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**OAK RIDGE
NATIONAL
LABORATORY**

LOCKHEED MARTIN

**Results of the Measurement Survey of
Elevation and Environmental Media in
Surface Impoundments 3513 (B) and
3524 (A) at Oak Ridge National
Laboratory, Oak Ridge, Tennessee**

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D. A. Rose
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DEPARTMENT OF ENERGY

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National Laboratory, Oak Ridge, Tennessee**

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Report Issued—July 1998

Prepared by the
Life Sciences Division
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managed by
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for the
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ACKNOWLEDGMENTS

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EXECUTIVE SUMMARY

A survey to measure the elevation and environmental media in impoundments 3513 (B) and 3524 (A) at the Oak Ridge National Laboratory (ORNL) was conducted during April 1998. Impoundments 3513 (B) and 3524 (A) are located in the Surface Impoundments Operable Unit (SIOU) of Waste Area Group 1. The investigation was performed by the Measurement Applications and Development Group of the Life Sciences Division of ORNL at the request of Bechtel Jacobs Company, L.L.C. The survey was a follow-up to a previous elevation survey.

Measurement activities were conducted at selected locations in order to determine the depth and appearance of the sediment and describe the clay underlying the impoundments prior to remediation. The survey included determination of elevations before removal of sediment/clay cores from selected locations, measurement of the length of the sediment and clay portions of the core, visual inspection of each core, measurement of beta-gamma radiation levels, and photographic documentation of each core before replacement in the impoundment.

The purpose of this survey was to provide additional data needed for remediation, by conducting the following activities:

- confirm depth of sludge to verify total volume for remediation;
- confirm elevation of sediment and clay;
- perform visual inspection and physical examination to characterize and confirm the presence of the clay on the bottom of the impoundments;
- perform field measurements of beta-gamma radiation levels; and
- visually inspect and photograph sediment and clay.

Results of the survey show that:

- sludge depth corresponded to that obtained with previous measurement techniques;
- elevation on the clay bottom corresponded to that obtained with previous measurement techniques;
- evaluation of clay showed a distinct clay bottom thought not to exist previously; and
- beta-gamma radiation levels of the clay were similar to background near the survey area.

1. INTRODUCTION

A measurement survey of the elevation and environmental media in impoundments 3513 (B) and 3524 (A) at the Oak Ridge National Laboratory (ORNL) was conducted during April 1998. The investigation was performed by the Measurement Applications and Development Group of the Life Sciences Division of ORNL at the request of Bechtel Jacobs Company. Measurement activities were conducted at selected locations in order to determine the depth and appearance of the sediment and describe the clay underlying the impoundments prior to remediation. The survey was a follow-up to a previous elevation survey.

Impoundments 3513 (B) and 3524 (A) are located in the Surface Impoundments Operable Unit (SIOU) of Waste Area Group (WAG) 1. SIOU consists of four impoundments located in the main plant area of Oak Ridge National Laboratory, just north of White Oak Creek. Figure 1 shows the general location of impoundments 3513 (B) and 3524 (A), which were presumably unlined.

The survey included the following:

- collection of sediment/clay cores from selected locations in each impoundment;
- measurement and documentation of the elevation at the water surface, at the top of sediment, at the top of clay, and at the bottom of each core;
- visual inspection of each core by a soil scientist to confirm the presence of clay and not material such as fly ash and soda lime compacted over the last 50 years;
- measurement and documentation of the background beta-gamma radiation level at the time and location of collection of each core, the highest beta-gamma level along the sediment portion of each core, and the highest beta-gamma level along the clay portion of each core;
- measurement and documentation of the length of the clay and of the sediment portion of each core;
- photographic documentation of each core; and
- replacement of each core in the impoundment.

1.1 SITE HISTORY

Surface Impoundments Operable Unit (SIOU) was used for management of low-level radioactive wastes generated from experiments and material processing at ORNL. Impoundment 3513 (B) was constructed in 1944 as a settling basin for various low-level

waste streams that were diluted with process wastewater. The water within the impoundment discharged into White Oak Creek through a series of overflow pipes located in the impoundment's southern berm until 1947, when direct discharge was discontinued. Before 1954, Impoundment 3513 (B) received the supernatant outflow through five pipes along the north side of the basin from the liquid low-level waste storage tanks of the South Tank Farm. Water in the basin was treated with fly ash and soda lime to precipitate radionuclides before being discharged to White Oak Creek. From 1957-1976, this impoundment received wastes that, based on the waste acceptance criteria in place during these years, did not require treatment in the Process Waste Treatment Plant. Effluent from the treatment plant was also discharged into the impoundment to allow settling of particulates. The impoundment was taken out of service in 1976 and is currently not in use.

