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Record of Decision:

OAK RIDGE RESERVATION (USDOE)
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OAK RIDGE, TN
02/21/1996

DOE/OR02-1410&D3

Record of Decision
for
Chestnut Ridge Operable Unit 2
(Filled Coal Ash Pond and Vicinity)
Oak Ridge, Tennessee

DOE/OR/02-1410&D3

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for
Chestnut Ridge Operable Unit 2
(Filled Coal Ash Pond and Vicinity)
Oak Ridge, Tennessee

Date Issued-January 1996

Prepared by
Jacobs ER Team
125 Broadway Avenue
Oak Ridge, Tennessee
under contract DE-AC05-93OR22028

Prepared for
U.S. Department of Energy
Office of Environmental Restoration and Waste Management

PREFACE

This Record of Decision for Chestnut Ridge Operable Unit 2 (Filled Coal Ash Pond and Vicinity), Oak Ridge, Tennessee (DOE/OR/02-1410&D3) was prepared in accordance with requirements under the Comprehensive Environmental Response, Compensation, and Liability Act to present the selected remedy to the public. This work was performed under Work Breakdown Structure 1.4.12.3.1.01 (Activity Data Sheet 2301, "Filled Coal Ash Pond"). This document provides the Environmental Restoration Program with information about the selected remedy for Chestnut Ridge Operable Unit 2, which involves improving and stabilizing the 62-ft dam that retains the coal ash, performing limited environmental enhancements, and implementing institutional controls to limit access to the site. Information in this document summarizes information from the remedial investigation (DOE/OR/01-1268/V1&V2-D2), the feasibility study (DOE/OR/02-1259&D2), and the proposed plan(DOE/OR/02-1329&D2).

ACRONYMS AND ABBREVIATIONS

Al	aluminum
ARAR	applicable or relevant and appropriate requirement
As	arsenic
Ba	barium
Be	beryllium
Cd	cadmium
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
COC	contaminant of concern
COPC	contaminant of potential concern
Cr	chromium
Cs	cesium
Cu	copper
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FCAP	Filled Coal Ash Pond
Fe	iron
FFA	Federal Facility Agreement
FR	Federal Register
FS	feasibility study
ft	foot
ha	hectare
Hg	mercury
K	potassium
km	kilometer
L	liter
m	meter
MCL	maximum contaminant level
Mn	manganese
MSDS	Material Safety Data Sheet
Na	sodium
NCP	National Contingency Plan
NPL	National Priorities List
O&M	operation and maintenance
ORR	Oak Ridge Reservation
OU	operable unit
Pb	lead
pCi	picocurie
PMP	probable maximum precipitation
Ra	radium
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
ROD	record of decision

ACRONYMS AND ABBREVIATIONS (continued)

SARA	Superfund Amendments and Reauthorization Act of 1986
Se	selenium
SHPO	state historic preservation officer
SWMU	solid waste management unit
TDEC	Tennessee Department of Environment and Conservation
Th	thorium
Tl	thallium
U	uranium
USC	United States Code
V	vanadium
Zn	zinc

PART 1. DECLARATION

SITE NAME AND LOCATION

U.S. Department of Energy
Oak Ridge Y-12 Plant Chestnut Ridge Operable Unit 2
Oak Ridge Reservation
Oak Ridge, Tennessee

STATEMENT OF BASIS AND PURPOSE

This record of decision (ROD) presents the selected remedial action for the Oak Ridge Y-12 Plant Chestnut Ridge Operable Unit (OU) 2, also known as the Filled Coal Ash Pond (FCAP). FCAP is 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 (SARA), 42 United States Code (USC) Section 9601 et seq., and to the extent practicable, the National Oil and Hazardous Substance Contingency Plan.

This decision is based on the administrative record for the Y-12 Plant Chestnut Ridge OU 2, including the remedial investigation (RI) report (CDM 1995), the feasibility study (FS) report (Jacobs ER Team 1995a), the proposed plan (Jacobs ER Team 1995b), and other documents contained in the administrative record file for this site.

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

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site may present an unacceptable risk to public health, welfare, or the environment if not addressed by implementing the response action selected in this ROD.

DESCRIPTION OF THE SELECTED REMEDY

This response action fits into the overall ORR cleanup strategy by addressing surface water and soil contaminated by coal ash and its leachate originating from the FCAP on Chestnut Ridge, south of the Y-12 Plant.

The selected remedy addresses the principal threats from the site to plants, animals, and humans by (1) upgrading containment of the coal ash with dam improvements and stabilization, (2) reducing contaminant migration into Upper McCoy Branch with a passive treatment system, and (3) restricting human access to the contamination by implementing institutional controls. Major components of the selected remedy are designed to:

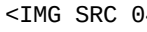
- minimize the migration of contaminants into surface water,

- minimize direct contact of humans and animals with the ash,
- reduce the potential for future failure of the dam, and
- preserve the local habitat in the long term.
-

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, and is cost-effective. The selected remedy uses permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. The selected remedy does not satisfy the statutory preference for treatment, which results in permanent and significant reduction of toxicity, mobility, or volume of the contamination, because treatment of the large volume of coal ash at this site is not practicable. The ash will remain in place at the site, and surface water will receive limited treatment. Institutional controls will restrict access to the contamination and reduce risk to human health. Actions taken to isolate the ash, restrict animal access, and reduce contaminant migration to surface water will reduce risk to ecological receptors. As required for remedies in which waste is left in place, a 5-year review will be conducted to verify that the remedy continues to protect human health and the environment.

APPROVALS



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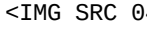
James Hall, Manager Date
U.S. Department of Energy
Oak Ridge Operations



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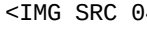
Earl C. Leming, Director Date
U.S. Department of Energy Oversight Division
Tennessee Department of Environment and Conservation



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John Hankinson, Regional Administrator Date
Region IV
U.S. Environmental Protection Agency

PART 2. DECISION SUMMARY

SITE NAME, LOCATION, AND DESCRIPTION

ORR is a 14,000-ha (35,000-acre) DOE facility in Anderson and Roane Counties, about 38 km (24 miles) northwest of Knoxville, Tennessee. The Y-12 Plant is on 324 ha (800 acres) in Bear Creek Valley, 3.2 km (2 miles) south of downtown Oak Ridge (Fig. 2.1).

FCAP is on Chestnut Ridge, approximately 0.8 km (0.5 miles) south of the Y-12 Plant (Fig. 2.2). The pond was constructed by building a southwest-facing earthen dam across Upper McCoy Branch (Fig. 2.3). The pond was used as a settling basin for coal ash slurry from the Y-12 Steam Plant from 1955 to 1967, when the pond was filled. From 1967 to 1989, the slurry continued to be discharged to the pond and then flowed across the dam down the Upper McCoy Branch and into Rogers Quarry.

Upper McCoy Branch has its headwaters along two tributaries near the crest of Chestnut Ridge. The tributaries join at the ash pond. Water flows over and through the ash in the pond. Surface water flows down the existing eroded spillway on the eastern end of the earthen dam. Subsurface flow exits in seeps and springs below the dam. Although minimal erosion appears to be occurring on the downstream dam face that is covered with grass and ground vegetation, the spillway channel for the darn has eroded approximately 4.6 m (15 ft) deep.

At the base of the dam is a spring that is a discharge point for groundwater. Water from this spring has cut a channel approximately 0.9 m (3 ft) deep into the valley. At times of heavy rainfall the stream sometimes overflows its banks. Since 1967, when the stream was diverted from flowing into Melton Hill Reservoir, Upper McCoy Branch has flowed approximately 0.8 km (0.5 miles) from the dam to Rogers Quarry, a 4-ha (10-acre) quarry that was used as a source of stone in the 1940s.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

The 19-m (62-ft)-high earthen dam across Upper McCoy Branch was constructed in 1955 to create a pond to serve as a settling basin for fly and bottom ashes generated by burning coal at the Y-12 Steam Plant. Ash from the steam plant was mixed with water to form a slurry and then pumped to the crest of Chestnut Ridge and released through a large pipe to flow across the Sluice Channel area and into the pond. The ash slurry eventually overtopped the dam and flowed along Upper McCoy Branch to Rogers Quarry. In 1989, a bypass pipe was constructed to carry the slurry directly to the quarry from the steam plant. All discharges from the steam plant to the ash pond stopped in 1989. Since then ash deposits in the ash pond, Upper McCoy floodplain, and the Sluice Channel Area have been left in place. The site is now well vegetated.

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FCAP was originally listed as a Resource Conservation and Recovery Act (RCRA) Section 3004(u) solid waste management unit (SWMU) under the 1984 Hazardous and Solid Waste Amendments general permit for ORR (Welch 1989). At that time, coal ash was subject to regulation as a hazardous waste under RCRA Subtitle C. ORR was subsequently listed on the National Priorities List (NPL), making FCAP subject to CERCLA regulations. In 1992, as a result of the FFA, CERCLA requirements

were invoked for the preparation of the planning and decision documents for the FCAP area, as well as the actual remediation. Fly and bottom ashes were later exempted from hazardous waste regulation under Subtitle C [58 Federal Register (FR) 42466, August 9, 1993], although the ash is still regulated as solid waste under Subtitle D. The site remains a CERCLA OU.

