METHOD 3050B

ACID DIGESTION OF SEDIMENTS, SLUDGES, AND SOILS

1.0 SCOPE AND APPLICATION

1.1 This method has been written to provide two separate digestion procedures, one for the preparation of sediments, sludges, and soil samples for analysis by flame atomic absorption spectrometry (FLAA) or inductively coupled plasma atomic emission spectrometry (ICP-AES) and one for the preparation of sediments, sludges, and soil samples for analysis of samples by Graphite Furnace AA (GFAA) or inductively coupled plasma mass spectrometry (ICP-MS). The extracts from these two procedures are not interchangeable and should only be used with the analytical determinations outlined in this section. Samples prepared by this method may be analyzed by ICP-AES or GFAA for all the listed metals as long as the detecion limits are adequate for the required end-use of the data. Alternative determinative techniques may be used if they are scientifically valid and the QC criteria of the method, including those dealing with interferences, can be achieved. Other elements and matrices may be analyzed by this method if performance is demonstrated for the analytes of interest, in the matrices of interest, at the concentration levels of interest (See Section 8.0). The recommended determinative techniques for each element are listed below:

FLAA/ICP-AES		GFAA/ICP-MS
Aluminum	Magnesium	Arsenic
Antimony	Manganese	Beryllium
Barium	Molybdenum	Cadmium
Beryllium	Nickel	Chromium
Cadmium	Potassium	Cobalt
Calcium	Silver	Iron
Chromium	Sodium	Lead
Cobalt	Thallium	Molybdenum
Copper	Vanadium	Selenium
Iron	Zinc	Thallium
Lead		
Vanadium		

1.2 This method is not a total digestion technique for most samples. It is a very strong acid digestion that will dissolve almost all elements that could become "environmentally available." By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment. If absolute total digestion is required use Method 3052.

2.0 SUMMARY OF METHOD

2.1 For the digestion of samples, a representative 1-2 gram (wet weight) or 1 gram (dry weight) sample is digested with repeated additions of nitric acid (HNO_3) and hydrogen peroxide (H_2O_2).

2.2 For GFAA or ICP-MS analysis, the resultant digestate is reduced in volume while heating and then diluted to a final volume of 100 mL.

2.3 For ICP-AES or FLAA analyses, hydrochloric acid (HCl) is added to the initial digestate and the sample is refluxed. In an optional step to increase the solubility of some metals (see Section 7.3.1: NOTE), this digestate is filtered and the filter paper and residues are rinsed, first with hot HCl and then hot reagent water. Filter paper and residue are returned to the digestion flask, refluxed with additional HCl and then filtered again. The digestate is then diluted to a final volume of 100 mL.

2.4 If required, a separate sample aliquot shall be dried for a total percent solids determination.

3.0 INTERFERENCES

3.1 Sludge samples can contain diverse matrix types, each of which may present its own analytical challenge. Spiked samples and any relevant standard reference material should be processed in accordance with the quality control requirements given in Sec. 8.0 to aid in determining whether Method 3050B is applicable to a given waste.

4.0 APPARATUS AND MATERIALS

4.1 Digestion Vessels - 250-mL.

4.2 Vapor recovery device (e.g., ribbed watch glasses, appropriate refluxing device, appropriate solvent handling system).

4.3 Drying ovens - able to maintain 30°C $\pm$ 4°C.

4.4 Temperature measurement device capable of measuring to at least 125°C with suitable precision and accuracy (e.g., thermometer, IR sensor, thermocouple, thermister, etc.)

4.5 Filter paper - Whatman No. 41 or equivalent.

4.6 Centrifuge and centrifuge tubes.

4.7 Analytical balance - capable of accurate weighings to 0.01 g.

4.8 Heating source - Adjustable and able to maintain a temperature of 90-95°C. (e.g., hot plate, block digestor, microwave, etc.)

4.9 Funnel or equivalent.

4.10 Graduated cylinder or equivalent volume measuring device.

4.11 Volumetric Flasks - 100-mL.

5.0 REAGENTS

5.1 Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination. If the purity of a reagent is questionable, analyze the reagent to determine the level of impurities. The reagent blank must be less than the MDL in order to be used.

5.2 Reagent Water. Reagent water will be interference free. All references to water in the method refer to reagent water unless otherwise specified. Refer to Chapter One for a definition of reagent water.

5.3 Nitric acid (concentrated), HNO_3. Acid should be analyzed to determine level of impurities. If method blank is < MDL, the acid can be used.

5.4 Hydrochloric acid (concentrated), HCl. Acid should be analyzed to determine level of impurities. If method blank is < MDL, the acid can be used.

5.5 Hydrogen peroxide (30%), H_2O_2. Oxidant should be analyzed to determine level of impurities. If method blank is < MDL, the peroxide can be used.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 All samples must have been collected using a sampling plan that addresses the considerations discussed in Chapter Nine of this manual.

6.2 All sample containers must be demonstrated to be free of contamination at or below the reporting limit. Plastic and glass containers are both suitable. See Chapter Three, Section 3.1.3, for further information.

6.3 Nonaqueous samples should be refrigerated upon receipt and analyzed as soon as possible.

6.4 It can be difficult to obtain a representative sample with wet or damp materials. Wet samples may be dried, crushed, and ground to reduce subsample variability as long as drying does not affect the extraction of the analytes of interest in the sample.

7.0 PROCEDURE

7.1 Mix the sample thoroughly to achieve homogeneity and sieve, if appropriate and necessary, using a USS #10 sieve. All equipment used for homogenization should be cleaned according to the guidance in Sec. 6.0 to minimize the potential of cross-contamination. For each digestion procedure, weigh to the nearest 0.01 g and transfer a 1-2 g sample (wet weight) or 1 g sample (dry weight) to a digestion vessel. For samples with high liquid content, a larger sample size may be used as long as digestion is completed.

> NOTE: All steps requiring the use of acids should be conducted under a fume hood by properly trained personnel using appropriate laboratory safety equipment. The use of an acid vapor scrubber system for waste minimization is encouraged.

7.2 For the digestion of samples for analysis by GFAA or ICP-MS, add 10 mL of 1:1 HNO_3, mix the slurry, and cover with a watch glass or vapor recovery device. Heat the sample to 95°C ± 5°C and reflux for 10 to 15 minutes without boiling. Allow the sample to cool, add 5 mL of concentrated HNO_3, replace the cover, and reflux for 30 minutes. If brown fumes are generated, indicating oxidation of the sample by HNO_3, repeat this step (addition of 5 mL of conc. HNO_3) over and over until no brown fumes are given off by the sample indicating the complete reaction with HNO_3. Using a ribbed watch glass or vapor recovery system, either allow the solution to evaporate to approximately 5 mL without boiling or heat at 95°C ± 5°C without boiling for two hours. Maintain a covering of solution over the bottom of the vessel at all times.

NOTE: Alternatively, for direct energy coupling devices, such as a microwave, digest samples for analysis by GFAA or ICP-MS by adding 10 mL of 1:1 HNO_3, mixing the slurry and then covering with a vapor recovery device. Heat the sample to 95°C ± 5°C and reflux for 5 minutes at 95°C ± 5°C without boiling. Allow the sample to cool for 5 minutes, add 5 mL of concentrated HNO_3, heat the sample to 95°C ± 5°C and reflux for 5 minutes at 95°C ± 5°C. If brown fumes are generated, indicating oxidation of the sample by HNO_3, repeat this step (addition of 5 mL concentrated HNO_3) until no brown fumes are given off by the sample indicating the complete reaction with HNO_3. Using a vapor recovery system, heat the sample to 95°C ± 5°C and reflux for 10 minutes at 95°C ± 5°C without boiling.

7.2.1 After the step in Section 7.2 has been completed and the sample has cooled, add 2 mL of water and 3 mL of 30% H_2O_2. Cover the vessel with a watch glass or vapor recovery device and return the covered vessel to the heat source for warming and to start the peroxide reaction. Care must be taken to ensure that losses do not occur due to excessively vigorous effervescence. Heat until effervescence subsides and cool the vessel.

NOTE: Alternatively, for direct energy coupled devices: After the Sec. 7.2 "NOTE" step has been completed and the sample has cooled for 5 minutes, add slowly 10 mL of 30% H_2O_2. Care must be taken to ensure that losses do not occur due to excessive vigorous effervesence. Go to Section 7.2.3.

7.2.2 Continue to add 30% H_2O_2 in 1-mL aliquots with warming until the effervescence is minimal or until the general sample appearance is unchanged.

NOTE: Do not add more than a total of 10 mL 30% H_2O_2.

7.2.3 Cover the sample with a ribbed watch glass or vapor recovery device and continue heating the acid-peroxide digestate until the volume has been reduced to approximately 5 mL or heat at 95°C ± 5°C without boiling for two hours. Maintain a covering of solution over the bottom of the vessel at all times.

NOTE: Alternatively, for direct energy coupled devices: Heat the acid-peroxide digestate to 95°C ± 5°C in 6 minutes and remain at 95°C ± 5°C without boiling for 10 minutes.