Impoundment 3513 (B) was presumed to be an unlined impoundment excavated into natural clay soil (see Sect. 3.2). Surface water runoff is contained by an earthen berm surrounding the impoundment and built up on the southern side. In February 1994 and again in January 1995, bentonite clay was applied along the south embankment/berm to prevent seeps, potentially changing the contours of the bottom of the impoundment along the southern berm. The impoundment dimensions are 228 by 228 feet at the top of the berm, sloping to 200 by 200 feet at the bottom.¹

Impoundment 3524 (A) was constructed in 1943 for short-term storage of short-lived radionuclides to allow decay, thus reducing the radioactivity of the wastewater. However, after 1954, the impoundment received only process wastewater. From 1949-57, the effluent from Impoundment 3524 (A) was pumped to Impoundment 3513 (B). In 1957, the Process Waste Treatment Plant was placed on line, and Impoundment 3524 (A) was used as an equalization basin for intermediate storage and collection of process wastewater for the Process Waste Treatment Plant. After it was removed from routine service in 1989, it was used occasionally to collect process wastewater when the holding capacity of the current storage tanks for the Process Waste Treatment Plant was exceeded. An additional surge tank was put into service in 1996 to store process wastewater during wet weather. The impoundment was then removed from the waste management emergency service inventory and made available for remediation.

Impoundment 3524 (A) initially consisted of two presumably unlined impoundments separated by a berm (see Sect. 3.2). In the early 1950s, the berm separating the two impoundments was removed, forming one impoundment. In 1961, an attempt was made to expand the impoundment further to the west; however, during excavation, shallow bedrock was encountered and construction activities ceased. The berms on the east and south sides were increased by adding fill on top of the original berms. The area and depth of the impoundment were increased both by excavation and by raising the height of the retaining berms. Currently, the impoundment has dimensions of 95 by 275 feet. The depth varies between the eastern and western ends and is greatest in the eastern end.¹

1.2 PROJECT OBJECTIVES

The sampling was conducted as a follow-up to a previous elevation survey in order to achieve the following objectives:

- obtain core samples in clear tubes with minimum disturbance of surrounding media;
- measure the depth of sediment to assist in confirming the calculated volume of sediment;
- confirm by visual inspection and manual separation of strata in the core that clay is present and not only material compacted over the last 50 years.

This survey was intended to enhance confidence in earlier assumptions of conditions at the bottom of the impoundments in a more refined assessment combining discrete measurements and visual and physical inspection of material.

2. SURVEY METHODS

2.1 COLLECTION OF SEDIMENT/CLAY CORES

A description of sampling methods is provided in "Impoundments A and B Elevation and Environmental Media Measurement Plan" (see Appendix A). Health and safety support was provided as specified in "Health and Safety Addendum: Sediment Sampling, Impoundments SIOU 3513 and 3524" (see Appendix B), a project-specific addendum to the original health and safety plan, "WAG 1 Surface Impoundments Operable Unit (SIOU) Treatability Study," SSHASP No 001-226/0010 0396. Revision of location coordinates to enhance accessibility was documented in "Procedure Change Notice: PCN-1" (see Appendix C).

Sediment/clay cores were collected from the bottom of each impoundment in accordance with LMES procedure *Collection of Sediment Samples*, ESP-304-1. A clear plastic tube approximately 2 inches in internal diameter and ten feet in length was inserted at specified locations in each impoundment. The tube was lowered to a perceived point of resistance at the top of the sediment, lowered further to a perceived point of resistance at the top of the clay, then driven into the clay layer to a depth ranging from 0.4 to 0.8 ft. The tube was then removed for measurement of core contents. Figure 5 shows the different media and elevations measured. A pontoon boat was used to gain access to sampling locations in both impoundments. Horizontally suspended wires designed as waterfowl barriers were used to maneuver the boat. Cores were collected systematically from six locations in impoundment 3513 (B) and three locations in impoundment 3524 (A). Alternate points within ten feet of specified coordinates were sampled if insufficient clay was collected to obtain a

representative core of the impoundment bottom. The sampled media contained organic materials such as leaves and small twigs, gravel, and bentonite.

The elevation in feet above mean sea level (AMSL) was taken by a civil surveyor at the top of the sediment, the top of clay, and at final sample depth as the core was being collected. The elevation at the impoundment surface was determined each day. Each core was photographed and visually inspected, and the length of sediment and of clay in the core was measured before the core was replaced in the impoundment.

Figure 2 shows sediment/clay core collection activities at location 2 in impoundment 3513 (B). A close-up view of the sediment/clay core from location 5A, impoundment 3513 (B) is shown in Fig. 3. Additional photographs for each core location are in project files. Photographs may also be viewed at URL <http://homer.hsr.ornl.gov/mad>.

2.2 RADIATION MEASUREMENTS

A description of typical methods and instrumentation providing guidance for the conduct of the radiological aspects of the survey is presented in *Procedures Manual for the ORNL Radiological Survey Activities (RASA) Program*, ORNL/TM-8600 (April 1987)² and *Measurement Applications and Development Group Guidelines*, ORNL-6782 (January 1995).³

Cores were scanned for beta-gamma radiation at the time of collection using a Geiger-Mueller closed side-window instrument. The following radiation levels were measured in counts per minute (the unit cpm is used as a relative comparison between radiation levels and is not equivalent to exposure):

- background level at the time and location of collection of each core;
- highest level along the sediment portion of each core; and
- highest level along the clay portion of each core.

Clay was removed from two cores taken from Impoundment 3524 (A), placed in metal pans, taken to an area of low background radiation, and checked for beta-gamma radiation with a beta-gamma pancake instrument. The readings on the clay were no higher than background measurements in the nearby area.