Site investigations under RCRA and CERCLA began in 1990 in which surface water, soils, ash, and groundwater were sampled. An RI report, an FS report, and a proposed plan were completed in accordance with CERCLA and the FFA (1992). This ROD presents the decision for Chestnut Ridge OU 2 and is based on information contained in the administrative record.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

The proposed plan for Chestnut Ridge OU 2 was issued in June 1995. DOE published a public notice regarding the project in The Knoxville News-Sentinel July 5, 1995, and set a public comment period from July 5, 1995, to August 5, 1995. The proposed plan was one of the topics discussed at the quarterly July 18, 1995, stakeholders meeting. No formal public meeting was requested. Few comments were received and few issues were raised by the public. Part 3 of this document, "Responsiveness Summary," addresses the informal comments made by the public during the July 18, 1995, stakeholders meeting, telephoned comments, and written comments received during the public comment period. Subsequent to comments and questions submitted during the period of community participation, DOE, in concurrence with the other FFA parties, determined that the actions suggested in the proposed plan, with some modifications, are justified. These modifications to the selected remedy are described in the "Documentation of Significant Changes" section.

SCOPE AND ROLE OF RESPONSE ACTION

The response action for FCAP will address contaminant abatement for surface waters, sediments, and soils of Upper McCoy Branch and will upgrade the dam to reduce risk of an uncontrolled release of the ash into the Upper McCoy Branch watershed. The principal threat to human health is limited risks from exposure to the radionuclide 228Th and its daughters through direct exposure to the ash under hypothetical trespasser and residential scenarios. Current risks to the environment are primarily to terrestrial biota through exposure and potential accumulation of selenium and arsenic from uptake or ingestion of the ash, its leachate, or organisms affected by it. The purposes and components of this response action are to (1) reduce or eliminate the risk of an uncontrolled release by strengthening the dam and spillway, (2) restrict human access to the site to control the potential for direct exposure, and (3) reduce or eliminate contaminant entry into the Upper McCoy Branch surface waters through enhancement of an existing wetland which currently acts as a natural passive treatment system. Implementation of these measures will constitute the final response action for this OU.

SUMMARY OF SITE CHARACTERISTICS

The nature and extent of contamination at the ash pond and vicinity were investigated by sampling and analyzing the ash, surface water, sediments, soil, and groundwater. Analysis of the ash for metals and radioactive substances indicates the ash is typical of coal ash from the combustion of eastern United States coals. Radioactivity in the coal ash is above background levels in soil (Energy Systems 1993); however, this is common to coal ash residues and not a result of plant processes associated with the Y-12 Plant. Contaminants leaching from the ash into underlying soil or surface water are primarily metals. Reference samples were collected as part of the RI for surface water, sediments, and groundwater to provide indicators of nearby

site conditions (CDM 1995). Soil data were compared to published background levels of soils at ORR (Energy Systems 1993). Ash data were also compared to published data for coal ash constituents (CDM 1995).

Surface water characterization during the RI indicated that the primary contaminants in surface water exceeding levels of nearby sampled reference points are metals, including Al, As, Fe, Mn, and Zn. Levels of Cu, Pb, Hg, Th isotopes, and 238U were also elevated in comparison to reference sample levels in the surface water, but to a lesser extent. Contaminant concentrations are consistently lower in the downstream water of Upper McCoy Branch, indicating that ash deposits in the floodplain and creek are not a primary source of surface water contaminants (CDM 1995).

Background concentrations of soil constituents were obtained from the Background Soil Characterization Project for the Oak Ridge Reservation (Energy Systems 1993). Soil samples were collected from beneath the ash at five locations along Upper McCoy Branch, beneath the ash at FCAP, and in the Sluice Channel. All the metals, except mercury and uranium, exceeded the background soil means in one or more samples. Arsenic and iron were the most elevated metals when compared to the background levels for local soils. Leachate from ash was detected in the underlying soil at the sampling locations.

Surface ash samples were collected from FCAP. The maximum metal concentration in ash exceeded the maximum background level for local soil in all eases except manganese, which is naturally high in local soils. Arsenic and iron concentrations were an order of magnitude greater than the background samples; however, these contaminants are commonly found in coal ash at the detected levels (CDM 1995).

Sediment samples were collected from nearby reference locations to determine reference levels and at 12 potentially affected locations adjacent to springs or seeps. Aluminum, Ba, Fe, Mn, K, and Na in the sediment are well above reference sediment levels. Uranium-238 and 232Th are also elevated. The elevated levels of these metals and all radionuclides are typically associated with coal and coal ash.

Groundwater quality for eight monitoring wells within Chestnut Ridge OU 2 was monitored during RI characterization of FCAP. Four of the eight wells are screened in the overburden and the other four are screened within the bedrock. Six piezometers were installed to evaluate flow directions. Certain samples were analyzed for total and dissolved metals, radiological parameters, common ions, various physical properties, volatile organic compounds, and semivolatile organic compounds.

Groundwater data from Chestnut Ridge OU 2 suggest that former activities at the site have had some impact on the groundwater, but the impact is limited. Data from both phases include four maximum contaminant level (MCL) exceedences for one analyte; initial samples from a duplicate sample at GW-676 exceeded the gross alpha MCL of 15 pCi/L. Interpretation of the groundwater data was problematic because a karst geologic system has developed on Chestnut Ridge. Initial attempts to compare topographically upgradient groundwater data to topographically downgradient well data were unsuccessful. The presence and extent of organics, metals, and radionuclides in groundwater at OU 2 is limited (CDM 1995).

SUMMARY OF SITE RISKS

HUMAN HEALTH RISKS

Human health risks were evaluated for current and future baseline conditions and were presented

in the RI report (CDM 1995). All scenarios were evaluated in the risk assessment using the upper 95 percent confidence limit of the mean concentrations. Current risks were evaluated for industrial workers given existing institutional controls and were found to be acceptable.

Future risks were estimated for trespasser and on-site resident scenarios. The most likely future exposure scenario was a trespasser scenario. Under this scenario, a hunter was hypothesized to spend 2 weeks each year on the site for 30 years. The actual site-specific allowable hunting days are currently fewer than the assumed 2 weeks. For this scenario, the excess cancer risk from external gamma exposures from the naturally occurring radionuclides in the coal ash was assessed. The risk was 6 x 10-5, which is within the EPA target risk range of 1 x 10-6 to 1 x 10-4 (EPA 1990). None of the contaminants of potential concern (COPCs) for groundwater exceeded acceptable risk levels using the trespasser scenario. This was the land use scenario used for selection of the remedy.

The second exposure scenario assumes that a future on-site resident is exposed to contaminants for 350 days each year for 30 years, as a child during the first 6 years and as an adult during the next 24 years. This scenario considered dermal contact with soil/ash, incidental ingestion of soil/ash, inhalation of these contaminated media, and direct gamma exposures; ingestion of homegrown vegetables and fruit; ingestion of contaminated surface and groundwater; and dermal contact with surface and groundwater and inhalation of volatile organic compounds. By using the upper 95 percent confidence limit of the mean values in conjunction with this residential exposure scenario, it is unlikely that actual risks at the site have been underestimated. The total excess cancer risk was calculated to be 1 x 10-3, of which 92 percent was attributable to external gamma exposures to 228Th and its daughters, most notably 208Tl. This is unacceptable because the cancer risk is greater than EPA's target range for acceptable risk. For noncarcinogenic risks for the on-site resident, hazard indices greater than 1 (unacceptable by EPA guidance) were determined for arsenic and manganese from ingestion of surface water and homegrown produce. Ingestion of home garden produce also had hazard indices greater than 1 for mercury and cadmium.

ECOLOGICAL RISKS

Although toxicity tests indicate that the surface water stream (Upper McCoy Branch) is recovering from the detrimental effects of the coal ash, the coal ash itself is toxic to soil invertebrates. Metal concentrations in sediments and surface water of Upper McCoy Branch exceeded ecological risk benchmarks and were sufficient to reduce survival or reproduction of benthic macroinvertebrates. Successful growth and reproduction of plants has been observed at the FCAP, Sluice Channel Area, and Upper McCoy Branch sites. However, evidence of contaminant accumulation in plants was observed on FCAP when tissue analyses were performed. Aluminum, As, Se, and V represented the highest risks to plants. Additionally, selenium and arsenic is taken up by some plants on the site, which poses potential risks to vegetation and animals in the food chain. The surface water, which serves as a drinking water source for area wildlife, and coal ash, which is ingested by the deer as a mineral supplement, could also have a detrimental effect on these animals. Furthermore, Al, Cd, Cr, Cu, Fe, Mn, Hg, V, and Zn concentrations in the ash could cause reduced microbial growth and reduction in the activities of enzymes involved in organic matter breakdown and nutrient cycling.

