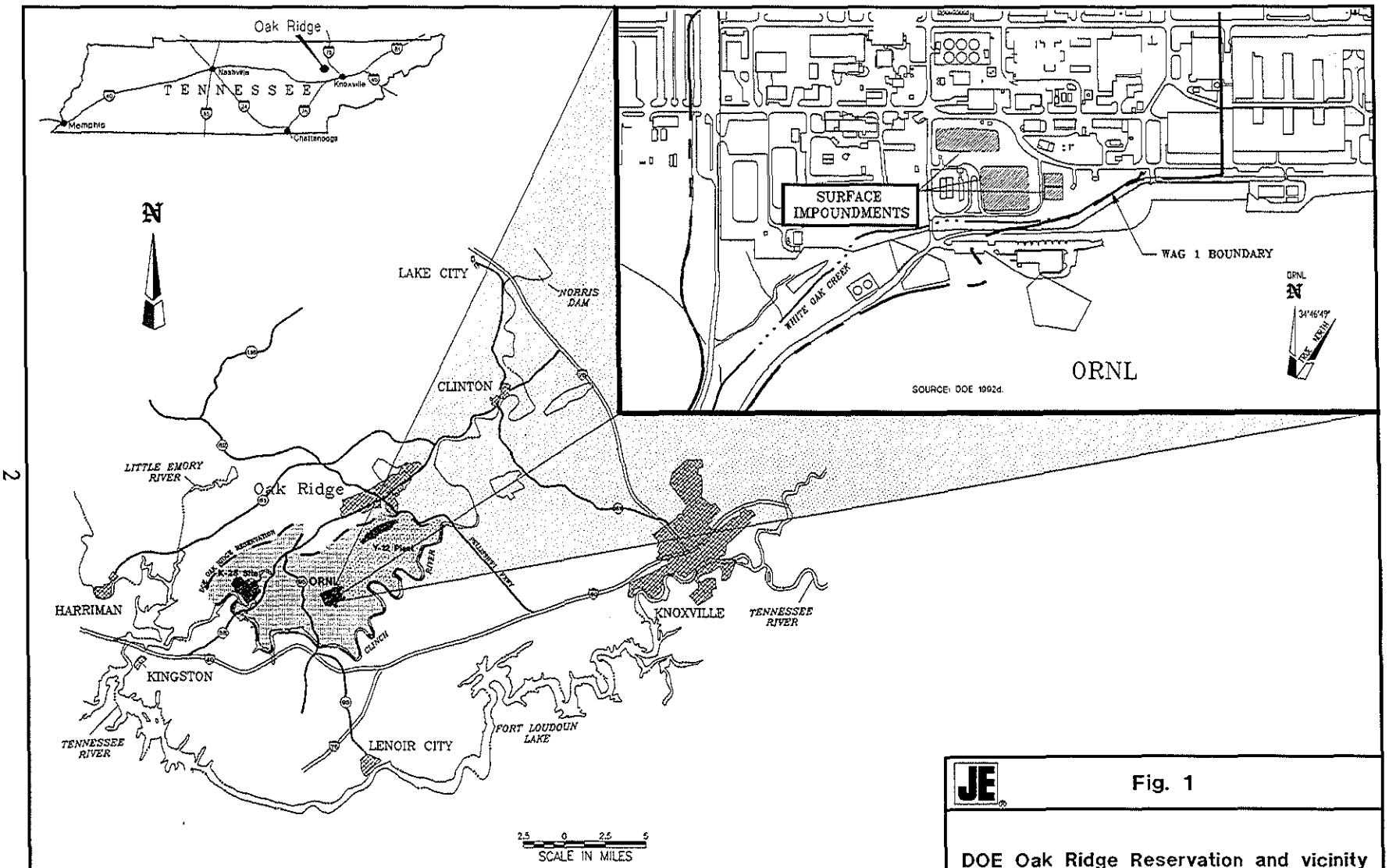
INTRODUCTION

This proposed plan identifies the U.S. Department of Energy's (DOE's) preferred alternative for protecting human health and the environment from the effects of contaminated sediments within the Surface Impoundments Operable Unit (SIOU). SIOU is part of Waste Area Grouping (WAG) 1 of the Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee (Fig. 1). This operable unit is located in the south-central part of the main ORNL plant area, just north of White Oak Creek. The SIOU consists of two lined and two unlined impoundments used as part of the ORNL waste management system to receive and contain various liquid waste streams containing radiological and hazardous constituents.

Investigations of the sediments in the impoundments indicate that they pose a potential risk to human health and the environment. This plan presents summaries of the remedial alternatives analyzed and considered for the site. This plan is being issued as part of the public participation requirements under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

This proposed plan acquaints the public with issues relating to contaminated sediments within the SIOU and offers the public an opportunity to participate in the selection or modification of the preferred alternative for remediation of this site. A 30-day public comment period has been designated for review and comment on this proposed plan. A public meeting is scheduled to discuss the cleanup alternatives and address any questions and concerns the public may have about the preferred alternative. The shaded boxes on this page and on page 13 describe how to participate in the process and how to obtain additional information.

This plan is based on the results of a remedial investigation (RI)/feasibility study (FS) report (DOE/OR/02-1346&D2, November 1995). The RI characterizes the nature and extent of contamination associated with the SIOU sediments and examines present and future risks, based on this information. The FS identifies a range of alternatives developed by screening and evaluating available technologies and comparing those alternatives against the



MODIFIED FROM: DOE 1993.

Fig. 1

DOE Oak Ridge Reservation and vicinity

DOE - ORNL, WAG 1 Surface Impoundments - Oak Ridge, Tennessee

DOCUMENT ID: 35H830 0040-20 / PPLAN	DRAWING ID: 96-12352.DWG	DRAWING DATE: JUNE 18, 1996 TG

2

remedy selection criteria in the National Contingency Plan [40 *Code of Federal Regulations* (CFR) 300.430].

This plan summarizes the alternatives and presents DOE's preferred alternative. Public comments are requested for all alternatives considered, in addition to DOE's preferred alternative. The preferred alternative may be modified, or a different alternative selected, as a result of public input. After the public comment period and consideration of public response, DOE will prepare a record of decision (ROD) presenting the selected remedy and will forward the ROD to the U.S. Environmental Protection Agency (EPA) and to the Tennessee Department of Environment and Conservation (TDEC) for final approval. After the three parties approve and issue the ROD, DOE will prepare an action plan and will implement remedial actions at SIOU.