The purpose of this check was to observe beta-gamma radiation without "shine" from the adjacent sediment for a quantitative assessment of contamination penetration into the clay.

Prior to exiting the site, survey personnel and equipment were checked for beta-gamma contamination by using a Bicon Analyst meter with an HP-260 probe ("pancake").

3. SURVEY RESULTS

3.1 OBSERVATIONS

Sampling locations at impoundments 3513 (B) and 3524 (A) are shown in Fig. 4. Table 1 shows the results of the elevation survey at core locations in both impoundments. Table 2 shows the estimated and measured thickness of sediment and clay and net radiation measurements for clay and sediment at each location.

In both impoundments a distinct interface was observed between the sediment and the clay layer in each core. The presence of the interface indicates that the sediment will resettle on top of the clay when disturbed and not form a clay/sediment mixture. Visual inspection supplemented by physical examination by the soil scientist confirmed that the clay bottom was actually clay and not fly ash and soda lime which had compacted over the last 50 years.

In impoundment 3513 (B), a very stiff, medium to dark gray clay was encountered. The depth of the clay layer was not determined, but plugs as thick as 0.8 ft were observed. All of the clay samples from impoundment 3513 (B) were composed of a grayish clay sparsely mixed with gravel ranging in size from 0.25 in. to 0.75 in. One of the 3513 (B) samples revealed a color change to yellowish-brown at the bottom of the core. The clay in impoundment 3524 (A) appears to be yellowish-brown in cores from locations 1 and 2 (western side of the impoundment), while the core from location 3 from 3524 (A) had gray clay on top of yellowish-brown clay. Gravel mixture similar to that in 3513 (B) was observed in 3524 (A). Also, rock was observed in a region of the impoundment immediately to the west of location 2 in 3524 (A) and extending generally to the south, almost to the bank.

3.2 CONCLUSIONS

This latest SIOU sampling effort generally substantiated some previously gathered information, and brought out some new information regarding the base materials in impoundments 3513 (B) and 3524 (A). The following table shows the sediment thickness at each location.

The survey confirmed that existing data from the last survey showing the sediment and clay levels in the impoundments is reasonably accurate. Visual inspection and manual separation of strata in the core confirmed that clay is present. The substrate beneath the loose, silty sediment consistently exhibited a stiffness, cohesiveness and smooth texture (excluding the entrained gravel). These are all characteristics associated with the properties defined as belonging to clays. The radiation levels in collected cores were also consistent with those documented in previous studies. The clay bottom material showed no radiation levels above background for the area of reduced background.

Based on coring activities described in this report, both impoundments appear to have been built on engineered clay liners, not natural ground as previously thought. These

observations would support speculation that clay for original impoundment construction was special clay imported as an impoundment liner.⁴

Location number	Thickness of sediment (feet) ^a	
	Estimated from survey at contact ^b	Measured ^c
<i>Impoundment 3513</i>		
1	1.9	1.8
2	2.6	2.3
3	1.3	2.2
4	1.4	1.6
5	1.0	2.6
5A	1.6	1.5
<i>Impoundment 3524</i>		
1	3.1	1.6
2	3.1	2.9
3	1.3	1.5

^aStatistics show a standard deviation of ± 0.5 feet between the two methods of determining sediment thickness.

^bTop of sediment elevation minus top of clay elevation.

^cA tape measure was placed alongside the coring device.

REFERENCES

1. *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, Jacobs ER Team and Lockheed Martin Energy Systems, Inc., Oak Ridge, Tennessee, November 1995.
2. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, *Procedures Manual for the ORNL Radiological Survey Activities (RASA) Program*, ORNL/TM-8600, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., April 1987.
3. Oak Ridge National Laboratory, Health Sciences Research Division, *Measurement Applications and Development Group Guidelines*, ORNL-6782, Martin Marietta Energy Systems, Inc., January 1995.
4. Personal communication from R. H. C. Coe III to M. E. Murray, dated May 1998.

Fig. 1. Locations of Impoundments 3513 and 3524 on the Oak Ridge National Laboratory site.

Fig. 2. View of sediment/clay core collected at location 2, Impoundment 3513.

ORNL-PHOTO 2235-98

Fig. 3. Close-up view of the sediment/clay core from location 5A, Impoundment 3513.

Location Number	Northing	Easting
<i>Impoundment 3513</i>		
1	21367	31039
2	21381	31157
3	21316	31096
4	21256	31036
5	21268	31157
5A	21277	31164
<i>Impoundment 3524</i>		
1	21542	30831
2	21526	30963
3	21541	31024

Fig. 4. Sampling locations for the sediment/clay core from impoundments 3513 (B) and 3524 (A).

Fig. 4. Schematic of coring tool and elevations.

Table 1. Results of elevation survey at core locations in impoundments 3513 (B)^a and 3524 (A)^a

Location number	Water surface ^b	Top of sediment	Top of clay	At final sample depth
<i>Impoundment 3513</i>				
1	779.2	774.4	772.5	771.8
2	778.3	774.5	772.0	771.0
3	778.7	774.0	772.8	772.0
4	778.7	774.5	773.1	772.8
5	778.3	773.4	772.4	771.8
5A	778.3	774.2	772.6	772.3
<i>Impoundment 3524</i>				
1	784.1	780.9	777.9	777.2
2	784.2	778.8	775.8	775.3
3	784.2	779.3	778.1	777.5

^aElevations were taken in feet above mean sea level (AMSL) from benchmark CP-7311. The surveyor targeted the top of the coring device as it was lowered to contact the perceived top of sediment, top of clay and final sample depth. See Fig. 5.

