PNNL-14344

Tank 241-AY-102 Data Report

M. J. Lindberg
W. J. Deutsch

July 2003

Prepared for CH2M HILL Hanford Group, Inc.
and the U.S. Department of Energy
under Contract DE-AC06-76RL01830

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Pacific Northwest National Laboratory
Richland, Washington 99352

Summary

Archived samples of sludge and drainable liquid from tank 241-AY-102 were characterized in the laboratory in order to evaluate analytical methods for testing tank waste and determine the composition and leaching characteristics of this material. The tests included physical characterization, quantitative analysis of waste composition, and short-term water leach and acid digestion of the waste material. The water leach tests were conducted over time periods of one day, two weeks, and one month to determine if contact time had an impact on leachability. Comparisons of the results of the water leach tests with the acid digestions allow for an estimation of the water leachable percentage of an element.

The average water leachability of Tc-99 was measured at 20% over the one-month time frame of the leach tests. There did not appear to be any temporal change in water leachability by comparing the results of the three sampling intervals. Approximately 24 to 48% of the total Cs-137 in the sludge is water leachable over a time period of one day to one month. There is a weak time dependence of cesium leachability with slightly more dissolved Cs-137 in the one-month test compared to the shorter tests.

Very little Sr-90 is water leachable with a mean value of 0.7% ± 0.1% throughout the tests. This is similar to the leachabilities of Am-241, Pu-239, and Np-237, which had mean percentages of 0.4%, 1.0%, and 3.8%, respectively. The leachable percentages for these radionuclides did not vary significantly over the one month time frame.

A relatively large percentage of the U-238 (51.6% to >100%) was found to be water leachable with a mean value of 73.7%. Sodium and molybdenum were also found to be relatively leachable with values of 40.4% and 42.4%, respectively. The remaining elements for which leachability could be calculated were Cr, Ag, Al, and Pb. The leachable percentages of these metals were all less than 5%. Leachability was not time dependent for any of these metals.

The radioactivities of the alpha-emitting transuranic isotopes with half-lives greater than 20 years were measured to determine if the sum exceeded 100 nCi/g, which is the minimum value for classification of the material as transuranic (TRU) waste. Although there was a discrepancy between the two methods used to measure the radioactivity of these isotopes, the sum of the radioactivities for both methods exceeds 100 nCi/g by a factor of 10 or more. Based on these measurements, the sludge in tank 241-AY-102 would be classified as TRU waste.

Contents

Tables

1.0 Introduction

This data report discusses the methods and philosophy used to characterize two samples of sludge and one sample of drainable liquid from tank 241-AY-102 and provides a summary of the results determined during the Tier 1 characterization (initial screening) of the material. Characterization was conducted in accordance with the client-approved test plan dated December 13, 2002, with exceptions noted in the discussion of the methods.

Characterization of residual tank waste is necessary to develop realistic source term release models for the long-term risk assessments required for tank closure. Testing samples from tank 241-AY-102 was conducted as part of the accelerated tank closure demonstration for tank 241-C-106. Material from tank 241-C-106 is currently not available for testing; therefore, archived samples of material from tank 241-AY-102 were used as a surrogate because the material was previously pumped from tank 241-C-106 to 241-AY-102. The Tier 1 testing described in this report was conducted to evaluate the test methods with actual tank waste and provide preliminary data on waste composition. Tier 1 testing of residual waste from tank 241-C-106 will be conducted when the final material is available.

A complete set of the Tier 1 laboratory results for tank 241-AY-102 will be sent electronically to the CH2M HILL Hanford Group, Inc., (CHG) technical representative, M. Connelly, in the form of an Excel workbook that will contain all the raw data and the summary set used to generate this report.

2.0 Sample Inventory and Description

Archived samples of waste from tank 241-AY-102 were shipped from the 222-S laboratory to the PNNL Radiological Process Laboratory (RPL 325) on December 16, 2002. These samples consisted of four jars of sludge (Jars 15935, 17785, 18686, and 18761) and two jars of drainable liquid (Jars 19332 and 18544). Sample designations, sources and sizes are listed in Table 1. The samples used for the Tier 1 tests described in this report came from jars 15935 and 18686 (sludges) and jar 19332 (drainable liquid). These samples of sludge were used because they represent discrete intervals in the cores collected from tank 241-AY-102 and are not composites of core segments. The remaining unused material from tank 241-AY-102 is presently stored in the Radiological Process Laboratory.

The two sludge samples used for testing were brown, hard solids that were very cohesive. They required aggressive scraping from the jar to remove sufficient aliquots for testing. Due to their dryness, the sludge was highly dispersible. The drainable liquid was translucent and yellow in color. A small amount of white crystals was noted on the bottom of the jar. The crystals were not incorporated into the liquid extracted for testing.

3.0 Tiered Characterization Approach

Tank waste samples were analyzed in a tiered approach similar to the one developed for investigating contaminant fate and transport issues associated with past single-shell tank leaks in the vadose zone. Such an approach allows for initial screening (the Tier 1 test described in this report) of samples using relatively inexpensive analytical techniques. This is followed by an analysis of the data to determine further analytical techniques (Tier 2) that would yield important risk assessment information.

The Tier 1 tests for waste samples from tank 241-AY-102 included (1) quantitative analyses of the composition of the waste material by gamma energy analysis and (2) initial analysis of contaminant mobility by short-term water leach tests and acid digestion of the waste material. Additional Tier 1 tests that are discussed in the client's test plan, and which may be conducted in the future depending on project needs, include quantitative analysis of fused samples, x-ray fluorescence, and x-ray diffraction. Details of the Tier 1 tests that were performed are provided in Section 3.1.

3.1 Tier 1 Tests

The following tests were conducted on the sludge samples from jars 15935 and 18686 and the drainable liquid from jar 19332, except as noted. In several cases, a duplicate analysis was conducted using sludge from jar 18686. Duplicate analyses on aliquots of drainable liquid were also performed for many analytes.

3.1.1 Moisture Content

The moisture contents of the two solid waste samples were measured in order to calculate dry weight concentrations for constituents in the waste. Dry weight concentrations provide a consistent measurement unit for comparison purposes that eliminates the effect of variable water content on sample concentrations.

Gravimetric water contents of the waste material were determined using accepted PNNL laboratory procedures. This procedure is based on the American Society for Testing and Materials procedure *Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock* (ASTM 1998). Samples for measurement were placed in tared containers, weighed, and dried in an oven at 105°C until constant weight has been achieved, usually within 24 to 48 hours. The containers were then removed from the oven, sealed, cooled, and weighed. At least two weighings, after an additional 24-hours of heating, were performed to ensure that all moisture had been removed. All weighings were performed using a calibrated balance. The gravimetric water content is computed as the percentage change in soil weight before and after oven drying.

3.1.2 Carbon Content of Residual Waste

The carbon fractions (inorganic and organic) of the waste material were determined by first measuring the inorganic carbon content of the material by acidification and then measuring the organic fraction by acidic potassium persulfate oxidation. Both measurements are determined on the same sample aliquot. The total carbon is calculated by adding the inorganic fraction concentration to the concentration of organic carbon. The procedure follows PNNL's hot persulfate wet oxidation method.

3.1.3 Short-Term Water Leaching Tests

Water leach tests were conducted on 0.19 to 0.37 g (wet weight) of the solids and 30 mL of deionized water for each test. The deionized water was added to screw-cap poly vials containing the waste sample. The vials were sealed and briefly shaken by hand, then placed on a mechanical orbital shaker. Three vials were prepared for each of the two solid waste materials as well as a duplicate for jar 18686 for each leaching period. The leach tests were sacrificed for analysis after the following periods: 1 day, 2 weeks and 1 month. Solution composition measurements over this timeframe provide information on the short-term variability of contaminant release. At each sampling interval, the solids were allowed to settle in the vial. The supernatant was carefully decanted and small aliquots saved for pH and electrical conductivity measurements. The remaining leachate was filtered (passed through 0.45 µm membranes) and analyzed for anion, cation, alkalinity, and radionuclide concentrations (described below). These water leach tests followed the general guidelines of *Shake Extraction of Solid Waste with Water* (ASTM 1999) with changes made to accommodate the small mass of material available for testing and longer test duration.

3.1.4 Strong Acid Digestion

Samples of the tank waste materials from the two sludge jars and the drainable liquor jar 19332 were digested with a strong acid (8M nitric acid) solution to estimate the total soluble constituents in the waste. This method follows the basic procedure described in the U.S. Environmental Protection Agency (EPA) Method 3050B, SW846 (EPA 2000) for the acid digestion of sediments, sludges and soils. Metals, actinides, total alpha, total beta, and gamma energy analysis were measured on these samples.

3.1.5 pH and Conductivity

Two, approximately 3-mL aliquots of the unfiltered supernatant from the water leach tests and the drainable liquid were used for pH and conductivity measurements. Solution pH values were measured with a solid-state pH electrode and a pH meter calibrated with buffers 4, 7, and 10. Conductivities were measured and compared to potassium chloride standards with a range of 0.001 M to 5.0 M. Conductivity and pH are measured using accepted PNNL laboratory procedures.

3.1.6 Alkalinity

The alkalinities of the water leaches and the drainable liquid were measured by standard titration with acid. The alkalinity procedure is equivalent to Method 2320 B (Clesceri et al. 1998).

3.1.7 Anions

The filtered water leachates and drainable liquid were analyzed for anions using an ion chromatograph. Fluoride, acetate, formate, chloride, nitrite, bromide, nitrate, nitrite, carbonate, phosphate, sulfate, and oxalate were separated on a Dionex AS17 column with a gradient elution of 1 mM to 35 mM NaOH and need measured using a conductivity detector. This methodology is based on EPA SW-846 (EPA 2000). Method 9056 (EPA 2000) was used, with the exception of using the gradient elution with sodium hydroxide.

3.1.8 Cations and Trace Metals

Major cation analysis (including Al, Si, Ca, Mg, Na, K, Fe, and Mn) of the water leachates and drainable liquid were performed by inductively coupled plasma-atomic emission spectroscopy (ICP-AES). High-purity calibration standards were used to generate calibration curves and verify continuing calibration during the analysis run. Dilutions of 10x and 5x were made for each sample and analyzed to investigate and correct for matrix interferences. Details are found in EPA Method 6010B (EPA 2000). An inductively coupled plasma-mass spectrometer (ICP-MS) was used to analyze trace metals including Cr, Mo, As, Se, Cd, Ag, Cd, Pb, ^{99}Tc, uranium isotopes, and several transuranics in the acid and water leachates. This method is similar to EPA Method 6020 (EPA 2000). Typical instrument detection limits for the ICP-AES and ICP-MS instruments are at the parts per billion level.