SITE BACKGROUND

The SIOU is within the DOE Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee. ORNL is one of three major DOE installations at ORR and is subdivided into various WAGs. SIOU is part of WAG 1 and consists of Impoundment 3524, Impoundment 3513, and Impoundments 3539 and 3540. The SIOU is in the south-central part of ORNL's main plant area, north of White Oak Creek (Fig. 2).

The impoundments were used as part of ORNL's waste management system. They contain radiologically and chemically contaminated sediments. The two larger impoundments (3513 and 3524) are unlined and release contaminants to the environment because of groundwater intrusion. A water cover is maintained over the sediments within these two impoundments to provide radiation shielding and to prevent airborne release of sediments.

Various chemical and radiological substances were released into the environment during past operations at the impoundments. However, contaminant releases of the magnitude that occurred in the past no longer take place. Current activities are closely monitored for compliance with state and federal environmental laws.

The chemicals of concern identified in the SIOU sediments are n-nitroso-di-n-propylamine, mercury, zinc, Aroclor-1254, and Aroclor-1260. The principle radionuclides of concern and their estimated content (in curies) are ^{241}Am (3.1), ^{137}Cs (133), ^{60}Co (1.3), ^{238}Pu (0.3), ^{239}Pu (6.6), and ^{90}Sr (36).

Impoundment 3524

Impoundment 3524 was built in 1943 for short-term storage of wastewater and to allow for final precipitation of radioisotopes before discharge to White Oak Creek. Initially this impoundment consisted of two unlined impoundments separated by a berm. In the early 1950s, the berm separating the two impoundments was removed, forming one impoundment that received process wastewater only. From 1949 until 1957, effluent from Impoundment 3524 was pumped to Impoundment 3513. In 1957, the Process Waste Treatment Plant was placed on line, and Impoundment 3524 was used as an equalization basin for intermediate storage and collection of process wastewater for the treatment plant until 1989. Recently, it was used as an emergency storage basin to provide backup overflow capacity for the process wastewater storage tanks during storms. This impoundment is no longer needed as backup for overflow because of completion of the Surge Tank Project in June 1996.

Impoundment 3513

Impoundment 3513 was built in 1944 as a settling basin for various low-level radioactive waste streams that were diluted with process wastewater. It is an unlined impoundment excavated into natural clay. From 1944 until 1947, excess water within the impoundment exited through pipes on the impoundment's southern berm directly into White Oak Creek. These pipes were plugged in 1947. From 1957 until 1976, this impoundment received waste that did not require treatment in the Process Waste Treatment Plant. Wastewater exiting the Process Waste Treatment Plant was also discharged into the impoundment to allow settling of particulates. The impoundment was taken out of service in 1976 and is currently not in use. Periodic seeps through the southern berm to White Oak Creek have appeared, but corrective actions are being taken to mitigate this problem until a final remedy for the impoundments is completed.

Impoundments 3539 and 3540

Impoundments 3539 and 3540 are lined impoundments that were built in 1964 to receive process wastewater from Building 4500. The

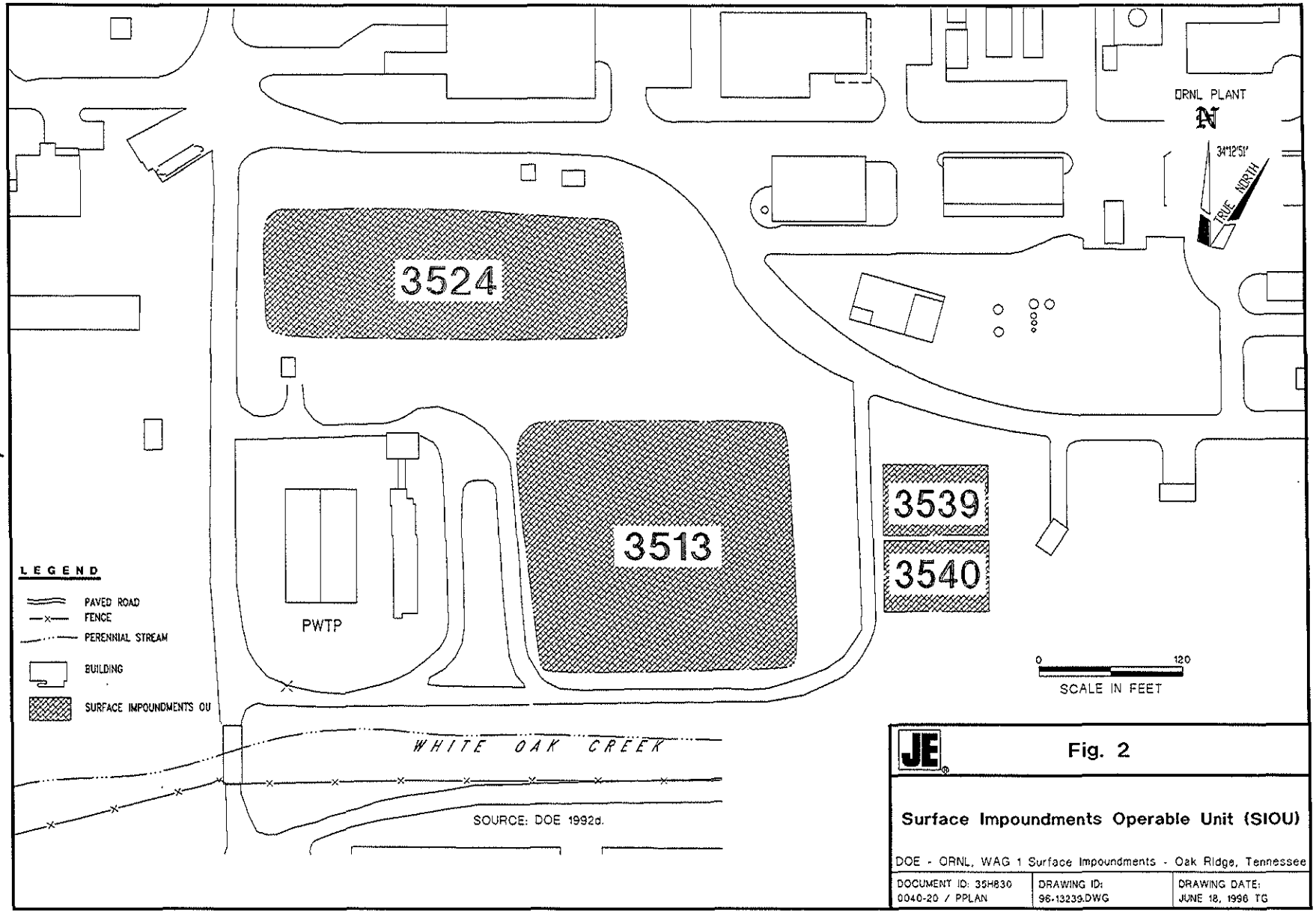


Fig. 2

Surface Impoundments Operable Unit (SIOU)

