Surface Sediments in Precooler Ponds 2, 4 and 5: March 2000 (U)

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Executive Summary

Ponds 2, 4 and 5 are inactive reactor precooling impoundments located in the east-central portion of the Department of Energy's (DOE) Savannah River Site (SRS) in Aiken, South Carolina. From 1961 to 1988, cooling water from P Reactor was discharged through a series of canals and precooler ponds to Pond C. Cooling water then flowed from Pond C to Par Pond and was recirculated back to P Reactor. Releases from R Reactor, in the form of process leaks and purges, contaminated Par Pond with ^{137}Cs and other radioactive constituents. Consequently, the P-Reactor canal and precooler ponds received secondary ^{137}Cs contamination as a result of recirculating contaminated cooling water from Par Pond. Makeup cooling water from the Savannah River contaminated the system with nonradioactive constituents.

Several inspections of the Precooler Pond System by Westinghouse Savannah River Company (WSRC), the Federal Energy Regulatory Commission (FERC), and DOE have identified increased seepage, saturation and disrepair of Pond 2, Pond 4, and Pond 5 earthen dams. Repairing these structures would require stripping of topsoil and vegetation from the face of the dam and downstream from the toe, the installation of a new drain system and monitoring equipment, and reinforcement of the embankment with additional pervious material on the downstream face of the dam.

In March 2000, sediment samples were collected from Ponds 2, 4 and 5 by Savannah River Technology Center (SRTC) Environmental Analysis Section (EAS) personnel. Samples were analyzed at the WSRC Environmental Monitoring Section (EMS) laboratories. Confirmation analyses were performed at General Engineering Laboratories (GEL) to determine levels of radioactive, lead and mercury in sediments that could be exposed if the precooler dams are eliminated or allowed to fail.

Radioisotope levels measured in the precooler pond sediment samples exceeded background levels for SRS soils. The highest average gross beta activity (173 pCi/g) was found in Pond 5 sediments, whereas the maximum gross beta measurement (462 pCi/g) occurred in a Pond 4 sample. The highest average gross alpha activity (50 pCi/g) was found in Pond 4 sediments. Pond 2 sediments had the lowest gross alpha (29 pCi/g) and beta (87 pCi/g) activities. The average ^{137}Cs level in sediments was highest in Pond 5 (40 pCi/g) and lowest in Pond 2 (18 pCi/g). The sediments also displayed evidence of lead and mercury contamination that exceeded background levels for SRS soils and exceeded ecological risk screening levels.

The radionuclide inventory of Ponds 2, 4, and 5 was found to be dominated by ^{137}Cs and also contained the man-made radionuclide ^{60}Co. The ^{60}Co and ^{137}Cs activities in all three precooler ponds studied exceeded human health risk screening levels. Therefore, SRS would have to notify EPA in advance of draining the pond. The RCRA/CERCLA investigation would probably be accelerated and EPA/SCDHEC would most likely expect the Work Plan within a year.

Because the ^{60}Co and ^{137}Cs human health screening criteria were exceeded, a dose assessment was performed to further assess the human health risks associated with drying of the sediments. Actual levels of activity found in the samples were used to calculate potential radiation doses to a person working in the precooler pond areas. The largest potential dose to a precooler pond worker was conservatively calculated to be 61 mrem/y, which was less than the 100 mrem/y dose that would require radiation worker classification and posting as a Soil Contamination Area. Therefore, work on the sediments could proceed as a non-radiological job. The potential dose calculated for Pond 5 was the largest, whereas the dose calculated for Pond 2 was the lowest.

Table of Contents

List of Figures

List of Tables

Introduction

Pond 2, Pond 4 and Pond 5 are inactive reactor cooling impoundments built in 1961 on the R-Reactor Effluent System in the east-central portion of the Department of Energy's (DOE) Savannah River Site (SRS) in Aiken, South Carolina. These precooler ponds are part of the Par Pond cooling water system and are considered part of the Par Pond operable unit. The entire Par Pond cooling water system is contaminated with radioisotopes released during reactor operations in the 1950s and 1960s. Submerged surface sediment samples from Pond 2, Pond 4 and Pond 5 were collected to help determine the spatial distribution of surface contamination in these precooler ponds. Samples were analyzed for lead, mercury, gross alpha, gross beta, and gamma activity. The intent was not to characterize the ponds, but to identify the maximum levels of contamination that could be exposed if the ponds are drained to remove the danger of dam failure.

Par Pond was created in 1958 by the construction of an earthen dam on Lower Three Runs (Figure 1). The 1012-hectare (2500-acre) recirculating cooling water reservoir was built to dissipate heat from the cooling water effluent discharged from P and R Reactors. In 1958, the cooling water effluent pathway from R Reactor was rerouted through Pond C to the Hot Arm of Par Pond. In 1961, R-Reactor cooling water began discharging to Par Pond through the newly constructed R Canal and Pond B. This water discharge system was used until R Reactor was shut down in 1964. P Reactor began discharging to Par Pond in 1961. The cooling water was discharged through a series of canals and precooler ponds to Pond C and then to Par Pond. Pond 1, Pond 2, Pond 3, Pond 4, Pond 5, and Pond C, and the canals connecting these ponds to each other and P Reactor make up the P-Reactor canal system (Halverson et al. 1998). P Reactor continued to discharge cooling water into Par Pond via the canal system until the reactor was shut down in 1988 (DOE 1995a).

Releases in the form of leaks and purges contaminated Par Pond and its associated precooler ponds with ^{137}Cs and other radioactive constituents. Makeup cooling water from the Savannah River contaminated the system with nonradioactive constituents. All radioactive releases to Par Pond ceased when R Reactor was shut down in 1964 (DOE 1995b). Although P Reactor released no measurable ^{137}Cs into Par Pond (DOE 1995a), parts of the P-Reactor canal system, including Ponds 4 and 5, received releases from R Reactor before the construction of Par Pond (DOE 1995b). In addition, the P-Reactor Canal system received secondary ^{137}Cs contamination as a result of recirculating contaminated cooling water from Par Pond through the reactor facilities to the discharge canal and precooler ponds and back to Par Pond (DOE 1995a). Radionuclides from the contaminated cooling water remain in the water and surface sediments of the pond (Halverson et al. 1998). However, it is likely that historically high flows through the canals prevented significant accumulation of contaminants (DOE 1995b). Estimates of the contamination levels in the sediments of the precooler system have not been available because the P-Reactor canal system has not been surveyed or sampled in detail.

Inspections of the Ponds 2, 4 and 5 dams by Westinghouse Savannah River Company (WSRC), the Federal Energy Regulatory Commission (FERC), and DOE have identified increased seepage and saturation through the dams to the downstream face of the dams. The soil within the dams is losing shearing strength, thus decreasing the slope stability and internal friction angle characteristics of the soil, which are the properties which hold the embankment in place. The saturation problem appears to result from toe drain failures and root system penetration by trees and vegetation that were allowed to flourish over the dam face for a number of years.

The precooler ponds were constructed by impounding natural drainages, which allows them to receive rainfall and surface and near-surface runoff. Although river water is no longer pumped to the canals, the canals and ponds have not totally drained.

The Pond 2 dam, 685-2G, is approximately 23 feet high. The dam was designed to impound a pond that is 14 feet deep with a surface area of 30 acres and a storage capacity of 48 acre-feet of water (Table 1). In March 2000, the water elevation in Pond 2 measured 259 ft above mean sea level (msl). The Pond 4 dam, 685-4G, is approximately 30 feet high, designed to impound pond that is 18 ft deep. The Pond 5 dam, 685-5G, is approximately 14 feet high, impounding a 2 feet deep pond. Pond 4 and Pond 5 are connected. Together they were designed to have a normal surface area of 60 acres and a storage capacity of 292 acre-feet of water (Table 1). In March 2000, the water elevation in Ponds 4 and 5 measured 239 ft above msl.

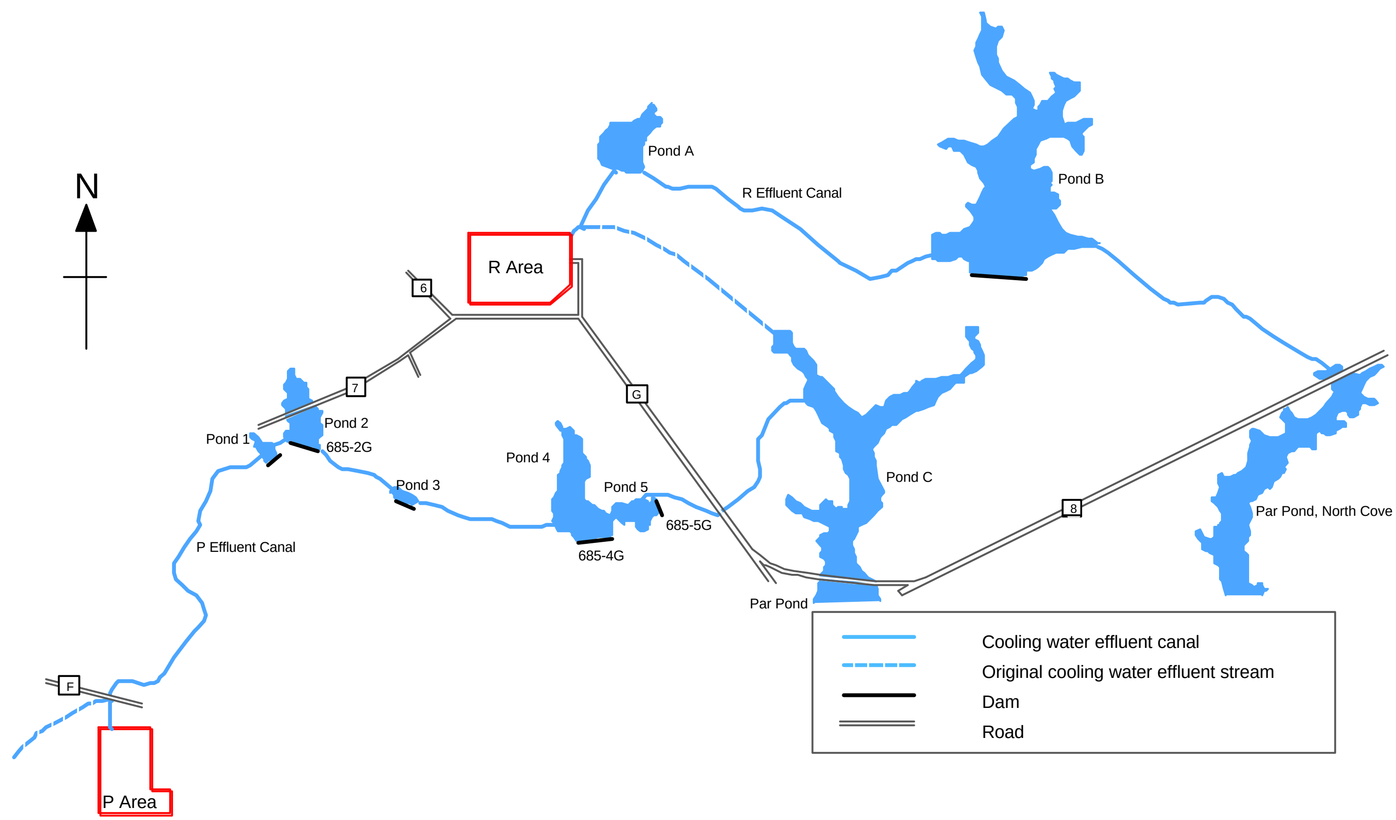

Figure 1. The Par Pond Cooling Water System at the Savannah River Site.

Table 1. Precooler Pond and Dam Data.

Impoundment Name	Length (ft)	Structural Height (ft)	Normal/ Max. Hydraulic Height (ft)	Top of Dam Elev. (MSL)	Normal/ Max. Pool Elev. (MSL)	Drainage Area (sq-mi)	Normal Storage (ac-ft)	Max. Storage (ac-ft)	Max. Surface Area (ac)
Pond 2, 685-2G	1,050	23	13 / 17	270	260 / 264	1.4	138	48	30
Pond 4, 685-4G	1,030	27	17 / 21	250	240 / 244	1.2	722	292	60
Pond 5, 685-5G	870	15	5 / 9	250	240 / 244	Included with Pond 4 Dam, 685-4G			

Source: Smith 2000

Objectives

This sampling program was designed to determine the levels of radioactive contamination, lead and mercury in the surface sediments that would be exposed after dewatering of the precooler ponds. Soil samples were collected by the Environmental Analysis Section (EAS) of the Savannah River Technology Center (SRTC) and were analyzed by the Environmental Monitoring Section (EMS) at SRS. Confirmation analyses were performed on a subset of the samples at an independent offsite laboratory, General Engineering Laboratories (GEL) of Charleston, SC. The data provided by this sediment sampling study will be used to determine and prioritize future actions to repair the dams and to determine safety, health and radiological control precautions necessary if the precooler ponds are drained.

The objectives of this report are to:

- describe the sampling methodology used during the March 2000 sampling events at the precooler ponds,
- present the results of the analyses performed on the sediment samples from the precooler ponds, and
- provide dose estimates and compare, where possible, these estimates to risk-based standards.

Site Description

The dams for Pond 2 and Pond 4 were built across similar topography and the wetlands below the dams remain quite similar in composition. Both dams extend across seep and subsurface headwaters of the Lower Three Runs watershed. Beginning down the slope at the ends of the dams, much of the area is a closed canopy of planted loblolly pine (*Pinus taeda*). The pine component of the stand dissipates towards the floodplain areas. Present in the understory at the time of sampling were loblolly pine, red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), and American holly (*Ilex opaca*). The herbaceous and vine layer was sparse and consisted mainly of grape (*Vitis* sp.), poison oak (*Rhus toxicodendron*), and jessamine (*Gelsemium sempervirens*). Soils of both areas are mapped as either Blanton or Fuquay series (Rogers 1990).

Moving from the slope to the floodplain, most of the overstory changed to sweetgum, red maple, tulip tree (*Liriodendron tulipifera*) and sweet bay (*Magnolia virginiana*). A number of species were present in the understory, including tulip tree, red maple, red bay (*Persea borbonia*) and sweetgum. Blackgum (*Nyssa sylvatica*) was also an understory component below the Pond 4 dam. The shrub layer consisted primarily of wax myrtle (*Myrica cerifera*) and doghobble (*Leucothhoe axillaris*). The herbaceous layer was dominated by maidencane (*Panicum hemitomon*), sensitive fern (*Onoclea sensibilis*), cinnamon fern (*Osmunda cinnamomea*), and juncus (*Juncus* sp.). Primary vine components were jessamine and grape. Soils of this area are mapped as Fluvaquents and are listed for the SRS as hydric soils.

The wetlands below the Pond 2 dam currently receive water from nearby seeps and from leakage through the dam. Several meandering streams run through the current wetland area, which is approximately 400 feet in width below the dam. This width increases further away from the dam. The wetlands below the Pond 4 dam are primarily seep and groundwater fed. Much of the dam leakage has channeled through the wetland area near the dam. The wetland below the Pond 4 dam is approximately 300 feet wide and generally located on the south side of the channeled flow. Both wetland areas are jurisdictional as they meet all criteria necessary to delineate them according the Corp. of Engineers methodology.

No evidence of wetlands was found below the Pond 5 dam. This area is topographically without a natural drainage like that associated with the Ponds 2 and 4 dams, and no evidence of historical wetlands was found. The soils are mapped as udorthents and highly disturbed. The vegetation at the time of sampling was dominated by a closed canopy of planted pine.

Methods

Sampling

Sampling was performed in accordance with procedures in WSRC Procedure Manual 3Q5. Samples were collected by repeatedly dredging the sediment surface. Initial attempts to use a soil auger failed. The surface sediment core could not be retained in the auger bucket. The sampling teams anchored their boats at each selected sampling location. The sediment dredge was attached to a rope and deployed within a 5-meter area of the anchored boat. Typically, three or four scoops of sediment were sufficient. The sediment at each sampling location was promptly placed in polyethylene bags. The bags were then sealed and labeled. The sediment dredge was thoroughly rinsed after each use to avoid sample carryover to the next location. Split samples and replicate samples were collected at the same location, but were placed in separate sample containers without homogenization in the field.

Sixty-six samples were scheduled for collection from 57 sampling locations. Every effort was made to collect the planned number of samples, but in a several cases, samples could not be collected due to heavy growth of aquatic vegetation. The number of samples actually collected and submitted for analyses were 47 standard samples, 3 replicates and 6 split samples, for a total of 56 samples from 47 sampling locations. Actual sampling locations are shown in Figures 3 and 4. Coordinates for these points are listed in Table 2.

Figure 2. Photograph of Sediment Sampling Activities at Pond 4.

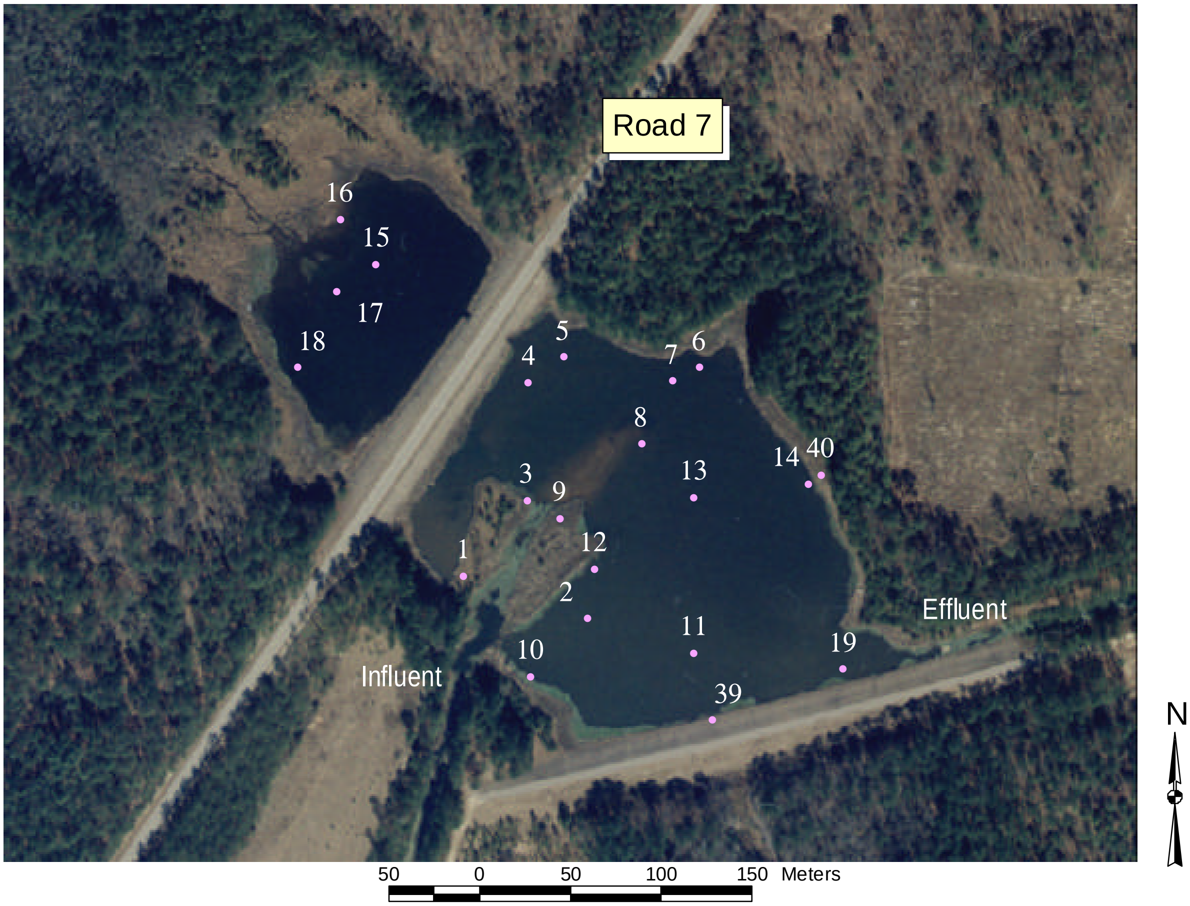

Figure 3. Sampling Sites at the Pond 2 Dam.

