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Closure Report for the Central Facilities Area Sewage Treatment Plant Lagoon 3 and Land Application Area

November 2017

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November 2017

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ABSTRACT

Because of significantly reduced wastewater discharges to the Central Facilities Area Sewage Treatment Plant, wastewater has not been land applied since 2011. The future need to land apply wastewater was evaluated. Based on the current wastewater flows into the Central Facilities Area Sewage Treatment Plant, expected future missions at Central Facilities Area, and the discovery in 2014 that Lagoon 3 was leaking at an unacceptable rate, it was determined that the Central Facilities Area Sewage Treatment Plant is significantly oversized and that Lagoons 1 and 2 could be converted to total evaporation lagoons. Therefore, the decision was made to remove the existing sludge in Lagoon 3 and transfer it to Lagoon 2 for additional treatment, decommission Lagoon 3 and the land application area, and terminate the wastewater reuse permit.

A closure plan was submitted and approved by the Idaho Department of Environmental Quality in 2016. This report describes the closure activities that were performed. Closure activities included:

- Characterizing the soil/liner in Lagoon 3 to determine whether further characterization and/or remediation will be required under the Comprehensive Environmental Response, Compensation, and Liability Act.
- Based on the results from the soil/liner sampling, determining whether additional sampling will be required for the land application area.
- Removing the sludge in Lagoon 3 and placing it in Lagoon 2.
- Puncturing the Lagoon 3 soil/liner to prevent ponding of storm water and becoming a source for vectors.
- Installing a permanent cap on the inlet piping to Lagoon 3.

Samples were collected on November 10, 2016, and were submitted for analysis to an off-site laboratory. Data validation and evaluation were performed by Portage, INC. Sample results confirmed that there is no hazard to human health and the environment and that Lagoon 3 and the land application area could be closed.

In August 2017, sludge was removed from Lagoon 3 and placed in Lagoon 2, the soil/liner was punctured in 4 places, and caps were installed on the primary and bypass inlet lines.

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ACRONYMS

BEA	Battelle Energy Alliance, LLC
CCN	correspondence control number
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
DEQ	Idaho Department of Environmental Quality
DOE-ID	U. S. Department of Energy Idaho Operations Office
ESL	ecological screening level
EPA	U.S. Environmental Protection Agency
FSP	field sampling plan
GEL	GEL Laboratories, LLC
HQ	Hazard Quotient
INL	Idaho National Laboratory
LAA	land application area
mg/kg	milligrams/kilogram
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
SAP	sampling and analysis plan
STP	Sewage Treatment Plant
TCLP	Toxicity Characteristic Leaching Procedure
ug/kg	microgram/kilogram
WRP	Wastewater Reuse Permit

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1. INTRODUCTION

The Central Facilities Area (CFA) Sewage Treatment Plant (STP) is a municipal wastewater facility operated by Battelle Energy Alliance, LLC (BEA), under Wastewater Reuse Permit (WRP) LA-000141-03 issued by the State of Idaho, Department of Environmental Quality (DEQ). The WRP was issued on March 17, 2010 (Neher 2010). The WRP expired on March 16, 2015; however, the CFA STP continues to operate under the terms and conditions of WRP LA-000141-03.

Because of significantly reduced wastewater discharges to the CFA STP, wastewater has not been land applied since 2011. The future need to land apply wastewater was evaluated. Based on the current wastewater flows into the CFA STP and expected future missions at CFA, it was determined that the CFA STP is significantly oversized and that Lagoons 1 and 2 could be converted to total evaporation lagoons. Therefore, the decision was made to remove the existing sludge in Lagoon 3 and transfer it to Lagoon 2 for additional treatment, decommission Lagoon 3, close the land application area (LAA), and terminate the WRP.

On December 17, 2014, personnel from DEQ, BEA, and the U.S. Department of Energy Idaho Operations Office (DOE-ID) met to discuss closure of Lagoon 3 and the LAA (73.5 acres) and the termination of the WRP (Lewis 2014). It was determined that Lagoon 3 could be left in place and did not have to be filled with soil. On February 23, 2015, the closure plan was submitted (Miller 2015) to DEQ. Comments on the closure plan were received from DEQ (Rackow 2015) on June 16, 2015. Following evaluation of the comments from DEQ and further investigation by DEQ and BEA of the sludge disposal requirements, a meeting was held on February 4, 2016 (Lewis 2016). At this meeting, it was agreed to by all parties that the best approach for handling the sewage sludge in Lagoon 3 would be to scrape up the sludge and discharge it into CFA STP Lagoon 2.

The closure plan was revised and resubmitted (Miller 2016a) to DEQ for review and approval on May 6, 2016. On July 5, 2016, DEQ approved (Rackow 2016a) the closure plan.

This report documents the closure of CFA STP Lagoon 3 and the LAA in accordance with the approved closure plan. Because the CFA STP is now an evaporative lagoon system, BEA officially requests termination of WRP LA-000141-03.

2. BACKGROUND

The CFA STP was constructed in 1994 and began accepting wastewater in August 1995. The CFA STP replaced an existing sewage treatment facility that operated from 1953 until wastewater was routed to the CFA STP (DOE-ID 2000).

The CFA STP (see Figure 1) is located approximately five miles north of the Idaho National Laboratory (INL) Site's southern boundary and southeast of the CFA, which is about 50 miles west of Idaho Falls in Butte County, Idaho. The STP is approximately 2,200 ft downgradient of the nearest drinking water well and 4,000 ft north of Highway 26. The wastewater LAA is approximately 2,200 ft from the nearest inhabited building.

As shown in Figure 1, the STP consists of:

- A 1.7-acre partial-mix, aeration lagoon (Lagoon 1)
- A 10.3-acre facultative lagoon (Lagoon 2)
- A 0.5-acre polishing lagoon (Lagoon 3)

- A 73.5-acre wastewater LAA consisting of desert steppe and crested wheatgrass vegetative communities
- A computerized center-pivot, sprinkler irrigation system.

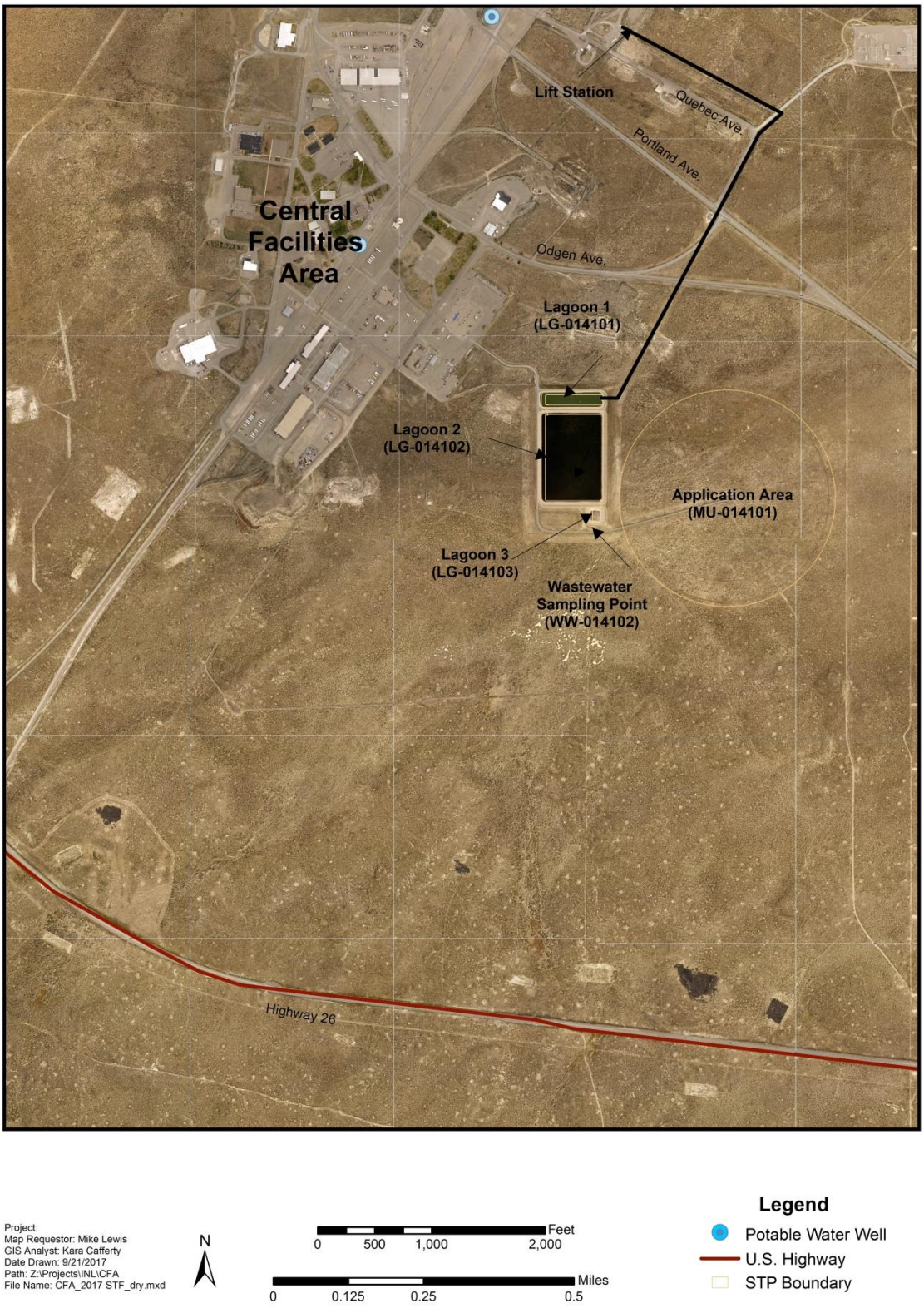

Figure 1. Map showing location of the Central Facilities Area Sewage Treatment Plant.