DOE - ORNL, WAG 1 Surface Impoundments - Oak Ridge, Tennessee

DOCUMENT ID: 35H830 0040-20 / PPLAN	DRAWING ID: 96-13239.DWG	DRAWING DATE: JUNE 18, 1996 TG

process waste was ultimately discharged into White Oak Creek after verifying radionuclide content and pH adjustments of the water in the ponds. Wastewater from Building 4500 exceeding acceptable limits was pumped to Impoundment 3524 before treatment at the Process Waste Treatment Plant. These impoundments were taken out of service in 1990, but they were also available as backup overflow capacity for the process wastewater storage tanks during storms. As is the case with Impoundment 3524, these impoundments are no longer needed as backup for overflow because of completion of the Surge Tank Project in June 1996.

SCOPE AND ROLE OF THE OPERABLE UNIT

This operable unit only addresses remediation of water and sediments within the impoundments to control current and future releases to groundwater, surface water, and the air. Groundwater and surface soils within the boundaries of SIOU will be addressed by other CERCLA actions outside the scope of SIOU actions. Other sources in WAG 1 also contribute to groundwater contamination and surrounding soils could be recontaminated from contaminant migration from these sources.

The goal for remediation of this operable unit is to reduce potential risks to human health and the environment from surface water and sediment within SIOU to acceptable levels.

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 receptors (i.e., fish and daphnids in White Oak Creek) and piscivorous wildlife receptors (i.e., mink and belted kingfisher). Risk and hazards were calculated using current contaminant concentrations, and contaminant concentrations were modeled for future, likely exposure locations. Contaminant exposure was estimated for wildlife feeding from SIOU, White Oak Creek, White Oak Dam, and Clinch River. Estimated contaminant concentrations were compared to a series of benchmarks based upon National Ambient Water Quality Criteria, no observed adverse effect levels, lowest observed adverse effect levels, and chronic dose benchmarks.

No toxicity benchmarks were exceeded for aquatic receptors in White Oak Creek and at White Oak Dam for the current exposure scenario. However, benchmarks were exceeded for aquatic receptors in White Oak Creek and at White Oak Dam based on estimated future contaminant concentrations if releases from the impoundments are allowed to continue. Mercury concentrations in fish at SIOU resulted in unacceptable risks to minks and kingfishers eating those fish for current and future exposure scenarios. In addition, radiation doses to a mink exposed to the sediment in the impoundments would exceed the chronic dose benchmark for current and future exposure scenarios.

Human Health Radiological Risks

Radiation levels in the sediments at SIOU are extremely hazardous. Without the water cover on the impoundments 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 enforces strict institutional and engineering controls that mitigate against uncontrolled human exposures to contaminants within SIOU. Risks to current employees at ORNL and possible off-site human receptors are mitigated because institutional controls are currently in place (such as 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).

DOE mandates institutional controls to ensure regulatory compliance concerning exposures to on-site individuals and to prevent 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 a 5-day period during which the water cover over Impoundment 3524 is lost. Risks to on-

site employees and residents, primarily from external exposure to gamma radiation, range up to 8×10^{-4} and 2×10^{-1}, respectively. These risks exceed the EPA target risk range.

Potential future off-site residents also have unacceptable risks from radioactive contaminants should institutional controls be lost. For these receptors, the main risk is inhalation of wind-blown particulates derived from the sediments assuming a 5-day period when the sediments are dry. 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. Although there is significant uncertainty in the data and assumptions used to estimate these risks, sufficiently conservative assumptions were used so that it is very unlikely that the risks are underestimated. However, this degree of conservatism is not considered inappropriate. Even if risks are 100 times less than estimated, they remain unacceptable, and remediation is still warranted.

If uncontrolled, the principle short-lived radionuclides of concern (^{90}Sr, ^{137}Cs, and ^{60}Co) are expected to present unacceptable risks for hundreds of years. The principle 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

Institutional controls mandated by DOE mitigate current risks to human receptors. Chemical carcinogenic risks to current and future on-site employees were calculated to be acceptable, as were risks to future residents at Clinch River.

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 and at White Oak Dam. Risks from residential use of surface water were estimated to be 2×10^{-3} at White Oak Creek and 8×10^{-4} at White Oak Dam.

Chemical carcinogenic risks calculated for the exposure scenarios were always less significant than radiological risks. 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. Actions taken to reduce radiological risk would effectively reduce all chemical risks.

SUMMARY 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' berm, and embankments; and
- prevent the bioaccumulation of contaminants in ecological receptors.

The alternatives evaluated ranged from no action to complete removal of contaminated sediments and 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:

- 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 5A—off-SIOU consolidation cell
- Alternative 5B—Oak Ridge Reservation disposal cell
- Alternative 6—removal, treatment, and off-site disposal

After the FS for SIOU was issued, a separate CERCLA action was initiated to consider the practicality of developing a mixed waste landfill on the ORR. This disposal cell would be designed to accept wastes from all nearby DOE environmental restoration projects, as well as currently generated processing wastes from ORNL, the Oak Ridge Y-12 Plant, and the Oak Ridge K-25 Site. Although the investigation is not yet complete, it appears the most suitable sites on the ORR are west or northwest of the Y-12 Plant, outside ORNL boundaries. An additional alternative, Alternative 5B, has been developed to address the possibility of SIOU waste disposal in the proposed Environmental Management Waste Management Facility (EMWMF).