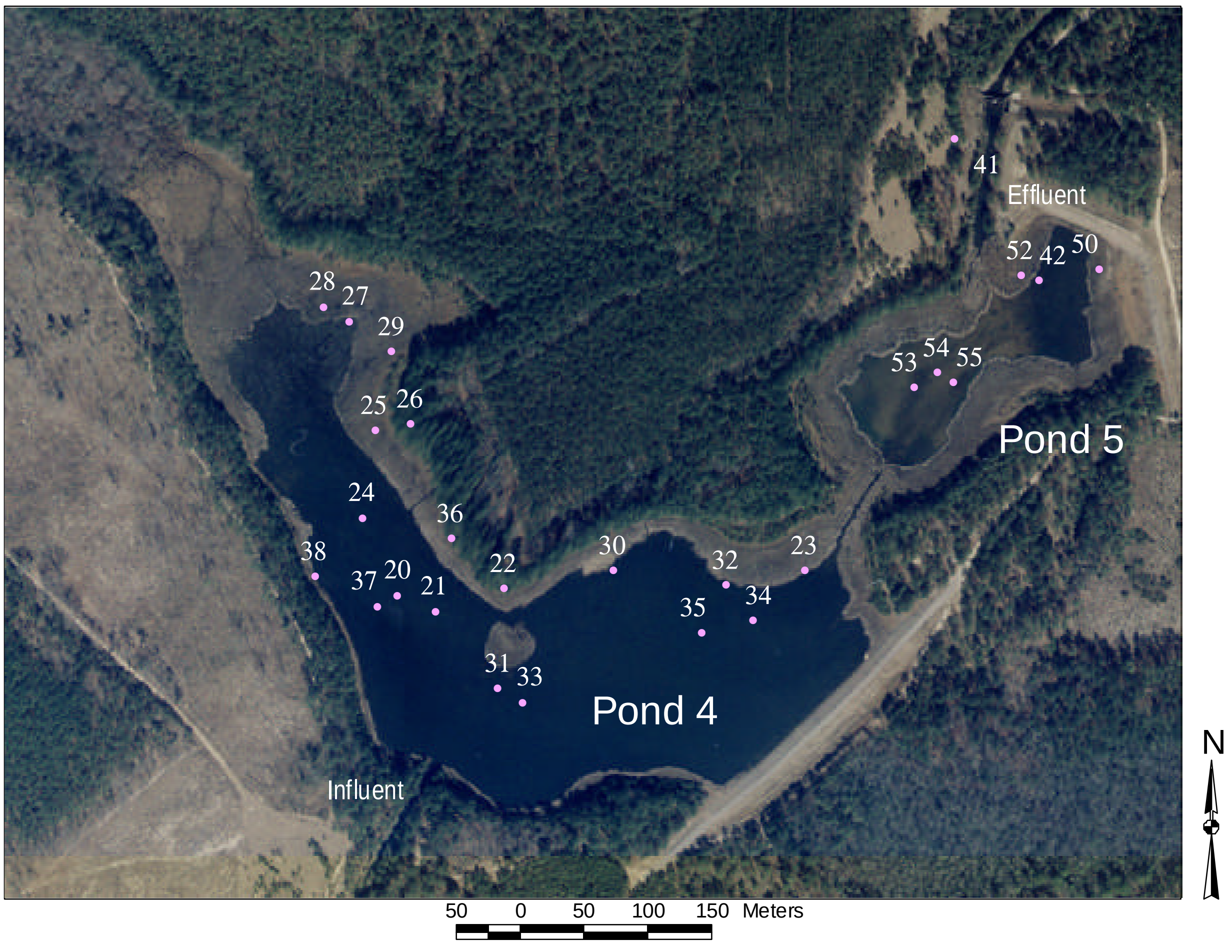

Figure 4. Sampling Sites at the Pond 4 and Pond 5 Dams.

Table 2. Pond 2, Pond 4 and Pond 5 Sediment Sampling Locations

Station ID	Sample No.	UTM-East	UTM-North	SRS-East	SRS-North
Pond 2					
P25-001-01	120722	445419	3679489	69349	52375
P25-002-01	120732	445487	3679466	69485	52183
P25-002-01-D	120738	445487	3679466	69485	52183
P25-003-01	120723	445454	3679531	69523	52419
P25-004-01	120724	445455	3679596	69649	52589
P25-005-01	120725	445474	3679610	69728	52589
P25-006-01	120726	445549	3679604	69915	52428
P25-007-01	120727	445534	3679597	69863	52440
P25-008-01	120728	445517	3679562	69750	52380
P25-009-01	120729	445472	3679521	69549	52358
P25-010-01	120730	445456	3679434	69340	52157
P25-010-01-A	120731	445456	3679434	69340	52157
P25-011-01	120736	445546	3679447	69605	52019
P25-011-01-D	120737	445546	3679447	69605	52019
P25-012-01	120733	445491	3679493	69548	52247
P25-013-01	120734	445546	3679533	69771	52247
P25-014-01	120735	445609	3679540	69952	52144
P25-015-01	120739	445371	3679661	69554	52924
P25-016-01	120740	445351	3679686	69547	53029
P25-017-01	120741	445349	3679646	69467	52927
P25-018-01	120742	445328	3679604	69328	52856
P25-019-01	120743	445628	3679438	69805	51836
P25-039-01	120744	445556	3679410	69560	51901
P25-040-01	120745	445616	3679545	69980	52144
P25-040-01-D	120746	445616	3679545	69980	52144
Pond 4					
P25-020-01	120703	447488	3680249	76307	50396
P25-021-01	120704	447519	3680236	76362	50301
P25-022-01	120705	447576	3680255	76552	50242
P25-023-01	120718	447824	3680270	77239	49802
P25-023-01-D	120719	447824	3680270	77239	49802
P25-024-01	120706	447459	3680313	76353	50622
P25-025-01	120707	447469	3680385	76519	50793

Table 2 (cont.). Pond 2, Pond 4 and Pond 5 Sediment Sampling Locations

Station ID	Sample No.	UTM-East	UTM-North	SRS-East	SRS-North
P25-026-01	120708	447499	3680390	76608	50749
P25-027-01	120709	447448	3680475	76636	51074
P25-028-01	120710	447427	3680487	76602	51145
P25-029-01	120711	447483	3680450	76681	50937
P25-030-01	120715	447666	3680270	76820	50108
P25-030-01-A	120714	447666	3680270	76820	50108
P25-031-01	120712	447571	3680173	76380	50034
P25-031-01-D	120716	447666	3680270	76820	50108
P25-032-01	120717	447759	3680258	77043	49896
P25-033-01	120713	447591	3680161	76410	49963
P25-034-01	120720	447781	3680228	77044	49774
P25-035-01	120721	447739	3680218	76913	49829
P25-036-01	120702	447532	3680296	76514	50435
P25-037-01	120700	447472	3680240	76246	50401
P25-038-01	120701	447420	3680265	76157	50569
Pond 5					
P25-041-01	120747	447948	3680626	78255	50507
P25-042-01	120748	448017	3680509	78212	50064
P25-050-01	120749	448067	3680518	78363	49991
P25-050-01-A	120750	448067	3680518	78363	49991
P25-052-01	120751	448002	3680513	78180	50103
P25-052-01-D	120752	448002	3680513	78180	50103
P25-053-01	120753	447914	3680421	77769	50029
P25-054-01	120754	447933	3680433	77843	50024
P25-055-01	120755	447947	3680425	77864	49976

Field Notes

Samplers documented the following essential field sample information in the red logbook issued to EAS for this project by the Environmental Monitoring Section (EMS) Groundwater Monitoring Group:

- Sample ID
- Sample station
- Sample date and time
- Initials of sampler
- Sample type and matrix
- Comments on any unusual circumstances, deviations from plans, or comments relating to the quality or representativeness of the samples
- Information on the parent sample of any field replicate or split

Sample Control (Chain-of-Custody)

EAS implemented chain of custody practices to insure the integrity of each sample and the accurate accounting of all documents and field/laboratory notes. Sampling Chain of Custody (COC) forms were provided by the EMS/Environmental Geochemistry group for all samples. When each analytical laboratory received the samples, an internal laboratory COC began and was maintained.

Preservation, Packaging and Shipping

Due to space constraints, the samples were not temperature preserved in the field. The samples were transferred within hours to refrigerated sample storage coolers at the EMS laboratories or at the B-Area well building.

Parent samples and replicates were delivered to the EMS laboratories. Split samples were packaged appropriately, delivered the well building for turnover to General Engineering Laboratories (GEL), an independent, offsite laboratory service from Charleston, South Carolina.

Analyses

The sediment samples were prepared and analyzed using routine EMS procedures. The procedures used by EMS to complete the analyses are listed in Table 3.

Table 3. EMS Procedures and EPA Methods used for the Pond 2, Pond 4 and Pond 5 Sediments Analyses.

Analysis	**EMS Procedures**	**EPA Methods**
Gamma pulse height analysis	3Q1-4-2420, 3Q1-6-1540	EPIA-013B
Gross alpha/beta analysis	3Q1-4-2900, 3Q1-6-1010	EPIA-001
Lead (total)	3Q1-5-2024, 2025	EPA3050B & EPA6010B
Mercury (total)	3Q1-5-2028	EPA7471A

The sediment samples were analyzed for lead (Pb) using EPA SW846 Method 6010B. Samples were not dried before analysis. A sample of 0.5 - 1.0 gm was placed into a digestion tube with nitric acid added and the mixture was heated to 95 °C for 2 hours, treated with hydrogen peroxide to destroy all the organic matter, and finally treated with hydrochloric acid. The resulting mixture was brought to 50 ml volume and centrifuged to settle the solids. About 15-20 ml of the clear solution was analyzed by Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP) for total recoverable lead.

The lead content is expressed to dry basis by dividing the ICP readout (as is or wet basis) to the solid fraction.

Samples were analyzed for mercury (Hg) by cold vapor atomic absorption. A sample of 0.5 - 1.0 gm was placed into a 300 ml Biochemical Oxygen Demand (BOD) bottle with aqua regia added and the mixture was digested in a water bath at 95 °C for 2 minutes. Permanganate, persulfate solutions were added and digested for an additional 2 hours. The excess permanganate solution was removed with the addition of sodium chloride-hydroxylamine hydrochloride solution before mercury determination using a Cold Vapor Atomic Absorption (CVAA) spectrometry technique.

Just like the lead analysis above, the mercury result was expressed on a dry basis by dividing the instrument readout to the solid fraction.

Preparation for gamma analysis required the sediment samples to be weighed. The wet samples filled the bottles to the 500 ml level, which corresponded to the preferred EMS calibration geometry. These preparations were then sent to the counting room for analysis on the Canberra Genie-VMS™ gamma spectrometry system.

Because the samples had a higher water content than usual for sediment samples sent for laboratory analysis, EMS performed analyses on well-mixed 500 ml aliquots of the sediment, silt and water. This method alleviated their radiological control concerns. This method also simplified sample preparation, because it was not necessary to dry and homogenize the entire sample. To correct each of the measurements to a dry weight basis, EMS analyzed the percent moisture content of each sample on a separate representative aliquot.

Samples were placed in proximity to a high purity germanium detector (greater than 35% efficiency) and counted for 5000 seconds. The same detector was used for all samples. One out of ten samples was recounted (5000 seconds) for quality assurance purposes. If a sample received a recount to confirm or rule out the presence of a radionuclide(s), the sample was counted for 10,000 seconds.

For alpha/beta activity determination, a 0.5 gram aliquot was digested with acid. For quality control purposes, each group of approximately 8 samples contained one reagent blank, one reagent spike containing both an alpha- and beta-emitting isotope, and a matrix spike containing the same isotopes and one sample prepared in replicate. Each preparation was quantitatively transferred to a planchet and sent to the counting room for analysis on an Ortec Countmaster™ low background gas flow proportional counter. Instrument background and efficiencies were checked daily. The analyst ensured and documented that the instrument was operating within its tolerance limits on the previous and succeeding daily checks. Each sample was counted for 20 minutes.

After review by EMS counting room professional staff, the data were transferred to the information management system and then validated and verified by the EMS Data Manager. Before release, the EMS Quality Control Coordinator approved the data.

Typical minimum detectable concentrations (MDCs) are given below in Table 4. The MDCs for a specific sample can vary from one sample to the next because of variations in the sample preparation, size, and content, and because of variations in the chemical recoveries, counting efficiencies, reagent blanks, decay time, counting time and instrument backgrounds. Thus, the detectable concentrations listed below in Table 4 should be considered "typical" values for this project report.

Table 4. Representative EMS and GEL Minimum Detectable Concentrations.

Analyte	**EMS MDC**	**GEL MDC**[1]
Radioactive:	**(pCi/g)**	**(pCi/g)**
Gross Alpha	2.07	3.09
Gross Beta	2.88	5.26
Actinium-228	2.08	0.16
Cobalt-60	0.062	0.05
Cesium-137	0.080	0.06
Analyte	**EMS MDL**[1]	**GEL MDL**[1]
Non-Radioactive:	**(μg/kg)**	**(μg/kg)**
Lead	100	467
Mercury	0.9	37.3

[1]Average of the sample specific detection limits

Field Duplicates and Splits

Sample replicates were performed as part of the field sampling and will be referred to in this report as field duplicates. Preparation of the sample in duplicate and then analysis of each duplicate sample in the same laboratory is a good quality control on the repeatability of the sample preparation. This information can be used to separate effects due to sample inhomogenity from sample preparation variation.

Field duplicates are consecutive samples taken from the same site, so called co-located samples. A field duplicate is not a sample split obtained by vigorously mixing a large portion of the sample and then portioning the sample into separate containers. Field duplicates are normally inserted as part of the regular sample submission to the laboratory and are processed as a regular sample. Field duplicates are an assessment of the variability of the entire sample collection, delivery, and analysis procedure. In a project where the target analytes are almost always found in every sample, field duplicates are a very useful quality control measure.

Field duplicates are generally used as a measure of the ability of the laboratory to obtain the same result on the same sample after repeated sampling and analysis. Consequently, the field duplicates also can be used to determine the heterogeneity of the sediments at a sample location. Three field duplicates were collected and delivered to EMS, the screening laboratory. A comparison of lead, mercury, ^{137}Cs, Gross Alpha, and Gross Beta results for the replicates is shown in Table 5.

Splits are two separate aliquots of the same field sample, which have been processed and analyzed for the same parameters by two independent laboratories. For this project, six samples were split and sent to both EMS and GEL. Results are shown in Table 6.

Results from both split samples and field duplicate samples can be compared as relative percent difference (RPD). RPD is calculated as the difference between two samples divided by the average result of the two samples,

Table 5. Field Duplicate Results, Grouped by Analyte.

Location	Sample Station	Sample ID	Lab ID	Result	Units	% Solids	Relative % Difference
Mercury							
Pond 2	P25-010-01	120730	20007733	640	µg/kg	27	65
Pond 2	P25-010-01-A	120731	20007736	1256	µg/kg	31	
Pond 4	P25-030-01	120715	20007714	1265	µg/kg	23	126
Pond 4	P25-030-01-A	120714	20007717	286	µg/kg	24	
Pond 5	P25-050-01	120749	20009103	344	µg/kg	28	38
Pond 5	P25-050-01-A	120750	20009104	504	µg/kg	21	
Lead							
Pond 2	P25-010-01	120730	20007733	57990	µg/kg	27	2
Pond 2	P25-010-01-A	120731	20007736	56990	µg/kg	31	
Pond 4	P25-030-01	120715	20007714	68100	µg/kg	23	23
Pond 4	P25-030-01-A	120714	20007717	54250	µg/kg	24	
Pond 5	P25-050-01	120749	20009103	39470	µg/kg	28	9
Pond 5	P25-050-01-A	120750	20009104	43000	µg/kg	21	
Cs-137							
Pond 2	P25-010-01	120730	20007733	20.10	pCi/g	27	51
Pond 2	P25-010-01-A	120731	20007736	33.70	pCi/g	31	
Pond 4	P25-030-01	120715	20007714	31.00	pCi/g	23	38
Pond 4	P25-030-01-A	120714	20007717	21.20	pCi/g	24	
Pond 5	P25-050-01	120749	20009103	38.60	pCi/g	28	19
Pond 5	P25-050-01-A	120750	20009104	46.50	pCi/g	21	

Table 5 (cont.). Field Duplicate Results, Grouped by Analyte

Location	Sample Station	Sample ID	Lab ID	Result	Units	% Solids	Relative % Difference
Gross Beta							
Pond 2	P25-010-01	120730	20007733	125	pCi/g	27	15
Pond 2	P25-010-01-A	120731	20007736	108	pCi/g	31	
Pond 4	P25-030-01	120715	20007714	155	pCi/g	23	15
Pond 4	P25-030-01-A	120714	20007717	134	pCi/g	24	
Pond 5	P25-050-01	120749	20009103	198	pCi/g	28	11
Pond 5	P25-050-01-A	120750	20009104	221	pCi/g	21	
Gross Alpha							
Pond 2	P25-010-01	120730	20007733	38.30	pCi/g	27	21
Pond 2	P25-010-01-A	120731	20007736	47.30	pCi/g	31	
Pond 4	P25-030-01	120715	20007714	41.50	pCi/g	23	35
Pond 4	P25-030-01-A	120714	20007717	59.30	pCi/g	24	
Pond 5	P25-050-01	120749	20009103	37.90	pCi/g	28	24
Pond 5	P25-050-01-A	120750	20009104	48.30	pCi/g	21	

multiplied by one hundred to convert the number to a percentage. Relative percent difference is shown in Tables 5 and 6.

The < 35% RPD for the lead, gross alpha, and gross beta field duplicate analyses indicates that the EMS laboratories do have their preparation procedures in good statistical control. In the cases of poor comparability with mercury and Cs-137 analyses, the variation is most likely attributable to the bulk sediment sample's heterogeneity in physical characteristics.

The bulk sediment analysis is the analysis of a sample containing both solids and interstitial water. The bulk sediment's physical characteristics have considerable impact on the mobility of contaminants. Key physical characteristics include: 1) texture, a property determined by the amount of sand, silt, and clay particles in the sediment; 2) organic matter content, a property that is important because of the affinity of metals and nonpolar organic contaminants for sediments with high organic (humic) material content; and 3) water content in sediments. Interstitial waters can account for up to 90% of the top sediment layer.

Sediments collected in each of the ponds had a widely variable texture with visible bands of sand, silt, clay, and high organic (humic) content. There was an abundance of plant material and a great deal of decaying organic matter in all of the sediments. The percent solids typically ranged from 20-40 percent. Sediments are a notoriously difficult matrix for analysis. As described above the lead, mercury, gross alpha and gross beta analyses were performed on

Table 6. Split Sample Results, Grouped by Analyte.

Location	Sample Station	Sample ID	Lab ID	Lab	Result	Units	% Solids	Relative % Difference
Mercury								
Pond 2	P25-002-01	120732	20007734	EMS	424	μg/kg	26	57
Pond 2	P25-002-01-D	120738	23003002	GEL	236	μg/kg	21	
Pond 2	P25-011-01	120736	20007739	EMS	530	μg/kg	37	75
Pond 2	P25-011-01-D	120737	23003001	GEL	240	μg/kg	34	
Pond 4	P25-023-01	120718	20007718	EMS	603	μg/kg	22	4
Pond 4	P25-023-01-D	120719	22616002	GEL	582	μg/kg	26	
Pond 4	P25-031-01	120712	20007713	EMS	325	μg/kg	27	25
Pond 4	P25-031-01-D	120716	22616001	GEL	252	μg/kg	43	
Pond 2	P25-040-01	120745	20007742	EMS	216	μg/kg	43	21
Pond 2	P25-040-01-D	120746	23003003	GEL	175	μg/kg	36	
Pond 5	P25-052-01	120751	20009105	EMS	1038	μg/kg	24	NA
Pond 5	P25-052-01-D	120752	23592001	GEL	370	μg/kg	100	
Lead								
Pond 2	P25-002-01	120732	20007734	EMS	45670	μg/kg	26	7
Pond 2	P25-002-01-D	120738	23003002	GEL	42600	μg/kg	21	
Pond 2	P25-011-01	120736	20007739	EMS	46460	μg/kg	37	30
Pond 2	P25-011-01-D	120737	23003001	GEL	34400	μg/kg	34	
Pond 4	P25-023-01	120718	20007718	EMS	78600	μg/kg	22	64
Pond 4	P25-023-01-D	120719	22616002	GEL	40500	μg/kg	26	
Pond 4	P25-031-01	120712	20007713	EMS	25660	μg/kg	27	69
Pond 4	P25-031-01-D	120716	22616001	GEL	12500	μg/kg	43	
Pond 2	P25-040-01	120745	20007742	EMS	31600	μg/kg	43	24
Pond 2	P25-040-01-D	120746	23003003	GEL	24900	μg/kg	36	
Pond 5	P25-052-01	120751	20009105	EMS	55240	μg/kg	24	NA
Pond 5	P25-052-01-D	120752	23592001	GEL	9750	μg/kg	100	

Table 6 (cont.). Split Sample Results, Grouped by Analyte.

Location	Sample Station	Sample ID	Lab ID	Lab	Result	Units	% Solids	Relative % Difference
Cs-137								
Pond 2	P25-002-01	120732	816618	EMS	16.60	PCG	26	38
Pond 2	P25-002-01-D	120738	23003002	GEL	24.50	PCG	21	
Pond 2	P25-011-01	120736	816623	EMS	15.30	PCG	37	91
Pond 2	P25-011-01-D	120737	23003001	GEL	40.90	PCG	34	
Pond 4	P25-023-01	120718	816580	EMS	32.10	PCG	22	10
Pond 4	P25-023-01-D	120719	22616002	GEL	35.50	PCG	26	
Pond 4	P25-031-01	120712	816575	EMS	12.70	PCG	27	68
Pond 4	P25-031-01-D	120716	22616001	GEL	6.23	PCG	43	
Pond 2	P25-040-01	120745	816627	EMS	8.21	PCG	43	66
Pond 2	P25-040-01-D	120746	23003003	GEL	16.30	PCG	36	
Pond 5	P25-052-01	120751	816630	EMS	47.50	PCG	24	NA
Pond 5	P25-052-01-D	120752	23592001	GEL	56.00	PCG	100	
Gross Alpha								
Pond 2	P25-002-01	120732	816618	EMS	40.10	PCG	26	17
Pond 2	P25-002-01-D	120738	23003002	GEL	33.80	PCG	21	
Pond 2	P25-011-01	120736	816623	EMS	15.30	PCG	37	39
Pond 2	P25-011-01-D	120737	23003001	GEL	22.70	PCG	34	
Pond 4	P25-023-01	120718	816580	EMS	29.30	PCG	22	25
Pond 4	P25-023-01-D	120719	22616002	GEL	22.70	PCG	26	
Pond 4	P25-031-01	120712	816575	EMS	12.70	PCG	27	29
Pond 4	P25-031-01-D	120716	22616001	GEL	9.47	PCG	43	
Pond 2	P25-040-01	120745	816627	EMS	23.40	PCG	43	11
Pond 2	P25-040-01-D	120746	23003003	GEL	21.00	PCG	36	
Pond 5	P25-052-01	120751	816630	EMS	44.10	PCG	24	NA
Pond 5	P25-052-01-D	120752	23592001	GEL	23.90	PCG	100	

Table 6 (cont.). Split Sample Results, Grouped by Analyte.