3.1.9 Radionuclides

In addition to the radionuclides listed above that were analyzed in solution by ICP-MS, short-lived radionuclides and some of the actinides were analyzed by conventional counting methods. Cs-137, Co-60, K-40 and the Eu isotopes were measured by gamma energy analysis (using methods discussed below under Section 3.1.9.1). The actinides were determined by wet chemical separation and alpha spectroscopy.

3.1.9.1 Gamma Energy Analysis

Gamma energy analysis was performed directly on the two tank waste solids to quantify mixed fission products, activation products, and natural decay products. The materials used for this analysis were the dried solids from the moisture content determinations. In addition, three types of liquid samples were analyzed: the acid and water leachates and the drainable liquids. Germanium counters were efficiency calibrated for distinct geometries using mixed gamma standards traceable to the National Institute of Standards and Technology. Control samples were run throughout the analysis to ensure correct operation of the detectors. The controls contain isotopes with photo peaks spanning the full detector range and were monitored for peak position, counting rate, and full-width half-maximum.

3.1.9.2 Total Alpha and Total Beta

Gross alpha and beta measurements were made on the filtered water leach test supernatants and the drainable liquid. For each sample, a ~1-ml sample volume was placed in a 20-ml tared liquid scintillation vial and weighed. A 15-ml scintillation cocktail was then added and the samples mixed and counted on a Wallace model 1415 liquid scintillation counter.

3.1.9.3 Strontium-90

Strontium-90 separations were not performed during this study. A semi-quantitative number was determined by total beta analysis of the water leaches, drainable liquid, and acid extract.

3.1.9.4 Transuranics

Separations of the actinides Pu-238, Pu-239, Am-241, Cm-242, and Cm-243/244 were performed on the acid extracts of the sludges and supernatant solution. Accepted PNNL laboratory procedures were followed. It includes (1) tracer addition to the sample aliquots, (2) an iron carrier and reduction with ascorbic acid, and (3) separation of the individual actinides by chromatography.

4.0 Results and Discussion

4.1 Sample Preparation

Table 2 lists the digestion factors (wet solid to solution ratios) used for the water and acid extractions. These factors are calculated from the wet weight of sludge material divided by the volume of extracting solution. Thirty milliliters of deionized water was used for the water extractions and 50-ml of nitric acid were used for the acid extractions. For the drainable liquid samples, 5 ml was diluted with 45 ml of 8 M nitric acid to determine acid extractable concentrations. Table 2 also shows the measured moisture contents of the three sludge samples used for testing. Note that there is a considerable difference in moisture contents (55.3% and 39.8%) for the duplicate samples of material from jar 18686. This may be a result of heterogeneities in the material and the small mass of material used to measure moisture content. The average moisture content of 47.5% was used for jar 18686 to calculate dry weight concentrations, which are shown in all of the following mass concentration tables.

4.2 Carbon Content

Table 3 lists the carbon contents of the waste samples from tank 241-AY-102. The results show that approximately 1.8 to 2.4% of the solids are inorganic carbon and 0.2 to 0.4% are organic carbon on an oven-dry basis. Inorganic carbon may be present in the solids as carbonate minerals, while the organic carbon is likely present as organic anions (primarily oxalate and acetate), as discussed below in the section on anion analyses.

The drainable liquid carbon analyses show a very high inorganic carbon concentration of 12,700 mg/L and organic carbon concentrations of about 2,200 mg/L. These values reflect the high solubility of the solids contacting the tank supernatant.

4.3 pH and Electrical Conductivity

Table 4 lists the pH values of the water extracts and the drainable liquid. The water extract pH values range from 9.95 to 10.33 and the pH values for duplicate aliquots of drainable liquid are 12.26 and 12.38. These water extract values are consistent with a hundred-fold dilution (100 ml solution per gram of sludge) used in the water extract tests when compared to the undiluted drainable liquid. The electrical conductivities in the water extracts range from 570 to 1,060 µS/cm, compared to a value of 236,300 µS/cm for the drainable liquid. The water extract values are low if simple dilution were the controlling factor. However, these values may reflect the presence of highly soluble components in the drainable liquid that are not present to a great extent in the sludge material used in the water extract tests.

4.4 Alkalinity

The alkalinities of the water extracts and drainable liquid at pH endpoints of 8.3 and 4.5 are listed in Table 5. The alkalinity to a pH of 8.3 represents primarily the acid neutralization capacity as a result of the presence of hydroxyl and carbonate ions, while the alkalinity at pH equal 4.5 includes these ions plus bicarbonate and some organic acid anions. The total alkalinities (pH 4.5) for the water extracts range from 338 mg/L to 550 mg/L as $CaCO_3$ with no apparent impact of contact time over the month long tests.

Water soluble alkalinity makes up a very small percentage (<0.02%, 200 mg/g) of the solid sludge. The total alkalinities of the duplicate analyses of the drainable liquid are 114,000 and 118,000 mg/L as $CaCO_3$. The high alkalinity of the drainable liquid may be a result of the high solubility of CO_2 gas at the supernatant pH of 12 and the high concentrations of titratable organic acid anions (see Section 4.5).

4.5 Anions

The anion concentrations of the water leach tests in units of per gram of sludge are listed in Table 6, and the concentrations per liter of supernatant (water and drainable liquid) are listed in Table 7. These anion concentrations are generally low with the solid phase concentrations being less than 1% of the solid for each anion listed in Table 6. This suggests that the primary solids in the waste are relatively insoluble in dilute water. The non-carbonate anion concentrations in solution (Table 7) are also low in the range of <1 to 19 µg/mL (mg/L). As shown by the alkalinity measurements (Table 5), the dominant anion in the water extract solution appears to be HCO_3/CO_3 at a total concentration of about 450 mg/L.

The oxalate concentrations of 10.4 to 18.7 mg/L (Table 7) for the water leach tests are not consistent with water leach tests of tank 241-C-106 waste done by Brooks et al. (1997). They report thousands of mg/L oxalate in their water washes and estimate that oxalate accounts for >20% of the original tank 241-C-106 sludge. This discrepancy may be due to different environments in tank 241-C-106 compared to tank 241-AY-102 leading to enhanced solubility of sodium oxalate in tank 241-AY-102. Note that the oxalate concentration in the drainable liquid in tank 241-AY-102 was measured at a high value of 8,560 mg/L (Table 7).

4.6 Cations

The cation concentrations of the water leach and acid extract tests in units micrograms per gram of sludge are listed in Table 8, and the concentrations in micrograms per liter of supernatant (water extract, acid extract, and drainable liquid) are listed in Table 9. Note that the concentrations in micrograms per gram of sludge are calculated from the solution concentration for the test. These values represent only the soluble portion of the sludge component in the extracting solution and not the total concentration of the component in the sludge, except in the cases where the component is completely dissolved in the extracting solution.

The ability of water to dissolve components from the sludge can be estimated by comparing the components' concentrations in the water extracts with the concentrations in the acid extracts, which represent the upper end of the leachable concentrations. The water extractable percentage of the component mass of the sludge can be calculated from the concentration values in terms of mass of component per dry mass of sludge. These percentages for the metals are discussed in this section.

Except for sodium and aluminum, the concentrations of all of the metals analyzed by ICP-OES listed in Table 9 are below the instrument level of quantitation. This is shown in the table by the parentheses around the listed number. Because of the uncertainty concerning the concentrations of these components in the water extracts, it is not valid to calculate an extractable percentage for these components. The concentrations of sodium and aluminum were measured above the quantitation level for these components for some or all of the water extracts. The mean leachable percentage for sodium is 40.4% and for aluminum it is 2.7%. There does not appear to be a significant change in leachability for sodium or aluminum over the one-month timeframe of the tests.

It was possible to also quantify the water leachability of several additional metals using the ICP-MS technique. The results of these analyses are listed in Tables 10 and 11. Measurable concentrations of chromium, molybdenum, silver and lead were detected in the water extracts. These concentrations (per gram of sludge) are listed in Table 10. The tests show that the water leachable percentages for these metals are: chromium (4.4%), molybdenum (42.4%), silver (3.0%), and lead (0.4%). As with the other components and analytical methods, there does not appear to be a significant change in the leachability of these components over the one-month timeframe of the tests. In summary, the water leachable percentages of the components as measured using ICP-OES and ICP-MS techniques are:

- molybdenum 42.4%
- sodium 40.4%
- chromium 4.4%
- silver 3.0%
- aluminum 2.7%
- lead 0.4%

Note that the only major metal and trace metal components of the sludge that had quantifiable concentrations in the acid leach tests as measured by either ICP-OES or ICP-MS were:

- aluminum
- sodium
- barium
- iron
- manganese
- nickel
- silver
- cadmium
- lead

4.7 Radionuclides

The concentrations of Tc-99, U-238, Am-241, Pu-239, and Np-237 measured by ICP-MS in the water leach tests and acid extracts in units of micrograms of radionuclide per gram of oven-dry sludge are listed in Table 12. The measured concentrations of these radionuclides in micrograms per liter of supernatant or drainable liquid are shown in Table 13. The water leachable percentages (assuming the acid extractable amount accounts for all the radionuclide in the solid) for these radionuclides are shown in Table 14. A large percentage of the U-238 (51.6% to >100%) is water leachable with a mean value of 73.7%. Very little of the Am-241, Pu-239, or Np-237 is water leachable with mean percentages of 0.4%, 1.0%, and 3.8%, respectively. The mean water leachability of Tc-99 is 20%. (If the acid extractable amount is not representative of the total quantity of the radionuclide in the sludge, then the calculated percentages of the water leachable fractions are conservatively high numbers.) There does not appear to be any temporal change in water leachability over the one-month time frame of the leach tests.