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

The highly radioactive nature of the sediment in the impoundments requires that remedial design pay close attention to (1) protecting workers from exposure to gamma radiation and (2) containing 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) are included for each alternative to address radiation hazards. These controls greatly increase remediation costs for this site.

The costs presented are revisions to the initial estimates in the RI/FS and reflect savings expected from the use of incentive task orders as an innovative contracting mechanism. The DOE estimated costs in all alternatives do not include a 25 percent contingency. The RI/FS provides a detailed discussion of the base action.

ALTERNATIVE 1—NO ACTION

DOE Estimated Cost: $5.2 million
Projected Annual O&M Cost: $173 thousand
Time to Implement: None

Alternative 1 assumes that existing institutional controls, including actively maintaining the water cover on the impoundments, are maintained for a reasonable period of time (i.e., 30–100 years). After this period of time, the site is assumed to be abandoned. This alternative makes no provisions for containment, removal, treatment, or disposal of wastes. There are unacceptable risks 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

DOE Estimated Cost: $10.5 million
Projected Annual O&M Cost: $87 thousand
Time to Implement: 1.75 years

Alternative 2 includes placing a multilayer cap over the sediment to protect against airborne contamination and direct contact with, or direct exposure to radiation from, the contaminated sediments. This alternative includes institutional controls for the outfall from White Oak Dam to limit access and exposure to groundwater and surface water contamination. Risks from exposures to contaminants beyond this point are acceptable. Institutional controls limiting access to White Oak Creek would be required for approximately 100 years, until radioactive decay of ^{90}Sr (half-life of 28.9 years), the only mobile contaminant posing unacceptable risk, reduces exposures to acceptable levels. Institutional controls at the site of the capped impoundments 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. Note that the costs for institutional controls have been projected for only 30 years (per EPA guidance) because the present value of costs beyond that time are not considered significant or accurate.

Alternative 2 meets three of the four remedial action objectives. It does not prevent movement of contaminants to groundwater or surface water.

Alternative 2 would not meet several applicable or relevant and appropriate requirements (ARARs), and up to four waivers would be required. Attachment 1 summarizes the ARARs identified for each alternative. The wastes would remain in contact with water [TDEC 1200-2-11-.17(2) (f)], and long-term isolation [TDEC 1200-2-11-.17(2) (a)] could not be ensured, so waivers from these requirements would be needed. Similarly, the cap design as planned for Alternative 2 would not meet all requirements under TDEC 1200-2-11-17(2) (d).

The requirements for annual dose protection limits [TDEC 1200-2-11-.16 (2)] could be met for a receptor at Clinch River, but a waiver could be required if the receptor is assumed to be on site. It is unlikely that the waivers required for Alternative 2 would be granted.

ALTERNATIVE 3—CONSOLIDATION CELL WITH SIMPLE DEWATERING

DOE Estimated Cost: $18.3 million
Projected Annual O&M Cost: $85 thousand
Time to Implement: 2.75 years

Alternative 3 includes constructing an engineered containment cell in the location of Impoundment 3524 and consolidating the waste from all impoundments into the cell. Additional detail on the preferred alternative can be found in Section 5.2.3 of the RI/FS. This alternative meets all remedial action objectives and would isolate the wastes sufficiently. As for Alternative 2, Federal institutional controls at the consolidation cell site would be required indefinitely. A receptor at White Oak Creek would not be exposed to unacceptable risk from SIOU contamination; however, other sources could continue to contaminate White Oak Creek.

To construct the cell, the sediment and incidental subimpoundment soil would be transferred from Impoundment 3524 to Impoundment 3513 using a remotely operated hydraulic dredge or other appropriate equipment. During waste transfer, the water cover on both impoundments would be maintained as needed for shielding by pumping water between ponds, adding water if necessary, and treating excess water at the existing Process Waste Treatment Plant, which is adjacent to the site (see Fig. 2). Preliminary stability calculations for the berm between Impoundment 3513 and White Oak Creek indicate the berm is stable. The stability of the berm will be confirmed during remedial design. The potential for additional seepage from Impoundment 3513 to White Oak Creek will increase as wastes are added to the impoundment. A seepage control system will be designed during remedial design and implemented during remedial action. Figure 3 is a cross-section of the consolidation cell during different phases of construction and operation. A clay liner extending above the high water table would be placed in the former location of Impoundment 3524, and a multilayer leachate collection/detection system would cover the clay liner (Fig. 3, Detail A). The clay liner would be designed to be structurally stable and contain the waste under all expected loading conditions during remedial actions and for the operational life of the cell or as long as the cap is maintained.