Future site risks are expected to be similar to or less than the current risks, except in a catastrophic dam failure. Such a failure is possible in the long term because of dam erosion caused by high intensity storms. Dam failure and the subsequent release of ash would create significantly higher risks to human health and the environment because ash exposures would be dramatically increased.

DESCRIPTION OF ALTERNATIVES

Nine remedial alternatives spanning a wide range of cleanup options for Chestnut Ridge OU 2 were developed in the FS (Jacobs ER Team 1995a). The alternatives developed ranged from no action to complete removal and off-site disposal of the ash. The nine alternatives were screened in the FS based on effectiveness, implementability, and cost to develop a shorter list of alternatives for detailed analysis. In the application of all action alternatives, best management practices would be followed to control fugitive dust, erosion, runoff, and to minimize the area disturbed. Descriptions of the alternatives and results of the screening process are provided in the following paragraphs.

ALTERNATIVE 1: NO ACTION

The no action alternative provides a comparative baseline against which other alternatives can be evaluated. It was retained for detailed analysis in the FS, as required by the National Contingency Plan (NCP). Under this alternative, no action would be implemented and the material in the coal ash waste areas (i.e., the Sluice Channel Area, FCAP, and Upper McCoy Branch) would be left "as is," without implementing any containment, removal, treatment, or other mitigating actions. This alternative does not provide for soil, surface water, or groundwater monitoring, and it does not use institutional controls to reduce the potential for exposure (e.g., physical barriers, deed restrictions).

ALTERNATIVE 2: INSTITUTIONAL CONTROLS AND ENVIRONMENTAL ENHANCEMENT

Alternative 2 is intended to enhance the ongoing recovery of site vegetation and habitats, while providing controls to limit the access and use of the site to reduce human and ecological exposures by direct or indirect contact. This alternative includes access and use controls, monitoring, and environmental enhancements (placing salt licks on site, adding nutrients and organic material to the ash, planting preferred species, and installing a passive treatment system at the toe of the FCAP dam). This alternative was screened out from detailed analysis in the FS because it does not protect against dam failure.

ALTERNATIVE 3: INSTITUTIONAL CONTROLS AND DAM IMPROVEMENTS

Alternative 3 includes institutional controls, monitoring, environmental enhancements described in Alternative 2, and adds dam improvements. The dam improvements are intended to repair existing erosion damage to the emergency spillway on the eastern end of the dam. This alternative was also screened out because it does not provide enough stormwater retention capacity to prevent overtopping and erosion of the dam.

ALTERNATIVE 4: SURFACE WATER CONTROLS AND DAM IMPROVEMENTS

Alternative 4 includes institutional controls, environmental enhancements, dam improvements, surface controls, and monitoring. Alternative 4 was retained for detailed analysis in the FS. The following describes the primary components of this alternative.

Institutional Controls. Deed restrictions, fencing, and signs would be used to limit access to the site.

Environmental Enhancements. Environmental enhancements include establishing salt licks, adding nutrients and organic material to the ash, and planting or seeding of preferred species.

- On-Site Salt Licks-Salt licks would be established on or immediately adjacent to the site at strategic locations as a replacement source of mineral intake for deer that

now use FCAP as a "natural" salt lick. Salt licks would reduce deer exposure to ash and contaminated soil through ingestion. Existing patches of exposed ash sculled by deer would be covered with topsoil.

- Nutrient Addition-Nutrients, in the form of granular or dissolved fertilizer, would be added to the ash to accelerate the accumulation of plant biomass in order to dilute the accumulated contaminants and reduce further contaminant uptake. For example, selenium uptake would be reduced by adding sulphur, and arsenic by adding phosphorus. Over time, this would dilute selenium and arsenic concentrations in plant tissues and also reduce animal exposure to these contaminants. The addition of other nutrients, such as nitrogen and potassium, would promote overall vegetative growth and further dilute contaminant concentrations in plant and animal tissue. Fertilization of already vegetated areas typically results in a "jump-start" to the plant growth already present. Thereafter, the process accelerates on its own. Risk levels will also decrease on an ongoing basis.

- Organic Material Addition-Weathered organic material, such as manure or compost, would be added to the ash to enhance soil microbial populations and soil texture and expedite the natural recovery process. This would be done once.

- Planting/Seeding of Preferred Species-The perimeter of FCAP and areas below the dam where wetlands are present would be seeded or planted with facultative, nitrogen-fixing, wetland species with high habitat values and local hardiness. This would expedite the natural recovery process and maintain wetland habitats. This would be done once, monitored for success, and repeated if weather conditions interfere with plant establishment.

- Passive Treatment System-A passive water treatment system would be constructed near the toe of the dam, upstream of the spillway outfall after dam and spillway improvements are complete. Water seepage and runoff from the vicinity of the dam toe would be directed into a riprap area for oxygenation and a small sedimentation basin. Flow from this basin would then enter the wetland [approximately 0.2 ha (0.5 acre)], which would be relocated from the toe of the dam to just below the basin. The passive treatment system is intended to treat only the seepage water described above. Any additional site runoff and/or storm flow would exceed the capacity of the system and the space at the toe. Appropriate mitigation, according to best management practices, would be followed throughout construction.

Dam Improvements. Dam improvements would consist of the following elements:

- Spillway Repair-Erosion damage in the spillway would be repaired by filling and compacting the spillway area on the eastern end of the dam with suitable material. The adjacent slope would be backfilled and regraded.

Surface Water Controls. Surface controls include the following:

- Surface Water Diversions-Aboveground pipes and other methods would be used to collect surface water and divert it around FCAP to reduce water flow through the ash. Water would be released below the dam.

- Raising the Crest of the Dam-The crest of the FCAP dam would be raised by placing compacted fill at the top of the dam. The existing crest is almost level with the top of the impounded ash; thus, there is no capacity for impoundment of stormwater behind the dam. Greater storage capacity is required to properly control the

discharge of water through the spillway. Raising the crest would also prevent uncontrolled surface flow from overtopping the dam and the resulting erosion damage.

- Revegetation-Sediment runoff due to erosion would be minimized by establishing a vegetative cover (e.g., by seeding with native grasses) on areas where excavation or other disturbance of natural vegetation may have occurred.

Monitoring. This component is intended to ensure that the engineered features of the remedial actions continue to perform as expected and meet regulatory reporting requirements. Long-term physical surveillance of the darn will be conducted to determine future maintenance needs and prevent failure. Surface water and groundwater would be monitored to evaluate effectiveness and determine if existing and future receptors are threatened.

ALTERNATIVE 5: SURFACE WATER CONTROLS AND DAM STABILIZATION

Alternative 5 adds dam stabilization and includes institutional controls, environmental enhancements, dam improvements, surface water controls, and monitoring described in Alternative 4. Alternative 5 was retained for detailed analysis.

Dam Stabilization. Dam stabilization would provide all additional modifications necessary to satisfy requirements in the Tennessee Safe Dam Act of 1973, as amended May 1991. Following are some components that may be included in dam stabilization if deemed necessary in the detailed design phase.

- Rock Buttress-The entire outslope of the dam would be stabilized with a rock buttress to provide enhanced structural stability.

- Riprap-Rock riprap or gabions (rock-filled baskets) would be installed, as required, for slope protection due to high velocity flow under design conditions.

- Subsurface Drains-A subsurface drain would be installed at the toe of the dam, near the abandoned principal spillway outlet, to control seepage from and around the outlet pipe. The pipe (to be grouted) is blocked because the entire standpipe on the upstream side of the dam is filled with ash and buried below the FCAP surface.

ALTERNATIVE 6: CAP

Alternative 6 is a containment alternative intended to isolate the coal ash at FCAP, the Sluice Channel area, and Upper McCoy Branch from the environment and to reduce the generation and release of contaminated leachate to surface water. This alternative includes bulk liquid removal, wastewater discharge, surface flow controls, access and use controls, monitoring, dam improvements and stabilization, dust suppression, and capping. This alternative also would include construction of a clay cap over all coal ash and permanent diversion of surface water flow. This alternative was screened out because it is much more costly than retained alternatives, yet does not improve long-term reliability or effectiveness in protecting human health and the environment.

ALTERNATIVE 7: WASTE CONSOLIDATION AND CAPPING

Alternative 7 is identical to Alternative 6, except that waste would be excavated from the Sluice Channel Area and Upper McCoy Branch and consolidated into FCAP before capping. This additional measure would reduce the areal extent of the waste to be capped. The reduction in cap surface area would reduce material and labor costs in building the cap. This alternative was screened out because of little improvement in effectiveness at a much greater cost and

negative short-term effects to the environment.

ALTERNATIVE 8: WASTE CONSOLIDATION AND STABILIZATION AND CAPPING

Alternative 8 is identical to Alternative 7, except that in situ waste stabilization is added. Waste stabilization would minimize the potential for long-term waste settlement and the release of contaminants to the surface water and groundwater. Shallow soil mixing and the addition of stabilizing reagents is the specific stabilization method that would be implemented under this alternative. This alternative was screened out because of its limited additional effectiveness versus cost and negative short-term effects to the environment.