^bWater surface elevation was surveyed daily. Variations reflect significant rainfall during the survey.

Table 2. Measurements at core locations in impoundments 3513 (B) and 3524 (A)

Location number	Thickness of sediment (feet)			Clay core thickness (feet) ^a	Top of clay (feet AMSL)		Net radiation measurements (cpm) ^b	
	Survey at contact ^c	Measured ^d	Contour map (1997) ^e		Survey at contact	Contour map (1997) ^e	Clay	Sediment
Impoundment 3513 (B)								
1	1.9	1.8	1.8	0.7	772.5	772.6	770	6800
2	2.6	2.3	2.7	0.9	772.0	771.8	740	5700
3	1.3	2.2	1.0	0.7	772.8	772.8	760	8800
4	1.4	1.6	0.9	0.4	773.1	773.3	1400	2800
5 ^f	—	—	—	—	—	—	—	—
5A	1.6	1.5	1.5	0.3	772.6	772.6	1600	9600
Impoundment 3524 (A)								
1	3.1	1.6	0.8	0.6	777.9	777.7	440	3000
2	3.1	2.9	1.3	0.5	775.8	777.1	2800 ^g	8800
3	1.3	1.5	0.0	0.6	778.1	778.5	2100 ^g	9800

^aThis represents the thickness of the clay core removed and not the thickness of the clay bottom.

^bThe background measurement at each core location was subtracted to get the net radiation measurement in counts per minute (cpm); the unit cpm is used as a relative comparison between radiation levels and is not equivalent to exposure. The conversion factor for the closed side-window Geiger-Mueller survey instrument is: 1600 cpm = 1 mR/hour.

^cElevations were taken in feet above mean sea level (AMSL) from benchmark CP-7311. The surveyor targeted the top of the coring device as it was lowered to the perceived top of sediment and top of clay. The difference in the two elevations is the thickness of sediment.

^dA tape measure was placed alongside the coring device after the sediment core was on board the boat.

^eMeasurement survey locations and contour map locations are not identical.

^fData was not conclusive.

^gAdditional radiation levels measured in these clay cores, which had been separated from the columns, were equal to background in a nearby area.

IMPOUNDMENTS A AND B ELEVATION AND ENVIRONMENTAL MEDIA MEASUREMENT PLAN

Date Issued - *April 7, 1998*
Revision 0

Prepared by:

ORNL / MAD

Measurement Applications and Development Group
Life Sciences Division
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ATTACHMENTS

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LIST OF ACRONYMS

EPA	Environmental Protection Agency
ER	Environmental Restoration
LMER	Lockheed Martin Energy Research
LMES	Lockheed Martin Energy Systems
MAD	Measurement Applications and Development Group
ORNL	Oak Ridge National Laboratory
SIOU	Surface Impoundment Operable Unit
SHEST	Safety & Health Evaluation Support Team

REVISION LOG

Revision No.	Description of Changes
0 7/13/98	New Document

Impoundments A and B Elevation and Environmental Media Measurement Plan

1. PURPOSE

This measurement plan describes the methodology to obtain further information about the thickness of the sediment and elevation confirmation of the clay materials found in the SIOU Impoundments A (3524) and B (3513), located at Oak Ridge National Laboratory (ORNL). Visual observation of sediment/clay cores will provide information to evaluate the impoundment closure conditions.

2. OBJECTIVES

The objective of this plan is to describe the procedure for obtaining visual and elevation verification of the clay layer of ponds 3513 and 3524, which have previously been surveyed. The activities described in this plan do not include monitoring, characterization, construction or design considerations.

3. SCOPE

This plan provides supplemental instructions to guidelines and procedures established for inspecting clay and sediment cores sampling. Standard procedures may be referenced throughout this plan as applicable, and are available for review if necessary.

4. ORGANIZATION AND RESPONSIBILITIES

Overall coordination and implementation of the activities described in this plan are the responsibility of the Measurement Applications and Development Group (MAD) project manager. The MAD group project manager and the Field Team Leader will require input and support from personnel of DOE, Bechtel Jacobs Company, and ORNL organizations. The roles and responsibilities of these personnel are listed in Table 1.

5. CORE DESCRIPTION

The material identified for coring using this plan is the clay and sediment on the bottom of SIOU Impoundments 3513 and 3524. As part of the clay confirmation, the thickness of the *in-situ* sediment will be measured. The impoundments were used as part of the system for management of low-level radioactive wastes generated from experiments and material processing at ORNL.