A 350 gallons per minute pump moves wastewater from the polishing lagoon to the center-pivot sprinkler system, which waters the LAA at low pressure (approximately 30 lbs/in^2) to minimize aerosols and spray drift.

The design capacity of the CFA STP is 250,000 gallons per day. Currently, the average daily flow is less than 30,000 gallons per day. Due to significantly reduced wastewater discharges to the CFA STP, wastewater has not been land applied since 2011. Because wastewater has not been land applied for several years, future use of the CFA STP was evaluated. A determination was made to decommission Lagoon 3, close the LAA, and terminate coverage under the WRP.

Seepage testing of the three CFA STP wastewater lagoons was performed between August 26, 2014, and September 22, 2014. Seepage rates from Lagoons 1 and 2 were below the 0.25 inches/day requirement; however, Lagoon 3 was above the 0.25 inches/day (Miller 2014). Lagoon 3 was removed from service based on the seepage test results.

3. CLOSURE PLAN ACTIVITIES

The closure plan (Miller 2016a) identified the following activities:

- Remove the sludge in Lagoon 3 and place it in Lagoon 2.
- Puncture the Lagoon 3 liner to prevent ponding of storm water and becoming a source for vectors.
- Characterize the soil/liner in Lagoon 3 to determine whether further characterization and/or remediation will be required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).
- Based on the results from the soil/liner sampling, determine whether additional sampling will be required for the LAA.
- Install a permanent cap on the inlet piping to Lagoon 3.

The closure plan indicated that the first activity would be to remove the sludge from Lagoon 3 and place it into Lagoon 2 for further treatment and then puncture the soil/liner to prevent vector attraction from ponding water. However, because of concerns with not being able to collect representative soil/liner samples due to the soil/liner being disturbed by the heavy equipment tires/tracks and purposely puncturing the soil/liner, characterization samples were collected prior to the other work being performed.

3.1 Characterization Sampling

The field sampling plan (FSP) and the Quality Assurance Project Plan (QAPP) for Closure of the CFA STP Lagoon 3 and LAA were submitted (Miller 2016b) to DEQ for review. Comments were received on the QAPP from DEQ on October 13, 2016 (Rackow 2016b). The revised QAPP was submitted to DEQ on November 8, 2016 (Miller 2016c).

The FSP and the QAPP comprise the sampling and analysis plan (SAP) for this effort. Data collected under the SAP was used to evaluate risk of the lagoon and the LAA associated with the CFA STP.

Samples were collected on November 10, 2016 by Portage, INC, and submitted to GEL Laboratories, LLC (GEL), under full chain of custody. Once the sample results/data packages were received from GEL, data validation was performed by Portage, INC.

3.1.1 Sampling Design

The sampling design was systematic random sampling, which ensured even coverage of the soil/liner. The sample locations were determined using a systematic diamond grid with locations spaced 25 ft apart horizontally and vertically. A random-number generator was used to determine the location of the first point in the grid, while the rest of the grid was laid out according to the location of that point. This

ensured that sample locations were random even though the grid was systematic. Fourteen sampling locations were selected and samples were collected at each of those points. Figure 2 shows the layout of the samples on the liner.

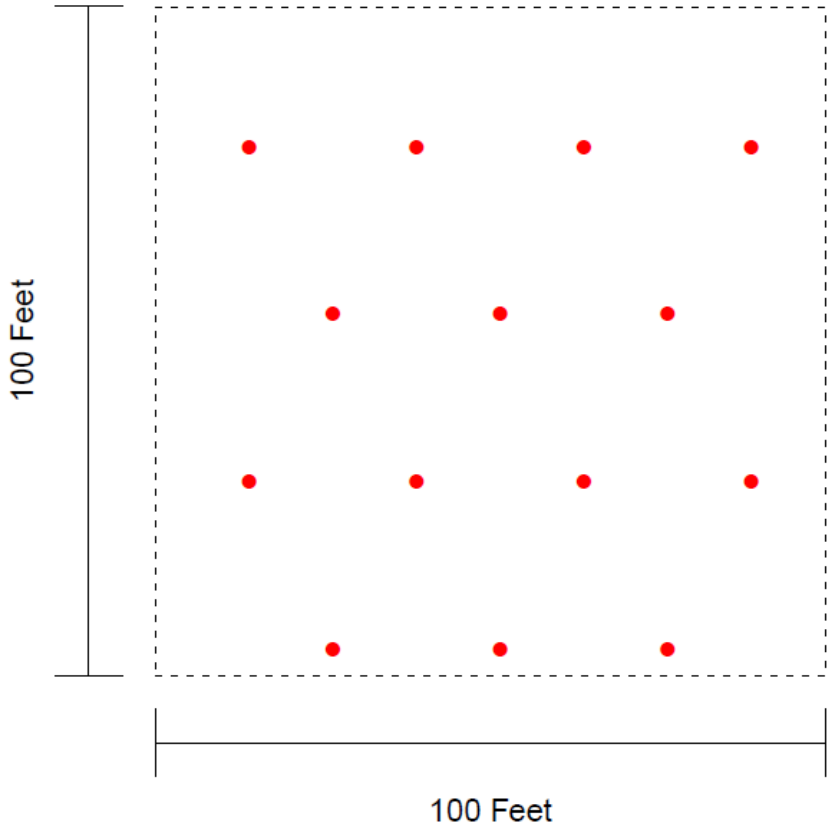

Figure 2. Illustration of the sampling design for Lagoon 3.

3.1.2 Data Summary

This section shows the numerical summary statistics for the soil/liner data.

Table 1 lists the analytes that were measured in the soil and identifies those that were detected and those that were not detected. Ten of the analytes were not detected in any of the samples.

Table 1. Detected and undetected analytes from the Lagoon 3 soil/liner sampling event.

Detected Analytes		
Arsenic	Copper	Selenium
Barium	Lead	Silver
Beryllium	Manganese	Methylene chloride[a]
Cadmium	Mercury	
Chromium	Nickel	
Undetected Analytes		
Thallium	Tritium	Toluene
Cesium-137	1,4-Dichlorobenzene	Xylenes (total)
Iodine-129	Benzene	
Strontium-90	Ethylbenzene	

a. Methylene chloride was detected in only 1 of 14 samples. Summary statistics were not performed for this analyte.

Table 2 shows the summary statistics for the detected analytes. The summary statistics that were calculated for the detected constituents were measures of center (mean and median), measures of spread (standard deviation), and the Shapiro-Wilk test to determine if the data followed a normal distribution.

Table 2. Summary statistics for analytes detected in the Lagoon 3 soil/liner samples.

Analyte	Number of Samples	Number of Detections	Are Data Normal?	Median (mg/kg)	Mean (mg/kg)	Standard Deviation (mg/kg)
Arsenic	14	14	Yes	5.02	5.07	1.39
Barium	14	14	Yes	199	204	20.4
Beryllium	14	14	Yes	1.435	1.43	0.0435
Cadmium	14	14	No	0.384	0.412	0.0941
Chromium	14	14	No	26.2	26.4	0.960
Copper	14	14	Yes	32.4	33.0	3.66
Lead	14	14	Yes	17.7	17.9	1.29
Manganese	14	14	No	291	305	92.9
Mercury	14	14	No	0.0179	0.0362	0.0607
Nickel	14	14	No	23.1	23.7	1.75
Selenium	14	14	Yes	1.44	1.45	0.215
Silver	14	14	Yes	0.743	0.742	0.0664

3.2 Comparison to Screening Levels

The action levels for this sampling effort are a series of screening levels. Table 3 compares the analyte maximum sample result concentration with applicable screening levels.