7.2.4 After cooling, dilute to 100 mL with water. Particulates in the digestate should then be removed by filtration, by centrifugation, or by allowing the sample to settle. The sample is now ready for analysis by GFAA or ICP-MS.

7.2.4.1 Filtration - Filter through Whatman No. 41 filter paper (or equivalent).

7.2.4.2 Centrifugation - Centrifugation at 2,000-3,000 rpm for 10 minutes is usually sufficient to clear the supernatant.

7.2.4.3 The diluted digestate solution contains approximately 5% (v/v) HNO_3. For analysis, withdraw aliquots of appropriate volume and add any required reagent or matrix modifier.

7.3 For the analysis of samples for FLAA or ICP-AES, add 10 mL conc. HCl to the sample digest from 7.2.3 and cover with a watch glass or vapor recovery device. Place the sample on/in the heating source and reflux at 95°C ± 5°C for 15 minutes.

NOTE: Alternatively, for direct energy coupling devices, such as a microwave, digest samples for analysis by FLAA and ICP-AES by adding 5 mL HCl and 10 mL H_2O to the sample digest from 7.2.3 and heat the sample to 95°C ± 5°C, Reflux at 95°C ± 5°C without boiling for 5 minutes.

7.4 Filter the digestate through Whatman No. 41 filter paper (or equivalent) and collect filtrate in a 100-mL volumetric flask. Make to volume and analyze by FLAA or ICP-AES.

NOTE: Section 7.5 may be used to improve the solubilities and recoveries of antimony, barium, lead, and silver when necessary. These steps are optional and are not required on a routine basis.

7.5 Add 2.5 mL conc. HNO_3 and 10 mL conc. HCl to a 1-2 g sample (wet weight) or 1 g sample (dry weight) and cover with a watchglass or vapor recovery device. Place the sample on/in the heating source and reflux for 15 minutes.

7.5.1 Filter the digestate through Whatman No. 41 filter paper (or equivalent) and collect filtrate in a 100-mL volumetric flask. Wash the filter paper, while still in the funnel, with no more than 5 mL of hot (~95°C) HCl, then with 20 mL of hot (~95°C) reagent water. Collect washings in the same 100-mL volumetric flask.

7.5.2 Remove the filter and residue from the funnel, and place them back in the vessel. Add 5 mL of conc. HCl, place the vessel back on the heating source, and heat at 95°C ± 5°C until the filter paper dissolves. Remove the vessel from the heating source and wash the cover and sides with reagent water. Filter the residue and collect the filtrate in the same 100-mL volumetric flask. Allow filtrate to cool, then dilute to volume.

NOTE: High concentrations of metal salts with temperature-sensitive solubilities can result in the formation of precipitates upon cooling of primary and/or secondary filtrates. If precipitation occurs in the flask upon cooling, do not dilute to volume.

7.5.3 If a precipitate forms on the bottom of a flask, add up to 10 mL of concentrated HCl to dissolve the precipitate. After precipitate is dissolved, dilute to volume with reagent water. Analyze by FLAA or ICP-AES.

7.6 Calculations

7.6.1 The concentrations determined are to be reported on the basis of the actual weight of the sample. If a dry weight analysis is desired, then the percent solids of the sample must also be provided.

7.6.2 If percent solids is desired, a separate determination of percent solids must be performed on a homogeneous aliquot of the sample.

8.0 QUALITY CONTROL

8.1 All quality control measures described in Chapter One should be followed.

8.2 For each batch of samples processed, a method blank should be carried throughout the entire sample preparation and analytical process according to the frequency described in Chapter One. These blanks will be useful in determining if samples are being contaminated. Refer to Chapter One for the proper protocol when analyzing method blanks.

8.3 Spiked duplicate samples should be processed on a routine basis and whenever a new sample matrix is being analyzed. Spiked duplicate samples will be used to determine precision and bias. The criteria of the determinative method will dictate frequency, but 5% (one per batch) is recommended or whenever a new sample matrix is being analyzed. Refer to Chapter One for the proper protocol when analyzing spiked replicates.

8.4 Limitations for the FLAA and ICP-AES optional digestion procedure. Analysts should be aware that the upper linear range for silver, barium, lead, and antimony may be exceeded with some samples. If there is a reasonable possibility that this range may be exceeded, or if a sample's analytical result exceeds this upper limit, a smaller sample size should be taken through the entire procedure and re-analyzed to determine if the linear range has been exceeded. The approximate linear upper ranges for a 2 gram sample size:

Ag	2,000 mg/kg
As	1,000,000 mg/kg
Ba	2,500 mg/kg
Be	1,000,000 mg/kg
Cd	1,000,000 mg/kg
Co	1,000,000 mg/kg
Cr	1,000,000 mg/kg
Cu	1,000,000 mg/kg
Mo	1,000,000 mg/kg
Ni	1,000,000 mg/kg
Pb	200,000 mg/kg
Sb	200,000 mg/kg
Se	1,000,000 mg/kg
Tl	1,000,000 mg/kg
V	1,000,000 mg/kg
Zn	1,000,000 mg/kg

NOTE: These ranges will vary with sample matrix, molecular form, and size.

9.0 METHOD PERFORMANCE

9.1 In a single laboratory, the recoveries of the three matrices presented in Table 2 were obtained using the digestion procedure outlined for samples prior to analysis by FLAA and ICP-AES. The spiked samples were analyzed in duplicate. Tables 3-5 represents results of analysis of NIST Standard Reference Materials that were obtained using both atmospheric pressure microwave digestion techniques and hot-plate digestion procedures.

10.0 REFERENCES

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4. Kimbrough, David E., and Wakakuwa, Janice R. Acid Digestion for Sediments, Sludges, Soils, and Solid Wastes. A Proposed Alternative to EPA SW 846 Method 3050, Environmental Science and Technology, Vol. 23, Page 898, July 1989.

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6. Kimbrough, David E., and Wakakuwa, Janice R. A Study of the Linear Ranges of Several Acid Digestion Procedures, Environmental Science and Technology, Vol. 26, Page 173, January 1992. Presented Sixth Annual Waste Testing and Quality Assurance Symposium, July 1990.

7. Kimbrough, David E., and Wakakuwa, Janice R. A Study of the Linear Ranges of Several Acid Digestion Procedures, Sixth Annual Waste Testing and Quality Assurance Symposium, Reprinted in Solid Waste Testing and Quality Assurance: Fourth Volume, ASTM STP 1076, Ed., American Society for Testing and Materials, Philadelphia, 1992.

8. NIST published leachable concentrations. Found in addendum to certificate of analysis for SRMs 2709, 2710, 2711 - August 23, 1993.

9. Kingston, H.M. Haswell, S.J. ed., Microwave Enhanced Chemistry, Professional Reference Book Series, American Chemical Society, Washington, D.C., Chapter 3, 1997.

TABLE 1

STANDARD RECOVERY (%) COMPARISON FOR METHODS 3050A AND 3050B[a]

Analyte	METHOD 3050A[a]	METHOD 3050B w/option[a]
Ag	9.5	98
As	86	102
Ba	97	103
Be	96	102
Cd	101	99
Co	99	105
Cr	98	94
Cu	87	94
Mo	97	96
Ni	98	92
Pb	97	95
Sb	87	88
Se	94	91
Tl	96	96
V	93	103
Zn	99	95

a All values are percent recovery. Samples: 4 mL of 100 mg/mL multistandard; n = 3.

TABLE 2

PERCENT RECOVERY COMPARISON FOR METHODS 3050A AND 3050B

Analyte	Sample 4435		Sample 4766		Sample HJ		Average	
	Percent Recovery[a,c]							
	3050A	3050B	3050A	3050B	3050A	3050B	3050A	3050B
Ag	9.8	103	15	89	56	93	27	95
As	70	102	80	95	83	102	77	100
Ba	85	94	78	95	b	b	81	94
Be	94	102	108	98	99	94	99	97
Cd	92	88	91	95	95	97	93	94
Co	90	94	87	95	89	93	89	94
Cr	90	95	89	94	72	101	83	97
Cu	81	88	85	87	70	106	77	94
Mo	79	92	83	98	87	103	83	98
Ni	88	93	93	100	87	101	92	98
Pb	82	92	80	91	77	91	81	91
Sb	28	84	23	77	46	76	32	79
Se	84	89	81	96	99	96	85	94
Tl	88	87	69	95	66	67	74	83
V	84	97	86	96	90	88	87	93
Zn	96	106	78	75	b	b	87	99

a - Samples: 4 mL of 100 mg/mL multi-standard in 2 g of sample. Each value is percent recovery and is the average of duplicate spikes.

b - Unable to accurately quantitate due to high background values.

c - Method 3050B using optional section..