Table 1. Roles and Responsibilities		
Role	Person	Responsibility
DOE Program Manager	J. D. Kopotic	Provides direction and oversight for the DOE
Bechtel Jacobs Company Project Manager	Charles Mansfield	Oversees project management and coring activities
Bechtel Jacobs Company Technical Support	Rob Coe	Provides engineering support for the project
ORNL/ LMER MAD Project Manager	Michael Murray	Oversees all MAD activities, interfaces with project managers
ORNL/ LMER MAD Field Team Leader	Doug Rose	Oversees all field activities, access to the work areas, and support of outside organizations
ORNL/ LMER SHEST Coordinator	Greg Rowland	Coordinates all aspects of the project relating to SHEST support
Bechtel Jacobs Company Quality Assurance	Tom Koepp	Coordinates QA support and ensures QA compliance for the project
ORNL / LMER Health and Safety Officers	Dennis Rice Doug Rose	Provides health and safety oversight and assists in coring activities
Soil review	(To be named)	Provide confirmation of clay materials and other support

6. CORE INSPECTION

6.1 NOTIFICATION

The MAD Field Team Leader will notify the Quality Assurance representative and Bechtel Jacobs Company project management before coring activities begin.

6.2 PRE-TASK MEETING

The MAD Field Team Leader will schedule and conduct a pre-task meeting with project field personnel prior to coring operations. The objectives of this meeting will be to discuss safety issues, operation logistics, and other details, resolve any technical or operational issues, and ensure schedules are agreed upon by all responsible organizations. Project specific training will consist of a verbal walk-through of the expected coring methods. Task based training records will be used to document the training given. Records for required SARA/OSHA and radiological worker training will also be verified in the pre-task meeting.

6.3 CORING OPERATIONS

The MAD Field Team Leader will ensure field activities adhere to this plan and the Health and Safety Plan, and applicable Lockheed Martin Energy Research (LMER) and Bechtel Jacobs Company procedures. **Coring activities shall not be initiated prior to receipt of a signed copy of this plan.** Signed copies of the plan will be distributed prior to the initiation of coring activities.

6.3.1 Logbook Entries

The MAD Field Team Leader will maintain a logbook to provide a daily written record of all visual inspection activities. Each daily logbook entry must include, but is not limited to, the following items:

- distance from surveyor target to bottom of coring tool;
- core location and elevation during collection (based on surveyor's information);
- length of clay portion;
- length of sediment;
- clay/sediment description (color, texture, presence of foreign matter, algae, nonhomogeneous granules);
- unusual core appearance;
- unusual circumstances;
- unusual site conditions (weather, wind, temperature).
- core "refusal"
- surveyor's benchmark (logged but not required daily)
- pond water level

6.3.2 Inspection Overview

Coring activities will involve visual observation (as per Sect. 6.3.1) and measurement of the delineation between the sediment and clay strata for each core. Coring will involve intrusive and systematic methods. The field team will follow the general guidelines of the LMES procedure *Collection of Sediment Samples*, ESP-304-1, Rev. 1, dated February 28, 1996.

Five core locations will be used in pond 3513 and three in pond 3524. Each core will consist of a core of clay of four to six inches. The number of cores collected should represent the distribution of clay and sediment of each impoundment. Figure 1 shows the core locations for both ponds. Table 2 provides the north and east coordinates for each location. The actual coring location should be within plus or minus 10 feet of the values in Table 2. For instance, the coring tool will be relocated if it strikes rock on the west side of pond 3524. At the direction of the DOE Program manager and the Bechtel Jacobs Company manager, the number of locations may be altered based on changing project goals.

Specific equipment for taking cores may include plastic tubing, stainless collection devices (stainless steel trays, coring sleeves, etc.). Other supplies and equipment will include material handling tools such as stainless steel scoops and spatulas, and radiological contamination control supplies. Any deviations from this method will be approved by the MAD Field Team Leader, Bechtel Jacobs Company project management, and the MAD Group project manager. Equipment that is fabricated and designed on-site must meet the requirements and support the needs of the field team. The equipment should be designed with decontamination processes in mind.

6.3.3 Coring Methodology

After the conclusion of the pre-task meeting, all materials necessary for coring activities will be staged and inspected prior to entering the radiological buffer area. The selected locations will then be accessed using a pontoon boat as has been used in previous surface impoundment projects.

After proceeding to the selected core location, verify the coordinates and log the location (see Fig. 1 and Table 2). A clear rigid tube approximately eight feet in length will be inserted into the clay bottom. The elevation and location at the top of the tube and the water level will be measured by surveyors and documented in the the logbook. The clear tube/core will be removed, cleaned on the outside, inspected, and photographed with a tape measure placed alongside to measure the thickness of the sediment and clay strata. The core will be visually inspected, photographed, and returned to the pond.

Equipment will be decontaminated/rinsed to ensure no visible residual materials exist between coring of each location. Simple decontamination will ensure that no cross-contamination from each core location occurs.

7. QUALITY ASSURANCE (QA) REQUIREMENTS

Any exceptions or deviations to this plan require authorization from the Project Manager and MAD Field Team Leader or their representatives. The stated sample collection procedure, *Collection of Sediment Samples*, ESP-304-1, Rev. 1, dated February 28, 1996, may be "red-lined" during activities to reflect actual core collection methods used by the field team. The "red-line" instances will be documented in the project field logbook and must be approved by the MAD Field Team Leader. The field team will receive procedural training on the elements of this plan and specific coring procedures, as required by ESP-304-1.