The first step to eliminate analytes from further concern, the maximum measured concentration for each analyte was compared to the INL Site soil background level (see Table 3). If an analyte is less than the INL Site soil background level for all samples, it is considered sufficient for determining that analyte is within safe levels and further screening is not necessary. If the anlayte concentration was above the applicable INL Site soil background level or a background level did not exist, the analyte concentrations were then compared to the Resource Conservation and Recovery Act (RCRA) Toxicity Characteristic Leaching Procedure (TCLP) and CERCLA Residential and Ecological screening levels. If the analyte concentration was below the RCRA and CERCLA screening levels, it was considered safe and no further screening was necessary.

With the exception of copper, lead, manganese, selenium, and thallium, all other analytes screened out based on the above criteria. Copper, lead, manganese, selenium, and thallium were above both the applicable CERCLA ecological screening levels (ESLs) and the INL Site soil background levels. For thallium, all sample results were below the laboratory instruments minimum detection level. However, the minimum detection level was above the ESL and the INL Site soil background level. Although thallium is not expected to be above the screening levels, it is discussed below with the other four metals.

3.3 Summary Information for Copper, Lead, Manganese, Selenium, and Thallium

Copper – Copper was detected in all 14 samples. The sample concentrations ranged from 27.6 mg/kg to 40.5 mg/kg with a mean of 33 mg/kg (see Table 2). All sample results were above the INL Site soil background level of 22 mg/kg. One sample result was below the ESL concentration of 28 mg/L. For comparison, soil background concentrations in the western U.S. range from approximately 15 mg/kg to 55 mg/kg, according to the U.S. Environmental Protection Agency (EPA 2007a).

Copper is an essential micronutrient in both plants and animals. In animals, copper is essential for hemoglobin formation, carbohydrate metabolism, catecholamine biosynthesis, and cross-linking of collagen, elastin, and hair keratin (EPA 2007a).

Lead – Lead was detected in all 14 samples. The sample concentrations ranged from 15.9 mg/kg to 20.9 mg/kg with a mean of 17.9 mg/kg (see Table 2). Two sample results were below the INL Site soil background level of 17 mg/kg while 12 were above. All 14 sample results were above the ESL of 11 mg/kg. For comparison, soil background concentrations in the western U.S. range from approximately 8 mg/kg to 35 mg/kg (EPA 2007b).

Lead is not considered an essential element in plants or animals. In plants, lead inhibits growth, reduces photosynthesis, interferes with cell division and respiration, reduces water absorption, and assists in transpiration. In animals, lead interferes with the synthesis of heme (EPA 2007b), which is commonly known as a component of hemoglobin.

Manganese – Of the 14 samples collected and analyzed for manganese, only one sample result (610 mg/kg) was above the INL Site soil background level of 490 mg/L. The sample concentrations ranged from 233 mg/kg to 610 mg/kg with a mean value of 305 mg/kg (see Table 2). Soil background concentrations in the U.S. range from approximately 40 mg/kg to 900 mg/kg with a mean of 330 mg/kg. The ESL of 220 mg/kg is less than the fifth percentile of reported background soil concentrations in the western U.S. (EPA 2007c).

Manganese is one of the most abundant trace elements on the Earth's surface and is an essential micronutrient for both plants and animals.

Selenium – Selenium was detected in all 14 samples. The sample concentrations ranged from 0.959 mg/kg to 1.78 mg/kg with a mean of 1.45 mg/kg (see Table 2). All sample results were above the INL Site soil background level of 0.22 mg/kg and the ESL of 0.52 mg/kg (EPA 2007d). Soils in the U.S. have selenium concentrations ranging from less than 0.1 mg/kg to 4.4 mg/kg (CAST 1994). United States Geological Survey (USGS 2017) data shows concentrations of selenium in Butte County soils ranging from 0.102 mg/kg to 1.468 mg/kg.

Selenium is a naturally occurring element found in all environmental media and is an essential micronutrient for animals, although it is toxic in large doses (EPA 2007d). Certain plant species require higher levels of selenium and can be used as indicators of high selenium content in the soil.

Thallium – Thallium was not detected in any of the samples. However, the detection limit (<0.639 mg/kg) was above the INL Site soil background concentration of 0.43 mg/kg and the ESL of

0.1 mg/kg (DOE-ID 1999). In soils, thallium concentrations typically range from 0.1 mg/kg to 1.0 mg/kg (EPA 2009).

Thallium is a toxic heavy metallic element that exists in the environment mainly combined with other elements (e.g., primarily oxygen, sulfur, and the halogens) in inorganic compounds. Thallium is quite stable in the environment, since it is neither transformed nor biodegraded.

Table 3. Comparison of data to background and screening levels associated with the closure of Lagoon 3.

Analyte	Maximum Sample Concentration	INL Site Soil Background Level[a]	RCRA TCLP Screening Level[b]	CERCLA Residential Soil Screening Level[c]	CERCLA Ecological Screening Level[c]	RCRA or CERCLA Screening Level Exceeded?
Metals	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Arsenic	8.46	5.8	100	21.6	18	No
Barium	249	300	2000	15000	330	No
Beryllium	1.53	1.8	NA[d]	160[e]	NA	No
Cadmium	0.697	2.2	20	70	0.36	Yes[f] Ecological
Chromium	29.0	33	100	28000	26.0	Yes[f] Ecological
Copper	40.5	22	NA	3100	28	Yes Ecological
Lead	20.9	17	100	400	11	Yes Ecological
Manganese	610	490	NA	1800	220	Yes Ecological
Mercury	0.246	0.05	4	4.3	8.4	No
Nickel	29.0	35	NA	1500	38.0	No
Selenium	1.78	0.22	20	390	0.52	Yes Ecological
Silver	0.826	NA	100	390	4.2	No
Thallium[g]	<0.639	0.43	NA	6.3	0.1	Yes[h] Ecological
Organics	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	
1,4-Dichlorobenzene[g]	<0.351	NA	NA	2600[e]	NA	No
Benzene[g]	<0.351	NA	NA	1200[e]	NA	No
Ethylbenzene[g]	<0.351	NA	NA	5800[e]	NA	No
Methylene chloride	2.27	NA	NA	57000[e]	NA	No
Toluene[g]	<0.351	NA	NA	4900000[e]	NA	No
Xylenes (total)[g]	<1.05	NA	NA	580000[e]	NA	No

Analyte	Maximum Sample Concentration	INL Site Soil Background Level[a]	RCRA TCLP Screening Level[b]	CERCLA Residential Soil Screening Level[c]	CERCLA Ecological Screening Level[c]	RCRA or CERCLA Screening Level Exceeded?
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	
Cesium-137[g]	<0.0528	0.82	NA	6	4950	No
Iodine-129[g]	<1.18	NA	NA	3.3[e]	NA	No
Strontium-90[g]	<1.85	0.49	NA	23.1[e]	3340	No
Tritium[g]	<4.49	NA	NA	23	NA	No

a. Background Dose Equivalent Rates and Surficial Soil Metal and Radionuclide Concentrations for the Idaho National Engineering Laboratory (Rood, Harris, and White 1996).

b. Screening levels 20 times the value listed in 40 CFR 261.24, Table 1, "Maximum Concentration of Contaminants for the Toxicity Characteristics."

c. Residential screening levels are 10-6 risk-based levels or hazard quotient of 1 taken from Operable Unit 10-08 Remedial Design/Remedial Action Work Plan (DOE-ID 2010), unless footnoted otherwise.

d. NA = not applicable.

e. The EPA regional screening level (EPA 2015) for 10-6 risk-based level or hazard quotient of 1, whichever is more restrictive.

f. The maximum chromium sample result was over the CERCLA Ecological Screening Level but was below the INL Site Soil Background Level, therefore, no further characterization is required.

g. Analyte was not detected in any samples. Maximum value listed is the largest detection limit.

h. Thallium was undetected in all 14 samples. However, the detection level was higher than the INL Soil Background Level and the CERCLA Ecological Screening Level.

3.4 Evaluation of Parameters Exceeding Ecological Screening Levels

Ecological soil screening levels are concentrations of contaminants in the soil that are protective of ecological receptors that commonly come into contact with and/or consume biota that live in or on the soil. The EPA did not design the ESLs to be used as cleanup levels, but they should be used for additional risk assessment (EPA 2007a).

Contaminants that exceeded an ESL were assessed using the Hazard Quotient (HQ) analysis described in the OU-10-04 Remedial Investigation/Feasibility Study, as updated by the OU 10-08 Remedial Investigation/Baseline Risk Assessment (DOE-ID 2008) and the Refined Waste Area Group Ecological Risk Assessments (VanHorn 2013). The HQ is a unitless ratio of dose to toxicity reference value (hazard quotient [HQ] = dose/toxicity reference value). HQ > 10 is the adopted point of departure for potential population-level ecological risk at the INL Site (VanHorn 2013). HQs provide essentially a yes or no determination of risk and are therefore well-suited for screening level assessments (EPA 1988).

