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Remedial Action Report on the Surface Impoundments Operable Unit at the Oak Ridge National Laboratory, Oak Ridge, Tennessee

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Dave Hamrin 02/11/04

ORNL Technical Information Officer Date

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Remedial Action Report on the Surface Impoundments Operable Unit at the Oak Ridge National Laboratory, Oak Ridge, Tennessee

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PREFACE

This Remedial Action Report, *Remedial Action Report on the Surface Impoundments Operable Unit at the Oak Ridge National Laboratory, Oak Ridge, Tennessee* (DOE/OR/01-2086&D2), addresses Stage 2 remedial action of the Surface Impoundments Operable Unit (SIOU) at the Oak Ridge National Laboratory (ORNL). Stage 2 remedial action at SIOU follows a previous stand-alone operation to remove sediments and water from Impoundments C and D. This work was completed in September 1998 and is referred to as Stage 1 remedial action. The *Remedial Action Report 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) (DOE 1999) describes the Stage 1 remedial action. Stage 2 remedial action at SIOU was conducted in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986. Work was also in conformance with the *Remedial Action Work Plan/Remedial Design Report for the Stage 2 Remedial Action on the Surface Impoundments Operable Unit A and B at the Oak Ridge National Laboratory, Oak Ridge, Tennessee* (DOE/OR/01-1816&D3) (DOE 2000). This document describes implementation of the selected remedy, as approved in the Record of Decision (ROD) for the SIOU at ORNL (DOE/OR/02-1630&D2) (DOE 1997).

Sediments and water from SIOU Impoundments A and B were treated and disposed of according to planned actions presented in the Remedial Action Work Plan/Remedial Design Report. All activities described in the ROD were accomplished. This work was performed under Work Breakdown Structure 1.12.01.03.01.01.

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ACRONYMS

ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirement
CFR	*Code of Federal Regulations*
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DOT	Department of Transportation
EMWMF	Environmental Management Waste Management Facility
EPA	U.S. Environmental Protection Agency
ETTP	East Tennessee Technology Park
NDA	Non-Destructive Analysis
NDEP	Nevada Department of Environmental Protection
NTS	Nevada Test Site
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
PCB	polychlorinated biphenyl
PVC	polyvinyl chloride
PWTP	Process Waste Treatment Plant
RAWP	Remedial Action Work Plan
RDR	Remedial Design Report
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SIOU	Surface Impoundments Operable Unit
WAC	Waste Acceptance Criteria
WEAF	Waste Examination and Assay Facility

EXECUTIVE SUMMARY

Wastewater impoundments 3524 and 3513 were identified as Surface Impoundments Operable Units (SIOUs) A and B at Oak Ridge National Laboratory (ORNL). Hereinafter they will be referred to, respectively, as Impoundment A and Impoundment B. The impoundments were remediated in accordance with requirements of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended by the Superfund Amendments and Reauthorization Act of 1986. The remediation was authorized by a Record of Decision (ROD) signed in September 1997 by representatives of the U.S. Department of Energy (DOE), the Tennessee Department of Environment and Conservation, and the U.S. Environmental Protection Agency, Region 4. Use of the impoundments began in the 1940s for collection and treatment of ORNL wastewater for reduction of radionuclide levels prior to discharge to White Oak Creek. The impoundments were removed from service when other liquid waste treatment facilities were built at ORNL.

Sediments and water from Impoundments A and B were treated in a treatment facility constructed in accordance with design features detailed in the *Remedial Action Work Plan/Remedial Design Report (RAWP/RDR) for the Stage 2 Remedial Action on the Surface Impoundments Operable Unit A and B at Oak Ridge National Laboratory* (DOE/OR/01-1816&D3) (DOE 2000). Remediation involved removal and treatment of discrete batches of impoundment sediment and subimpoundment soil. The treatment process was carried out in a facility designed to produce a waste form that met waste acceptance criteria (WAC) for the low-level waste disposal facility at the Nevada Test Site (NTS). Sediments were retrieved and transferred from Impoundment A to Impoundment B during the project mobilization. After transfer to Impoundment B, a physical survey of the bottom was performed to ensure removal of the sediment, and the impoundment was filled with rock and flowable fill. Material from Impoundment B was pumped to a treatment facility and treated in batches. Each batch contained approximately 10,500 lb of sediment and 5500 lb of Portland cement.

Sediment treatment began in November 2001 and was completed in August 2003. The remedial action produced 994 solidified waste forms. The SIOU treatment facility was designed and constructed to prepare a waste form that met NTS WAC. Due to regulatory change, the NTS determined that the polychlorinated biphenyl (PCB) concentration was to be determined on the in-situ untreated sediment using a dry-weight basis (versus wet-weight with approximately 20% solids). When the concentration of the PCBs was calculated on a dry-weight basis the average was greater then the 50 ppm threshold (average 69.3 ppm) and could not be accepted by NTS. Therefore, as indicated in the ROD, the Environmental Management Waste Management Facility (EMWMF) was used as the contingency disposal facility. In November and December 2002, 108 waste forms of treated waste were transported to Envirocare of Utah, Inc., for disposal. This shipment provided staging space while approvals for disposal at the EMWMF were being obtained. The remainder of the waste forms were transported to the EMWMF in the spring and summer of 2003.

Once impoundment sediments were removed and requirements of the RAWP had been verified by physical surveys of the contours of the impoundment bottom, Impoundment B was filled with rock and flowable fill. Impoundment water removed during backfilling was transferred to the ORNL Process Waste Treatment Plant. Temporary facilities used to treat the solids and liquids were dismantled and removed from the site.

1. INTRODUCTION AND PURPOSE

This remediation was authorized by a Comprehensive Environmental Response, Compensation, and Liability Act Record of Decision (ROD) to reduce the risk to human health and the environment by reducing the radiological contamination entering White Oak Creek from the Oak Ridge National Laboratory (ORNL) Surface Impoundments Operable Unit (SIOU).

This document describes the remedial action performed at the SIOU site to reduce the radiological contamination entering White Oak Creek. The remedial activities included the construction of a temporary treatment facility, dredging and treating the impoundment sediments and 0.1 ft of subimpoundment soil to meet disposal facility waste acceptance criteria (WAC), transport and disposal of the waste forms, demolition and disposal of the temporary treatment facility, backfilling, and site restoration.

2. SITE DESCRIPTION

ORNL is located on the U.S. Government-owned Oak Ridge Reservation (ORR), which is within the corporate limits of the city of Oak Ridge. ORR lies within the Tennessee Valley between the Cumberland and Southern Appalachian mountain ranges in the eastern portion of the state of Tennessee. As shown on Fig. 1, ORR occupies about 37,000 acres and includes three major complexes with a total fenced area of about 2000 acres: ORNL, the Y-12 National Security Complex, and the East Tennessee Technology Park (ETTP) (formerly known as the Oak Ridge K-25 Site). The impoundments were located in the area of ORNL shown in Fig. 1. Impoundment A was positioned east of the Third Street/White Oak Avenue intersection. Impoundment B lay southeast of Impoundment A. Figure 2 shows the location of the principal impoundment remedial activities.

The impoundments were used to manage low-level radioactive liquid wastes generated from experiments and material processing at ORNL. Sediments were radiologically and chemically contaminated. Impoundments A and B were unlined and released contaminants to the environment as a result of groundwater intrusion. Constant water covering the sediments in these two impoundments provided radiation shielding and prevented airborne release of sediments. Other sources in Bethel Valley also contribute to groundwater contamination, which could continue to contaminate surrounding soils after remediation of the impoundments.

Impoundment A was excavated in natural clay in 1943 and used for short-term storage of wastewater and final precipitation of radioisotopes before discharge to White Oak Creek. This impoundment initially consisted of two unlined impoundments separated by a berm. In the early 1950s, the berm separating the impoundments was removed, forming one impoundment that received process wastewater only. From 1949 to 1957 effluent from Impoundment A was pumped to Impoundment B (3513). In 1957, the Process Waste Treatment Plant (PWTP) was placed on-line; Impoundment A was used as an equalization basin for intermediate storage and collection of process wastewater for the treatment plant until 1989. Impoundment A was used as an emergency storage basin for overflow from the process wastewater storage tanks during storms until June 1996 when a surge tank was installed to provide adequate storage capacity.

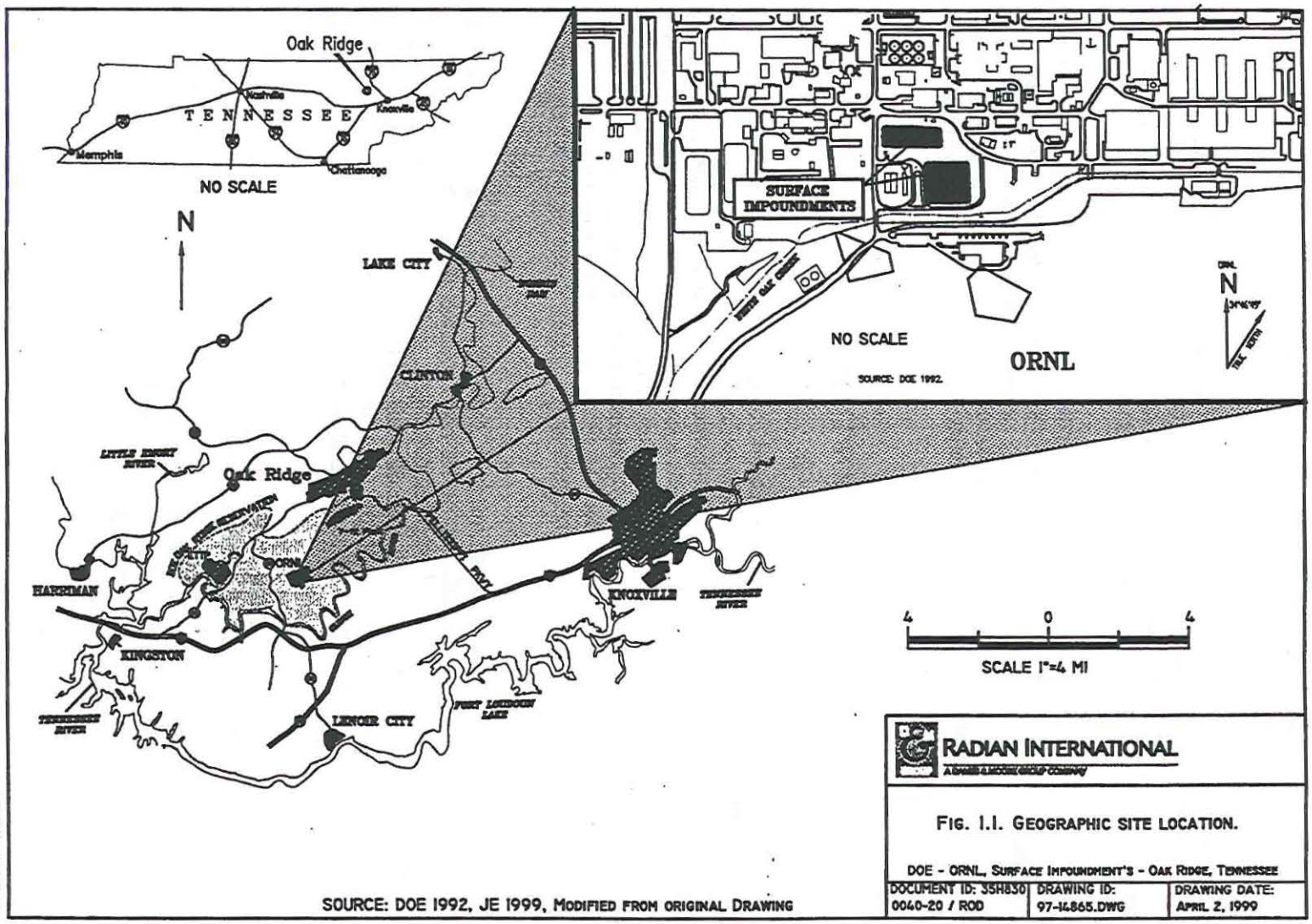

Fig. 1. Location of the impoundment remediation project at ORNL.