Location	Sample Station	Sample ID	Lab ID	Lab	Result	Units	% Solids	Relative % Difference
Gross Beta								
Pond 2	P25-002-01	120732	816618	EMS	100.00	PCG	26	85
Pond 2	P25-002-01-D	120738	23003002	GEL	40.50	PCG	21	
Pond 2	P25-011-01	120736	816623	EMS	58.70	PCG	37	22
Pond 2	P25-011-01-D	120737	23003001	GEL	46.90	PCG	34	
Pond 4	P25-023-01	120718	816580	EMS	123.00	PCG	22	95
Pond 4	P25-023-01-D	120719	22616002	GEL	43.90	PCG	26	
Pond 4	P25-031-01	120712	816575	EMS	86.00	PCG	27	146
Pond 4	P25-031-01-D	120716	22616001	GEL	13.5	PCG	43	
Pond 2	P25-040-01	120745	816627	EMS	43.20	PCG	43	26
Pond 2	P25-040-01-D	120746	23003003	GEL	33.20	PCG	36	
Pond 5	P25-052-01	120751	816630	EMS	200.00	PCG	24	NA
Pond 5	P25-052-01-D	120752	23592001	GEL	72.30	PCG	100	

small (<1 gram) sample aliquots taken from the bulk sample. Although efforts were made to mix and homogenize the bulk sample there can be no guarantee that the sample aliquot was representative of the bulk sample.

The mercury, lead, ^{137}Cs, gross alpha, and gross beta analysis results for the split samples sent to EMS and to GEL are shown in Table 6 above. These split results are generally in agreement, but there are occasional wide variations in targeted analytes for each co-located, split sample. There are two likely causes for the differences. As mentioned earlier, the field duplicates and splits were taken from the same sample location, but were not homogenized in the field before being placed in separate sample containers. The inherent heterogeneity of soil and sediment samples can lead to very different analysis results when samples are not thoroughly mixed before duplication or splitting.

Another difference may be in the sample preparation methods. EMS chose not to dry the samples before radioanalytical analyses. After the analyses, an aliquot of the wet sample was dried to determine the percent solids. The measurement results were later reported as specific activity per unit of dry weight after the percent solids correction. However, GEL did dry the samples before radioanalytical analyses. All GEL measurement results were reported directly as activity per unit of dry weight. The percent solids analysis was not used to correct the specific activity of the sample.

GEL reported Sample ID (120752), Sample Station P25-052-01-D to have 100% solids. This result is unlikely. The average percent solids value from the other split samples analyzed at both laboratories was 32% and generally both laboratories were in good agreement for the percent solids. The RPD between Sample Id (120752) and (120751) is shown in Table 6 as Not Applicable (NA) due to the obvious error in the percent solids result for the split sample.

Discussion

Analytical Results

Two laboratories provided analytical services. The Environmental Monitoring Section (EMS) of the Environment, Safety, Health and Quality Assurance Division provided laboratory screening results and General Engineering Laboratories (GEL) from Charleston, SC performed the confirmation results on the split samples.

EMS and GEL analytical results for the March 2000 sampling events at Ponds 2, 4, and 5 are presented in Appendix A (metals data) and Appendix B (radiological data). Lab blanks and standards are not presented. Sample data for metals include the sample station, sample field identification number, sample lab identification number, lab performing the analysis, lab quality control code, analyte, Sample Specific Method Detection Limit (ssMDL), and the Sample Specific Environmental Quantification Limit (ssEQL), result (reported as dry weight), and percent solids. Sample data for radionuclides include the sample station, sample field identification number, sample lab identification number, analyte, results code, result, uncertainty, and lab performing the analyses. Data presented in Appendixes A and B should be considered scoping level data.

Metals Data

Table 7 lists the average and maximum results for the mercury and lead analyses from Pond 2, Pond 4 and Pond 5 sediment samples. Mercury results for all the ponds were within national and SRS background ranges, but exceeded the current EPA Region IV Ecological Risk Benchmark of 100 µg/kg (10 ppb) (Table 10).

Lead and mercury were present in measurable levels in all the samples. The maximum lead and mercury levels were found in Pond 4. The maximum lead concentration found in Pond 4 was roughly twice the maximum levels found in the other two ponds. Differences in the maximum mercury levels found in each pond were much smaller. Average lead and mercury levels were highest in Pond 4 and lowest in Pond 5.

Mercury has been well known as an environmental pollutant for several decades. As early as the 1950s it was established that emissions of mercury to the environment could have serious effects on human health. These early studies demonstrated that fish and other wildlife from various ecosystems commonly attain mercury levels of toxicological concern when directly affected by mercury-containing emissions from human-related activities. Human health concerns arise when fish and wildlife from these ecosystems are consumed by humans.

Regional occurrences of mercury contamination often cannot be linked to individual emissions of mercury, but instead are due to widespread air pollution. When scientists measure mercury levels in air and surface water, however, the observed levels are extraordinarily low, and scientists may need to take extreme precautions to avoid direct contact with the sediment samples or the sample containers, to avert sample contamination.

Once in surface water, mercury enters a complex cycle in which one form can be converted to another. It can be brought to the sediments by particle settling and then later released by diffusion or resuspension. It can enter the food chain, or it can be released back to the atmosphere by volatilization. The concentration of dissolved organic carbon (DOC) and pH determine the ultimate fate of mercury in an ecosystem. Many scientists currently think that higher acidity and DOC levels enhance the mobility of mercury in the environment, thus making it more likely to enter the food chain. Many of the details of the aquatic mercury cycle are still unknown, however, and remain areas of active research.

Soils have average mercury content of about 30 µg/kg dry weight. However, Okefenokee Swamp soils had a concentration of 540 µg/kg dry weight, and saltmarsh concentrations were as high as 1,700 µg/kg dry weight (Nixon and Lee, 1986).

Table 7. Metals Detected at Pond 2, Pond 4 and Pond 5 Sampling Locations – March 2000.

Analyte	Number of Samples[1]	Number of Detects	Average[1] (μg/kg)	Maximum (μg/kg)
Pond 2				
Total Mercury	22	22	536	1,256
Total Lead	22	22	40,055	57,990
Pond 4				
Total Mercury	20	20	555	1,350
Total Lead	20	20	54,879	109,000
Pond 5				
Total Mercury	8	8	498	1,038
Total Lead	8	8	38,246	55,240

[1]Includes duplicates

Average lead results for each of the ponds exceeded the maximum range of SRS soil background concentrations, and the average results for Ponds 4 and 5 exceeded the EPA Region IV ecological benchmark values (Tables 7 and 10).

Lead enters the environment from a variety of natural and human sources. Natural processes such as soil weathering, erosion, and forest fires contribute to significant releases of lead. Natural processes rarely result in elevated concentrations in the environment.

Lead released into the atmosphere is a major source of environmental contamination. Deposited on the soil, in surface waters and on plants, lead can enter the food chain. Lead particles can be transported in the air for considerable distances, up to thousands of kilometers from their source, before being deposited through precipitation.

Since lead is largely insoluble in water, it is usually a minor constituent of surface and ground water. It tends to be absorbed by soil and sediment particles, especially those near the source of the lead. And because of lead's low solubility in water, its "uptake" in plants is usually limited.

Radiological Data

Table 8 lists the radioisotopes detected at each of the Precooler ponds by EMS and the water body specific average and maximum sediment sample results. Cesium-137 and ^{60}Co are man-made radioisotopes. The remaining radioisotopes detected are naturally occurring.

As expected, ^{137}Cs was detected in all of the precooler pond sediment samples. The radionuclide inventory of Ponds 2, 4, and 5, as well as Par Pond, is dominated by ^{137}Cs. Although there has been no input of ^{137}Cs to the Par Pond system in more than 30 years, previous studies on the Par Pond system have indicated that ^{137}Cs remains in the surface sediments. In an aquatic system, many radionuclides reside almost entirely in the sediments. The average ^{137}Cs level in sediments was highest in Pond 5 and lowest in Pond 2. The average Pond 5 ^{137}Cs level was roughly twice the average Pond 2 level.

Table 8. Radionuclides Detected at Pond 2, Pond 4 and Pond 5 Sampling Locations – March 2000.[1]

Analyte	Number of Samples	Number of Detects	Average (pCi/g)	Maximum (pCi/g)
Pond 2				
Gross Alpha	22	21	28.9	68.00
Gross Beta	22	20	87.2	223.00
Actinium-228	22	7	1.7	4.48
Bismuth-212	22	2	3.2	5.19
Bismuth-214	22	20	2.0	4.87
Cobalt-60	22	14	0.62	3.53
Cesium-137	22	22	17.5	33.70
Potassium-40	22	19	5.8	11.80
Lead-212	22	22	1.2	3.46
Lead-214	22	22	1.9	4.53
Radium-224	22	1	6.4	6.43
Radium-226	22	8	7.4	10.20
Thorium-234	22	1	0.80	0.80
Thallium-208	22	19	0.49	1.41
Pond 4				
Gross Alpha	20	20	50.0	129.00
Gross Beta	20	20	162.8	462.00
Actinium-228	20	7	1.5	1.96
Bismuth-212	20	6	1.5	1.95
Bismuth-214	20	19	1.6	2.33
Cobalt-60	20	4	0.16	0.19
Cesium-137	20	20	24.6	45.70
Potassium-40	20	19	4.6	7.72
Lead-212	20	19	1.1	1.69
Lead-214	20	18	1.6	2.58
Radium-224	20	1	1.8	1.77
Radium-226	20	6	7.7	11.70
Thallium-208	20	18	0.48	0.65

[1]Includes duplicates

Table 8 (cont.). Radionuclides Detected at Pond 2, Pond 4 and Pond 5 Sampling Locations – March 2000.[1]

Analyte	Number of Samples	Number of Detects	Average (pCi/g)	Maximum (pCi/g)
Pond 5				
Gross Alpha	8	8	38.9	54.00
Gross Beta	8	8	172.5	228.00
Actinium-228	8	3	1.9	2.06
Bismuth-212	8	4	1.5	1.75
Bismuth-214	8	8	1.9	2.47
Cobalt-60	8	1	0.14	0.14
Cesium-137	8	8	40.4	50.30
Potassium-40	8	8	6.0	7.07
Lead-212	8	8	1.4	2.07
Lead-214	8	8	1.9	2.27
Radium-226	8	3	10.2	16.6
Thallium-208	8	7	0.56	0.76

[1]Includes duplicates

Cobalt-60 was detected in 19 samples, most often in Pond 2. Cobalt-60 was detected in 64% of the Pond 2 samples, but only 20% and 13% of the Pond 4 and Pond 5 samples, respectively. The average Pond 2 ^{60}Co activity was approximately three times that of Pond 4 and four times that of Pond 5.

WSRC Environmental Restoration (ER) uses 20 pCi/g alpha activity and 50 pCi/g beta activity as the levels above which the activity is considered indicative of contamination. Gross beta activity was detected in 48 samples. If 50 pCi/g is used as a screening level, the average gross beta activities in Ponds 2, 4, and 5 all exceed the contamination level set by ER. The maximum gross beta measurement occurred in Pond 4 (462 pCi/g), whereas the highest average gross beta activity (173 pCi/g) was found in Pond 5 sediments.

Gross alpha was detected in 49 samples. The average gross alpha activities in Ponds 2, 4, and 5 exceeded the 20 pCi/g contamination screening level set by ER. The highest average gross alpha activity (50 pCi/g) was found in Pond 4 sediments. The maximum individual gross alpha measurement also occurred in Pond 4 (129 pCi/g).

No other radionuclides were detected in all the samples; however, ^{214}Bi, ^{40}K, ^{212}Pb, ^{214}Pb, and ^{208}Tl were detected in most of the samples. There were no significant differences in the remaining naturally occurring radioisotopes between the three ponds.

The range of radioanalytical results for the precooler pond sediments may reflect the nonhomogeneous nature of sediment contamination. It should also be noted that the screening values for alpha and beta activities are on a dry weight basis. The dry weight activities reported by EMS are not direct measurements, but are corrected measurements using measured percent solids for the conversion.

Results from the March 2000 sediment study were compared to results obtained by Halverson and Noonkester (1996). Table 9 compares the gross alpha, gross beta, ^{60}Co and ^{137}Cs results between the two studies. In the 1995/1996 study, sediment samples were collected from shallow water along the edges of the ponds. Additional samples were taken along the shorelines. Thirty-six samples were analyzed in the 1995/1996 study. The results from the March 2000 samples were expected to exceed those from the earlier study because the March 2000 samples were collected from deeper locations. Samples collected in March 2000 exceeded the gross alpha, gross beta, ^{60}Co and ^{137}Cs found in the earlier study. In Pond 2, the March 2000 samples had roughly five times the gross alpha and gross beta activity, seven times the ^{60}Co activity and three times the ^{137}Cs activity as the 1995/1996 samples. For Ponds 4 and 5 combined, the March 200 samples had roughly ten times the gross alpha activity, four times the gross beta activity, and twice the ^{137}Cs activity as the 1995/1996 samples, but the ^{60}Co activities were similar.

For the Ponds 2, 4 and 5 samples collected in March 2000, the ^{137}Cs results are shown in Figure 5.

Radiocesium contamination and transport mechanisms for atmospheric, surface water, groundwater, soils, and sediments have been extensively studied by SRTC and ecological mechanisms have been studied by the Savannah River Ecology Laboratory (SREL).

SRTC has produced a Radiological Assessment Program (RAP) summary document (Carlton et. al. 1992) entitled "Cesium in the Savannah River Site Environment (U)." It is the fourth in a series of eight documents on individual radioisotopes released to the environment as a result of SRS operations. The document details SRS processes involving radiocesium and the historic releases and stored inventories of radiocesium at the SRS.

The RAP document also introduces the long term and continuing studies performed by researchers at SREL. Studies in Par Pond and Pond B have shown: (1) that most of the ^{137}Cs resides in the sediments of the ponds; (2) that a small fraction of the ^{137}Cs is remobilized to the water during the summer anoxia; (3) that ^{137}Cs is available to the biota through this remobilization and by root uptake by macrophytes; and, (4) that ^{137}Cs concentrations in pond biota do not show biomagnification.

Table 9. Radionuclides Detected in March 2000 Samples Compared to August 1995 and April 1996 Samples.

	March 2000 Samples		**August 1995 & April 1996 Samples[1,2]**	
Analyte	**Average (pCi/g)**	**Maximum (pCi/g)**	**Average (pCi/g)**	**Maximum (pCi/g)**
Pond 2				
Gross Alpha	28.9	68	5.20	7.60
Gross Beta	87.2	223	17	35
Cobalt-60	0.62	3.53	0.089	0.12
Cesium-137	17.5	33.7	6.21	23.90
Pond 4				
Gross Alpha	50.0	129	4.90	9.40
Gross Beta	162.8	462	37	240
Cobalt-60	0.16	0.186	0.12	0.18
Cesium-137	24.6	45.7	11.80	87.40
Pond 5				
Gross Alpha	38.9	54	4.90	9.40
Gross Beta	172.5	228	37	240
Cobalt-60	0.14	0.137	0.12	0.18
Cesium-137	40.4	50.3	11.80	87.40

[1]In the August 1995 and April 1996 samples, Pond 4 and Pond 5 sample results were reported together.
[2]Source: Halverson and Noonkester (1996)

Figure 5. Cesium-137 Sample Locations and Results at Pond 2 (upper photo) and Ponds 4 and 5 (lower photo).

Survey Data Comparison to Background and Benchmarks

The background concentration of a given element in soil represents the concentration present after the soil was formed and underwent some degree of weathering. It gives no indication of the maximum concentration of the element that a soil can immobilize, i.e., the element loading capacity of the soil. Background radionuclides fall into three categories: (1) naturally occurring isotopes, (2) global man-made isotopes dispersed as atmospheric fallout from nuclear weapons testing, and (3) constituents potentially released from the site and deposited by atmospheric fallout.

In 1996, a background soil data set specific to SRS was compiled from ongoing investigations in the SRS environmental restoration program (PRC 1996). Background sediment data was collected also during the Comprehensive Cooling Water Study in the 1980s (DuPont 1985 and DuPont 1987). These data sets were used to compare with results from the March 2000 sampling of sediments from Pond 2, Pond 4 and Pond 5 (Table 10).

The EPA has established generic soil screening levels for 110 non-radioactive chemical contaminants commonly found in soil for assessing human health hazards at a waste site. Equations for accurate calculation of risk associated with the inhalation and migration of contaminants to ground water requires site-specific input parameters. Conservative default values have been developed for use where site-specific data are not available. These default values have been used to calculate generic soil screening levels. For soil ingestion and inhalation of volatiles and fugitive dusts, soil screening levels correspond to a 1×10^{-6} risk level for carcinogens and a hazard quotient of 1 for noncarcinogens. The default values are conservative and are likely to be protective for the majority of site conditions across the nation. However, the generic soil screening levels are not necessarily protective of all known human exposure pathways and, therefore, are not sufficient for a full evaluation of the site. A more detailed site-specific approach is necessary to evaluate the additional pathways or site conditions (EPA 1996). However, the soil screening levels can be used as an initial step in assessing the human health hazards associated with a site. The soil screening levels for mercury and lead are shown in Table 10.

The Environmental Restoration Department has developed risk-based radionuclide activity levels in soil and groundwater that are protective of human health exposures at the 1×10^{-6} risk level. The EPA Standard Default exposure scenario presented in the EPA Region III Risk-Based Concentration Table (April 30, 1996) for chemicals has been adapted for calculation of radionuclide Risk-Based Activities (RBAs). The benchmark levels for ^{60}Co and ^{137}Cs are shown in Table 10.

The EPA Region IV has established ecological soil and sediment screening values for non-radioactive contaminants at hazardous waste sites. Ecological screening values are based on contaminant levels associated with a low probability of unacceptable risks to ecological receptors. These numbers are based on conservative endpoints and sensitive ecological effects data. They are useful for a preliminary screening of site contaminant levels to determine if there is a need to conduct further investigations at the site. Exceedences of the ecological screening values may indicate the need for further evaluation of the potential ecological risks posed by the site. The decision concerning the necessity for evaluation requires the weighing of such factors as the frequency, magnitude, and pattern of these exceedences. Because the concern at the precooler ponds is exposure if the ponds are drained, the soil screening values would be applicable. The soil screening values for lead and mercury are shown in Table 10.

Ecological benchmarks for radioactive contaminants are based on technical standards developed by DOE (DOE 2000) to meet the requirements for protection of biota in DOE Orders 5400.1 (DOE 1990) and 5400.5 (DOE 1993). The biota dose limit for terrestrial animals is 0.1 rad/day and for aquatic animals is 1 rad/day. (Avoiding impairment of reproductive capability is the critical biological concern in establishing the dose limits for aquatic and terrestrial biota (DOE 2000). Using a graded approach allowed under the technical standards, the soil or sediment concentration data can be used to determine whether radionuclide concentrations at a site are likely to result in a doses exceeding the biota dose limit. The benchmark concentrations for ^{137}Cs and ^{60}Co are listed in Table 10.

The results from the analysis of Pond 2, Pond 4 and Pond 5 sediments were compared to human health and ecological benchmarks (Table 10). Several of the results exceeded these targets, as noted below.

Table 10. Nationwide and SRS Background Soil Concentrations Compared to Pond 2, Pond 4 and Pond 5 Sediments.

Constituent	Nationwide Soils[1,2]	SRS Background Soils	Human Health Risk Benchmark	Ecological Risk Benchmark	Pond 2[6]	Pond 4[6]	Pond 5[6]
Radioactive (pCi/g)							
Gross Alpha	NA	<0.01 to 44[3]			Avg. 28.9 Max. 68.00	Avg. 50.0 Max. 129.00	Avg. 38.9 Max. 54.00
Nonvolatile Beta	NA	<0.01 to 55[3]			Avg. 87.2 Max. 223.00	Avg. 162.8 Max. 462.00	Avg. 172.5 Max. 228.00
Cesium-137	<4	<3[3] <2[4]	0.104[5]	100[8]	Avg. 17.5 Max. 33.70	Avg. 24.6 Max. 45.7	Avg. 40.4 Max. 50.3
Cobalt-60	NA	<4[4]	0.0223[5]	700[8]	Avg. 0.62 Max. 3.53	Avg. 0.16 Max. 0.186	Avg. 0.14 Max. 0.14
Nonradioactive (µg/kg)							
Mercury (total)	<10 to 4,600	<3 to 900[3]	23,000 ingestion[6] 10,000 inhalation of volatiles[6]	100[7]	Avg. 536 Max. 1,256	Avg. 555 Max. 1,350	Avg. 498 Max. 1,038
Lead	<10,000 to 700,000	<200 to 35,000[3]	400,000 ingestion[6]	50,000[7]	Avg. 40,055 Max. 57,990	Avg. 54,879 Max. 109,000	Avg. 38,246 Max. 55,250

1 EPA 1994 for radionuclides
2 Shacklette and Boerngen 1984 for metals
3 PRC 1996.
4 Meyer's Branch sediment data, DuPont , 1987. Used as background soil data in WSRC 1992.
5 Combined Worker Soil Exposure Risk Based Activity. Source: Nix 2000.
6 Source: EPA 1996
7 Source: Data listed in the EPA Region IV website, originating in Friday 1998.
8 Source: Soil Biota Concentration Guides found in DOE 2000.
NA – Not Applicable

- All but three samples exceeded the current EPA Region IV ecological risk screening value of 100 µg/kg (10 ppb) for mercury. Mercury results for some individual samples in each pond exceeded SRS background levels.

- Average lead results for all three ponds exceeded the range of SRS soil background concentrations, although they were within the national background range. The average lead concentration for Pond 4 exceeded the ecological risk screening value. Lead results for some individual samples in Pond 2 and Pond 5 also exceeded the ecological risk screening levels.

- The average gross alpha activity in Pond 4 samples exceeded that of SRS background soils. The gross alpha activities in individual samples from Pond 2 and Pond 5 exceeded SRS background levels, although the average gross alpha activities were within background levels.