Authorizations for deviations to procedures and this plan can be made via telephone, verbal communications, or written instructions. When authorization is other than written correspondence, the Project Manager or MAD Field Team Leader shall document the date, requestor's name, and the deviation or exception. Nonconforming items shall be administered by guidance in the *Life Sciences Division Quality Assurance Management Plan*, QAMP-98-LSD-001.

The QA Specialist or his/her designee will be contacted to conduct a surveillance at the start of operations. Requirements such as field logbook entries will be reviewed for compliance to the procedures mentioned in this plan. This surveillance report and any corrective action documentation will become part of the program's QA records. QA and other relevant project documentation will be maintained with the MAD Group for a minimum of three years.

Attachment B lists project-specific quality assurance requirements addressed in this plan.

8. DATA DELIVERABLES

A report of the activities covered by this plan and the results will be prepared. The report should contain at a minimum: a summary of the work activities; descriptions of the clay/sediment cores; locations and elevations of the core materials; problems encountered; non-conformances; and comparison with previous survey data.

9. HEALTH AND SAFETY (H&S)

Health and Safety (H&S) support will be obtained from site H&S organizations. Preliminary reviews (e.g., Site Safety Reviews, Radiation Work Permits, etc.), requests for H&S services, and establishment of communication with H&S organizations are addressed in the project-specific addendum for the original Health and Safety Plan, *WAG 1 Surface Impoundments Operable Unit (SIOU) Treatability Study*, SSHASP No 001-226/0010 0396. The listing for the new personnel is contained in the H&S addendum prepared for the project. An additional SSHO may be appointed for the project to act as an alternate and assist in any scheduling conflicts that may arise during the project activities. No additional hazards other than those addressed in the original plan are anticipated.

10. REFERENCES

Cleaning and Decontaminating Sample Containers and Sampling Devices. ESP-801. Revision 0. Martin Marietta Energy Systems. August 27, 1988.

Collection of Sediment Samples, ESP-304-1, Rev. 1. February 28, 1996.

Life Sciences Division Quality Assurance Management Plan, QAMP-98-LSD-001, November 1997.

Table 2. Coordinates for Core Locations in Ponds 3524 (A) and 3513 (B)

Location Number	Northing $\pm$ 10 Feet	Easting $\pm$ 10 Feet
<i>Pond 3513</i>		
1	21390	31020
2	21390	31180
3	21315	31100
4	21240	31020
5	21240	31180
<i>Pond 3524</i>		
1	21540	30830
2	21540	30940
3	21540	31050

Fig. 1. Ponds 3524 (A) and 3513 (B) core locations.

Attachment A

Contact List					
Role	Person	Phone	Building	Mail Stop	Email Address
DOE Program Manager	James D. Kopotic	576-9441	Jefferson	Oak Ridge	kopoticjd@oro.doe.gov
Bechtel Jacobs Company Project Manager	Charlie Mansfield	241-6168	Jefferson	Oak Ridge	QZA
Bechtel Jacobs Company Technical Support	Rob Coe	241-5026	1000	Room 235A	OE9
MAD Group Leader	Ray Foley	576-7584	1062	6420	FOL
MAD Project Manager	Michael Murray	574-5838	7710	6379	XMU
MAD Field Team Leader	Doug Rose	574-5837	7710	6379	NFX
SHEST Coordinator	Greg Rowland	576-6445	2652-C	6290	DR9
Bechtel Jacobs Company Quality Assurance	Tom Koepp	576-8057	K-1330	7298	TK7
Health and Safety Officer	Dennis Rice Doug Rose	576-8565 574-5837	1062 7710	6420 6379	YQ3 NFX
Health Physics	JoEllen Francis	574-6701	2652-B	6290	FJZ
Laboratory Shift Superintendent		574-6606			
Civil Survey Barge, Waggoner, Sumner & Cannon	Keith Craft	481-0496			
Technical Writer	Kathy Brown	574-7808	1062	6420	XKP
Geologist	(to be named)				

Attachment B

Quality Assurance Profile for the SIOU Impoundments 3513 and 3524 Visual Core Inspection		
EPA QAMS 005/80	DOE Order 5700.6C Criteria	Location in Measurement Plan
5.1 Title Page	4. Documents and Records	Title Page
5.2 Table of Contents	4. Documents and Records	Contents Page iii
5.3 Project Description	1. Program	Sect. 6.3, Coring Operations
5.4 Project Organization and Responsibility	1. Program 2. Personnel Training and Qualification	Sect. 4, Organization and Responsibilities Sect. 6.2, Pre-Task Meeting
5.5 QA Objectives for Measuring Data	6. Design	Sect. 7, Quality Assurance (QA) Requirements
5.6 Sampling Procedures	4. Documents and Records 5. Work Processes 6. Design	Sect. 6.3, Coring Operations
5.7 Sample Custody	4. Documents and Records 5. Work Processes	No samples will be collected for analysis
5.8 Calibration Controls and Frequency	5. Work Processes	Calibrated instruments will not be used
5.9 Analytical Procedures	4. Documents and Records 5. Work Processes 6. Design	No samples will be collected for analysis
5.10 Data Reduction, Validation, and Reporting	7. Procurement 8. Inspection and Acceptance Testing	NA: Visual inspection and photograph
5.11 Internal QC Checks	6. Design 8. Inspection and Acceptance Testing	Sect. 7, Quality Assurance (QA) Requirements
5.12 Performance and System Auditing and Frequency	9. Management Assessments 10. Independent Assessments	Sect. 7, Quality Assurance (QA) Requirements
5.13 Preventive Maintenance Procedures and Scheduling	5. Work Processes	Equipment requiring preventive maintenance will not be used
5.14 Specific Routine Procedures	6. Design	Sect. 6, Core Inspection
5.15 Corrective Action	3. Quality Improvement 9. Management Assessment 10. Independent Assessment	Sect. 7, Quality Assurance Requirements
5.16 QA Reports to Management	2. Personnel Training and Qualifications 3. Quality Improvement 9. Management Assessment 10. Independent Assessment	Sect. 7, Quality Assurance Requirements