The analysis determined that the HQ for copper, lead, manganese, and thallium were less than 1 and the HQ for selenium (3.77) was less than 10 (see Table 4). Having an HQ less than 10 indicates the ecological risk is acceptable and thus screened from further evaluation under CERCLA. The following paragraphs are included and support the elimination of these inorganics from being a concern for populations of ecological receptors.

For comparison purposes, Table 5 includes the EPA's 40 CFR 503.13, Table 3, "Pollutant Concentrations," for copper, lead, and selenium. These EPA Pollutant Concentrations are used to determine whether sewage biosolids can be applied to agricultural land, forest, a public contact site, or a reclamation site. As shown in Table 5, the Pollutant Concentrations in sewage sludge that can be applied to agricultural land are significantly higher than the sample results, INL Site soil background, and CERCLA ESLs.

The maximum sample concentration for selenium was 1.78 mg/kg and exceeded the ESL of 0.52 mg/kg. Selenium also had the highest HQ at 3.77. However, the maximum sample concentration is significantly lower than the EPA level for applying sewage sludge to agricultural land at a concentration of 100 mg/kg (see Table 5).

Similar to selenium, when comparing the maximum copper and lead sample results to the EPA allowable levels in sewage sludge (see Table 5), the sample results are more than an order of magnitude lower than the EPA levels.

Table 4. Results of ecological risk evaluation for specific metals.

Functional Groups	Copper	Lead	Manganese	Selenium	Thallium	Maximum Hazard Quotient
Great Basin spadefoot toad	NA	NA	NA	NA	NA	**0.00E+00**
Mourning dove	6.42E-03	1.10E-03	5.11E-04	7.23E-03	5.47E-04	**7.23E-03**
Blue-winged teal	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Sage sparrow	1.41E-01	6.41E-03	1.70E-03	2.96E-01	1.32E-02	**2.96E-01**
Ferruginous hawk	2.43E-05	1.10E-06	2.93E-07	5.10E-05	2.27E-06	**5.10E-05**
Loggerhead shrike	9.27E-03	4.21E-04	1.12E-04	1.95E-02	8.66E-04	**1.95E-02**
Burrowing owl	1.76E-03	7.99E-05	2.12E-05	3.70E-03	1.65E-04	**3.70E-03**
Black-billed magpie	4.46E-03	5.31E-04	2.30E-04	6.82E-03	2.82E-04	**6.82E-03**
Mule deer	1.38E-03	1.13E-04	5.28E-04	4.36E-03	2.03E-04	**4.36E-03**
Pygmy rabbit	4.63E-01	3.80E-02	1.77E-01	1.46E+00	6.82E-02	**1.46E+00**
Townsend's western big-eared bat	2.55E-02	5.54E-04	1.48E-03	1.50E-01	4.12E-03	**1.50E-01**
Coyote	1.74E-06	3.79E-08	1.01E-07	1.03E-05	2.81E-07	**1.03E-05**
Deer mouse	5.87E-01	3.35E-02	1.45E-01	2.51E+00	5.99E-02	**2.51E+00**
Sagebrush lizard	NA	NA	NA	NA	NA	**0.00E+00**
Plants	3.47E-01	1.39E-02	3.88E-01	3.77E+00	2.56E-02	**3.77E+00**
Grasshoppers, beetles	NA	NA	NA	NA	NA	**0.00E+00**
Maximum Hazard Quotient	**5.87E-01**	**3.80E-02**	**3.88E-01**	**3.77E+00**	**6.82E-02**	**3.77E+00**

a. Hazard Quotient values are unitless.

Table 5. Comparison of sample maximum concentrations to the Idaho National Laboratory Site soil background levels, Comprehensive Environmental Response, Compensation, and Liability Act ecological screening levels, and the Environmental Protection Agency sewage sludge pollutant concentrations.

Analyte	Maximum Sample Concentration (mg/kg)	INL Site Soil Background Level[a] (mg/kg)	CERCLA Ecological Screening Level[b] (mg/kg)	Sewage Sludge Pollutant Concentration[c] (mg/kg)
Copper	40.5	22	28	1500
Lead	20.9	17	11	300
Manganese[d]	610	490	220	NA
Selenium	1.78	0.22	0.52	100
Thallium[e]	<0.639	0.43	0.1	NA

a. Background Dose Equivalent Rates and Surficial Soil Metal and Radionuclide Concentrations for the Idaho National Engineering Laboratory (Rood, Harris, and White 1996).
b. Residential screening levels are 10-6 risk-based levels or hazard quotient of 1 taken from Operable Unit 10-08 Remedial Design/Remedial Action Work Plan (DOE-ID 2010).
c. 40 CFR 503, Standards for the Use or Disposal of Sewage Sludge, Subsection .13, Pollutant Limits, Table 3, Pollutant Concentrations.
d. Only one sample result was above the ecological screening level.
e. Analyte was not detected in any samples. Maximum value listed is the highest detection limit reported.

4. LAGOON 3 CLOSURE ACTIVITIES

Sludge from CFA STP Lagoon 3 (see Figure 1) was removed and placed in CFA STP Lagoon 2 in August 2017 for additional treatment. It was estimated that 20 cubic yards of sludge was transferred from Lagoon 3 to Lagoon 2. Below is a summary of the closure activities:

August 9, 2017 – Management authorization to begin work was obtained. RadCon completed spot surveys of the bottom of Lagoon 3.

August 10, 2017 – A front end loader and backhoe were able to drive down the riprap near the northwest corner of Lagoon 3 to access the sludge. The front end loader scraped up the sludge from the bottom of the lagoon and piled it in the northeast corner. Once all the sludge was in the pile, the front end loader began picking up the sludge, drove out of the lagoon and dumped the sludge into Lagoon 2. Once all the sludge was removed from Lagoon 3, a water truck being used for dust suppression was used to spray any sludge that had been deposited on the Lagoon 2 riprap into the water in the lagoon. The backhoe punctured the soil/liner, approximately 2 to 3 feet deep, near the southwest corner of Lagoon 3 (see Figure 4).

August 15, 2017 – RadCon completed clearance surveys for the equipment.

August 16, 2017 – Plastic caps were placed on both the primary (see Figure 4) and bypass inlet pipes in Lagoon 3 to prevent any wastewater from entering the lagoon in the future.

August 29, 2017 – The backhoe was brought back in and punctured the Lagoon 3 soil/liner in 3 more places (southeast, northcentral, and northeast) at an approximate depth of 2 to 3 feet.

August 30, 2017 – Laborers transferred sludge that was left on and near the splash guards that could not be picked up by the front end loader into Lagoon 2 using shovels and a bucket. Figure 5 shows Lagoon 3 after all the work had been completed.

Figure 3. Dried sludge in the bottom of the Central Facilities Area Sewage Treatment Plant Lagoon 3.

Figure 4. Cap placed on primary inlet pipe.

Figure 5. Photo showing Central Facilities Area Sewage Treatment Plant Lagoon 3 after all work was completed.

5. Conclusion

The CFA STP was placed into operation in August 1995. By this time, significant environmental regulations had been enacted by the regulatory agencies that were being implemented at the INL. These restrictions included no RCRA hazardous waste, no PCBs, no petroleum products, etc. New wastewater discharges into the CFA STP had to be reviewed and approved by the INL environmental organization. The regulations and environmental awareness helped ensure the CFA STP lagoons were not contaminated with hazardous materials.

As seen from the sampling data, the majority of contaminants sampled for in the Lagoon 3 soil/liner were below the applicable screening levels. Only copper, lead, manganese, and selenium had detected sample results above both the ESL and the INL Site soil background level. Thallium concentrations were below the laboratory instruments minimum detection level. However, the minimum detection level was above the ESL and INL Site soil background level. Therefore, an HQ analysis was performed on these five metals to further assess the potential impacts to human health and the environment. All five metals were below an HQ of 10, indicating the ecological risk is acceptable.

Although copper, lead, manganese, selenium, and thallium (detection level) were above the INL Site soil background levels, they were within the background range of soils in the U.S. In addition, Table 5 shows that the maximum copper, lead, and selenium concentrations in the soil/liner were significantly less than EPA, 40 CFR 503 concentrations allowed in sewage sludge used for land application.

The work described in the closure plan has been completed. The soil/liner sample results show there are no hazards to human health and the environment. Therefore, both Lagoon 3 and the LAA can be considered closed and the WRP can be terminated.

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Appendix A

Soil/Liner Sample Data from Central Facilities Area Sewage Treatment Plant Lagoon 3

Table A-1. Central Facilities Area Sewage Treatment Plant Lagoon 3 soil/liner metals sample data.

