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Remedial Action Report on the Surface Impoundments Operable Unit C (3539) and D (3540) at the Oak Ridge National Laboratory Oak Ridge, Tennessee

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American Technologies, Inc.

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

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Remedial Action Report on the Surface Impoundments Operable Unit C (3539) and D (3540) at the Oak Ridge National Laboratory Oak Ridge, Tennessee

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Prepared by
American Technologies, Inc.
Oak Ridge, Tennessee
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Office of Environmental Management

BECHTEL JACOBS COMPANY LLC
managing the
Environmental Management Activities at the
East Tennessee Technology Park
Oak Ridge Y-12 Plant Oak Ridge National Laboratory
Paducah Gaseous Diffusion Plant Portsmouth Gaseous Diffusion Plant
under contract DE-AC05-98OR22700for the
U.S. DEPARTMENT OF ENERGY

PREFACE

This Remedial Action Report (RAR) on the Surface Impoundments Operable Unit C (3539) and D (3540) at the Oak Ridge National Laboratory, Oak Ridge, Tennessee (DOE/OR/01-1784&D2) was prepared in accordance with requirements under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. This work was performed under Work Breakdown Structure 01.05.02.03.35.10 (Activity Data Sheet # 3322 "Surface Impoundments Design Documents and Design Studies"). This document summarizes the work performed during remedial activities for Stage 1 of the selected remedy in the Record of Decision (DOE/OR/02-1630&D2).

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ACRONYMS

ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirement
ATI	American Technologies, Inc.
BMP	Best Management Practices
DOT	U.S. Department of Transportation
CERCLA	Comprehensive Environmental Response, Compensation, and LiabilityAct
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
LLW	Low-level waste
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
PPE	personnel protective equipment
RAR	Remedial Action Report
RAWP	Remedial Action Work Plan
RDWP	Remedial Design Work Plan
RDR	Remedial Design Report
RCRA	Resource Conservation and Recovery Act of 1976
ROD	Record of Decision
SIOU	Surface Impoundments Operable Unit
TBC	to be considered
TDEC	Tennessee Department of Environment and Conservation
WAC	Waste Acceptance Criteria

EXECUTIVE SUMMARY

Surface Impoundments Operable Unit (SIOU) in the Bethel Valley watershed of Oak Ridge National Laboratory (ORNL) consists of four impoundments containing low-level radioactive waste. The Impoundments are located in the south-central part of the laboratory's main plant area, north of White Oak Creek. The purpose of this action was to remove the water, sediment, and top layer of the subimpoundment soil from Impoundments C and D and consolidate them in Impoundment B. This consolidation, along with backfill of Impoundments C and D, provides an area for construction of the treatment facility for Impoundments A and B. Residual contamination in groundwater and soils within the boundaries of the project will be addressed separately in the Bethel Valley watershed decision-making process.

Remediation of Impoundments C and D at ORNL was conducted in accordance with the Comprehensive Environmental Response, Compensation and Liability Act and the Record of Decision requirements. All work was performed in accordance with the performance specification and the requirements specified in the Remedial Design Work Plan for the SIOU (DOE/OR/02-1677&D2) and the Remedial Action Work Plan/Remedial Design Report for the SIOU Stage 1 (DOE/OR/01-1726&D1).

The remedial action was initiated on August 6, 1998 and was completed on September 18, 1998. A Bechtel Jacobs Company LLC subcontractor, American Technologies, Inc., performed field work, with environmental, safety, and health oversight provided by Bechtel Jacobs Company.

The project scope consisted of the transfer of all water and sediment from Impoundments C and D to the adjacent Impoundment B. Approximately 0.1 to 0.2 ft of the subimpoundment soil was also removed and transferred to Impoundment B. Both impoundments were backfilled with 6–12 in. diameter stone (riprap), covered with 6 in. of flowable fill, and topped with 1 ft of crushed stone. Over 1500 person-hours were expended during the remedial activities without incidents, accidents, or injuries.