4.7.1 Gamma Energy Analysis Results

The activities of the gamma emitters found in the solids, the water leachates, the acid extracts, and in the residual solids after acid extraction are shown in Table 15. The units are microcuries per gram of starting solid except for the material retained on the filters after acid extract that are total microcuries. Direct GEA on the sludges detected the fission products Cs-137, Eu-154, and Eu-155, the activation product Co-60 and naturally occurring K-40. The gamma spectrum in the sludges was dominated by Cs-137. The data in Table 15 for the water extracts and the sludges suggest that 24 to 48% of the total Cs-137 in the sludge is water leachable over a time period of one day to one month. The time dependence of the Cs-137 is not strong, but it does appear that slightly more of the Cs-137 in both test suites for sludge from jar 18686 show increased leaching between the two week and one month sampling times.

Table 16 shows the GEA results for the acid extract and the direct analysis of the drainable liquor. Only Cs-137 was detected in these fluids. The acid extractable levels are greater than the direct levels for Cs-137, which suggests the possibility of heterogeneities in the drainable liquid. The liquid was not shaken prior to sampling for analysis because of the presence of particulates on the bottom of the jar. The gamma measurements on the water and acid extracts reported in microcuries per milliliter of extract are shown in Table 17.

4.7.2 Transuranic Waste Components

DOE defines transuranic (TRU) waste as radioactive waste that, at the time of assay, contains more than 100 nCi/g of alpha-emitting isotopes with atomic numbers greater than 92 and half-lives greater than 20 years (DOE 1988). Alpha-emitting transuranic isotopes were measured in the acid-extractable portions of the two samples of sludge. Selected transuranic isotopes were measured in the acid extracts by both ICP-MS and alpha energy analysis (AEA). Table 18 show the AEA results after wet chemical separation for Pu-239+240, Pu-238, Np-237, Am-241, Cm-243+244, and Cm-242 in units of microcuries per milliliter of acid extract. For the solids, the acid extract values are converted to microcuries per gram of sludge in Table 19. These AEA values can be compared with the values determined by ICP-MS after converting the microgram/gram results provided in Table 12 to activity. The comparison provided in

Table 20 shows that there is a significant difference between the results for the two analytical methods for Am-241, Pu-239, and Np-237; however, the total radioactivity for both methods and sludges significantly exceeds 100 nCi/g. Based on the definition above, this would classify the sludge in tank 241-AY-102 as TRU waste. Note that this is the radioactivity of the acid-extractable isotopes and may not be the total radioactivity of the TRU components in the sludge. The discrepancy between the ICP-MS and AEA analyses is being evaluated.

4.7.3 Gross Alpha, Gross Beta, and Sr-90

The gross alpha, gross beta, and a semi-quantitative measurement of the Sr-90 content of the water and acid extracts and drainable liquid are shown in Tables 21 and 22. Table 21 reports the data as microcuries per milliliter of extract of drainable liquor and Table 22 reports the data per gram of solid (sludge). Assuming that the acid extracts represent the total Sr-90 in the sludge, the amount of Sr-90 that is water extractable between one day and one month is $0.7 \pm 0.1\%$. There does not appear to be any time dependence on the amount of Sr-90 that leaches into water over a one-month time period.

Table 1. Tank AY-102 Tier 1 Test Method

Jar Number	LABCORE Number	Tank ID	Core Number	Segment Number	Matrix	Gross Wt. (g)	Net Wt. (g)	Vial Size (mL)	Radiological Information
15935	S00T000035	AY-102	270	10	Sludge	237.4	21.8	250	8 R Beta 0.7 R Gamma
17785	S00T000922	AY-102	270	Composite of sludge segments only	Sludge	244.8	25	250	No working dose taken
18686	S01T000153	AY-102	281	11	Sludge	200.6	74.7	125	8 R Beta 0.7 R Gamma
18761	S00T001024	AY-102	270	Composite of entire tank	Sludge	288.3	160	125	No working dose taken
18544	S00T001026	AY-102	273	Composite	DL	513.6	287.4	250	No working dose taken
19332	S01T000007	AY-102	270	Composite	DL	164.4	80.6	60	70 mr
DL = Drainable liquid.									

Table 2. Digestion Factors and Moisture Content

Sample #	Water Leach	Digest Factor (g/L)
Jar 15935	Water Extract 24 hr	8.1567
Jar 18686	Water Extract 24 hr	10.0600
Jar 18686 DUP	Water Extract 24 hr	12.4433
Jar 15935	Water Extract 2 wk	6.4467
Jar 18686	Water Extract 2 wk	9.9333
Jar 18686 DUP	Water Extract 2 wk	8.6400
Jar 15935	Water Extract 1 mon	6.2900
Jar 18686	Water Extract 1 mon	7.0600
Jar 18686 DUP	Water Extract 1 mon	12.0533
Sample #	**Acid Digest**	**Digest Factor (g/L)**
Jar 15935	Acid Extract	3.3000
Jar 15935 DUP	Acid Extract	3.5940
Jar 18686	Acid Extract	4.8920
Sample #	**Drainable Liquid**	**Dilution Factor**
Jar 19332	Acid Extract	10.0
Jar 19332 DUP	Acid Extract	10.0
Sample #	**Moisture Content**	**Percent Solid (%)**
Jar 15935	Moisture Content	35.1
Jar 18686	Moisture Content	55.3
Jar 18686 DUP	Moisture Content	39.8
	AVE Jar 18686	47.5
DUP = Duplicate sample.		

Table 3. Carbon Content of Residual Waste

Solid	TIC (µg/g)	TOC (µg/g)	TC (µg/g)
Blank	<7.00E+00	<1.80E+01	
Jar # 15935	2.40E+04	1.83E+03	2.58E+04
Jar # 15935 DUP	2.35E+04	1.73E+03	2.52E+04
Jar # 18686	1.84E+04	3.94E+03	2.23E+04
Drainable Liquid			
Jar # 19332	1.16E+04	2.02E+03	1.36E+04
Jar # 19332 DUP	1.16E+04	1.99E+03	1.36E+04
Drainable Liquid	**(mg/L)**	**(mg/L)**	**(mg/L)**
Jar # 19332	12,700	2,210	14,900
Jar # 19332 DUP	12,700	2,180	14,900
DUP = Duplicate sample. TC = Total carbon. TIC = Total inorganic carbon. TOC = Total organic carbon.			

Table 4. pH and Electrical Conductivity

Water Extracts	pH	Electrical Conductivity (µS/cm)
Jar 15935	10.05	1060
Jar 18686	10.20	570.1
Jar 15935 2WK	10.03	851.3
Jar 18686 DUP	10.33	1040
Jar 18686 2WK	10.26	823.6
Jar 18686 DUP 2Wk	10.23	790.2
Jar 15935 1 MON	9.95	NA
Jar 18686 1 MON	10.07	NA
Jar 18686 DUP 1 MON	10.22	NA
Drainable Liquid		
Jar 19332	12.26	236,300
Jar 19332 Dup	12.38	NA
DUP = Duplicate sample. NA = Not analyzed.		

Table 5. Alkalinity

Solid	Akalinity $CaCO_3$ at pH 8.3 Endpoint (mg/L)	Total Akalinity $CaCO_3$ at pH 4.5 Endpoint (mg/L)	Akalinity $CaCO_3$ (mg/g) at pH 8.3 Endpoint (mg/g solid)	Total Akalinity $CaCO_3$ (mg/g) at pH 4.5 Endpoint (mg/g solid)
Jar 15935 WE	142	543	37	98
Jar 18686 WE	124	338	26	61
Jar 18686 WE DUP	124	339	21	61
Jar 15935 WE 2WK	127	443	41	80
Jar 18686 WE 2WK	54	497	11	89
Jar 18686 DUP 2WK	164	437	40	79
Jar 15935 WE 1 MON	109	436	49	198
Jar 18686 WE 1 MON	136	377	41	112
Jar 18686 DUP 1 MON	205	550	36	96
Drainable Liquid	**(mg/L)**	**(mg/L)**		
Jar 19332	56,668	114,207		
Jar 19332 DUP	59,875	117,770		
DUP = Duplicate sample.				

Table 6. Anions from Water Leach Per Gram of Sludge

Sample Name	Fluoride (µg/g)	Acetate (µg/g)	Formate (µg/g)	Chloride (µg/g)	Nitrite (µg/g)	Bromide (µg/g)	Nitrate (µg/g)	Carbonate (µg/g)	Sulfate (µg/g)	Oxalate (µg/g)	Phosphate (µg/g)
15935 WE 1Day	9.37E+02	4.26E+03	<3.95E+02	5.38E+02	4.34E+03	<4.79E+02	1.17E+03	<1.75E+05	3.58E+03	5.52E+03	2.85E+04
18686 WE 1Day	1.09E+02	1.25E+03	<2.36E+02	4.47E+02	2.42E+02	<2.87E+02	<6.11E+02	<1.05E+05	1.14E+03	2.17E+03	4.83E+03
18686 WE DUP 1Day	1.20E+02	1.47E+03	2.45E+02	3.38E+02	2.49E+02	<2.32E+02	7.72E+02	<8.46E+04	1.63E+03	3.13E+03	5.79E+03
15935 WE 2 Wk	7.05E+02	4.80E+03	<5.00E+02	5.27E+02	4.75E+03	<6.06E+02	1.75E+03	<2.21E+05	4.16E+03	5.70E+03	2.72E+04
18686 WE 2 Wk	1.40E+02	1.74E+03	3.54E+02	3.16E+02	2.27E+02	<2.90E+02	6.22E+02	<1.06E+05	1.81E+03	3.23E+03	6.24E+03
18686 WE DUP 2 Wk	1.38E+02	1.67E+03	4.10E+02	3.60E+02	2.61E+02	<3.34E+02	<7.11E+02	<1.22E+05	1.79E+03	4.03E+03	6.25E+03
15935 WE 1 Mon	1.04E+03	5.46E+03	5.85E+02	3.38E+02	5.17E+03	5.60E+02	1.73E+03	<2.27E+05	4.47E+03	8.49E+03	2.70E+04
18686 WE 1Mon	2.03E+02	2.05E+03	3.71E+02	2.10E+02	3.45E+02	2.59E+02	5.87E+02	<1.49E+05	1.84E+03	3.45E+03	7.59E+03
18686 WE DUP 1 Mon	2.11E+02	1.75E+03	3.28E+02	1.77E+02	2.92E+02	2.00E+02	3.76E+02	<8.73E+04	1.36E+03	3.05E+03	7.13E+03
WE Prep Blank	<2.80E-03	<1.60E-02	3.00E-02	3.56E-02	1.43E-02	<1.37E-02	3.66E-02	<5.00E+00	<5.20E-02	<2.14E-02	<2.40E-02
DUP = Duplicate sample.											