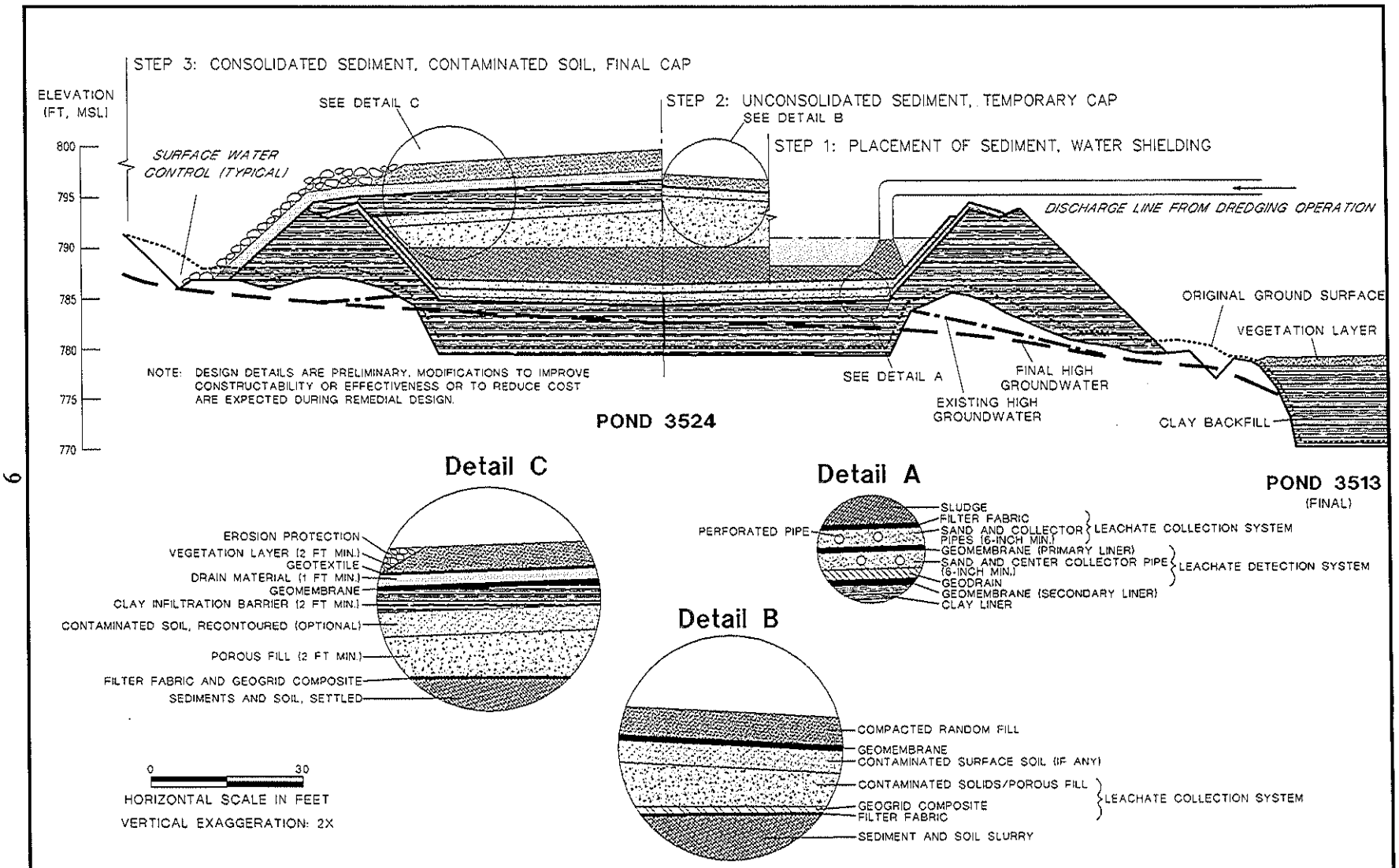
Approximately 3,800 m^3 (5,000 yd^3) of sediment from all impoundments would then be transferred into the liner using the same equipment and water management methods detailed previously (Fig. 3, Step 1). Although the scope of the project is to address only sediment and water in the impoundments, incidental contaminated subimpoundment and surface soil may be encountered. For the cost estimate, a volume of 4,600 m^3 (6,000 yd^3) of soil was assumed to be placed in the consolidation cell.

A fabric filter and geogrid structural frame would be placed through the water cover over the sediment and an interim cover of riprap or other porous fill would be placed over the filter. When the interim cover provided sufficient shielding, the water cover would be removed by pumping surface water and operating the leachate collection system. The sediment would be dewatered by surcharging the waste with a temporary cap (Fig. 3, Step 2) and removing leachate or by other means for an estimated 2 years until no further settlement of the cap was expected. The temporary cap would be designed to prevent infiltration of rainfall into the cell (Fig. 3, Detail B).

The water collected during initial and long-term dewatering would be transferred to the Process Waste Treatment Plant. The Process Waste Treatment Plant currently accepts surface water containing metals, volatile and semivolatile organic compounds, and radionuclides from the impoundments during periods of high runoff. The same constituents are expected in the leachate from the consolidation cell and, therefore, should meet the Process Waste Treatment Plant waste acceptance criteria.

A final, multilayer engineered cap on the cell would be completed (Fig. 3, Step 3), and the cell would be inspected and maintained on a regular basis.

Alternative 3 would require a CERCLA waiver from the Toxic Substances Control Act (TSCA) requirement that wastes be disposed of at least 15 m (50 ft) above the high water table [40 CFR 761.75 (b) (3)] based on equivalent protection provided by the liner. Alternative 3 would comply with all other ARARs.



JE	**Fig. 3**	**Alternative 3 section - liner, placement of wastes, temporary cap, and final cap** DOE - ORNL, WAG 1 Surface Impoundments - Oak Ridge, Tennessee	DOCUMENT ID: 35H830 0040-20 / PPLAN	DRAWING ID: 96-12996.DWG	DRAWING DATE: JUNE 18, 1996 TG

ALTERNATIVE 4—CONSOLIDATION CELL WITH EX SITU TREATMENT

DOE Estimated Cost: $45.7 million
Projected Annual O&M Cost: $85 thousand
Time to Implement: 4 years

Alternative 4 includes relocating the sediment from Impoundments 3524, 3539, and 3540 to Impoundment 3513; constructing a treatment facility for stabilization and solidification of the waste; installing a liner and leachate detection system (part of consolidation cell) at the former location of Impoundment 3524; transferring all of the sediments within SIOU to the treatment facility; treating the sediment (stabilization/solidification is the representative treatment process analyzed); placing the solidified waste in the lined cell; and installing a multilayer cap over the consolidation cell to isolate the waste from the environment. Institutional controls for this alternative would be the same as those required for Alternative 3 and would be needed indefinitely.

A waiver under CERCLA of the TSCA requirement that wastes be disposed of at least 15 m (50 ft) above the high water table [40 CFR 761.75(b) (3)] would be requested for Alternative 4 as well (Attachment 1) based on equivalent protection by the liner. Resource Conservation and Recovery Act of 1976 (RCRA) land disposal restrictions (LDRs) would be triggered under Alternative 4, and one or more treatability variances might be requested to comply with LDRs as provided for under 40 CFR 268.44. A treatability variance would not be a waiver of ARARs; Alternative 4 would comply with all other ARARs.

ALTERNATIVE 5A—OFF-SIOU CONSOLIDATION CELL

DOE Estimated Cost: $23.1 million
Projected Annual O&M Cost: $85 thousand
Time to Implement: 3.5 years

Alternative 5A includes removal of all sediments and surface water from SIOU; possible treatment of sediment (simple dewatering with in situ drainage beds is the representative process option analyzed); transport of sediment to a newly constructed, off-SIOU consolidation cell; consolidation of the waste in the lined cell; and capping the cell when the contents have sufficiently stabilized. Alternative 5A was developed in the FS assuming the consolidation cell would be located in WAG 5 at ORNL.