- Average gross beta activity in all three ponds exceeded SRS background levels.

- The average ^{137}Cs measured in the sediment samples from all three ponds exceeded SRS and national background levels. The average ^{137}Cs activities in all three ponds exceeded human health risk screening levels.

- The average ^{60}Co activities in all three ponds exceeded human health risk screening levels.

Because the sediments exceeded the human health risk screening values for all three ponds, exposing the sediments by draining any of the ponds would accelerate the CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) schedule for that pond. Draining the ponds would significantly alter the exposure scenario. Therefore, SRS would have to notify EPA in advance of draining the pond. The RCRA/CERCLA investigation would probably be accelerated and EPA/SCDHEC would most likely expect the Work Plan within a year.

Dose Estimate for Precooler Pond Workers

Because the sediments exceeded the human health risk screening values, dose rates were calculated. The potential doses to a person working in each precooler pond area and exposed to radioactivity in the pond soil were estimated using the data from the March 2000 sampling program (Table 11). The exposure pathways considered were the inhalation of resuspended soil, incidental ingestion of soil, external ground shine, and dermal contact. The potential doses were based on a thorough assessment of onsite worker exposures to radiologically contaminated soil, which was previously performed at SRS (Jannik 1995). In this assessment, the doses from inhalation, ingestion, and ground shine were determined using the RESRAD dosimetry code (Yu, et al. 1993). The doses from dermal contact were determined using standard EPA methods (EPA 1992).

For the sediment samples taken from the precooler pond areas and analyzed by EMS, ^{60}Co, ^{137}Cs, gross beta, gross alpha, and several naturally occurring radionuclides were detected. The numerical average was used for the radiation dose calculations (DOE 1991). Doses for various naturally occurring radionuclides were not calculated separately since they were contained in the gross alpha and gross beta determinations. Conservatively, the gross beta was assumed to be ^{90}Sr and the gross alpha was assumed to be ^{239}Pu.

The largest potential onsite worker dose was estimated to be 61 mrem/y and it occurred at Pond 5. This is less than the 100 mrem/y dose that would require radiation worker classification and the area to be posted as a Soil Contamination Area. Therefore, work on the sediments could proceed as a non-radiological job. The dose calculations assumed that a worker performs an average of light and moderate work activity at each pond, 8 h/d for 250 d/y.

Table 11. Dose Estimates for Precooler Pond Workers

Dose Estimates for Precooler Pond 2 Worker

Radionuclide	Radioactivity (Average) pCi/g	Dose[1] (mrem/y of exposure)
Co-60	0.62	2.94
Cs-137	17.5	19.1
Gross Beta[2]	87.2	0.29
Gross Alpha[3]	28.9	11.7
Total		**34.0**

Dose Estimates for Precooler Pond 4 Worker

Radionuclide	Radioactivity (Average) pCi/g	Dose[1] (mrem/y of exposure)
Co-60	0.16	0.76
Cs-137	24.6	26.9
Gross Beta[2]	162.8	0.54
Gross Alpha[3]	50.0	20.2
Total		**48.3**

Dose Estimates for Precooler Pond 5 Worker

Radionuclide	Radioactivity (Average) pCi/g	Dose[1] (mrem/y of exposure)
Co-60	0.14	0.66
Cs-137	40.4	44.1
Gross Beta[2]	172.5	0.57
Gross Alpha[3]	38.9	15.7
Total		**61.0**

[1]Committed effective dose equivalent
[2]Assumes all activity is ^{90}Sr
[3]Assumes all activity is ^{239}Pu

Summary

Radioisotope levels measured in the precooler pond sediment samples exceeded background levels for SRS soils. The highest average gross beta activity (172.5 pCi/g) occurred in Pond 5 sediments, whereas the maximum gross beta measurement occurred in a Pond 4 sample. The highest average gross alpha activity (50 pCi/g) was found in Pond 4 sediments. Pond 2 sediments had the lowest gross alpha and beta activities. The average ^{137}Cs level in sediments was highest in Pond 5 and lowest in Pond 2.

The radionuclide inventory of Ponds 2, 4, and 5 was found to be dominated by ^{137}Cs and also contained the man-made radionuclide ^{60}Co. The ^{60}Co and ^{137}Cs activities in all three precooler ponds studied exceeded human health risk screening levels. Therefore, exposure of the pond sediments would accelerate the CERCLA process and require near-term initiation of a work plan and the RCRA/CERCLA investigation process.

Because the ^{60}Co and ^{137}Cs human health screening criteria were exceeded, a dose assessment was performed to further assess the human health risks associated with drying of the sediments. Actual levels of activity found in the samples were used to calculate potential radiation doses to a person working in the precooler pond areas. The largest potential dose to a precooler pond worker was conservatively calculated to be 61 mrem/y, which was less than the 100 mrem/y dose that would require radiation worker classification and posting as a Soil Contamination Area. Therefore, work on the sediments could proceed as a non-radiological job. The potential dose calculated for Pond 5 was the largest, whereas the dose calculated for Pond 2 was the lowest.

The sediments also displayed evidence of lead and mercury contamination that exceeded background levels for SRS soils and exceeded ecological risk screening levels. These results indicate that further evaluations should be conducted if the sediments are to be exposed.

Although these contaminants are present in sediments, they are not necessarily harmful. Bioavailablity is a measure of how likely it is that the contaminants will actually affect living organisms. Many factors affect the bioavailability of contaminants. To assess the ecological risks posed by contaminated sediments/soils at a site, it is not enough to measure the types and amounts of pollutants present. If the sediments are to be exposed and a more terrestrial ecosystem is allowed to develop, then researchers will need to conduct field surveys to assess the health of the developing communities and the levels of contaminants found in the resident species.

Project planning should emphasize on soil stabilization, sediment control, wetland protection, and maintenance to ensure long term erosion control. The appropriate sediment/soil management option should be selected after careful consideration of the risks posed by the contaminants, the benefits of the remediation, and the costs. Contaminated sediments/soils may either be left in place or removed. Contaminated sediments/soils should not be removed from a site if doing so would cause more harm than simply leaving them in place. In some cases, leaving sediments/soils in place poses lower risks to the environment than removing them. If sediments/soils are left in place, however, measures must be taken to limit the danger they pose to people and wildlife. Long-term biological and chemical monitoring should be established to measure any change in contaminant levels over time and the associated biological response.

A comparison of the regulatory impacts of the various options concerning the future of the dams (repair, breach or no action) is presented in Appendix D.

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Appendix A: Metals Data

ANALYTICAL DATA

Data Quality Case Narrative

EMS and GEL maintains acceptance criteria for QC samples through the use of statistical process control (SPC). The SPC limits are used to qualify data usability.

EMS and GEL instruments were properly calibrated during analyses.

All samples were analyzed within the required holding time.

No target analytes were detected in the method blank above the required acceptance limit.

All analyte recoveries in the matrix spike were within required acceptance limits.

All analyte recoveries in the laboratory control sample were within the required acceptance limits.

There were no Nonconformance reports associated with this batch of analyses.

Analytical Data Table Nomenclature

Laboratory results are presented for each sample collected. For each sample in the laboratory analyses table, the following information is presented:

Location: Name of Pond where the sample was taken.

Sample Station: Sample station number. A standard sample and its associated field replicate or split sample would have identical sample station numbers except for a suffix letter. An "A" at the end of the number indicates a replicate sample. A "D" at the end of the number indicates a split sample.

Sample ID: Sample number used in the field. It corresponds to the page number in the red logbook.

Lab ID: Internal sample number used in the analytical laboratory.

Lab: Analytical laboratory performing the analysis.

Lab QC Code.: Qualifier indicating a special sample prepared in the laboratory:

1 Duplicate

2A

2B

Analyte: Parameter measured.

ssMDL (pCi/kg): Sample Specific Method Detection Limit. The detection limit is the minimum concentration of a substance that can be identified, measured, and reported with 99% confidence that the analyte concentration is above zero. It answers the question, "Is it present".

ssEQL (pCi/kg): Sample Specific Environmental Quantitation Limit. Defined as 10 times the ssMDL, it is the minimum analyte concentration that can be quantified and reported.

Result (µg/kg): Measured result of the analysis

% Solids: Percent solids in the sediment sample.

Analytical Data

Metals

Location	Sample Station	Sample ID	Lab ID	Lab	Lab QC Code	Analyte	ssMDL (µg/kg)	ssEQL (µg/kg)	Result[1] (µg/kg)	% Solids
Pond 2	P25-001-01	120722	20007730	EM		HGTOT	2.078	20.78	1016	38.9
Pond 2	P25-001-01	120722	20007730	EM		PBTOT	245.3	2453	44480	38.9
Pond 2	P25-002-01	120732	20007734	EM		HGTOT	3.316	33.16	423.5	26.2
Pond 2	P25-002-01	120732	20007734	EM		PBTOT	348.1	3481	45670	26.2
Pond 2	P25-002-01-D	120738	23003002	GEL		HGTOT	62.4	137	236	21
Pond 2	P25-002-01-D	120738	23003002	GEL		PBTOT	924	2330	42600	21
Pond 2	P25-003-01	120723	20007731	EM		HGTOT	1.77	17.7	906.5	45.8
Pond 2	P25-003-01	120723	QCAA56-DUP	EM	1	HGTOT	1.195	11.95	911.4	45.8
Pond 2	P25-003-01	120723	QCAA57-MS	EM	2A	HGTOT	1.727	17.27	2339	45.8
Pond 2	P25-003-01	120723	QCAA58-MSD	EM	2B	HGTOT	1.551	15.51	2192	45.8
Pond 2	P25-003-01	120723	20007731	EM		PBTOT	211.4	2114	37090	45.8
Pond 2	P25-003-01	120723	QCAA73-DUP	EM	1	PBTOT	199.7	1997	37530	45.8
Pond 2	P25-003-01	120723	QCAA74-MS	EM	2A	PBTOT	217	2170	134900	45.8
Pond 2	P25-003-01	120723	QCAA75-MSD	EM	2B	PBTOT	217.1	2171	141300	45.8
Pond 2	P25-004-01	120724	20007732	EM		HGTOT	2.916	29.16	775.3	27.2
Pond 2	P25-004-01	120724	20007732	EM		PBTOT	340.3	3403	55930	27.2
Pond 2	P25-005-01	120725	20007727	EM		HGTOT	2.417	24.17	1146	32.6
Pond 2	P25-005-01	120725	20007727	EM		PBTOT	299.5	2995	47500	32.6

Location	Sample Station	Sample ID	Lab ID	Lab	Lab QC Code	Analyte	ssMDL (µg/kg)	ssEQL (µg/kg)	Result[1] (µg/kg)	% Solids
Pond 2	P25-006-01	120726	20007728	EM		HGTOT	2.342	23.42	532	35.7
Pond 2	P25-006-01	120726	20007728	EM		PBTOT	269.5	2695	37960	35.7
Pond 2	P25-007-01	120727	20007729	EM		HGTOT	1.857	18.57	475	44.4
Pond 2	P25-007-01	120727	20007729	EM		PBTOT	218.1	2181	30470	44.4
Pond 2	P25-008-01	120728	20007724	EM		HGTOT	0.6926	6.926	7.906	71.3
Pond 2	P25-008-01	120728	20007724	EM		PBTOT	130.9	1309	2265	71.3
Pond 2	P25-009-01	120729	20007725	EM		HGTOT	1.166	11.66	31.42	70.5
Pond 2	P25-009-01	120729	20007725	EM		PBTOT	137.5	1375	5287	70.5
Pond 2	P25-010-01	120730	20007733	EM		HGTOT	3.322	33.22	639.6	26.8
Pond 2	P25-010-01	120730	20007733	EM		PBTOT	367	3670	57990	26.8
Pond 2	P25-010-01-A	120731	20007736	EM		HGTOT	2.219	22.19	1256	30.5
Pond 2	P25-010-01-A	120731	20007736	EM		PBTOT	309.2	3092	56990	30.5
Pond 2	P25-011-01	120736	20007739	EM		HGTOT	2.009	20.09	530.3	36.8
Pond 2	P25-011-01	120736	20007739	EM		PBTOT	263.4	2634	46460	36.8
Pond 2	P25-011-01-D	120737	1000034982	GEL	2A	HGTOT	35.5	78.0	1050	34
Pond 2	P25-011-01-D	120737	1000034983	GEL	2B	HGTOT	35	76.9	1020	34
Pond 2	P25-011-01-D	120737	23003001	GEL		HGTOT	34.1	75.0	240	34
Pond 2	P25-011-01-D	120737	23003001	GEL		PBTOT	558	1410	34400	34
Pond 2	P25-012-01	120733	20007737	EM		HGTOT	2.655	26.55	447	28.6
Pond 2	P25-012-01	120733	20007737	EM		PBTOT	337.5	3375	53080	28.6

Location	Sample Station	Sample ID	Lab ID	Lab	Lab QC Code	Analyte	ssMDL (µg/kg)	ssEQL (µg/kg)	Result[1] (µg/kg)	% Solids
Pond 2	P25-013-01	120734	20007735	EM		HGTOT	3.097	30.97	513.5	25.2
Pond 2	P25-013-01	120734	20007735	EM		PBTOT	378.2	3782	51390	25.2
Pond 2	P25-014-01	120735	20007738	EM		HGTOT	1.74	17.4	275.7	39.4
Pond 2	P25-014-01	120735	20007738	EM		PBTOT	235.6	2356	35030	39.4
Pond 2	P25-015-01	120739	20007726	EM		HGTOT	4.941	49.41	245.1	16.2
Pond 2	P25-015-01	120739	20007726	EM		PBTOT	589	5890	36900	16.2
Pond 2	P25-016-01	120740	20007721	EM		HGTOT	4.497	44.97	424.1	17.4
Pond 2	P25-016-01	120740	QCAA53-DUP	EM	1	HGTOT	4.657	46.57	420.5	17.4
Pond 2	P25-016-01	120740	QCAA54-MS	EM	2A	HGTOT	5.067	50.67	4383	17.4
Pond 2	P25-016-01	120740	QCAA55-MSD	EM	2B	HGTOT	4.683	46.83	4146	17.4
Pond 2	P25-016-01	120740	20007721	EM		PBTOT	559.7	5597	39680	17.4
Pond 2	P25-016-01	120740	QCAA70-DUP	EM	1	PBTOT	555.2	5552	40520	17.4
Pond 2	P25-016-01	120740	QCAA71-MS	EM	2A	PBTOT	567.2	5672	329700	17.4
Pond 2	P25-016-01	120740	QCAA72-MSD	EM	2B	PBTOT	547.2	5472	334300	17.4
Pond 2	P25-017-01	120741	20007722	EM		HGTOT	4.855	48.55	404.9	23.5
Pond 2	P25-017-01	120741	20007722	EM		PBTOT	413.4	4134	47170	23.5
Pond 2	P25-018-01	120742	20007723	EM		HGTOT	2.817	28.17	147.3	29.3
Pond 2	P25-018-01	120742	20007723	EM		PBTOT	320.7	3207	27760	29.3
Pond 2	P25-019-01	120743	20007741	EM		HGTOT	2.491	24.91	1081	44.8
Pond 2	P25-019-01	120743	QCAA60-DUP	EM	1	HGTOT	2.996	29.96	936.9	44.8

Location	Sample Station	Sample ID	Lab ID	Lab	Lab QC Code	Analyte	ssMDL (µg/kg)	ssEQL (µg/kg)	Result[1] (µg/kg)	% Solids
Pond 2	P25-019-01	120743	QCAA61-MS	EM	2A	HGTOT	2.261	22.61	2882	44.8
Pond 2	P25-019-01	120743	QCAA62-MSD	EM	2B	HGTOT	2.677	26.77	3231	44.8
Pond 2	P25-019-01	120743	20007741	EM		PBTOT	210.8	2108	43590	44.8
Pond 2	P25-019-01	120743	QCAA76-DUP	EM	1	PBTOT	204.9	2049	43190	44.8
Pond 2	P25-019-01	120743	QCAA77-MS	EM	2A	PBTOT	221.9	2219	154300	44.8
Pond 2	P25-019-01	120743	QCAA78-MSD	EM	2B	PBTOT	209.2	2092	148300	44.8
Pond 4	P25-020-01	120703	20007707	EM		HGTOT	9.792	97.92	1169	13.8
Pond 4	P25-020-01	120703	20007707	EM		PBTOT	679.8	6798	98120	13.8
Pond 4	P25-021-01	120704	20007710	EM		HGTOT	4.133	41.33	185.3	23.1
Pond 4	P25-021-01	120704	20007710	EM		PBTOT	407.2	4072	42780	23.1
Pond 4	P25-022-01	120705	20007708	EM		HGTOT	3.185	31.85	102.3	34.7
Pond 4	P25-022-01	120705	20007708	EM		PBTOT	264.7	2647	24920	34.7
Pond 4	P25-023-01	120718	20007718	EM		HGTOT	4.78	47.8	602.7	22
Pond 4	P25-023-01	120718	20007718	EM		PBTOT	417.4	4174	78600	22
Pond 4	P25-023-01-D	120719	22616002	GEL		HGTOT	58.5	129	582	26
Pond 4	P25-023-01-D	120719	22616002	GEL		PBTOT	737	1860	40500	26
Pond 4	P25-024-01	120706	20007705	EM		HGTOT	9.884	98.84	989.1	12.4
Pond 4	P25-024-01	120706	20007705	EM		PBTOT	765.8	7658	96910	12.4
Pond 4	P25-025-01	120721	20007703	EM		HGTOT	12.66	126.6	911.6	12.1
Pond 4	P25-025-01	120721	20007703	EM		PBTOT	775.1	7751	91370	12.1

Location	Sample Station	Sample ID	Lab ID	Lab	Lab QC Code	Analyte	ssMDL (µg/kg)	ssEQL (µg/kg)	Result[1] (µg/kg)	% Solids
Pond 4	P25-026-01	120708	20007706	EM		HGTOT	5.945	59.45	480	22.6
Pond 4	P25-026-01	120708	20007706	EM		PBTOT	414.9	4149	49560	22.6
Pond 4	P25-027-01	120709	20007711	EM		HGTOT	5.334	53.34	257.1	20.4
Pond 4	P25-027-01	120709	QCAA24-DUP	EM	1	HGTOT	6.738	67.38	202.7	20.4
Pond 4	P25-027-01	120709	QCAA25-MS	EM	2A	HGTOT	5.557	55.57	209.3	20.4
Pond 4	P25-027-01	120709	QCAA26-MSD	EM	2B	HGTOT	4.68	46.8	144.1	20.4
Pond 4	P25-027-01	120709	20007711	EM		PBTOT	460.1	4601	26540	20.4
Pond 4	P25-027-01	120709	QCAA37-DUP	EM	1	PBTOT	469.9	4699	25900	20.4
Pond 4	P25-027-01	120709	QCAA38-MS	EM	2A	PBTOT	474.7	4747	311000	20.4
Pond 4	P25-027-01	120709	QCAA39-MSD	EM	2B	PBTOT	468.1	4681	304500	20.4
Pond 4	P25-028-01	120710	20007709	EM		HGTOT	4.867	48.67	215.6	18.6
Pond 4	P25-028-01	120710	20007709	EM		PBTOT	504.8	5048	43890	18.6
Pond 4	P25-029-01	120711	20007712	EM		HGTOT	5.059	50.59	84.69	23.9
Pond 4	P25-029-01	120711	20007712	EM		PBTOT	407.3	4073	9396	23.9
Pond 4	P25-030-01	120715	20007714	EM		HGTOT	4.976	49.76	1265	22.6
Pond 4	P25-030-01	120715	20007714	EM		PBTOT	423.2	4232	68100	22.6
Pond 4	P25-030-01-A	120714	20007717	EM		HGTOT	3.988	39.88	285.7	24.2
Pond 4	P25-030-01-A	120714	20007717	EM		PBTOT	376.2	3762	54250	24.2
Pond 4	P25-031-01	120712	20007713	EM		HGTOT	4.555	45.55	324.6	27.3
Pond 4	P25-031-01	120712	20007713	EM		PBTOT	354.2	3542	25660	27.3

Location	Sample Station	Sample ID	Lab ID	Lab	Lab QC Code	Analyte	ssMDL (µg/kg)	ssEQL (µg/kg)	Result[1] (µg/kg)	% Solids
Pond 4	P25-031-01-D	120716	1000032119	GEL	2A	HGTOT	33.4	73.3	1030	43
Pond 4	P25-031-01-D	120716	1000032120	GEL	2B	HGTOT	33.6	73.8	1030	43
Pond 4	P25-031-01-D	120716	22616001	GEL		HGTOT	34.2	75.2	252	43
Pond 4	P25-031-01-D	120716	1000032152	GEL	2A	PBTOT	456	1150	73500	43
Pond 4	P25-031-01-D	120716	1000032153	GEL	2B	PBTOT	452	1140	76600	43
Pond 4	P25-031-01-D	120716	22616001	GEL		PBTOT	452	1140	12500	43
Pond 4	P25-032-01	120717	20007715	EM		HGTOT	4.02	40.2	153	33.6
Pond 4	P25-032-01	120717	20007715	EM		PBTOT	272.1	2721	24820	33.6
Pond 4	P25-033-01	120713	20007716	EM		HGTOT	4.401	44.01	567.9	26.4
Pond 4	P25-033-01	120713	20007716	EM		PBTOT	371.4	3714	36850	26.4
Pond 4	P25-034-01	120720	20007719	EM		HGTOT	4.856	48.56	131.7	29.8
Pond 4	P25-034-01	120720	20007719	EM		PBTOT	315.6	3156	41150	29.8
Pond 4	P25-035-01	120707	20007720	EM		HGTOT	4.75	47.5	1258	21.8
Pond 4	P25-035-01	120707	20007720	EM		PBTOT	456.2	4562	69640	21.8
Pond 4	P25-036-01	120702	20007702	EM		HGTOT	5.869	58.69	459.1	18.3
Pond 4	P25-036-01	120702	20007702	EM		PBTOT	529.2	5292	75560	18.3
Pond 4	P25-037-01	120700	20007701	EM		HGTOT	5.877	58.77	311	19.75
Pond 4	P25-037-01	120700	QCAA28-MS	EM	2A	HGTOT	4.363	43.63	2567	19.75
Pond 4	P25-037-01	120700	QCAA29-MSD	EM	2B	HGTOT	4.681	46.81	2677	19.75
Pond 4	P25-037-01	120700	20007701	EM		PBTOT	471.8	4718	30460	19.75