Table 3
Results of Analysis of Nist Standard Reference Material 2704 "River Sediment" Using Method 3050B (µg/g ± SD)

Element	Atm. Pressure Microwave Assisted Method with Power Control	Atm. Pressure Microwave Assisted Method with Temperature Control (gas-bulb)	Atm. Pressure Microwave Assisted Method with Temperature Control (IR-sensor)	Hot-Plate	NIST Certified Values for Total Digestion (µg/g ±95% CI)
Cu	101 ± 7	89 ± 1	98 ± 1.4	100 ± 2	98.6 ± 5.0
Pb	160 ± 2	145 ± 6	145 ± 7	146 ± 1	161 ± 17
Zn	427 ± 2	411 ± 3	405 ± 14	427 ± 5	438 ± 12
Cd	NA	3.5 ± 0.66	3.7 ± 0.9	NA	3.45 ± 0.22
Cr	82 ± 3	79 ± 2	85 ± 4	89 ± 1	135 ± 5
Ni	42 ± 1	36 ± 1	38 ± 4	44 ± 2	44.1 ± 3.0

NA - Not Available

Table 4
Results of Analysis of NIST Standard Reference Material 2710 "Montana Soil (Highly Elevated Trace Element Concentrations)" Using Method 3050B (µg/g ± SD)

Element	Atm. Pressure Microwave Assisted Method with Power Control	Atm. Pressure Microwave Assisted Method with Temperature Control (gas-bulb)	Atm. Pressure Microwave Assisted Method with Temperature Control (IR-sensor)	Hot-Plate	NIST Leachable Concentrations Using Method 3050	NIST Certified Values for Total Digestion (µg/g ±95% CI)
Cu	2640 ± 60	2790 ± 41	2480 ± 33	2910 ± 59	2700	2950 ± 130
Pb	5640 ± 117	5430 ± 72	5170 ± 34	5720 ± 280	5100	5532 ± 80
Zn	6410 ± 74	5810 ± 34	6130 ± 27	6230 ± 115	5900	6952 ± 91
Cd	NA	20.3 ± 1.4	20.2 ± 0.4	NA	20	21.8 ± 0.2
Cr	20 ± 1.6	19 ± 2	18 ± 2.4	23 ± 0.5	19	39*
Ni	7.8 ± 0.29	10 ± 1	9.1 ± 1.1	7 ± 0.44	10.1	14.3 ± 1.0

NA - Not Available

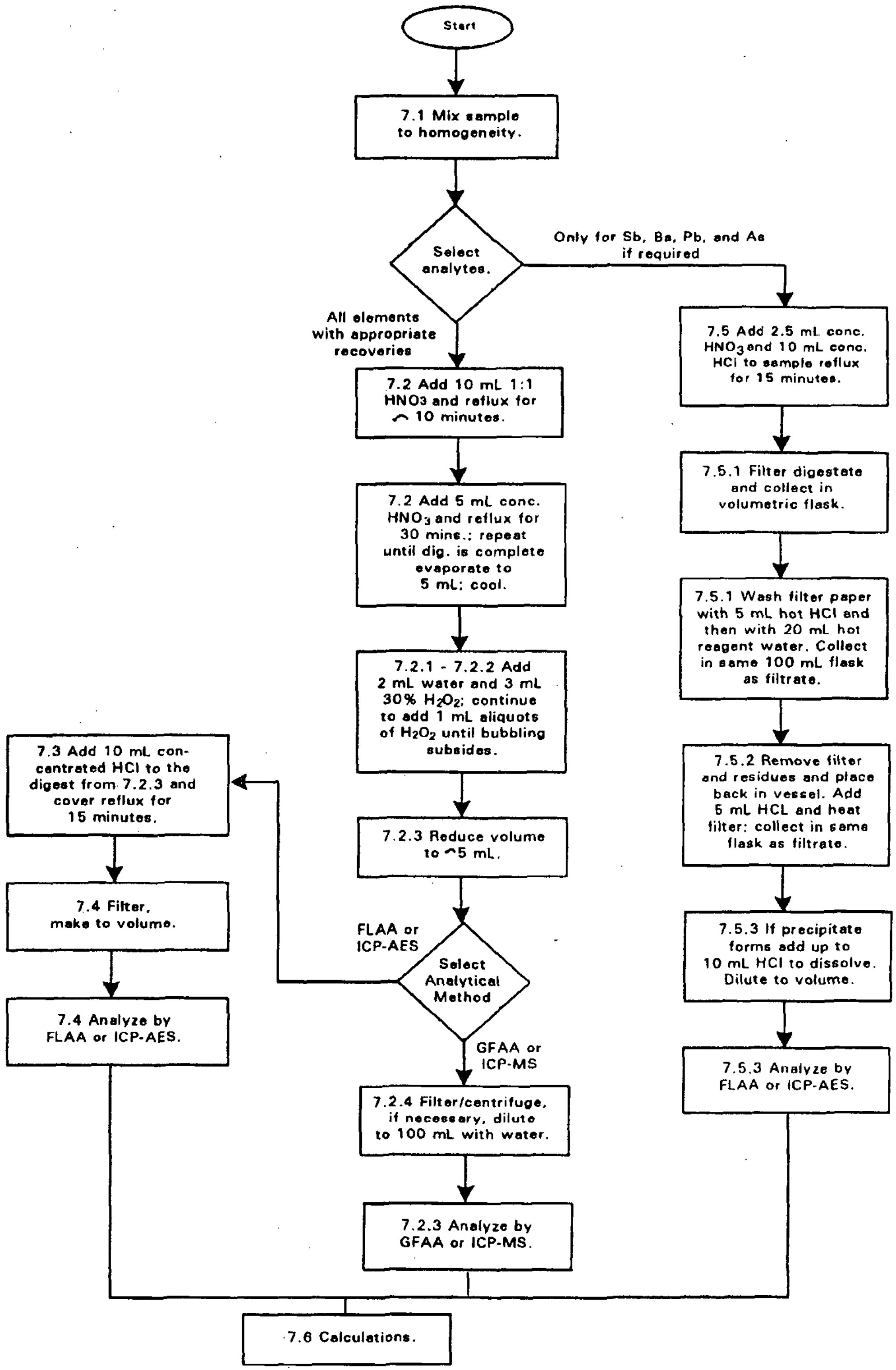
* Non-certified values, for information only.

Table 5
Results of Analysis of NIST Standard Reference Material 2711
"Montana Soil (Moderately Elevated Trace Element Concentrations)" Using Method 3050B
(μg/g ± SD)

Element	Atm. Pressure Microwave Assisted Method with Power Control	Atm. Pressure Microwave Assisted Method with Temperature Control (gas-bulb)	Atm. Pressure Microwave Assisted Method with Temperature Control (IR-sensor)	Hot-Plate	NIST Leachable Concentrations Using Method 3050	NIST Certified Values for Total Digestion (μg/g ±95% CI)
Cu	107 ± 4.6	98 ± 5	98 ± 3.8	111 ± 6.4	100	114 ± 2
Pb	1240 ± 68	1130 ± 20	1120 ± 29	1240 ± 38	1100	1162 ± 31
Zn	330 ± 17	312 ± 2	307 ± 12	340 ± 13	310	350.4 ± 4.8
Cd	NA	39.6 ± 3.9	40.9 ± 1.9	NA	40	41.7 ± 0.25
Cr	22 ± 0.35	21 ± 1	15 ± 1.1	23 ± 0.9	20	47*
Ni	15 ± 0.2	17 ± 2	15 ± 1.6	16 ± 0.4	16	20.6 ± 1.1

NA - Not Available
* Non-certified values, for information only.

METHOD 3050B
ACID DIGESTION OF SEDIMENTS, SLUDGES, AND SOILS



1860

Determination of Lead-210 in Drinking Water

Method 909.0

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March 1982

Determination of Lead-210 in Drinking Water

Method 909.0

1. Scope and Application

1.1. Lead-210 is not regulated by the National Interim Primary Drinking Water Regulations (NIPDWR). However, based upon its maximum permissible concentration (MPC) published in NBS Handbook 69, the maximum concentration level (MCL) calculated by applying the formula in the NIPDWR would be 1 pCi/L or less, depending upon the choice of critical organ.

1.2 The sensitivity of the method as defined in the NIPDWR is approximately 0.7 pCi/L for a one liter sample size using liquid scintillation counting and 0.2 pCi/L using a low background beta counter.

2. Summary of Method

2.1 Lead carrier is added and concentrated by precipitation as the chromate. It is further purified from its bismuth-210 daughter by selected dissolution of lead sulfide from a 1.5<u>N</u> hydrochloric acid solution. Lead is finally converted to the carbonate and the lead-210 concentration calculated by either counting the lead-210 beta emission by liquid scintillation technique or counting the ingrown bismuth-210 daughter activity by low background end window counting.

3. Sample Handling and Preservation

3.1 If the sample cannot be analyzed within 24 hours, it is recommended that the sample be preserved using nitric acid to a concentration of 0.01N (pH 2).

4. Interferences

4.1 Lead-214 will not interfere as the time delay from lead separation and counting (10 half lives) allows for its total decay.

4.2 Lead-212 can interfere with the lead-210 determination and cause a positively biased result. However, a 2 to 3 day storage at the end of Step 8.14 will allow for sufficient decay.