1. SITE DESCRIPTION

Surface Impoundments Operable Unit (SIOU) in the Bethel Valley watershed of Oak Ridge National Laboratory (ORNL) consists of Impoundments A (3524), B (3513), C (3539), and D (3540) containing low-level radioactive waste (LLW). The Impoundments are located in the south-central part of the laboratory's main plant area, north of White Oak Creek. Figure 1 depicts the location of the impoundments at ORNL.

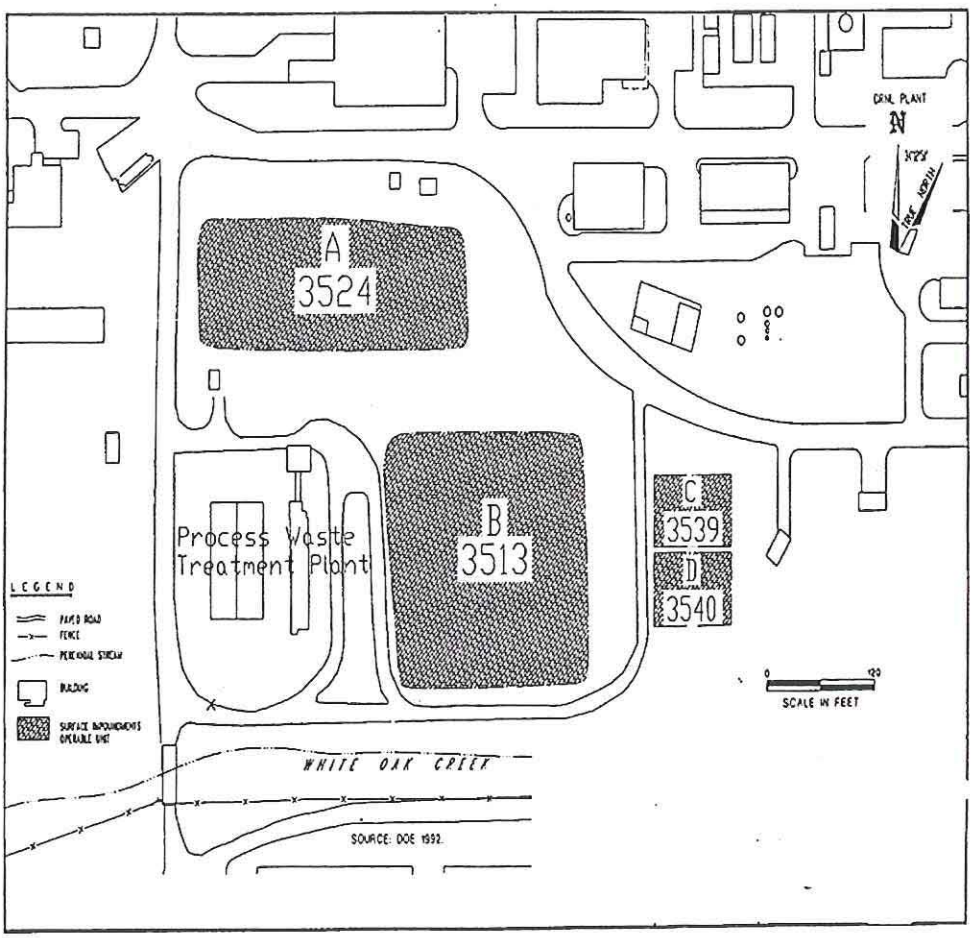

Fig. 1. Location of Impoundments at the ORNL.

Impoundments C and D are compacted clay-lined impoundments built in 1964 to receive process wastewater from Building 4500. Historically, if contaminant levels were acceptable, the process waste was discharged into White Oak Creek after verification of radionuclide content and pH adjustments of water in the ponds. Impoundments C and D were taken out of service in 1990 but were available for overflow from the process wastewater storage tanks during storms until additional tank storage was installed in June 1996. At the start of remediation activities, Impoundments C and D contained sediment with very low levels of radioactive contamination (approximately 0.3 Ci).

2. PROJECT REQUIREMENTS

The U.S. Department of Energy (DOE) issued the Proposed Plan for SIOU June 30, 1997. DOE published a public notice about the project in the Knoxville News-Sentinel, the Roane County News, and the Oak Ridger on June 30, 1997, and set a public comment period from June 30, 1997 to July 30, 1997. DOE presented the preferred alternative described in the Proposed Plan and solicited public input at a public meeting held on July 15, 1997.