Table 7. Anions from Water Leach and Drainable Liquid per mL Supernatant

Sample Name	Fluoride (µg/mL)	Acetate (µg/mL)	Formate (µg/mL)	Chloride (µg/mL)	Nitrite (µg/mL)	Bromide (µg/mL)	Nitrate (µg/mL)	Carbonate (µg/mL)	Sulfate (µg/mL)	Oxalate (µg/mL)	Phosphate (µg/mL)
Water Leaches											
18686 WE 1Day	5.21E-01	5.96E+00	<1.13E+00	2.14E+00	1.16E+00	<1.37E+00	<2.92	<5.00E+02	5.43E+00	1.04E+01	2.31E+01
18686 WE DUP 1Day	7.12E-01	8.70E+00	1.45E+00	2.00E+00	1.47E+00	<1.37E+00	4.57E+00	<5.00E+02	9.61E+00	1.85E+01	3.42E+01
15935 WE 1Day	2.68E+00	1.22E+01	<1.13E+00	1.54E+00	1.24E+01	<1.37E+00	3.36E+00	<5.00E+02	1.02E+01	1.58E+01	8.15E+01
18686 WE 2 Wk	6.60E-01	8.20E+00	1.67E+00	1.49E+00	1.07E+00	<1.37E+00	2.94E+00	<5.00E+02	8.55E+00	1.52E+01	2.94E+01
18686 WE DUP 2 Wk	5.65E-01	6.84E+00	1.68E+00	1.48E+00	1.07E+00	<1.37E+00	<2.92	<5.00E+02	7.36E+00	1.66E+01	2.57E+01
15935 WE 2 Wk	1.59E+00	1.09E+01	<1.13E+00	1.19E+00	1.07E+01	<1.37E+00	3.96E+00	<5.00E+02	9.40E+00	1.29E+01	6.14E+01
18686 WE 1 Month	6.79E-01	6.89E+00	1.25E+00	7.05E-01	1.16E+00	8.69E-01	1.97E+00	<5.00E+02	6.16E+00	1.16E+01	2.55E+01
18686 WE DUP 1 month	1.21E+00	1.00E+01	1.88E+00	1.01E+00	1.67E+00	1.14E+00	2.15E+00	<5.00E+02	7.79E+00	1.75E+01	4.08E+01
15935 WE 1 month	2.30E+00	1.20E+01	1.29E+00	7.44E-01	1.14E+01	1.23E+00	3.81E+00	<5.00E+02	9.86E+00	1.87E+01	5.95E+01
WE Prep Blank	<2.80E-03	<1.60E-02	3.00E-02	3.56E-02	1.43E-02	<1.37E-02	3.66E-02	<5.00E+00	<5.20E-02	<2.14E-02	<2.40E-02
Drainable Liquid											
19332	6.55E+01	4.76E+02	1.26E+02	1.75E+02	9.01E+03	5.27E+02	7.65E+02	NA	2.51E+03	8.56E+03	3.36E+03
19332 DUP	6.89E+01	4.50E+02	2.05E+02	2.22E+02	9.10E+03	4.92E+02	8.83E+02	NA	2.83E+03	8.58E+03	2.62E+03

DUP = Duplicate sample.
NA = Not analyzed.

Table 8. Cations by ICP-OES per Gram of Sludge

Sample Number	Al (µg/g)	As (µg/g)	B (µg/g)	Ba (µg/g)	Be (µg/g)	Bi (µg/g)	Ca (µg/g)	Cd (µg/g)	Co (µg/g)	Cr (µg/g)	Cu (µg/g)	Fe (µg/g)
Water Leaches												
15935 WE	1.60E+03	ND	(2.86E+03)	ND	(4.91E+01)	(2.93E+03)	ND	(6.83E+01)	(1.09E+02)	(4.29E+02)	(1.58E+03)	(3.47E+02)
18686 WE	2.54E+03	ND	(1.00E+03)	(2.15E+01)	(4.83E+01)	(1.44E+03)	(1.25E+02)	(2.69E+01)	(1.11E+02)	(3.05E+02)	(1.46E+03)	(9.04E+02)
18686 WE DUP	2.37E+03	ND	(7.40E+02)	(1.21E+01)	(3.72E+01)	(5.06E+02)	(2.58E+02)	(1.00E+01)	(1.20E+02)	(2.24E+02)	(1.16E+03)	(7.49E+02)
15935 WE 2Wk	2.73E+03	ND	(3.55E+03)	(4.39E+02)	(4.41E+01)	(2.82E+03)	(7.14E+02)	(1.08E+02)	(2.64E+02)	(2.20E+02)	(8.60E+02)	(3.08E+02)
18686 WE 2Wk	3.24E+03	ND	(1.77E+03)	(1.13E+01)	(2.09E+01)	(1.59E+03)	ND	(4.72E+01)	(8.36E+01)	(2.84E+02)	(7.70E+02)	(4.46E+02)
18686 WE 2Wk DUP	3.72E+03	ND	(1.90E+03)	(9.57E+01)	(2.38E+01)	(1.66E+03)	ND	(3.70E+01)	(3.20E+01)	(3.59E+02)	(6.80E+02)	(5.90E+02)
15935 WE 1 Month	(9.14E+02)	(1.97E+02)	(6.90E+03)	(5.68E+02)	(4.90E+02)	ND	(1.47E+03)	(2.80E+02)	(6.53E+02)	(4.27E+02)	(7.60E+03)	(1.53E+03)
18686 WE 1 Month	(3.83E+03)	(6.20E+02)	(5.15E+03)	(5.65E+02)	(4.93E+02)	(7.79E+02)	ND	(2.49E+02)	(6.21E+02)	(5.20E+02)	(8.26E+03)	(1.55E+03)
Blank WE µg/L	ND	(3.68E+01)	(1.96E+02)	(1.73E+01)	(2.11E+01)	ND	(4.48E+01)	(1.05E+01)	(2.19E+01)	(1.22E+01)	(3.43E+02)	(3.96E+01)
Acid Extracts												
Blank AE	1.55E+02	ND	5.34E+02	(2.56E+01)	(1.55E+00)	(8.55E+01)	2.11E+03	(2.71E+00)	(1.08E+01)	(1.81E+01)	(9.53E+01)	(8.40E+01)
15935 AE	1.10E+05	ND	(6.10E+03)	(1.36E+03)	(9.22E+01)	(9.89E+03)	(1.11E+04)	(5.37E+02)	ND	(5.56E+03)	(4.23E+02)	1.26E+05
15935 AE DUP	1.33E+05	ND	(6.85E+03)	(1.41E+03)	(6.04E+01)	(5.60E+03)	(1.13E+04)	(3.88E+02)	(1.68E+02)	(5.98E+03)	(4.76E+02)	1.55E+05
15935-Ave.	1.21E+05	ND	(6.48E+03)	(1.39E+03)	(7.63E+01)	(7.74E+03)	(1.12E+04)	(4.62E+02)	(1.68E+02)	(5.77E+03)	(4.49E+02)	1.41E+05
18686 AE	9.12E+04	ND	(3.80E+03)	1.28E+03	(3.91E+01)	(5.27E+03)	(9.79E+03)	(1.67E+02)	ND	(3.30E+03)	ND	1.16E+05

DUP = Duplicate sample.
ND = Not detectable.

Table 8. (contd)

Sample Number	K (µg/g)	Li (µg/g)	Mg (µg/g)	Mn (µg/g)	Mo (µg/g)	Ni (µg/g)	P (µg/g)	Pb (µg/g)	Se (µg/g)	Sr (µg/g)	Tl (µg/g)	V (µg/g)
Water Leaches												
15935 WE	ND	(6.85E+03)	(6.02E+01)	(1.07E+02)	(1.50E+02)	(5.21E+02)	(5.01E+03)	(5.81E+02)	ND	(3.86E+01)	(7.39E+02)	(2.12E+03)
18686 WE	(2.73E+03)	(2.43E+03)	(7.41E+01)	(1.68E+02)	(2.10E+02)	(4.40E+02)	(1.87E+03)	(1.89E+02)	ND	(2.58E+01)	(1.21E+03)	(5.96E+02)
18686 WE DUP	(1.33E+02)	(1.67E+03)	(4.91E+01)	(1.40E+02)	(1.86E+02)	(3.21E+02)	(1.58E+03)	ND	(9.56E+01)	(1.77E+01)	(1.54E+03)	(3.44E+02)
15935 WE 2Wk	ND	(9.66E+03)	(5.25E+01)	(7.45E+01)	(6.03E+02)	(3.15E+02)	(3.23E+03)	(8.07E+02)	ND	(5.61E+01)	(3.25E+02)	(3.07E+03)
18686 WE 2Wk	ND	(4.45E+03)	(3.02E+01)	(4.18E+01)	ND	(3.01E+02)	(6.78E+02)	(1.55E+01)	ND	(2.91E+01)	(8.72E+02)	(1.54E+03)
18686 WE 2Wk DUP	ND	(4.48E+03)	(2.33E+01)	(5.57E+01)	(2.01E+02)	(2.88E+02)	ND	ND	ND	(2.70E+01)	(1.07E+03)	(1.55E+03)
15935 WE 1 Month	ND	ND	ND	(3.76E+02)	(9.74E+02)	(1.93E+03)	(1.27E+04)	(1.77E+03)	(9.56E+03)	(2.82E+02)	(1.80E+03)	(2.53E+03)
18686 WE 1 Month	ND	ND	ND	(4.27E+02)	(1.11E+03)	(1.71E+03)	(7.14E+03)	(8.98E+02)	(6.14E+03)	(4.38E+02)	(4.76E+03)	(1.83E+03)
Blank WE	ND	ND	ND	(1.51E+01)	(5.91E+01)	(5.80E+01)	(1.31E+02)	(6.00E+01)	(2.28E+02)	(2.05E+01)	(1.36E+02)	(6.75E+01)
Acid Extracts												
Blank AE	ND	(1.92E+02)	131	(5.01E+00)	(1.74E+01)	(1.67E+01)	ND	(2.25E+01)	ND	(7.33E+00)	(1.01E+01)	(7.01E+01)
15935 AE	ND	(1.72E+04)	(1.71E+03)	6.40E+04	(1.61E+03)	8.83E+03	(5.12E+03)	(8.51E+03)	ND	(6.54E+02)	(4.18E+03)	(5.60E+03)
15935 AE DUP	ND	(1.89E+04)	(1.92E+03)	7.78E+04	(7.90E+02)	1.03E+04	(5.13E+03)	(1.08E+04)	ND	(8.44E+02)	(2.01E+03)	(7.09E+03)
15935-Ave.	ND	(1.80E+04)	(1.82E+03)	7.09E+04	(1.20E+03)	9.56E+03	(5.13E+03)	(9.68E+03)	ND	(7.49E+02)	(3.09E+03)	(6.34E+03)
18686 AE	ND	(1.01E+04)	(1.22E+03)	2.57E+04	ND	(4.18E+03)	(1.63E+03)	(5.17E+03)	ND	(3.76E+02)	(4.14E+02)	(3.23E+03)

DUP = Duplicate sample.
ND = Not detectable.