ALTERNATIVE 9: EXCAVATION AND OFF-SITE DISPOSAL

Alternative 9 includes excavation of solids and sediments and lowering of moisture content by use of a thickening agent, bulk liquid removal and wastewater discharge, sediment control barriers during excavation, grading and revegetation; solids disposal at an off-site solid waste disposal facility, and site restoration. Waste would be treated to the extent necessary to meet the transportation requirements and waste acceptance criteria of the off-site disposal facility. Alternative 9 was retained for detailed analysis to address the regulatory preference for removal and treatment.

All coal ash and underlying contaminated soils in the Sluice Channel Area, FCAP, and Upper McCoy Branch would be excavated by dredging and dry mechanical excavation methods, as required. Incidental and standing water, construction stormwater, and decontamination water would be pumped into tank trucks and transported to the Y-12 West End Treatment Facility. The waste would be excavated and blended with a thickening agent to lower the overall moisture content. The waste would be placed in trucks, sealed with liners, and transported to the disposal facility. The dam would be excavated and removed and, after sampling and analysis, soil with contaminant concentrations below action levels would be used to backfill and regrade the site.

When excavation is complete, the site would be restored by grading to original (predam construction), natural contours, establishing native plant species, and allowing natural vegetative succession. Maintenance and postremedial action monitoring would not be required under this alternative.

Chestnut Ridge Landfill is the designated off-site solid waste disposal facility, owned and operated by Waste Management of North America. The landfill is approximately 16 km (10 miles) west of the OU 2 site in Heiskell, Tennessee. This landfill formerly accepted coal ash produced by the ORR K-25 Site and currently accepts ash from the Y-12 Steam Plant. The moisture content of the waste would be lowered to meet waste acceptance criteria, and documentation would be provided showing that the waste passes toxicity characteristic leaching procedure metals testing and the paint filter test for release of free liquids. All necessary approvals and certifications would be provided before shipment.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

DOE, TDEC, and EPA screened the nine alternatives in the FS. After consideration, four alternatives (Alternatives 1, 4, 5, and 9) were retained for detailed analysis and evaluation against the nine criteria provided by CERCLA for final remedial actions.

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

This criterion addresses an alternative's ability to provide adequate long- and short-term protection of human health and the environment. All of the alternatives except the no action

alternative adequately protect human health and the environment by eliminating, reducing, or controlling risk through treatment, engineering controls, or institutional actions.

The overall protectiveness of the three action alternatives is approximately the same. Alternative 9 is slightly more reliable because off-site disposal removes the source of contamination from the site. Alternatives 4 and 5 would achieve protection by repairing the dam spillway, raising the crest of the dam, diverting uncontaminated runoff around FCAP, providing environmental enhancements, and implementing institutional controls.

The no action alternative is not considered further in this comparative analysis of alternatives because it does not provide the most basic requirement of protecting human health and the environment.

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This criterion addresses an alternative's ability to meet applicable or relevant and appropriate requirements (ARARs) of all federal and state environmental statutes.

Alternatives 4, 5, and 9 comply with identified federal and state ARARs. The "Statutory Determinations" section summarizes the ARARs for the selected remedy.

LONG-TERM EFFECTIVENESS AND PERMANENCE

Long-term effectiveness and permanence refers to the magnitude of expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

Alternatives 4, 5, and 9 would be effective in the long term and provide permanent solutions. Alternatives 4 and 5 provide institutional controls, surface water controls, and dam improvements while leaving the ash in place and enhancing the rate of natural recovery in the area. These alternatives would be equally effective in reducing the residual risks to potential receptors, with the exception that Alternative 5 would have slightly greater long-term reliability because of the additional structural stabilization of the dam. Alternative 9 would be slightly more reliable in reducing residual risks to potential receptors at the site because all ash and contaminated soil would be removed, and there would be no on-site dependence on the reliability of institutional controls.

Long-term environmental impacts are dramatically different between the on-site and off- site disposal alternatives. Minimal impacts would occur under Alternatives 4 and 5, and no critical habitats of threatened or endangered species would be directly affected. Construction of the dam modifications for Alternative 5 would affect a portion of the small wetland [less than 0.2 ha (0.5 acre)] below the dam. This would be mitigated by relocating the wetland slightly downstream as part of the passive treatment system. Because of the extensive excavation and removal of all ash and contaminated soil to health-based levels, Alternative 9 would destroy existing site habitats, including several acres of wetlands. The affected habitats would eventually recover, but it would take 30-50 years for the area to reach successional stages equivalent to those currently present.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Reduction of toxicity, mobility, or volume through treatment addresses the anticipated performance of treatment that permanently and significantly reduces toxicity, mobility, or volume of waste.

Alternatives 4 and 5 would not reduce toxicity or mobility of the ash in FCAP through treatment. The passive treatment system would remove and concentrate contamination from surface water; however, this would result in only a slight reduction of contaminant volume. Alternative 9 increases the volume and decreases the mobility of contaminants due to the addition of lime to meet the waste acceptance criteria of the off-site disposal facility.

SHORT-TERM EFFECTIVENESS AND ENVIRONMENTAL IMPACTS

This criterion considers impacts to community, site workers, and the environment during construction and implementation and includes the time until protection is achieved.

During remediation, Alternatives 4, 5, and 9 protect the community and workers through the use of engineered and institutional controls. However, Alternatives 4 and 5 would be more protective because the waste would not be disturbed, there would be virtually no potential for off-site migration of dust or other airborne contaminants. Short-term risks to the community (not including transportation) and to nonremedial workers would be approximately equal and within acceptable limits for all three alternatives. Risks to the community along the transportation route and to workers during waste excavation and handling would be higher for Alternative 9.

Short-term environmental effects associated with Alternatives 4 and 5 would be minor. Alternative 9 would destroy approximately 6 ha (15 acres) of habitat and require relocation of a state-listed plant species of special concern and mitigation for wetland destruction.

The duration of remedial activities for Alternatives 4 and 5 would be approximately the same, 4 months, with environmental enhancement actions continuing for up to 5 years. Maintenance and surveillance actions would be required and CERCLA 5-year reviews would be performed until the site no longer presents a hazard. Alternative 9 would require a remediation period of approximately 4 years due to the time involved in waste removal. After the first 5-year review, no further surveillance or maintenance would be expected for Alternative 9.

IMPLEMENTABILITY

Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the chosen solution.

Alternatives 4, 5, and 9 are technically feasible to implement, although Alternative 9 would involve greater amounts of time, equipment, and activity. All three alternatives could be performed using conventional equipment and construction methods. Excavation of FCAP ash under Alternative 9 would be moderately difficult because of the working conditions caused by the unstable substrate (saturated ash). All other components of the three action alternatives would be easy to implement.

Implementation of Alternatives 4 and 5 would not be subject to administrative barriers. The administrative feasibility of Alternative 9 is moderately difficult because of the logistical arrangements and documentation required for off-site disposal.

COST

The differences in cost, including capital costs and operation and maintenance (O&M) costs, are expressed as estimated, total, present-worth cost for each alternative. Alternatives 4 and 5 are estimated at $4.3 and $4.6 million, respectively. Alternative 9 is estimated to be more than an order of magnitude higher in cost at $65 million.

STATE ACCEPTANCE

This criterion evaluates whether the state agrees with, opposes, or has no comment on the preferred alternative. The state of Tennessee concurs with the selected remedy.

COMMUNITY ACCEPTANCE

Community acceptance addresses the issues and concerns the public may have regarding each of the alternatives and the preferred alternative in particular. The proposed plan (Jacobs ER Team 1995b) presented Alternative 5, with minor modifications from the alternative described in the FS, as the preferred alternative. The "Highlights of Community Participation" section summarizes community participation. The selected remedy was not modified based on public comments. The "Responsiveness Summary" in Part 3 provides comments submitted during the public comment period and responses to these comments.

SELECTED REMEDY

Based on CERCLA requirements, the comparative analysis of the alternatives presented in the FS (Jacobs ER Team 1995a), and public comments, DOE, with the concurrence of EPA and the state of Tennessee, has determined that the preferred alternative as presented in the proposed plan and subsequently modified by agreement of all FFA parties is selected as the most appropriate remedy for the FCAP OU. The modifications to the preferred alternative agreed to by the FFA parties are summarized in the "Documentation of Significant Changes" section of this ROD because the changes were made following closure of the public comment period. For simplicity and brevity, the components of the selected remedy are rearranged here from the way they were presented in the FS and proposed plan and in the description of alternatives previously presented in this document. The selected remedy reflects the best balance of the evaluation criteria.

The RI risk assessment indicates a current risk to ecological receptors and the potential for future risk to human and ecological receptors, particularly if the dam fails. The selected remedy reduces risks by implementing institutional controls, environmental enhancements, surface water controls, dam improvements and stabilization, and monitoring.

