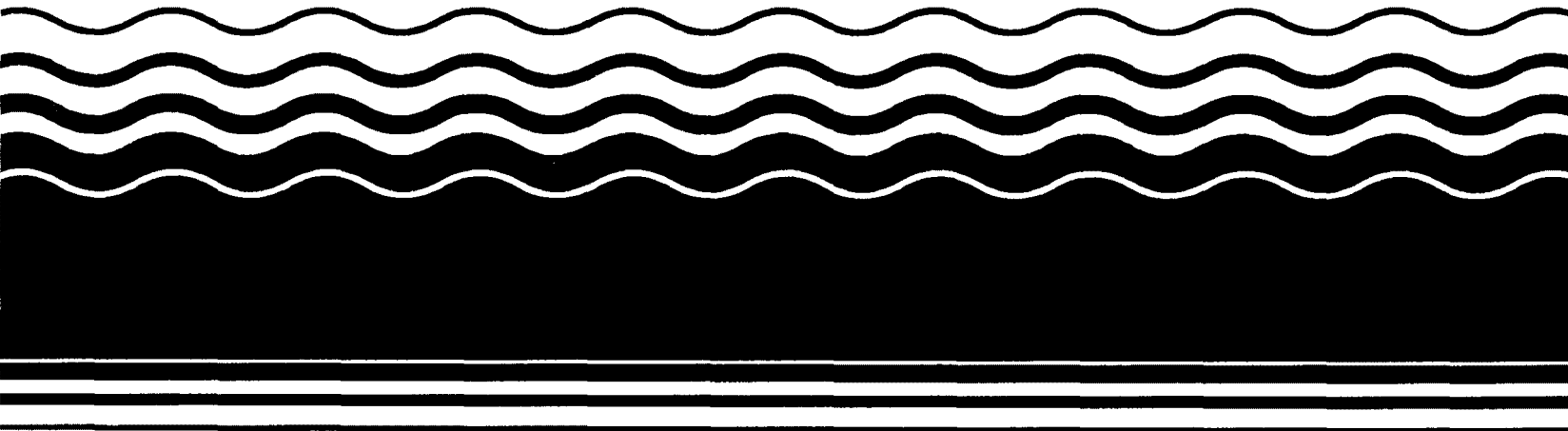


**PB97-964017
EPA/541/R-97/075
November 1997**

**EPA Superfund
Record of Decision:**

**Oak Ridge Reservation (USDOE),
Clinch River & Poplar Creek Operable Units,
Oak Ridge, TN
9/23/1997**





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4

ATLANTA FEDERAL CENTER
100 ALABAMA STREET, S.W.
ATLANTA, GEORGIA 30303-3104

SEP 19 1997

4WD-FFB

MEMORANDUM

SUBJECT: CLINCH RIVER AND POPLAR CREEK OPERABLE UNIT
RECORD OF DECISION
OAK RIDGE RESERVATION, OAK RIDGE, TN

FROM: Victor L. Weeks, RPM *yw 9/19/97*
Oak Ridge Reservation

THRU: Camilla B. Warren, Chief *C.B. Warren*
DOE Remedial Section

Jon D. Johnston, Chief *Jon D. Johnston*
Federal Facilities Branch

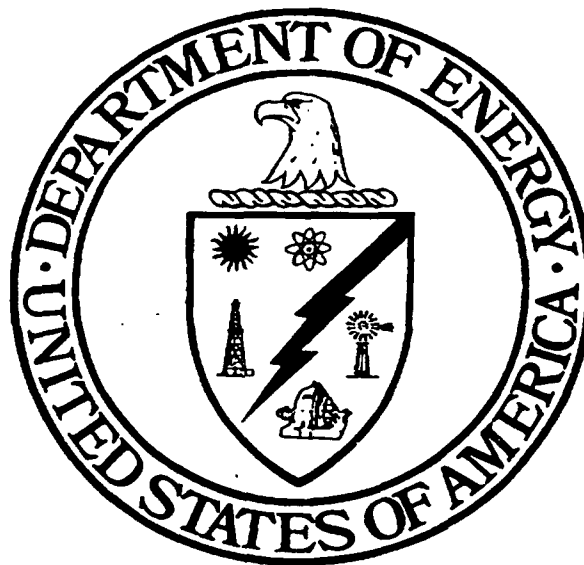
Jewell A. Harper, Deputy Director
Waste Management Division

TO: Richard D. Green, Acting Director *R.D. Green*
Waste Management Division

This is to recommend your signature for the attached Record of Decision (ROD) which provides for dredging restrictions and fish consumption advisories for off-site surface water located down-stream of Oak Ridge Reservation, Oak Ridge, Tennessee. The Department of Energy and the State of Tennessee have signed the ROD. The ROD will become final upon your signature. To establish a basis for your signature, please find the attached information concerning this ROD.

Attachments

**Record of Decision
for the Clinch River/Poplar Creek Operable Unit,
Oak Ridge, Tennessee**



**Record of Decision
for the Clinch River/Poplar Creek Operable Unit,
Oak Ridge, Tennessee**

Date Issued—August 1997

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

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

PREFACE

This Record of Decision for the Clinch River/Poplar Creek Operable Unit, Oak Ridge, Tennessee (DOE/OR/02-1547&D3) was prepared in accordance with requirements under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and documents the selected remedy. This work was performed under Work Breakdown Structure 1.4.12.3.1.02 (Activity Data Sheet 9302, "Watts Bar"). This document provides the Environmental Restoration Program with information about the selected remedy for Clinch River/Poplar Creek Operable Unit, which involves continuance of existing institutional controls and long-term monitoring of water, sediment, and fish. This document summarizes information from the remedial investigation/feasibility study (DOE/OR/01-1393&D3) and the proposed plan (DOE/OR/02-1429&D2).

ACRONYMS AND ABBREVIATIONS

Ag	silver
ARAR	applicable or relevant and appropriate requirement
As	arsenic
AWQC	ambient water quality criteria
B	boron
Be	beryllium
Cd	cadmium
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	<i>Code of Federal Regulations</i>
cm	centimeter
Co	cobalt
COE	U.S. Army Corps of Engineers
Cr	chromium
CR	Clinch River
CRM	Clinch River mile
Cs	cesium
Cu	copper
DOE	U.S. Department of Energy
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ETTP	East Tennessee Technology Park
Fe	iron
FFA	Federal Facility Agreement
FS	feasibility study
g	gram
ha	hectare
Hg	mercury
LAG	interagency agreement
in.	inch
kg	kilogram
lb	pound
LOC	Local Oversight Committee
m	meter
Mn	manganese
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act of 1969
Ni	nickel
ORR	Oak Ridge Reservation
ORREM	Oak Ridge Reservation Environmental Monitoring
ORREMSSAB	Oak Ridge Reservation Environmental Management Site Specific Advisory Board
OU	operable unit
oz	ounce

ACRONYMS AND ABBREVIATIONS (continued)

Pb	lead
PC	Poplar Creek
PCB	polychlorinated biphenyl
PCM	Poplar Creek mile
RCERB	Roane County Environmental Review Board
RI	remedial investigation
ROD	record of decision
SARA	Superfund Amendments and Reauthorization Act of 1986
Se	selenium
Sr	strontium
TBC	to be considered
Tc	technetium
TDEC	Tennessee Department of Environment and Conservation
TVA	Tennessee Valley Authority
U	uranium
USC	<i>United States Code</i>
V	vanadium
WBRIWG	Watts Bar Reservoir Interagency Working Group
yd	yard
Zn	zinc

PART 1. DECLARATION

SITE NAME AND LOCATION

U.S. Department of Energy
Oak Ridge Reservation
Clinch River/Poplar Creek Sediment and Biota Operable Unit
Oak Ridge, Tennessee

STATEMENT OF BASIS AND PURPOSE

This record of decision (ROD) presents the selected remedy for the Clinch River (CR)/Poplar Creek (PC) Operable Unit (OU) sediment and biota within the areal extent described here. Surface water is not addressed in this ROD. This remedial action was selected 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) 9601 et seq., and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [Title 40 *Code of Federal Regulations* (CFR) 300]. This decision is based on the administrative record for this site.

This ROD is issued by the U.S. Department of Energy (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 to the Federal Facility Agreement (FFA) for this response action, and they concur with the selected remedy.

ASSESSMENT OF THE OU

If actual or threatened releases of hazardous substances from this OU are not addressed by implementing the response action selected in this ROD, such releases could present a current or potential threat to public health, welfare, and/or the environment.

DESCRIPTION OF SELECTED REMEDY

The selected remedy for the CR/PC OU addresses the sediments and biota in the Watts Bar and Melton Hill Reservoirs from Clinch River mile (CRM) 0.0 at the confluence of the Clinch and Tennessee rivers upstream to CRM 44 near the Solway Bridge. The OU includes the

Poplar Creek embayment from the creek mouth at CRM 12 upstream to its confluence with East Fork Poplar Creek at Poplar Creek mile (PCM) 5.5. Because the Clinch River forms the southern and eastern boundary and Poplar Creek (along with East Fork Poplar Creek) drains the northern and western boundaries, this OU receives all surface waters leaving the Oak Ridge Reservation (ORR) and thus has received many ORR-related contaminants.