Sample ID	Lab Sample ID	Analyte Name	Detection Limit	Result	Units	Lab Qualifiers	Validation Flag
CFAN160011-Liner Sample 1	410494001	Arsenic	0.616	4.91	mg/kg		
CFAN160012-Liner Sample 2	410494002	Arsenic	0.61	3.89	mg/kg		
CFAN160013-Liner Sample 3	410494003	Arsenic	0.637	5.64	mg/kg		
CFAN160014-Liner Sample 4	410494004	Arsenic	0.599	5.91	mg/kg		
CFAN160015-Liner Sample 5	410494005	Arsenic	0.618	6.24	mg/kg		
CFAN160016-Liner Sample 6	410494006	Arsenic	0.578	5.13	mg/kg		
CFAN160017-Liner Sample 7	410494007	Arsenic	0.617	2.95	mg/kg	B	
CFAN160018-Liner Sample 8	410494008	Arsenic	0.596	3.59	mg/kg		
CFAN160019-Liner Sample 9	410494009	Arsenic	0.6	3.93	mg/kg		
CFAN160020-Liner Sample 10	410494010	Arsenic	0.595	5.97	mg/kg		
CFAN160021-Liner Sample 11	410494011	Arsenic	0.629	8.46	mg/kg		
CFAN160022-Liner Sample 12	410494012	Arsenic	0.592	4.35	mg/kg		
CFAN160023-Liner Sample 13	410494013	Arsenic	0.639	4.52	mg/kg		
CFAN160024-Liner Sample 14	410494014	Arsenic	0.601	5.54	mg/kg		
CFAN160011-Liner Sample 1	410494001	Barium	0.123	189	mg/kg		
CFAN160012-Liner Sample 2	410494002	Barium	0.122	184	mg/kg		
CFAN160013-Liner Sample 3	410494003	Barium	0.127	209	mg/kg		
CFAN160014-Liner Sample 4	410494004	Barium	0.12	219	mg/kg		
CFAN160015-Liner Sample 5	410494005	Barium	0.124	210	mg/kg		
CFAN160016-Liner Sample 6	410494006	Barium	0.116	195	mg/kg		
CFAN160017-Liner Sample 7	410494007	Barium	0.123	182	mg/kg		
CFAN160018-Liner Sample 8	410494008	Barium	0.119	199	mg/kg		
CFAN160019-Liner Sample 9	410494009	Barium	0.12	233	mg/kg		
CFAN160020-Liner Sample 10	410494010	Barium	0.119	214	mg/kg		
CFAN160021-Liner Sample 11	410494011	Barium	0.126	249	mg/kg		
CFAN160022-Liner Sample 12	410494012	Barium	0.118	175	mg/kg		
CFAN160023-Liner Sample 13	410494013	Barium	0.128	196	mg/kg		
CFAN160024-Liner Sample 14	410494014	Barium	0.12	199	mg/kg		
CFAN160011-Liner Sample 1	410494001	Beryllium	0.123	1.41	mg/kg		
CFAN160012-Liner Sample 2	410494002	Beryllium	0.122	1.43	mg/kg		
CFAN160013-Liner Sample 3	410494003	Beryllium	0.127	1.41	mg/kg		
CFAN160014-Liner Sample 4	410494004	Beryllium	0.12	1.37	mg/kg		

Sample ID	Lab Sample ID	Analyte Name	Detection Limit	Result	Units	Lab Qualifiers	Validation Flag
CFAN160015-Liner Sample 5	410494005	Beryllium	0.124	1.39	mg/kg		
CFAN160016-Liner Sample 6	410494006	Beryllium	0.116	1.44	mg/kg		
CFAN160017-Liner Sample 7	410494007	Beryllium	0.123	1.46	mg/kg		
CFAN160018-Liner Sample 8	410494008	Beryllium	0.119	1.44	mg/kg		
CFAN160019-Liner Sample 9	410494009	Beryllium	0.12	1.45	mg/kg		
CFAN160020-Liner Sample 10	410494010	Beryllium	0.119	1.49	mg/kg		
CFAN160021-Liner Sample 11	410494011	Beryllium	0.126	1.53	mg/kg		
CFAN160022-Liner Sample 12	410494012	Beryllium	0.118	1.39	mg/kg		
CFAN160023-Liner Sample 13	410494013	Beryllium	0.128	1.45	mg/kg		
CFAN160024-Liner Sample 14	410494014	Beryllium	0.12	1.39	mg/kg		
CFAN160011-Liner Sample 1	410494001	Cadmium	0.123	0.364	mg/kg	B	
CFAN160012-Liner Sample 2	410494002	Cadmium	0.122	0.395	mg/kg	B	
CFAN160013-Liner Sample 3	410494003	Cadmium	0.127	0.372	mg/kg	B	
CFAN160014-Liner Sample 4	410494004	Cadmium	0.12	0.435	mg/kg	B	
CFAN160015-Liner Sample 5	410494005	Cadmium	0.124	0.37	mg/kg	B	
CFAN160016-Liner Sample 6	410494006	Cadmium	0.116	0.357	mg/kg	B	
CFAN160017-Liner Sample 7	410494007	Cadmium	0.123	0.427	mg/kg	B	
CFAN160018-Liner Sample 8	410494008	Cadmium	0.119	0.303	mg/kg	B	
CFAN160019-Liner Sample 9	410494009	Cadmium	0.12	0.391	mg/kg	B	
CFAN160020-Liner Sample 10	410494010	Cadmium	0.119	0.485	mg/kg	B	
CFAN160021-Liner Sample 11	410494011	Cadmium	0.126	0.697	mg/kg		
CFAN160022-Liner Sample 12	410494012	Cadmium	0.118	0.346	mg/kg	B	
CFAN160023-Liner Sample 13	410494013	Cadmium	0.128	0.442	mg/kg	B	
CFAN160024-Liner Sample 14	410494014	Cadmium	0.12	0.377	mg/kg	B	
CFAN160011-Liner Sample 1	410494001	Chromium	0.185	26	mg/kg		
CFAN160012-Liner Sample 2	410494002	Chromium	0.183	26.3	mg/kg		
CFAN160013-Liner Sample 3	410494003	Chromium	0.191	25.8	mg/kg		
CFAN160014-Liner Sample 4	410494004	Chromium	0.18	25	mg/kg		
CFAN160015-Liner Sample 5	410494005	Chromium	0.185	25.8	mg/kg		
CFAN160016-Liner Sample 6	410494006	Chromium	0.173	26.3	mg/kg		
CFAN160017-Liner Sample 7	410494007	Chromium	0.185	27.3	mg/kg		
CFAN160018-Liner Sample 8	410494008	Chromium	0.179	26.1	mg/kg		
CFAN160019-Liner Sample 9	410494009	Chromium	0.18	25.8	mg/kg		

Sample ID	Lab Sample ID	Analyte Name	Detection Limit	Result	Units	Lab Qualifiers	Validation Flag
CFAN160020-Liner Sample 10	410494010	Chromium	0.178	27.3	mg/kg		
CFAN160021-Liner Sample 11	410494011	Chromium	0.189	29	mg/kg		
CFAN160022-Liner Sample 12	410494012	Chromium	0.178	26.6	mg/kg		
CFAN160023-Liner Sample 13	410494013	Chromium	0.192	26.4	mg/kg		
CFAN160024-Liner Sample 14	410494014	Chromium	0.18	25.9	mg/kg		
CFAN160011-Liner Sample 1	410494001	Copper	0.369	27.6	mg/kg		
CFAN160012-Liner Sample 2	410494002	Copper	0.366	35	mg/kg		
CFAN160013-Liner Sample 3	410494003	Copper	0.382	36.4	mg/kg		
CFAN160014-Liner Sample 4	410494004	Copper	0.359	38.2	mg/kg		
CFAN160015-Liner Sample 5	410494005	Copper	0.371	40.5	mg/kg		
CFAN160016-Liner Sample 6	410494006	Copper	0.347	34.7	mg/kg		
CFAN160017-Liner Sample 7	410494007	Copper	0.37	31.1	mg/kg		
CFAN160018-Liner Sample 8	410494008	Copper	0.357	30	mg/kg		
CFAN160019-Liner Sample 9	410494009	Copper	0.36	30.8	mg/kg		
CFAN160020-Liner Sample 10	410494010	Copper	0.357	33.5	mg/kg		
CFAN160021-Liner Sample 11	410494011	Copper	0.377	28.9	mg/kg		
CFAN160022-Liner Sample 12	410494012	Copper	0.355	31.3	mg/kg		
CFAN160023-Liner Sample 13	410494013	Copper	0.384	33.7	mg/kg		
CFAN160024-Liner Sample 14	410494014	Copper	0.361	30.7	mg/kg		
CFAN160011-Liner Sample 1	410494001	Lead	0.406	15.9	mg/kg		
CFAN160012-Liner Sample 2	410494002	Lead	0.403	18.1	mg/kg		
CFAN160013-Liner Sample 3	410494003	Lead	0.42	17.2	mg/kg		
CFAN160014-Liner Sample 4	410494004	Lead	0.395	17.3	mg/kg		
CFAN160015-Liner Sample 5	410494005	Lead	0.408	17.1	mg/kg		
CFAN160016-Liner Sample 6	410494006	Lead	0.381	17.3	mg/kg		
CFAN160017-Liner Sample 7	410494007	Lead	0.407	18.2	mg/kg		
CFAN160018-Liner Sample 8	410494008	Lead	0.393	17.2	mg/kg		
CFAN160019-Liner Sample 9	410494009	Lead	0.396	18.7	mg/kg		
CFAN160020-Liner Sample 10	410494010	Lead	0.393	18.5	mg/kg		
CFAN160021-Liner Sample 11	410494011	Lead	0.415	20.9	mg/kg		
CFAN160022-Liner Sample 12	410494012	Lead	0.391	18.1	mg/kg		
CFAN160023-Liner Sample 13	410494013	Lead	0.422	19.9	mg/kg		
CFAN160024-Liner Sample 14	410494014	Lead	0.397	16.8	mg/kg		