Alternative 5A would require institutional controls at the site of the consolidation cell indefinitely. No institutional controls would be needed for SIOU because all contamination included in the operable unit scope (water and sediment) would be removed; however, such controls may be needed at the site to address contamination from other sources. This alternative would meet all remedial action objectives.

A waiver under CERCLA of the TSCA requirement that wastes be disposed of at least 15 m (50 ft) above the high water table [40 CFR 761.75(b) (3)] would be requested for Alternative 5A (Attachment 1) based on equivalent protection given by the liner. Alternative 5A could require a waiver from RCRA LDR requirements (40 CFR 268). No contingency treatment for RCRA constituents was included in costing this alternative. If LDRs could not be met, contingency actions would be required, or a waiver would be requested on the basis of attainment of an equivalent standard of performance.

ALTERNATIVE 5B—OAK RIDGE RESERVATION DISPOSAL CELL

DOE Estimated Cost: $50.1 million
Projected Annual O&M Cost: $11,500
Time to Implement: 3.5 years

Alternative 5B includes removal of all sediments and surface water from SIOU; treating the sediment to meet LDRs in a newly constructed treatment facility (stabilization/solidification is the representative process option analyzed); transport of the treated waste in appropriate containers over public roads, pursuant to U.S. Department of Transportation requirements; disposal of the treated waste in the EMWMF; and backfilling the closed impoundments. Costs for interim storage of the wastes, if the EMWMF is not available to receive waste as it is being treated, are not included in the cost estimate. If such storage is necessary, capital costs are estimated at $6 million and operating and maintenance costs would be about $300,000 per year. Treatment costs would be similar to those for Alternative 4, but transportation requirements would add significantly to the cost and complexity of this alternative.

Institutional controls at the SIOU site would be needed only to address risks from other sources in the area because SIOU contaminant sources would

be removed. The costs for construction, disposal, operation, maintenance, and institutional control of the EMWMF would be prorated and charged to the SIOU project as a disposal fee.

Implementation of Alternative 5B would meet all remedial action objectives and ARARs. Because of the uncertainties regarding the feasibility, schedule, waste acceptance criteria, public acceptance, regulatory approval, funding, and construction of the EMWMF, there are significant uncertainties associated with this alternative.

ALTERNATIVE 6—REMOVAL, TREATMENT, AND OFF-SITE DISPOSAL

DOE Estimated Cost: $55.2 million
Projected Annual O&M Cost: $82 thousand
Time to Implement: 4 years

Alternative 6 includes removal of all sediments within SIOU, construction of a treatment facility, treatment of sediments, as required, to meet ARARs and applicable disposal facility waste acceptance criteria, containerization of treated wastes, and transport of all treated waste to the Nevada Test Site.

The treatment process includes base-catalyzed destruction of polychlorinated biphenyls followed by stabilization/solidification to meet U.S. Department of Transportation transport, RCRA LDR, and Nevada Test Site waste acceptance criteria requirements.

This alternative meets all remedial action objectives and ARARs. No waivers would be needed (Attachment 1).

As for Alternative 5A, institutional controls would not be needed at the site for SIOU contaminants, but could be needed because of other contaminant sources. Institutional controls at the Nevada Test Site (or other final disposal location) would be needed indefinitely.

EVALUATION OF ALTERNATIVES

Table 1 summarizes the performance of the alternatives against seven of the nine CERCLA criteria (see box on page 13). 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 will be evaluated after a regulatory agency review and a public comment period.

Community acceptance of the preferred alternative will be evaluated based upon public comments received. Details of the selected alternative will be described in the ROD for the site.

SUMMARY OF THE PREFERRED ALTERNATIVE

The preferred alternative for cleaning up SIOU is Alternative 3—consolidation cell with appropriate liners, caps, and leachate collection system for simple dewatering. Based on current information, this alternative appears to provide the best balance of the nine CERCLA criteria developed by EPA (see page 13 for a description of evaluation criteria). While not meeting the statutory preference for treatment of wastes, this alternative was found to offer the same level of risk reduction as Alternatives 4, 5, 5B, and 6 without incurring the additional costs. Alternative 3 protects future employees and on-site residents from direct radiation and prevents airborne migration of sediments from the impoundments as long as the cap is maintained. Contamination of potential drinking and irrigation water would be significantly reduced by the cap and liner. Risks to future residents at White Oak Creek, at White Oak Dam, and at Clinch River are all within the acceptable EPA target range.

The leachate collection system will be maintained and operated indefinitely to monitor the overall integrity of the consolidation cell. Site surveillance and maintenance would be required as long as the contaminated media remain under the cap. Institutional controls, such as continued site ownership by the government and placing a notice in the site deed, would prevent on-site residential and farming land uses that could result in direct exposure to contaminated sediments.

In summary, Alternative 3 would substantially reduce site risks through waste consolidation, surface water controls, engineering controls (i.e., the cap, liner, and leachate collection system), and institutional controls. Institutional controls would allow safe management of sediment remaining in the consolidation cell.

Based on information available at this time, DOE believes that Alternative 3 would protect human health and the environment, would comply with ARARs (with the exception of the CERCLA waiver of the TSCA requirement that wastes be disposed of at least 15 m (50 ft) above the high

Table 1. Evaluation of alternatives for CERCLA criteria, WAG 1, SIOU, ORNL, Oak Ridge, Tennessee