Location	Sample Station	Sample ID	Lab ID	Lab	Lab QC Code	Analyte	ssMDL (µg/kg)	ssEQL (µg/kg)	Result[1] (µg/kg)	% Solids
Pond 4	P25-037-01	120700	QCAA34-MS	EM	2A	PBTOT	464.5	4645	311900	19.75
Pond 4	P25-037-01	120700	QCAA35-MSD	EM	2B	PBTOT	476.2	4762	337100	19.75
Pond 4	P25-037-01	120700	QCAA36-DUP	EM	1	PBTOT	480.8	4808	46520	19.75
Pond 4	P25-038-01	120701	20007704	EM		HGTOT	6.734	67.34	1350	15
Pond 4	P25-038-01	120701	20007704	EM		PBTOT	617.4	6174	109000	15
Pond 2	P25-039-01	120744	20007740	EM		HGTOT	3.154	31.54	306	26.6
Pond 2	P25-039-01	120744	20007740	EM		PBTOT	364.8	3648	46920	26.6
Pond 2	P25-040-01	120745	20007742	EM		HGTOT	2.125	21.25	215.5	42.8
Pond 2	P25-040-01	120745	20007742	EM		PBTOT	223.5	2235	31600	42.8
Pond 2	P25-040-01-D	120746	23003003	GEL		HGTOT	32.2	70.7	175	36
Pond 2	P25-040-01-D	120746	23003003	GEL		PBTOT	517	1300	24900	36
Pond 5	P25-041-01	120747	20009101	EM		HGTOT	3.252	32.52	354.2	24.6
Pond 5	P25-041-01	120747	QCAA21-DUP	EM	1	HGTOT	3.252	32.52	400.2	24.6
Pond 5	P25-041-01	120747	QCAA22-MS	EM	2A	HGTOT	3.252	32.52	2117	24.6
Pond 5	P25-041-01	120747	QCAA23-MSD	EM	2B	HGTOT	3.252	32.52	1826	24.6
Pond 5	P25-041-01	120747	20009101	EM		PBTOT	382.7	3827	29050	24.6
Pond 5	P25-041-01	120747	QCAA15-DUP	EM	1	PBTOT	388.7	3887	28520	24.6
Pond 5	P25-041-01	120747	QCAA16-MS	EM	2A	PBTOT	375.4	3754	228200	24.6
Pond 5	P25-041-01	120747	QCAA17-MSD	EM	2B	PBTOT	371.9	3719	227800	24.6
Pond 5	P25-042-01	120748	20009102	EM		HGTOT	3.226	32.26	314.1	24.8

Location	Sample Station	Sample ID	Lab ID	Lab	Lab QC Code	Analyte	ssMDL (µg/kg)	ssEQL (µg/kg)	Result[1] (µg/kg)	% Solids
Pond 5	P25-042-01	120748	20009102	EM		PBTOT	368.4	3684	36380	24.8
Pond 5	P25-050-01	120749	20009103	EM		HGTOT	2.888	28.88	344.4	27.7
Pond 5	P25-050-01	120749	20009103	EM		PBTOT	343	3430	39470	27.7
Pond 5	P25-050-01-A	120750	20009104	EM		HGTOT	3.902	39.02	503.9	20.5
Pond 5	P25-050-01-A	120750	20009104	EM		PBTOT	483.5	4835	43000	20.5
Pond 5	P25-052-01	120751	20009105	EM		HGTOT	3.347	33.47	1038	23.9
Pond 5	P25-052-01	120751	20009105	EM		PBTOT	389.8	3898	55240	23.9
Pond 5	P25-052-01-D	120752	23592001	GEL		HGTOT	14.5	31.9	370	100
Pond 5	P25-052-01-D	120752	1000040463	GEL	2A	PBTOT	190	481	35700	100
Pond 5	P25-052-01-D	120752	1000040464	GEL	2B	PBTOT	192	485	38100	100
Pond 5	P25-052-01-D	120752	23592001	GEL		PBTOT	194	490	9750	100
Pond 5	P25-053-01	120753	20009106	EM		HGTOT	3.361	33.61	274.7	23.8
Pond 5	P25-053-01	120753	20009106	EM		PBTOT	390.9	3909	46790	23.8
Pond 5	P25-054-01	120754	20009107	EM		HGTOT	1.995	19.95	880.3	40.1
Pond 5	P25-054-01	120754	20009107	EM		PBTOT	234.1	2341	27830	40.1
Pond 5	P25-055-01	120755	20009108	EM		HGTOT	2.192	21.92	275.3	36.5
Pond 5	P25-055-01	120755	20009108	EM		PBTOT	253.8	2538	28210	36.5

[1] Results reported as dry weight

Appendix B: Radioanalytical Data

RADIOANALYTICAL DATA

Data Quality Case Narrative

EMS and GEL maintains acceptance criteria for QC samples through the use of statistical process control (SPC). The SPC limits are used to qualify data usability.

EMS and GEL instruments were properly calibrated during analyses.

All samples were analyzed within the required holding time.

No target analytes were detected in the method blank above the required acceptance limit.

All analyte recoveries in the matrix spike were within required acceptance limits.

All analyte recoveries in the laboratory control sample were within the required acceptance limits.

There were no Nonconformance reports associated with this batch of analyses.

Radioanalytical Data Table Nomenclature

Laboratory results are presented for each sample collected. For each sample in the laboratory analyses table, the following information is presented:

Location: Name of Pond where the sample was taken.

Sample Station: Sample station number. A standard sample and its associated field replicate or split sample would have identical sample station numbers except for a suffix letter. An "A" at the end of the number indicates a replicate sample. A "D" at the end of the number indicates a split sample.

Sample ID: Sample number used in the field. It corresponds to the page number in the red logbook.

Sample Date: Date the sample was collected.

Lab ID: Internal sample number used in the analytical laboratory.

Lab: Analytical laboratory performing the analysis.

Lab QC Code.: Qualifier indicating a sample analysis significance:

- -1 Analysis indeterminate
- 0, U Not measured
- 1 Measured

Analyte: Parameter measured in the sediment sample.

Result (pCi/g): Measured result of the sediment sample analysis.

Uncertainty (pCi/g): One standard deviation of the measured result in the sediment sample.

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 2	P25-001-01	120722	816596	3/9/00	EMS	1	AC228	1.41	0.19
Pond 2	P25-001-01	120722	816596	3/9/00	EMS	1	ALPHAG	19.70	4.31
Pond 2	P25-001-01	120722	816596	3/9/00	EMS	1	BETAG	66.10	4.87
Pond 2	P25-001-01	120722	816596	3/9/00	EMS	1	BI214	1.53	0.17
Pond 2	P25-001-01	120722	816596	3/9/00	EMS	0	CO60	0.08	0.04
Pond 2	P25-001-01	120722	816596	3/9/00	EMS	1	CS137	20.20	1.05
Pond 2	P25-001-01	120722	816596	3/9/00	EMS	1	K40	6.49	0.78
Pond 2	P25-001-01	120722	816596	3/9/00	EMS	1	PB212	0.97	0.16
Pond 2	P25-001-01	120722	816596	3/9/00	EMS	1	PB214	1.45	0.21
Pond 2	P25-001-01	120722	816596	3/9/00	EMS	1	RA226	7.79	1.90
Pond 2	P25-001-01	120722	816596	3/9/00	EMS	1	TL208	0.50	0.09
Pond 2	P25-002-01	120732	816618	3/9/00	EMS	1	ALPHAG	40.10	7.52
Pond 2	P25-002-01	120732	816618	3/9/00	EMS	1	BETAG	100.00	6.82
Pond 2	P25-002-01	120732	816618	3/9/00	EMS	1	BI214	2.89	0.24
Pond 2	P25-002-01	120732	816618	3/9/00	EMS	1	CO60	0.51	0.05
Pond 2	P25-002-01	120732	816618	3/9/00	EMS	1	CS137	16.60	0.91
Pond 2	P25-002-01	120732	816618	3/9/00	EMS	1	K40	6.74	1.11
Pond 2	P25-002-01	120732	816618	3/9/00	EMS	1	PB212	1.74	0.18
Pond 2	P25-002-01	120732	816618	3/9/00	EMS	1	PB214	2.83	0.27
Pond 2	P25-002-01	120732	816618	3/9/00	EMS	1	RA224	6.43	2.18
Pond 2	P25-002-01	120732	816618	3/9/00	EMS	1	RA226	6.47	1.92

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 2	P25-002-01	120732	816618	3/9/00	EMS	1	TL208	0.40	0.10
Pond 2	P25-002-01-D	120738	23003002	3/9/00	GP		AC228	1.62	0.39
Pond 2	P25-002-01-D	120738	23003002	3/9/00	GP		ALPHAG	33.80	6.32
Pond 2	P25-002-01-D	120738	23003002	3/9/00	GP	U	BA133	-0.03	0.09
Pond 2	P25-002-01-D	120738	23003002	3/9/00	GP		BETAG	40.50	4.37
Pond 2	P25-002-01-D	120738	23003002	3/9/00	GP		CO60	0.67	0.12
Pond 2	P25-002-01-D	120738	23003002	3/9/00	GP	U	CS134	0.06	0.06
Pond 2	P25-002-01-D	120738	23003002	3/9/00	GP		CS137	24.50	2.56
Pond 2	P25-002-01-D	120738	23003002	3/9/00	GP	U	EU152	-0.17	0.18
Pond 2	P25-002-01-D	120738	23003002	3/9/00	GP	U	EU154	0.09	0.13
Pond 2	P25-002-01-D	120738	23003002	3/9/00	GP	U	EU155	0.11	0.14
Pond 2	P25-002-01-D	120738	23003002	3/9/00	GP		K40	10.70	1.59
Pond 2	P25-002-01-D	120738	23003002	3/9/00	GP		PB212	1.81	0.23
Pond 2	P25-002-01-D	120738	23003002	3/9/00	GP	U	PM144	-0.01	0.04
Pond 2	P25-002-01-D	120738	23003002	3/9/00	GP	U	PM146	0.07	0.12
Pond 2	P25-002-01-D	120738	23003002	3/9/00	GP	U	SB125	0.07	0.20
Pond 2	P25-003-01	120723	816597	3/9/00	EMS	1	ALPHAG	16.80	3.53
Pond 2	P25-003-01	120723	816597	3/9/00	EMS	1	BETAG	46.70	3.78
Pond 2	P25-003-01	120723	816597	3/9/00	EMS	1	BI214	1.51	0.09
Pond 2	P25-003-01	120723	816597	3/9/00	EMS	0	CO60	0.16	0.03
Pond 2	P25-003-01	120723	816597	3/9/00	EMS	1	CS137	15.60	0.58

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 2	P25-003-01	120723	816597	3/9/00	EMS	1	K40	5.95	0.49
Pond 2	P25-003-01	120723	816597	3/9/00	EMS	1	PB212	1.02	0.09
Pond 2	P25-003-01	120723	816597	3/9/00	EMS	1	PB214	1.51	0.12
Pond 2	P25-003-01	120723	816597	3/9/00	EMS	1	RA226	4.36	1.50
Pond 2	P25-003-01	120723	816597	3/9/00	EMS	1	TL208	0.35	0.05
Pond 2	P25-004-01	120724	816598	3/9/00	EMS	1	AC228	1.78	0.17
Pond 2	P25-004-01	120724	816598	3/9/00	EMS	1	ALPHAG	68.00	6.65
Pond 2	P25-004-01	120724	816598	3/9/00	EMS	1	BETAG	109.00	5.44
Pond 2	P25-004-01	120724	816598	3/9/00	EMS	1	BI214	2.14	0.15
Pond 2	P25-004-01	120724	816598	3/9/00	EMS	1	CO60	0.41	0.04
Pond 2	P25-004-01	120724	816598	3/9/00	EMS	1	CS137	21.20	0.80
Pond 2	P25-004-01	120724	816598	3/9/00	EMS	1	K40	8.01	0.75
Pond 2	P25-004-01	120724	816598	3/9/00	EMS	1	PB212	1.31	0.11
Pond 2	P25-004-01	120724	816598	3/9/00	EMS	1	PB214	2.06	0.16
Pond 2	P25-004-01	120724	816598	3/9/00	EMS	1	RA226	9.93	2.76
Pond 2	P25-004-01	120724	816598	3/9/00	EMS	1	TL208	0.44	0.07
Pond 2	P25-005-01	120725	816593	3/9/00	EMS	1	ALPHAG	34.70	6.18
Pond 2	P25-005-01	120725	816593	3/9/00	EMS	1	BETAG	111.00	6.61
Pond 2	P25-005-01	120725	816593	3/9/00	EMS	1	BI212	1.15	0.32
Pond 2	P25-005-01	120725	816593	3/9/00	EMS	1	BI214	1.73	0.18
Pond 2	P25-005-01	120725	816593	3/9/00	EMS	0	CO60	0.22	0.05

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 2	P25-005-01	120725	816593	3/9/00	EMS	1	CS137	19.60	1.05
Pond 2	P25-005-01	120725	816593	3/9/00	EMS	1	K40	5.95	0.86
Pond 2	P25-005-01	120725	816593	3/9/00	EMS	1	PB212	0.73	0.18
Pond 2	P25-005-01	120725	816593	3/9/00	EMS	1	PB214	1.81	0.21
Pond 2	P25-005-01	120725	816593	3/9/00	EMS	1	TL208	0.42	0.10
Pond 2	P25-006-01	120726	816594	3/9/00	EMS	1	ALPHAG	27.10	5.22
Pond 2	P25-006-01	120726	816594	3/9/00	EMS	1	BETAG	76.90	5.44
Pond 2	P25-006-01	120726	816594	3/9/00	EMS	1	BI214	2.25	0.17
Pond 2	P25-006-01	120726	816594	3/9/00	EMS	1	CO60	0.62	0.06
Pond 2	P25-006-01	120726	816594	3/9/00	EMS	1	CS137	19.60	1.02
Pond 2	P25-006-01	120726	816594	3/9/00	EMS	1	K40	7.45	0.86
Pond 2	P25-006-01	120726	816594	3/9/00	EMS	1	PB212	1.37	0.15
Pond 2	P25-006-01	120726	816594	3/9/00	EMS	1	PB214	2.28	0.21
Pond 2	P25-006-01	120726	816594	3/9/00	EMS	1	TL208	0.70	0.10
Pond 2	P25-007-01	120727	816595	3/9/00	EMS	1	ALPHAG	12.40	3.16
Pond 2	P25-007-01	120727	816595	3/9/00	EMS	1	BETAG	43.40	3.79
Pond 2	P25-007-01	120727	816595	3/9/00	EMS	1	BI214	1.33	0.14
Pond 2	P25-007-01	120727	816595	3/9/00	EMS	1	CO60	3.53	0.16
Pond 2	P25-007-01	120727	816595	3/9/00	EMS	1	CS137	10.20	0.55
Pond 2	P25-007-01	120727	816595	3/9/00	EMS	1	K40	4.25	0.71
Pond 2	P25-007-01	120727	816595	3/9/00	EMS	1	PB212	0.96	0.10

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 2	P25-007-01	120727	816595	3/9/00	EMS	1	PB214	1.39	0.15
Pond 2	P25-007-01	120727	816595	3/9/00	EMS	1	RA226	4.03	1.47
Pond 2	P25-007-01	120727	816595	3/9/00	EMS	1	TL208	0.27	0.08
Pond 2	P25-008-01	120728	816590	3/9/00	EMS	1	AC228	0.31	0.05
Pond 2	P25-008-01	120728	816590	3/9/00	EMS	0	ALPHAG	-0.01	0.43
Pond 2	P25-008-01	120728	816590	3/9/00	EMS	0	BETAG	2.12	0.87
Pond 2	P25-008-01	120728	816590	3/9/00	EMS	1	BI214	0.32	0.04
Pond 2	P25-008-01	120728	816590	3/9/00	EMS	0	CO60	0.02	0.01
Pond 2	P25-008-01	120728	816590	3/9/00	EMS	1	CS137	0.95	0.06
Pond 2	P25-008-01	120728	816590	3/9/00	EMS	1	K40	0.75	0.22
Pond 2	P25-008-01	120728	816590	3/9/00	EMS	1	PB212	0.23	0.03
Pond 2	P25-008-01	120728	816590	3/9/00	EMS	1	PB214	0.35	0.05
Pond 2	P25-008-01	120728	816590	3/9/00	EMS	1	TH234	0.80	0.26
Pond 2	P25-009-01	120729	816591	3/9/00	EMS	1	ALPHAG	2.28	1.03
Pond 2	P25-009-01	120729	816591	3/9/00	EMS	0	BETAG	3.85	1.38
Pond 2	P25-009-01	120729	816591	3/9/00	EMS	1	BI214	0.58	0.06
Pond 2	P25-009-01	120729	816591	3/9/00	EMS	1	CO60	0.06	0.02
Pond 2	P25-009-01	120729	816591	3/9/00	EMS	1	CS137	2.46	0.14
Pond 2	P25-009-01	120729	816591	3/9/00	EMS	1	K40	1.09	0.25
Pond 2	P25-009-01	120729	816591	3/9/00	EMS	1	PB212	0.34	0.05
Pond 2	P25-009-01	120729	816591	3/9/00	EMS	1	PB214	0.55	0.06

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 2	P25-009-01	120729	816591	3/9/00	EMS	1	TL208	0.15	0.03
Pond 2	P25-010-01	120730	816617	3/9/00	EMS	1	ALPHAG	38.30	7.39
Pond 2	P25-010-01	120730	816617	3/9/00	EMS	1	BETAG	125.00	7.39
Pond 2	P25-010-01	120730	816617	3/9/00	EMS	1	BI214	2.01	0.19
Pond 2	P25-010-01	120730	816617	3/9/00	EMS	1	CO60	0.22	0.05
Pond 2	P25-010-01	120730	816617	3/9/00	EMS	1	CS137	20.10	1.06
Pond 2	P25-010-01	120730	816617	3/9/00	EMS	1	K40	5.68	0.83
Pond 2	P25-010-01	120730	816617	3/9/00	EMS	1	PB212	0.91	0.17
Pond 2	P25-010-01	120730	816617	3/9/00	EMS	1	PB214	1.97	0.22
Pond 2	P25-010-01	120730	816617	3/9/00	EMS	1	TL208	0.34	0.12
Pond 2	P25-010-01-A	120731	816620	3/9/00	EMS	1	AC228	1.93	0.26
Pond 2	P25-010-01-A	120731	816620	3/9/00	EMS	1	ALPHAG	47.30	7.32
Pond 2	P25-010-01-A	120731	816620	3/9/00	EMS	1	BETAG	108.00	6.48
Pond 2	P25-010-01-A	120731	816620	3/9/00	EMS	1	BI214	2.53	0.23
Pond 2	P25-010-01-A	120731	816620	3/9/00	EMS	1	CO60	0.19	0.04
Pond 2	P25-010-01-A	120731	816620	3/9/00	EMS	1	CS137	33.70	1.76
Pond 2	P25-010-01-A	120731	816620	3/9/00	EMS	1	K40	8.19	1.04
Pond 2	P25-010-01-A	120731	816620	3/9/00	EMS	1	PB212	1.65	0.17
Pond 2	P25-010-01-A	120731	816620	3/9/00	EMS	1	PB214	3.01	0.25
Pond 2	P25-010-01-A	120731	816620	3/9/00	EMS	1	RA226	6.37	2.15
Pond 2	P25-010-01-A	120731	816620	3/9/00	EMS	1	TL208	0.80	0.12

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 2	P25-011-01	120736	816623	3/9/00	EMS	1	AC228	0.98	0.16
Pond 2	P25-011-01	120736	816623	3/9/00	EMS	1	ALPHAG	15.30	3.76
Pond 2	P25-011-01	120736	816623	3/9/00	EMS	1	BETAG	58.70	4.42
Pond 2	P25-011-01	120736	816623	3/9/00	EMS	1	CO60	0.22	0.04
Pond 2	P25-011-01	120736	816623	3/9/00	EMS	1	CS137	15.30	0.82
Pond 2	P25-011-01	120736	816623	3/9/00	EMS	1	K40	4.97	0.76
Pond 2	P25-011-01	120736	816623	3/9/00	EMS	1	PB212	0.83	0.11
Pond 2	P25-011-01	120736	816623	3/9/00	EMS	1	PB214	1.35	0.17
Pond 2	P25-011-01	120736	816623	3/9/00	EMS	1	TL208	0.31	0.07
Pond 2	P25-011-01-D	120737	23003001	3/9/00	GP		AC228	1.50	0.22
Pond 2	P25-011-01-D	120737	1000036845	3/9/00	GP		AC228	1.72	0.34
Pond 2	P25-011-01-D	120737	23003001	3/9/00	GP		ALPHAG	22.70	6.05
Pond 2	P25-011-01-D	120737	23003001	3/9/00	GP	U	BA133	-0.01	0.08
Pond 2	P25-011-01-D	120737	1000036845	3/9/00	GP	U	BA133	0.01	0.09
Pond 2	P25-011-01-D	120737	23003001	3/9/00	GP		BETAG	46.90	5.94
Pond 2	P25-011-01-D	120737	23003001	3/9/00	GP		CO60	0.19	0.06
Pond 2	P25-011-01-D	120737	1000036845	3/9/00	GP		CO60	0.20	0.06
Pond 2	P25-011-01-D	120737	23003001	3/9/00	GP	U	CS134	-0.08	0.04
Pond 2	P25-011-01-D	120737	1000036845	3/9/00	GP	U	CS134	0.01	0.05
Pond 2	P25-011-01-D	120737	23003001	3/9/00	GP		CS137	40.90	0.41
Pond 2	P25-011-01-D	120737	1000036845	3/9/00	GP		CS137	41.20	4.74