This OU does not include surface water. The Surface water OU will be addressed in a separate ROD following remediation of upstream contaminant sources. Some surface water related items are discussed in this ROD for information purposes. The selected alternative's surface water sampling and irrigation survey activities will be conducted to allow later preparation of a ROD that addresses surface water. The CR/PC OU, previously designated for purposes of the remedial investigation (RI), has been redesignated as two OUs: one for CR/PC sediment and biota and one for CR/PC surface water. A decision has been made to select a remedy for the CR/PC sediment and biota OU and defer a decision on the CR/PC surface water OU until upstream remedial actions are completed and contaminant input is minimized. References in this ROD to the CR/PC OU apply only to sediment and biota.

The response action was chosen from a full range of actions that could possibly address the two primary risks identified in the RI. The two primary risks to human health posed by CR/PC are exposure to (1) mercury, chromium, arsenic, and ¹³⁷Cs in deep sediment of the main river channel and (2) polychlorinated biphenyls (PCBs), chlordane, arsenic, and mercury in fish tissue. Present ecological risk in CR/PC is not serious enough to warrant an action that would be harmful to the environment in the short-term. The selected remedy does not address ecological risk.

The selected remedy components are as follows:

- existing institutional controls to control potential sediment-disturbing activities,
- fish consumption advisories to reduce exposure to contaminants in fish tissue,
- annual monitoring to detect changes in CR/PC contaminant levels or mobility, and
- survey to confirm effectiveness of fish consumption advisories.

DOE will be responsible for undertaking any appropriate CERCLA response actions required based on monitoring data. An interagency agreement (IAG) among DOE, TDEC, EPA, Tennessee Valley Authority (TVA), and the U.S. Army Corps of Engineers (COE) became effective February 1991. The IAG provides for the coordination and review of permitting and other use activities that could result in the disturbance, resuspension, removal, and/or disposal of contaminated sediments or potentially contaminated sediments in Watts Bar Reservoir.

Existing controls on sediment-disturbing activities are defined in *Rules of the Tennessee Department of Environment and Conservation*, Chapter 1200-4-7, "Aquatic Resource Alteration Permit Process"; Section 26A of the Tennessee Valley Authority Act of 1933; and Section 10 of the Rivers and Harbors Act of 1910 (COE authority).

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 requirements (ARARs), and is cost-effective. This remedy uses permanent solutions and alternative treatment technologies to the maximum extent practicable for this OU. However, because treatment of the principal threats of the site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element.

The following factors contributed to the decision that active removal and/or treatment is not practicable for the sediment or biota of CR/PC:

- Sediments determined to pose a risk to human health in a future risk scenario do not pose a current risk because they are underwater year round, are covered by cleaner sediments, and are relatively stable and do not migrate.
- Removing sediment or fish from the OU in a volume sufficiently effective to reduce risk would be a massive, very expensive, and destructive undertaking.
- Removing sediment from the OU would kill all existing organisms that live in the sediment, leave the habitat less suitable for rehabilitation in the short-term, and kill many fish because of sediment loading during dredging.

Hazardous substances above health-based levels will remain in the OU if this remedy is implemented. Because hazardous substances are to remain in the OU, it is recognized by DOE, TDEC, and EPA that Natural Resource Damage claims, in accordance with CERCLA, may be applicable.

This ROD does not address restoration or rehabilitation of any natural resource injuries that may have occurred at the OU, or whether such injuries have occurred. DOE has agreed to fund a pilot study of the Watts Bar OU that will examine natural resource issues, and that may provide a model for addressing such issues for this OU; however, this study has not yet been

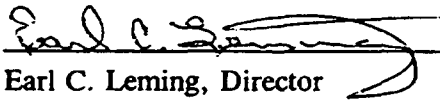
completed. In the interim, neither DOE nor TDEC waives any rights or defenses they may have under CERCLA Section 107(a)(4)(c). A review will be conducted within 5 years after commencement of remedial action, according to CERCLA Section 121, to ensure that the controls and advisories for CR/PC continue to adequately protect human health and the environment. Also, DOE has agreed to provide status reports to TDEC and EPA on the monitoring and assessment program for CR/PC. Monitoring results will be summarized in the annual ORR Remediation Effectiveness Report.

APPROVALS



Rodney R. Nelson, Assistant Manager
U.S. Department of Energy
Oak Ridge Operations Office

9/19/97
Date



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

9/19/97
Date



Richard D. Green, Acting Director
Waste Management Division
U.S. Environmental Protection Agency—Region 4

9/23/97
Date

PART 2. DECISION SUMMARY

OU NAME, LOCATION, AND DESCRIPTION

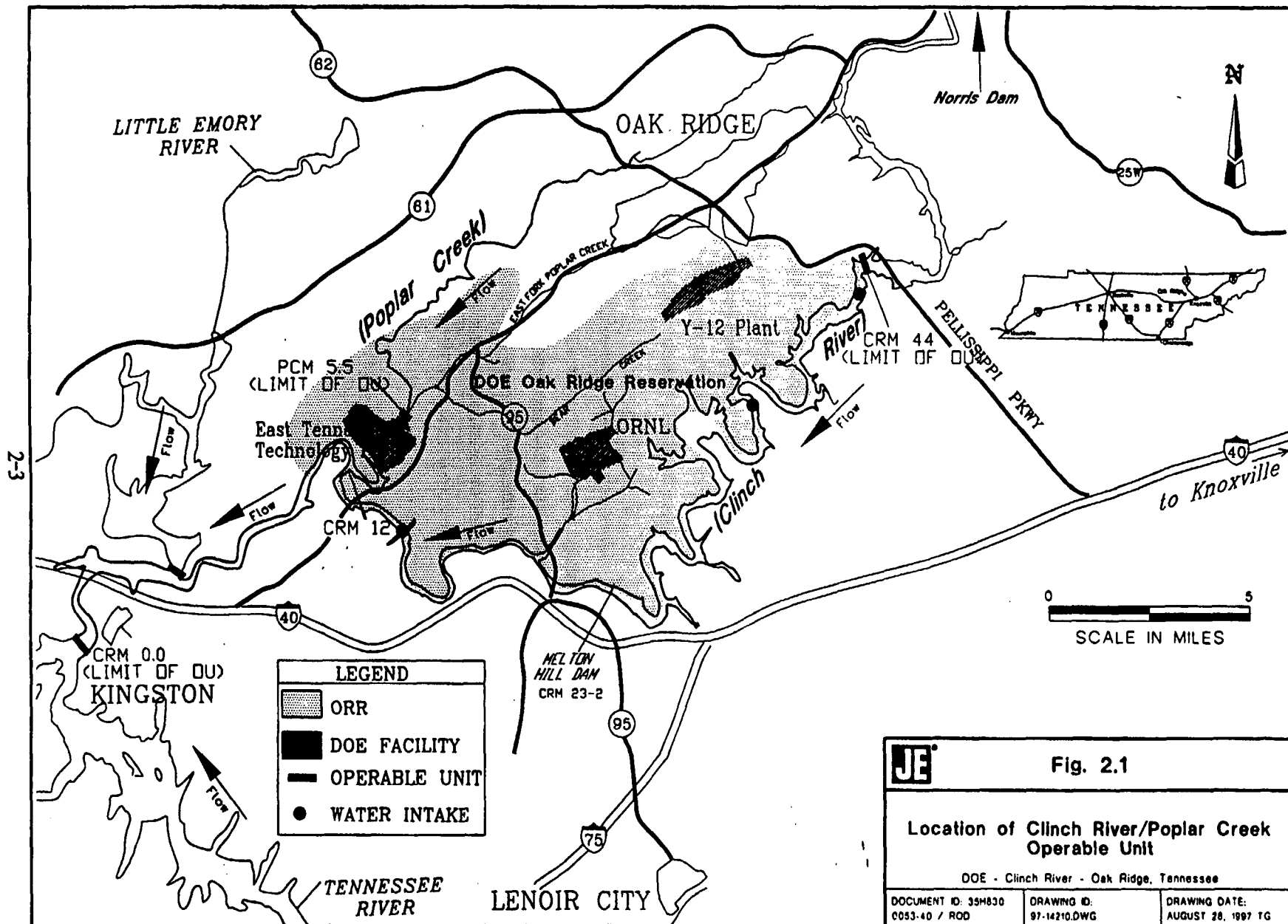
The CR/PC OU consists of the Watts Bar and Melton Hill Reservoir sediment and biota from CRM 0.0 at the confluence of the Clinch and Tennessee rivers upstream to CRM 44 near the Solway Bridge. The OU includes the Poplar Creek embayment from the creek's mouth at CRM 12 upstream to its confluence with East Fork Poplar Creek at PCM 5.5 (Fig. 2.1). DOE will address surface water within this OU following completion of decision documents and actions taken at the upstream sources of contamination.