HEALTH and SAFETY ADDENDUM

Date: March 24, 1998

Project: Sediment Sampling, Impoundments SIOU 3513 and 3524

Initiator of Form: D.A. Rose / D.E. Rice **Phone :** 574-5837 / 576-8565

Task or Hazard: ORNL/MAD personnel will collect and visually inspect clay coring materials from each of the impoundments. The cores will be photographed and returned to the impoundments. ORNL/MAD personnel will perform these activities under the guidelines and requirements of the original Health & Safety Plan (No. 001-226/0010 0396, completed and signed March 1996). The new task of sampling these impoundments will be performed using the guidelines and requirements of this addendum. The new task will require the use of a boat. Also, other work over water will be required. Potential hazards are covered under the original plan. No additional hazards other than those covered under the original H&S plan are anticipated. Appropriate sampling tools will be devised and fabricated for the task. Perimeter support services will be provided by P&E and Health Physics personnel. A new "Roles and Responsibilities" list will be prepared due to changes in support personnel. The new list can be found in the project SAP, and will be available to on-site workers at all times.

Project / Facility Managers Information

Name: William Brickeen	Phone / Pager Contact: 576-1579
Name: Hollis Wooten	Phone / Pager Contact: 241-4872 / 873-5038
Name: R.H. Coe III	Phone / Pager Contact: 241-5026 / 873-4937

Additional Hazards:

Physical Hazards

☒ Cold Stress	☐ Compressed Gas/Cylinders	☐ Confined Space	☐ Enclosed Space
☒ Ergonomics	☐ Explosive/Flammable	☒ Heat Stress	☐ High Pressure
☐ Manual Lift	☐ Noise	☐ Oxygen Deficient	☐ Oxygen Enriched
☒ Tripping/ Falling	☒ Work On/Over Water (See administrative controls)		

Safety and Construction Hazards

- ☐ Demolition
- ☐ Drum Handling
- ☒ Electrical (See additional comments)
- ☐ Elevated Work (See additional comments)
- ☐ Energized Sources (Lockout/ Tagout)
- ☐ Excavation/ Penetration
- ☒ Hoisting/ Rigging (See additional comments)
- ☐ Overhead Hazards
- ☐ Trenching/ Shoring
- ☐ Underground Hazards
- ☐ Welding/ Burning/ Cutting

Additional Hazards: (cont.)

Chemical Hazards

☐ Asbestos	☒ Carcinogen	☐ Corrosive	☐ Inorganics
☐ Lead	☐ Manmade Mineral Fibers	☒ Mercury	☒ Metals
☐ Mutagen	☐ OSHA Specific	☒ PCBs	☐ Reproductive Toxicant
☐ Volatile Organic	☐ Other _____		

Ionizing Radiological Hazards

- ☒ External Exposure
☐ Internal Exposure
☒ Contamination Hazard (Type: **Beta-Gamma**)

Note Possible Routes: ☐ Ingestion, ☐ Inhalation, ☐ Absorption

Non-Ionizing Radiological Hazards

☐ High Voltage	☐ Laser	☐ Microwave
☐ RF	☐ UV	

Biological / Vector Hazards

☐ Bacterial	☐ Medical Wastes	☐ Parasites	☒ Plants (Allergens)
☒ Wildlife (snakes, ticks, insects)			

Controls:**Engineering Controls:**

- Support personnel involved with engineering aspects of the tasks will be responsible for controls.
- A boat with handrail support will be utilized during sample collections.
- Hoisting and rigging of the boat will be performed by the ORNL P&E rigging crews. A hoisting and rigging plan is not required due to general lift activities. No critical lifts are anticipated. If a need arises, a lift plan will be developed and implemented.

Administrative Controls:

- RCT will implement controls such as RWP requirements, etc.
- ORNL / MAD will be responsible for daily activity controls such as access, sampling activities, etc.
- Facility manager/representative will be responsible for obtaining the appropriate work permits as required.
- Quality control measures will be addressed in the Sampling and Analysis Plan and will be the responsibility of the MAD sampling team.
- D. A. Rose will replace P. Abston as SSHO (original plan); D.E. Rice will be designated as the alternate
- All personnel will review and sign off on original H&S plan. The signature list will be maintained in the project logbook.
- Pre-task and daily H&S briefings will be performed by the SSHO or the SSHO alternate.
- For the work performed on water, spotters will be on-site at all times during work in the water.
- Personal flotation devices (PFDs) will be worn at all times during work performed on water.