Institutional Controls. Institutional controls limit access to the site to (1) prevent prolonged exposure of humans to contaminants, (2) control future development and disturbance of the site, and (3) prevent destruction of engineered actions. Access to the site will be confined to authorized personnel through the use of fencing, gates, and signs. Deed restrictions or continued government ownership will limit access and use of the site, thereby eliminating public exposure to on-property contamination.

Environmental Enhancements. A passive treatment system will be constructed to lessen migration of contaminants from ash into surface water. First, the wetland at the toe of the dam will be carefully excavated, and plants will be set aside for later relocation. Then construction of the dam and spillway improvements will be performed promptly. An oxygenation area and a settling basin will be constructed at the toe of the dam. Finally, the excavated wetland plants will be relocated just downgradient of the small basin and upstream of the emergency spillway outfall. The system will intercept and treat contaminated water seeping under the dam, reducing contaminant levels in the surface water of Upper McCoy Branch. The system will be able to remove metals by oxidation, sedimentation/precipitation, settling, filtration, and biological processes similar to those occurring in the existing wetland. Contaminated sludge in the bottom of the basin may be removed, if necessary, as determined by periodic inspections and review of monitoring data. Any removed material would be sampled, characterized, and disposed of in an approved facility.

Dam Improvements and Stabilization. This component will modify the dam to bring it into compliance with all requirements for existing dams of the Tennessee Safe Dam Act and will include actions to satisfy appropriate requirements for new dams, although these are not ARARs for this action. The entire outslope of the dam will be stabilized, if necessary, with a rock buttress to provide enhanced structural stability. The crest elevation of the dam will be raised to provide capacity for impoundment of stormwater behind the dam and to minimize erosion. The spillway will be repaired by backfilling and compacting the spillway channel, increasing its capacity to meet the requirements of the Tennessee Safe Dam Act, and protecting it from further erosion. Trees will be removed from the dam and all voids filled with compacted soil to seal the roots. A subsurface drain at the toe of the dam will be installed, if required, to control seepage from and around the abandoned primary spillway pipe and the existing underdrain system.

Monitoring. Monitoring will verify the effectiveness of the remedial actions and provide the basis for CERCLA 5-year review. A monitoring and surveillance plan will be developed during the remedial design phase. Monitoring will consist of the following actions.

- Physical Surveillance and Maintenance-Scheduled periodic inspections will assess the condition of the dam and emergency spillway. Scheduled maintenance actions will be performed periodically and unscheduled maintenance will be performed, as required, based on surveillance and monitoring findings.

- Monitoring-Surface water will be periodically sampled and characterized. These monitoring results will be analyzed to verify that the passive treatment system reduces contaminant levels in water entering Upper McCoy Branch at least as well as the existing wetlands and to evaluate whether the passive treatment system requires maintenance.

- CERCLA 5-Year Report-DOE will prepare a report for the postremediation, 5-year review as required by CERCLA 121 (c) for remedial actions that leave waste in place. Revisions to monitoring frequency, adding or eliminating remedial actions, and determining if future 5-year reviews are necessary will be addressed, as appropriate, in the report.

The estimated capital cost for the selected remedy is about $1,120,000 plus a 35 percent contingency for a total of about $1,760,000. Monitoring and O&M costs for 30 years are estimated at about $1,200,000 plus a 35 percent contingency for a total of about $1,620,000. A breakdown of the projected cost components is provided in Table 2.1. These estimates were developed by subtracting cost savings resulting from changes to the scope of action from the cost estimates for comparison of the alternatives during preparation of the FS (Jacobs ER Team 1995a). The original FS cost estimates, together with modifications to the selected remedy, are enumerated in the "Documentation of Significant Changes" section.

STATUTORY DETERMINATIONS

Section 121 of CERCLA establishes several statutory requirements and preferences, including compliance with ARARs. Statutory requirements specify that, when complete, the selected remedy must be cost-effective. It must use permanent solutions and innovative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that use treatment that permanently and significantly reduces the toxicity, mobility, or volume of hazardous substances.

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy is protective of human health and the environment through continued containment of the ash and reduction in the potential for exposure of humans and biota to the ash.

COMPLIANCE WITH ARARs

All alternatives retained for detailed analysis in the FS report would meet all ARARs; the selected remedy would meet or exceed all ARARs (Table 2.2).

Chemical-specific requirements set health- or risk-based concentration limits or discharge limitations in various environmental media or else indicate a safe level of discharge that may be considered for a remedial activity. Available ARARs and to-be-considered guidance for radionuclides address only man-made, not naturally occurring, radionuclides. Therefore, no ARARs for radionuclides are included in this decision document. Groundwater at the site would be potential drinking water under current state classification (TDEC Rules, Chapter 1200-4-6.05). However, no unique contaminants were identified as originating from FCAP and the few contaminants in the groundwater (above background levels) did not exceed MCLs. Thus, no action is being taken on groundwater at the OU.

Table 2.1. Revised estimates for cost components of the modified selected remedy for Chestnut Ridge Operable Unit 2' Oak Ridge, Tennessee

Project Cost Item	Cost ($Thousands)2
CAPITAL COSTS	
Direct Cost:	
Environmental enhancement3	0
Access and use restrictions	40
Surface water controls3	0
Dam controls (improvements, stabilization)4	480
Mobilization and demobilization	120
Direct Cost Total (rounded)	640
Indirect Cost:	
Remedial design work plan	12
Remedial design report	140
Remedial action work plan	12
Remedial action integration	500
Contingency - 35 percent	456
Indirect Cost Total (rounded)	1,120
TOTAL CAPITAL COST	1,760
O&M COSTS	
Environmental enhancement3	0
Monitoring5	1,200
Contingency - 35 percent	420
TOTAL O&M COST	1,620
TOTAL PROJECT ESCALATED COST6	3,380
TOTAL PROJECT PRESENT WORTH7	1,450

1Originally estimated for comparison purposes in the feasibility study and modified based on revised bases of estimates.
2Escalated.
3Components eliminated as part of modification.
4Passive treatment system costs are included here as part of construction.
5Originally included costs for groundwater monitoring.
6All costs were reduced as site- and remedy-specific data became available to replace initial conservative assumptions made for the feasibility study cost estimate.
7Present value cost is based on 30-year present value, using a 6 percent discount rate.

Note: Costs presented in table are rounded. O&M = operation and maintenance

Table 2.2. ARARs/TBC guidance for the selected alternative for Chestnut Ridge Operable Unit, Oak Ridge, Tennessee

Actions	Requirements	Citation
	Chemical-specific	
	None	
	Location-specific	
Wetlands		
Presence of wetlands, as defined in Executive Order 11990 § 7(c)	Whenever possible, actions must avoid or minimize adverse impacts on wetlands and act to preserve and enhance their natural and beneficial values. New construction in wetlands areas should be particularly avoided unless there are no practicable alternatives. Wetlands protection considerations shall be incorporated into planning, regulating, and decision-making processes - applicable	Executive Order 11990 10 CFR 1022
Presence of wetlands as defined in 40 CFR 230.3(t) and 33 CFR 328.3(b)	Action to avoid degradation or destruction of wetlands must be taken to the extent possible. If adverse impacts are unavoidable, action must be taken to enhance, or create alternative wetlands. - applicable to actions involving discharge of dredge or fill material into wetlands	Clean Water Act §404 40 CFR 230 33 CFR 323
Floodplains		
Within "lowland and relatively flat areas adjoining inland and coastal waters and other floodprone areas such as offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year." [Executive Order 11988 §6(c)]	Action shall be taken to reduce the risk of flood loss, minimize the impact of floods on human safety, health and welfare, and restore and preserve the natural and beneficial values of floodplains - applicable The potential effects of actions in floodplains shall be evaluated and consideration of flood hazards and floodplain management ensured - applicable If action is taken in floodplains, alternatives that avoid adverse effects and incompatible development and minimize potential harms shall be considered- applicable	Executive Order 11988 10 CFR 1022
Aquatic resources		
Within areas encompassing or affecting waters of the state of Tennessee, as defined in TCA 69-3-103(32), and the presence of wildlife or aquatic life	Discharge of "substances" that "will result or will likely result in harm, potential harm or detriment to the health of animals, birds, fish, or aquatic life" is prohibited - applicable	Tennessee Water Quality Control Act of 1977 (TCA 69-3-101 et seq.)
	Abate existing pollution of the waters of Tennessee - applicable	Tennessee Water Quality Control Act of 1977 [TCA 69-3-102(b)]
Within areas affecting stream or waters of the state of Tennessee, as defined in TDEC 1200-4-7-.01	Must comply with the substantive requirements, as set by the State, of the individual aquatic resource alteration permit process, including best management practices, and erosion and siltation controls - applicable	TDEC 1200-4-7 et seq.