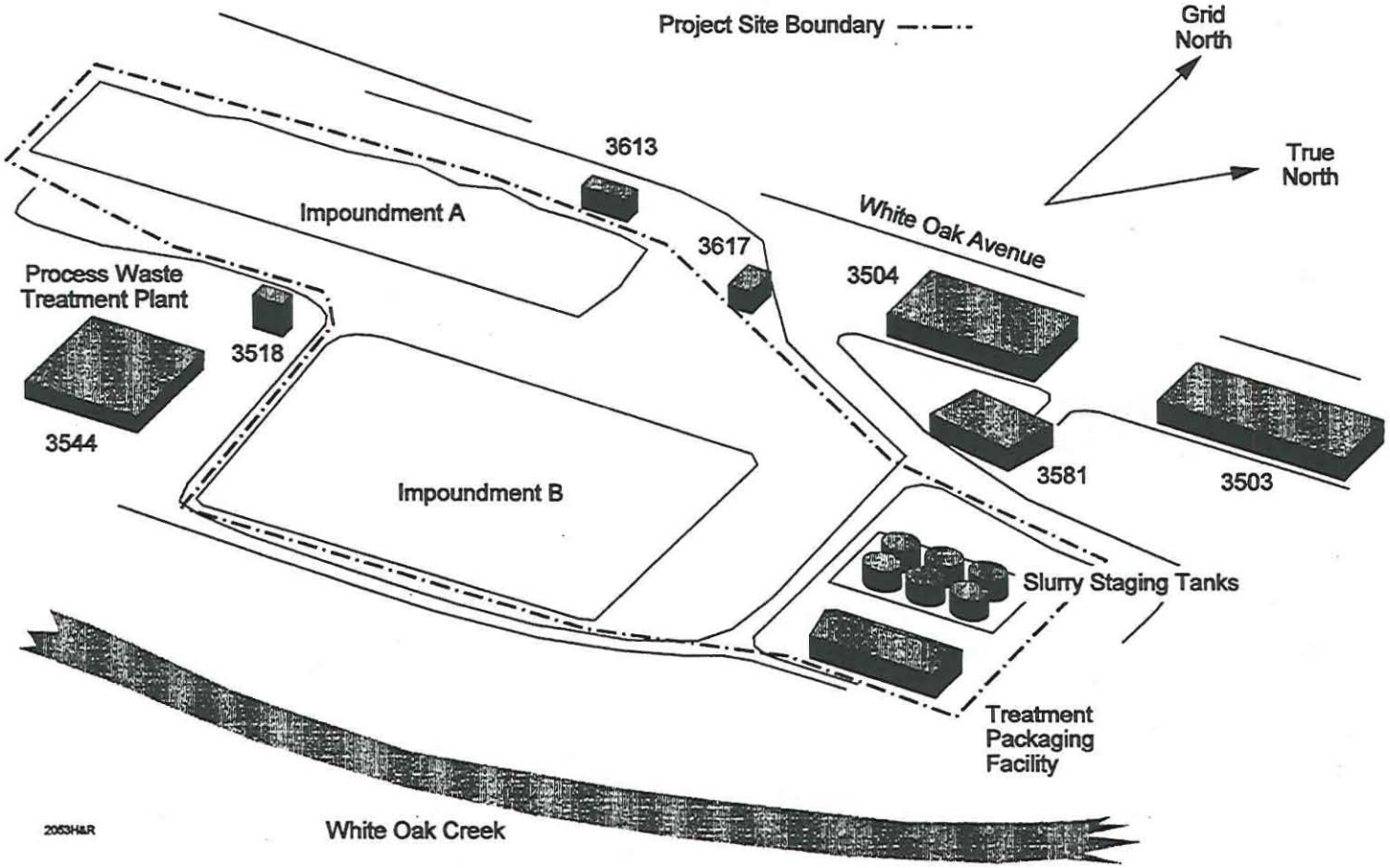

Fig. 2. Location of principal activities of the impoundment remediation project.

Impoundment B was excavated in natural clay in 1944, was unlined, and was used as a settling basin for low-level radioactive waste streams that were diluted with process wastewater. From 1944 to 1947, excess water in the impoundment flowed through pipes on the impoundment's southern berm directly into White Oak Creek. These pipes were plugged in 1947. From 1957 to 1976, Impoundment B received waste that did not require treatment in PWTP. Wastewater from the PWTP also was discharged into the impoundment to allow particulate settling. The impoundment had not been used since 1976.

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

Institutional controls reduced exposures to on-site individuals and prevented long-term direct contact with the sediments, which would result in a near certain probability of cancer. Radiological risks to future on-site employees and residents were evaluated, assuming 5 days during which the water cover over Impoundment A (3524) is lost. Risks to on-site employees and residents, primarily from direct external exposure to gamma radiation from the unshielded sediments, would range up to 8×10^{-2} and 2×10^{-1}, respectively (i.e., 8 in 100 and 2 in 10 additional cases of cancer over those expected under natural conditions). These risks greatly exceeded the U.S. Environmental Protection Agency (EPA) target risk range of 1×10^{-4} to 1×10^{-6} (i.e., 1 in 10,000 to 1 in 1 million additional cases of cancer over those expected under natural conditions).

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

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

Previous studies calculated the risks to on-site employees from heavy metals and organic chemical carcinogens to be acceptable, as were risks to future residents beyond the current U.S. Department of Energy (DOE) boundary at the Clinch River near White Oak Creek.

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

Chemical carcinogenic risks calculated for the exposure scenarios were always less significant than radiological risks in all scenarios, thus actions taken to reduce the radiological risk effectively reduced the chemical risk.

3. PROJECT REQUIREMENTS

The remedial action described herein fits into the overall ORR cleanup strategy through treatment of contaminated sediment, water, and subimpoundment soils at SIOU. The selected remedy, Alternative 6 in the ROD and RDWP (DOE/OR/02-1677&D2) (DOE 1998), was intended to address the principal threats to industrial workers and to mitigate the release of contamination to groundwater by:

- removing the surface water, sediments, and approximately 0.1 ft of subimpoundment soil from both impoundments;
- discharging surface water to the existing PWTP for treatment;
- treating sediments and incidental subimpoundment soil to meet applicable or relevant and appropriate requirements (ARARs) and disposal WAC;
- containerizing the treated wastes;
- transporting treated waste to appropriate waste disposal facilities and disposal therein;
- backfilling of the impoundments, and
- demobilization and restoration of the site.

The Remedial Investigation/Feasibility Study (RI/FS) (DOE 1995) identified the remedial action objectives that must be addressed as:

- prevent direct exposure to, direct contact with, and inhalation or ingestion of contaminated sediments by humans and animals;
- prevent movement of contaminants to groundwater and surface water;
- prevent failure of the impoundments berm/embankment; and
- prevent the bioaccumulation of contaminants in ecological receptors.

The removal of the sediment from the impoundments followed by treatment and disposition in an engineered disposal facility addressed the four remedial action objectives identified in the RI/FS.

Compliance with applicable or relevant and appropriate requirements (ARARs) was ensured by incorporating ARARs into project planning documents. A crosswalk for implementing the ARARs identified in the ROD was included in the Remedial Action Work Plan/Remedial Design Report (RAWP/RDR) (DOE 2000). The drawing or specification that implemented each of the ARARs (both applicable and "to be considered") was included in the RAWP/RDR. The remediation was implemented in accordance with the RDR/RAWP to ensure compliance with the ARARs. All work in radiological areas was controlled by radiological work permits. Project design and operations were consistent with an approach that maintained radiation exposures ALARA.

4. REMEDIATION ACTIVITIES

This section provides an overview of the remediation activities and a description of the treatment process.

4.1 PROJECT OVERVIEW

The sediment treatment facility was constructed east of Impoundment B at the former site of Impoundments C&D. It consisted of six settling tanks; process piping, pumps, and valves; and an enclosure (Rubb Tent) to house equipment for blending sediment slurry with Portland cement and the subsequent filling of waste containers. Figure 3 is a photographic view of the impoundment dredge and sediment pumping system, and Fig. 4 is a general view of the treatment facility enclosure from atop a settling tank, the sand wall used to shield radioactivity in tanks, and a view of the top of the three south settling tanks and the access catwalk.

There were four principal remedial activities of the Stage 2 SIOU remediation project: sediment dredging, slurry settling, treatment/packaging, and waste transportation and disposal.

Sediment was dredged from Impoundment A and transferred to Impoundment B during the mobilization phase. When this dredging was completed, Impoundment A was filled with rock and flowable fill. As the backfilling occurred, surface water from Impoundment A was pumped to Impoundment B. Minor amounts of Impoundment B water were transferred to the PWTP to manage the total volume of water in Impoundment B during this transfer. The filled Impoundment A was later used as a staging area for waste package shipments while Impoundment B sediment was remediated.

The dredged slurry was staged and concentrated in one or more of the slurry staging tanks while awaiting treatment. Excess impoundment water was returned to Impoundment B.

From the settling tanks, sediment of approximately 20% suspended solids was pumped to the temporary treatment/packaging facility (Fig. 4). The sediment entered one of two mixers where it was combined with Portland cement. The Portland cement waste mixture was then emptied into a soft-sided waste shipping/disposal container (Lift Liner™) fitted inside a temporary loading mold. This mixing/handling process was repeated until the waste container was filled to approximately 16,000 lb. Layout of the treatment/packaging facility is shown in Fig. 5.

Each Lift Liner™ was composed of three individual layers of plastic material. The innermost liner (the inner inner liner) was made of a 30-mil polyvinyl chloride (PVC) membrane. Surrounding the innermost liner was the middle liner (the inner liner), a 2-ply, 45-mil, woven, reinforced polypropylene fabric. This liner also had a 2-mil polypropylene coating. The outer liner consisted of single-layer side walls, a double-layered bottom, and 20 securing straps made of 1-in. nylon webbing. This outer liner was constructed of 25-mil woven polypropylene with a 2-mil polypropylene coating and was equipped with lifting straps. The Lift Liner meets Department of Transportation (DOT) IP-2 specifications for transport of low-level waste.

The Lift Liner™ system remained in the loading mold until the waste matrix had sufficiently hardened.

Fig. 3. View of dredge and sediment pumping system.