The Clinch River flows out of Virginia into the state of Tennessee, leaving Norris Lake to enter the OU in Melton Hill Reservoir and then into Watts Bar Reservoir. The river flows within Anderson, Knox, Loudon, and Roane counties in the OU. These TVA reservoirs provide flood control, hydropower generation, navigation, municipal and industrial water supply, wildlife habitat, and recreation. Poplar Creek drains portions of ORR and enters the Clinch River near the downstream end of the OU. The shorelines of the OU are used primarily for agricultural, recreational, residential, and industrial purposes.

OU HISTORY AND ENFORCEMENT ACTIVITIES

On November 21, 1989, EPA placed ORR on the National Priorities List under CERCLA. On January 1, 1992, an FFA was implemented by DOE, EPA, and TDEC. The agreement provides a procedural framework and schedule for evaluating, prioritizing, and managing areas of contamination on ORR. The agreement specifies that CERCLA procedures be followed to evaluate and remediate contamination problems.

CR/PC is contaminated because of past activities at DOE's ORR and non-DOE industrial and municipal sources. ORR comprises three major installations—Oak Ridge National Laboratory, Oak Ridge Y-12 Plant, and East Tennessee Technology Park (ETTP; formerly Oak Ridge K-25 Site). These facilities were built in the 1940s as research, development, and process facilities in support of the Manhattan Project. Activities at these facilities have resulted in the release of hazardous substances and radioactive contamination to the on-site and off-site environment. In January 1997, DOE presented the public with the proposed plan for CR/PC and solicited public comments. The proposed plan presented monitoring, advisories, and institutional controls as the preferred remedial action.



The current or threatened release of hazardous substances from ORR is the focus of current source control actions specified under CERCLA. These releases are being quantified at the source; similarly, remedies will be accomplished at the source. The CR/PC RI (DOE 1996a) determined contaminant concentrations in CR/PC fish, water, and sediment and the threat those contaminants might pose to human health and the environment. The measurement of ambient concentrations in these media inevitably integrates all contaminant sources previously mentioned for ORR, as well as any non-ORR sources that contribute to CR/PC.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

An RI/feasibility study (FS) (DOE 1996a) was conducted in accordance with CERCLA requirements, including the public participation requirements of CERCLA - Sections 113(K)(2)(B)(i-v) and 117. Newspaper notices in *The Oak Ridger* and *The Knoxville News-Sentinel* December 5, 1996, and *The Roane County News* December 6, 1996, indicated the availability of documents at the Information Resource Center in Oak Ridge, Tennessee, and announced public meetings. The RI/FS and proposed plan (DOE 1996b) were released to the public in December 1996. DOE encourages public participation in commenting on the preferred alternative for CR/PC and set a comment period of December 4, 1996, to January 24, 1997.

Public meetings were held January 14, 1997, in Kingston, Tennessee, and January 16, 1997, in Oak Ridge, Tennessee. The "Responsiveness Summary" of this ROD summarizes the major issues raised during the public comment period. This decision document presents the selected remedial action for management of CR/PC in accordance with CERCLA, as amended, and NCP to the maximum extent practicable. The decision for this site is based on the administrative record.

SCOPE AND ROLE OF THE OU

Melton Hill and Watts Bar Reservoirs, which include the CR/PC OU, are the first impoundments downstream of ORR. Any surface waters originating on or passing through ORR flow into the CR/PC OU. Because the reservoirs are efficient sediment traps, CR/PC OU sediments contain contaminants released from ORR and have the potential of receiving current or future contaminant releases. The selected remedy for the CR/PC OU addresses potential risks caused by human ingestion of contaminated fish and exposures of humans and biota to contaminated sediments.

Surface water is not a part of this OU. Following completion of upstream source remediations, DOE will address surface water ambient water quality criteria (AWQC) exceedances and will issue a separate ROD. To provide sufficient data to issue this other ROD, DOE will collect surface water samples and will survey irrigation activities as part of the monitoring program in the selected remedy of this ROD. Surface water risk assessment and AWQC are discussed in this ROD for informational purposes only.

SUMMARY OF OU CHARACTERISTICS

Reservoirs within this OU were built by TVA to provide navigation, flood control, and hydroelectric power generation. Land surrounding the reservoir is currently used for residential, agricultural, industrial, and recreational purposes. Waters of the reservoir are used for domestic water supply, industrial water supply, fish and aquatic life, recreation, irrigation, livestock watering, wildlife, and navigation. There are four potable water intakes within the OU: city of Oak Ridge, the West Knox Utility District, ETTP, and a part-time system at Clark Center Recreation Park.

The CR/PC OU is an integrator of waterborne substances in the surface waters leaving ORR. Once these substances enter the CR/PC OU, they may be found in the water, sediment, or biota. The fate of a substance depends on the flow rate of the surface water and the physical and chemical properties of the substance. Dissolved substances are usually flushed through the reservoirs in a matter of weeks, whereas particle-associated substances may accumulate in the sediments and remain indefinitely.

In the OU, peak concentrations of metals and radionuclides are found in deep-water sediments in the old river or creek channel. The highest concentrations of each are generally buried 20–60 cm (8–32 in.) in the deep-water sediments. DOE-related contaminants are found in proportion to the water depth, with little contamination in near-shore sediment. Those few DOE-related contaminants above background levels in the near-shore sediments are arsenic in McCoy Branch, and chromium and manganese in Poplar Creek.

Particle-associated and dissolved contaminants accumulate in CR/PC OU biota. Contamination of CR/PC OU fish with PCBs, As, Hg, ¹³⁷Cs, and pesticides is documented in the RI. Sampling data indicate that sediment and surface water contamination by organic compounds is minimal. Inorganic contaminants in CR/PC OU sediments are similar to those found in other TVA reservoirs. They include Ag, As, B, Be, Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Se, V, and Zn. Radionuclides detected in sediment include ¹³⁷Cs, ⁶⁰Co, ²³⁸U, ²³⁵U, and ⁹⁹Tc.

SUMMARY OF OU RISKS

A baseline risk assessment evaluated potential current and future risk to human health and the environment posed by radioactive and chemical contaminants at CR/PC if remedial action was not taken. Results from this assessment were used to determine a need for action at the site.

Risk to human health was evaluated for the following exposure scenarios, each of which contains one or more pathways through which exposure occurs: (1) use of untreated surface water as drinking water, (2) fish consumption, (3) recreational shoreline use during winter drawdown, (4) swimming, (5) hunting or consumption of waterfowl, (6) agricultural use of main channel sediments that could be placed on shore, and (7) irrigation with untreated surface water.

Surface water meets current drinking water standards. The greatest unacceptable risk to human health from contaminants in CR/PC is associated with the consumption of certain PCB-contaminated fish species. Mercury, chlordane, and arsenic in fish also pose potential risks. Children are potentially at greater risk than adults because of their low body weight. Catfish consumption poses a risk in the entire OU. Consumption of bass from the Clinch River below Melton Hill Dam is a risk, and all fish species within Poplar Creek are considered a risk for consumption. Consumption of largemouth bass, bluegill, and catfish from Poplar Creek posed a risk to human health in the RI, and TDEC advisories warn against consumption of any fish from Poplar Creek.

Recreational shoreline use is considered an acceptable risk to the public (see Part 3 of this ROD, Issue 2, response to second comment). Swimming is also considered an acceptable risk, and consumption of local/resident geese is an acceptable risk to human health.

If deep-water sediments were dredged and used for farming or gardening, several contaminants could pose an unacceptable risk to human health through consumption of the resulting agricultural products (e.g., vegetables, milk, meat, etc.). If they are left in place, these sediments do not pose a risk to human health because no exposure pathway exists.

Section 5.3 of the RI presents the toxicity assessment for contaminants causing these risks to human health. PCBs have generally been shown to cause cancer in laboratory animals, but little evidence is available for humans. Chlordane is also a suspected carcinogen. Arsenic is a proven carcinogen and can cause nervous system and cardiovascular damage. Mercury causes nervous system and kidney damage. Cesium-137 can cause cancer.

Significant ecological risks were identified in Poplar Creek but not in the Clinch River. The weight of evidence suggests that toxic effects are causing a risk of a 20 percent reduction in fish species richness and abundance. Habitat factors and upstream coal mining may also be impacting richness and abundance in Poplar Creek. Although risks to benthic invertebrates in Poplar Creek are not high and the evidence is not consistent, the weight of evidence suggests that toxic effects are causing a risk of a 20 percent reduction in benthic invertebrate species richness and abundance. Sediment pore water and water above sediments were not found to be toxic, but some whole sediment samples were found to be lethal to an amphipod. Risks to fish-eating wildlife are estimated to be insignificant. Risks to bats inhabiting Poplar Creek are estimated to be insignificant, but swallows might be at risk of a 20 percent reduction in population production if feeding exclusively on Poplar Creek emergent aquatic insects. Animals foraging on hypothetical dredge spoil were estimated to be at risk.