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 2	P25-011-01-D	120737	23003001	3/9/00	GP	U	EU152	-0.07	0.16
Pond 2	P25-011-01-D	120737	1000036845	3/9/00	GP	U	EU152	0.01	0.17
Pond 2	P25-011-01-D	120737	23003001	3/9/00	GP	U	EU154	0.02	0.09
Pond 2	P25-011-01-D	120737	1000036845	3/9/00	GP	U	EU154	0.00	0.08
Pond 2	P25-011-01-D	120737	23003001	3/9/00	GP	U	EU155	0.12	0.13
Pond 2	P25-011-01-D	120737	1000036845	3/9/00	GP	U	EU155	0.04	0.12
Pond 2	P25-011-01-D	120737	23003001	3/9/00	GP		K40	10.60	0.98
Pond 2	P25-011-01-D	120737	1000036845	3/9/00	GP		K40	9.98	1.34
Pond 2	P25-011-01-D	120737	23003001	3/9/00	GP		PB212	1.57	0.13
Pond 2	P25-011-01-D	120737	1000036845	3/9/00	GP		PB212	1.49	0.18
Pond 2	P25-011-01-D	120737	23003001	3/9/00	GP	U	PM144	0.00	0.04
Pond 2	P25-011-01-D	120737	1000036845	3/9/00	GP	U	PM144	0.02	0.02
Pond 2	P25-011-01-D	120737	23003001	3/9/00	GP	U	PM146	0.02	0.10
Pond 2	P25-011-01-D	120737	1000036845	3/9/00	GP	U	PM146	0.01	0.10
Pond 2	P25-011-01-D	120737	23003001	3/9/00	GP	U	SB125	0.09	0.22
Pond 2	P25-011-01-D	120737	1000036845	3/9/00	GP	U	SB125	0.07	0.19
Pond 2	P25-012-01	120733	816621	3/9/00	EMS	1	ALPHAG	39.20	6.92
Pond 2	P25-012-01	120733	816621	3/9/00	EMS	1	BETAG	88.10	6.11
Pond 2	P25-012-01	120733	816621	3/9/00	EMS	1	BI214	2.36	0.21
Pond 2	P25-012-01	120733	816621	3/9/00	EMS	1	CO60	0.40	0.06
Pond 2	P25-012-01	120733	816621	3/9/00	EMS	1	CS137	18.30	0.98

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 2	P25-012-01	120733	816621	3/9/00	EMS	1	K40	5.77	1.07
Pond 2	P25-012-01	120733	816621	3/9/00	EMS	1	PB212	1.27	0.15
Pond 2	P25-012-01	120733	816621	3/9/00	EMS	1	PB214	2.40	0.23
Pond 2	P25-012-01	120733	816621	3/9/00	EMS	1	TL208	0.33	0.10
Pond 2	P25-013-01	120734	816619	3/9/00	EMS	1	ALPHAG	34.10	7.08
Pond 2	P25-013-01	120734	816619	3/9/00	EMS	1	BETAG	96.50	6.82
Pond 2	P25-013-01	120734	816619	3/9/00	EMS	1	BI214	2.66	0.26
Pond 2	P25-013-01	120734	816619	3/9/00	EMS	1	CO60	0.41	0.06
Pond 2	P25-013-01	120734	816619	3/9/00	EMS	1	CS137	21.10	1.11
Pond 2	P25-013-01	120734	816619	3/9/00	EMS	1	K40	8.07	1.16
Pond 2	P25-013-01	120734	816619	3/9/00	EMS	1	PB212	1.68	0.20
Pond 2	P25-013-01	120734	816619	3/9/00	EMS	1	PB214	2.97	0.29
Pond 2	P25-013-01	120734	816619	3/9/00	EMS	1	RA226	10.20	2.86
Pond 2	P25-013-01	120734	816619	3/9/00	EMS	1	TL208	0.56	0.13
Pond 2	P25-014-01	120735	816622	3/9/00	EMS	1	AC228	0.97	0.16
Pond 2	P25-014-01	120735	816622	3/9/00	EMS	1	ALPHAG	15.80	3.54
Pond 2	P25-014-01	120735	816622	3/9/00	EMS	1	BETAG	48.60	3.84
Pond 2	P25-014-01	120735	816622	3/9/00	EMS	1	BI214	1.49	0.15
Pond 2	P25-014-01	120735	816622	3/9/00	EMS	1	CO60	0.26	0.05
Pond 2	P25-014-01	120735	816622	3/9/00	EMS	1	CS137	9.26	0.51
Pond 2	P25-014-01	120735	816622	3/9/00	EMS	1	K40	3.82	0.58

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 2	P25-014-01	120735	816622	3/9/00	EMS	1	PB212	0.94	0.10
Pond 2	P25-014-01	120735	816622	3/9/00	EMS	1	PB214	1.66	0.15
Pond 2	P25-014-01	120735	816622	3/9/00	EMS	1	TL208	0.51	0.08
Pond 2	P25-015-01	120739	816592	3/9/00	EMS	1	ALPHAG	27.80	7.60
Pond 2	P25-015-01	120739	816592	3/9/00	EMS	1	BETAG	158.00	11.40
Pond 2	P25-015-01	120739	816592	3/9/00	EMS	1	BI214	1.86	0.31
Pond 2	P25-015-01	120739	816592	3/9/00	EMS	0	CO60	0.00	0.07
Pond 2	P25-015-01	120739	816592	3/9/00	EMS	1	CS137	30.70	1.66
Pond 2	P25-015-01	120739	816592	3/9/00	EMS	0	K40	3.34	1.42
Pond 2	P25-015-01	120739	816592	3/9/00	EMS	1	PB212	1.53	0.29
Pond 2	P25-015-01	120739	816592	3/9/00	EMS	1	PB214	1.66	0.36
Pond 2	P25-016-01	120740	816587	3/9/00	EMS	1	AC228	4.48	0.48
Pond 2	P25-016-01	120740	816587	3/9/00	EMS	1	ALPHAG	52.70	9.80
Pond 2	P25-016-01	120740	816587	3/9/00	EMS	1	BETAG	223.00	12.80
Pond 2	P25-016-01	120740	816587	3/9/00	EMS	1	BI212	5.19	0.91
Pond 2	P25-016-01	120740	816587	3/9/00	EMS	1	BI214	4.87	0.38
Pond 2	P25-016-01	120740	816587	3/9/00	EMS	0	CO60	0.04	0.07
Pond 2	P25-016-01	120740	816587	3/9/00	EMS	1	CS137	29.30	1.56
Pond 2	P25-016-01	120740	816587	3/9/00	EMS	1	K40	5.60	1.37
Pond 2	P25-016-01	120740	816587	3/9/00	EMS	1	PB212	3.46	0.35
Pond 2	P25-016-01	120740	816587	3/9/00	EMS	1	PB214	4.53	0.46

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 2	P25-016-01	120740	816587	3/9/00	EMS	1	TL208	1.41	0.21
Pond 2	P25-017-01	120741	816588	3/9/00	EMS	1	ALPHAG	31.00	6.50
Pond 2	P25-017-01	120741	816588	3/9/00	EMS	1	BETAG	93.10	7.35
Pond 2	P25-017-01	120741	816588	3/9/00	EMS	1	BI214	1.32	0.14
Pond 2	P25-017-01	120741	816588	3/9/00	EMS	0	CO60	-0.05	0.03
Pond 2	P25-017-01	120741	816588	3/9/00	EMS	1	CS137	13.40	0.52
Pond 2	P25-017-01	120741	816588	3/9/00	EMS	0	K40	1.03	0.50
Pond 2	P25-017-01	120741	816588	3/9/00	EMS	1	PB212	0.87	0.11
Pond 2	P25-017-01	120741	816588	3/9/00	EMS	1	PB214	1.26	0.16
Pond 2	P25-017-01	120741	816588	3/9/00	EMS	1	TL208	0.41	0.08
Pond 2	P25-018-01	120742	816589	3/9/00	EMS	1	ALPHAG	5.72	2.67
Pond 2	P25-018-01	120742	816589	3/9/00	EMS	1	BETAG	27.70	4.09
Pond 2	P25-018-01	120742	816589	3/9/00	EMS	0	CO60	0.11	0.04
Pond 2	P25-018-01	120742	816589	3/9/00	EMS	1	CS137	16.00	0.86
Pond 2	P25-018-01	120742	816589	3/9/00	EMS	0	K40	1.62	0.60
Pond 2	P25-018-01	120742	816589	3/9/00	EMS	1	PB212	1.06	0.16
Pond 2	P25-018-01	120742	816589	3/9/00	EMS	1	PB214	0.92	0.20
Pond 2	P25-019-01	120743	816626	3/9/00	EMS	1	ALPHAG	16.70	3.46
Pond 2	P25-019-01	120743	816626	3/9/00	EMS	1	BETAG	45.60	3.69
Pond 2	P25-019-01	120743	816626	3/9/00	EMS	1	BI214	2.75	0.19
Pond 2	P25-019-01	120743	816626	3/9/00	EMS	1	CO60	0.90	0.07

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 2	P25-019-01	120743	816626	3/9/00	EMS	1	CS137	33.10	1.69
Pond 2	P25-019-01	120743	816626	3/9/00	EMS	1	K40	11.80	1.10
Pond 2	P25-019-01	120743	816626	3/9/00	EMS	1	PB212	1.59	0.17
Pond 2	P25-019-01	120743	816626	3/9/00	EMS	1	PB214	2.72	0.23
Pond 2	P25-019-01	120743	816626	3/9/00	EMS	1	RA226	10.20	2.71
Pond 2	P25-019-01	120743	816626	3/9/00	EMS	1	TL208	0.71	0.09
Pond 4	P25-020-01	120703	816569	3/2/00	EMS	1	ALPHAG	58.40	8.26
Pond 4	P25-020-01	120703	816569	3/2/00	EMS	1	BETAG	154.00	8.49
Pond 4	P25-020-01	120703	816569	3/2/00	EMS	1	BI214	1.82	0.20
Pond 4	P25-020-01	120703	816569	3/2/00	EMS	0	CO60	0.09	0.05
Pond 4	P25-020-01	120703	816569	3/2/00	EMS	1	CS137	31.00	1.61
Pond 4	P25-020-01	120703	816569	3/2/00	EMS	1	K40	6.77	1.03
Pond 4	P25-020-01	120703	816569	3/2/00	EMS	1	PB212	1.13	0.20
Pond 4	P25-020-01	120703	816569	3/2/00	EMS	1	PB214	1.91	0.25
Pond 4	P25-020-01	120703	816569	3/2/00	EMS	1	RA226	8.17	2.49
Pond 4	P25-020-01	120703	816569	3/2/00	EMS	1	TL208	0.57	0.11
Pond 4	P25-021-01	120704	816572	3/2/00	EMS	1	ALPHAG	68.60	11.20
Pond 4	P25-021-01	120704	816572	3/2/00	EMS	1	BETAG	200.00	11.90
Pond 4	P25-021-01	120704	816572	3/2/00	EMS	1	BI214	2.14	0.31
Pond 4	P25-021-01	120704	816572	3/2/00	EMS	0	CO60	0.40	0.09
Pond 4	P25-021-01	120704	816572	3/2/00	EMS	1	CS137	25.90	1.38

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 4	P25-021-01	120704	816572	3/2/00	EMS	1	K40	5.49	1.39
Pond 4	P25-021-01	120704	816572	3/2/00	EMS	1	PB212	1.15	0.24
Pond 4	P25-021-01	120704	816572	3/2/00	EMS	1	PB214	2.47	0.29
Pond 4	P25-021-01	120704	816572	3/2/00	EMS	1	RA226	11.70	3.93
Pond 4	P25-021-01	120704	816572	3/2/00	EMS	1	TL208	0.53	0.15
Pond 4	P25-022-01	120705	816570	3/2/00	EMS	1	AC228	1.53	0.12
Pond 4	P25-022-01	120705	816570	3/2/00	EMS	1	ALPHAG	9.42	1.62
Pond 4	P25-022-01	120705	816570	3/2/00	EMS	1	BETAG	27.50	1.97
Pond 4	P25-022-01	120705	816570	3/2/00	EMS	1	BI212	1.64	0.26
Pond 4	P25-022-01	120705	816570	3/2/00	EMS	1	BI214	1.45	0.09
Pond 4	P25-022-01	120705	816570	3/2/00	EMS	-1	CO60	0.13	0.02
Pond 4	P25-022-01	120705	816570	3/2/00	EMS	1	CS137	9.60	0.37
Pond 4	P25-022-01	120705	816570	3/2/00	EMS	1	K40	2.01	0.37
Pond 4	P25-022-01	120705	816570	3/2/00	EMS	1	PB212	1.43	0.09
Pond 4	P25-022-01	120705	816570	3/2/00	EMS	1	PB214	1.38	0.11
Pond 4	P25-022-01	120705	816570	3/2/00	EMS	1	RA226	4.55	1.32
Pond 4	P25-022-01	120705	816570	3/2/00	EMS	1	TL208	0.65	0.06
Pond 4	P25-023-01	120718	816580	3/2/00	EMS	1	ALPHAG	29.30	5.98
Pond 4	P25-023-01	120718	816580	3/2/00	EMS	1	BETAG	123.00	7.12
Pond 4	P25-023-01	120718	816580	3/2/00	EMS	1	BI212	1.40	0.51
Pond 4	P25-023-01	120718	816580	3/2/00	EMS	1	BI214	1.56	0.21

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 4	P25-023-01	120718	816580	3/2/00	EMS	0	CO60	0.10	0.05
Pond 4	P25-023-01	120718	816580	3/2/00	EMS	1	CS137	32.10	1.66
Pond 4	P25-023-01	120718	816580	3/2/00	EMS	1	K40	5.64	0.88
Pond 4	P25-023-01	120718	816580	3/2/00	EMS	1	PB212	1.59	0.18
Pond 4	P25-023-01	120718	816580	3/2/00	EMS	1	PB214	1.88	0.23
Pond 4	P25-023-01	120718	816580	3/2/00	EMS	1	TL208	0.54	0.11
Pond 4	P25-023-01-D	120719	22616002	3/2/00	GP		AC228	1.79	0.26
Pond 4	P25-023-01-D	120719	22616002	3/2/00	GP		ALPHAG	22.70	4.87
Pond 4	P25-023-01-D	120719	22616002	3/2/00	GP	U	BA133	0.01	0.04
Pond 4	P25-023-01-D	120719	22616002	3/2/00	GP		BETAG	43.90	4.85
Pond 4	P25-023-01-D	120719	22616002	3/2/00	GP		CO60	0.12	0.03
Pond 4	P25-023-01-D	120719	22616002	3/2/00	GP		CS134	0.16	0.03
Pond 4	P25-023-01-D	120719	22616002	3/2/00	GP		CS137	35.50	4.74
Pond 4	P25-023-01-D	120719	22616002	3/2/00	GP	U	EU152	-0.09	0.07
Pond 4	P25-023-01-D	120719	22616002	3/2/00	GP	U	EU154	0.04	0.05
Pond 4	P25-023-01-D	120719	22616002	3/2/00	GP	U	EU155	0.06	0.07
Pond 4	P25-023-01-D	120719	22616002	3/2/00	GP		K40	7.88	0.98
Pond 4	P25-023-01-D	120719	22616002	3/2/00	GP		PB212	1.99	0.20
Pond 4	P25-023-01-D	120719	22616002	3/2/00	GP	U	PM144	0.00	0.01
Pond 4	P25-023-01-D	120719	22616002	3/2/00	GP	U	PM146	0.04	0.04
Pond 4	P25-023-01-D	120719	22616002	3/2/00	GP	U	SB125	0.01	0.08

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 4	P25-024-01	120706	816567	3/2/00	EMS	1	AC228	1.59	0.24
Pond 4	P25-024-01	120706	816567	3/2/00	EMS	1	ALPHAG	39.00	6.86
Pond 4	P25-024-01	120706	816567	3/2/00	EMS	1	BETAG	138.00	7.72
Pond 4	P25-024-01	120706	816567	3/2/00	EMS	1	BI212	1.86	0.53
Pond 4	P25-024-01	120706	816567	3/2/00	EMS	1	BI214	1.69	0.13
Pond 4	P25-024-01	120706	816567	3/2/00	EMS	0	CO60	0.06	0.03
Pond 4	P25-024-01	120706	816567	3/2/00	EMS	1	CS137	30.00	1.12
Pond 4	P25-024-01	120706	816567	3/2/00	EMS	1	K40	4.97	0.59
Pond 4	P25-024-01	120706	816567	3/2/00	EMS	1	PB212	1.20	0.12
Pond 4	P25-024-01	120706	816567	3/2/00	EMS	1	PB214	1.64	0.17
Pond 4	P25-024-01	120706	816567	3/2/00	EMS	1	TL208	0.50	0.08
Pond 4	P25-025-01	120707	816565	3/2/00	EMS	1	ALPHAG	49.00	7.71
Pond 4	P25-025-01	120707	816565	3/2/00	EMS	1	BETAG	162.00	8.32
Pond 4	P25-025-01	120707	816565	3/2/00	EMS	1	BI214	1.45	0.18
Pond 4	P25-025-01	120707	816565	3/2/00	EMS	0	CO60	0.15	0.04
Pond 4	P25-025-01	120707	816565	3/2/00	EMS	1	CS137	25.40	1.34
Pond 4	P25-025-01	120707	816565	3/2/00	EMS	1	K40	2.13	0.79
Pond 4	P25-025-01	120707	816565	3/2/00	EMS	1	PB212	1.04	0.19
Pond 4	P25-025-01	120707	816565	3/2/00	EMS	1	PB214	1.50	0.23
Pond 4	P25-025-01	120707	816565	3/2/00	EMS	1	TL208	0.48	0.13
Pond 4	P25-026-01	120708	816568	3/2/00	EMS	1	ALPHAG	80.90	11.20

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 4	P25-026-01	120708	816568	3/2/00	EMS	1	BETAG	211.00	10.80
Pond 4	P25-026-01	120708	816568	3/2/00	EMS	1	BI214	1.59	0.26
Pond 4	P25-026-01	120708	816568	3/2/00	EMS	0	CO60	0.08	0.06
Pond 4	P25-026-01	120708	816568	3/2/00	EMS	1	CS137	33.00	1.74
Pond 4	P25-026-01	120708	816568	3/2/00	EMS	1	K40	6.05	0.99
Pond 4	P25-026-01	120708	816568	3/2/00	EMS	1	PB212	1.44	0.19
Pond 4	P25-026-01	120708	816568	3/2/00	EMS	1	PB214	1.64	0.26
Pond 4	P25-026-01	120708	816568	3/2/00	EMS	1	TL208	0.36	0.12
Pond 4	P25-027-01	120709	816573	3/2/00	EMS	1	ALPHAG	129.00	17.10
Pond 4	P25-027-01	120709	816573	3/2/00	EMS	1	BETAG	420.00	18.50
Pond 4	P25-027-01	120709	816573	3/2/00	EMS	1	BI214	1.65	0.34
Pond 4	P25-027-01	120709	816573	3/2/00	EMS	0	CO60	0.05	0.06
Pond 4	P25-027-01	120709	816573	3/2/00	EMS	1	CS137	45.70	1.69
Pond 4	P25-027-01	120709	816573	3/2/00	EMS	-1	K40	5.43	1.31
Pond 4	P25-027-01	120709	816573	3/2/00	EMS	1	PB212	1.30	0.27
Pond 4	P25-027-01	120709	816573	3/2/00	EMS	1	PB214	1.83	0.43
Pond 4	P25-027-01	120709	816573	3/2/00	EMS	1	TL208	0.49	0.18
Pond 4	P25-028-01	120710	816571	3/2/00	EMS	1	AC228	1.31	0.27
Pond 4	P25-028-01	120710	816571	3/2/00	EMS	1	ALPHAG	81.00	12.10
Pond 4	P25-028-01	120710	816571	3/2/00	EMS	1	BETAG	140.00	10.10
Pond 4	P25-028-01	120710	816571	3/2/00	EMS	1	BI214	0.74	0.17

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 4	P25-028-01	120710	816571	3/2/00	EMS	0	CO60	0.05	0.05
Pond 4	P25-028-01	120710	816571	3/2/00	EMS	1	CS137	14.70	0.83
Pond 4	P25-028-01	120710	816571	3/2/00	EMS	1	K40	3.48	0.92
Pond 4	P25-028-01	120710	816571	3/2/00	EMS	1	PB212	1.04	0.17
Pond 4	P25-028-01	120710	816571	3/2/00	EMS	1	PB214	1.08	0.23
Pond 4	P25-028-01	120710	816571	3/2/00	EMS	1	TL208	0.48	0.10
Pond 4	P25-029-01	120711	816574	3/2/00	EMS	1	ALPHAG	76.20	16.00
Pond 4	P25-029-01	120711	816574	3/2/00	EMS	1	BETAG	462.00	23.30
Pond 4	P25-029-01	120711	816574	3/2/00	EMS	0	CO60	0.00	0.08
Pond 4	P25-029-01	120711	816574	3/2/00	EMS	1	CS137	33.30	1.81
Pond 4	P25-029-01	120711	816574	3/2/00	EMS	0	K40	3.99	1.81
Pond 4	P25-030-01	120715	816576	3/2/00	EMS	1	AC228	1.30	0.19
Pond 4	P25-030-01	120715	816576	3/2/00	EMS	1	ALPHAG	41.50	7.66
Pond 4	P25-030-01	120715	816576	3/2/00	EMS	1	BETAG	155.00	8.28
Pond 4	P25-030-01	120715	816576	3/2/00	EMS	1	BI214	1.89	0.12
Pond 4	P25-030-01	120715	816576	3/2/00	EMS	-1	CO60	0.16	0.03
Pond 4	P25-030-01	120715	816576	3/2/00	EMS	1	CS137	31.00	1.13
Pond 4	P25-030-01	120715	816576	3/2/00	EMS	1	K40	7.26	0.62
Pond 4	P25-030-01	120715	816576	3/2/00	EMS	1	PB212	1.18	0.13
Pond 4	P25-030-01	120715	816576	3/2/00	EMS	1	PB214	1.90	0.16
Pond 4	P25-030-01	120715	816576	3/2/00	EMS	1	RA226	7.67	2.27