The Record of Decision (ROD) was issued September 24, 1997 (DOE 1997). The ROD describes the selected remedy for all four surface impoundments. This remedy addresses the principal threats to industrial workers and mitigates the release of contamination to groundwater by (1) removal of the water, sediment, and subimpoundment soil from the SIOU and (2) transport of all treated waste to an approved disposal facility. The remedial action goals of the ROD for the ORNL Impoundments were to:

- Reduce the potential threats to human health and the environment by removing the surface water, sediment, and subimpoundment soil, and backfilling the ponds with riprap, flowable fill, and gravel.
- Comply with the applicable or relevant and appropriate requirements (ARARs) as specified in the ROD.
- Provide remedial actions that are consistent with planned ORNL remedial activities.
- Comply with the requirements of the Remedial Action Work Plan (RAWP)/Remedial Design Report (RDR).

The ROD incorporates all public comments from the Proposed Plan in the Responsiveness Summary section of the ROD. A post-ROD sampling plan for Impoundments C and D was submitted to the U.S. Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC), who concurred with the plan November 25, 1997. The D2 Remedial Design Work Plan (RDWP) (DOE 1998a) was submitted with a letter dated March 13, 1998.

The RAWP/RDR was submitted in April 1998 (DOE 1998b). This report specified the design and plans for actions to be taken for Stage 1 remediation of the SIOU. Stage 1 remediation included transfer of the surface water, sediment, and subimpoundment soil from Impoundments C and D to Impoundment B. The regulatory agencies concurred with the RAWP/RDR on May 12, 1998. The following summarizes the schedule developed for the Stage 1 remedial activities in the RAWP/RDR:

• Submit RAWP/RDR	May 4, 1998
• EPA and TDEC comment documents	May 18, 1998
• Submit RDR and RAWP, D2	June 1, 1998
• EPA and TDEC approve documents	June 15, 1998
• Procurement	June 22, 1998
• Fieldwork	July 13, 1998 to September 28, 1998

This Remedial Action Report (RAR) documents the method by which the requirements set forth in the RAWP/RDR was carried out. This action transferred the surface water, sediment, and approximately 0.03m (0.1 ft) of subimpoundment soil from Impoundments C and D to Impoundment B. This action was followed by backfilling and installation of a gravel pad to provide an area for construction of the treatment facility for Impoundments A and B.

This remedial action complies with all ARARs and to-be-considered (TBC) guidance. The following identifies the ARARs developed for Stage 1 field activities, provides the citations that drive the requirements, and discusses how the requirements were met.

ARAR –Discharge of Radionuclides into the Ambient Air from a DOE Facility: Exposure to members of the public from all radiation sources released into the atmosphere shall not cause an effective does equivalent (EDE) to be > 10 mrem/year.
Citation: 40 CFR 61.92 and Rules of the TDEC Chapter 1200-3-11-.08
Addressed: The surface of Impoundments C and D were kept moist during the removal of sediment and subimpoundment soil until backfilling was begun. Monitoring of fugitive emissions for compliance with National Emission Standards for Hazardous Air Pollutants is accomplished by the Oak Ridge Reservation perimeter air monitoring network, as specified in *Compliance Plan—National Emission Standards for Hazardous Air Pollutants for Airborne Radionuclides on the Oak Ridge Reservation, Oak Ridge, Tennessee* (ES/ESH-45, March 15, 1994). These perimeter air monitors showed no increase in radionuclides during sediment removal activities. In addition, a pair of air samples, taken immediately up and downwind of the impoundments during sediment removal, showed radionuclides to be less than 10 percent of the Derived Air Concentrations established by DOE order for personnel protection.

ARAR – Point-Source Discharge of Radionuclides into the Ambient Air from a DOE Facility: Radiological emission measurements must be performed at all release points with a potential to discharge radionuclides into the air in quantities that could cause EDE in excess of 1 percent of the standard (01.mrem/year) as measured at the facility boundary. All radionuclides that could contribute > 10 percent of the standard (1 mrem/year) for the release point shall be measured.
Citation: 40 CFR 61.93 and Rules of the TDEC 1200-3-11-.08.
Addressed: The cited ARAR, which applies to air emission point sources, was incorrectly included in the D1 Remedial Action Report. No point sources were associated with Surface Impoundments C and D remedial actions.