Table 2.2. (continued)

Actions	Requirements	Citation
Within area encompassing aquatic ecosystem with dependent fish, wildlife, or other aquatic life or habitat	Degradation of destruction of aquatic ecosystems must be avoided to the extent possible. Discharges that cause or contribute to significant to significant degradation of the water of such ecosystems are prohibited. - applicable to any action involving the discharge of dredge or fill material into an aquatic ecosystem	Clean Water Act §404 40 CFR 230 33 CFR 323
Within areas affecting stream or river -and presence of fish or wildlife resources	The effects of water-related projects on fish and wildlife resources must be considered. Action must be taken to prevent, migrate, or compensate for project-related damages or losses to fish and wildlife resources - applicable	Fish and Wildlife Coordination Act (16 USC 661 et seq.)
Endangered, Threatened, or Rare Species		
Presence of Tennessee state-listed "species of special concern"	Protected species (i.e., endangered species) may not be uprooted, dug, taken, removed, damaged or destroyed, possessed, or otherwise disturbed for any purpose - relevant and appropriate to "species of special concern" present at the site	Tennessee Rare Plant Protection and Conservation Act of 1985 (TCA 11-26-201 et seq.)
Archaeological and Historic Resources		
Actions involving alteration of terrain which might cause irreparable loss or destruction of significant scientific prehistoric, historic, or archaeological resources	The Secretary of Interior must be advised of the presence of the data. A survey of affected areas for resources and data must be conducted and steps taken to recover, protect, and preserve data therefrom or request that DOI do so - applicable if actions impact any such identified resources	Archaeological and Historic Preservation Act of 1974 (16 USC 469a-c)
Actions impacting any archaeological resources Steps must be taken to protect archaeological resources and sites - applicable if actions Archaeological Resources Protection public land (i.e., within the ORR impact any such identified resources tion Act of 1979 (16 USC 470aa- boundaries)		II) 43 CFR 70
Actions impacting any federally owned, administered, or controlled prehistoric or historic resources -or- the likelihood of undiscovered resources	Consultation with the SHPO should be conducted if cultural resources are inadvertently discovered during remediation activities - applicable	National Historic Preservation Act (16 USC 470 a-w)
	Consultation should be initiated with the SHPO and Advisory Council on Historic Preservation before the initiation of any groundbreaking activities to determine the need for any additional archaeological or historic survey work and the need for an MOA regarding protection of archaeological resources - applicable	Executive Order 11593 36 CFR 800
Dams		
Actions involving/impacting construction or modification of a dam as defined in TCA 69-12-102(3)	Standards for existing dams: (relevant and appropriate to dams owned or operated by the U.S. government or any agency thereof)	Tennessee Safe Dam Act of 1973 (TCA 69-12-101 to -125); TDEC 1200-5-.06

Table 2.2. (continued)

Actions	Requirements	Citation
	! Stability - all dams shall be stable	
	! Slope protection - earth embankments shall be protected from surface erosion by appropriate vegetation or some other type protective surface such as riprap or paving and shall be maintained; all inappropriate vegetation shall be removed from the dam	
	! Emergency spillway - All dams shall have an emergency spillway system with capacity to pass a flow resulting from a 6-hour design storm for a hazard classification appropriate for the dam, or If applicant can successfully demonstrate by engineering analysis that the dam is a safe structure and is sufficient to protect against probably loss of human life downstream, dam design can be approved by the Commissioner.	
	Action-specific	
Fugitive dust emissions from construction activities	Take reasonable precautions to prevent particular matter from become airborne; no visible emissions are permitted beyond property boundary lines for more than 5 min/hour or 20 min/day - applicable	TDEC 1200-3-8.01
Dredge of contaminated sediments, discharge of fill material into waters of the U.S.	Activities are authorized under Nationwide Permit (NWP) 18 (Minor Discharges), NWP 26 (Headwaters and Isolated Waters Discharge), NWP 27 (Wetland Restoration and Creation Activities), and NWP 38 (Cleanup of Hazardous and Toxic Waste) provided that: ! Erosion and situation controls are used and maintained in effective operating condition ! No activity substantially disrupts the movement of those species of aquatic life indigenous to the water body ! Heavy equipment working in wetlands is placed on mats or other measures are taken to minimize soil disturbance ! Discharge does not exceed 25 cubic yards	33 CFR 330, Appendix
Releases of airborne radionuclides during construction, remediation, or transport activities	Releases of airborne emissions from all sources at DOE facilities, measured at the plant boundary Public exposure, airborne emissions - applicable 10 mrem/year	40 CFR 61.92

Table 2.2. (continued)

Actions	Requirements	Citation
	General public exposure, all sources - TBC 100 mrem/year EDE Temporary exemption, maximum limit - TBC 500 mrem/year EDE	DOE Order 5400.5, II.1a
	All releases shall be as-low-as-reasonably-achievable - TBC	DOE Order 5400.5, I.4
Releases to surface water	Implement good site planning and best management practices (BMPs) to control stormwater discharges, including: ! document BMP's in a stormwater control plan or equivalent document ! minimal clearing for grading ! removal of vegetation cover only within 20 days of construction ! perform weekly erosion control inspections and maintenance ! control measures to detain runoff ! discharges must not cause erosion Relevant and appropriate to activities that result in a disturbance of less than 5 acres of total land area	40 CFR 122; TDEC Chapter 1200-4-10.05
Institutional controls when hazardous substances are left in place	Institutional controls shall be required for all areas where containment is a remedial action; controls shall include, at a minimum, deed restrictions for sale and use of property, and securing the area to prevent human contact with hazardous substances - applicable	TDEC 1200-1-13.08(a((4)(iv)
Closure of a solid waste disposal facility with waste left in place	Operator of a Class II solid waste disposal facility must close the facility in a manner that: (1) minimizes the need for further maintenance; and (2) controls, minimizes, or elimi-nates, to the extent necessary to prevent threats to public health and the environment, post closure escape of solid waste, solid waste constituents, leachate, contaminated rainfall, or waste decomposition products to the ground or surface waters to the atmo-sphere - relevant and appropriate to unpermitted solid waste disposal facilities	TDEC 1200-1-7-.04(8)(a)

ARAR = applicable or relevant and appropriate requirements
BMP = best management practice
CFR = Code of Federal Regulations
DOE = U.S. Department of Energy
DOI = U.S. Department of Interior
EDE = effective dose equivalent
min = minute
MOA = memorandum of agreement
mrem = millirem
ORR = Oak Ridge Reservation
SHPO = state historic preservation officer
TBC = to be considered
TCA = Tennessee Code Annotated
TDEC = Tennessee Department of Environment and Conservation
USC = United States Code

Contaminants in leachate from FCAP contribute to existing pollution in surface waters of the Upper McCoy Branch. The Tennessee Water Quality Control Act of 1997, whose purpose is to "abate existing pollution... [and] reclaim polluted waters..." [TCA69-3-102.(b)], is cited as an ARAR for this reason. The goal of this remedial action is to abate this pollution through enhancement of the passive treatment system where leachate exists at the toe of the dam.

Little legislation or guidance governing cleanup of contaminated soils or sediments at CERCLA sites is available. Since coal ash is not a RCRA hazardous waste, none of the Subtitle C RCRA regulations, including land disposal restrictions and the proposed RCRA rules addressing hazardous soils, are ARARs.

Location-specific ARARs include requirements to avoid or minimize adverse impacts to wetlands. If such impacts cannot be avoided, mitigation and compensation are required. The selected remedy involves relocating a small, existing wetland approximately 61 m (200 ft) downgradient from its current location. The disturbance may be unavoidable if the dam is improved and the spillway is repaired. A wetlands delineation and wetlands assessment were completed per 10 Code of Federal Regulations (CFR) 1022 and in consultation with the U.S. Army Corps of Engineers as part of the FS. The substantive requirements of a wetlands mitigation plan (as identified in the FS) will be incorporated into the remedial design work plan and approved by DOE, with the concurrence of EPA and the state of Tennessee, before activities in the wetlands begin.

Since the remedial action will occur within a floodplain, actions must minimize any adverse impacts. A Notice of Floodplain and Wetland Involvement was published for investigative and remedial actions on the ORR October 4, 1993 (58 FR 51624). A floodplain delineation and assessment was completed as part of the FS.

A homestead was identified in the Sluice Channel Area during the RI. It was evaluated during the FS for eligibility for listing as a historic resource in consultation with the state historic preservation officer (SHPO). The SHPO concurred with DOE that the homestead was not eligible for listing in the National Register of Historic Places, and the consultation was completed. No mitigation would be required for the homestead. Location-specific ARARs related to cultural resources would be invoked only if discoveries of additional potential cultural resources were made fluting remedial activities.

A small population of lesser ladies tresses orchids (Spiranthes ovalis), a state-listed species of special concern was identified at the site during a survey of the OU and surrounding area for threatened and endangered plants (Cunningham 1993). The selected remedy is not expected to impact these plants; however, should any actions be taken upgradient of the dam, several location-specific ARARs would be triggered, requiring protection and mitigation for these plants.