CERCLA criteria	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 5A Off-SIOU consolidation cell	Alternative 5B ORR disposal 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	Total risk	Total risk	Total risk
Employee on site	8×10^{-2}	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$
Resident Clinch River	5×10^{-3}	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$
Resident White Oak Dam	5×10^{-3}	6×10^{-6}	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$
Resident White Oak Creek	7×10^{-2}	1×10^{-5}	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$
Resident on site	2×10^{-1}	1×10^{-5}	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$
Human health risk discussion	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 receptor at White Oak Dam. Possible risk to human health from migration of contamination to groundwater and White Oak Creek. Protective while DOE maintains institutional controls	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 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 while DOE maintains institutional controls	Protective to all receptors 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	No risk to environmental receptors	No risk to environmental receptors	No risk to environmental receptors	No risk to environmental receptors
2. Compliance with ARARs	No ARARs under CERCLA. Not protective as required by CERCLA	4 waivers required	1 waiver required	1 waiver required	3 waivers required	Meets all ARARs	Meets all ARARs
3. Long-term effectiveness	Not effective	Effective for period of institutional control	Very effective for period of institutional control	Very effective for period of institutional control	Very effective for period of institutional control	Very effective for period of institutional control	Very effective at site
4. Reduction of toxicity, mobility or volume through treatment	None	None	Small reduction in volume	Increase in volume. Some decrease in mobility of most contaminants	Small reduction in volume	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 small, adverse short-term effects	Potential for moderate, adverse short-term effects	Potential for moderately high, adverse short-term effects	Potential for moderately high, adverse short-term effects	Potential for high, adverse short-term effects	Potential for very high, adverse short-term effects
6. Implementability	Very easy to implement	Easy to implement	Somewhat difficult to implement	Difficult to implement	Fairly difficult to implement	Extremely difficult to implement, technically and administratively	Extremely difficult to implement, technically and administratively
7. DOE estimated cost	$5.2 million	$10.5 million	$16.3 million	$45.7 million	$23.1 million	$50.1 million	$55.2 million

ARAR = applicable or relevant and appropriate requirement
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
DOE = U.S. Department of Energy
ORNL = Oak Ridge National Laboratory
ORR = Oak Ridge Reservation
RME = reasonable maximum exposure
SIOU = Surface Impoundments Operable Unit
WAG = waste area grouping

EVALUATION CRITERIA

The following criteria are based on guidance published by EPA and are used to evaluate potential alternatives. The first seven criteria are highlighted in this proposed plan. The last two criteria, State and Community Acceptance, will be addressed during the public comment period.

1. *Overall protection of human health and the environment* addresses whether an alternative eliminates, reduces, or controls threats to public health and the environment.
2. *Compliance with applicable or relevant and appropriate requirements (ARARs)* addresses whether an alternative meets federal and state environmental laws and regulations.
3. *Short-term effectiveness* considers the time needed for an alternative to achieve remedial response objectives and the risks posed to workers, residents, and the environment during the remedial action.
4. *Long-term effectiveness* considers the ability of an alternative to protect public health and the environment long after remedial action is complete.
5. *Reduction of toxicity, mobility, and volume through treatment* evaluates an alternative's use of treatment to reduce the harmful nature of contaminants, the contaminants' ability to move in the environment, and the amount, or volume, of contamination present.
6. *Implementability* addresses the feasibility of an alternative from a technical and an administrative standpoint.
7. *Cost* considers the amount of money it will take to design, construct, operate, and maintain the alternative.
8. *State acceptance* addresses TDEC comments concerning the alternatives considered.
9. *Community acceptance* addresses the public comments on the alternatives being considered. One opportunity for the public to voice its opinion is to complete the attached comment sheet and send it to DOE. At the end of the public comment period, DOE will respond to every relevant question and comment. These responses will become part of the ROD.

water table], and would be cost-effective. EPA and TDEC concur with the release of this proposed plan for public comment.

COMMUNITY PARTICIPATION

Community involvement is critical to the CERCLA RI/FS process.

DOE encourages public participation in the selection of the preferred alternative for remediation of SIOU. Opportunities for public involvement are described in the shaded box on this page.

Comments will be responded to and documented as part of the subsequent ROD. Based on public comments or new information, DOE may modify the preferred alternative or select another.

THE NEXT STEP

Following the public comment period and consideration of public concerns, DOE will prepare a ROD. The ROD will describe the selected remedy and include the responses to public comments. A remedial design plan for implementing the alternative will be prepared after the ROD is signed by EPA, TDEC, and DOE.

OPPORTUNITIES FOR PUBLIC INVOLVEMENT

Public Comment Period: DOE will hold a 30-day public comment period for this proposed plan. The comment period provides an opportunity for local residents and interested parties to express their views and concerns on the remedial alternatives being considered. Copies of the proposed plan and supporting documents are available at the following location:

DOE Information Resource Center
105 Broadway Avenue
Oak Ridge, TN 37830

Hours: Monday through Friday, 7:30 a.m.–5:30 p.m.

Telephone: (423) 241-4582

A 30-day public comment period **{DATES}** has been designated for review and comment on this proposed plan. A public meeting is scheduled for **{DATES}** at **{PLACE}** to discuss the cleanup alternatives and address any questions and concerns the public may have about the preferred alternative.

Attachment 1. Applicable or relevant and appropriate requirements[a] for the remedial alternatives evaluated for the Surface Impoundments Operable Unit at the Oak Ridge National Laboratory, Oak Ridge, Tennessee

Requirements	Citation	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 5B	Alt. 6
Location-specific							
NHPA requirements for impacts to historic resources	NHPA, 16 USC 470a-w; EO 11593; 36 CFR 800; DOE-ORO Programmatic Agreement (May 9, 1994)	X	X	X	X	X	X
Chemical-specific							
NESHAP for radionuclide emissions from DOE facilities	40 CFR 61.92; 40 CFR 61.93	X	X	X	X	X	X
DOE Order radiation exposure limitations (TBC guidance)	DOE Order 5400.5 (I.4); DOE Order 5400.5 (II.1a)	X	X	X	X	X	X
DOE Order requirements for management of radioactivity left in place (TBC guidance)	DOE Order 5400.5 (IV); DOE Order 5400.5(II)(3)(b)	X	X	X	X		
EPA guidance for PCBs left in place (TBC guidance)	OSWER 9355.4-01, "Guidance on Remedial Actions for Superfund Sites with PCB Contamination"	X	X	X	X		
EPA guidance for cleanup of lead in soils (TBC guidance)	OSWER 9355.4-12, "Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites"	X	X	X	X	X	X
Action-specific							
Institutional control requirements	40 CFR 300.430(e)(3)(ii)(TBC); 40 CFR 264.14; TDEC 1200-1-11-.06(11); DOE Order 5400.5 (IV)(6)(c) (TBC)	X	X	X	X		X
Stormwater runoff control requirements	40 CFR 122; TDEC 1200-4-10-.05	X	X	X	X	X	X
Control of fugitive dust emissions	TDEC 1200-3-8-.010	X	X	X	X	X	X
RCRA design and operating requirements for a surface impoundment/landfill	40 CFR 264.221(c); 40 CFR 264.301; TDEC 1200-1-11-.06(11); TDEC 1200-1-11-.06(14)		X	X	X		
TSCA general design requirements for a chemical waste landfill	40 CFR 761.60(a)(4 and 5); 40 CFR 761.75(b); OSWER 9355.4-01, "Guidance on Remedial Actions for Superfund Sites with PCB Contamination" (TBC)		X[b]	X[b]	X[b]		