Sample ID	Lab Sample ID	Analyte Name	Detection Limit	Result	Units	Lab Qualifiers	Validation Flag
CFAN160011-Liner Sample 1	410494001	Manganese	0.246	256	mg/kg		
CFAN160012-Liner Sample 2	410494002	Manganese	0.244	234	mg/kg		
CFAN160013-Liner Sample 3	410494003	Manganese	0.255	291	mg/kg		
CFAN160014-Liner Sample 4	410494004	Manganese	0.24	339	mg/kg		
CFAN160015-Liner Sample 5	410494005	Manganese	0.247	307	mg/kg		
CFAN160016-Liner Sample 6	410494006	Manganese	0.231	253	mg/kg		
CFAN160017-Liner Sample 7	410494007	Manganese	0.247	233	mg/kg		
CFAN160018-Liner Sample 8	410494008	Manganese	0.238	278	mg/kg		
CFAN160019-Liner Sample 9	410494009	Manganese	0.24	291	mg/kg		
CFAN160020-Liner Sample 10	410494010	Manganese	0.238	318	mg/kg		
CFAN160021-Liner Sample 11	410494011	Manganese	0.252	610	mg/kg		
CFAN160022-Liner Sample 12	410494012	Manganese	0.237	303	mg/kg		
CFAN160023-Liner Sample 13	410494013	Manganese	0.256	290	mg/kg		
CFAN160024-Liner Sample 14	410494014	Manganese	0.241	271	mg/kg		
CFAN160011-Liner Sample 1	410494001	Mercury	4.86	17.8	mg/kg		
CFAN160012-Liner Sample 2	410494002	Mercury	4.55	20.4	mg/kg		
CFAN160013-Liner Sample 3	410494003	Mercury	5.14	17.9	mg/kg		
CFAN160014-Liner Sample 4	410494004	Mercury	4.96	18.6	mg/kg		
CFAN160015-Liner Sample 5	410494005	Mercury	4.56	17.8	mg/kg		
CFAN160016-Liner Sample 6	410494006	Mercury	4.64	17.1	mg/kg		
CFAN160017-Liner Sample 7	410494007	Mercury	4.45	246	mg/kg		
CFAN160018-Liner Sample 8	410494008	Mercury	4.29	17	mg/kg		
CFAN160019-Liner Sample 9	410494009	Mercury	4.8	17.3	mg/kg		
CFAN160020-Liner Sample 10	410494010	Mercury	5.03	16	mg/kg		
CFAN160021-Liner Sample 11	410494011	Mercury	5.23	25.7	mg/kg		
CFAN160022-Liner Sample 12	410494012	Mercury	4.54	38.9	mg/kg		
CFAN160023-Liner Sample 13	410494013	Mercury	4.74	18.7	mg/kg		
CFAN160024-Liner Sample 14	410494014	Mercury	4.86	16.9	mg/kg		
CFAN160011-Liner Sample 1	410494001	Nickel	0.185	21.6	mg/kg	E	J
CFAN160012-Liner Sample 2	410494002	Nickel	0.183	23.9	mg/kg	E	J
CFAN160013-Liner Sample 3	410494003	Nickel	0.191	22.7	mg/kg	E	J
CFAN160014-Liner Sample 4	410494004	Nickel	0.18	23.1	mg/kg	E	J
CFAN160015-Liner Sample 5	410494005	Nickel	0.185	22.9	mg/kg	E	J

Sample ID	Lab Sample ID	Analyte Name	Detection Limit	Result	Units	Lab Qualifiers	Validation Flag
CFAN160016-Liner Sample 6	410494006	Nickel	0.173	23.1	mg/kg	E	J
CFAN160017-Liner Sample 7	410494007	Nickel	0.185	24.8	mg/kg	E	J
CFAN160018-Liner Sample 8	410494008	Nickel	0.179	22.5	mg/kg	E	J
CFAN160019-Liner Sample 9	410494009	Nickel	0.18	22.9	mg/kg	E	J
CFAN160020-Liner Sample 10	410494010	Nickel	0.178	24.8	mg/kg	E	J
CFAN160021-Liner Sample 11	410494011	Nickel	0.189	29	mg/kg	E	J
CFAN160022-Liner Sample 12	410494012	Nickel	0.178	24	mg/kg	E	J
CFAN160023-Liner Sample 13	410494013	Nickel	0.192	23.8	mg/kg	E	J
CFAN160024-Liner Sample 14	410494014	Nickel	0.18	23.1	mg/kg	E	J
CFAN160011-Liner Sample 1	410494001	Selenium	0.616	1.69	mg/kg	B	
CFAN160012-Liner Sample 2	410494002	Selenium	0.61	1.28	mg/kg	B	
CFAN160013-Liner Sample 3	410494003	Selenium	0.637	1.57	mg/kg	B	
CFAN160014-Liner Sample 4	410494004	Selenium	0.599	1.33	mg/kg	B	
CFAN160015-Liner Sample 5	410494005	Selenium	0.618	1.28	mg/kg	B	
CFAN160016-Liner Sample 6	410494006	Selenium	0.578	0.959	mg/kg	B	
CFAN160017-Liner Sample 7	410494007	Selenium	0.617	1.33	mg/kg	B	
CFAN160018-Liner Sample 8	410494008	Selenium	0.596	1.48	mg/kg	B	
CFAN160019-Liner Sample 9	410494009	Selenium	0.6	1.47	mg/kg	B	
CFAN160020-Liner Sample 10	410494010	Selenium	0.595	1.6	mg/kg	B	
CFAN160021-Liner Sample 11	410494011	Selenium	0.629	1.7	mg/kg	B	
CFAN160022-Liner Sample 12	410494012	Selenium	0.592	1.78	mg/kg	B	
CFAN160023-Liner Sample 13	410494013	Selenium	0.639	1.41	mg/kg	B	
CFAN160024-Liner Sample 14	410494014	Selenium	0.601	1.38	mg/kg	B	
CFAN160011-Liner Sample 1	410494001	Silver	0.123	0.7	mg/kg		
CFAN160012-Liner Sample 2	410494002	Silver	0.122	0.77	mg/kg		
CFAN160013-Liner Sample 3	410494003	Silver	0.127	0.664	mg/kg		
CFAN160014-Liner Sample 4	410494004	Silver	0.12	0.586	mg/kg	B	
CFAN160015-Liner Sample 5	410494005	Silver	0.124	0.709	mg/kg		
CFAN160016-Liner Sample 6	410494006	Silver	0.116	0.732	mg/kg		
CFAN160017-Liner Sample 7	410494007	Silver	0.123	0.803	mg/kg		
CFAN160018-Liner Sample 8	410494008	Silver	0.119	0.826	mg/kg		
CFAN160019-Liner Sample 9	410494009	Silver	0.12	0.762	mg/kg		
CFAN160020-Liner Sample 10	410494010	Silver	0.119	0.725	mg/kg		

Sample ID	Lab Sample ID	Analyte Name	Detection Limit	Result	Units	Lab Qualifiers	Validation Flag
CFAN160021-Liner Sample 11	410494011	Silver	0.126	0.812	mg/kg		
CFAN160022-Liner Sample 12	410494012	Silver	0.118	0.821	mg/kg		
CFAN160023-Liner Sample 13	410494013	Silver	0.128	0.753	mg/kg		
CFAN160024-Liner Sample 14	410494014	Silver	0.12	0.72	mg/kg		
CFAN160011-Liner Sample 1	410494001	Thallium	0.616	0.616	mg/kg	U	
CFAN160012-Liner Sample 2	410494002	Thallium	0.61	0.61	mg/kg	U	
CFAN160013-Liner Sample 3	410494003	Thallium	0.637	0.637	mg/kg	U	
CFAN160014-Liner Sample 4	410494004	Thallium	0.599	0.599	mg/kg	U	
CFAN160015-Liner Sample 5	410494005	Thallium	0.618	0.618	mg/kg	U	
CFAN160016-Liner Sample 6	410494006	Thallium	0.578	0.578	mg/kg	U	
CFAN160017-Liner Sample 7	410494007	Thallium	0.617	0.617	mg/kg	U	
CFAN160018-Liner Sample 8	410494008	Thallium	0.596	0.596	mg/kg	U	
CFAN160019-Liner Sample 9	410494009	Thallium	0.6	0.6	mg/kg	U	
CFAN160020-Liner Sample 10	410494010	Thallium	0.595	0.595	mg/kg	U	
CFAN160021-Liner Sample 11	410494011	Thallium	0.629	0.629	mg/kg	U	
CFAN160022-Liner Sample 12	410494012	Thallium	0.592	0.592	mg/kg	U	
CFAN160023-Liner Sample 13	410494013	Thallium	0.639	0.639	mg/kg	U	
CFAN160024-Liner Sample 14	410494014	Thallium	0.601	0.601	mg/kg	U	

B = Either presence of analyte detected in the associated blank, or minimum detection limit < sample value < practical quantification limit
E = % difference of sample and SD is >10%. Sample concentration must meet flagging criteria.
J = Value is estimated.
U = Analyte was analyzed for, but not detected above the minimum detection limit.