DESCRIPTIONS OF ALTERNATIVES

The following four alternatives were evaluated in detail within the FS: no action; institutional controls and advisories; source containment, removal, and disposal; and removal and disposal.

ALTERNATIVE 1—NO ACTION

CERCLA requires that the no action alternative be evaluated to establish a baseline for comparing the other action alternatives. Under this alternative, DOE would not initiate any monitoring, controls, actions, or commitments to address potential risks to human health or the environment.

ALTERNATIVE 2—INSTITUTIONAL CONTROLS AND ADVISORIES

This alternative uses three methods to protect human health. First, state public fish consumption advisories (precautionary advisories and no-consumption advisories) would limit or prevent consumption of contaminated fish. Second, regulatory and institutional authorities administered by EPA, TDEC, COE, TVA, and DOE would be used to ensure that any disturbance of contaminated sediments would be done in a manner that is protective of human health and the environment. Third, a monitoring program would detect changes in contaminant concentrations in fish, turtles, and sediment, and would include a survey to confirm the effectiveness of the fish consumption advisories. This alternative does not address ecological risk. Surface water related monitoring would also take place.

ALTERNATIVE 3—SOURCE CONTAINMENT, REMOVAL, AND DISPOSAL

To protect human health and the environment, this alternative uses the actions in Alternative 2 plus containment of the most contaminated near-shore sediment [3.6 ha (9 acres)] and removal/disposal of 137,046 m³ (179,250 yd³) of the most contaminated deep-water sediments. The containment would be constructed of geotextile, geomembrane (plastic), and rock riprap. The removal would be accomplished with mechanical excavation and dredging, with sediments being dewatered and disposed of as necessary, based on characterization data.

ALTERNATIVE 4—REMOVAL AND DISPOSAL

This alternative protects human health and the environment and is similar to Alternative 3 because it includes removal of 137,046 m³ (179,250 yd³) of deep-water/main channel sediments. However, rather than in situ containment, Alternative 4 includes removal and disposal of 173,172 m³ (226,500 yd³) of near-shore sediment.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The alternatives were evaluated against the nine EPA criteria developed to measure overall feasibility and acceptability of remedial alternatives. The first two criteria must be met in initial screening of any alternative considered for selection in the ROD. The next five criteria represent the primary balancing criteria upon which the analysis is based, considering technical, cost, institutional, and risk considerations. The last two criteria (modifying criteria) were evaluated after a regulatory agency review and a public comment period.

This section demonstrates the balancing of trade-offs among alternatives necessary to select a remedy that uses institutional controls rather than active response measures. The rationale for the determination that active response measures are not practicable is presented in Part 1 of this ROD under "Statutory Determinations."

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The no action alternative would not protect human health or the environment because of the risks associated with sediment disturbance or fish consumption within the OU. Alternative 2, Institutional Controls and Advisories, would protect human health by advising either limited or no consumption of contaminated fish species and by eliminating unsafe disturbance and contact with main channel sediments. Alternative 2 does nothing to protect the environment because the

short-term damage to the environment that removing contaminated sediment would cause would impact the environment more significantly than the current impacts from contamination. Alternatives 3 and 4 would protect human health and would protect the environment in the long term by removing or capping sediment, but would cause short-term destruction of benthic organisms, fish, and habitat. All of the alternatives would address the risk from fish consumption equally.

COMPLIANCE WITH ARARs

Alternative 1 does not protect human health or the environment and does nothing to comply with ARARs. Alternatives 2, 3, and 4 would comply with all ARARs or requirements to-be-considered (TBCs) for the portion of the OU covered by this ROD.

SHORT-TERM EFFECTIVENESS

Alternative 1 is not effective. In Alternatives 2, 3, and 4, fish consumption advisories and the permit program for sediment-disturbing activities for the CR/PC OU are already in place. Alternative 2 is effective in the short-term and includes no additional sediment-disturbing activities, but does not address ecological risk. The containment and removal associated with Alternatives 3 and 4 would be harmful to the environment in the short-term because existing benthic organisms, some fish, and benthic habitat would be destroyed.

LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 1 is not effective. Alternative 2 has potential for good long-term effectiveness. Health risks following implementation of this alternative would not exceed current levels because the controls and advisories are already in place. Future risks would be diminished by natural processes (radioactive decay and chemical degradation for sediments), and potential decrease in contaminant concentrations in fish as source areas are remediated through other DOE project activities. Because wastes would be left in place, the permanence of this alternative would rely on the institutional controls and the existence and funding of those state and federal agencies responsible. Additional controls could be implemented easily if conditions change in the future. Alternatives 3 and 4 may have greater long-term effectiveness than Alternative 2 because contaminants would be contained or removed from the OU. The permanence of alternatives would rely on safe, effective storage and disposal of all the wastes removed from CR/PC. These alternatives offer a somewhat permanent fix for ecological risks.

REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT

Active treatment does not take place in Alternative 2. Alternatives 3 and 4 would reduce volume in the long-term through dewatering, and mobility would be reduced through containment of sediments, but not through treatment.

IMPLEMENTABILITY

The main components of Alternative 2 have already been implemented. The monitoring plan would be easily implemented as a revision to the existing monitoring program for Lower Watts Bar Reservoir. Alternatives 3 and 4 would be difficult to implement because of numerous federal and state regulations and stringent work practices that must be satisfied before initiating and completing a major dredging and disposal project. Control of risk from fish consumption is implementable for all alternatives.

COST

Present-worth cost for implementing Alternative 2 for 30 years is approximately \$3.6 million. Using the assumptions provided in the FS regarding volumes of material to be contained or removed, Alternative 3 present-worth cost is approximately \$109.6 million, and Alternative 4 would cost approximately \$123.5 million. A sampling program would help further define remediation areas, and significant increases or decreases in volume might occur that would raise or lower the costs of these estimates.

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. The "Highlights of Community Participation" section in this part of the ROD summarizes the community participation efforts and activities associated with this project. Part 3 of the ROD summarizes all public comments on the remedial alternatives and presents DOE's responses to those comments. The preferred alternative was modified based on public comments (see "Documentation of Significant Changes" in this part of the ROD). The public accepts the selected remedy in its current form.

SELECTED REMEDY

DOE, with concurrence from EPA and the state of Tennessee, has determined that controls and advisories are the most appropriate remedy for the CR/PC OU, based on a review of CERCLA requirements, detailed analysis of the alternatives, and public comments. Alternative 2 provides much better short-term effectiveness and far lower costs than the other alternatives. Alternative 2 represents the best balance among the evaluation criteria for remedial actions.

CONTINUANCE OF EXISTING CONTROLS AND ADVISORIES REGARDING CR/PC ACTIVITIES

One threat to human health posed by the CR/PC OU is consumption of certain species of fish. Under the Tennessee Water Quality Control Act, Rules of the TDEC 1200-4-3, TDEC is authorized to issue fish consumption advisories to protect the public. TDEC's Division of Water Pollution Control currently posts two types of fish consumption advisories at more than 20 public and private access points surrounding the CR/PC OU. A precautionary advisory, the mildest form of advisory, warns children, pregnant women, and nursing mothers to avoid eating sauger and catfish from the Clinch River arm of Watts Bar Reservoir. All other people are warned to limit consumption of those fish to 0.54 kg (1.2 lb)/month. A no-consumption advisory warns the public to avoid eating catfish from Melton Hill, striped bass from the Clinch River arm, or any species from Poplar Creek. CR/PC OU advisories are issued because of PCB content in fish tissues (and for Poplar Creek, mercury and other contaminants). Recent revisions (July 30, 1995) to fish advisory procedures have changed the standards so that the no-consumption advisory is for typical consumers and protects to a level of an excess cancer risk of 10^{-4} , while the precautionary advisory is for sensitive consumers such as children and pregnant women and protects to a level of 10^{-5} . When an advisory is issued or changed, a press release is issued and signs are placed at frequently used access points. A list of advisories is printed in the *Tennessee Fishing Regulations*, published by the Tennessee Wildlife Resources Agency. Telephone numbers are provided with the advisories if the public desires further information regarding an advisory.

The FFA agencies, TVA, and COE have formed a permitting working group. The current interagency agreement for Watts Bar Reservoir Permit Coordination establishes a procedure for review of potential sediment-disturbing operations in the Clinch River below Melton Hill Dam, including Poplar Creek. The interagency agreement working group reviews requests for projects such as construction of beaches, boat ramps, docks, marinas, buoy anchors, fences, fish attractors, retaining walls, pump stations, culverts, and submerged lines or piping for their potential to disturb sediment. DOE provides technical analysis and risk assessment assistance when required. DOE must consider, propose, and implement appropriate response actions if an

existing control or advisory becomes ineffective for any reason or if a sediment-disturbing activity would, because of sediments contaminated by DOE activities, be potentially harmful to human health and/or the environment.