5. Apparatus

5.1 Liquid scintillation counter or low background beta counter

5.2 Millipore 300 mL ground glass filtering assembly

5.3 Membrane filter (PVC), e.g., Gelman 64515

5.4 Centrifuge

5.5 40 mL cone bottom centrifuge tubes

5.6 2.8 cm fiber glass filters

5.7 Convection oven.

6. Reagents

6.1 Acetic acid, glacial

6.2 Ammonium carbonate, 1.5M. Dissolve 144 g ammonium carbonate in 300 mL of water and dilute to 500 mL.

6.3 Ammonium hydroxide, 6M. Transfer 400 mL of concentrated ammonium hydroxide (30%) to 500 mL water and dilute to 1000 mL with water.

6.4 Barium carrier, 5 mg Ba^{++}/mL. Dissolve 4.4713 g of $BaCl_2 \cdot 2H_2O$ in water and dilute to 500 mL.

6.5 Bismuth carrier, 5 mg Bi^{+++}/mL. Dissolve 5.8026 g of $B_i(NO_3)_3 \cdot 5H_2O$ in 1 M HNO_3 and dilute to 500 mL with 1 M HNO_3.

6.6 Hexanoic acid, practical.

6.7 Hydrochloric acid, 12 M.

6 M - Transfer 500 mL of concentrated acid to 400 mL of water and dilute to 1000 mL with water.

1.5 M - Transfer 125 mL of concentrated acid to 700 mL of water and dilute to 1000 mL with water.

6.8 Hydrogen sulfide gas, lecture bottle.

6.9 Lead carrier, 10 mg Pb^{++}/mL. Dissolve 4 grams $Pb(NO_3)_2$ in 250 ml of 0.1 M HNO_3.

6.10 Scintillation solution. Commercially prepared universal liquid scintillation cocktail for aqueous and non-aqueous samples.

6.11 Sodium chromate, 1.5M. Dissolve 175 g of sodium chromate tetrahydrate in 350 mL water and dilute to 500 mL with water.

6.12 Sodium nitrite, 1 M. Dissolve 6.9 g of sodium nitrite in 70 mL water and dilute to 100 mL with water.

6.13 Toluene, reagent grade.

6.14 Water/ethanol wash solution, 1:1. Mix 200 mL of ethanol with 200 mL of water.

7. Calibration and standardization

7.1 Lead carrier solution

7.1.1 Transfer 10 mL of the lead carrier solution to a 150 mL beaker and dilute to 75 mL.

7.1.2 Add 1-2 drops of methyl orange indicator and neutralize by the dropwise addition of 6M NH_4OH.

7.1.3 Reacidify with 2 mL of glacial acetic acid and heat to near boiling.

7.1.4 Slowly bubble H_2S gas into the solution for 3-4 minutes.

7.1.5 Remove H_2S source and heat the solution to just boiling. Cool.

7.1.6 Filter through a tared fritted glass filtering funnel of fine porosity.

7.1.7 Wash several times with 10 mL portion of water.

7.1.8 Dry at 105-110°C. Cool and weigh.

7.2 Counter Efficiency

7.2.1 Transfer 1 mL each of the lead and bismuth carrier to a 40 mL cone bottom centrifuge tube.

7.2.2 Add an aliquot of the lead-210 standard tracer solution approximating 1000 dpm.

7.2.3 Dilute to 20 mL and add 1-2 drops of methyl orange.

7.2.4 Neutralize by the dropwise addition of 6M NH_4OH.

7.2.5 Reacidify with 2 mL of glacial acetic acid.

7.2.6 Heat to near boiling in a hot water bath and slowly bubble H_2S gas into the solution for 2-3 minutes.

7.2.7 Remove H_2S source and continue boiling for 2-3 minutes. Remove from bath and cool.

7.2.8 Centrifuge and discard supernate.

7.2.9 Add 20 mL 1.5M HCl and heat to boiling in a water bath with intermittent stirring, breaking up all large sulfide lumps.

7.2.10 Cool and filter through a 2.8 cm glass fiber filter, saving the filtrate and noting the time of filtration.

7.2.11 Neutralize filtrate by adding 5-6 mL of 6 M NH_4OH using pH paper to verify.

7.2.12 Reacidify by adding 2 mL of glacial acetic acid.

7.2.13 Heat to near boiling in a water bath and slowly bubble H_2S gas into the solution for 2-3 minutes.

7.2.14 Remove H_2S source and continue heating for 2-3 minutes. Cool.

7.2.15 Centrifuge and discard the supernate.

7.2.16 Add 3 mL 6M HCl and heat in a water bath to dissolve the sulfides.

7.2.17 Add 0.5 mL of 1M $NaNO_2$ to oxidize excess sulfide ions. Heat until effervescence ceases and dilute to 20 mL with water.

7.2.18 Filter through a 2.8 cm glass fiber filter, saving the filtrate.

7.2.19 Dropwise add 6M NH_4OH until a pearlescent precipitate persists. Then add 5 mL 1.5M ammonium carbonate solution.

7.2.20 Heat in a hot water bath with stirring until the excess ammonium carbonate begins to decompose (60°C).

7.2.21 Cool and centrifuge, discarding the supernate.

7.2.22 Add 20 mL 1:1 water/ethanol wash solution breaking up the precipitate with a glass rod.

7.2.23 Filter through a tared 2.8 cm glass fiber filter, washing the tube and precipitate several times with 10 mL volume of the wash solution.

7.2.24 Dry filter at 105-110°C. Cool and weigh.

7.3 Liquid Scintillation Counting

7.3.1 Place the weighed filter at the bottom of a glass scintillation vial with the precipitate facing upwards.

7.3.2 Add 0.5 mL each of glacial acetic acid and water. Evaporate to dryness in an oven at 120°C.

7.3.3 Cool and add 0.25 mL hexanoic acid wetting the filter completely. Add 3 mL of toluene and swirl occasionally over a period of 30 minutes to solubilize the lead hexanoate.

7.3.4 Add 10 mL of the scintillation solution, mix thoroughly and place in a liquid scintillation counter.

7.3.5 After 30 minutes, determine the beta spectrum of the lead-210 emissions.

7.3.6 Set the beta window to include about 95% of the beta emissions.

7.3.7 Count the standard over a period of two weeks at this window setting, noting the time of each count.

7.4 Low Background Beta Counter

7.4.1 Transfer the filter from step 7.2.24 to a planchet conforming to your standard counting geometry. (It would be desirable to cover the filter to prevent loss of precipitate).

7.4.2 Count the standard over a period of two weeks noting the time of each count.

8. Procedure

8.1 Acidify a 1-liter volume of a tap water sample with 25 mLs of glacial acetic acid.

8.2 Add 10 mgs of lead carrier and 5 mgs of the holdback carriers Bi and Ba. (Five mgs of these additional holdback carriers, Fe, Co, Ni, Ce, Mn, Sr, Zn, and Cu may be added when needed.)

8.3 With constant stirring, add 20 mLs of 0.5M sodium chromate.

8.4 Heat to 70° C on a hot plate with stirring until the precipitate is fully developed.

8.5 Remove from hot plate and cool in a cold water bath.

8.6 Filter with vacuum through a 47 mm 0.45 micron membrane filter.

8.7 Wash precipitate thoroughly with small quantities of distilled water.

8.8 Transfer the filter to a 40 mL cone bottom centrifuge tube and dropwise add 1 mL of conc. HCl contacting the precipitate and heat in a boiling water bath to reduce the chromate and dissolve the precipitate. Dilute to 20 mL with water.

8.9 Remove filter and wash with 10 mL water, adding the wash to the centrifuge tube.

8.10 Add sufficient 6$\underline{M}$ ammonium hydroxide to neutralize the acid.

8.11 Add 2 mL glacial acetic acid and place centrifuge tube in a boiling water bath for 2-3 minutes.

8.12 Carefully bubble a slight stream of hydrogen sulfide gas into the solution for 2-3 minutes to completely precipitate the lead.

8.13 Remove the hydrogen sulfide source and continue boiling for 5 minutes.

8.14 Remove from the water bath, cool, and centrifuge, discarding the supernate.

8.15 Add 20 mL 1.5$\underline{N}$ HCl to selectively dissolve PbS, heating in a boiling water bath. (Precipitate is nearly completely solubilized).

8.16 Filter through a 2.8 cm glass fiber filter to remove the Bi_2S_3 precipitate, collecting the filtrate in a clean 40 mL centrifuge tube. (Note time as initial Pb-210 separation.)

8.17 Neutralize by the addition of 5-6 mL 6$\underline{M}$ NH_4OH. Add 2 mL glacial acetic acid and reprecipitate the PbS using H_2S gas, heating in a boiling water bath.

8.18 Cool, centrifuge and discard supernate.

8.19 Add 3 mL 6M HCl to dissolve the sulfides and heat in a boiling water bath. Add 0.5 mL 1M sodium nitrite and heat in a hot water bath until effervescence ceases. Remove from water bath and dilute to 20 mL with water.