Table A-2. Central Facilities Area Sewage Treatment Plant Lagoon 3 soil/liner organic sample data.

Sample ID	Lab Sample ID	Analyte Name	Detection Limit	Result	Units	Lab Qualifiers	Validation Flag
CFAN160011-Liner Sample 1	410494001	1,4-Dichlorobenzene	0.348	1.05	µg/kg	U	
CFAN160012-Liner Sample 2	410494002	1,4-Dichlorobenzene	0.328	0.986	µg/kg	U	
CFAN160013-Liner Sample 3	410494003	1,4-Dichlorobenzene	0.346	1.04	µg/kg	U	
CFAN160014-Liner Sample 4	410494004	1,4-Dichlorobenzene	0.34	1.02	µg/kg	U	
CFAN160015-Liner Sample 5	410494005	1,4-Dichlorobenzene	0.328	0.985	µg/kg	U	
CFAN160016-Liner Sample 6	410494006	1,4-Dichlorobenzene	0.333	1	µg/kg	U	
CFAN160017-Liner Sample 7	410494007	1,4-Dichlorobenzene	0.328	0.984	µg/kg	U	
CFAN160018-Liner Sample 8	410494008	1,4-Dichlorobenzene	0.329	0.989	µg/kg	U	
CFAN160019-Liner Sample 9	410494009	1,4-Dichlorobenzene	0.332	0.998	µg/kg	U	
CFAN160020-Liner Sample 10	410494010	1,4-Dichlorobenzene	0.31	0.932	µg/kg	U	
CFAN160021-Liner Sample 11	410494011	1,4-Dichlorobenzene	0.329	0.989	µg/kg	U	
CFAN160022-Liner Sample 12	410494012	1,4-Dichlorobenzene	0.312	0.936	µg/kg	U	
CFAN160023-Liner Sample 13	410494013	1,4-Dichlorobenzene	0.351	1.05	µg/kg	U	
CFAN160024-Liner Sample 14	410494014	1,4-Dichlorobenzene	0.332	0.998	µg/kg	U	
CFAN160011-Liner Sample 1	410494001	Benzene	0.348	1.05	µg/kg	U	
CFAN160012-Liner Sample 2	410494002	Benzene	0.328	0.986	µg/kg	U	
CFAN160013-Liner Sample 3	410494003	Benzene	0.346	1.04	µg/kg	U	
CFAN160014-Liner Sample 4	410494004	Benzene	0.34	1.02	µg/kg	U	
CFAN160015-Liner Sample 5	410494005	Benzene	0.328	0.985	µg/kg	U	
CFAN160016-Liner Sample 6	410494006	Benzene	0.333	1	µg/kg	U	
CFAN160017-Liner Sample 7	410494007	Benzene	0.328	0.984	µg/kg	U	
CFAN160018-Liner Sample 8	410494008	Benzene	0.329	0.989	µg/kg	U	
CFAN160019-Liner Sample 9	410494009	Benzene	0.332	0.998	µg/kg	U	
CFAN160020-Liner Sample 10	410494010	Benzene	0.31	0.932	µg/kg	U	
CFAN160021-Liner Sample 11	410494011	Benzene	0.329	0.989	µg/kg	U	
CFAN160022-Liner Sample 12	410494012	Benzene	0.312	0.936	µg/kg	U	
CFAN160023-Liner Sample 13	410494013	Benzene	0.351	1.05	µg/kg	U	
CFAN160024-Liner Sample 14	410494014	Benzene	0.332	0.998	µg/kg	U	
CFAN160011-Liner Sample 1	410494001	Ethylbenzene	0.348	1.05	µg/kg	U	
CFAN160012-Liner Sample 2	410494002	Ethylbenzene	0.328	0.986	µg/kg	U	
CFAN160013-Liner Sample 3	410494003	Ethylbenzene	0.346	1.04	µg/kg	U	
CFAN160014-Liner Sample 4	410494004	Ethylbenzene	0.34	1.02	µg/kg	U	

CFAN160015-Liner Sample 5	410494005	Ethylbenzene	0.328	0.985	µg/kg	U	
CFAN160016-Liner Sample 6	410494006	Ethylbenzene	0.333	1	µg/kg	U	
CFAN160017-Liner Sample 7	410494007	Ethylbenzene	0.328	0.984	µg/kg	U	
CFAN160018-Liner Sample 8	410494008	Ethylbenzene	0.329	0.989	µg/kg	U	
CFAN160019-Liner Sample 9	410494009	Ethylbenzene	0.332	0.998	µg/kg	U	
CFAN160020-Liner Sample 10	410494010	Ethylbenzene	0.31	0.932	µg/kg	U	
CFAN160021-Liner Sample 11	410494011	Ethylbenzene	0.329	0.989	µg/kg	U	
CFAN160022-Liner Sample 12	410494012	Ethylbenzene	0.312	0.936	µg/kg	U	
CFAN160023-Liner Sample 13	410494013	Ethylbenzene	0.351	1.05	µg/kg	U	
CFAN160024-Liner Sample 14	410494014	Ethylbenzene	0.332	0.998	µg/kg	U	
CFAN160011-Liner Sample 1	410494001	Methylene chloride	1.74	5.23	µg/kg	U	
CFAN160012-Liner Sample 2	410494002	Methylene chloride	1.64	4.93	µg/kg	U	
CFAN160013-Liner Sample 3	410494003	Methylene chloride	1.73	5.2	µg/kg	U	
CFAN160014-Liner Sample 4	410494004	Methylene chloride	1.7	5.1	µg/kg	U	
CFAN160015-Liner Sample 5	410494005	Methylene chloride	1.64	4.92	µg/kg	U	
CFAN160016-Liner Sample 6	410494006	Methylene chloride	1.67	5.01	µg/kg	U	
CFAN160017-Liner Sample 7	410494007	Methylene chloride	1.64	4.92	µg/kg	U	
CFAN160018-Liner Sample 8	410494008	Methylene chloride	1.65	4.94	µg/kg	U	
CFAN160019-Liner Sample 9	410494009	Methylene chloride	1.66	4.99	µg/kg	U	
CFAN160020-Liner Sample 10	410494010	Methylene chloride	1.55	2.27	µg/kg	J	J
CFAN160021-Liner Sample 11	410494011	Methylene chloride	1.65	4.95	µg/kg	U	
CFAN160022-Liner Sample 12	410494012	Methylene chloride	1.56	4.68	µg/kg	U	
CFAN160023-Liner Sample 13	410494013	Methylene chloride	1.76	5.27	µg/kg	U	
CFAN160024-Liner Sample 14	410494014	Methylene chloride	1.66	4.99	µg/kg	U	
CFAN160011-Liner Sample 1	410494001	Toluene	0.348	1.05	µg/kg	U	
CFAN160012-Liner Sample 2	410494002	Toluene	0.328	0.986	µg/kg	U	
CFAN160013-Liner Sample 3	410494003	Toluene	0.346	1.04	µg/kg	U	
CFAN160014-Liner Sample 4	410494004	Toluene	0.34	1.02	µg/kg	U	
CFAN160015-Liner Sample 5	410494005	Toluene	0.328	0.985	µg/kg	U	
CFAN160016-Liner Sample 6	410494006	Toluene	0.333	1	µg/kg	U	
CFAN160017-Liner Sample 7	410494007	Toluene	0.328	0.984	µg/kg	U	
CFAN160018-Liner Sample 8	410494008	Toluene	0.329	0.989	µg/kg	U	
CFAN160019-Liner Sample 9	410494009	Toluene	0.332	0.998	µg/kg	U	
CFAN160020-Liner Sample 10	410494010	Toluene	0.31	0.932	µg/kg	U	
CFAN160021-Liner Sample 11	410494011	Toluene	0.329	0.989	µg/kg	U	