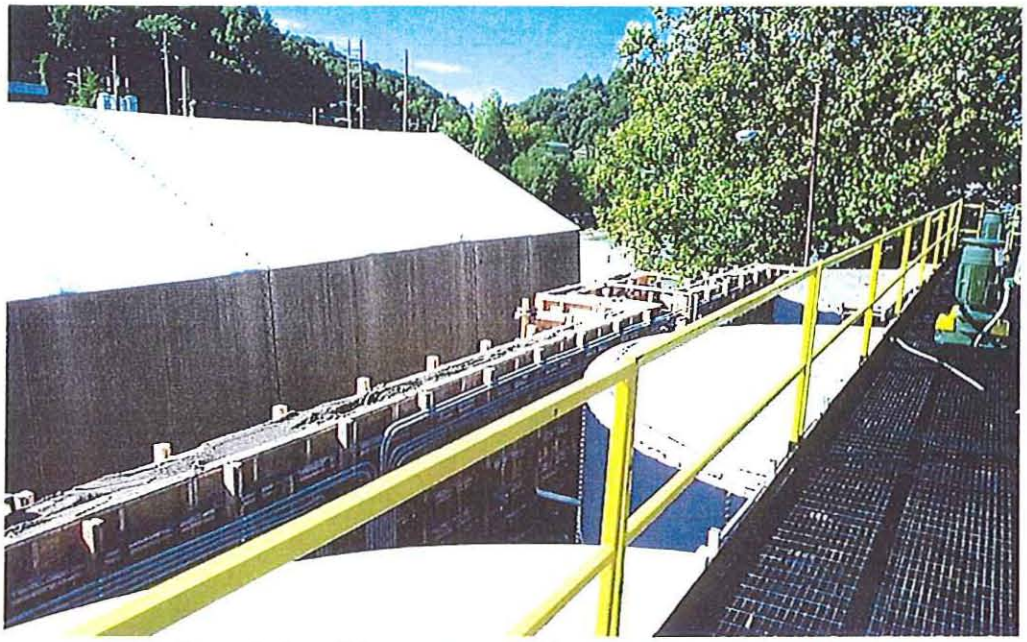

Fig. 4. General view of the treatment facility area from atop a settling tank.

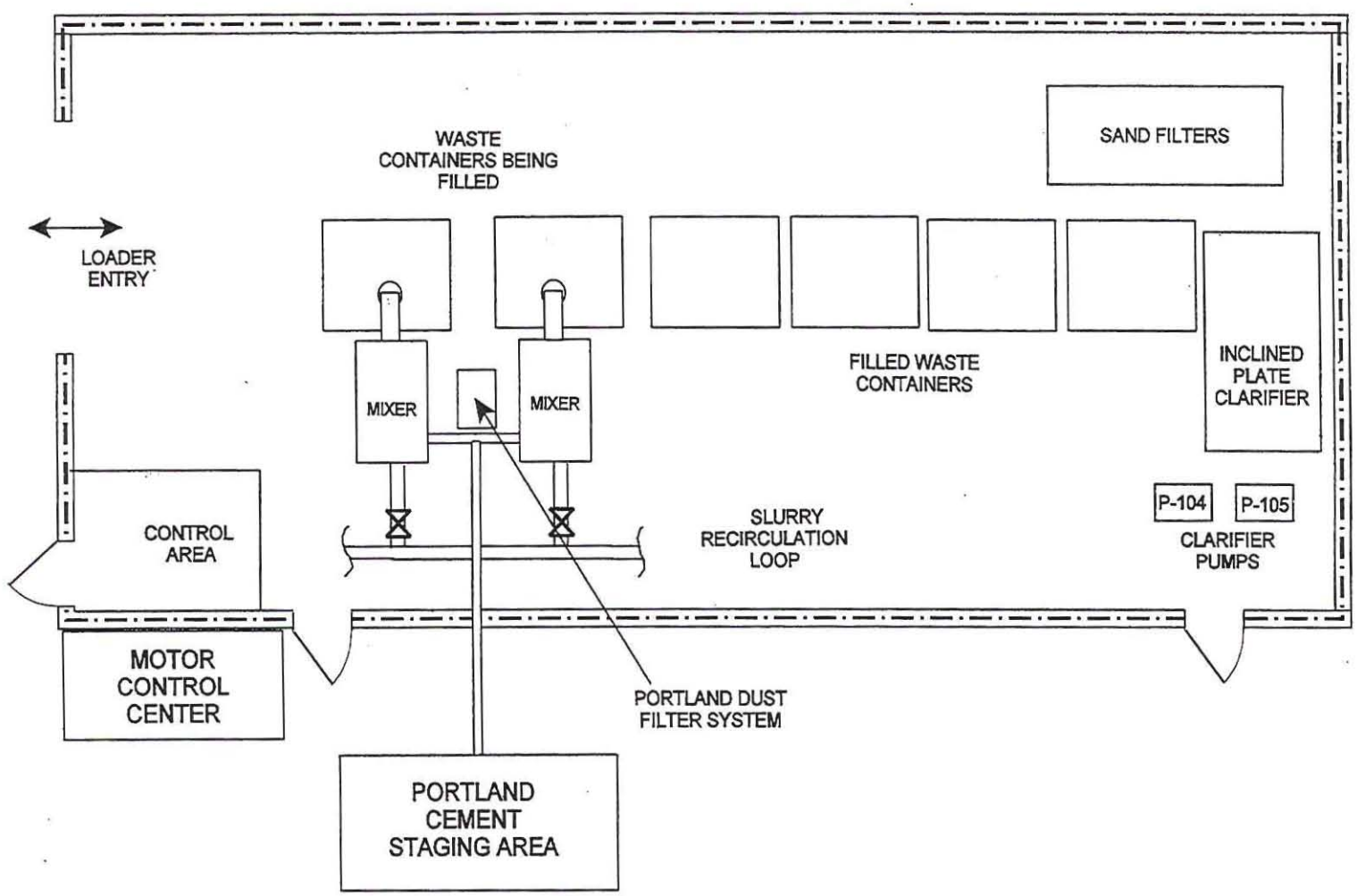

Fig. 5. Layout of the treatment/packaging facility.

The waste package remained inside the treatment/packaging facility for overnight curing, next-day cleaning, and radiation monitoring. When these activities were completed, the waste package was moved to Impoundment A for additional curing until equipment was available to move it to the staging area.

The waste form was tested for hardness using a penetrometer, then was removed from the temporary mold for transportation to the disposal facility.

The ROD identified the NTS as the primary disposal facility with an ORR facility, if constructed, as an alternate. A remedial action subcontract was awarded in 1998 for the removal, treatment, and transportation of the sediment to NTS. Waste Form Analysis field and laboratory testing was performed and data were obtained for operations and final waste form characterization. The NTS profile and data package was developed by the subcontractor and submitted for review by NTS in August 1999. The data package utilized analytical data from the 1995 RI/FS. DOE obtained additional in-situ (untreated) data on Resource Conservation and Recovery Act (RCRA) constituents and PCBs in February 2001 to supplement the data from the RI/FS. All RCRA constituents were well below regulatory limits and PCBs averaged 11.1 ppm statistical mean (wet-weight basis). Analytical results for PCBs on the final waste forms showed a PCB mean of 3.5 ppm. However, when the PCB concentration in the untreated in-situ sediment is calculated on a dry-weight basis, it averages 69.3 ppm statistical mean. As a result, DOE was informed that NTS could not accept the waste even though both the in-situ and final waste form concentrations were less then 50 ppm. As allowed under 40 *Code of Federal Regulations* (*CFR*) 761.61, DOE developed a Risk-Based Disposal Request and obtained approval from both EPA Region IV and IX to dispose the final waste forms in the NTS disposal facility. The profile was resubmitted in August 2002 with EPA approvals for review by NTS and the Nevada Department of Environmental Protection (NDEP). NTS DOE indicated that a WAC deviation could be obtained if acceptable to the NDEP. In January 2003, NDEP informed DOE–Nevada that the deviation would not be accepted for disposal of the final waste forms.

At the time the ROD was being written, and initial discussions were underway for an ORR disposal facility for CERCLA remediation waste. Since no agreement had been made regarding the facility and the waste acceptance criteria was unknown, a paragraph was added to the ROD that stated the ORR disposal facility "would serve as the contingency disposal facility for this alternative" should NTS not be available. Additionally, the ROD stated, "If the new ORR disposal facility is available, it will likely be chosen because of the reduced transportation costs and disposal fees."

After it was determined that the NTS could not accept the waste, the EMWMF was identified as the alternate disposal facility. The characterization data utilized for the final waste forms has been obtained from three sampling events. The in-situ sediment sampling data from the SIOU in 1994 as part of the RI/FS was used for the total metals, herbicides, and pesticides. The PCB data used were obtained as part of the February 2001 in-situ sampling performed to provide additional data for NTS. The radionuclide data used were obtained as part of the final waste form sampling to provide data for Envirocare of Utah.

While the approvals were obtained for disposal at the EMWMF, 108 waste forms were disposed at Envirocare of Utah, Inc. Disposal of these containers at Envirocare provided the staging space needed to continue the remedial action while approvals were obtained for disposal at the EMWMF.

4.2 TREATMENT PLANT DESCRIPTION

The temporary 33 ft by 80 ft treatment/packaging facility structure was a ventilated fabric enclosure (Rubb Tent) housing the treatment equipment items except the settling tanks and associated pumps, valves, and piping. A negative pressure dust collection system located in the facility was installed to remove any Portland cement dust generated during the treatment process.

The treatment/packaging equipment was installed on a concrete slab that was coated with epoxy and constructed to facilitate drainage of leaks, spills, or surface decontamination water back to Impoundment B.

4.3 PROCESS DESCRIPTION

The three remedial activities are described below.

4.3.1 Sediment Dredging

Removal of sediment, subimpoundment soil, and water from the impoundments was conducted using a remotely operated commercial dredge equipped with a cutting head designed for removing sediments and subimpoundment soils (see Fig. 6). Impoundment A sediment was retrieved and transferred to Impoundment B during project mobilization. The impoundment was filled with clean graded stone and flowable fill so that it could be used as an interim staging area for waste packages generated from the treatment of sediments pumped from Impoundment B to the treatment facility.

Fig. 6. Dredge used to remove impoundment sediments.

Figure 7 shows Impoundment A backfilling with crushed rock, and Fig. 8 shows the application of flowable fill over the crushed rock. During the backfilling, all the displaced water was transferred into Impoundment B or to the PWTP.

Fig. 7. View of the partially filled Impoundment A.

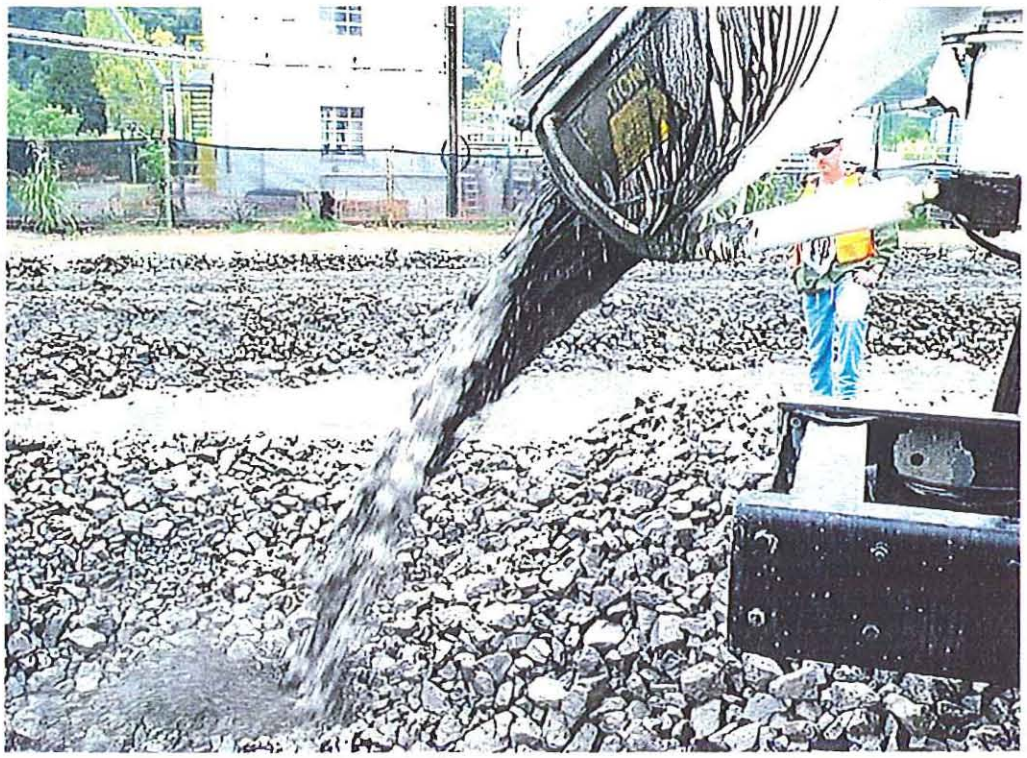

Fig. 8. Application of flowable fill over crushed rock on Impoundment A.