8.20 Filter through a fiber glass filter to remove any precipitated sulfur or other insolubles into a clean 40 mL cone bottom centrifuge tube. Wash with 10 mL water.

8.21 Add sufficient 6M ammonium hydroxide to neutralize the acid.

8.22 Add 5 mL of 1.5M ammonium carbonate.

8.23 Heat in a boiling water bath for 3 minutes, remove and cool.

8.24 Centrifuge and discard the supernate.

8.25 Wash precipitate with 15 mL of 1:1 water:ethanol solution.

8.26 Filter through a tared 2.8 cm fiber glass filter and rinse with 10 mL 1:1 water/ethanol solution.

8.27 Dry at 105°C, cool and weigh to determine lead carrier recovery. (If liquid scintillation counting is to be used, continue at step 8.28. If Low Background Beta counting is to be used, continue at step 8.33).

8.28 Place filter at the bottom of scintillation vial with the precipitate facing upwards.

8.29 Add 0.5 mL glacial acetic acid and 0.5 mL water and take to dryness in a 120°C oven.

8.30 Cool and add 0.25 mL of hexanoic acid and 3 mL toluene. Mix and let stand for 20 minutes with occasional mixing.

8.31 Add 10 mL of scintillation solution. Mix throughly and place sample into the liquid scintillation counter.

8.32 Using the predetermined window setting for counting only the lead-210 beta emissions, count for sufficient time to meet the method detection limit.

8.33 Place the filter on a planchet conforming to your standard geometry. (It would be desirable to cover the filter to prevent loss of precipitate during storage.)

8.34 Store for about 2 weeks to allow sufficient Bi-210 ingrowth.

8.35 Place in the counter and count for sufficient time to meet the method detection limit and note time of count.

9. Calculation

9.1 Lead standardization

$$\text{Lead, mg/mL} = \frac{\text{mg PbS} \times 0.86599}{10}$$

9.2 Liquid scintillation counter

9.2.1 Bismuth-210 crosstalk (Z)

9.2.1.1 Determine the bismuth ingrowth factors, $(1-e^{-\lambda t})$ where t equals the time difference from time of separation (step 7.2.10) to time of counting for the various count times.

9.2.1.2 Plot the observed count rates as the ordinate against the ingrowth factors.

9.2.1.3 By linear least squares analysis, solve for the intercept, A, and slope, B. (The intercept is the count rate due to the lead-210 emission and the slope is the count rate due to the amount of the for the various count times where t is the time difference between time of separation and time of count.

9.3.1.2 Plot the observed count rates as the ordinate against the ingrowth factors.

9.3.1.3 By linear least square analysis solve for the intercept A and slope B. (The intercept A represents the count rate due to lead-210 and the slope B represents the count rate of bismuth-210 at equilibrium.)

9.3.1.4 Efficiency determination

Lead-210 efficiency, E_1 = A/dpm recovered

Bismuth-210 efficiency, E_2 = B/dpm recovered

Total efficiency = $E_1 + E_2 (1 - e^{-\lambda t})$

9.3.2 Concentration

$$\text{Lead-210 concentration pCi/L} = \frac{G - B}{V \times (E_1 + E_2(1-e^{-\lambda t})) \times R \times 2.22}$$

where:

G = gross count rate in lead-210 window

B = background count rate

V = volume of sample, liter

E_1 = Lead-210 efficiency

E_2 = Bismuth-210 efficiency

$(1-e^{-\lambda t})$ = Bismuth-210 ingrowth factor

R = chemical recovery

2.22 = constant (dpm/pCi)

10. Precision and Accuracy

10.1 Liquid scintillation counting

10.1.1 Accuracy

10.1.1.1 Four samples at lead-210 concentrations ranging from 0 to 41 pCi/L were analyzed. A plot and linear least square solution of pCi/L found versus pCi/L added showed that the intercept was not different from zero and that the slope showed a +1% bias.

10.1.1.2 Seven samples were also analyzed at a single concentration level (7.72 pCi/L). The average of the seven determinations was 7.96 pCi/L. This showed a +3% bias.

10.1.2 Precision

10.1.2.1 Based upon the seven replicate values at 7.72 pCi/L, the relative standard deviation was found to be ± 8%.

10.2 Low background beta counting

10.2.1 Accuracy

10.2.1.1 Eight samples were analyzed at a single concentration level of 7.72 pCi/l. The average concentration found was 7.85 pCi/l. This shows as +2% bias.

10.2. Precision

10.2.2.1 Based upon the eight replicate values at 7.72 pCi/l, the relative standard deviation was calculated to be ± 5%.

PERFORMANCE EVALUATION

First Choice for Quality | RTC

Quarterly Study

LPTP08-S1

6-Feb-2008 through 21-Mar-2008

RT1014
RTC Labcode

WY00002
US EPA Labcode

Energy Labs
Jim Yocum
PO Box 3258
Casper WY 82602

Thank you for participating in study LPTP08-S1. Additional information about this study may be found online at www.rt-corp.com you have any questions or comments about this study please contact me.

Sincerely,

Christopher Rucinski
Quality Director

2931 Soldier Springs Road
Laramie, WY 82070
(307) 742-5452
www.rt-corp.com

ACCREDITED
Certificate # 2122.01

Dataset

LPTP08-S1 Set 1

Accreditors

Evaluations of this dataset will be sent to the accreditor(s) listed below using your laboratory's labcode listed above each accrediting agency. If any of the information listed below is incorrect, please contact RTC immediately.

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Miscellaneous Analytes

Analysis
EPA 1010 (1986)
Auto Analyzer
Method Number 10116606
Technology Code: AUTO

	Result Units	Accept / Warn	Z	Evaluation
Ignitability (Flashpoint) 1, 4 1780 / 029 - Lot 013068	188 °F	172 to 206 178 to 200	-0.18	**Acceptable**

Analysis
EPA 9045C 3 (1995)
Ion Selective Electrode
Method Number 10198400
Technology Code: ISE

	Result Units	Accept / Warn	Z	Evaluation
pH 1, 4 1900 / 023 - Lot 013026	5.38 Units	5.28 to 6.48 5.48 to 6.28	-2.50	**Acceptable**

TCLP Metals

Analysis
EPA 6010 (1986)
Atomic Emission - Inductvely Coupled Plasma Spectrometry
Method Number 10155201
Technology Code: ICP-AES

	Result Units	Accept / Warn	Z	Evaluation
Extraction Fluid 4 1311 / 005 - Lot 000718	1	1.00 to 1.00		**Acceptable**

Analysis
EPA 6010B (1996)
Atomic Emission - Inductvely Coupled Plasma Spectrometry
Method Number 10155609
Technology Code: ICP-AES

	Result Units	Accept / Warn	Z	Evaluation
Arsenic, As 4 1010 / 005 - Lot 000718	2.82 mg/L	1.89 to 4.38	-0.76	**Acceptable**
Barium, Ba 4 1015 / 005 - Lot 000718	<10 mg/L	1.31 to 2.95		**Acceptable**
Cadmium, Cd 4 1030 / 005 - Lot 000718	13.8 mg/L	10.5 to 15.7	0.81	**Acceptable**
Chromium, Cr (total) 4 1040 / 005 - Lot 000718	<0.5 mg/L	0.00 to 0.977		**Acceptable**
Lead, Pb 4 1075 / 005 - Lot 000718	3.63 mg/L	0.915 to 8.83	-0.94	**Acceptable**
Selenium, Se 4 1140 / 005 - Lot 000718	7.05 mg/L	5.12 to 9.50 5.85 to 8.77	-0.35	**Acceptable**
Silver, Ag 4 1150 / 005 - Lot 000718	<0.5 mg/L	0 to 0.0507		**Acceptable**

Analysis
EPA 7470A 1 (1994)
Atomic Absorption - Cold Vapor Spectrometry
Method Number 10165807
Technology Code: CVAAS

	Result Units	Accept / Warn	Z	Evaluation
Mercury, Hg 4 1095 / 005 - Lot 000718	1.5 mg/L	0.00 to 2.89	0.21	**Acceptable**

Trace Metals

Analysis
EPA 6010 (1986)
Atomic Emission - Inductvely Coupled Plasma Spectrometry

Method Number 10155201
Technology Code: ICP-AES

	Result Units	Accept / Warn	Z	Evaluation
Silicon, Si [4] 1145 / 001 - Lot 013023	2300 mg/Kg	0.00 to 2460	2.73	**Acceptable**

Analysis
EPA 6010B (1996)
Atomic Emission - Inductvely Coupled Plasma Spectrometry