MONITORING PLAN

Monitoring of sediment and fish will be continued to determine whether there is a change in the currently calculated risk that would pose a threat to human health and/or the environment. Turtles will also be monitored initially to build data on PCB levels in turtle flesh. DOE monitoring will be coordinated with EPA, TDEC, TVA, and other federal, state, and local agencies. Also included will be a survey program to confirm that fish consumption advisories are effective. The scope of this monitoring program will be determined and agreed upon in the remedial action work plan submitted to EPA and TDEC following approval of this ROD. Monitoring will begin in fiscal year 1998 and will continue as long as necessary. Data will be incorporated into the ORR Remediation Effectiveness Report annually and will be available to the public. Collected data will be used in the CERCLA-required 5-year-review of the remedial action. If data warrant, a review will be conducted earlier. Concurrent with this plan, some surface water related monitoring will also be conducted.

STATUTORY DETERMINATIONS

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Analysis of existing data reveals no unacceptable risk to human health or the environment from sediments or fish consumption in the CR/PC OU under the conditions that this remedy will maintain. DOE will ensure that future sediment-disturbing activities within the CR/PC OU will be done in a manner that continues to be protective of human health and the environment. Natural sedimentation will continue to cover existing contamination and reduce its availability to the environment. Also, radioactive decay of ¹³⁷Cs will lessen its contribution to risk over time. DOE will monitor for any increase in contaminant levels and could respond to any increases in the overall system or to areas of higher concentrations should such areas be found. There will be no unacceptable short-term risks or cross-media impacts from implementation of this remedy. Institutional controls will continue to limit access and exposure.

COMPLIANCE WITH ARARs

The selected remedy complies with all ARARs or TBCs shown in Table 2.1.

COST EFFECTIVENESS

Actions under CERCLA must consider the estimated total present-worth cost of the alternatives. Alternative 2 is cost-effective 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 the CR/PC OU. 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. As previously discussed, Alternatives 3 and 4 may provide a more permanent solution but are not very practicable or feasible because of the extreme cost and destruction of habitat and organisms associated with sediment removal.

PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The statutory preference for treatment will not be met because removal and treatment of the contaminated sediment and fish is not feasible at this time. As previously discussed, the sediments are stable and their removal would be expensive and destructive. The negative effects of sediment removal would outweigh any potential benefits from treatment.

DOCUMENTATION OF SIGNIFICANT CHANGES

The chosen alternative that was presented to the public in the proposed plan was changed by the addition of three elements to the monitoring program: (1) turtle sampling, (2) survey of fish consumption to confirm the effectiveness of the advisory program, and (3) survey of local irrigation practices to determine whether irrigation poses a threat to human health or the environment.

Table 2.1. ARARs and TBC guidance for Alternative 2 for the Clinch River/Poplar Creek OU, Oak Ridge, Tennessee

Actions	Requirements	Prerequisites	Citations
<i>Alternative 2--Institutional Controls and Advisories</i>			
Chemical- or radionuclide-specific	Residual concentrations of radionuclides in soils shall be derived using the basic dose limit of 100 mrem/year and the DOE RESRAD model with site-specific input parameters	Residual radioactive materials left in place without restrictions—TBC	DOE Order 5400.5(IV)
	The public must not receive an effective dose equivalent greater than 100 mrem/year	Dose received by the public from all sources of radiation exposure and routine activities, including remedial action, at a DOE facility—TBC	DOE Order 5400.5
	All releases of radioactive material must be ALARA	Releases of radioactive material from DOE activities—TBC	DOE Order 5400.5
Location-specific	None		
Action-specific			
Institutional controls	Controls include periodic monitoring, as appropriate; appropriate shielding; physical barriers to prevent access, fences, and warning signs; and restrictions on land use	Interim management of residual radioactive material above acceptable guidelines—TBC	DOE Order 5400.5(IV)(6)(c)
	Controls recommended for long-term management of contamination left in place include restrictions on land use, deed restrictions, well-drilling prohibitions, etc.	Long-term management of contamination left in place—TBC	40 CFR 300.430(e)(3)

ALARA = as low as reasonably achievable
 ARAR = applicable or relevant and appropriate requirement
 CFR = Code of Federal Regulations
 DOE = U.S. Department of Energy

mrem = millirem
 OU = operable unit
 RESRAD = Residual Radioactivity (computer model)
 TBC = to be considered

Turtles were sampled in response to findings that identify local consumers and levels of PCBs in turtle tissue that may be a risk to human health. The fish consumption advisory survey is being conducted to satisfy the public's questions on how well the advisories are known to the general public. The irrigation survey is being conducted because the assumptions used in the risk assessment are questionable and the lack of human health risk concerns needs to be confirmed.

REFERENCES

- DOE (U.S. Department of Energy). 1996a. *Remedial Investigation/Feasibility Study of the Clinch River/Poplar Creek Operable Unit*, DOE/OR/01-1393/&D3. Oak Ridge Operations, Oak Ridge, TN.
- DOE. 1996b. *Proposed Plan for Clinch River/Poplar Creek Operable Unit, Oak Ridge, Tennessee*, DOE/OR/02-1429&D2. Oak Ridge, TN.
- EPA (U.S. Environmental Protection Agency). 1989. *Exposure Factors Handbook*, EPA/600/8-89/043. Office of Health and Environmental Assessment, Washington, DC.
- EPA. 1985. *Handbook Remedial Action At Waste Disposal Sites (Revised)*, EPA/625/6-85/006. Office of Emergency and Remedial Response, Washington, DC.
- TVA (Tennessee Valley Authority). 1990. *Tennessee River and Reservoir System Operation and Planning Review, Final Environmental Impact Statement*, TVA/RDG/EQS-91/1. Knoxville, TN.
- TVA. 1987. *Watts Bar Reservoir Land Management Plan (Final Draft)*. Knoxville, TN.

PART 3. RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

This section of the ROD documents formal public comments on the proposed plan for CR/PC OU, Oak Ridge, Tennessee, and DOE's response to those comments. Comments were submitted in writing or made verbally at the two public meetings. The public comment period was December 5, 1996, through January 24, 1997. A public meeting was held January 14, 1997, at Roane State Community College in Harriman, Tennessee; and January 16, 1997, at Pollard Auditorium in Oak Ridge, Tennessee. In addition to these meetings and the notices announcing them, DOE has periodically met and provided fact sheets to interested members of the public.

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. Third, it allows DOE to formally respond to public comments.

This report was prepared pursuant to the terms of the 1992 FFA signed by DOE, EPA, and TDEC, as well requirements contained in the following:

- CERCLA as amended by SARA, 42 USC, Section 9601, et seq.;
- NCP, 40 CFR 300; and
- *Community Relations in Superfund, A Handbook*, January 1992, EPA/540/R-92/009.

After reviewing transcripts from public meetings and written comments, DOE grouped comments according to common issues, summarized each comment (sometimes direct quotes are provided rather than a summary), and prepared a response to each issue and comment.

ISSUE 1: FISH CONSUMPTION ADVISORIES

Comment: Bob Peele stated that the wording in the proposed plan and the actual state fish consumption advisories was different and confusing with regard to the amount of fish that can be safely consumed. Ms. Barbara also questioned the differences in wording regarding the amount of fish safe to consume.

Comment: Kenneth Campbell stated that there are areas around the Clinch River which are not posted with fish consumption advisory signs, and wondered how the public was to be made aware of the advisories without those signs being posted.

Comment: Alfred Brooks stated that recent studies have shown that turtles have higher concentrations of PCBs than fish do and that turtles should be added to the consumption advisories. Mr. Brooks also thought there should be more effort to provide information on the risk (or lack of risk) of fish consumption to tourists and try to help them understand that occasional consumption of these fish is not a problem.

Comment: The Local Oversight Committee (LOC) stated that the fish consumption advisories do not prevent people from eating contaminated fish and that DOE should acknowledge this fact in the evaluation of the preferred alternative.

Comment: The Oak Ridge Reservation Environmental Management Site Specific Advisory Board (ORREMSSAB) also questions whether the fish consumption advisory program actually prevents people from eating contaminated fish. They recommend a program be implemented to determine the effectiveness of the advisory program, and they would like more detailed advisories that indicate the amount of fish consumption that is considered unsafe as well as appropriate methods for cleaning and preparing fish for consumption.

Response: The TDEC Division of Water Pollution Control issues fish consumption advisories to fulfill the requirements of state law and to keep the public informed of potential health hazards. Two types of advisories are used: "No Consumption" advisories warn people not to eat any amount of the listed species, while a "Precautionary Advisory" suggests that no more than 0.5 kg (1.2 lb)/month of the listed species be consumed. The advisories are determined based on actual concentrations of contaminants (like PCBs) in fish tissue compared to the U.S. Food and Drug Administration guidelines or using EPA risk assessment methodology. The risk assessment prepared for the CR/PC OU in the RI was performed using EPA methodology. The EPA method uses a consumption rate of 54 g (1.9 oz) of fish tissue per day as a conservative estimate of the amount of fish a local resident might eat throughout his/her lifespan. The risk assessment determined that there is a risk to the public if a resident eats that amount of fish for 30 years; however, no attempt was made to determine a "safe" amount of fish that could be eaten. The management of risk is difficult to undertake for an entire population and an amount that may seem safe to one individual may seem very risky to another. The proposed plan quoted the fish consumption advisories verbatim; however, the presentation at the two public meetings did contain a reference to that 54 g (1.9 oz)/day amount and this may have caused some confusion. The state advisory program contains a no-consumption advisory on certain fish species that may be considered "safe" to eat once a month or five times a year or for one week each year (as a tourist might do), but by law the program must try to protect the most sensitive members of our population and the people who may be accustomed to eating fish several times a week during most of their lives.