Table 8. (contd)

Sample Number	Zn (µg/g)	Na (µg/g)	Si (µg/g)	S (µg/g)	Ti (µg/g)	Zr (µg/g)
Water Leaches						
15935 WE	(3.17E+02)	9.38E+04	ND	(3.46E+02)	ND	ND
18686 WE	(5.92E+02)	3.31E+04	(4.07E+02)	(2.76E+03)	(7.51E+01)	(8.98E+01)
18686 WE DUP	(2.04E+02)	4.28E+04	(2.40E+02)	(7.83E+02)	(3.59E+01)	(4.70E+01)
15935 WE 2Wk	(8.42E+02)	9.40E+04	ND	ND	ND	ND
18686 WE 2Wk	(3.92E+02)	4.92E+04	ND	ND	ND	ND
18686 WE 2Wk DUP	(4.10E+02)	5.06E+04	ND	(2.70E+03)	ND	ND
15935 WE 1 Month	(1.31E+03)	(1.04E+05)	(1.24E+03)	(1.69E+03)	(2.30E+02)	(2.95E+02)
18686 WE 1 Month	(9.96E+02)	(5.25E+04)	(1.45E+03)	ND	(3.11E+02)	(4.42E+02)
Blank WE	(4.75E+01)	(1.93E+01)	(5.33E+01)	(1.59E+02)	(1.48E+01)	(1.63E+01)
Acid Extracts						
Blank AE	1.43E+02	2.65E+03	(1.71E+02)	(6.60E+02)	(5.20E+00)	(4.61E+00)
15935 AE	(2.37E+03)	1.91E+05	(1.61E+04)	(3.21E+03)	(1.84E+02)	(7.95E+02)
15935 AE DUP	(1.51E+03)	2.36E+05	(2.26E+03)	ND	(1.92E+02)	(2.18E+02)
15935-Ave.	(1.94E+03)	2.13E+05	(9.17E+03)	(3.21E+03)	(1.88E+02)	(5.06E+02)
18686 AE	(6.56E+02)	1.23E+05	(7.19E+02)	ND	(1.88E+02)	(3.92E+02)

DUP = Duplicate sample.
ND = Not detectable.

Table 9. Cations by ICP-OES per Liter of Supernatant

Sample Number	Al (µg/L)	As (µg/L)	B (µg/L)	Ba (µg/L)	Be (µg/L)	Bi (µg/L)	Ca (µg/L)	Cd (µg/L)	Co (µg/L)	Cr (µg/L)	Cu (µg/L)	Fe (µg/L)
Water Leaches												
15935 WE	4.57E+03	ND	(8.17E+03)	ND	(1.40E+02)	(8.38E+03)	ND	(1.95E+02)	(3.13E+02)	(1.23E+03)	(4.51E+03)	(9.92E+02)
18686 WE	1.21E+04	ND	(4.79E+03)	(1.03E+02)	(2.31E+02)	(6.88E+03)	(5.98E+02)	(1.29E+02)	(5.32E+02)	(1.46E+03)	(6.99E+03)	(4.32E+03)
18686 DUP WE	1.40E+04	ND	(4.38E+03)	(7.18E+01)	(2.20E+02)	(2.99E+03)	(1.53E+03)	(5.92E+01)	(7.10E+02)	(1.32E+03)	(6.86E+03)	(4.43E+03)
15935 WE 2wk	6.16E+03	ND	(8.03E+03)	(9.93E+02)	(9.96E+01)	(6.38E+03)	(1.61E+03)	(2.43E+02)	(5.97E+02)	(4.98E+02)	(1.94E+03)	(6.97E+02)
18686 WE 2wk	1.53E+04	ND	(8.36E+03)	(5.32E+01)	(9.87E+01)	(7.49E+03)	ND	(2.23E+02)	(3.95E+02)	(1.34E+03)	(3.63E+03)	(2.10E+03)
18686 dup WE 2wk	1.53E+04	ND	(7.78E+03)	(3.93E+02)	(9.76E+01)	(6.82E+03)	ND	(1.52E+02)	(1.31E+02)	(1.47E+03)	(2.79E+03)	(2.42E+03)
15935 WE 2wk	6.16E+03	ND	(8.03E+03)	(9.93E+02)	(9.96E+01)	(6.38E+03)	(1.61E+03)	(2.43E+02)	(5.97E+02)	(4.98E+02)	(1.94E+03)	(6.97E+02)
15935-1month WE	(2.02E+03)	(4.34E+02)	(1.52E+04)	(1.25E+03)	(1.08E+03)	ND	(3.24E+03)	(6.17E+02)	(1.44E+03)	(9.41E+02)	(1.68E+04)	(3.37E+03)
18686-1month WE	(1.28E+04)	(2.08E+03)	(1.73E+04)	(1.90E+03)	(1.66E+03)	(2.61E+03)	ND	(8.36E+02)	(2.08E+03)	(1.74E+03)	(2.77E+04)	(5.21E+03)
18686-1month DUP WE	(1.35E+04)	ND	(1.64E+04)	(1.52E+03)	(1.43E+03)	(3.86E+02)	(4.19E+02)	(5.10E+02)	(1.90E+03)	(1.11E+03)	(2.15E+04)	(4.55E+03)
Blank WE	ND	(3.68E+01)	(1.96E+02)	(1.73E+01)	(2.11E+01)	ND	(4.48E+01)	(1.05E+01)	(2.19E+01)	(1.22E+01)	(3.43E+02)	(3.96E+01)
Acid Extracts												
Blank AE	1.55E+04	ND	53,389	(2.56E+03)	(1.55E+02)	(8.55E+03)	211,360	(2.71E+02)	(1.08E+03)	(1.81E+03)	(9.53E+03)	(8.40E+03)
15935 AE	1.27E+05	ND	(7.06E+03)	(1.57E+03)	(1.07E+02)	(1.14E+04)	(1.29E+04)	(6.21E+02)	ND	(6.43E+03)	(4.89E+02)	146,036
15935 DUP AE	1.68E+05	ND	(8.63E+03)	(1.78E+03)	(7.61E+01)	(7.06E+03)	(1.43E+04)	(4.89E+02)	(2.12E+02)	(7.53E+03)	(6.00E+02)	195,173
18686 AE	2.12E+05	ND	(8.83E+03)	2,976	(9.09E+01)	(1.23E+04)	(2.28E+04)	(3.87E+02)	ND	(7.66E+03)	ND	269,259
Drainable Liquid												
19332 AE	1.41E+04	ND	(8.61E+03)	(2.38E+02)	(1.34E+02)	(7.73E+03)	(2.04E+03)	(2.84E+02)	(7.72E+02)	(3.54E+03)	(1.42E+03)	(4.41E+02)
19332 DUP AE	1.32E+04	ND	(7.15E+03)	ND	(1.23E+02)	(6.16E+03)	(1.65E+03)	(2.44E+02)	(4.18E+02)	(3.38E+03)	(5.65E+02)	(5.61E+02)

DUP = Duplicate sample.
ND = Not detectable.

Table 9. (contd)