Before the dredging began, the bottom of each impoundment was raked in an effort to locate any foreign items that were not suitable for grinding by the auger head. Such items included wire, wood, loose pipe, or other objects not normally found in an impoundment. These items were containerized and disposed by decontamination and decommissioning (D&D) and miscellaneous waste generated during the operations.

Following the transfer of Impoundment A sediment to Impoundment B, the dredge was used to thoroughly homogenize the sediments. This step produced a more homogeneous feed for the treatment process.

Flexible transfer hoses and PVC piping were employed to transfer the dredged sediment from Impoundment B to the settling tanks. The dredge retrieved the sediment in Impoundment B until a shallow layer of fine particle material remained that could not be removed by the dredge. To retrieve this remaining sediment, a high-density low slump flowable fill wall was used to displace the sediment. This resulted in a smaller area that increased the sediment depth. The impoundment area was decreased to approximately 30 ft x 30 ft to consolidate the remaining sediment. Residual water was removed using a pump to further increase the percent solids of the sediment. Portland cement was then added directly to the sediment and mixed in-situ using a trackhoe bucket. Once the Portland cement was thoroughly mixed with the sediment, it was placed directly into the Lift Liner™ mold for curing.

4.3.2 Sediment Staging

Dredged sediment was routinely transferred to one or more of six 25,600-gal modular settling tanks. The tanks had open tops with fabric dust covers. A sparging ring was located in the bottom of the tank around the tank perimeter. A portion of this system is visible in Fig. 4. The tanks were interconnected with discharge transfer pumps and piping to allow the transfer of sediment. Figure 9 provides a view of pumps and piping in the space between the tank area and the shield wall. Each tank was equipped with overflow alarms, overflow return to the impoundment, and a level sensor. An approximately 1-ft-thick sand shield wall was constructed around the tank area to minimize radiation exposure.

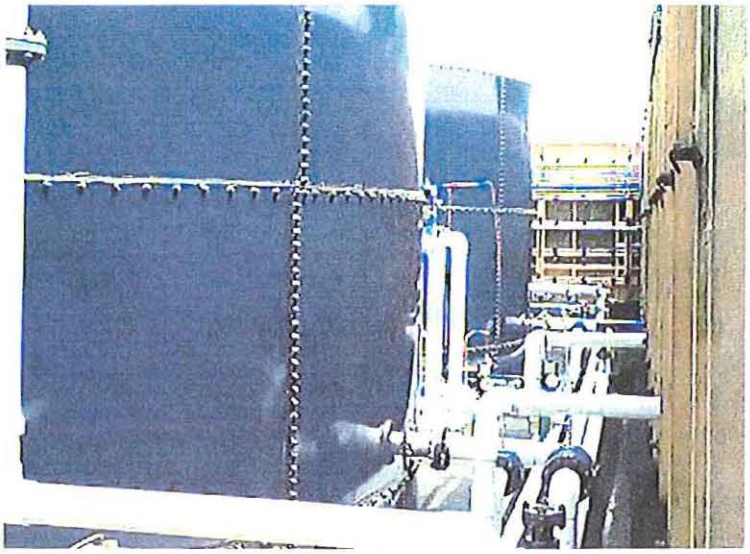

Fig. 9. View of pumps and piping between the staging tanks and the shield wall.

Staging the sediment for treatment was a cyclic process. Each day, one or more tanks received the approximately 5% dredged sediment. The sediment remained in the tanks overnight, allowing the solid material to settle in the water and concentrate toward the bottom of the tank. The overnight settling resulted in a concentrated layer of sediment and a supernate layer of mostly water.

The next work day, the supernate in the filled settling tanks was recycled back into the impoundment. Following removal of the supernate, the tanks were sparged and agitated. Sparging was accomplished by blowing compressed air through the sparging rings in the bottom of the tanks. Next, the agitator was employed to prevent this material from resettling before the slurry was transferred out of the tanks. Then a sample was taken and sent to the Waste Examination and Assay Facility (WEAF) for non-destructive analysis (NDA) using a high-resolution gamma-ray spectrometer (detects gamma-ray emitters such as ^{137}Cs and ^{241}Am) to ensure a homogeneous material. The concentrated sediment then served as feed for the treatment/packaging activity, and the transfer took place at the rate at which the Portland cement mixers could process the slurry.

4.3.3 Treatment/Packaging

The Lift Liner™ waste shipping/disposal container was fitted in a temporary mold and positioned under a mixer chute for filling to the appropriate weight. Figure 10 shows the two mixers in the processing facility. The mold dollies were positioned in tandem under these mixer chutes.

Fig. 10. View of the two sediment/cement mixers.

Approximately 2500 lb of the sediment (approximate 20% solids content) was pumped into one of two mixers. In the mixer, the sediment was combined with approximately 1250 lb of Portland cement from a silo located on the south side of the treatment facility. Each final waste form was approximately 8.3 yd^3 (225 ft^3). Figure 11 provides a view of the silo used to distribute Portland cement. After the proper amount of Portland cement had been added, the sediment/Portland cement was mixed and then emptied into the Lift Liner™. The Lift Liner™ remained under the mixer chute until it neared its maximum weight capacity of approximately 16,000 lb of sediment-Portland cement mixture.

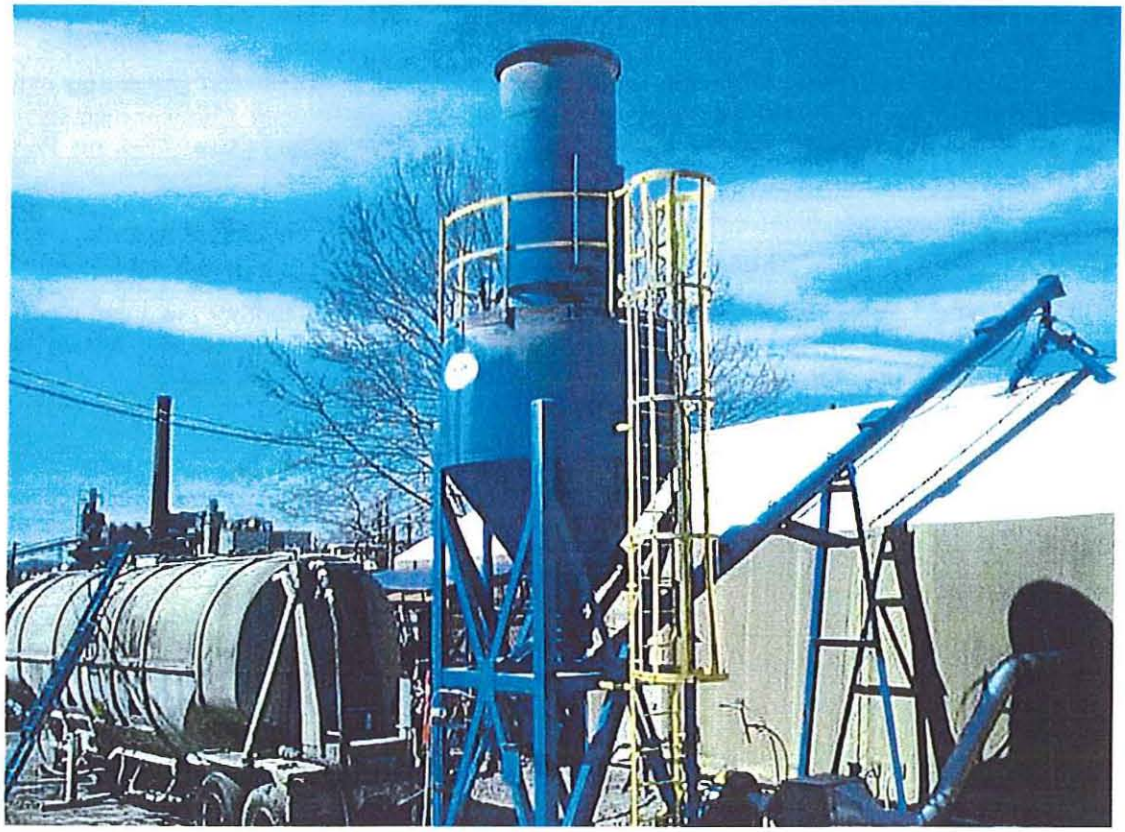

Fig. 11. Silo used to distribute Portland cement to the treatment facility.

After curing, the filled waste containers and molds were removed from the treatment facility to the Impoundment A staging area.

After curing for 2 to 5 days, the Portland cement waste form was tested for hardness using a pocket penetrometer. Once the penetrometer measurements showed that the Portland cement had cured, the waste form was removed from the temporary mold and prepared for shipment. The final waste forms produced from the in-situ process were also allowed to cure for 2 to 5 days. Since this produced a soil-like consistency product, no penetrometer was used. Prior to sealing the Lift Liner™, each final waste form was inspected to confirm that there were no free liquids present. Table 1 gives a summary of the progress of treatment of SIOU sediment.

Table 1. Summary of treated waste progress

Date	Number of Lift Liners filled	Quantity of slurry treated (lb)
July 2001	2	19,933
August 2001	6	60,451
September 2001	14	141,562
October 2001	0	0
November 2001	16	161,756
December 2001	40	414,831
January 2002	39	412,884
February 2002	61	646,625
March 2002	55	571,206
April 2002	51	528,667
May 2002	62	654,642
June 2002	43	448,554
July 2002	90	903,504
August 2002	55	575,745
September	30	319,013
October 2002	51	520,485
November 2002	64	674,078
December 2002	24	245,148
January 2003	14	148,877
February 2003	24	254,351
March 2003	36	374,420
April 2003	45	415,196
May 2003	10	106,597
June 2003	20	213,182
July 2003	8	85,236
August 2003	121	1,066,400
September (tank residue)	13	221,000
Totals	**994**	**10,186,201**

4.4 CONTROL OF TREATMENT AND SHIPPING PROCESSES

All sediment staging and treatment operations were controlled from the control room by a human-machine interface computer program. Various procedures and checklists were used to ensure the validity of data used to characterize each package of treated SIOU sediment that was shipped for disposal.

4.5 SURVEY OF FINAL BOTTOM CONTOURS OF IMPOUNDMENTS

As sediment was dredged, surveys of the impoundment bottom were conducted periodically to ensure that the subimpoundment soil removal criterion of 0.1–0.2 ft was being met. Multiple measuring campaigns were used to determine that the impoundment sediment and subimpoundment soil had been removed. A survey crew obtained bottom elevation readings using a base and moving point method. A leveled laser-based survey instrument was located on the bank at a known grid position and elevation. A flotation platform served as the survey's moving point. If areas were identified where less than 0.1 ft of the subimpoundment soil was removed or where sediment was still present, the dredge was repositioned, and the dredging process continued until the proper depth was achieved. The final bottom contours of Impoundments A and B showing that at least 0.1 ft of subimpoundment soil has been removed are provided in Appendices A and B.