ARAR – Release of Radionuclides into the Environment (ROD Determination – TBC): DOE will carry out all DOE activities to ensure that radiation doses to individuals are as low as reasonably achievable (ALARA).
Citation: DOE Order 5400.5(I.4) and 10 CFR 834 (proposed).
Addressed: The following actions were taken to maintain personnel exposures ALARA:

- The surface of Impoundments C and D was kept moist to prevent visible emissions.
- Workers were prevented from direct contact with sludge material through the use of personnel protective clothing and equipment.
- Radiological control boundaries were established to prevent the inadvertent spread of contamination on personnel, materials, equipment, etc., beyond the established boundary.
- The sludge removal process used the water pressure from a fire hose to wash the sludge to the transfer pump. Workers were able to remain up on the embankment during the sludge pumping.

- After the sludge was removed, the fire hose was also used to scarify and loosen an additional layer (0.1 to 0.2 ft) of impoundment clay to ensure greater removal effectiveness.

ARAR – Control of Stormwater Discharges Associated with Construction Activities at Industrial Sites [ROD Determination – Relevant and Appropriate for Site with < 2 ha (5 acres) Affected]: Implement good site planning and Best Management Practices (BMP) to control stormwater discharges include:

- documentation of BMP in a stormwater control plan or equivalent,
- minimal clearing for grading,
- removal of vegetation cover only within 20 days of construction,
- weekly erosion control inspections and maintenance,
- control measures to detain runoff, and
- discharges that do not cause erosion.

Citation: 40 CFR 122 and Rules of the TDEC 1200-4-10-.05.
Addressed: Work areas were covered with plastic sheeting for secondary containment and all discharge piping external to the impoundment had secondary containment. Action was completed with no grading or vegetative cover removed. Equipment placement and operations were established to prevent contact with run-off.

ARAR – Nonpoint-Source Air Emissions (ROD Determination – Applicable): Take reasonable precautions to prevent particulate matter from becoming airborne; no visible emissions are permitted beyond the property boundary lines for more than 5 minutes/hour or 20 minutes/day. Potential nonpoint-sources of fugitive emissions are included in the plantwide fugitive emissions plan.
Citation: Rules of the TDEC 1200-3-8-.01.
Addressed: The surfaces of Impoundments C and D were kept moist during the removal of sediment and subimpoundment soil to prevent particulate matter from becoming airborne. Air monitoring is discussed above.

ARAR – Generators of LLW (ROD Determination – TBC): LLW generators must characterize and segregate LLW from uncontaminated waste and otherwise minimize the amount of LLW generated. Subsequent management of LLW must be in accordance with DOE Order 5820.2A.
Citation: DOE Order 5820.2A (III.3).
Addressed: Radioactively contaminated trash and PPE were packaged, labeled, and containerized separately from the non-radiological waste.

ARAR – Transportation of Hazardous and Radioactive Materials Above Exempt Quantities (ROD Determination – Applicable): The waste must meet packaging, labeling, marking, placarding, and pre-transport requirements in accordance with U.S. Department of Transportation (DOT) regulations.
Citation: 49 CFR 171, 172, 173, 174, 177, 178, and 179 and DOE Order 460.1 (TBC).
Addressed: Stage 1 action did not require off-site transportation. Waste trash and PPE will meet applicable DOE regulations prior to shipment by Bechtel Jacobs Company LLC Waste Operations.

ARAR – Packaging of Radioactive Material Above Exempt Quantities for Public Transport (ROD Determination – Applicable): Waste must meet packaging requirements based on the maximum activity of radioactive material in a package.
Citation: 49 CFR 173.431, 49 CFR 173.433, 49 CFR 173.435, and 49 CFR 173.411.

Addressed: Stage 1 action did not require off-site transportation. Contaminated waste trash and PPE to be shipped off-site by Bechtel Jacobs Company Waste Operations will meet the applicable DOT regulations.