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 4	P25-030-01	120715	816576	3/2/00	EMS	1	TL208	0.62	0.08
Pond 4	P25-030-01-A	120714	816579	3/2/00	EMS	1	ALPHAG	59.30	9.17
Pond 4	P25-030-01-A	120714	816579	3/2/00	EMS	1	BETAG	134.00	8.11
Pond 4	P25-030-01-A	120714	816579	3/2/00	EMS	1	BI212	1.95	0.68
Pond 4	P25-030-01-A	120714	816579	3/2/00	EMS	1	BI214	1.74	0.20
Pond 4	P25-030-01-A	120714	816579	3/2/00	EMS	1	CO60	0.17	0.04
Pond 4	P25-030-01-A	120714	816579	3/2/00	EMS	1	CS137	21.20	1.13
Pond 4	P25-030-01-A	120714	816579	3/2/00	EMS	1	K40	5.25	1.05
Pond 4	P25-030-01-A	120714	816579	3/2/00	EMS	1	PB212	0.84	0.17
Pond 4	P25-030-01-A	120714	816579	3/2/00	EMS	1	PB214	1.81	0.24
Pond 4	P25-030-01-A	120714	816579	3/2/00	EMS	1	TL208	0.32	0.10
Pond 4	P25-031-01	120712	816575	3/2/00	EMS	1	ALPHAG	38.50	7.12
Pond 4	P25-031-01	120712	816575	3/2/00	EMS	1	BETAG	86.00	7.15
Pond 4	P25-031-01	120712	816575	3/2/00	EMS	1	BI212	0.93	0.33
Pond 4	P25-031-01	120712	816575	3/2/00	EMS	1	BI214	1.39	0.19
Pond 4	P25-031-01	120712	816575	3/2/00	EMS	0	CO60	-0.02	0.05
Pond 4	P25-031-01	120712	816575	3/2/00	EMS	1	CS137	12.70	0.71
Pond 4	P25-031-01	120712	816575	3/2/00	EMS	1	K40	2.07	0.63
Pond 4	P25-031-01	120712	816575	3/2/00	EMS	1	PB212	0.67	0.15
Pond 4	P25-031-01	120712	816575	3/2/00	EMS	1	PB214	1.30	0.20
Pond 4	P25-031-01	120712	816575	3/2/00	EMS	1	TL208	0.38	0.11

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 4	P25-031-01-D	120716	22616001	3/2/00	GP		AC228	0.74	0.18
Pond 4	P25-031-01-D	120716	1000034149	3/2/00	GP		AC228	0.77	0.15
Pond 4	P25-031-01-D	120716	22616001	3/2/00	GP		ALPHAG	9.47	2.48
Pond 4	P25-031-01-D	120716	1000033491	3/2/00	GP	J	ALPHAG	6.38	2.55
Pond 4	P25-031-01-D	120716	1000033492	3/2/00	GP		ALPHAG	91.50	11.40
Pond 4	P25-031-01-D	120716	22616001	3/2/00	GP	U	BA133	-0.02	0.03
Pond 4	P25-031-01-D	120716	1000034149	3/2/00	GP	U	BA133	0.02	0.02
Pond 4	P25-031-01-D	120716	22616001	3/2/00	GP		BETAG	13.50	2.51
Pond 4	P25-031-01-D	120716	1000033491	3/2/00	GP	J	BETAG	9.54	3.07
Pond 4	P25-031-01-D	120716	1000033492	3/2/00	GP		BETAG	147.00	11.10
Pond 4	P25-031-01-D	120716	22616001	3/2/00	GP	U	CO60	0.03	0.02
Pond 4	P25-031-01-D	120716	1000034149	3/2/00	GP	J	CO60	0.03	0.02
Pond 4	P25-031-01-D	120716	22616001	3/2/00	GP	U	CS134	0.00	0.02
Pond 4	P25-031-01-D	120716	1000034149	3/2/00	GP	J	CS134	0.07	0.02
Pond 4	P25-031-01-D	120716	22616001	3/2/00	GP		CS137	6.23	0.84
Pond 4	P25-031-01-D	120716	1000034149	3/2/00	GP		CS137	6.21	0.83
Pond 4	P25-031-01-D	120716	22616001	3/2/00	GP	U	EU152	-0.01	0.05
Pond 4	P25-031-01-D	120716	1000034149	3/2/00	GP	U	EU152	-0.05	0.05
Pond 4	P25-031-01-D	120716	22616001	3/2/00	GP	U	EU154	-0.04	0.05
Pond 4	P25-031-01-D	120716	1000034149	3/2/00	GP	U	EU154	-0.03	0.04
Pond 4	P25-031-01-D	120716	22616001	3/2/00	GP	U	EU155	0.06	0.06

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 4	P25-031-01-D	120716	1000034149	3/2/00	GP	U	EU155	0.04	0.05
Pond 4	P25-031-01-D	120716	22616001	3/2/00	GP		K40	1.35	0.40
Pond 4	P25-031-01-D	120716	1000034149	3/2/00	GP		K40	1.98	0.40
Pond 4	P25-031-01-D	120716	22616001	3/2/00	GP		PB212	0.84	0.11
Pond 4	P25-031-01-D	120716	1000034149	3/2/00	GP		PB212	0.88	0.10
Pond 4	P25-031-01-D	120716	22616001	3/2/00	GP	U	PM144	0.00	0.02
Pond 4	P25-031-01-D	120716	1000034149	3/2/00	GP	U	PM144	-0.01	0.01
Pond 4	P25-031-01-D	120716	22616001	3/2/00	GP	U	PM146	0.03	0.03
Pond 4	P25-031-01-D	120716	1000034149	3/2/00	GP	U	PM146	-0.01	0.03
Pond 4	P25-031-01-D	120716	22616001	3/2/00	GP	U	SB125	0.04	0.06
Pond 4	P25-031-01-D	120716	1000034149	3/2/00	GP	U	SB125	0.06	0.05
Pond 4	P25-032-01	120717	816577	3/2/00	EMS	1	ALPHAG	29.90	5.76
Pond 4	P25-032-01	120717	816577	3/2/00	EMS	1	BETAG	73.20	5.76
Pond 4	P25-032-01	120717	816577	3/2/00	EMS	1	BI214	1.65	0.16
Pond 4	P25-032-01	120717	816577	3/2/00	EMS	0	CO60	0.12	0.04
Pond 4	P25-032-01	120717	816577	3/2/00	EMS	1	CS137	12.30	0.68
Pond 4	P25-032-01	120717	816577	3/2/00	EMS	1	K40	4.29	0.69
Pond 4	P25-032-01	120717	816577	3/2/00	EMS	1	PB212	1.12	0.13
Pond 4	P25-032-01	120717	816577	3/2/00	EMS	1	PB214	0.97	0.15
Pond 4	P25-032-01	120717	816577	3/2/00	EMS	1	RA226	7.14	2.03
Pond 4	P25-032-01	120717	816577	3/2/00	EMS	1	TL208	0.44	0.07

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 4	P25-033-01	120713	816578	3/2/00	EMS	1	AC228	1.02	0.16
Pond 4	P25-033-01	120713	816578	3/2/00	EMS	1	ALPHAG	22.10	3.32
Pond 4	P25-033-01	120713	816578	3/2/00	EMS	1	BETAG	77.80	4.15
Pond 4	P25-033-01	120713	816578	3/2/00	EMS	1	BI214	1.07	0.12
Pond 4	P25-033-01	120713	816578	3/2/00	EMS	0	CO60	0.10	0.04
Pond 4	P25-033-01	120713	816578	3/2/00	EMS	1	CS137	11.60	0.62
Pond 4	P25-033-01	120713	816578	3/2/00	EMS	1	K40	2.74	0.48
Pond 4	P25-033-01	120713	816578	3/2/00	EMS	1	PB212	1.00	0.11
Pond 4	P25-033-01	120713	816578	3/2/00	EMS	1	PB214	0.79	0.14
Pond 4	P25-033-01	120713	816578	3/2/00	EMS	1	TL208	0.32	0.07
Pond 4	P25-034-01	120720	816581	3/2/00	EMS	1	AC228	1.96	0.23
Pond 4	P25-034-01	120720	816581	3/2/00	EMS	1	ALPHAG	31.70	7.40
Pond 4	P25-034-01	120720	816581	3/2/00	EMS	1	BETAG	138.00	8.39
Pond 4	P25-034-01	120720	816581	3/2/00	EMS	1	BI214	2.33	0.21
Pond 4	P25-034-01	120720	816581	3/2/00	EMS	0	CO60	0.15	0.06
Pond 4	P25-034-01	120720	816581	3/2/00	EMS	1	CS137	24.90	1.30
Pond 4	P25-034-01	120720	816581	3/2/00	EMS	1	K40	6.16	0.88
Pond 4	P25-034-01	120720	816581	3/2/00	EMS	1	PB212	1.69	0.20
Pond 4	P25-034-01	120720	816581	3/2/00	EMS	1	PB214	1.87	0.23
Pond 4	P25-034-01	120720	816581	3/2/00	EMS	1	TL208	0.58	0.14
Pond 4	P25-035-01	120721	816584	3/2/00	EMS	1	ALPHAG	27.00	5.13

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 4	P25-035-01	120721	816584	3/2/00	EMS	1	BETAG	157.00	7.12
Pond 4	P25-035-01	120721	816584	3/2/00	EMS	1	BI212	1.07	0.30
Pond 4	P25-035-01	120721	816584	3/2/00	EMS	1	BI214	1.22	0.17
Pond 4	P25-035-01	120721	816584	3/2/00	EMS	0	CO60	0.08	0.04
Pond 4	P25-035-01	120721	816584	3/2/00	EMS	1	CS137	23.70	1.24
Pond 4	P25-035-01	120721	816584	3/2/00	EMS	1	K40	3.40	0.73
Pond 4	P25-035-01	120721	816584	3/2/00	EMS	1	PB212	0.79	0.14
Pond 4	P25-035-01	120721	816584	3/2/00	EMS	1	PB214	1.39	0.18
Pond 4	P25-035-01	120721	816584	3/2/00	EMS	1	RA226	6.75	2.06
Pond 4	P25-035-01	120721	816584	3/2/00	EMS	1	TL208	0.34	0.09
Pond 4	P25-036-01	120702	816564	3/2/00	EMS	1	AC228	1.81	0.20
Pond 4	P25-036-01	120702	816564	3/2/00	EMS	1	ALPHAG	18.90	3.91
Pond 4	P25-036-01	120702	816564	3/2/00	EMS	1	BETAG	70.10	4.86
Pond 4	P25-036-01	120702	816564	3/2/00	EMS	1	BI214	1.54	0.16
Pond 4	P25-036-01	120702	816564	3/2/00	EMS	0	CO60	0.19	0.05
Pond 4	P25-036-01	120702	816564	3/2/00	EMS	1	CS137	16.20	0.85
Pond 4	P25-036-01	120702	816564	3/2/00	EMS	1	K40	2.65	0.80
Pond 4	P25-036-01	120702	816564	3/2/00	EMS	1	PB212	1.34	0.14
Pond 4	P25-036-01	120702	816564	3/2/00	EMS	1	RA	1.77	0.17
Pond 4	P25-036-01	120702	816564	3/2/00	EMS	1	TL208	0.63	0.09
Pond 4	P25-037-01	120700	816563	3/2/00	EMS	1	ALPHAG	73.60	10.50

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 4	P25-037-01	120700	816563	3/2/00	EMS	1	BETAG	163.00	9.76
Pond 4	P25-037-01	120700	816563	3/2/00	EMS	1	BI214	1.51	0.22
Pond 4	P25-037-01	120700	816563	3/2/00	EMS	1	CO60	0.19	0.05
Pond 4	P25-037-01	120700	816563	3/2/00	EMS	1	CS137	19.50	1.06
Pond 4	P25-037-01	120700	816563	3/2/00	EMS	1	K40	3.38	1.11
Pond 4	P25-037-01	120700	816563	3/2/00	EMS	1	PB212	0.46	0.16
Pond 4	P25-037-01	120700	816563	3/2/00	EMS	1	PB214	1.29	0.24
Pond 4	P25-038-01	120701	816566	3/2/00	EMS	1	ALPHAG	36.50	6.73
Pond 4	P25-038-01	120701	816566	3/2/00	EMS	1	BETAG	164.00	8.85
Pond 4	P25-038-01	120701	816566	3/2/00	EMS	1	BI214	2.33	0.26
Pond 4	P25-038-01	120701	816566	3/2/00	EMS	0	CO60	0.12	0.06
Pond 4	P25-038-01	120701	816566	3/2/00	EMS	1	CS137	37.50	1.93
Pond 4	P25-038-01	120701	816566	3/2/00	EMS	1	K40	7.72	1.10
Pond 4	P25-038-01	120701	816566	3/2/00	EMS	1	PB212	1.22	0.22
Pond 4	P25-038-01	120701	816566	3/2/00	EMS	1	PB214	2.58	0.29
Pond 4	P25-038-01	120701	816566	3/2/00	EMS	1	TL208	0.35	0.13
Pond 2	P25-039-01	120744	816624	3/9/00	EMS	1	ALPHAG	39.50	4.62
Pond 2	P25-039-01	120744	816624	3/9/00	EMS	1	BETAG	74.50	3.96
Pond 2	P25-039-01	120744	816624	3/9/00	EMS	1	BI214	1.69	0.20
Pond 2	P25-039-01	120744	816624	3/9/00	EMS	1	CO60	0.40	0.06
Pond 2	P25-039-01	120744	816624	3/9/00	EMS	1	CS137	10.30	0.58

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 2	P25-039-01	120744	816624	3/9/00	EMS	1	K40	4.98	1.01
Pond 2	P25-039-01	120744	816624	3/9/00	EMS	1	PB212	0.61	0.13
Pond 2	P25-039-01	120744	816624	3/9/00	EMS	1	PB214	1.82	0.18
Pond 2	P25-039-01	120744	816624	3/9/00	EMS	1	TL208	0.39	0.09
Pond 2	P25-040-01	120745	816627	3/9/00	EMS	1	ALPHAG	23.40	4.05
Pond 2	P25-040-01	120745	816627	3/9/00	EMS	1	BETAG	43.20	3.69
Pond 2	P25-040-01	120745	816627	3/9/00	EMS	1	BI214	1.32	0.12
Pond 2	P25-040-01	120745	816627	3/9/00	EMS	1	CO60	0.53	0.05
Pond 2	P25-040-01	120745	816627	3/9/00	EMS	1	CS137	8.21	0.45
Pond 2	P25-040-01	120745	816627	3/9/00	EMS	1	K40	3.89	0.60
Pond 2	P25-040-01	120745	816627	3/9/00	EMS	1	PB212	0.67	0.13
Pond 2	P25-040-01	120745	816627	3/9/00	EMS	1	PB214	1.36	0.15
Pond 2	P25-040-01	120745	816627	3/9/00	EMS	1	TL208	0.26	0.08
Pond 2	P25-040-01-D	120746	23003003	3/2/00	GP		AC228	1.99	0.38
Pond 2	P25-040-01-D	120746	23003003	3/9/00	GP		ALPHAG	21.00	4.58
Pond 2	P25-040-01-D	120746	1000036737	3/9/00	GP		ALPHAG	21.00	4.58
Pond 2	P25-040-01-D	120746	1000036738	3/9/00	GP		ALPHAG	150.00	15.40
Pond 2	P25-040-01-D	120746	23003003	3/9/00	GP	U	BA133	0.03	0.07
Pond 2	P25-040-01-D	120746	23003003	3/2/00	GP		BETAG	33.20	4.25
Pond 2	P25-040-01-D	120746	1000036737	3/2/00	GP		BETAG	31.90	4.09
Pond 2	P25-040-01-D	120746	1000036738	3/2/00	GP		BETAG	299.00	15.10

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 2	P25-040-01-D	120746	23003003	3/9/00	GP		CO60	0.55	0.11
Pond 2	P25-040-01-D	120746	23003003	3/9/00	GP	U	CS134	0.01	0.04
Pond 2	P25-040-01-D	120746	23003003	3/9/00	GP		CS137	16.30	1.79
Pond 2	P25-040-01-D	120746	23003003	3/9/00	GP	U	EU152	0.02	0.14
Pond 2	P25-040-01-D	120746	23003003	3/9/00	GP	U	EU154	-0.11	0.10
Pond 2	P25-040-01-D	120746	23003003	3/9/00	GP	U	EU155	0.15	0.11
Pond 2	P25-040-01-D	120746	23003003	3/9/00	GP		K40	7.89	1.20
Pond 2	P25-040-01-D	120746	23003003	3/9/00	GP		PB212	1.75	0.21
Pond 2	P25-040-01-D	120746	23003003	3/9/00	GP	U	PM144	0.03	0.04
Pond 2	P25-040-01-D	120746	23003003	3/9/00	GP	U	PM146	0.01	0.08
Pond 2	P25-040-01-D	120746	23003003	3/9/00	GP	U	SB125	-0.02	0.15
Pond 5	P25-041-01	120747	816625	3/27/00	EMS	1	AC228	1.86	0.25
Pond 5	P25-041-01	120747	816625	3/27/00	EMS	1	ALPHAG	40.30	6.99
Pond 5	P25-041-01	120747	816625	3/27/00	EMS	1	BETAG	196.00	9.46
Pond 5	P25-041-01	120747	816625	3/27/00	EMS	1	BI214	1.59	0.19
Pond 5	P25-041-01	120747	816625	3/27/00	EMS	0	CO60	0.05	0.05
Pond 5	P25-041-01	120747	816625	3/27/00	EMS	1	CS137	44.30	2.30
Pond 5	P25-041-01	120747	816625	3/27/00	EMS	1	K40	5.32	0.98
Pond 5	P25-041-01	120747	816625	3/27/00	EMS	1	PB212	1.15	0.21
Pond 5	P25-041-01	120747	816625	3/27/00	EMS	1	PB214	1.34	0.26
Pond 5	P25-041-01	120747	816625	3/27/00	EMS	1	TL208	0.37	0.13

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 5	P25-042-01	120748	816628	3/27/00	EMS	1	ALPHAG	38.30	6.99
Pond 5	P25-042-01	120748	816628	3/27/00	EMS	1	BETAG	167.00	8.79
Pond 5	P25-042-01	120748	816628	3/27/00	EMS	1	BI214	2.09	0.29
Pond 5	P25-042-01	120748	816628	3/27/00	EMS	0	CO60	0.15	0.05
Pond 5	P25-042-01	120748	816628	3/27/00	EMS	1	CS137	50.30	2.58
Pond 5	P25-042-01	120748	816628	3/27/00	EMS	1	K40	7.07	1.18
Pond 5	P25-042-01	120748	816628	3/27/00	EMS	1	PB212	2.07	0.25
Pond 5	P25-042-01	120748	816628	3/27/00	EMS	1	PB214	2.27	0.28
Pond 5	P25-042-01	120748	816628	3/27/00	EMS	1	RA226	16.60	4.45
Pond 5	P25-042-01	120748	816628	3/27/00	EMS	1	TL208	0.48	0.15
Pond 5	P25-050-01	120749	816629	3/27/00	EMS	1	ALPHAG	37.90	6.51
Pond 5	P25-050-01	120749	816629	3/27/00	EMS	1	BETAG	198.00	9.02
Pond 5	P25-050-01	120749	816629	3/27/00	EMS	1	BI214	1.36	0.25
Pond 5	P25-050-01	120749	816629	3/27/00	EMS	0	CO60	0.00	0.05
Pond 5	P25-050-01	120749	816629	3/27/00	EMS	1	CS137	38.60	1.99
Pond 5	P25-050-01	120749	816629	3/27/00	EMS	1	K40	4.68	0.76
Pond 5	P25-050-01	120749	816629	3/27/00	EMS	1	PB212	1.49	0.30
Pond 5	P25-050-01	120749	816629	3/27/00	EMS	1	PB214	1.18	0.31
Pond 5	P25-050-01-A	120750	816632	3/27/00	EMS	1	ALPHAG	48.30	6.44
Pond 5	P25-050-01-A	120750	816632	3/27/00	EMS	1	BETAG	221.00	8.24
Pond 5	P25-050-01-A	120750	816632	3/27/00	EMS	1	BI214	1.67	0.29