In addition to physical survey data, post-remedial action sampling and analysis was performed at each impoundment. These results were reviewed by DOE and regulatory agencies prior to backfill of each impoundment. Upon verification of removal of the sediment and subimpoundment soil from Impoundment B, the Impoundments were filled with rock and flowable fill. A separate *Post-Remediation Sampling Project Report of the Surface Impoundment Operable Units at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (BJC/OR-1752) provides all results of the sampling and analysis from Impoundments A & B.

4.6 FACILITY DECONTAMINATION AND DEMOLITION

After treatment of the final sediment, the tanks and piping were thoroughly rinsed in preparation for dismantling. The interior surfaces of pipes were treated to fix the internal contamination. Following this treatment, the tanks, pipes, and treatment facilities were dismantled and placed into roll-off waste containers and transferred to the EMWMF for disposal. The sand shielding wall was dismantled, and the sand was placed in Impoundment B. The concrete floor pad was demolished and placed into Impoundment B with other rock and flowable fill. Other project areas were covered with topsoil, seed, and fertilizer except for the former impoundment areas, which were paved with asphalt. Contaminated lumber, plastic, equipment, and other items were packaged in roll-offs and transported to the EMWMF. Uncontaminated D&D debris was transported and disposed at the ORR Y-12 Industrial Landfill.

The approximate amount of D&D waste generated and disposal location is provided in Table 2.

Table 2. Location and volume of disposed D&D waste

Location	Approximate volume (ft^3)
EMWMF	5,750
Y-12 Industrial Landfill	8,100

4.7 PROJECT DATES

Table 3 provides the major project activities and document completions for the remediation of Impoundments A & B.

Table 3. Major project activities and document completion dates

Impoundments A & B activities	Date of completion
Remedial action subcontract award for Impoundments A and B	October 1998
Remedial Action Work Plan/Remedial Design Report D3 approved	April 2000
Mobilization to SIOU by remedial action subcontractor	December 1999
Transfer of sediment from impoundment A to impoundment B complete	August 2000
Backfill of impoundment A complete	September 2000
Start of sediment removal and treatment impoundment B	July 2001
Shipment of final waste forms to off-site disposal facility	November–December 2002
Shipment of final waste forms to EMWMF	April–August 2003
Sediment removal and treatment complete	August 2003
Backfill of impoundment B complete	September 2003
Site restoration and demobilization complete	January 2004

5. DEVIATIONS FROM THE RECORD OF DECISION

Three minor deviations were made to the project scope as described in Alternative 6 of the ROD. The deviations are as follows:

- The ROD anticipated that the waste would be disposed of at NTS. As a result of revised polychlorinated biphenyl (PCB) regulations, NTS determined that they could not accept the final waste. As indicated in the ROD, the on-ORR EMWMF was selected as the contingency facility for disposal. Additionally, approximately 900 yd^3 of waste were disposed of at Envirocare of Utah, Inc., while approvals were being obtained for disposal at EMWMF.

- It was anticipated that the impoundments would be filled with soil. The impoundments were filled with free-draining rock fill (6- to 12-in. graded riprap) and flowable grout to fill the void spaces.

- Instead of a vegetative cover being established over the site, an asphalt cover will be placed over each remediated impoundment.

6. COSTS

The ROD estimated a total capital cost of $47.4M and present value of capital cost as $38.7M.

The ROD cost estimate included the remediation of Impoundments C and D and assumed these two small impoundments would require chemical dechlorination of PCBs. The total estimated cost for the remedial action of Impoundments C & D was estimated at $4.3M and included the cost for removal; treatment, packaging, and transportation; and disposal at Envirocare of Utah, Inc. Subsequent testing showed that chemical dechlorination would not be required. The sediment from Impoundments C and D was transferred to Impoundment B and treated with the sediments from Impoundments A and B.

Additionally, the ROD estimate assumed transportation and disposal of the final waste forms to NTS. The use of the EMWMF reduced disposal cost by approximately $3.6M and transportation by approximately $2M. Table 4 provides a comparison of the approximate cost with the estimated cost used in the ROD for Impoundments A and B. The ROD estimated costs for Impoundments C & D remedial action ($4.295M) are not included.

Table 4. Total project cost

Remedial action task	Project cost ($K)	ROD estimate ($K)
Project management, support and reports	9,291	13,008
RAWP/RDR, work plans, procedures, and safety documentation	4,300	6,980
Site preparation and mobilization	1,696	1,005
Treatment plant construction and start-up	1,656	7,304
Retrieval and treatment	4,504	4,407
Transportation and disposal	2,664	7,766
D&D, site restoration, Remedial Action Report	2,616	2,604
Approximate total cost	**26,727**	**43,072**

Note: The sum of $43,072K for Impoundments A & B and $4,295K for Impoundments C&D equals $47,367K, or rounded to $47.4M total capital cost, as estimated in the ROD.

7. WASTE MANAGEMENT AND TRANSPORTATION ACTIVITIES

7.1 SHIPPING PREPARATION AND SHIPMENT STAGING

The waste forms were temporarily staged prior to transport to a disposal facility. Prior to shipment for disposal, each waste form was given a tamper seal and inspected to ensure that each had proper packaging, labeling, and markings in accordance with the waste manifest. Upon certification and finalization of all shipping paperwork, shipment certification was complete, and the waste forms were loaded for transport to disposal. Figure 12 shows some of the filled and cured treated waste containers staged at an interim storage location.

Fig. 12. Interim storage area for treated waste containers following curing.

7.2 WASTE CONTAINER TRANSPORT AND DISPOSAL

The remedial work produced 994 waste forms of treated sediment and subimpoundment soil. In November and December 2002, 108 waste forms were transported via truck and rail to Envirocare of Utah, Inc. (see Fig. 13). Final disposal of these waste forms at Envirocare was in December 2002.

Each rail car contained 12 waste forms. Figure 14 shows the loading of one rail car where a waste form supported from a crane is being placed on top of the first layer, and Fig. 15 shows a filled rail car before final closure.

Fig. 13. Truck transport of treated waste form from Impoundment A storage to ETTP for rail shipment to Utah.

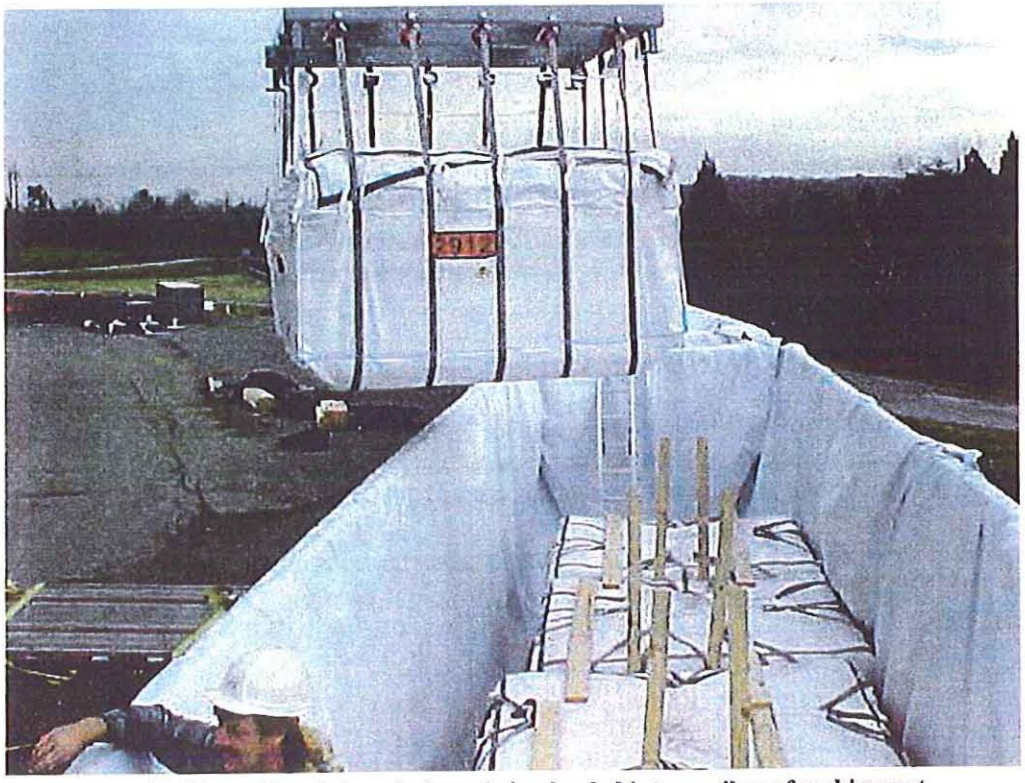

Fig. 14. View of treated waste form being loaded into a rail car for shipment.

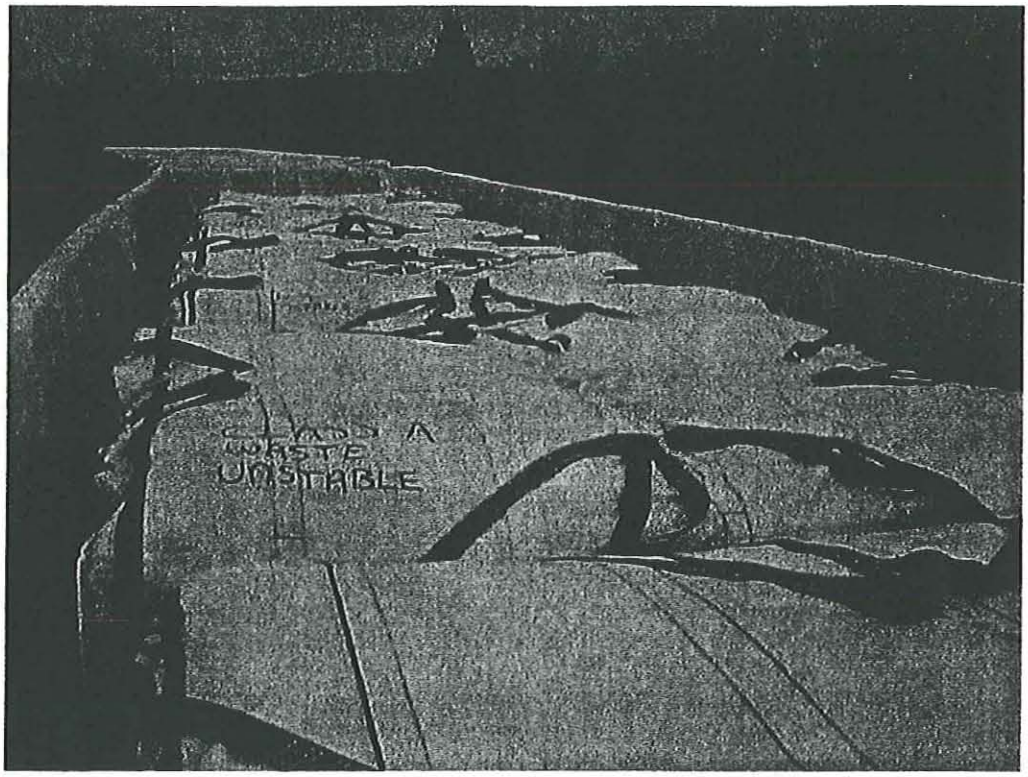

Fig. 15. View of loaded rail car prior to closure for transport by rail.