ARAR – Waste Shipment from One Field Organization to Another for Disposal (ROD Determination – TBC): Generators must certify before shipment that the waste meets the waste acceptance criteria (WAC) of the receiving facility.
Citation: DOE Order 5820.2A (III).
Addressed: Stage 1 action did not require off-site disposal of waste at another DOE Field Organization. Bechtel Jacobs Company Waste Operations will certify that waste will meet the WAC of the receiving facility prior to shipment.

ARAR – Shipments of LLW (ROD Determination – Applicable): LLW must be disposed of on-site; if off-site disposal is required because of lack of capacity, disposal must be at a DOE facility. Off-site disposal of LLW to a commercial facility requires an exemption from the on-site disposal requirements of DOE Order 5820.2A; requests for exemption must be approved by the DOE ORO. Shipments must meet DOE Order and implementing procedural requirements for off-site shipments.
Citation: DOE Order 5820.2A.
Addressed: Contaminated trash and PPE will be disposed of by Bechtel Jacobs Company Waste Operations off-site at another DOE facility or a commercial facility.

3. REMEDIATION ACTIVITIES

Stage 1 of the remedial action began on July 1, 1998 (12 days ahead of the target schedule developed from the RAWP/RDR) with the issuance of the subcontract. The remediation effort consisted of the following major activities and milestones:

- development of project plans and other submittals;
- field mobilization and site preparation;
- transfer of water and sediment to Impoundment B;
- removal and transfer of 0.1 to 0.2 ft of subimpoundment soil to Impoundment B; and
- backfill of Impoundments C and D.

The sequence of transfer activities started with the pumping of the water, sediment, and subimpoundment soil first from Impoundment C and then from Impoundment D. Both impoundments were back-filled simultaneously.

3.1 MOBILIZATION AND SITE PREPARATION

Site preparation included the following activities:

- preparation of submittals including the Environmental Compliance Plan, Site Safety and Health Plan, project schedule, etc.;
- placement of the construction boundary fence;
- personnel training consisting of radiological worker, hazardous waste operator, medical surveillance and site specific training;
- placement and setup of a site office trailer;
- establishment of control zones;
- establishment of necessary utilities services;
- placement of necessary equipment;
- installation of secondary containment around the transfer line to Impoundment B; and
- construction of a secondary containment for the transfer pump.

3.2 TRANSFER OF SURFACE WATER AND SEDIMENT TO IMPOUNDMENT B

Surface water and sediment were transferred to Impoundment B using a Godwin Model CD-100M pump which was placed in a radiological buffer zone midway between Impoundments C and D. The pump retrieved surface water and sediment from the impoundments through a suction hose that was moved throughout the ponds using manually-operated guide lines. The transfer pump discharged through a double-contained discharge hose directly into Impoundment B. The end of the discharge line was kept below the surface of Impoundment B at all times to minimize the potential for splashing or release of airborne contaminants.

System performance during initial surface water transfer indicated a need to make two process modifications. First, testing and checkout revealed that the Godwin pump that was initially used was insufficient to adequately transfer the sediment due to the presence of larger-than-expected solids. This

pump was removed from service, decontaminated, and replaced with a Thompson Model 6TSV that is designed to handle solids up to three inches in diameter. The three-inch suction line was also replaced with a four-inch line. This arrangement yielded a discharge capacity of 500 to 1,500 gallons per minute.

The second process modification was necessary due to inability to effectively suspend the sediment in the water so that both could be pumped simultaneously. The initial approach called for agitation and suspension of the mixture by recirculating it through the transfer pump prior to transfer. When recirculation efforts failed to adequately suspend the heavy sediment, this approach was abandoned, and the surface water and sediment were transferred separately.

Water was transferred by placing the suction hose in the collection sump at the west end of each impoundment and pumping the water directly to Impoundment B. Removal of the remaining sediment began after the surface water was removed.

Sediment was agitated and mixed with clean water from the ORNL site fire water system, which was also used to wash sediment from the riprap along the sides of the impoundments. Initially, a Godwin HL 80 "Jetting" pump was placed in-line to increase the pressure of the supply water to 150 psi. Following initial test and checkout, it was determined that the site firewater system had sufficient pressure to perform the required tasks, and the jetting pump was removed.