Sample Number	K (µg/L)	Li (µg/L)	Mg (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	P (µg/L)	Pb (µg/L)	Se (µg/L)	Sr (µg/L)	Tl (µg/L)	V (µg/g)
Water Leaches												
15935 WE	ND	(1.96E+04)	(1.72E+02)	(3.05E+02)	(4.30E+02)	(1.49E+03)	(1.43E+04)	(1.66E+03)	ND	(1.10E+02)	(2.11E+03)	(6.06E+03)
18686 WE	(1.30E+04)	(1.16E+04)	(3.54E+02)	(8.02E+02)	(1.00E+03)	(2.10E+03)	(8.95E+03)	(9.04E+02)	ND	(1.23E+02)	(5.79E+03)	(2.85E+03)
18686 DUP WE	(7.86E+02)	(9.86E+03)	(2.90E+02)	(8.27E+02)	(1.10E+03)	(1.90E+03)	(9.36E+03)	ND	(5.65E+02)	(1.05E+02)	(9.10E+03)	(2.03E+03)
15935 WE 2wk	ND	(2.18E+04)	(1.19E+02)	(1.68E+02)	(1.36E+03)	(7.11E+02)	(7.30E+03)	(1.82E+03)	ND	(1.27E+02)	(7.34E+02)	(6.94E+03)
18686 WE 2wk	ND	(2.10E+04)	(1.43E+02)	(1.97E+02)	ND	(1.42E+03)	(3.20E+03)	(7.31E+01)	ND	(1.37E+02)	(4.12E+03)	(7.27E+03)
18686 DUP WE 2wk	ND	(1.84E+04)	(9.55E+01)	(2.29E+02)	(8.24E+02)	(1.18E+03)	ND	ND	ND	(1.11E+02)	(4.41E+03)	(6.38E+03)
15935 WE 2wk	ND	(2.18E+04)	(1.19E+02)	(1.68E+02)	(1.36E+03)	(7.11E+02)	(7.30E+03)	(1.82E+03)	ND	(1.27E+02)	(7.34E+02)	(6.94E+03)
15935-1month WE	ND	ND	ND	(8.28E+02)	(2.15E+03)	(4.25E+03)	(2.79E+04)	(3.91E+03)	(2.11E+04)	(6.23E+02)	(3.98E+03)	(5.57E+03)
18686-1month WE	ND	ND	ND	(1.43E+03)	(3.71E+03)	(5.75E+03)	(2.39E+04)	(3.01E+03)	(2.06E+04)	(1.47E+03)	(1.60E+04)	(6.14E+03)
18686-1month DUP WE	ND	ND	ND	(1.19E+03)	(4.29E+03)	(4.72E+03)	(1.99E+04)	(4.86E+03)	(1.20E+04)	(9.27E+02)	(7.54E+03)	(6.42E+03)
Blank WE	ND	ND	ND	(1.51E+01)	(5.91E+01)	(5.80E+01)	(1.31E+02)	(6.00E+01)	(2.28E+02)	(2.05E+01)	(1.36E+02)	(6.75E+01)
Acid Extracts												
Blank AE	ND	(1.92E+04)	13,134	(5.01E+02)	(1.74E+03)	(1.67E+03)	ND	(2.25E+03)	ND	(7.33E+02)	(1.01E+03)	(7.01E+03)
15935 AE	ND	(1.99E+04)	(1.98E+03)	73,989	(1.86E+03)	10,210	(5.93E+03)	(9.84E+03)	ND	(7.56E+02)	(4.83E+03)	(6.47E+03)
15935 DUP AE	ND	(2.38E+04)	(2.42E+03)	98,063	(9.95E+02)	12,961	(6.46E+03)	(1.37E+04)	ND	(1.06E+03)	(2.53E+03)	(8.93E+03)
18686 AE	ND	(2.34E+04)	(2.84E+03)	59,730	ND	(9.71E+03)	(3.78E+03)	(1.20E+04)	ND	(8.75E+02)	(9.61E+02)	(7.51E+03)
Drainable Liquid												
19332 AE	ND	(2.25E+04)	(1.91E+02)	ND	(1.76E+03)	(1.33E+03)	(9.48E+04)	ND	ND	(1.30E+02)	(3.19E+03)	(6.82E+03)
19332 DUP AE	ND	(2.05E+04)	(2.04E+02)	ND	(1.91E+03)	(8.08E+02)	(9.08E+04)	(6.17E+02)	ND	(1.34E+02)	(3.94E+03)	(5.85E+03)

DUP = Duplicate sample.
ND = Not detectable.

Table 9. (contd)

Sample Number	Zn (µg/L)	Na (µg/L)	Si (µg/L)	S (µg/L)	Ti (µg/L)	Zr (µg/L)
Water Leaches						
15935 WE	(9.07E+02)	268,334	ND	(9.89E+02)	ND	ND
18686 WE	(2.83E+03)	158,203	(1.94E+03)	(1.32E+04)	(3.59E+02)	(4.29E+02)
18686 DUP WE	(1.20E+03)	253,258	(1.42E+03)	(4.63E+03)	(2.12E+02)	(2.78E+02)
15935 WE 2wk	(1.90E+03)	212,365	ND	ND	ND	ND
18686 WE 2wk	(1.85E+03)	232,149	ND	ND	ND	ND
18686 DUP WE 2wk	(1.68E+03)	207,881	ND	(1.11E+04)	ND	ND
15935 WE 2wk	(1.90E+03)	212,365	ND	ND	ND	ND
15935-1month WE	(2.89E+03)	(2.30E+05)	(2.73E+03)	(3.72E+03)	(5.07E+02)	(6.51E+02)
18686-1month WE	(3.34E+03)	(1.76E+05)	(4.87E+03)	ND	(1.04E+03)	(1.48E+03)
18686-1month DUP WE	(3.39E+03)	(2.55E+05)	(3.70E+03)	(2.18E+03)	(7.71E+02)	(9.99E+02)
Blank WE	(4.75E+01)	(1.93E+01)	(5.33E+01)	(1.59E+02)	(1.48E+01)	(1.63E+01)
Acid Extracts						
Blank AE	14,274	265,408	(1.71E+04)	(6.60E+04)	(5.20E+02)	(4.61E+02)
15935 AE	(2.74E+03)	220,748	(1.86E+04)	(3.71E+03)	(2.13E+02)	(9.19E+02)
15935 DUP AE	(1.91E+03)	297,408	(2.84E+03)	ND	(2.42E+02)	(2.74E+02)
18686 AE	(1.52E+03)	285,222	(1.67E+03)	ND	(4.37E+02)	(9.12E+02)
Drainable Liquid						
19332 AE	(1.24E+03)	5,616,995	(1.89E+03)	(7.88E+04)	(1.37E+02)	(1.57E+02)
19332 DUP AE	(4.06E+02)	5,558,201	(1.07E+03)	(6.66E+04)	(9.77E+01)	ND

DUP = Duplicate sample.
ND = Not detectable.

Table 10. Trace Metals by ICP-MS per Gram of Sludge

Sample Number	Cr-52 (µg/g)	Cr-53 (µg/g)	As-75 (µg/g)	Se-82 (µg/g)	Mo-95 (µg/g)	Mo-98* (µg/g)	Mo-100 (µg/g)
Water Leaches							
15935-WE	1.16E+02	9.60E+01	<8.74E+01	(2.20E+00)	NA	(7.38E+00)	(1.27E+01)
18686-WE	1.09E+02	9.88E+01	<5.23E+01	(6.69E-01)	NA	(3.16E+00)	(5.02E+00)
18686-WE DUP	1.30E+02	1.22E+02	<4.23E+01	(9.98E-01)	NA	(3.62E+00)	(5.46E+00)
15935-WE 2WK	3.19E+02	2.97E+02	<1.11E+02	(1.32E+01)	NA	(7.36E+00)	(1.33E+01)
18686-2Wk-WE	6.06E+01	4.93E+01	<5.30E+01	(1.08E+00)	NA	(3.47E+00)	(6.25E+00)
18686-2Wk-WE DUP	1.60E+02	1.47E+02	<6.09E+01	(1.24E+00)	NA	(4.24E+00)	(6.38E+00)
15935-WE 1 Month	1.15E+02	1.14E+02	(5.23E+00)	(1.50E+01)	1.27E+01	8.08E+00	(8.91E+00)
18686-WE 1 Month	1.60E+02	1.59E+02	(2.18E+00)	(5.04E+00)	5.10E+00	2.77E+00	(3.04E+00)
18686-WE 1 Month DUP	1.39E+02	1.39E+02	(1.10E+00)	(3.17E+00)	4.88E+00	2.71E+00	(3.28E+00)
WE Blank	<0.250	(5.00E-03)	(6.00E-02)	(1.60E-01)	(7.58E-02)	0.078	(4.20E-02)
Acid Extracts							
Blank-AE	(2.10E+02)	1.88E+02	(4.70E+00)	(2.53E+01)	NA	(1.88E+01)	(1.03E+01)
15935-AE	3.68E+03	3.59E+03	(1.17E+01)	(4.50E+00)	NA	(1.49E+01)	(1.91E+01)
15935-AE DUP	4.88E+03	4.79E+03	(2.03E+01)	(1.48E+01)	NA	(1.68E+01)	(2.37E+01)
15935[Ave]	4.28E+03	4.19E+03	1.60E+01	9.63E+00	NA	1.59E+01	2.14E+01
18686-AE	2.76E+03	2.71E+03	(7.10E+00)	<107.55	NA	(8.39E+00)	(1.31E+01)

Sample Number	Ru-102* (µg/g)	Ru-104 (µg/g)	Ag-107 (µg/g)	Ag-109* (µg/g)	Cd-111 (µg/g)	Cd-114* (µg/g)	Pb-206 (µg/g)	Pb-208* (µg/g)
Water Leaches								
15935-WE	4.20E+01	4.12E+01	3.87E+01	3.79E+01	(1.01E+00)	(2.10E-01)	2.47E+01	2.62E+01
18686-WE	1.28E+01	1.21E+01	4.31E+01	4.33E+01	(7.74E-01)	(4.64E+00)	3.77E+01	4.14E+01
18686-WE DUP	1.57E+01	1.46E+01	5.51E+01	5.65E+01	(6.26E-01)	(5.24E-01)	3.20E+01	3.63E+01
15935-WE 2WK	3.22E+01	3.15E+01	1.12E+02	1.13E+02	(1.15E+00)	(2.21E-01)	4.05E+01	4.48E+01
18686-2Wk-WE	1.96E+01	1.94E+01	2.65E+01	2.63E+01	(4.24E-01)	(8.47E-02)	1.19E+01	1.34E+01
18686-2Wk-WE DUP	1.66E+01	1.61E+01	5.29E+01	5.40E+01	(1.53E+00)	(9.99E-01)	3.00E+01	3.35E+01
15935-WE 1 Month	(3.45E+01)	(3.24E+01)	5.76E+01	5.82E+01	(9.98E-01)	(8.73E-01)	2.14E+01	2.38E+01
18686-WE 1 Month	1.29E+01	1.20E+01	5.41E+01	5.45E+01	(5.96E-01)	(8.35E-01)	2.62E+01	2.91E+01
18686-WE 1 Month DUP	1.18E+01	1.11E+01	5.38E+01	5.40E+01	(4.67E-01)	(4.89E-01)	1.52E+01	1.73E+01
WE Blank	(4.50E-03)	(7.50E-03)	(5.00E-04)	(1.00E-03)	(8.75E-03)	(1.15E-02)	(1.10E-01)	(1.17E-01)
Acid Extracts								
Blank-AE	(1.37E+01)	(1.32E+01)	(7.30E+00)	(7.40E+00)	1.44E+01	3.23E+01	5.50E+02	5.91E+02
15935-AE	1.86E+02	1.75E+02	1.48E+03	1.51E+03	2.12E+02	1.92E+02	7.95E+03	8.85E+03
15935-AE DUP	2.40E+02	2.27E+02	1.51E+03	1.55E+03	2.66E+02	2.42E+02	1.00E+04	1.12E+04
15935[Ave]	2.13E+02	2.01E+02	1.50E+03	1.53E+03	2.39E+02	2.17E+02	8.97E+03	1.00E+04
18686-AE	1.88E+02	1.78E+02	2.46E+03	2.52E+03	1.04E+02	9.39E+01	5.08E+03	5.68E+03

*Isotopes suggested for use to quantify the element.
DUP = Duplicate sample.
Ruthenium result is suspect due to fission product yields being different than natural abundances.