Dams in Tennessee are subject to periodic inspection and certification under the Tennessee Safe Dams Act of 1973, as amended July 1989 (TCA Sect. 69-12-101 et seq.). These regulations [TDEC 1200-5-7.02(32)] do not legally apply to the U.S. government. However, the substantive requirements of the regulations for existing dams are relevant and appropriate to this action. TDEC 1200-5-7.06 lists standards for existing dams, and addresses stability, slope protection, and emergency spillways. Compliance with these regulations may be achieved by meeting the specifications enumerated in the regulations or by gaining the approval of the FFA parties. The selected remedy will bring the dam into compliance with all specifications for existing dams and will voluntarily meet some of the specifications for new dams, although these are not ARARs.

Action-specific ARARs for remedial action at FCAP include requirements for surface water controls during remediation and site planning to minimize adverse effects from erosion and stormwater discharges into the creek which could result from activities such as grading,

clearing, and excavation. Best management practices will be followed to minimize the potential release of hazardous substances into surface waters (40 CFR 125.104), to control stormwater discharges (40 CFR 122, TDEC 1200-4-10-.05), and for nonpoint source controls (TDEC 1200-4-3-.06). These practices would comply with the substantive requirements of the aquatic resources alteration and stormwater permitting process (TDEC 1200-4-10-.05, TDEC 1200-4-7 et seq.). Precautions must also be taken to prevent fugitive dust from becoming airborne (TDEC 1200-3-8-.01). Since substantive rather than administrative requirements must be followed, it should be possible to combine these requirements into one best management plan for the project which also incorporates the wetland and floodplain mitigation measures discussed previously.

TDEC Class II solid waste disposal general performance requirements for closure with waste in place are relevant and appropriate for the selected remedy. Requirements include minimizing the need for further maintenance and minimizing the escape of solid waste and leachate, which could pose threats to public health and the environment. These requirements will be met by repairing the dam and constructing the passive treatment system.

COST EFFECTIVENESS

Actions taken under CERCLA must consider the estimated total present-worth costs of the alternatives. Alternatives 4, 5, and 9 in the FS meet the regulatory requirements and reduce risk to human health and the environment to acceptable levels. Alternative 5, with an estimated cost of $4.6 million, is less than 7 percent more costly than Alternative 4 and provides for greater stability of the dam. Alternative 9 is more than 10 times as costly as Alternative 5. Alternative 5 is, therefore, considered the most cost-effective remedy for the protection of human health and the environment.

USE OF PERMANENT SOLUTIONS TO THE MAXIMUM EXTENT PRACTICABLE

DOE believes the selected remedy represents the maximum extent to which permanent solutions can be used in a cost-effective manner for FCAP. Of the remediation alternatives, DOE believes 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.

PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The coal ash in FCAP is not regulated as a hazardous waste. Some toxic constituents in the ash have limited mobility through leaching into surface water. Treatment of the ash to reduce volume would require dewatering. Dewatering would produce a large liquid waste stream and would not necessarily reduce the mobility of the residual hazardous constituents. Treatment of the large volume of ash to reduce toxicity or mobility would increase volume significantly, and the costs are not commensurate with the slight reduction of risk that would be achieved.

The passive treatment system at the toe of the dam is expected to effectively reduce the mobility and bioavailability of the contaminants leached from the dam. The system should equal or exceed the reduction in contaminant concentrations in surface water currently occurring in the natural wetland.

DOCUMENTATION OF SIGNIFICANT CHANGES

The preferred alternative in the proposed plan included minor refinements to Alternative 5 of the FS (i.e., deletion of surface water diversions upgradient of FCAP). The surface water diversions were eliminated because of uncertainties about their effectiveness in reducing contaminant migration, the potential for adverse effects on wildlife habitat and wetlands

resulting from implementation, and difficulty in justifying installation and maintenance costs for the diversion structures. The determination to eliminate that component is documented in the administrative record in a May 30, 1995, letter to DOE (Jacobs ER Team 1995c).

Subsequently, additional changes were agreed to by the FFA managers during a December 6, 1995, meeting. The managers reviewed several components of the selected remedy at DOE's request. The revisions incorporated into the selected remedy are based on regulator comments, a regulatory decision by the state that the structure at FCAP is a dam, and comments raised during the FFA managers meeting. The resulting changes included eliminating implementation of portions of the environmental enhancements. Design requirements for the emergency spillway were also discussed during the FFA managers meeting.

Portions of the environmental enhancements component of the selected remedy, which will not be implemented, include adding nutrients and organic amendments to FCAP soils, planting preferred wetland species at the OU, and placing man-made salt licks on site for deer and other animals use. The managers concurred that there is not a specific regulatory driver for these measures, and current funding constraints within the DOE Environmental Restoration Program argued against their implementation.

Groundwater monitoring was also eliminated from the project as a result of a comment from the state during review of the draft (D1 version) ROD. There was not a specific regulatory driver mandating groundwater monitoring because the remedial action does not include action on groundwater. These changes to the selected remedy will result in cost savings. The difference between the original cost estimates prepared for comparison of the alternatives in the FS and the estimated costs for the remedy, as it will now be implemented, are presented in Table 2.3.

Regulations for the Tennessee Safe Dam Act include guidance for the design of an emergency spillway with a capacity of 1/3 PMP. This was believed to be overly conservative for FCAP, and an alternate design may be approved by the state administrator of the dam program. DOE, EPA, and TDEC agreed that a design storm event suitable under best engineering management practices will be approved before remedial design. This is also expected to result in cost savings, which cannot be estimated at this time.

Table 2.3. Cost components of the selected remedy for Chestnut Ridge OU 2, and as presented in the FS for Alternative 5', Oak Ridge, Tennessee

Project cost item	Cost ($Thousands)2	
CAPITAL COSTS		
Direct Cost:	**FS Estimate**	**Revised Estimate**
Environmental enhancements	24	0
Access and use restrictions	96	40
Surface water controls3	360	0
Dam controls (improvements, stabilization)4	480	480
Mobilization and demobilization	280	120
Direct Cost Total (rounded)	1,200	640
Indirect Cost:		
Remedial design work plan	22	12
Remedial design report	280	140
Remedial action work plan	21	12
Remedial action integration	810	500
Contingency - 35 percent	830	456
Indirect Cost Total (rounded)	2,000	1,120
TOTAL CAPITAL COST	3,200	1,760
O&M COSTS		
Environmental enhancement3	1,300	0
Monitoring5	4,300	1,200
Contingency - 35 percent	1,900	4.20
TOTAL O&M COST	7,500	1,620
TOTAL PROJECT ESCALATED COST6	10,700	3,380
TOTAL PROJECT PRESENT WORTH7	4,600	1,450

1Originally estimated for comparison purposes in the feasibility study and modified based on revised bases of estimates.
2Escalated.
3Components eliminated as part of modification.
4Passive treatment system costs are included here as part of construction.
5Originally included costs for groundwater monitoring.
6All costs were reduced as site- and remedy-specific data became available to replace initial conservative assumptions made for the feasibility study cost estimate.
7Present value cost is based on 30-year present value, using 6 percent discount rate.

Note: Costs presented in table are rounded.

FS = feasibility study
O&M = operation and maintenance

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PART 3. RESPONSIVENESS SUMMARY

This "Responsiveness Summary" documents the public comments on the Proposed Plan for Chestnut Ridge Operable Unit 2 (Filled Coal Ash Pond and Vicinity), Oak Ridge, Tennessee (Jacobs ER Team 1995b). The proposed plan was issued in June 1995. The public comment period started July 5, 1995, and ended August 5, 1995. DOE announced the availability of the proposed plan in a public notice published in The Knoxville News-Sentinel July 5, 1995. The public notice advised that the proposed plan would be one of the topics discussed at the quarterly stakeholders meeting July 18, 1995, and that a formal public meeting would be arranged if requested. This document addresses the informal comments made by the public during the July 18, 1995, stakeholders meeting and telephone and written comments received during the public comment period.

This "Responsiveness Summary" serves three 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 were integrated into the decision-making process. Finally, it allows DOE to formally respond to public comments.

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 SARA, 42 USC, Section 9601, et seq.;
- NCP, 40 CFR 300.430; and
- Community Relations in Superfund, A Handbook, EPA/540/R-92/009.

COMMENTS FROM QUARTERLY STAKEHOLDERS MEETING

No formal transcripts were made at the quarterly stakeholders meeting and no formal public meeting was requested. Although individuals making comments did not identify themselves, the Chestnut Ridge OU 2 issues raised at the stakeholders meeting were recorded. DOE's responses to those issues follow.

ISSUE 1: WHAT ARE THE CONSTITUENTS PRESENT IN THE COAL ASH? HOW DO THEY DIFFER FROM OTHER COAL ASH? DO ALL OTHER ASH DISPOSAL SITES NEED THE REMEDIATION PROPOSED HERE?

Response: The constituents in the FCAP ash are typical of constituents in ash from combustion of eastern United States coal. None of the constituents present at the FCAP were out of concentration ranges typical for eastern coal; the median values at the FCAP were comparable to median values for other coal. The constituents and their concentrations are presented in Table 1.3 of the FS Report and are based on FCAP sampling results and published literature values (Jacobs ER Team 1995a).