Attachment 1 (continued)

Requirements	Citation	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 5B	Alt. 6
TDEC radiation protection standards (performance objectives for limiting human exposure)	TDEC 1200-2-11-.16(1), (2), and (5)	X[c]	X	X	X		
TDEC radiation protection standards (technical requirements for land disposal)	TDEC 1200-2-11-.17(1)(a),(b),(d-j); TDEC 1200-2-11-.17(2)(b) and (c)				X		
TDEC radiation protection standards (technical requirements for land disposal)	TDEC 1200-2-11-.17(2)(a),(d)(e)(f); TDEC 1200-2-11-.17(3)(g),(h),(j),(k); TDEC 1200-2-11-.17(4)(b),(c) and (d); TDEC 1200-2-11-.17(7)(b)(1)	X[c]	X	X	X		
RCRA and TDEC closure requirements [including simple capping (Alternative 2)] TDEC requirements for elimination of free liquids under radiation protection standards	40 CFR 264.228(a)(2)(i-ii); TDEC 1200-11-.06(11) TDEC 1200-2-11-.17(7)(a)(3)	X[c]	X[d]	X	X[d]		X
TSCA requirements for elimination of free liquids	40 CFR 761.75(b)(8)(ii)		X[d]	X	X[d]	X	
TDEC radiation protection standards (technical requirements for land disposal)	TDEC 1200-2-11-.17(7)(b)(2) and (3); TDEC 1200-2-11-.17(3)(d)			X			
RCRA land disposal requirements	40 CFR 268; 40 CFR 268,40; 40 CFR 268.44; 40 CFR 268.48; TDEC 1200-1-11-.10			X	X[c]	X	X
RCRA requirements for tanks used for storage or treatment RCRA requirements for miscellaneous treatment unit	40 CFR 264.191-197; 40 CFR 264.553; TDEC 1200-1-11-.06(10)			X		X	X
Characterization/storage of residuals from treatment (and storage of treated waste, if necessary)	40 CFR 264.601 TDEC 1200-1-11-.06(27)(a) 40 CFR 262.11, 262.34, 264.170 et seq. TDEC 1200-1-11-.03(1)(b); TDEC 1200-1-11-.03(4)(e); TDEC (1200-1-11-.06(9) FFCA §105; TDEC Comm. Order for the ORR STP (Oct. 2, 1995)						
Closure requirements for a surface impoundment/landfill	40 CFR 264.310; 40 CFR 264.228(a)(2); TDEC 1200-11-.06(11) and (14); DOE Order 5400.5(IV)(6)(b)(1)and(4)(TBC)		X	X	X	X	

Attachment 1 (continued)

Requirements	Citation	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 5B	Alt. 6
Postclosure care requirements	40 CFR 264.117; 40 CFR 264.228(b); 40 CFR 264.310; 40 CFR 264 Subpart F; TDEC 1200-1-11-.06(7); TDEC 1200-1-11-.06(11); TDEC 1200-1-11-.06(14); DOE Order 5400.5(IV) (TBC)		X	X	X		
DOT/RCRA transportation requirements	49 CFR 171, 172, 173, 177, 178, 179 and 180; 49 CFR 195				X	X	X
DOE requirements for transportation off site (TBC guidance)	DOE Order 5820.2A(III); DOE Memorandum on Low-Level Waste Shipments (May 17, 1991); Grumbly Memorandum (October 12, 1993)					X	X

[a]An "X" is used to indicate that the requirement is ARAR for the alternative at the column header.
[b]A CERCLA waiver from 40 CFR 761.75(b)(3) would be required pursuant to 40 CFR 761.75(c)(4) (see text).
[c]A CERCLA waiver would be required for one or more of the requirements [see text for discussion of the specific requirements and CERCLA §104(d) justifications].
[d]A CERCLA interim waiver may be required from RCRA, TDEC, and TSCA requirements for elimination of free liquids from the waste with the expectation that the requirements will ultimately be met.
[e]Required under another project for the Environmental Management Waste Management Facility.

ARAR = applicable or relevant and appropriate requirement
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR = *Code of Federal Regulations*
DOE = U.S. Department of Energy
DOT = U.S. Department of Transportation
EO = Executive Order
EPA = U.S. Environmental Protection Agency
NESHAP = National Emission Standards for Hazardous Air Pollutants
NHPA = National Historic Preservation Act
ORO = Oak Ridge Operations
OSWER = Office of Solid Waste and Emergency Response
PCB = polychlorinated biphenyl
RCRA = Resource Conservation and Recovery Act of 1976
TBC = to be considered
TDEC = Tennessee Department of Environment and Conservation
TSCA = Toxic Substances Control Act
USC = *United States Code*

SURFACE IMPOUNDMENTS OPERABLE UNIT, WASTE AREA GROUPING 1, OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
PUBLIC COMMENT SHEET

DOE is interested in your comments on the alternatives being considered in the *Proposed Plan for Surface Impoundments Operable Unit, Waste Area Grouping 1, Oak Ridge National Laboratory, Oak Ridge, Tennessee*, including the preferred alternative. The mailing address is preprinted on the back of this form. You may use this form to submit your comments. We must receive your comments on or before the close of the public comment period. If you have questions, please contact Mr. Nelson Lingle, Chief; Oak Ridge Remediation Branch; DOE Oak Ridge Operations; 105 Broadway Avenue; Oak Ridge, TN 37830; (423) 576-5580.

Name: _____

Address: _____

City: _____ State/Zip: _____

Telephone: _____

MAILING LIST ADDITIONS:

Please add my name to the Environmental Restoration Program mailing list to receive additional information on the progress at the Oak Ridge Reservation: ☐ Yes ☐ No

Place
Stamp
Here

Mr. Nelson Lingle, Chief
Oak Ridge Remediation Branch
DOE Oak Ridge Operations
105 Broadway Avenue
Oak Ridge, TN 37830