Method Number 10155609
Technology Code: ICP-AES

	Result Units	Accept / Warn	Z	Evaluation
Boron, B [4, 5] 1025 / 001 - Lot 013023	72 mg/Kg	57.4 to 105	-1.13	**Acceptable**
Calcium, Ca [1, 4] 1035 / 001 - Lot 013023	13000 mg/Kg	10500 to 18100	-1.03	**Acceptable**
Iron, Fe [1, 4] 1070 / 001 - Lot 013023	15000 mg/Kg	5600 to 24600 8770 to 21400	-0.03	**Acceptable**
Lithium, Li [4] 1080 / 001 - Lot 013023	140 mg/Kg	101 to 245	-1.39	**Acceptable**
Magnesium, Mg [1, 4] 1085 / 001 - Lot 013023	2900 mg/Kg	1920 to 3930 2260 to 3600	-0.08	**Acceptable**
Potassium, K [1, 4] 1125 / 001 - Lot 013023	4900 mg/Kg	2500 to 5230 2950 to 4770	2.28	**Acceptable**
Sodium, Na [1, 4] 1155 / 001 - Lot 013023	2000 mg/Kg	1320 to 2750 1560 to 2510	-0.15	**Acceptable**

Analysis
EPA 6020 (1994)
Mass Spectrometry - Inductively Coupled Plasma

Method Number 10156000
Technology Code: ICP-MS

	Result Units	Accept / Warn	Z	Evaluation
Bismuth, Bi [3] 205 / 001 - Lot 013023	<0.57 mg/Kg	0.0 to 0.0 0.0 to 0.0		**Acceptable**
Aluminum, Al [1, 4] 1000 / 001 - Lot 013023	20900 mg/Kg	2260 to 26700 3730 to 26700	9.60	**Acceptable**
Antimony, Sb [1, 4] 1005 / 001 - Lot 013023	18.9 mg/Kg	0.00 to 124 0.00 to 97.3	-0.89	**Acceptable**
Arsenic, As [1, 4] 1010 / 001 - Lot 013023	143 mg/Kg	90.6 to 168 104 to 155	1.06	**Acceptable**
Barium, Ba [1, 4] 1015 / 001 - Lot 013023	154 mg/Kg	91.9 to 163 104 to 151	2.26	**Acceptable**
Beryllium, Be [1, 4] 1020 / 001 - Lot 013023	38.2 mg/Kg	28.5 to 51.0 32.2 to 47.2	-0.41	**Acceptable**
Cadmium, Cd [1, 4] 1030 / 001 - Lot 013023	226 mg/Kg	154 to 266 173 to 247	0.86	**Acceptable**
Chromium, Cr (total) [1, 4] 1040 / 001 - Lot 013023	53.1 mg/Kg	36.8 to 72.4 42.8 to 66.5	-0.26	**Acceptable**
Cobalt, Co [1, 4] 1050 / 001 - Lot 013023	63.7 mg/Kg	49.9 to 84.4 55.7 to 78.6	-0.60	**Acceptable**
Copper, Cu [1, 4] 1055 / 001 - Lot 013023	81.9 mg/Kg	58.2 to 99.8 65.2 to 92.9	0.42	**Acceptable**

Trace Metals (continued)

Analysis
EPA 6020 (1994)
Mass Spectrometry - Inductively Coupled Plasma

(continued)
Method Number 10156000
Technology Code: ICP-MS

	Result Units	Accept / Warn	Z	Evaluation
Lead, Pb [1,4] 1075 / 001 - Lot 013023	144 mg/Kg	96.9 to 170 109 to 157	0.89	**Acceptable**
Manganese, Mn [1,4] 1090 / 001 - Lot 013023	169 mg/Kg	88.0 to 265	-0.25	**Acceptable**
Molybdenum, Mo [1,4] 1100 / 001 - Lot 013023	84.2 mg/Kg	53.1 to 101 61.1 to 93.1	0.89	**Acceptable**
Nickel, Ni [1,4] 1105 / 001 - Lot 013023	141 mg/Kg	91.8 to 160 103 to 149	1.33	**Acceptable**
Selenium, Se [1,4] 1140 / 001 - Lot 013023	44.7 mg/Kg	20.5 to 55.5 26.3 to 49.7	1.15	**Acceptable**
Silver, Ag [1,4] 1150 / 001 - Lot 013023	22.8 mg/Kg	13.6 to 29.0 16.2 to 26.5	0.57	**Acceptable**
Strontium, Sr [4] 1160 / 001 - Lot 013023	337 mg/Kg	233 to 424 265 to 392	0.27	**Acceptable**
Thallium, Tl [1,4] 1165 / 001 - Lot 013023	46.3 mg/Kg	25.7 to 58.4 31.1 to 52.9	0.78	**Acceptable**
Tin, Sn [1,4] 1175 / 001 - Lot 013023	183 mg/Kg	64.6 to 248	0.87	**Acceptable**
Titanium, Ti [4] 1180 / 001 - Lot 013023	153 mg/Kg	84.6 to 233	-0.23	**Acceptable**
Vanadium, V [1,4] 1185 / 001 - Lot 013023	65.4 mg/Kg	37.1 to 92.8 46.4 to 83.6	0.05	**Acceptable**
Zinc, Zn [1,4] 1190 / 001 - Lot 013023	760 mg/Kg	530 to 906 592 to 844	0.67	**Acceptable**
Uranium, U [4] 3035 / 071 - Lot 013025	352 mg/Kg	167 to 311 191 to 287	4.73	**Not Acceptable**

Analysis
EPA 7471A 1 (1994)
Atomic Absorption - Cold Vapor Spectrometry

Method Number 10166208
Technology Code: CVAAS

	Result Units	Accept / Warn	Z	Evaluation
Mercury, Hg [1,4] 1095 / 001 - Lot 013023	31 mg/Kg	12.4 to 35.7 16.3 to 31.8	1.79	**Acceptable**

Volatiles - Low Level (Solids)

Analysis
EPA 8260B 2 (1996)
Gas Chromatography - Mass Spectrometry

Method Number 10184802
Technology Code: GC-MS

	Result Units	Accept / Warn	Z	Evaluation
Acetone [1,4] 4315 / 002-L - Lot 013067	<20 µg/Kg	0.00 to 192		**Acceptable**
Acetonitrile [4] 4320 / 002-L - Lot 013067	<20 µg/Kg	0.0 to 0.0		**Acceptable**
Acrolein (Propenal) [4] 4325 / 002-L - Lot 013067	<20 µg/Kg	0.0 to 0.0		**Acceptable**

Volatiles - Low Level (Solids) (continued)

Analysis
EPA 8260B 2 (1996)
Gas Chromatography - Mass Spectrometry

(continued)
Method Number 10184802
Technology Code: GC-MS

	Result Units	Accept / Warn	Z	Evaluation
T-amylmethylether (TAME) [4] 4370 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0		Acceptable
Benzene [1, 4] 4375 / 002-L - Lot 013067	100 µg/Kg	58.1 to 134 70.7 to 121	0.32	Acceptable
Bromobenzene [4, 5] 4385 / 002-L - Lot 013067	200 µg/Kg	90.6 to 264	0.79	Acceptable
Bromodichloromethane [1, 4] 4395 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0 0.0 to 0.0		Acceptable
Bromoform [1, 4] 4400 / 002-L - Lot 013067	37 µg/Kg	21.7 to 65.8 29.1 to 58.5	-0.92	Acceptable
2-Butanone (Methyl ethyl ketone, MEK) [1, 4] 4410 / 002-L - Lot 013067	180 µg/Kg	0.00 to 764	-1.13	Acceptable
Carbon disulfide [4] 4450 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0		Acceptable
Carbon tetrachloride [1, 4] 4455 / 002-L - Lot 013067	98 µg/Kg	50.8 to 154 67.9 to 136	-0.24	Acceptable
Chlorobenzene [1, 4] 4475 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0 0.0 to 0.0		Acceptable
Chloroethane [4, 5] 4485 / 002-L - Lot 013067	140 µg/Kg	5.09 to 235	0.51	Acceptable
2-Chloroethyl vinyl ether [4] 4500 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0		Acceptable
Chloroform [1, 4] 4505 / 002-L - Lot 013067	170 µg/Kg	95.4 to 218 116 to 198	0.64	Acceptable
1,2-Dibromo-3-chloropropane (DBCP) [4, 5] 4570 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0		Acceptable
1,2-Dibromoethane (EDB, Ethylene dibromide) [4, 5] 4585 / 002-L - Lot 013067	51 µg/Kg	29.2 to 67.3	0.43	Acceptable
1,2-Dichlorobenzene [1, 4] 4610 / 002-L - Lot 013067	98 µg/Kg	41.3 to 122 54.8 to 109	1.21	Acceptable
1,3-Dichlorobenzene [1, 4] 4615 / 002-L - Lot 013067	35 µg/Kg	9.25 to 44.6 15.1 to 38.7	1.37	Acceptable
1,4-Dichlorobenzene [1, 4] 4620 / 002-L - Lot 013067	200 µg/Kg	58.5 to 241 88.9 to 211	1.65	Acceptable
Dichlorodifluoromethane [4, 5] 4625 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0		Acceptable
1,1-Dichloroethane [1, 4] 4630 / 002-L - Lot 013067	89 µg/Kg	55.8 to 142 70.2 to 128	-0.70	Acceptable
1,2-Dichloroethane [1, 4] 4635 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0 0.0 to 0.0		Acceptable
1,1-Dichloroethylene [4, 5] 4640 / 002-L - Lot 013067	96 µg/Kg	43.4 to 144	0.14	Acceptable
cis-1,2-Dichloroethylene [4, 5] 4645 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0		Acceptable
1,2-Dichloropropane [1, 4] 4655 / 002-L - Lot 013067	180 µg/Kg	100 to 229 122 to 208	0.70	Acceptable