Figures 2 and 3 depict sediment removal operations. The suction hose of the transfer pump was placed in the low point of the impoundments and the sediment was washed toward the inlet of the suction hose using fresh water from fire hose nozzles. At the same time, residual sediment was washed from the sides of the impoundment using the fire hose. The bottom of the impoundment was kept moist at all times to prevent the release of airborne contaminants. All water and sediment was transferred without splashing or spilling outside the impoundments.

Fig. 2. Sediment transfer using fire hose.

Fig. 3. Washing sediment from riprap sides.

3.3 REMOVAL OF SUBIMPOUNDMENT SOIL

Following the transfer of the surface water and sediment, the fire hose was used to scarify and loosen a thin layer (0.1 to 0.2 ft) of subimpoundment soil from the bottom of Impoundments C and D. The loosened soil was washed to the low point of each impoundment and the water/soil mixture was transferred to Impoundment B using the transfer pump. Figure 4 depicts subimpoundment soil removal activities. This operation was similar to conventional scabbling techniques used for the removal of contamination from concrete surfaces. Once the sediment was removed, preliminary elevation surveys were performed to determine that the remedial action objectives had been met.

Fig. 4. Subimpoundment soil removal.

Figures 5 and 6 depict Impoundment C following the removal of the subimpoundment soil to the required elevations.

Fig. 5. Impoundment C after removal of subimpoundment soil.

Fig. 6. Impoundment D after removal of subimpoundment soil.

A final elevation survey of the impoundment bottoms was conducted to compare final elevations to the preliminary elevations provided in the RAWP/RDR to ensure that the specified amount (0.1 to 0.2 ft) of subimpoundment soil was removed. Figure 7 shows the results of the pre- and post-remedial action elevation surveys of the subimpoundment soil. Each final survey data point was collected within three feet of its corresponding initial survey point.