Permits Required

☒ Radiation Work Permit	☐ Lockout / Tagout	☐ PACSE	☐ Excavation/
Penetration
☐ Hoisting/ Rigging			

Are Changes Required in Existing Permits ? ☐ Yes ☒ No

Are Design / Specification Needed ? ☐ Yes ☒ No

Other (Specify): A new RWP will be issued prior to the start of work.

Personal Protective Equipment: (Suggestions for minimum site access only, work to be performed under RWP PPE requirements)

Level of Protection

- ☐ Level "A" ☐ Level "B" ☒ Level "C"
☒ Level "D" ☐ Modified

Respiratory Protection

- ☐ SCBA ☐ Full-face ☐ Half-face
☐ PAPR ☐ Supplied Air ☐ Other _____
Cartridge Type: _____

Protective Clothing

- ☒ Apron (Rubber if applicable) ☐ Impermeable Suit
☐ Saranex ☒ Tyvek ☐ Encapsulating Suit
☐ Splash Suit ☐ Welded Saranex ☐ Lab Coat
☒ Company Clothing (Khakis) ☐ Other _____ ☐ Other _____

Head/Eye/Ear

- ☐ Ear Plugs ☐ Ear Muffs ☐ Splash Shield ☐ Monogoggles
☒ Safety Glasses ☐ Welding Goggles ☐ Face Shield ☐ Goggles

☐ Hard Hat ☐ Laser Eyewear

Gloves

- ☒ Cotton (Inner) ☐ PVC ☐ Leather
☐ Latex (Inner) ☐ Welding Gloves ☒ Nitrile
☐ Neoprene ☐ Insulating ☐ Vinyl
☐ Rubber (Outer) ☐ Other _____

Footwear

- ☐ Chemical Overboots ☐ Shoe Covers ☒ Other: Black rubber
☒ Steel-toed Leather ☐ Steel-toed Rubber ☐ Other _____

Health & Safety Monitoring Requirements: No routine monitoring is anticipated during the sampling activities due to open air conditions. Initially, OVM measurements will be performed on samples as a precaution.

Additional Comments / Changes

1. Chemical hazards listed were found in small quantities in the sediments of the impoundments, and should pose no risk to the workers.
2. Heat and cold stress concerns will be addressed and emphasized at all times. All workers may use their option of stop work authority when dealing with heat and cold stress issues. Shaded rest areas and iced drinking fluids will be available at when heat stress is likely. A warm shelter will be available when necessary during cold weather.
3. In case of injuries or an emergency, workers should contact appropriate organizations such as the LSS office, etc. The emergency contacts list is available in the original Health & Safety Plan and will be readily accessible at the work site. Evacuation procedures for general plant announcements will be followed.
4. When electrical equipment (pumps, lighting, etc.) is utilized at the site, GFCI outlets will be made available and used by workers.
5. A site map is attached showing the approximate locations of zones for contamination control.

Approvals

(Original signed and located in project files)

Project Manager Date

Health & Safety Officer Date

Health Physics (If Applicable) Date

SHEST (If Applicable) Date

ORNL ER Program ES&H Manager Date

Facility Manager Date

Other (Specify) Date

Procedure Change Notice: PCN - 1

Procedure: IMPOUNDMENTS A AND B ELEVATION AND ENVIRONMENTAL MEDIA MEASUREMENT PLAN, Revision 0

Prepared by: Measurement Applications and Development Group
Life Sciences Division
Oak Ridge National Laboratory

Description of changes:

At the request of the Bechtel Jacobs Company SIOU project engineer, the locations of points 1, 2, 4, and 5 will be moved closer to the center of pond 3513. Table 2 will read as follows:

Table 2. Coordinates for Core Locations in Ponds 3524 (A) and 3513 (B)		
Location Number	Northing $\pm$ 10 Feet	Easting $\pm$ 10 Feet
<i>Pond 3513</i>		
1	21370	31040
2	21370	31160
3	21315	31100
4	21260	31040
5	21260	31160
<i>Pond 3524</i>		
1	21540	30830
2	21540	30940
3	21540	31050

Approved by/date: ORNL / MAD Project Manager - M.E. Murray

ORNL / MAD Field Team Leader - D. A. Rose

Bechtel Jacobs Company Project Engineer - R. Coe

(Original signed and located in project files)

INTERNAL DISTRIBUTION

1-3. K. J. Brown	24-25. D. A. Rose
4-6. R. H. C. Coe III	26. R. E. Swaja
7. R. D. Foley	27. M. S. Uziel
8. R. C. Gosslee	28. J. K. Williams
9. C. A. Johnson	29. W. Winton
10. J. D. Lawrence	30. Central Research Library
11-13. C. W. Mansfield	31-33. MAD Records Center
14-23. M. E. Murray	34. Laboratory Records - RC

EXTERNAL DISTRIBUTION

- 35-40. James Kopotic, Project Manager, 55 Jefferson Building, U.S. Department of Energy, Oak Ridge, TN 37830
- 41-42. Office of Scientific and Technical Information, U.S. Department of Energy, P.O. Box 62, Oak Ridge, TN 37831