Volatiles - Low Level (Solids) (continued)

Analysis
EPA 8260B 2 (1996)
Gas Chromatography - Mass Spectrometry

(continued)
Method Number 10184802
Technology Code: GC-MS

	Result Units	Accept / Warn	Z	Evaluation
cis-1,3-Dichloropropene [4, 5] 4680 / 002-L - Lot 013067	89 µg/Kg	52.1 to 125	0.06	**Acceptable**
trans-1,3-Dichloropropene [4, 5] 4685 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0		**Acceptable**
trans-1,2-Dichloroethylene [4, 5] 4700 / 002-L - Lot 013067	160 µg/Kg	73.7 to 231	0.30	**Acceptable**
Ethylbenzene [1, 4] 4765 / 002-L - Lot 013067	210 µg/Kg	106 to 268 133 to 241	0.85	**Acceptable**
Hexachlorobutadiene [1, 4] 4835 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0		**Acceptable**
2-Hexanone [4, 5] 4860 / 002-L - Lot 013067	230 µg/Kg	0.00 to 574	-0.57	**Acceptable**
Isopropylbenzene [4, 5] 4900 / 002-L - Lot 013067	150 µg/Kg	68.5 to 219	0.26	**Acceptable**
Methyl bromide (Bromomethane) [4, 5] 4950 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0		**Acceptable**
Methyl chloride (Chloromethane) [4, 5] 4960 / 002-L - Lot 013067	63 µg/Kg	23.3 to 93.5	0.39	**Acceptable**
Methylene chloride (Dichloromethane) [1, 4] 4975 / 002-L - Lot 013067	190 µg/Kg	83.8 to 257 113 to 229	0.67	**Acceptable**
4-Methyl-2-pentanone (MIBK) [1, 4] 4995 / 002-L - Lot 013067	170 µg/Kg	76.3 to 258 106 to 227	0.10	**Acceptable**
Methyl tert-butyl ether (MTBE) [1, 4] 5000 / 002-L - Lot 013067	85 µg/Kg	35.7 to 130 51.3 to 114	0.15	**Acceptable**
Naphthalene [1, 4] 5005 / 002-L - Lot 013067	81 µg/Kg	46.2 to 109	0.31	**Acceptable**
Styrene [4, 5] 5100 / 002-L - Lot 013067	47 µg/Kg	37.5 to 70.2	-1.26	**Acceptable**
1,1,1,2-Tetrachloroethane [1, 4] 5105 / 002-L - Lot 013067	170 µg/Kg	109 to 224 128 to 205	0.19	**Acceptable**
1,1,2,2-Tetrachloroethane [1, 4] 5110 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0 0.0 to 0.0		**Acceptable**
Tetrachloroethylene (Perchloroethylene) [1, 4] 5115 / 002-L - Lot 013067	75 µg/Kg	33.6 to 109 46.2 to 96.4	0.30	**Acceptable**
Toluene [1, 4] 5140 / 002-L - Lot 013067	78 µg/Kg	38.2 to 94.6 47.6 to 85.2	1.23	**Acceptable**
1,2,4-Trichlorobenzene [1, 4] 5155 / 002-L - Lot 013067	140 µg/Kg	79.6 to 185	0.44	**Acceptable**
1,1,1-Trichloroethane [1, 4] 5160 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0 0.0 to 0.0		**Acceptable**
1,1,2-Trichloroethane [1, 4] 5165 / 002-L - Lot 013067	180 µg/Kg	96.2 to 226 118 to 204	0.88	**Acceptable**
Trichloroethene (Trichloroethylene) [1, 4] 5170 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0 0.0 to 0.0		**Acceptable**
Trichlorofluoromethane [4, 5] 5175 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0		**Acceptable**

Volatiles - Low Level (Solids) (continued)

Analysis
EPA 8260B 2 (1996)
Gas Chromatography - Mass Spectrometry

(continued)
Method Number 10184802
Technology Code: GC-MS

	Result Units	Accept / Warn	Z	Evaluation
1,2,3-Trichloropropane [1,4] 5180 / 002-L - Lot 013067	50 µg/Kg	14.1 to 75.1	0.53	**Acceptable**
1,2,4-Trimethylbenzene [4] 5210 / 002-L - Lot 013067	51 µg/Kg	29.4 to 64.9	0.65	**Acceptable**
1,3,5-Trimethylbenzene [4] 5215 / 002-L - Lot 013067	110 µg/Kg	65.4 to 141	0.53	**Acceptable**
Vinyl acetate [4] 5225 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0		**Acceptable**
Vinyl chloride [4,5] 5235 / 002-L - Lot 013067	110 µg/Kg	28.9 to 181	0.20	**Acceptable**
m+p-Xylene [4] 5240 / 002-L - Lot 013067	110 µg/Kg	50.4 to 157 68.1 to 139	0.36	**Acceptable**
o-Xylene [4] 5250 / 002-L - Lot 013067	54 µg/Kg	21.9 to 74.8 30.7 to 66.0	0.64	**Acceptable**
Xylene, total [1,4] 5260 / 002-L - Lot 013067	170 µg/Kg	83.2 to 251 111 to 223	0.11	**Acceptable**
Di-isopropylether (DIPE) [4] 9375 / 002-L - Lot 013067	<2.0 µg/Kg	0.0 to 0.0		**Acceptable**

Group Analysis Summary
Acceptable 58 / 58
Score 100.0% - **(Acceptable)**

End of LPTP08-S1 Set 1

Dataset

LPTP08-S1 Set 2

Accreditors

Evaluations of this dataset will be sent to the accreditor(s) listed below using your laboratory's labcode listed above each accrediting agency. If any of the information listed below is incorrect, please contact RTC immediately.

Accrediting Labcode 128640
A2LA

222 Atefeh Fahti
5301 Buckeystown Pike
Suite 350
Frederick MD 21704-8307
UNITED STATES

Accrediting Labcode WY00002
Florida Dept. of Health

229 Stephen Arms
PO Box 210
1217 Pearl Street
Jacksonville FL 32231
UNITED STATES

Accrediting Labcode WY00002
Nebraska Health and Human Services System
Department of Regulation & Licensure

504 Sandra Irons
State Certification Officer
P.O. Box 95007
Lincoln NE 68509-5007
UNITED STATES

Accrediting Labcode WY00002
Nevada Division of Env. Protection

118 Donald Lafara
901 S. Stewart Street
Ste. 4001
Carson City NV 89701-5249
UNITED STATES

Accrediting Labcode T104704181-05-TX
Texas CEQ

384 Frank Jamison
Quality Assurance/Laboratory Accreditation
PO Box 13087 (MC-176)
Austin TX 78711-3087
UNITED STATES

Accrediting Labcode WY00002
Utah Bureau of Laboratory Improvement

215 Kristin Brown
46 N. Medical Drive
Salt Lake City UT 84113-1105
UNITED STATES

Trace Metals

Analysis
EPA 6010B (1996)
Atomic Emission - Inductvely Coupled Plasma Spectrometry