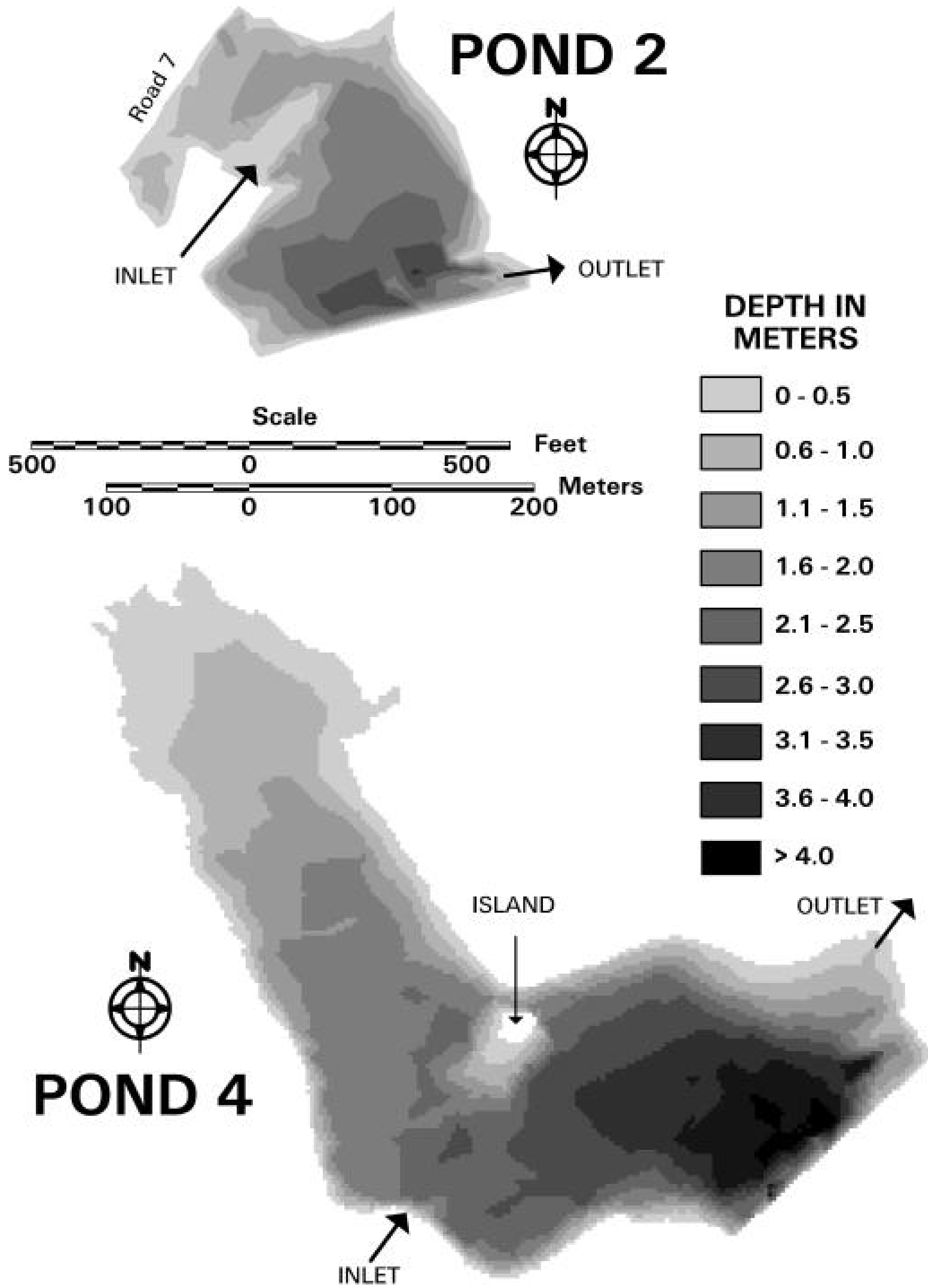
Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 5	P25-050-01-A	120750	816632	3/27/00	EMS	0	CO60	0.02	0.05
Pond 5	P25-050-01-A	120750	816632	3/27/00	EMS	1	CS137	46.50	2.42
Pond 5	P25-050-01-A	120750	816632	3/27/00	EMS	1	K40	6.48	1.28
Pond 5	P25-050-01-A	120750	816632	3/27/00	EMS	1	PB212	1.10	0.21
Pond 5	P25-050-01-A	120750	816632	3/27/00	EMS	1	PB214	2.11	0.30
Pond 5	P25-050-01-A	120750	816632	3/27/00	EMS	1	TL208	0.59	0.14
Pond 5	P25-052-01	120751	816630	3/27/00	EMS	1	ALPHAG	44.10	8.14
Pond 5	P25-052-01	120751	816630	3/27/00	EMS	1	BETAG	200.00	9.85
Pond 5	P25-052-01	120751	816630	3/27/00	EMS	1	BI212	1.55	0.53
Pond 5	P25-052-01	120751	816630	3/27/00	EMS	1	BI214	2.47	0.25
Pond 5	P25-052-01	120751	816630	3/27/00	EMS	0	CO60	0.13	0.06
Pond 5	P25-052-01	120751	816630	3/27/00	EMS	1	CS137	47.50	2.48
Pond 5	P25-052-01	120751	816630	3/27/00	EMS	1	K40	6.89	1.16
Pond 5	P25-052-01	120751	816630	3/27/00	EMS	1	PB212	1.03	0.27
Pond 5	P25-052-01	120751	816630	3/27/00	EMS	1	PB214	2.21	0.32
Pond 5	P25-052-01	120751	816630	3/27/00	EMS	1	TL208	0.55	0.12
Pond 5	P25-052-01-D	120752	23592001	3/27/00	GP		AC228	1.59	0.34
Pond 5	P25-052-01-D	120752	1000041697	3/27/00	GP		AC228	1.80	0.31
Pond 5	P25-052-01-D	120752	23592001	3/27/00	GP		ALPHAG	23.90	2.36
Pond 5	P25-052-01-D	120752	23592001	3/27/00	GP	U	BA133	-0.46	0.11
Pond 5	P25-052-01-D	120752	1000041697	3/27/00	GP	U	BA133	0.01	0.06

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 5	P25-052-01-D	120752	23592001	3/27/00	GP		BETAG	72.30	2.80
Pond 5	P25-052-01-D	120752	23592001	3/27/00	GP	J	CO60	0.12	0.06
Pond 5	P25-052-01-D	120752	1000041697	3/27/00	GP		CO60	0.13	0.04
Pond 5	P25-052-01-D	120752	23592001	3/27/00	GP	U	CS134	0.00	0.06
Pond 5	P25-052-01-D	120752	1000041697	3/27/00	GP	U	CS134	0.02	0.03
Pond 5	P25-052-01-D	120752	23592001	3/27/00	GP		CS137	58.50	7.84
Pond 5	P25-052-01-D	120752	1000041697	3/27/00	GP		CS137	56.00	6.05
Pond 5	P25-052-01-D	120752	23592001	3/27/00	GP	U	EU152	-0.07	0.20
Pond 5	P25-052-01-D	120752	1000041697	3/27/00	GP	U	EU152	0.02	0.12
Pond 5	P25-052-01-D	120752	23592001	3/27/00	GP	U	EU154	0.00	0.11
Pond 5	P25-052-01-D	120752	1000041697	3/27/00	GP	U	EU154	-0.03	0.05
Pond 5	P25-052-01-D	120752	23592001	3/27/00	GP	U	EU155	0.10	0.12
Pond 5	P25-052-01-D	120752	1000041697	3/27/00	GP	U	EU155	0.06	0.11
Pond 5	P25-052-01-D	120752	23592001	3/27/00	GP		K40	7.94	1.29
Pond 5	P25-052-01-D	120752	1000041697	3/27/00	GP		K40	8.00	0.99
Pond 5	P25-052-01-D	120752	23592001	3/27/00	GP		PB212	1.64	0.22
Pond 5	P25-052-01-D	120752	1000041697	3/27/00	GP		PB212	1.65	0.19
Pond 5	P25-052-01-D	120752	23592001	3/27/00	GP	U	PM144	-0.02	0.05
Pond 5	P25-052-01-D	120752	1000041697	3/27/00	GP	U	PM144	-0.01	0.02
Pond 5	P25-052-01-D	120752	23592001	3/27/00	GP	U	PM146	-0.05	0.13
Pond 5	P25-052-01-D	120752	1000041697	3/27/00	GP	U	PM146	0.03	0.07

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 5	P25-052-01-D	120752	23592001	3/27/00	GP	U	SB125	-0.23	0.24
Pond 5	P25-052-01-D	120752	1000041697	3/27/00	GP	U	SB125	-0.07	0.14
Pond 5	P25-053-01	120753	816633	3/27/00	EMS	1	AC228	1.70	0.28
Pond 5	P25-053-01	120753	816633	3/27/00	EMS	1	ALPHAG	54.00	10.20
Pond 5	P25-053-01	120753	816633	3/27/00	EMS	1	BETAG	228.00	11.50
Pond 5	P25-053-01	120753	816633	3/27/00	EMS	1	BI212	1.53	0.49
Pond 5	P25-053-01	120753	816633	3/27/00	EMS	1	BI214	2.17	0.25
Pond 5	P25-053-01	120753	816633	3/27/00	EMS	0	CO60	0.13	0.06
Pond 5	P25-053-01	120753	816633	3/27/00	EMS	1	CS137	38.80	2.04
Pond 5	P25-053-01	120753	816633	3/27/00	EMS	1	K40	6.69	1.12
Pond 5	P25-053-01	120753	816633	3/27/00	EMS	1	PB212	1.25	0.22
Pond 5	P25-053-01	120753	816633	3/27/00	EMS	1	PB214	2.02	0.28
Pond 5	P25-053-01	120753	816633	3/27/00	EMS	1	TL208	0.59	0.12
Pond 5	P25-054-01	120754	816631	3/27/00	EMS	1	ALPHAG	17.50	3.78
Pond 5	P25-054-01	120754	816631	3/27/00	EMS	1	BETAG	72.70	4.69
Pond 5	P25-054-01	120754	816631	3/27/00	EMS	1	BI212	1.15	0.33
Pond 5	P25-054-01	120754	816631	3/27/00	EMS	1	BI214	1.68	0.16
Pond 5	P25-054-01	120754	816631	3/27/00	EMS	0	CO60	0.11	0.04
Pond 5	P25-054-01	120754	816631	3/27/00	EMS	1	CS137	30.50	1.56
Pond 5	P25-054-01	120754	816631	3/27/00	EMS	1	K40	5.69	0.72
Pond 5	P25-054-01	120754	816631	3/27/00	EMS	1	PB212	1.60	0.18

Location	Sample Station	Sample ID	Lab ID	Sample Date	Lab	Lab QC Code	Analyte	Result (pCi/g)	Uncertainty (pCi/g)
Pond 5	P25-054-01	120754	816631	3/27/00	EMS	1	PB214	1.74	0.21
Pond 5	P25-054-01	120754	816631	3/27/00	EMS	1	RA226	7.78	2.37
Pond 5	P25-054-01	120754	816631	3/27/00	EMS	1	TL208	0.76	0.10
Pond 5	P25-055-01	120755	816634	3/27/00	EMS	1	AC228	2.06	0.19
Pond 5	P25-055-01	120755	816634	3/27/00	EMS	1	ALPHAG	30.50	4.87
Pond 5	P25-055-01	120755	816634	3/27/00	EMS	1	BETAG	97.40	4.92
Pond 5	P25-055-01	120755	816634	3/27/00	EMS	1	BI212	1.75	0.58
Pond 5	P25-055-01	120755	816634	3/27/00	EMS	1	BI214	2.22	0.18
Pond 5	P25-055-01	120755	816634	3/27/00	EMS	1	CO60	0.14	0.03
Pond 5	P25-055-01	120755	816634	3/27/00	EMS	1	CS137	26.60	1.37
Pond 5	P25-055-01	120755	816634	3/27/00	EMS	1	K40	4.78	0.62
Pond 5	P25-055-01	120755	816634	3/27/00	EMS	1	PB212	1.68	0.17
Pond 5	P25-055-01	120755	816634	3/27/00	EMS	1	PB214	2.24	0.22
Pond 5	P25-055-01	120755	816634	3/27/00	EMS	1	RA226	6.08	2.11
Pond 5	P25-055-01	120755	816634	3/27/00	EMS	1	TL208	0.61	0.10

Appendix C: Bathymetric Maps of Pond 2 and Pond 4


POND 2
Road 7
N
INLET
OUTLET
DEPTH IN METERS
0 - 0.5
0.6 - 1.0
1.1 - 1.5
1.6 - 2.0
2.1 - 2.5
2.6 - 3.0
3.1 - 3.5
3.6 - 4.0
> 4.0
Scale
500 0 500 Feet
100 0 100 200 Meters
ISLAND
OUTLET
N
POND 4
INLET

Appendix D: Regulatory Matrix

Environmental Regulatory Compliance Area	Potential Impacts and Compliance Requirements	Pond 2, Pond 4 and Pond 5 Alternative Scenarios		
		Embankment or Dam Failure	**Engineered Breaching of Dam and Elimination of Pond**	**Repair Dam**
National Environmental Policy Act (NEPA)	Potential Impacts	A broad spectrum of environmental impacts associated with proposed restoration activities would need to be addressed under NEPA.	A broad spectrum of environmental impacts associated with a proposed breaching of the dam and elimination of the pond would need to be addressed under NEPA.	A broad spectrum of environmental impacts associated with the proposed repair of the dam would need to be addressed under NEPA.
	Compliance Requirements	Because CERCLA becomes the regulatory driver in this scenario, a NEPA values impact assessment document would have to be prepared in support of the CERCLA process.	Again because CERCLA becomes the regulatory driver in this scenario, a NEPA values impact assessment document would have to be prepared in support of the CERCLA process.	Pursuant to 10 CFR Part 1021, an environmental assessment of the proposed dam repair would have to be completed prior to the initiation of detailed design activities or the signing of any subcontracts associated with implementing the proposed action.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	Potential Impacts	Potential adverse human health effects from exposure to contaminated sediments as a result of the dam failure. In addition, the spread of contaminated sediments downstream from the failed dam would increase the size of the CERCLA unit.	Potential adverse human health effects from exposure to contaminated sediments as a result of breaching of the dam and elimination of the pond.	None
	Compliance Requirements	A Baseline Risk Assessment would have to be prepared to evaluate the potential human health and ecological receptor impacts. This would be followed by preparation of a proposed plan and implementation of removal of contaminated sediments or other remedial action, depending upon the results of the Baseline Risk Assessment.	A Baseline Risk Assessment would have to be prepared to evaluate the potential human health and ecological receptor impacts. This would be followed by preparation of a proposed plan and implementation of removal of contaminated sediments or other remedial action, depending upon the results of the Baseline Risk Assessment.	None

Environmental Regulatory Compliance Area	**Potential Impacts and Compliance Requirements**	**Pond 2, Pond 4 and Pond 5 Alternative Scenarios**		
		Embankment or Dam Failure	**Engineered Breaching of Dam and Elimination of Pond**	**Repair Dam**
CERCLA Natural Resource Damage Assessment (NRDA)	Potential Impacts	Potentially extensive physical harm (including death) could be realized by a number of natural resources (e.g., fish and wildlife populations) either residing in or downstream from the pond.	Potential harm (e.g., contaminant exposure) could be realized by a number of natural resources (e.g., fish and wildlife populations) residing in or around the pond.	None
	Compliance Requirements	The SRS Natural Resource Trustees would have to be notified of the incident. Meetings with the Trustees would have to be held to determined the nature and extent of the damage. Compensation actions (e.g., either mitigation activities or payment for the damages incurred) would have to be implemented. DOE-SR would also be liable for third-party lawsuits under NRDA.	The SRS Natural Resource Trustees would have to be notified of the planned breaching of the dam and elimination of the pond. Mmeetings with the Trustees would have to be held to determined the nature and extent of the damage. Compensation actions (e.g., either mitigation activities or payment for the damages incurred) would have to be implemented. DOE-SR would also be liable for third-party lawsuits under NRDA.	None
National Emission Standards for Hazardous Air Pollutants (NESHAP)	Potential Impacts	Potential human health effects could occur due to the exposure to wind-borne resuspension of contaminated sediments from the pond lakebed and the contaminated sediment deposited downstream from the failed dam.	Potential human health effects could occur due to the exposure to wind-borne resuspension of contaminated sediments from the pond lakebed.	None
	Compliance Requirements	Both reporting and monitoring would possibly be required to ensure that any member of the public would not receive in any year an annual dose equivalent of 10 mrem/yr because of the dam failure.	Both reporting and monitoring would possibly be required to ensure that any member of the public would not receive in any year an annual dose equivalent of 10 mrem/yr because of exposure to the contaminated sediments.	None

Environmental Regulatory Compliance Area	Potential Impacts and Compliance Requirements	Pond 2, Pond 4 and Pond 5 Alternative Scenarios		
		Embankment or Dam Failure	**Engineered Breaching of Dam and Elimination of Pond**	**Repair Dam**
Section 404 of the Clean Water Act (CWA)	Potential Impacts	**Pond 2 and Pond 4:** Extensive sedimentation and uncontrolled fill of erosional material would occur in the stream drainage corridor below the dam. **Pond 5:** None	None	**Pond 2 and Pond 4:** A small acreage of jurisdictional wetlands downstream from the dam would be filled by the placement of a new filter blanket. **Pond 5:** None
	Compliance Requirements	**Pond 2 and Pond 4:** This would entail the implementation of corrective actions (e.g., dredging out sediment fill from and restoration of all wetland areas impacted by the dam failure). **Pond 5:** None	None	**Pond 2 and Pond 4:** This action would require a Section 404 permit (probably a Nationwide Permit 26). **Pond 5:** None
Occupational Health and Safety Act (OSHA)	Potential Impacts	The potential would exist for the exposure of on-site workers to hazardous substances.	The potential would exist for the exposure of on-site workers to hazardous substances.	The potential for impacts to on-site workers would have to be assessed by Safety and Health Operations Field Industrial Hygiene.
	Compliance Requirements	A health and safety plan would have to be prepared for the clean-up/restoration project. Employees involved in the clean-up/restoration work in the impacted area would have to receive Hazardous Waste Operations and Safety training under 29 CFR 1910.120, and wear appropriate protective equipment/clothing.	A health and safety plan would have to be prepared for the proposed breaching of the dam and elimination of the pond. Employees working on the exposed lake bed would have to receive Hazardous Waste Operations and Safety training under 29 CFR 1910.120, and wear appropriate protective equipment/clothing.	If the occupational exposure assessment conducted by Safety and Health Operations Field Industrial Hygiene (IH) determine a significant potential for occupational exposure to hazardous substances, a health and safety plan would have to be prepared for the proposed dam repair.

Environmental Regulatory Compliance Area	Potential Impacts and Compliance Requirements	Pond 2, Pond 4 and Pond 5 Alternative Scenarios		
		Embankment or Dam Failure	**Engineered Breaching of Dam and Elimination of Pond**	**Repair Dam**
Endangered Species Act (ESA)	Potential Impacts	Impacts to Federally listed species would occur in the form of traumatic physical harm and contamination exposure due to ingestion.	Impacts to Federally listed species would occur in the form of elimination of habitat.	Little to no impact to any of the Federally listed species would be expected as a result of the proposed action.
	Compliance Requirements	An informal consultation (under Section 7) would have to be initiated with the United States Fish and Wildlife Service (USFWS)/Charleston (for the proposed clean-up activities) to determine the extent of any mitigation/corrective measures which might need to be implemented.	A Biological Assessment (BA) would have to be completed for the proposed breaching of the dam and elimination of the pond. Based on the findings of the BA, the USFWS/Charleston might have to be contacted regarding their concurrence of those findings reported in that document.	A Biological Assessment (BA) would have to be completed for the proposed dam repair project. Based on the findings of the BA, the USFWS/Charleston might have to be contacted regarding their concurrence of those findings reported in that document.
Fish and Wildlife Coordination Act (FWCA)	Potential Impacts	None	Impacts to fish and wildlife resources would occur in the form of loss of habitat.	Little to no impact to fish and wildlife resources would be expected as a result of the proposed action.
	Compliance Requirements	None	Consultation with the USFWS/Charleston on the proposed breaching of the dam and elimination of the pond would have to be initiated to determine ways to minimize any potential impacts to these resources.	Consultation with the USFWS/Charleston on the proposed dam repair would have to be initiated to ensure that no impacts to these resources would occur.

Environmental Regulatory Compliance Area	**Potential Impacts and Compliance Requirements**	**Pond 2, Pond 4 and Pond 5 Alternative Scenarios**		
		Embankment or Dam Failure	**Engineered Breaching of Dam and Elimination of Pond**	**Repair Dam**
DOE Compliance with Floodplain/ Wetlands Environmental review Requirements (10 CFR Part 1022)	Potential Impacts	**Pond 2 and Pond 4:** Restoration activities would take place within on-site wetlands and probably 100-year floodplain. **Pond 5:** None	**Pond 2 and Pond 4:** The proposed activities would take place within on-site wetlands and probably 100-year floodplain. **Pond 5:** None	**Pond 2 and Pond 4:** The proposed activities would take place within on-site wetlands and probably 100-year floodplain. **Pond 5:** None
	Compliance Requirements	**Pond 2 and Pond 4:** A Floodplain/Wetlands Notice of Involvement and an Assessment would have to be prepared and issued for public review and comment. **Pond 5:** None	**Pond 2 and Pond 4:** A Floodplain/Wetlands Notice of Involvement and an Assessment would have to be prepared and issued for public review and comment. **Pond 5:** None	**Pond 2 and Pond 4:** A Floodplain/Wetlands Notice of Involvement and an Assessment would have to be prepared and issued for public review and comment. **Pond 5:** None
National Historic Preservation Act (NHPA)	Potential Impacts	Potential exposure of archaeological or cultural resources would occur as a result of the dam failure.	Potential exposure of archaeological or cultural resources would occur as a result of the drawdown.	No impacts from the proposed action would be expected.
	Compliance Requirements	A review of the potential impacts would have to be conducted by the Savannah River Archaeological Research Program (SRARP) and possibly a consultation with the State Historic Preservation Office (SHPO) through the SRARP would have to be initiated.	A review of the proposed action would have to be conducted by SRARP and possibly a consultation with the South Carolina SHPO through the SRARP would have to be initiated.	A review of the proposed action would have to be conducted by SRARP.