The remaining waste forms were transported to the EMWMF during the period April 2002 through August 2003. The last 13 final waste forms were generated during the D&D of the facility settling tanks. The tank residue that could not be removed during the pre-D&D flushing process was mixed with Portland cement and placed in Lift Liners. This tank residue consisted of sediment, sand, and gravel. These waste forms were transported to the EMWMF at the completion of the D&D in January 2004.

8. OPERATION AND MAINTENANCE PLANS

There were no unexpected occurrences or alterations made to the operation and maintenance plans originally presented in the ROD. No institutional controls will be needed at the site. Excavation institutional controls will remain in place for potential residual subsurface contamination around the site.

9. MONITORING SCHEDULE AND/OR EXPECTATIONS

No additional monitoring of groundwater or surface water is required.

10. REFERENCES

BJC (Bechtel Jacobs Company LLC) 2004. *Post-Remediation Sampling Project Report of the Surface Impoundment Operable Units at Oak Ridge National Laboratory, Oak Ridge, Tennessee*, BJC/OR-1752, Bechtel Jacobs Company LLC, Oak Ridge, TN, February.

Department of Energy (DOE) 2000. *Remedial Action Work Plan/Remedial Design Report for the Stage 2 Remedial Action on the Surface Impoundments Operable Unit A and B at the Oak Ridge National Laboratory, Oak Ridge, Tennessee*, DOE/OR/01-1816&D3, March.

DOE 1999. *Remedial Action Report 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.

DOE 1998. *Remedial Design Work Plan for the Surface Impoundments Operable Unit, Oak Ridge National* Laboratory, *Oak Ridge, Tennessee*, DOE/OR/01-1677&D2, March.

DOE 1997. *Record of Decision for the Surface Impoundments Operable Unit, Oak Ridge National Laboratory,* Oak *Ridge, Tennessee*, DOE/OR/02-1630&D2.

DOE 1995. *Remedial Investigation/Feasibility Study for Surface Impoundments Operable Unit Waste Area Grouping 1, Oak Ridge National Laboratory, Oak Ridge, Tennessee,* DOE/OR/02-1346&D2, November.

APPENDIX A

FINAL SUBIMPOUNDMENT SOIL SURVEY ELEVATIONS
IMPOUNDMENT A

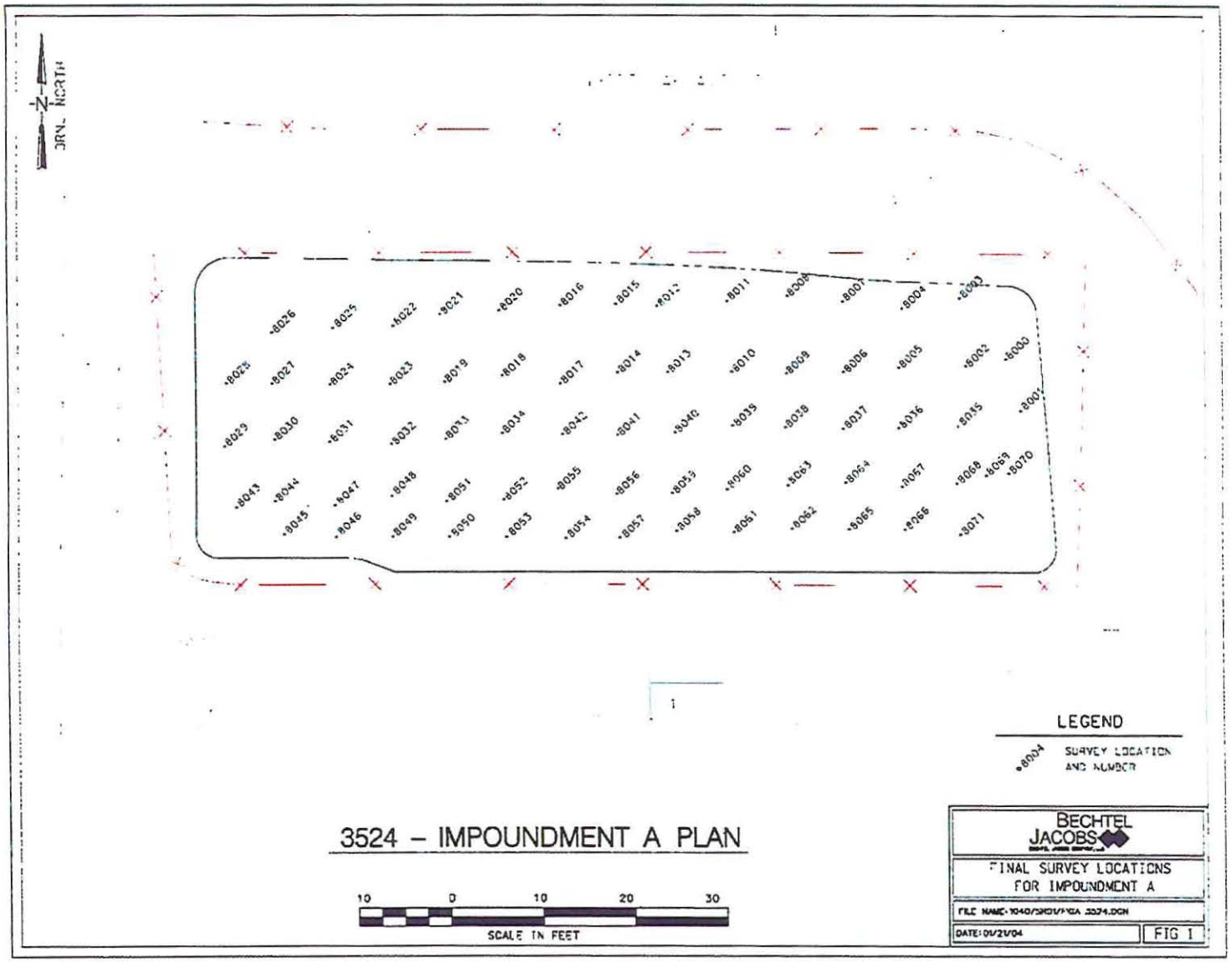

Fig. A.1. Impoundment A plan.

Table A.1. Final Subimpoundment Soil Survey Elevations Impoundment A

ORIG POINT #	LAT	LONG	BASE TYPE	97 ELEV. (feet)	NEW POINT #	LAT	LONG	AUG00 ELEV. (feet)	ELEVATION DIFFERENCE (feet)	DISTANCE from ORIG & NEW POINTS (feet)
1251	31055.49	21523.16	clay	777.96	8068	31055.30	21523.07	777.91	-0.050	0.21
1253	31036.61	21523.39	clay	778.24	8067	31036.20	21522.62	778.06	-0.180	0.87
1255	31015.29	21522.98	rock	778.93	8064	31016.11	21523.41	778.84	-0.092	0.92
1257	30995.77	21522.69	rock	779.19	8063	30995.59	21522.49	778.83	-0.355	0.27
1259	30974.59	21521.74	clay	776.83	8060	30974.04	21520.85	776.76	-0.066	1.05
1262	30955.38	21520.83	rock	776.63	8059	30954.72	21520.03	776.18	-0.448	1.04
1264	30935.33	21519.58	clay	774.81	8056	30935.15	21519.97	774.54	-0.267	0.44
1266	30914.46	21520.63	clay	776.44	8055	30914.31	21521.51	776.28	-0.156	0.89
1268	30895.04	21517.53	rock	778.94	8052	30894.93	21517.34	778.82	-0.119	0.22
1270	30875.33	21516.82	clay	779.07	8051	30875.04	21516.71	779.00	-0.073	0.31
1272	30855.25	21517.59	clay	779.35	8048	30855.61	21518.57	779.11	-0.242	1.04
1274	30835.49	21515.77	clay	777.80	8047	30835.60	21515.32	777.42	-0.379	0.46
1276	30815.50	21516.47	clay	777.89	8044	30814.56	21516.76	777.53	-0.358	0.98
1278	30800.58	21515.64	rock	778.99	8043	30800.62	21514.72	778.89	-0.095	0.92
1279	31073.82	21527.15	rock	782.05	8070	31073.26	21526.81	781.96	-0.086	0.65
1281	31065.43	21527.32	gravel	779.36	8069	31065.52	21526.31	779.12	-0.244	1.02
1283	31077.53	21547.84	clay	779.81	8001	31077.49	21548.84	779.64	-0.174	1.00
1285	31055.60	21543.51	rock	778.90	8035	31055.69	21543.56	778.81	-0.092	0.11
1286	31035.07	21542.92	rock	779.29	8036	31034.85	21542.61	779.05	-0.243	0.38

Table A.1. (continued)

ORIG POINT #	LAT	LONG	BASE TYPE	97 ELEV. (feet)	NEW POINT #	LAT	LONG	AUG00 ELEV. (feet)	ELEVATION DIFFERENCE (feet)	DISTANCE from ORIG & NEW POINTS (feet)
1288	31015.20	21542.76	clay	777.95	8037	31015.15	21542.26	777.79	-0.161	0.50
1290	30995.28	21543.08	clay	777.78	8038	30994.71	21542.78	777.46	-0.320	0.65
1292	30974.93	21542.71	clay	776.93	8039	30976.11	21543.35	776.83	-0.104	1.34
1294	30954.75	21540.16	clay	778.16	8040	30955.67	21540.99	778.09	-0.069	1.24
1296	30935.23	21539.73	clay	777.82	8041	30935.38	21539.99	777.81	-0.007	0.30
1298	30915.66	21540.07	clay	778.07	8042	30916.03	21540.19	777.88	-0.189	0.39
1300	30894.92	21541.24	rock	779.14	8034	30894.67	21540.58	778.83	-0.313	0.80
1302	30874.37	21538.96	clay	779.09	8033	30874.44	21538.66	779.33	0.240	0.31
1304	30854.63	21536.59	clay	778.73	8032	30855.49	21536.77	778.51	-0.224	0.88
1306	30834.49	21537.05	clay	777.77	8031	30833.83	21537.58	777.45	-0.322	0.84
1308	30814.52	21536.07	rock	777.25	8030	30814.38	21538.33	776.91	-0.339	2.26
1310	30796.44	21535.80	clay	780.25	8029	30796.49	21536.05	781.33	1.077	0.26
1312	31072.45	21566.32	clay	780.27	8000	31072.45	21567.01	779.22	-1.051	0.68
1313	31035.25	21563.19	rock	779.15	8005	31035.08	21563.95	778.92	-0.230	0.78
1314	31015.34	21562.76	rock	778.74	8006	31015.20	21562.48	778.44	-0.303	0.32
1315	31056.26	21564.59	rock	779.39	8002	31058.22	21564.80	779.14	-0.254	1.98
1317	30995.17	21562.22	rock	775.01	8009	30995.17	21561.77	774.79	-0.223	0.45
1319	30974.39	21562.46	rock	775.30	8010	30975.65	21562.43	775.35	0.053	1.25
1321	30953.70	21562.21	rock	775.49	8013	30953.35	21562.13	775.08	-0.407	0.36
1323	30934.92	21562.43	rock	777.82	8014	30935.51	21562.05	777.74	-0.080	0.70

Table A.1. (continued)