CFAN160022-Liner Sample 12	410494012	Toluene	0.312	0.936	µg/kg	U	
CFAN160023-Liner Sample 13	410494013	Toluene	0.351	1.05	µg/kg	U	
CFAN160024-Liner Sample 14	410494014	Toluene	0.332	0.998	µg/kg	U	
CFAN160011-Liner Sample 1	410494001	Xylenes (total)	1.05	3.14	µg/kg	U	
CFAN160012-Liner Sample 2	410494002	Xylenes (total)	0.986	2.96	µg/kg	U	
CFAN160013-Liner Sample 3	410494003	Xylenes (total)	1.04	3.12	µg/kg	U	
CFAN160014-Liner Sample 4	410494004	Xylenes (total)	1.02	3.06	µg/kg	U	
CFAN160015-Liner Sample 5	410494005	Xylenes (total)	0.985	2.95	µg/kg	U	
CFAN160016-Liner Sample 6	410494006	Xylenes (total)	1	3	µg/kg	U	
CFAN160017-Liner Sample 7	410494007	Xylenes (total)	0.984	2.95	µg/kg	U	
CFAN160018-Liner Sample 8	410494008	Xylenes (total)	0.989	2.97	µg/kg	U	
CFAN160019-Liner Sample 9	410494009	Xylenes (total)	0.998	2.99	µg/kg	U	
CFAN160020-Liner Sample 10	410494010	Xylenes (total)	0.932	2.8	µg/kg	U	
CFAN160021-Liner Sample 11	410494011	Xylenes (total)	0.989	2.97	µg/kg	U	
CFAN160022-Liner Sample 12	410494012	Xylenes (total)	0.936	2.81	µg/kg	U	
CFAN160023-Liner Sample 13	410494013	Xylenes (total)	1.05	3.16	µg/kg	U	
CFAN160024-Liner Sample 14	410494014	Xylenes (total)	0.998	2.99	µg/kg	U	

J = Value is estimated.
U = Analyte was analyzed for, but not detected above the minimum detection limit.

Table A-3. Central Facilities Area Sewage Treatment Plant Lagoon 3 soil/liner radiological sample data.

Sample ID	Lab Sample ID	Analyte Name	Detection Limit	Result	Units	Lab Qualifiers	Validation Flag
CFAN160011-Liner Sample 1	410494001	Cs-137	0.0522	0.0231	pCi/g	U	U
CFAN160012-Liner Sample 2	410494002	Cs-137	0.0428	0.0164	pCi/g	U	U
CFAN160013-Liner Sample 3	410494003	Cs-137	0.0406	0.0186	pCi/g	U	U
CFAN160014-Liner Sample 4	410494004	Cs-137	0.0491	0.0103	pCi/g	U	U
CFAN160015-Liner Sample 5	410494005	Cs-137	0.0513	0.03	pCi/g	U	UJ
CFAN160016-Liner Sample 6	410494006	Cs-137	0.049	0.0184	pCi/g	U	U
CFAN160017-Liner Sample 7	410494007	Cs-137	0.0465	0	pCi/g	UI	U
CFAN160018-Liner Sample 8	410494008	Cs-137	0.0523	-0.0172	pCi/g	U	U
CFAN160019-Liner Sample 9	410494009	Cs-137	0.0528	0.0442	pCi/g	U	UJ
CFAN160020-Liner Sample 10	410494010	Cs-137	0.0415	-0.0147	pCi/g	U	U
CFAN160021-Liner Sample 11	410494011	Cs-137	0.0457	0.0183	pCi/g	U	U
CFAN160022-Liner Sample 12	410494012	Cs-137	0.0417	0.0246	pCi/g	U	U
CFAN160023-Liner Sample 13	410494013	Cs-137	0.0294	0.0251	pCi/g	U	U
CFAN160024-Liner Sample 14	410494014	Cs-137	0.0408	-0.0165	pCi/g	U	U
CFAN160011-Liner Sample 1	410494001	H-3	4.49	2.47	pCi/g	U	U
CFAN160012-Liner Sample 2	410494002	H-3	4.4	0.183	pCi/g	U	U
CFAN160013-Liner Sample 3	410494003	H-3	4.27	-0.434	pCi/g	U	U
CFAN160014-Liner Sample 4	410494004	H-3	4.21	0.962	pCi/g	U	U
CFAN160015-Liner Sample 5	410494005	H-3	4.35	0.272	pCi/g	U	U
CFAN160016-Liner Sample 6	410494006	H-3	4.27	0.0109	pCi/g	U	U
CFAN160017-Liner Sample 7	410494007	H-3	4.27	1.89	pCi/g	U	U
CFAN160018-Liner Sample 8	410494008	H-3	4.23	2.62	pCi/g	U	U
CFAN160019-Liner Sample 9	410494009	H-3	3.99	0.313	pCi/g	U	U
CFAN160020-Liner Sample 10	410494010	H-3	4.29	0.872	pCi/g	U	U
CFAN160021-Liner Sample 11	410494011	H-3	4.13	0.873	pCi/g	U	U
CFAN160022-Liner Sample 12	410494012	H-3	4.17	0.992	pCi/g	U	U
CFAN160023-Liner Sample 13	410494013	H-3	4.22	3.39	pCi/g	U	UJ
CFAN160024-Liner Sample 14	410494014	H-3	4.02	0.269	pCi/g	U	U
CFAN160011-Liner Sample 1	410494001	I-129	1.11	0.15	pCi/g	U	U
CFAN160012-Liner Sample 2	410494002	I-129	0.994	0.0653	pCi/g	U	U
CFAN160013-Liner Sample 3	410494003	I-129	0.77	-0.0313	pCi/g	U	U
CFAN160014-Liner Sample 4	410494004	I-129	0.647	-0.231	pCi/g	U	U

Sample ID	Lab Sample ID	Analyte Name	Detection Limit	Result	Units	Lab Qualifiers	Validation Flag
CFAN160015-Liner Sample 5	410494005	I-129	0.432	-0.099	pCi/g	U	U
CFAN160016-Liner Sample 6	410494006	I-129	1.11	-0.107	pCi/g	U	U
CFAN160017-Liner Sample 7	410494007	I-129	0.381	-0.206	pCi/g	U	U
CFAN160018-Liner Sample 8	410494008	I-129	0.809	-0.251	pCi/g	U	U
CFAN160019-Liner Sample 9	410494009	I-129	0.769	0.208	pCi/g	U	U
CFAN160020-Liner Sample 10	410494010	I-129	0.782	-0.152	pCi/g	U	U
CFAN160021-Liner Sample 11	410494011	I-129	0.614	-0.0772	pCi/g	U	U
CFAN160022-Liner Sample 12	410494012	I-129	0.97	-0.217	pCi/g	U	U
CFAN160023-Liner Sample 13	410494013	I-129	1.18	0.295	pCi/g	U	U
CFAN160024-Liner Sample 14	410494014	I-129	0.866	0.186	pCi/g	U	U
CFAN160011-Liner Sample 1	410494001	Sr-90	1.43	0.47	pCi/g	U	U
CFAN160012-Liner Sample 2	410494002	Sr-90	1.73	1.49	pCi/g	U	UJ
CFAN160013-Liner Sample 3	410494003	Sr-90	1.85	0.272	pCi/g	U	U
CFAN160014-Liner Sample 4	410494004	Sr-90	1.17	0.374	pCi/g	U	U
CFAN160015-Liner Sample 5	410494005	Sr-90	0.741	0.363	pCi/g	U	U
CFAN160016-Liner Sample 6	410494006	Sr-90	0.866	0.295	pCi/g	U	U
CFAN160017-Liner Sample 7	410494007	Sr-90	1.55	0.645	pCi/g	U	U
CFAN160018-Liner Sample 8	410494008	Sr-90	1.03	-0.0162	pCi/g	U	U
CFAN160019-Liner Sample 9	410494009	Sr-90	1.19	0.416	pCi/g	U	U
CFAN160020-Liner Sample 10	410494010	Sr-90	1.19	0.651	pCi/g	U	U
CFAN160021-Liner Sample 11	410494011	Sr-90	0.721	0.0146	pCi/g	U	U
CFAN160022-Liner Sample 12	410494012	Sr-90	1.12	0.373	pCi/g	U	U
CFAN160023-Liner Sample 13	410494013	Sr-90	0.771	0.0273	pCi/g	U	U
CFAN160024-Liner Sample 14	410494014	Sr-90	1.17	0.0395	pCi/g	U	U

U = Analyte was analyzed for, but not detected above the minimum detected activity.
UI = Gamma Spectroscopy--Uncertain identification.
UJ = The analysis was performed, however, the result is highly questionable due to analytical and/or laboratory quality control anomalies.