Table 11. Trace Metal by ICP-MS per Liter of Supernatant

Sample Number	Cr-52 (µg/L)	Cr-53 (µg/L)	As-75 (µg/L)	Se-82 (µg/L)	Mo-95 (µg/L)	Mo-98* (µg/L)	Mo-100 (µg/L)
Water Leaches							
15935-WE	3.33E+02	2.74E+02	<2.50E+02	(6.30E+00)	NA	(2.11E+01)	(3.63E+01)
18686-WE	5.20E+02	4.72E+02	<2.50E+02	(3.20E+00)	NA	(1.51E+01)	(2.40E+01)
18686-WE DUP	7.68E+02	7.23E+02	<2.50E+02	(5.90E+00)	NA	(2.14E+01)	(3.23E+01)
15935-2Wk-WE	7.21E+02	6.72E+02	<2.50E+02	(2.98E+01)	NA	(1.66E+01)	(3.01E+01)
18686-2Wk-WE	2.86E+02	2.33E+02	<2.50E+02	(5.10E+00)	NA	(1.64E+01)	(2.95E+01)
18686-2Wk-WE DUP	6.56E+02	6.04E+02	<2.50E+02	(5.10E+00)	NA	(1.74E+01)	(2.62E+01)
15935 WE 1 month	252.78	252.10	(1.15E+01)	(3.30E+01)	28.075	17.825	(1.97E+01)
18686 WE 1 month	535.30	533.78	(7.30E+00)	(1.69E+01)	17.125	9.300	(1.02E+01)
18686 WE 1 month DUP	797.45	794.65	(6.30E+00)	(1.82E+01)	27.950	15.525	(1.88E+01)
Acid Extracts							
Blank-AE	(2.10E+00)	(1.88E+00)	(4.70E-02)	(2.53E-01)	NA	(1.88E-01)	(1.03E-01)
15935-AE	4.26E+03	4.15E+03	(1.35E+01)	(5.20E+00)	NA	(1.73E+01)	(2.22E+01)
15935-AE DUP	6.15E+03	6.04E+03	(2.56E+01)	(1.86E+01)	NA	(2.12E+01)	(2.98E+01)
18686-AE	6.42E+03	6.30E+03	(1.65E+01)	<250.00	NA	(1.95E+01)	(3.05E+01)

Sample Number	Ru-102* (µg/L)	Ru-104 (µg/L)	Ag-107 (µg/L)	Ag-109* (µg/L)	Cd-111 (µg/L)	Cd-114* (µg/L)	Pb-206 (µg/L)	Pb-208* (µg/L)
Water Leaches								
15935-WE	1.20E+02	1.18E+02	1.11E+02	1.08E+02	(2.90E+00)	(6.00E-01)	7.05E+01	7.49E+01
18686-WE	6.11E+01	5.78E+01	2.06E+02	2.07E+02	(3.70E+00)	(2.22E+01)	1.80E+02	1.98E+02
18686-WE DUP	9.28E+01	8.63E+01	3.26E+02	3.34E+02	(3.70E+00)	(3.10E+00)	1.89E+02	2.15E+02
15935-2Wk-WE	7.29E+01	7.11E+01	2.54E+02	2.55E+02	(2.60E+00)	(5.00E-01)	9.15E+01	1.01E+02
18686-2Wk-WE	9.25E+01	9.14E+01	1.25E+02	1.24E+02	(2.00E+00)	(4.00E-01)	5.63E+01	6.31E+01
18686-2Wk-WE DUP	6.81E+01	6.60E+01	2.17E+02	2.22E+02	(6.30E+00)	(4.10E+00)	1.23E+02	1.37E+02
15935 WE 1 month	76.100	71.525	127.05	128.33	(2.20E+00)	(1.93E+00)	47.250	52.375
18686 WE 1 month	(4.33E+01)	(4.03E+01)	181.35	182.98	(2.00E+00)	(2.80E+00)	87.750	97.500
18686 WE 1 month DUP	67.575	63.600	307.88	309.23	(2.68E+00)	(2.80E+00)	87.275	99.300
Acid Extracts								
Blank-AE	(1.37E-01)	(1.32E-01)	(7.30E-02)	(7.40E-02)	0.144	0.323	5.50	5.91
15935-AE	2.15E+02	2.02E+02	1.71E+03	1.75E+03	2.45E+02	2.22E+02	9.19E+03	1.02E+04
15935-AE DUP	3.02E+02	2.86E+02	1.91E+03	1.96E+03	3.35E+02	3.04E+02	1.26E+04	1.41E+04
18686-AE	4.37E+02	4.13E+02	5.72E+03	5.85E+03	2.42E+02	2.18E+02	1.18E+04	1.32E+04

*Isotopes suggested for use to quantify the element.
DUP = Duplicate sample.
NA = Not analyzed.
Ruthenium result is suspect due to fission product yields being different than natural abundances.

Table 12. Tc-99, U-238, and Actinides by ICP-MS per Gram Sludge

Sample Number	Tc-99 (µg/g)	U-238 (µg/g)	Am-241 (µg/g)	Pu-239 (µg/g)	Np-237 (µg/g)
Water Leaches					
15935 WE	1.06E+00	1.33E+03	(2.10E-02)	5.25E-01	1.14E+00
18686 WE	2.97E-01	6.31E+02	(2.14E-02)	5.77E-01	4.90E-01
18686 WE DUP	4.30E-01	9.56E+02	(1.35E-02)	5.51E-01	4.85E-01
15935 WE 2Wk	9.38E-01	1.79E+03	(1.77E-02)	7.79E-01	9.25E-01
18686 WE 2Wk	4.66E-01	6.05E+02	(8.47E-03)	2.25E-01	5.04E-01
18686 WE 2Wk DUP	4.58E-01	8.09E+02	(1.46E-02)	4.19E-01	4.94E-01
15935 WE 1 Month	(1.04E+00)	1.25E+03	(9.07E-03)	5.69E-01	1.09E+00
18686 WE 1 Month	(4.92E-01)	8.27E+02	(5.96E-03)	4.90E-01	5.51E-01
18686 WE 1 Month DUP	4.37E-01	7.63E+02	(3.49E-03)	3.46E-01	3.57E-01
WE Blank	<0.025	<0.005	<0.002	<0.002	<0.002
Acid Extracts					
Blank AE (µg/L)	(4.00E-01)	9.60E+00	<1.00E+00	(1.00E+00)	(1.00E-01)
15935 AE	4.50E+00	1.47E+03	3.20E+00	5.20E+01	1.67E+01
15935 AE DUP	5.14E+00	1.76E+03	3.81E+00	6.28E+01	2.05E+01
15935[Ave]	4.82E+00	1.61E+03	3.51E+00	5.74E+01	1.86E+01
18686 AE	2.19E+00	1.17E+03	2.55E+00	4.56E+01	1.41E+01
DUP = Duplicate sample.					

Table 13. Tc-99, U-238, and Actinides by ICP-MS per Liter Supernatant

Sample Number	Tc-99 (µg/L)	U-238 (µg/L)	Am-241 (µg/L)	Pu-239 (µg/L)	Np-237 (µg/L)
Water Leaches					
15935-WE	3.05E+00	3.81E+03	(0.06)	1.50E+00	3.27E+00
18686-WE	1.42E+00	3.02E+03	(0.10)	2.76E+00	2.34E+00
18686 WE-DUP	2.54E+00	5.65E+03	(0.08)	3.26E+00	2.87E+00
15935-WE 2Wk	2.12E+00	4.04E+03	(0.04)	1.76E+00	2.09E+00
18686-WE 2Wk	2.20E+00	2.86E+03	(0.04)	1.06E+00	2.38E+00
18686-WE 2Wk DUP	1.88E+00	3.32E+03	(0.06)	1.72E+00	2.03E+00
15935 WE 1 month	(2.30E+00)	2.77E+03	(2.00E-02)	1.26E+00	2.40E+00
18686 WE 1 month	(1.65E+00)	2.78E+03	(2.00E-02)	1.65E+00	1.85E+00
18686 WE 1 month DUP	2.50E+00	4.37E+03	(2.00E-02)	1.98E+00	2.05E+00
Blank WE	<0.025	<0.005	<0.002	<0.002	<0.002
Acid Extracts					
Blank AE	(0.40)	9.600	<1.000	(1.00)	(0.10)
15935-AE	5.200	1695.0	3.703	60.100	19.300
15935-AE DUP	6.475	2216.7	4.800	79.100	25.825
18686-AE	5.100	2726.0	5.920	105.900	32.675
Drainable Liquid					
	Tc-99 (µg/L)	**U-238 (µg/L)**	**Am-241 (µg/L)**	**Pu-239 (µg/L)**	**Np-237 (µg/L)**
19332 AE	7.92E+02	5.23E+05	<1.00E+01	8.40E+01	2.99E+02
19332 AE DUP	7.75E+02	5.12E+05	<1.00E+01	6.80E+01	3.02E+02
DUP = Duplicate sample.					

Table 14. Water Leachable Percentages of Radionuclides

Sample Number	Water Leachable % (assumes acid leach = total in solid)				
	Tc-99	U-238	Am-241	Pu-239	Np-237
15935 WE	22.1	82.7	(0.6)	0.9	6.2
15935 WE 2Wk	19.5	110.9	(0.5)	1.4	5.0
15935 WE 1 Month	(21.7)	77.8	(0.3)	1.0	3.1
18686 WE	13.5	53.8	(0.8)	1.3	3.5
18686 WE DUP	19.6	81.5	(0.5)	1.2	3.5
18686 WE 2Wk	21.2	51.6	(0.3)	0.5	3.6
18686 WE 2Wk DUP	20.9	69.0	(0.6)	0.9	3.5
18686 WE 1 Month	(22.4)	70.6	(0.2)	1.1	3.5
18686 WE 1 Month DUP	19.9	65.1	(0.1)	0.8	2.5
Mean	20.1	73.7	0.4	1.0	3.8
DUP = Duplicate sample.					