ORIG POINT #	LAT	LONG	BASE TYPE	97 ELEV. (feet)	NEW POINT #	LAT	LONG	AUG00 ELEV. (feet)	ELEVATION DIFFERENCE (feet)	DISTANCE from ORIG & NEW POINTS (feet)
1324	30915.62	21558.70	rock	778.46	8017	30915.36	21558.16	778.20	-0.259	0.60
1326	30894.16	21560.97	rock	778.78	8018	30894.79	21560.94	778.53	-0.246	0.64
1328	30874.09	21558.55	clay	779.43	8019	30874.47	21558.66	779.36	-0.072	0.40
1330	30854.64	21558.30	clay	779.40	8023	30855.27	21558.03	779.25	-0.150	0.69
1332	30834.31	21557.97	clay	777.70	8024	30834.05	21557.91	777.25	-0.453	0.26
1334	30814.10	21558.06	rock	777.60	8027	30813.64	21558.25	777.27	-0.328	0.50
1336	30796.89	21556.19	clay	778.69	8028	30797.50	21558.25	778.49	-0.196	2.15
1338	31056.72	21505.15	*bottom	780.66	8071	31056.53	21505.21	781.38	0.724	0.20
1340	31056.47	21588.40	gravel/rc	781.48	8003	31056.63	21588.19	781.68	1.024	0.27
1342	31035.92	21586.41	gravel/c	781.27	8004	31036.12	21584.62	781.09	-0.182	1.80
1344	31015.25	21587.28	gravel	781.63	8007	31015.16	21587.17	781.63	0.004	0.13
1346	30995.70	21589.13	rock	781.10	8008	30995.60	21589.12	781.28	0.180	0.10
1348	30974.72	21587.34	clay	781.68	8011	30974.58	21587.10	781.97	0.289	0.28
1350	30951.31	21586.42	rock	780.48	8012	30949.63	21585.35	780.67	0.189	2.00
1352	30935.88	21585.70	gravel	781.49	8015	30935.13	21586.05	781.88	0.389	0.83
1354	30915.28	21585.15	clay	781.58	8016	30915.62	21585.52	781.71	0.126	0.50
1356	30894.39	21583.85	clay	781.53	8020	30893.65	21583.79	781.92	0.389	0.75
1358	30873.57	21582.74	clay	781.58	8021	30872.95	21582.41	781.90	0.316	0.70
1360	30855.57	21577.66	rock	781.24	8022	30856.46	21578.36	781.51	0.270	1.13
1362	30834.91	21577.80	clay	781.59	8025	30834.93	21577.87	781.74	0.153	0.07

APPENDIX B

FINAL SUBIMPOUNDMENT SOIL SURVEY ELEVATIONS
IMPOUNDMENT B

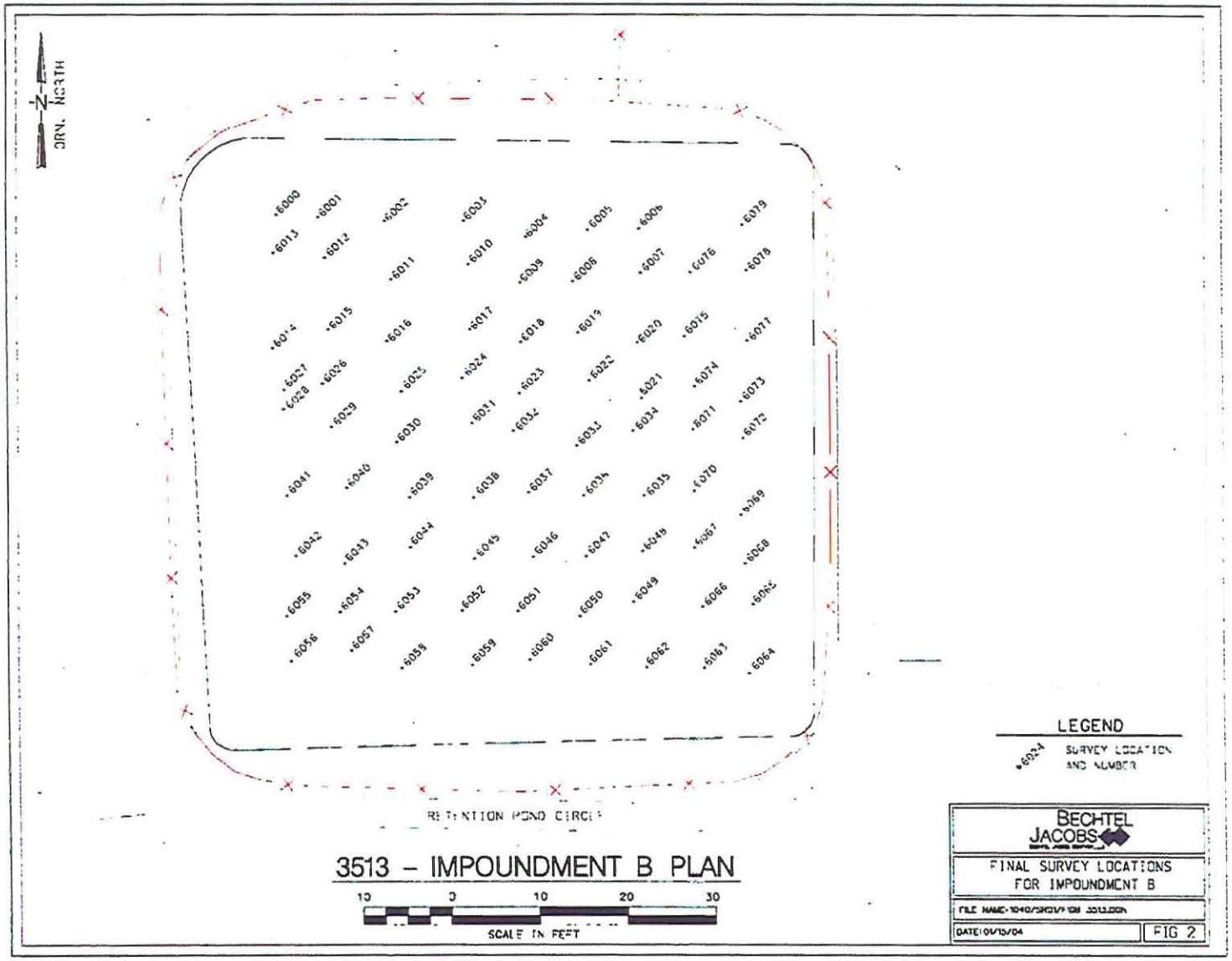

Fig. B.1. 3513 Impoundment B plan.

Table B.1. Final Subimpoundment Soil Survey Elevations Impoundment B

Survey coordinate ID #	Survey location-Northing	Survey location-Easting	Current elevation (ft)	Original coordinate ID #	Original coordinate-Northing	Original coordinate-Easting	Original elevation (ft)	Delta - Northing	Delta - Easting	Distance from original point (ft)	Cut below original (ft)
6000	21399.42824	31025.93772	771.95	1199	21399.95710	31024.77555	772.34	0.52886	-1.16217	1.3	0.39
6001	21398.22248	31039.71549	772.15	1162	21401.26340	31042.82999	772.32	3.04092	3.11450	4.4	0.17
6002	21396.96253	31063.13950	771.87	1157	21399.40840	31063.93353	772.30	2.44587	0.79403	2.6	0.43
6003	21396.76020	31090.78650	771.89	1119	21399.91000	31091.29368	772.22	3.14980	0.50718	3.2	0.33
6004	21391.26794	31112.78773	771.68	1097	21390.07218	31111.05452	772.15	-1.19576	-1.73321	2.1	0.48
6005	21393.67644	31134.42523	771.71	1093	21391.43098	31131.57956	771.81	-2.24546	-2.84567	3.6	0.10
6006	21393.99927	31152.56309	771.70	1048	21391.83778	31151.13190	771.99	-2.16149	-1.43119	2.6	0.29
6007	21378.39154	31153.35760	771.91	1049	21375.52655	31151.10800	772.36	-2.86499	-2.24960	3.6	0.45
6008	21375.40658	31129.34310	771.87	1091	21375.86155	31131.32416	772.17	0.45497	1.98106	2.0	0.30
6009	21374.99892	31110.55241	772.02	1099	21375.61295	31111.29792	772.15	0.61403	0.74551	1.0	0.13
6010	21381.26266	31092.44822	772.08	1121	21378.83096	31091.37528	772.36	-2.43170	-1.07294	2.7	0.28
6011	21376.09795	31065.27856	772.05	1155	21377.22545	31063.91483	772.30	1.12750	-1.36373	1.8	0.25
6012	21383.76124	31042.16209	772.31	1164	21388.06538	31042.66049	772.46	4.30414	0.49840	4.3	0.16
6013	21385.29919	31023.54690	771.95	1197	21386.54317	31025.24025	772.10	1.24398	1.69335	2.1	0.15
6014	21352.26364	31023.06176	772.28	1195	21352.63221	31026.30775	772.65	0.36857	3.24599	3.3	0.37
6015	21358.57618	31043.07719	772.31	1166	21359.65112	31044.46569	772.46	1.07494	1.38850	1.8	0.15
6016	21354.56688	31063.66745	772.32	1153	21353.07731	31065.56483	772.65	-1.48957	1.89738	2.4	0.33
6017	21358.55909	31092.73239	772.19	1123	21356.25311	31090.54038	772.62	-2.30598	-2.19201	3.2	0.43
6018	21354.23725	31110.63740	772.21	1101	21354.43811	31111.56452	772.37	0.20086	0.92712	0.9	0.16
6019	21357.34037	31131.06568	772.07	1089	21355.45401	31131.02696	772.41	-1.88636	-0.03872	1.9	0.34
6020	21353.93124	31152.18729	771.90	1056	21354.70061	31151.31490	772.09	0.76937	-0.87239	1.2	0.19

Table B.1. (continued)

Survey coordinate ID #	Survey location-Northing	Survey location-Easting	Current elevation (ft)	Original coordinate ID #	Original coordinate-Northing	Original coordinate-Easting	Original elevation (ft)	Delta - Northing	Delta - Easting	Distance from original point (ft)	Cut below original (ft)
6021	21334.32787	31153.25297	771.83	1058	21336.17027	31151.19530	771.95	1.84240	-2.05767	2.8	0.12
6022	21340.68203	31134.65927	772.19	1087	21337.75518	31131.77366	772.65	-2.92685	-2.88561	4.1	0.46
6023	21336.07866	31110.19499	772.31	1103	21337.01587	31111.79172	772.47	0.93721	1.59673	1.9	0.17
6024	21341.56259	31089.73038	772.49	1125	21339.09878	31091.30028	772.88	-2.46381	1.56990	2.9	0.39
6025	21337.09901	31068.50492	772.51	1151	21336.04287	31066.81853	772.87	-1.05614	-1.68639	2.0	0.36
6026	21339.61874	31040.76987	772.56	1168	21339.57298	31044.81699	772.92	-0.04576	4.04712	4.0	0.36
6027	21337.53438	31027.00938	772.62	1193	21337.73188	31026.52855	772.93	0.19750	-0.48083	0.5	0.31
6028	21330.72638	31026.76787	772.63	1191	21328.29526	31027.20495	772.90	-2.43112	0.43708	2.5	0.27
6029	21324.24079	31043.81285	772.38	1170	21328.05706	31044.29619	772.92	3.81627	0.48334	3.8	0.54
6030	21318.89862	31066.79190	772.52	1149	21322.52425	31065.53923	772.72	3.62563	-1.25267	3.8	0.21
6031	21325.63500	31093.55499	772.50	1127	21324.90675	31091.39498	772.77	-0.72825	-2.16001	2.3	0.27
6032	21322.91818	31107.88235	772.44	1105	21322.81085	31111.89512	772.69	-0.10733	4.01277	4.0	0.25
6033	21317.73565	31130.21253	772.05	1085	21320.45494	31131.58246	772.16	2.71929	1.36993	3.0	0.11
6034	21322.95808	31150.20048	771.78	1061	21320.44904	31151.09630	771.98	-2.50904	0.89582	2.7	0.20
6035	21300.17122	31153.92348	771.96	1063	21298.55510	31151.25370	772.19	-1.61612	-2.66978	3.1	0.23
6036	21300.16953	31132.59692	772.11	1083	21297.90150	31130.90566	772.48	-2.26803	-1.69126	2.8	0.37
6037	21301.35764	31113.18775	772.26	1107	21298.89000	31111.56872	772.69	-2.46764	-1.61903	3.0	0.43
6038	21299.53146	31093.48212	772.53	1129	21300.03080	31091.14598	772.78	0.49934	-2.33614	2.4	0.25
6039	21299.66670	31070.94709	772.56	1147	21299.71390	31067.13843	772.92	0.04720	-3.80866	3.8	0.36
6040	21303.02600	31048.77902	772.51	1172	21300.62890	31045.94809	772.73	-2.39710	-2.83093	3.7	0.22
6041	21300.35518	31027.82464	772.66	1189	21300.33560	31027.81116	772.89	-0.01958	-0.01348	0.0	0.23
6042	21279.01707	31031.16368	772.74	1187	21281.48076	31028.08796	772.99	2.46369	-3.07572	3.9	0.25