The fish consumption advisories are provided in special brochures, the Tennessee Fishing Regulations, in TVA's annual *Riverpulse* report, and on signs posted at most public access points that are paved or maintained by government funds. TDEC has agreed that some public access areas may not be posted or may have had the signs stolen or vandalized (a common problem), and they will try to correct this problem. In addition to listing which species should be avoided in the various lakes, the advisories describe methods of preparing and cooking the fish to reduce the amount of contaminants consumed.

Turtles were not considered in the risk assessment and are not addressed in this ROD; however, TDEC conducted turtle sampling and analysis for PCBs recently and the report was made available to the public in May 1997. Based on the data provided in this report, TDEC will determine whether posting the reservoirs to advise against consumption of turtles is necessary. Turtle sampling will be added to the scope of the monitoring program mandated in this ROD. In response to these comments, a survey will be added to the monitoring program in an effort to confirm the effectiveness of the fish consumption advisory program.

ISSUE 2: RISK ASSESSMENT AND REMEDIAL INVESTIGATION QUESTIONS

Comment: Bob Peele and the ORREMSSAB wanted to know why manganese is treated as a ubiquitous, non-DOE-related contaminant in some areas of the RI or proposed plan, and is listed as related to K-25 Site activities in other areas of the RI.

Response: Statements in the executive summary and in other areas of the RI refer to manganese as ubiquitous in surface waters throughout the region, and therefore to some extent the sediments throughout the region also contain some manganese. The sediments immediately downstream of ETTP contain elevated levels of manganese thought to be related to DOE operations. Manganese concentrations were triggering human health risk criteria throughout the operable unit, not just downstream of ETTP. The elevated levels in Poplar Creek were "more" elevated than naturally high background levels, possibly because of coal mining upstream in addition to DOE activities; however, they made no significant change in the risk associated with that area of the OU.

Comment: ORREMSSAB—In the proposed plan, only sediments in the main channel of the Clinch River or main creek bed of Poplar Creek are noted to present potential risk to human health. Nothing is said in the plan about how the preferred alternative protects the public from contamination of near-shore sediments. A reader could conclude that no significant levels of contaminants were found to be present in near-shore sediments. For instance, Tables E-35 through E-37 (Appendix E, RI/FS) clearly show that a number of contaminants exceed the

acceptable noncarcinogenic hazard index of 1.0 for several reaches of the Clinch River and Poplar Creek. The excess lifetime cancer risk of 10^{-4} (1 occurrence of cancer in 10,000 people) is also exceeded when risks are added across pathways for some subreaches.

There is no indication in the plan why these risk levels are acceptable. An alternative to reduce these risks should be favored unless there is valid reason to discount these high levels. Either some institutional control to inhibit human contact with near-shore sediment in the less safe reaches must be devised and shown effective, or the most seriously contaminated near-shore areas that are accessible should be treated in a manner similar to Alternative 3 or 4.

The FS indicates that many of the high risk levels are within the reservation along Poplar Creek and are therefore under institutional control preventing residential use. Since such control is important, the ORREMSSAB recommends that this control be listed in the preferred alternative. Such controls must also seek to prevent sediment contact by fishermen who may access Poplar Creek by boat and wade in shallow portions.

Response: By far, the majority of the noncarcinogenic hazard for Clinch River and Poplar Creek near-shore sediments is derived from manganese. Manganese is a naturally occurring and ubiquitous metal, present at relatively high concentrations throughout East Tennessee. No other contaminant by itself exceeds the hazard index of 1.0. The carcinogenic risk is only exceeded when risks are summed for all contaminants and all pathways in a given subreach. No single pathway would be determined to be a pathway of concern. Two subreaches (one in Poplar Creek and one in the Clinch River) when added across all contaminants and all pathways do provide a carcinogenic risk of 1.8 and 1.1×10^{-4} , respectively. However, in both cases, the risk is driven by the presence of chromium. Chromium usually occurs in two states in the environment, Cr(III) and Cr(VI). Chromium-6 is much more toxic but reacts over time to form Cr(III). The conservative risk assessment methodology used for this RI assumes all chromium to be Cr(VI), assumes 8 hours of exposure each day for 175 days per year (the entire period of water drawdown) for 30 years, uses models to predict airborne particle generation from sediments, and uses the upper 95 percent confidence level concentrations of contaminants rather than actual values or means/averages. Given the extreme conservatism built into the risk assessment, the fact that sediments rarely dry out enough to generate dust during the winter months, and the fact that the hazard is primarily driven by manganese, the FFA parties have concluded that no real threat is being posed to the public. The area within Poplar Creek that is slightly worse than the Clinch River area is within ORR and is controlled so that residential development cannot take place. The fishermen in question would definitely not be at risk based on exposure durations.

Comment: Mr. Campbell, Ms. Bryan, and the ORREMSSAB question the amount of data obtained at Kingston City Park. They wonder if enough sampling occurred and if the samples were deep enough, and how safe it is for children to swim and wade in these public recreation areas.

Response: In 1991, TVA collected five 30-cm (12-in.) core sediment samples from the swimming area at 12 recreation areas on the Tennessee River, including Southwest Point Park (just downstream of Kingston City Park), and 7 areas on the Clinch River. These data indicate no health risks in the Kingston area any different from those throughout the state. DOE has in the past conducted near-shore sampling throughout the Clinch River/Watts Bar system; those data support the conclusion that near-shore recreation areas are not contaminated to the extent that human health risk is a problem for the child recreational user. A comparison of the TVA data from Southwest Point Park with the DOE data and preliminary remediation goals from the RI indicate that the risks associated with this particular recreation area are not high enough to be of any concern to the recreational user. In addition, TDEC recently completed a radiation screening of public recreation and access areas along the Clinch River and will make this report available to the public in March 1997. TDEC's results indicate background levels of radionuclides at these recreation areas. The radionuclides are known to be a very good indicator of DOE-related contamination at a site because most of the high releases of contaminants in the past were accompanied by radioactive contamination. In summary, DOE, TDEC, and TVA all have determined that the safety and welfare of recreation area users is not at risk because of DOE-related contamination (and based on TVA data, any other source of contamination).

Comment: The ORREMSSAB recommends that exposure to near-shore sediment should be included in the swimming/wading scenario.

Response: The risks to individuals in the shoreline use scenario were driven by inhalation of sediments, not dermal contact. In the summer, when swimming and wading take place, no inhalation of sediments takes place and risks are low. Additionally, EPA guidance documents for conducting risk assessments state that "in most cases it is unnecessary to evaluate human exposures to sediments covered by surface water." The surface water tends to be the carrier for contaminants that will permeate the skin, and evaluation of dermal contact to the water itself is sufficient to fully characterize the risks.

Comment: On pages 2-8 of the RI/FS it says that sediments were dredged from the Clinch River between Grubb Island and Melton Hill Dam in 1952 and 1962 and dredged materials were placed on Grubb and Jones Islands. Much of this stretch of the river is downstream and in close proximity to White Oak Creek and is likely to have been contaminated.

Exposure to these materials was not addressed in the risk assessment and risk remediation of the islands is not included in the Plan. The ORREMSSAB recommends that remediation of the islands or controls on use thereof should be included in the Plan unless it is being addressed under another activity.

Response: TVA, as published in *Sediment Characterization Task 2 Instream Contaminant Study* in April 1985, found that samples collected on Grubb Island (CRM 18.3) and Jones Island (CRM 19.7, 20.1, 20.5, and 20.6) revealed concentrations of contaminants in the range of those reported for the Tennessee River upstream of any DOE influence, indicating no significant contamination on the islands. Additionally, TVA owns these islands and restricts them to recreational use for which all near-shore sediments in the OU are not a risk.

Comment: In Table B-5 (Appendix B, RI/FS), metal concentrations in surface water are compared to ambient water quality criteria. One column in this summary table is labeled "maximum detection limit." It is unclear whether the column should read "minimum detection limit" or "maximum detected" and the reader is unable to conclusively compare the data to the ambient water quality criteria. The ORREMSSAB recommends that clarity be provided in the RI/FS report.