Coal ash is regulated as a solid waste under RCRA. It is exempted from being a hazardous waste, but facilities with coal ash must comply with storage and disposal requirements for solid waste. These facilities would not normally require remediation due to the presence of the ash. When ORR was placed on the NPL, SWMUs, including FCAP, were evaluated under CERCLA guidelines to determine whether they pose unacceptable risks to human health and the environment. The ash at FCAP was found to pose such risks largely because it had been placed behind a dam and situated above a natural water body (a small creek). This presents a risk of dam failure and release of the ash under circumstances not present at other sites. In addition, the site conditions are more conducive for transport of the constituents into the environment than at other sites. Thus, remediation of this site is appropriate and required under CERCLA, but may not be required at other coal ash disposal sites.

ISSUE 2: ARE THE COSTS FOR THIS PROJECT JUSTIFIED? CAN THE MONEY PROPOSED FOR THIS PROJECT BE BETTER USED ELSEWHERE?

Response: Compared to many other potential remedial actions on the ORR, the cost for this action is small. Although the "no action" alternative assumes that the site is abandoned and there is zero cost, significant expenditures for existing and planned monitoring and maintenance programs would be incurred even if remedial actions were not taken at the site. Over a 30-year period, only a slight reduction from the $5.6 monitoring and O&M costs projected for Alternatives 4 and 5 and the selected remedy would be expected. In addition, the most significant risk results from possible failure of the dam and release of the ash. This would not pose a large human health safety risk, because the area is occupied by people only rarely. Failure of the dam and release of the ash would, however, significantly damage the local environment and require cleanup at a cost many times the proposed capital remediation cost. DOE feels that the project costs are justified because (1) the incremental cost of the project above already committed expenditures is small, (2) remediation is needed to meet regulatory requirements, and (3) the remediation could prevent greater expenditures in the future.

ISSUE 3: COAL ASH IS SOLD AS A RESOURCE. HAS RESALE OF THE ASH BEEN CONSIDERED TO REDUCE COSTS OR TO MAKE A PROFIT FROM REMEDIATION OF THE SITE?

Response: Resale of the ash for industrial use was investigated in a draft Environmental Restoration Program, Chestnut Ridge Operable Unit 2, Technical Summary (Radian 1993) and eliminated from further consideration. The ash in the FCAP consists of both fly ash and bottom ash. Due to placement methods and its exposure to the environment for decades, the ash is mixed with soil and sediment. Resale at a profit to users of low volumes of high quality ash (e.g., for metal or mineral extraction or as a concrete or asphalt additive) is not possible because the ash would not be accepted without significant treatment and analysis to produce and guarantee a homogeneous product that meets the users specifications. Reuse for high volume, low technology applications (e.g., road base and subbase or structural fill) would require excavation and transport of the ash. Transport would be either as a slurry (requiring the addition of water) or as solid granular material (requiring dewatering). The material would have to be dewatered before use. If users could be found, they would likely accept the material at no charge, rather than pay a fee for receipt of the material. Thus, disposal costs could be avoided, but excavation, dewatering, transportation, and environmental restoration costs would still be incurred. There would be significant, adverse short-term effects on the environment during and after the excavation process. The overall cost of reuse would, therefore, be similar to Alternative 9 in the FS with the elimination of the disposal fees ($65 million less $5 million = about $60 million). This remedy would actually be more costly than the selected remedy and would cause adverse environmental effects.

ISSUE 4: ARE THERE MATERIAL SAFETY DATA SHEETS THAT DESCRIBE THE HAZARDS ASSOCIATED WITH COAL ASH?

Response: Coal ash is a combustion by-product of a naturally occurring energy source (raw material). It is not classified as a hazardous waste under RCRA (although there are low concentrations of hazardous constituents in the ash), and no Material Safety Data Sheets (MSDSs) are available. MSDSs are provided by chemical and other material manufacturers to purchasers of the manufactured material. They describe components of the material sold and the requirements for safe handling, use, and disposal of hazardous materials. As stated, coal ash is the result of combustion of a natural, as opposed to manufactured, product. The risks to human health associated with the FCAP ash were calculated based on certain residential and trespasser scenarios that consider long-term exposure to or ingestion of the ash or its leachate in accordance with EPA and CERCLA protocols. These risks and risks to environmental receptors were determined to be unacceptable, as explained in Issue 1. Institutional Control is the lowest

cost remedial action that will mitigate the risks to human health. Because the scenarios leading to unacceptable human health risks are considered unlikely, institutional controls are the only actions in the selected remedy designed to reduce human health risk. The other actions in the selected remedy address potential catastrophic failure of the dam and reduction of the risks to environmental receptors.

WRITTEN COMMENTS

Three written comments were received. Two of the comments and DOE responses to them follow. The third comment by W. L. McCullough is similar to Issue 3, which is discussed on page 3-4, and is not included here.

COMMENT 1. Fred F. Haywood

"This proposed plan fails to demonstrate that the FCAP and vicinity poses a significant threat to human health and the environment. In this case, the only action which can be justified is stabilization of the dam to prevent catastrophic failure. Risk associated with 228Th represents only a portion of the total potential exposure due to gamma-rays. Radionuclides in the uranium decay chain are also present in the ash. However, protection of the public from this radiation source, or the need for it is poorly justified."

Response: Radionuclides evaluated as COPCs in the RI (Tables 5-1 .a, b, and c; Tables 5.3 through 5.5) included risk contributions from 228Th, 230Th, 232Th, 234Th, 234U, 235U, 238U, and 137Cs. These contaminants were evaluated for trespasser and residential scenarios for inhalation of dust, external radiation exposure, incidental ingestion of soil, and ingestion of homegrown vegetables. External radiation exposure from 228Th, with a risk greater than 1 x 104 under the residential scenario, was the only radionuclide that exhibited a risk greater than 1 x 10-6. Therefore, 228Th was the only radionuclide retained as a relevant contaminant of concern (COC) and discussed in the proposed plan. Assuming continued DOE ownership of the property and access restrictions to the site, DOE agrees that there is little current or future risk to human health from exposure to radioactivity or other constituents in the ash. DOE also agrees that stabilization of the dam to prevent catastrophic failure is justified. CERCLA requires not only protection of human health, but also protection of the environment from the risks resulting from site contaminants. There is a potential risk to sensitive ecological receptors, which could result from contact with or ingestion of surface waters in Upper McCoy Branch contaminated by the ash or its leachate. There are existing, documented risks to on-site terrestrial biota from contact with or ingestion of the ash, plant uptake of ash constituents, and plant ingestion resulting in bioaccumulation of ash constituents in animals. Stabilization of the darn and protection of the ecological receptors are the drivers for the proposed actions. Other than continued institutional control through DOE ownership of the land, no actions are proposed to protect the public from exposure to radiation.

Dam stabilization is, by far, the most costly portion of the capital expenditures for remedial action. The dam stabilization actions will probably destroy a portion of the existing wetlands at the foot of the dam. Under current law, DOE would be obligated, at a minimum, to replace those wetlands. DOE has chosen to provide the required replacement wetlands in conjunction with environmental enhancements designed to reduce risk to ecological receptors in Upper McCoy Branch. The cost of the replacement wetlands is small compared to the cost of dam rehabilitation, and the additional cost of incorporating a passive treatment system into the wetland replacement is an insignificant part of the total project cost. Another small cost will be incurred for placement of salt licks for deer and addition of nutrients (i.e., fertilizer) and organic matter (e.g., sewage sludge, compost, or manure) to the ash pond to enhance recovery of the habitat, reduce plant uptake of constituents in the ash, and reduce exposure to and ingestion of the ash by wildlife.

As described for Issue 2, the most significant cost element for this project is for continued monitoring and O&M actions. Most of this cost would be incurred regardless of the scope of remedial actions. Because the incremental costs of the remedial actions to protect the environment are small compared to the construction costs for dam rehabilitation and the continued monitoring and O&M costs, DOE feels that the actions described in the selected remedy are justified.

COMMENT 2. William A. Goldsmith

"The only component of Alternative 4 or Alternative 5 that would control radiation exposures from the ash pile is the component that restricts access. This component costs nothing. The proposed plan fails to demonstrate how Alternative 4 or Alternative 5 would control risks. Risks other than those attributable to 228Th are poorly identified. Risks attributable to 228Th are not distinctly different from those that may be attributable to natural background radiation. No expenditure for remediation is warranted based on the information provided in this proposed plan."

Response: As discussed in the response to Comment 1, DOE agrees that the human health risks from exposure to radiation are unlikely and do not warrant remediation other than continued institutional controls. As discussed in the responses to Comment 1 and Issue 2, the drivers for remediation of this site are the control of ecological risks and the prevention of catastrophic failure of the dam to reduce the likelihood of greater expenditures in the future. DOE feels that the expenditures to mitigate these risk drivers are justified.