Table B.1. (continued)

Survey coordinate ID #	Survey location-Northing	Survey location-Easting	Current elevation (ft)	Original coordinate ID #	Original coordinate-Northing	Original coordinate-Easting	Original elevation (ft)	Delta - Northing	Delta - Easting	Distance from original point (ft)	Cut below original (ft)
6043	21276.31796	31048.39333	772.75	1174	21280.29106	31047.21699	772.99	3.97310	-1.17634	4.1	0.24
6044	21281.99137	31071.38388	772.79	1145	21279.80626	31067.59764	772.98	-2.18511	-3.78624	4.4	0.19
6045	21277.85314	31094.05908	772.51	1131	21279.62546	31091.11788	772.73	1.77232	-2.94120	3.4	0.22
6046	21278.53336	31114.84956	772.70	1109	21279.07196	31111.08932	773.06	0.53860	-3.76024	3.8	0.36
6047	21278.70274	31133.54421	772.75	1081	21278.38856	31131.72586	772.92	-0.31418	-1.81835	1.8	0.17
6048	21280.78737	31153.22487	772.56	1066	21279.21456	31151.34510	772.85	-1.57281	-1.87977	2.5	0.29
6049	21262.72093	31150.10510	772.39	1069	21258.85092	31150.17440	773.14	-3.87001	0.06930	3.9	0.75
6050	21257.66548	31131.20503	772.88	1079	21259.85192	31132.28696	773.17	2.18644	1.08193	2.4	0.29
6051	21259.45507	31109.28024	772.97	1111	21260.94152	31111.32932	773.25	1.48645	2.04908	2.5	0.28
6052	21259.66962	31089.59407	772.39	1133	21261.82422	31091.17628	772.65	2.15460	1.58221	2.7	0.26
6053	21259.41396	31065.90414	772.70	1143	21260.59342	31067.07623	772.91	1.17946	1.17209	1.7	0.21
6054	21259.13178	31046.68629	772.97	1176	21262.51683	31048.43460	773.25	3.38505	1.74831	3.8	0.28
6055	21257.78443	31027.86168	772.97	1185	21261.47592	31028.40716	773.10	3.69149	0.54548	3.7	0.13
6056	21242.15734	31029.30886	773.12	1183	21242.67189	31029.27366	773.54	0.51455	-0.03520	0.5	0.42
6057	21245.96628	31050.75093	773.23	1178	21242.07598	31048.59890	773.57	-3.89030	-2.15203	4.4	0.34
6058	21239.78614	31067.88860	773.08	1141	21241.26268	31069.37194	773.31	1.47654	1.48334	2.1	0.23
6059	21240.60355	31093.07255	772.56	1135	21240.92048	31090.97538	773.34	0.31693	-2.09717	2.1	0.78
6060	21242.44015	31113.38527	772.38	1113	21239.36618	31110.27422	772.55	-3.07397	-3.11105	4.4	0.17
6061	21241.07056	31134.84397	772.65	1077	21240.20258	31131.31736	773.29	-0.86798	-3.52661	3.6	0.64
6062	21239.66349	31154.65589	772.82	1071	21238.50428	31151.13820	773.08	-1.15921	-3.51769	3.7	0.26
6063	21239.37572	31174.89922	773.54	1041	21238.72278	31171.48104	773.83	-0.65294	-3.41818	3.5	0.29
6064	21237.59447	31190.86181	773.70	1019	21238.31518	31188.70988	773.90	0.72071	-2.15193	2.3	0.20

Table B.1. (continued)

Survey coordinate ID #	Survey location-Northing	Survey location-Easting	Current elevation (ft)	Original coordinate ID #	Original coordinate-Northing	Original coordinate-Easting	Original elevation (ft)	Delta - Northing	Delta - Easting	Distance from original point (ft)	Cut below original (ft)
6065	21261.93580	31192.25072	772.47	1017	21258.46932	31189.19828	772.89	-3.46648	-3.05244	4.6	0.42
6066	21261.13366	31174.23636	772.27	1039	21258.78082	31171.10814	772.96	-2.35284	-3.12822	3.9	0.69
6067	21282.03221	31171.47184	772.38	1037	21277.69996	31172.84775	772.53	-4.33225	1.37591	4.5	0.15
6068	21276.30400	31189.52144	772.50	1015	21277.30485	31188.00708	773.06	1.00085	-1.51436	1.8	0.56
6069	21293.78464	31187.70993	772.10	1013	21298.10030	31188.86958	772.42	4.31566	1.15965	4.5	0.32
6070	21301.98505	31171.66899	772.16	1035	21299.44670	31171.91084	772.49	-2.53835	0.24185	2.5	0.33
6071	21323.40732	31171.07658	771.93	1033	21319.48064	31170.67674	772.16	-3.92668	-0.39984	3.9	0.23
6072	21320.36501	31188.90999	771.41	1011	21319.02524	31189.19708	771.79	-1.33977	0.28709	1.4	0.38
6073	21333.22920	31188.25033	771.67	1009	21337.06747	31190.34768	772.56	3.83827	2.09735	4.4	0.89
6074	21338.59618	31172.04233	771.61	1031	21337.36667	31171.29434	771.79	-1.22951	-0.74799	1.4	0.18
6075	21356.21407	31168.41806	771.53	1029	21357.07471	31171.54334	771.75	0.86064	3.12528	3.2	0.22
6076	21378.63891	31170.55771	771.75	1027	21375.89285	31172.10884	772.26	-2.74606	1.55113	3.2	0.51
6077	21354.84589	31190.57434	772.55	1007	21356.23041	31189.86198	772.85	1.38452	-0.71236	1.6	0.30
6078	21379.31629	31190.64875	771.62	1002	21379.46126	31191.45878	771.83	0.14497	0.81003	0.8	0.21
6079	21395.42277	31189.15115	771.45	1001	21395.17529	31189.71578	771.81	-0.24748	0.56463	0.6	0.36

1024 21238.31518 31188.70988 771.50
1137 21223.94365 31093.30239 773.89
1139 21220.09054 31072.95445 775.31

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Date: September 30, 2003

BECHTEL JACOBS
Bechtel Jacobs Company LLC

Reservation Cleanup and Waste Management Project Document Comments Form

Title of Document: *Remedial Acton Report on the Surface Impoundments Operable Unit at the Oak Ridge National Laboratory, Oak Ridge, Tennessee*
Document number or other identifier: DOE/OR/01-2086&D1

Name of Commentor:	**Martha Berry, Senior RPM**
Organization of Commentor:	**United States Environmental Protection Agency**

Comment No.	Page/ Reference	Comments	Responses
1.	Executive Summary	More information should be provided in the third paragraph discussion on waste disposition.	More information has been included.
2.	Section 2	This chapter should provide more detail about the operational history and the releases of contaminants of concern. This should include a summary of previous investigations and a discussion of the conceptual site model.	Section has been revised to include more history and release of contaminants.
3.	Section 3	A discussion of the Remedial Actions Objectives and how the selected remedy addressed these RAOs should be added.	RAOs from the RI/FS have been added and a statement as to how they were met has been added.
4.	Section 4	This section should provide a more detailed description of the NTS WAC/PCB remediation waste issue. This section should also describe the results of verification/confirmation testing (including QA/QC info), project start and completion dates and identification of any important milestone completion dates or deviations from the original schedule in the ROD. Finally, this section should document the final inspection and certification that the remedy is operational and functional.	This Section has been revised to include more information. A new Section 4.7 has been added that includes project activities and dates. Drawings showing the final survey locations will be included to provide additional verification of the completions. As with Stage 1 of the project, the results of the confirmation sampling will be provided in a separate document that documents the final end state.
5.	Chapter 4, P. 10	A sentence describing the disposition of the raked material should be added.	A sentence has been added in Sect. 4.3.1describing the disposition.

Date: September 30, 2003

BECHTEL JACOBS
Bechtel Jacobs Company LLC

Reservation Cleanup and Waste Management Project Document Comments Form

Title of Document: *Remedial Acton Report on the Surface Impoundments Operable Unit at the Oak Ridge National Laboratory, Oak Ridge, Tennessee*
Document number or other identifier: DOE/OR/01-2086&D1

Name of Commentor:	**Doug McCoy**
Organization of Commentor:	**Tennessee Department of Environment and Conservation**

Comment No.	Page/ Reference	Comments	Responses
General			
1.		Currently, this remedial action is not complete. On-going activities include D&D of the treatment/packaging facility, waste disposition, and site restoration. The State expects all activities associated with this action to be complete before the D2 version of this document is submitted.	Agree
2.		Following project completion, the document should be updated throughout to ensure consistency with the final actions taken. Specifically, the waste volumes (Tables 1 and 2) and the cost (Table 3) should be updated with final totals.	The document has been updated to reflect final waste volumes and cost.
3.		The document should include a more detailed discussion of the NTS waste acceptance issue. Specifically, explain how the waste form was prepared to meet the NTS WAC. Also, explain why NTS did not approve the waste form for disposal.	A more detailed discussion of the NTS waste acceptance issue has been included in the Executive Summary and in Section 4.1.
4.		The document should summarize the project schedule, including project start and completion dates, major construction activities, and important milestone dates.	A new Section 4.7 has been added that includes project activities and dates.

Comment No.	Page/ Reference	Comments	Responses
Specific Comments			
1.	Page iii, Preface	The document number for the Stage 1 Remedial Action Report is incorrectly identified. The correct number should be DOE/OR/01-1784&D2.	This has been corrected.
2.	Section 3, Project Requirements	This section should identify the goals and objectives of the action, as well as the applicable or relevant and appropriate requirements for the project.	The RAO from the RI/FS have been added and more information on how the ARARs were incorporated through the RAWP/RDR.
3.	Section 4, Remediation Activities	Provide the results of the confirmation sampling that was done for Impoundments A and B in this section.	As with Stage 1 of the project, the results of the confirmation sampling will be provided in a separate document.
4.	Section 4.3.3 Treatment/ Packaging, Table 1	Please sum up the columns in this table and add a total line.	The columns have been summed and totaled.
5.	Section 4.5, Survey of Final Bottom Contours of Impoundments	Include a map with Appendices A and B that shows the locations of the survey points.	A map with the survey points has been added.
6.	Section 6, Costs	It is not clear whether the costs presented in Table 3 includes both Stage 1 and Stage 2 activities. Please clarify the text. Also, include estimated and actual costs in the tables.	The Table has been revised to clarify and the estimated and actual costs have been included.