Response: The column should read "minimum detection limit" and it was presented in Table B-5 as a way of flagging those criteria for which compliance is difficult to evaluate. It is useful in those cases where all or most values are nondetects and the maximum detection limit is less than the criteria. It also serves to note those criteria/analyte combinations where at least some of our data are inadequate (i.e., if the minimum detection limit is greater than the criterion). In these situations it is difficult to evaluate compliance, and this table seemed an appropriate way to identify these situations. In general, the detection limits were adequate for the purpose of evaluating compliance in those reaches investigated most thoroughly (Poplar Creek, McCoy Branch, and the lower Clinch River). Detection limits are less adequate for some of the upstream "reference" reaches or for certain analytes that Oak Ridge Reservation Environmental Monitoring (ORREM) measured but the RI team did not. In both cases, we relied primarily on ORREM data and we have more problems with detection limits. As a rule, though, our data are adequate for contaminants of concern in the reaches of concern. Neither the RI/FS nor the proposed plan will be revised; rather, the responses to comments will be documented in this ROD.

Comment: It is known that people living in areas adjacent to the Operable Unit I ingest turtle meat. Sampling of turtle tissue is not reported in the RI/FS or considered in the risk assessment. The ORREMSSAB recommends that this potential exposure scenario should be evaluated and the results included in the plan.

Response: Although turtles were not assessed and are not addressed by this ROD, TDEC has completed a study on PCBs in turtles and the report was made available in May 1997. It is expected that the turtles will have concentrations similar to or higher than the fish on which a risk assessment was performed. TDEC is considering the addition of turtles to the advisory program. Turtles will be sampled as part of the monitoring program associated with the preferred alternative.

Comment: On page 5-19 of the RI/FS it is stated that only adults were considered for exposure to carcinogens in the risk assessment because the end result would not be substantially different than if children were considered. It is generally accepted in the health sciences community that children may be more susceptible to the effects of carcinogens than adults. Therefore, the ORREMSSAB recommends that risk calculations for child exposures to carcinogens should be conducted and the RI/FS amended to include them. In addition, the ORREMSSAB recommends that the fact that children were not evaluated when considering exposure to carcinogens be included in the uncertainty analysis in the RI/FS. Discussion of increased susceptibility of children, as well as other populations such as pregnant women, should also be included in the uncertainty analysis.

Response: Children were evaluated separately for those pathways where differences in body weight and ingestion patterns cause children to be more susceptible. (See RI Tables E41 versus E42 and E44 versus E45.) Even though children have a greater exposure factor compared with that of adults (a factor of roughly 2; intake is typically half that of adults, but body weight is only a fourth), this factor is applicable to only 6 years of the 30-year exposure period for carcinogens. The combination of these parameters results in a factor of about 1.2 over the full 30-year exposure period. Given the uncertainties and considerable conservatism in risk assessment, this is not considered "substantial."

Comment: Ms. Barbara wanted to know why an Environmental Impact Statement (EIS) wasn't performed instead of an FS.

Response: In accordance with DOE policy, separate NEPA documentation is not required for DOE's CERCLA actions; NEPA values have been incorporated throughout the CERCLA process (i.e., RI/FS), cumulating in this ROD.

Comment: Mr. Alfred Brooks asked what the primary cause of risk is in fish consumption.

Response: PCB concentrations account for the majority of risk to human health from fish consumption.

Comment: Mr. Phelps asked about genetic damage in fish; stated that the pine tree damage on ORR was caused by nuclear accidents; asked about ⁹⁰Sr sampling; stated that star wars was a cover-up for ⁹⁰Sr dangers; asked about the "bear creek barrier"; wanted to know if the uranium and mercury formed an amalgam as they mixed in the creeks downstream of Y-12; and warned against using national security as a reason for not answering questions.

Response: The Clinch River and Poplar Creek have the same number of fish deformations and problems as the national average of 1 to 2 percent, based on approximately 2,000 fish sampled in the last 5 years. Pine beetles are known to be the cause of the dead pines. Strontium-90 was included as an analyte in all appropriate samples taken during the RI. Strontium-90 tends to be soluble and flow immediately downstream when released into a riverine environment. Known sources of ⁹⁰Sr throughout ORR are being addressed, and any process discharges are treated for—⁹⁰Sr before release. Within the CR/PC OU, all ⁹⁰Sr concentrations are well below the levels known to cause human health risks. DOE is unaware of the star wars coverup problem, or of any "bear creek barrier." Although some industrial processes are capable of combining mercury and uranium, the natural environment within a creek or river does not provide the conditions necessary for chemical interaction between these elements. There are no known national security issues associated with this project or remedial action.

Comment: Mr. Peele asked about the exceedances of ambient water quality concentrations mentioned in the proposed plan.

Response: This ROD does not include surface water. In upper McCoy Branch embayment, the AWQC for human recreation was exceeded for arsenic. This criterion assumes that X concentration in surface water equals Y concentration in fish tissue (and furthermore that Y concentration is harmful to fish, although Y is based on FDA tissue concentrations). By sampling fish and analyzing them for arsenic, DOE showed that fish were not being impacted by the periodic high levels of arsenic in the surface water. Those arsenic levels did not exceed drinking water standards. In Poplar Creek, mercury exceeded the AWQC for fish and aquatic life but again did not exceed drinking water standards. Actions ongoing at ORR are addressing both the source of arsenic to McCoy Branch and the source of mercury to Poplar Creek. It is hoped that these actions will eventually lower the surface water concentrations to below the

AWQC. Allowing these other actions time to be effective is much more sensible than spending enormous amounts of time and money attempting to treat McCoy Branch embayment or Poplar Creek.

Comment: Mr. Earl Allred asked if the concentrations of contaminants in fish are getting lower with time, and if there is anything that can be done other than wait.

Response: Fish samples collected after the RI was published do show a definite decrease in ¹³⁷Cs and mercury concentrations in fish tissue from the earlier data used in the RI report. PCBs are more of an international/regional/statewide problem, and those levels will decline much more slowly. PCBs were designed to be very difficult to destroy and they will remain in the environment and the biota for a longer period of time. DOE is taking measures to reduce and eliminate sources of contamination (including PCBs) to the river systems, but with PCBs there are so many other non-DOE sources that the problem is likely to remain for some time.

Comment: Marina Hyman asked if the major concentrations of mercury and arsenic are on the bottoms of the rivers and creeks, or also on the sides. She also asked where the drinking water for Oak Ridge is collected.

Response: The majority of the sediment contamination is within the old river and creek channels at the bottom. Where a channel approaches the sides or the banks, some contamination may be near the shore but would still be submerged beneath the deeper water. Shallow waters near the shore typically have much less contamination than the deeper water areas. Oak Ridge gets its drinking water from the Clinch River within Melton Hill Lake, where the water meets drinking water standards and has little if any DOE-related contamination.

ISSUE 3: MONITORING AND ASSESSMENT PROGRAM

Comment: Mr. Campbell asked if the monitoring program would include grab samples of sediment, and how many years it would last. The ORREMSSAB suggested that surface water be included in the monitoring program, that it should include suspended sediment during flooding or low flow conditions, and that potable water intakes be sampled. The LOC and the ORREMSSAB also recommends that turtles be sampled in the monitoring program. The ORREMSSAB recommends that plans to inhibit irrigation be included in the monitoring program. The ORREMSSAB desires to participate in the meetings that will be held to determine the exact details of the monitoring program. Ms. Bryan wanted to know if the water intakes are monitored, what analyses are performed, and under what laws. Mr. Josh Johnson asked what projections were made to come up with the \$3.6 million cost estimate for the remedial action.

The LOC questioned if the \$3.6 million included the cost of the fish consumption advisory program, or the revenue loss to downstream communities from loss of tourism.

Response: The monitoring program will consist of surface water sampling near municipal intakes, sediment core samples throughout the OU, fish and turtle samples throughout the OU, a survey to confirm the effectiveness of the fish consumption advisory program, and a survey to determine the amount of long-term irrigation occurring within the OU. The exact locations, analytes, and numbers of samples will be determined in May 1997 at a meeting with DOE, TDEC, EPA, and other stakeholders who may desire to send a representative (such as TVA, COE, and the ORREMSSAB). The program would last as long as necessary, with regulatory review at least every 5 years. With the current amount of data on surface water and the absence of any real threat to human health from the surface waters within this OU, extensive storm/drought sampling is not necessary or cost-effective. Contaminants leaving ORR are diluted tremendously as they enter Poplar Creek or the Clinch River, and high flow events compound that dilution. During low flow periods, very few contaminants will be washing out of the contaminated areas on ORR to enter the system. The analyses are performed on unfiltered samples that include any suspended sediments collected during the sampling event.

If the survey data indicate that there are people who irrigate to the extent that it could be a risk, DOE would address that problem through some type of remedial action. Similarly, if the surveys determine that fish consumption is a realistic threat to the local population, DOE would work with TDEC to address that problem in a protective manner.

Water intakes are monitored by the treatment plant in order to determine what treatment techniques will be needed to clean that water to the desired level. Legally, treatment plants monitor the water they discharge either to the public utilities or to the environment. The Safe Drinking Water Act of 1974 regulates the drinking water plants and determines in part what analyses they perform. DOE will monitor the water around the intakes as part of the monitoring program, and will analyze the samples for all DOE-related contaminants that may pose a risk to human health. The waters within the OU already meet drinking water standards (other than possible biological contamination) before the water is run through the treatment plant, which makes it safe for the public to drink.