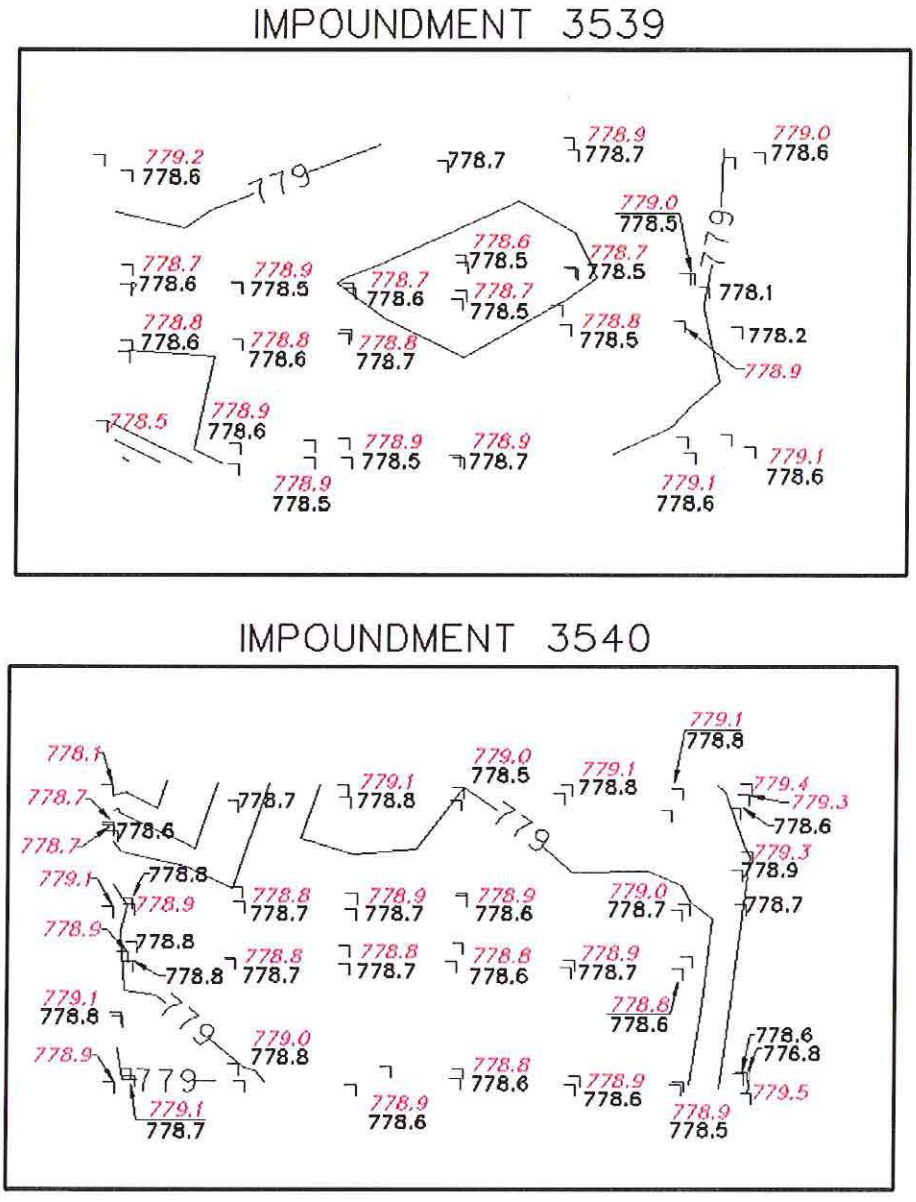

Fig. 7. Subimpoundment soil elevations before and after remediation.

Tables 1 and 2 further illustrate the elevations of Impoundments C and D before and after remediation.

Table 1. Impoundment C soil elevations before and after remediation

Survey Point	Initial Elevation	Final Elevation	Survey Point	Initial Elevation	Final Elevation
1	779.2	778.6	11	778.6	778.5
2	778.7	778.6	12	778.7	778.5
3	778.8	778.6	13	778.9	778.7
4	778.9	778.6	14	778.9	778.7
5	778.9	778.5	15	779.0	778.5
6	778.8	778.6	16	778.7	778.5
7	778.9	778.5	17	778.8	778.5
8	778.8	778.7	18	779.0	778.6
9	778.7	778.6	19	779.1	778.6
10	778.9	778.5	20	779.1	778.6

Table 2. Impoundment D soil elevations before and after remediation

Survey Point	Initial Elevation	Final Elevation	Survey Point	Initial Elevation	Final Elevation
1	778.7	778.6	14	778.9	778.6
2	778.9	778.8	15	778.8	778.6
3	778.9	778.8	16	778.8	778.6
4	779.1	778.8	17	779.1	778.8
5	779.1	778.7	18	779.1	778.8
6	779.0	778.8	19	779.0	778.7
7	778.8	778.7	20	778.9	778.7
8	778.8	778.7	21	778.8	778.6
9	778.9	778.7	22	778.9	778.6
10	778.8	778.7	23	778.9	778.5
11	778.9	778.6	24	779.3	778.6
12	779.1	778.8	25	779.3	778.9
13	779.0	778.5	26	779.5	778.6

Following completion of the final elevation survey, Bechtel Jacobs Company collected sub-impoundment soil samples and performed a walkover radiological survey and pre-backfill inspection. Results of the sampling and survey are presented in the post-remedial action radiological report (BJC/OR-195). The Bechtel Jacobs Company Project Manager and Site Technical Representative (STR), signed the final inspection and acceptance report that formally documents completion of the Stage 1 remedial activities in accordance with the ROD.

Fig. 8. Backfilling with riprap.

3.4 BACKFILLING OF IMPOUNDMENTS

Backfilling of Impoundments C and D was initiated upon review of the final elevation surveys. Approximately 2,260 tons of free-draining durable rock fill (6–12 in. graded riprap) was placed in the two impoundments to a level of approximately 18 in. below the final grade. Figure 8 depicts placement of the riprap. Figure 9 shows Impoundment C after it was filled. A total of 104 truckloads of riprap were delivered and placed over a two-day period.