Table 15. Gamma Energy Analysis per Gram of Sludge

Sample Number	Units	K-40	Co-60	Cs-137	Eu-154	Eu-155
Solids						
15935_solid	µCi/g	1.231E+00	9.973E-01	9.304E+02	1.705E+01	2.207E+02
18686_solid	µCi/g		3.850E-01	5.321E+02	7.299E+00	3.221E+00
18686_solid duplicate	µCi/g	2.451E+00	7.103E-01	9.958E+02	1.662E+01	8.066E+00
Water Leaches						
Blank_WE	µCi/mL	ND	ND	ND	ND	ND
15935_WE 1 Day	µCi/g	ND	ND	2.481E+02	ND	ND
18686_WE_1 Day	µCi/g	ND	ND	1.717E+02	ND	ND
18686Dup_WE_1 Day	µCi/g	ND	ND	3.148E+02	ND	ND
15935_WE_2Wk	µCi/g	ND	ND	2.124E+02	ND	ND
18686_WE_2Wk	µCi/g	1.409E+01	ND	3.429E+02	ND	ND
18686Dup_WE_2Wk	µCi/g	ND	ND	2.916E+02	ND	ND
15935_WE_1Month	µCi/g	ND	ND	2.121E+02	ND	ND
18686_WE_1month	µCi/g	ND	ND	2.474E+02	ND	ND
18686_WEDup_1month	µCi/g	ND	ND	5.399E+02	ND	ND
Acid Extract						
Blank_AE	µCi/mL	ND	ND	1.677E-05	ND	ND
15935_AE	µCi/g	ND	ND	1.028E+03	1.607E+01	4.900E+02
15935Dup	µCi/g	ND	ND	1.260E+03	1.946E+01	3.005E+02
18686_AE	µCi/g	ND	ND	3.884E+03	4.443E+01	1.087E+03
Acid Extract Filters						
15935_filter	(µCi/filt)	ND	ND	6.962E+00	9.754E-02	ND
15935 Dup Filter	(µCi/filt)	ND	ND	6.962E+03	9.057E+01	ND
18686 Filter	(µCi/filt)	8.958E+01	1.244E+01	5.640E+03	1.308E+02	ND
ND = Not detected.						

Table 16. Gamma Energy Analyses Direct Liquid

Drainable Liquid Acid Extract	K-40 (µCi/mL)	Co-60 (µCi/mL)	Cs-137 (µCi/mL)	Eu-154 (µCi/mL)	Eu-155 (µCi/mL)
19332_AE	ND	ND	3.714E+01	ND	ND
19332Dup_AE	ND	ND	3.568E+01	ND	ND
Drainable Liquid Direct	**K-40**	**Co-60**	**Cs-137**	**Eu-154**	**Eu-155**
19332_Direct	ND	ND	2.173E+01	ND	ND
19332_Direct	ND	ND	2.970E+01	ND	ND
ND = Not detected.					

Table 17. Gamma Energy Analysis per mL Supernatant

Sample Number	K-40 (µCi/mL)	Co-60 (µCi/mL)	Cs-137 (µCi/mL)	Eu-154 (µCi/mL)	Eu-155 (µCi/mL)
Water Leaches					
Blank_WE	ND	ND	ND	ND	ND
15935_WE 1 Day	ND	ND	8.676E-02	ND	ND
18686_WE_1 Day	ND	ND	3.592E-02	ND	ND
18686Dup_WE_1 Day	ND	ND	5.325E-02	ND	ND
15935_WE_2Wk	ND	ND	9.400E-02	ND	ND
18686_WE_2Wk	2.986E-03	ND	7.265E-02	ND	ND
18686Dup_WE_2Wk	ND	ND	7.104E-02	ND	ND
15935_WE_1Month	ND	ND	9.619E-02	ND	ND
18686_WE_1month	ND	ND	7.375E-02	ND	ND
18686_WEDup_1month	ND	ND	9.426E-02	ND	ND
Acid Extract					
Blank_AE	ND	ND	1.677E-05	ND	ND
15935_AE	ND	8.614E+02	8.889E-01	1.390E-02	4.236E-01
15935Dup_AE	ND	ND	9.999E-01	1.544E-02	2.385E-01
18686_AE	ND	ND	1.671E+00	1.912E-02	4.676E-01
ND = Not detected.					

Table 18. Actinides by AEA per mL Supernatant

Sample	Pu-239 (µCi/mL)	Pu-238 (µCi/mL)	Np-237 (µCi/mL)	Am-241 (µCi/mL)	Cm-244/243 (µCi/mL)	Cm-242 (µCi/mL)
Acid Extracts						
15935	1.043E-03	1.351E-04	4.923E-05	1.509E-03	1.303E-05	3.226E-06
15935 DUP	1.026E-03	1.549E-04	5.767E-05	1.714E-03	1.580E-05	3.578E-06
18686	9.492E-04	1.865E-04	6.994E-05	6.680E-04	9.782E-06	1.426E-06
Drainable Liquid						
19332 DUP	2.289E-03	5.614E-04	2.843E-04[(a)]	2.630E-03	4.363E-05	5.058E-06
19332	2.679E-03	4.786E-04	7.283E-04	2.063E-04	7.439E-06	4.959E-07

(a) Torn filter, lost sample portion.
DUP = Duplicate sample

Table 19. Actinides by AEA per Gram Sludge

Acid Extract						
Sample	Pu-239 (µCi/g)	Pu-238 (µCi/g)	Np-237 (µCi/g)	Am-241 (µCi/g)	Cm-244/243 (µCi/g)	Cm-242 (µCi/g)
15935 AE	9.013E-01	1.168E-01	4.256E-02	1.305E+00	1.126E-02	2.789E-03
15935 AE DUP	8.151E-01	1.231E-01	4.583E-02	1.362E+00	1.255E-02	2.843E-03
18686 AE	5.537E-01	1.088E-01	4.080E-02	3.897E-01	5.706E-03	8.317E-04

DUP = Duplicate sample.

Table 20. Concentrations of Transuranic Components of AY-102 Tank Waste per Gram Sludge

Sample Number	ICP-MS Am-241 (nCi/g)	AEA Am-241 (nCi/g)	ICP-MS Pu-239 (nCi/g)	AEA Pu-239 (nCi/g)	ICP-MS Np-237 (nCi/g)	AEA Np-237 (nCi/g)	ICP-MS Pu-238 (nCi/g)	AEA Pu-238 (nCi/g)	ICP-MS Cm-244/243 (nCi/g)	AEA Cm-244/243 (nCi/g)	ICP-MS Cm-242 (nCi/g)	AEA Cm-242 (nCi/g)
Blank AE µg/L												
15935 AE	1.10E+04	1.30E+03	3.22E+03	9.01E+02	1.18E+01	4.26E+01	NA	1.17E+02	NA	1.13E+01	NA	2.79E+00
15935 AE Dup	1.31E+04	1.36E+03	3.90E+03	8.15E+02	1.44E+01	4.58E+01	NA	1.23E+02	NA	1.26E+01	NA	2.84E+00
15935[Ave]	1.20E+04	1.33E+03	3.56E+03	8.58E+02	1.31E+01	4.42E+01	NA	1.20E+02	NA	1.19E+01	NA	2.82E+00
18686 AE	8.74E+03	3.90E+02	2.83E+03	5.54E+02	9.91E+00	4.08E+01	NA	1.09E+02	NA	5.71E+00	NA	8.32E-01

DUP = Duplicate sample.
NA = Not analyzed.

Table 21. Total Alpha Total Beta per mL of Supernatant

Sample Number	Gross Beta (µCi/ml)	Gross Alpha (µCi/ml)	Sr-90 (µCi/ml)
Water Leaches			
15935 WE	3.172E-01	2.847E-02	3.027E-01
18686 WE	4.556E-01	3.847E-02	4.505E-01
18686 DUP WE	5.275E-01	4.603E-02	5.454E-01
15935 2wk WE	3.637E-01	3.258E-02	3.515E-01
18686 2wk WE	3.406E-01	2.995E-02	3.392E-01
18686dup 2wk WE	3.592E-01	3.185E-02	3.516E-01
15935 1 month WE	3.396E-01	3.046E-02	3.166E-01
18686 1 Month WE	3.094E-01	2.693E-02	3.066E-01
18686 DUP 1 Month WE	3.710E-01	3.115E-02	3.568E-01
WE Blank	6.883E-05	5.045E-06	8.559E-06
Acid Extract			
15935 AE	3.075E+01	7.790E+00	2.470E+01
15935 DUP AE	3.813E+01	1.147E+01	2.329E+01
18636 AE	3.364E+01	8.640E+00	2.545E+01
Blank AE	3.711E-03	2.986E-04	3.047E-03
Drainable Liquid Acid Extract			
19332 AE	3.557E+01	2.601E+00	1.936E-02
19332 DUP AE	3.475E+01	2.438E+00	1.618E-02
Drainable Liquid Direct			
19332 Direct	3.052E+01	4.827E+00	1.354E-02

DUP = Duplicate sample.
Note: Sr-90 results are indicative only; they are not a result of analytical separation or analysis.

Table 22. Total Alpha Total Beta per Gram of Sludge

Sample Number	Gross Beta (µCi/g)	Gross Alpha (µCi/g)	Sr-90 (µCi/g)
Water Extracts			
15935 WE	1.109E+02	9.957E+00	1.059E+02
18686 WE	9.531E+01	8.048E+00	9.424E+01
18686 DUP WE	8.922E+01	7.785E+00	9.224E+01
15935 2wk WE	1.609E+02	1.442E+01	1.555E+02
18686 2wk WE	7.216E+01	6.345E+00	7.187E+01
18686 DUP 2wk WE	8.749E+01	7.758E+00	8.564E+01
15935 1 month WE	1.540E+02	1.381E+01	1.436E+02
18686 1 Month WE	9.224E+01	8.028E+00	9.140E+01
18686 DUP 1 Month WE	6.479E+01	5.439E+00	6.231E+01
Acid Extracts			
15935 AE	2.658E+04	6.734E+03	2.135E+04
15935 DUP AE	3.026E+04	9.104E+03	1.849E+04
18636 AE	1.447E+04	3.717E+03	1.095E+04

DUP = Duplicate samples.
Note: Sr-90 results are indicative only; they are not a result of analytical separation or analysis.

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