The cost estimate for this monitoring program was based in part on the cost of a similar program already implemented for Lower Watts Bar Reservoir. The cost may increase slightly because the monitoring program is being expanded as a result of public comments. Not included in the cost estimate were sampling of turtles, a survey of fish consumers, and a survey for irrigation activity. Finally, the cost quoted in the proposed plan was a "present-worth cost," and

was labelled as such. The present-worth cost of a remedial action is the amount of money that would have to be invested today at some standard interest rate and rate of inflation to fund the projected costs out to 30 years. Thus the present-worth cost may appear low because it is not the total amount of money that will be spent during those 30 years. The cost of the fish consumption advisory program is not included because this is an ongoing program that was in existence long before this project began and is done to fulfill the requirements of state law. Any revenue loss due to decreased tourism is not something that can be calculated readily and would also not be due solely to DOE contaminants. PCBs are the primary contaminant of concern in fish tissue and are attributable to almost every industry and municipality within the watershed. The advisory program is implemented within this OU in the same manner as it is throughout the state of Tennessee (and other states as well), and has little to do with DOE influences or releases.

ISSUE 4: PRIVATE SECTOR IMPACTS ON THE OPERABLE UNIT

Comment: The Roane County Environmental Review Board (RCERB) offers the following comments: (1) the Site Background section of the proposed plan should acknowledge the high state of flux of land use on the ORR; (2) private sector activities in the vicinity of the ORR are not closely monitored for releases of contaminants; and (3) the text of the proposed plan implies that contaminant sources have been eliminated and that risks will decrease over time. The text should clarify if this assumes DOE operations only, or if it considers risks from potential increases in private sector activities that historically had been done by DOE. The LOC offered a related comment: the proposed plan would have benefitted greatly by the inclusion of NEPA values into the RI/FS process such that the impact of DOE's changing mission on the ORR would have been addressed. This would have included the transfer of DOE waste management activities to private-sector firms and the range of potential activities within the OU.

Response: The changes in land use are not very significant from the standpoint of this OU. Current use on ORR is industrial and future land use is assumed to be industrial. Current releases from DOE activities are regulated and monitored according to state and federal law, as will any releases that may occur from future private sector activities. There is no reason to believe that private sector activities will release any more contaminants than DOE activities. We were unable to find a statement in the proposed plan implying that sources of contamination have been removed; in fact, on page 3 there is a statement that upstream contaminant sources are still present. DOE cannot be liable or guarantee through this ROD that private sector businesses are complying with state and federal laws regarding contaminant releases; however, DOE is addressing its own sources of contamination and it is safe to assume that releases to the OU will decline over time. For a discussion of NEPA's relationship to this process, see the response to

Ms. Barbara in Issue 2 above. Again, this OU does not include ORR or surrounding lands, and the change in land use from DOE industrial to private sector industrial is not expected to impact this river system to any significant extent.

ISSUE 5: SEDIMENT-DISTURBANCE CONTROLS

Comment: Mr. Earl Allred asked what limits and permitting would be considered for dredging in Poplar Creek or the Clinch River, and how would the disposal of the dredged sediments be handled.

Comment: The ORREMSSAB and the RCERB want to know how the proposed dredging for a barge terminal at ETPP would be handled and would input from downstream users be solicited.

Comment: The RCERB wants to add text that states that "dredging for barge docks" and "barge activity" will trigger Watts Bar Reservoir Interagency Working Group (WBRIWG) review.

Comment: The LOC recommends that the WBRIWG be expanded to cover other issues such as fishing and recreation and should include members from the Tennessee Wildlife Resources Agency; city of Oak Ridge; Roane, Meigs, and Rhea county governments; and possibly other stakeholder groups.

Response: The Interagency Agreement for Watts Bar Reservoir Permit Coordination was established for one reason: to allow the agencies with permit authority over actions taken in Watts Bar Reservoir (TVA, COE, and TDEC) to discuss proposed sediment-disturbing activities with DOE and EPA relative to any DOE contaminants that may be present in the sediments before conducting the normal permit review process. The WBRIWG consists of the above named groups because of their permit authority or their knowledge of the sediment contamination and how that contamination may impact the public if disturbed. The basic process of obtaining a permit is the same for any organization or individual: (1) an application is completed and submitted to TVA/COE/TDEC (depending on scope of activity); (2) if the proposed activity would occur within Watts Bar Reservoir or its tributaries, the application is forwarded to the WBRIWG for review; (3) the WBRIWG reviews available data for the location involved or DOE collects any necessary data on sediment contamination; (4) if the location appears to be uncontaminated or clean enough to pose no significant health risks, then the application is forwarded back to TVA/COE/TDEC for their standard review process; and (5) if the location appears to be contaminated and sediments may pose a health risk, DOE works with the applicant

to determine how best to approach the conduct of the requested activity (assuming TVA/COE/TDEC permit the action based on their own statutory program of review). The interagency agreement covers any potential sediment-disturbing activity (other than locations predetermined to be free of DOE-related contaminants) and thus barge terminal construction would be covered. Barge activity is ongoing on the reservoir and need not be permitted or reviewed by the working group.

If dredging is necessary in a location with contaminated sediments, DOE will assume the financial and waste management responsibility that is over and above the costs that would normally be incurred and the dredging and subsequent disposal of sediments will take place in accordance with best management practices and in compliance with all state and federal laws regarding downstream impacts and disposal of hazardous and/or radioactive materials. Assuming that construction of the barge terminal is subject to federal review, it would also be subject to public review and comment through the NEPA process.

Fishing or other recreational activities do not qualify as potential sediment-disturbing activities and would not fall under the charter for the WBRIWG. Other agencies under other laws regulate fishing, wildlife, and boating activities, and general recreation does not seem in need of regulation. The use of the WBRIWG to review or permit other activities is not necessary or legally valid. The addition of other members and groups to the WBRIWG is unnecessary for the permitting process as it now works in accordance with the statutory authorities of TVA, COE, and TDEC.

ISSUE 6: OTHER CONCERNS

Comment: The LOC recommends adding water intakes to the site map and making the OU boundaries clearer.

Comment: The RCERB suggests adding water flow directions to the map.

Response: These items will be added to the map in the ROD.

Comment: The LOC asks if any steps are being taken to reduce arsenic input to the OU.

Response: There are two sites previously used for coal ash disposal upstream of McCoy Branch embayment on which DOE is completing CERCLA documentation. This could help decrease the amount of arsenic leaching from the coal ash into the embayment. The remedial action on one of these sites, the Filled Coal Ash Pond, is complete.

Comment: The ORREMSSAB recommends that if Poplar Creek surface water contamination is seen to increase, DOE review the possibility of treating the whole flow of Poplar Creek.

Response: Treating the entire flow of Poplar Creek would involve the construction of an enormous plant with acres of water holding ponds similar to a plant for a large city like New York City. The cost of this effort would likely consume DOE's entire Environmental Restoration budget for several years. This does not seem reasonable or cost-effective for a creek that did not exceed drinking water standards during the RI.

Comment: Mary Bryan/the ORREMSSAB desires the opportunity to comment early in the RI phase of a project.

Response: We are currently following the CERCLA process for obtaining public input and comments. The DOE public relations department is continuing to work with the ORREMSSAB and has begun providing early drafts of DOE's CERCLA documents to the ORREMSSAB for review.

Comment: Mr. Peele recommends that DOE issue periodic reminders and begin education campaigns in the schools regarding the controls and advisories that are part of this remedial action.

Response: The only control really applicable to the general public is the fish consumption advisory program implemented by TDEC. DOE will be conducting a survey as part of the monitoring program to determine whether this program is entirely effective. Should the program be found ineffective, DOE will work with TDEC to increase public awareness of these controls. The same holds true for irrigation practices within the OU. The sediment disturbance controls are for deep sediments that are not exposed to the general public and cannot legally be removed or disturbed without following the permitting process of TVA, COE, and TDEC.

Comment: Riley Sain recommends that DOE, in the final ROD, (1) clearly state that surface waters are not included in this OU, (2) identify the OUs to which these waters have been relegated, and (3) provide an estimate of the schedule under which the public can anticipate a final ROD on this portion of the environment surrounding the ORR.

Response: The ROD does state that surface waters are not part of this OU. The surface waters will be formally placed into another OU, although they will be monitored as part of the monitoring program mandated in this ROD to allow DOE and the public to note the changes in

contamination levels that occur over time. When DOE has completed the CERCLA actions that are addressing the sources of contaminants entering these surface waters, data will be gathered through the monitoring program to verify that the two AWQC which were exceeded either have or have not been met. Addressing these downstream surface waters prior to completing the upstream cleanup activities would not be the most effective way to handle this problem; however, if after DOE completes source cleanups the surface waters still fail to meet AWQC, DOE will take steps to solve this problem.

Comment: The Friends of Oak Ridge National Laboratory, Alfred Brooks, and Stuart Clark all recommend that DOE implement the alternative selected in the Proposed Plan.

Response: That is being accomplished through the formal CERCLA process and the approval of this ROD.