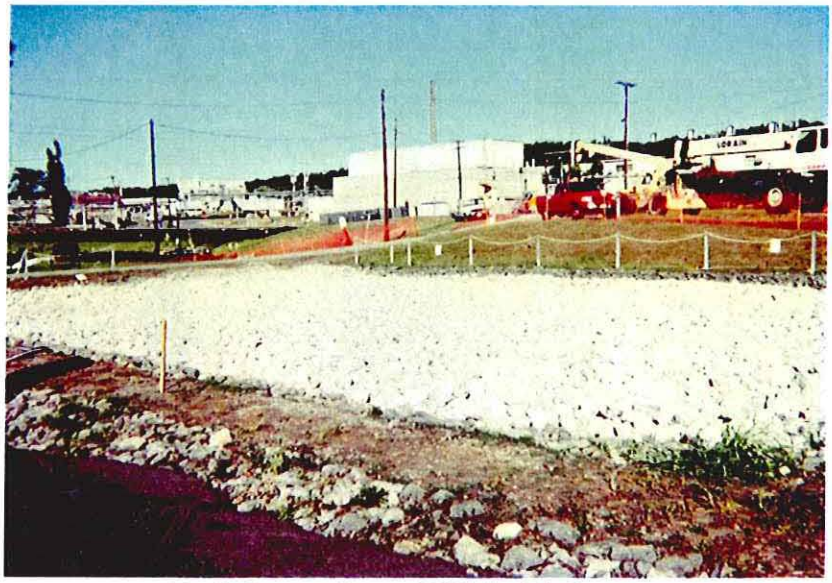

Fig. 9. Impoundment C filled with riprap.

Approximately 330 yd^3 of flowable fill (controlled low strength material) was used to fill the voids in the riprap and help form a uniform mass. Once the riprap was covered, additional flowable fill was poured to an elevation of approximately twelve inches below the final grade and manually leveled. Figures 10 and 11 illustrate the placement and final grade of the flowable fill. This activity, which required 41 truckloads of material, was completed in one day.

Fig. 10. Placement of flowable fill.

Fig. 11. Impoundment D following placement of flowable fill.

Once the flowable fill had cured, approximately 660 tons of Tennessee Department of Transportation Class A, gradation D base stone (aggregate) was placed over Impoundments C and D, then crowned and compacted in accordance with the specifications. This required 30 truckloads of aggregate, which was placed in one day. Figure 12 depicts Impoundments C and D following placement, grading, and final compaction of the aggregate. The final surface of the former impoundment area is crowned at elevation 788.0 and slopes to elevation 787.0 at the perimeter.

Due to the large number of trucks involved in the delivery of the fill materials, close coordination with ORNL site security and operations personnel was essential to ensure safe and smooth traffic flow and to enable timely completion of the work.

Fig. 12. Impoundments C and D at final grade.

4. DEVIATIONS FROM THE RECORD OF DECISION

The Stage 1 remedial action was completed with no deviations from the ROD.

5. WASTE MANAGEMENT AND TRANSPORTATION ACTIVITIES

Two bags of radioactively contaminated incinerable trash were packaged, labeled, and placed in 55-gallon drums provided by Bechtel Jacobs Company. This waste included disposable PPE, wipes, and other miscellaneous contaminated trash. One B-25 type Low Specific Activity box was used for temporary storage of radioactively contaminated reusable materials. These include fire hose, suction hoses, and discharge lines to be held for reuse at the discretion of the government.

The subcontractor disposed of non-radiological waste such as cardboard, miscellaneous sanitary waste, aluminum, plastic, and office waste. No hazardous waste was generated by this remediation project.

6. PROJECTS COSTS

Table 3 presents a summary of estimated and actual project costs.

Table 3. Estimated and Actual Project Costs

Project Activity	Estimated Cost ($1000)	Actual Cost ($1000)
Project Management	161	154
Remedial Design Report/Remedial Action Work Plan	211	13
Remedial Action	510	224
Remedial Action Report	18	34
TOTALS	900	425

7. MONITORING SCHEDULE AND/OR EXPECTATIONS

There is no monitoring and review requirements defined in the ROD for Stage 1 of the remedial activities for Impoundments C and D. There were no occurrences or events during the Stage 1 remediation that would require any monitoring above that stated for the Stage 2 remedial activities.

8. REFERENCES

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