Method Number 10155609
Technology Code: ICP-AES

Analyte	Result Units	Accept / Warn	Z	Evaluation
Aluminum, Al [1, 4] 1000 / 001 - Lot 013023	1900 mg/Kg	2260 to 26700 3730 to 26700	-3.24	**Not Acceptable**
Antimony, Sb [1, 4] 1005 / 001 - Lot 013023	16 mg/Kg	0.00 to 124 0.00 to 97.3	-1.00	**Acceptable**
Arsenic, As [1, 4] 1010 / 001 - Lot 013023	130 mg/Kg	90.6 to 168 104 to 155	0.05	**Acceptable**
Barium, Ba [1, 4] 1015 / 001 - Lot 013023	130 mg/Kg	91.9 to 163 104 to 151	0.22	**Acceptable**
Beryllium, Be [1, 4] 1020 / 001 - Lot 013023	36 mg/Kg	28.5 to 51.0 32.2 to 47.2	-0.99	**Acceptable**
Cadmium, Cd [1, 4] 1030 / 001 - Lot 013023	210 mg/Kg	154 to 266 173 to 247	0.00	**Acceptable**
Chromium, Cr (total) [1, 4] 1040 / 001 - Lot 013023	54 mg/Kg	36.8 to 72.4 42.8 to 66.5	-0.11	**Acceptable**
Cobalt, Co [1, 4] 1050 / 001 - Lot 013023	63 mg/Kg	49.9 to 84.4 55.7 to 78.6	-0.72	**Acceptable**
Copper, Cu [1, 4] 1055 / 001 - Lot 013023	70 mg/Kg	58.2 to 99.8 65.2 to 92.9	-1.30	**Acceptable**
Lead, Pb [1, 4] 1075 / 001 - Lot 013023	130 mg/Kg	96.9 to 170 109 to 157	-0.27	**Acceptable**
Manganese, Mn [1, 4] 1090 / 001 - Lot 013023	170 mg/Kg	88.0 to 265	-0.22	**Acceptable**
Molybdenum, Mo [1, 4] 1100 / 001 - Lot 013023	74 mg/Kg	53.1 to 101 61.1 to 93.1	-0.38	**Acceptable**
Nickel, Ni [1, 4] 1105 / 001 - Lot 013023	130 mg/Kg	91.8 to 160 103 to 149	0.36	**Acceptable**
Selenium, Se [1, 4] 1140 / 001 - Lot 013023	33 mg/Kg	20.5 to 55.5 26.3 to 49.7	-0.85	**Acceptable**
Silver, Ag [1, 4] 1150 / 001 - Lot 013023	20 mg/Kg	13.6 to 29.0 16.2 to 26.5	-0.51	**Acceptable**
Strontium, Sr [4] 1160 / 001 - Lot 013023	320 mg/Kg	233 to 424 265 to 392	-0.27	**Acceptable**
Thallium, Tl [1, 4] 1165 / 001 - Lot 013023	39 mg/Kg	25.7 to 58.4 31.1 to 52.9	-0.56	**Acceptable**
Tin, Sn [1, 4] 1175 / 001 - Lot 013023	180 mg/Kg	64.6 to 248	0.77	**Acceptable**
Titanium, Ti [4] 1180 / 001 - Lot 013023	150 mg/Kg	84.6 to 233	-0.35	**Acceptable**
Vanadium, V [1, 4] 1185 / 001 - Lot 013023	60 mg/Kg	37.1 to 92.8 46.4 to 83.6	-0.53	**Acceptable**
Zinc, Zn [1, 4] 1190 / 001 - Lot 013023	730 mg/Kg	530 to 906 592 to 844	0.19	**Acceptable**
Phosphorus, P [4] 1715 / 001 - Lot 013023	220 mg/Kg	105 to 309	0.39	**Acceptable**

End of LPTP08-S1 Set 2

Sample Information

Metals in Soil

SPE-001

Study Lot 013023
Mfg Lot 013023

	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Aluminum, Al 1000 Trace Metals	mg/Kg	6,690.00	1,480.00	7,699.10	4,735.07	6,686.59	3,989.88	24300
Antimony, Sb 1005 Trace Metals	mg/Kg	43.13	27.08	43.13	21.96	43.13	25.46	83.5
Arsenic, As 1010 Trace Metals	mg/Kg	129.29	12.90	128.30	13.92	129.29	12.30	148
Barium, Ba 1015 Trace Metals	mg/Kg	127.34	11.82	132.47	30.90	127.34	11.86	129
Beryllium, Be 1020 Trace Metals	mg/Kg	39.73	3.75	39.39	4.07	39.73	4.04	42.3
Boron, B 1025 Trace Metals	mg/Kg	80.80	7.78	79.38	12.05	80.75	7.78	85.5
Cadmium, Cd 1030 Trace Metals	mg/Kg	209.95	18.62	208.96	14.89	209.95	14.98	254
Calcium, Ca 1035 Trace Metals	mg/Kg	14,300.00	1,260.00	15,068.7	5,462.36	14,321.7	1,160.40	14300
Chromium, Cr (total) 1040 Trace Metals	mg/Kg	54.64	5.94	54.12	4.44	54.64	3.27	61.0
Cobalt, Co 1050 Trace Metals	mg/Kg	67.14	5.74	66.89	5.43	67.14	5.76	87.1
Copper, Cu 1055 Trace Metals	mg/Kg	79.02	6.93	83.43	47.41	79.02	4.89	66.4
Iron, Fe 1070 Trace Metals	mg/Kg	15,098.10	3,164.41	14,489.8	3,027.91	15,098.1	2,026.50	16200
Lead, Pb 1075 Trace Metals	mg/Kg	133.25	12.10	130.38	16.76	133.25	9.72	132
Lithium, Li 1080 Trace Metals	mg/Kg	173.35	23.96	158.83	48.16	173.35	23.96	172
Magnesium, Mg 1085 Trace Metals	mg/Kg	2,925.81	334.63	3,028.26	749.97	2,925.81	272.93	2990
Manganese, Mn 1090 Trace Metals	mg/Kg	176.41	29.47	173.93	31.79	176.41	29.47	178
Mercury, Hg 1095 Trace Metals	mg/Kg	24.05	3.89	32.16	56.96	24.05	3.09	27.9
Molybdenum, Mo 1100 Trace Metals	mg/Kg	77.08	8.01	75.60	12.44	77.08	8.70	87.4
Nickel, Ni 1105 Trace Metals	mg/Kg	125.91	11.36	123.85	17.94	125.91	10.94	119
Potassium, K 1125 Trace Metals	mg/Kg	3,862.58	455.04	3,881.59	776.30	3,862.58	502.40	3860
Selenium, Se 1140 Trace Metals	mg/Kg	37.98	5.84	37.53	6.44	37.98	6.03	43.8
Silicon, Si 1145 Trace Metals	mg/Kg	734.61	574.45	1,038.08	950.66	734.61	574.45	779
Silver, Ag 1150 Trace Metals	mg/Kg	21.32	2.57	21.35	7.49	21.32	1.63	25.5
Sodium, Na 1155 Trace Metals	mg/Kg	2,035.11	239.74	2,026.79	288.85	2,035.11	280.59	1950
Strontium, Sr 1160 Trace Metals	mg/Kg	328.49	31.85	320.36	49.92	328.49	25.96	352
Thallium, Tl 1165 Trace Metals	mg/Kg	42.03	5.45	42.04	5.58	42.03	5.69	46.4
Tin, Sn 1175 Trace Metals	mg/Kg	156.43	30.63	148.48	37.23	156.43	30.63	183
Titanium, Ti 1180 Trace Metals	mg/Kg	158.64	24.68	156.35	44.25	158.64	24.68	150
Vanadium, V 1185 Trace Metals	mg/Kg	64.97	9.29	63.79	9.08	64.97	4.93	62.0
Zinc, Zn 1190 Trace Metals	mg/Kg	718.01	62.77	698.53	73.66	718.01	53.04	758
Phosphorus, P 1715 Trace Metals	mg/Kg	206.73	34.06	208.80	35.61	206.73	34.06	221
Bismuth, Bi 205 Trace Metals	mg/Kg	0.00	0.00					

Volatiles on Soil - Low Level

SPE-002-L

Study Lot 013067
Mfg Lot 013067

	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Acetone 4315 Volatiles - Low Level (Solids)	µg/Kg	68.61	41.27	72.35	39.43	68.61	41.27	170
Acetonitrile 4320 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
Acrolein (Propenal) 4325 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
T-amylmethylether (TAME) 4370 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
Benzene 4375 Volatiles - Low Level (Solids)	µg/Kg	95.94	12.62	95.82	12.75	96.32	12.31	97.5
Bromobenzene 4385 Volatiles - Low Level (Solids)	µg/Kg	177.09	28.84	183.46	35.07	177.09	28.84	179
Bromodichloromethane 4395 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
Bromoform 4400 Volatiles - Low Level (Solids)	µg/Kg	43.79	7.35	44.89	8.63	44.91	6.54	44.2
2-Butanone (Methyl ethyl ketone, MEK) 4410 Volatiles - Low Level (Solids)	µg/Kg	339.84	141.32	345.70	125.16	339.84	141.32	269
Carbon disulfide 4450 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
Carbon tetrachloride 4455 Volatiles - Low Level (Solids)	µg/Kg	102.15	17.13	94.53	16.55	94.88	18.41	104
Chlorobenzene 4475 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
Chloroethane 4485 Volatiles - Low Level (Solids)	µg/Kg	120.24	38.38	117.16	37.49	120.24	38.38	126
2-Chloroethyl vinyl ether 4500 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
Chloroform 4505 Volatiles - Low Level (Solids)	µg/Kg	156.92	20.50	148.69	19.89	149.40	21.08	157
1,2-Dibromo-3-chloropropane (DBCP) 4570 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
1,2-Dibromoethane (EDB, Ethylene dibromide) 4585 Volatiles - Low Level (Solids)	µg/Kg	48.24	6.36	48.00	5.85	48.24	6.36	50.0
1,2-Dichlorobenzene 4610 Volatiles - Low Level (Solids)	µg/Kg	81.72	13.47	89.78	15.43	88.60	13.14	86.2
1,3-Dichlorobenzene 4615 Volatiles - Low Level (Solids)	µg/Kg	26.92	5.89	32.35	9.02	30.63	4.53	30.1
1,4-Dichlorobenzene 4620 Volatiles - Low Level (Solids)	µg/Kg	149.76	30.41	167.93	21.13	170.63	19.79	170
Dichlorodifluoromethane 4625 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
1,1-Dichloroethane 4630 Volatiles - Low Level (Solids)	µg/Kg	99.12	14.45	92.34	14.19	92.16	14.98	98.6
1,2-Dichloroethane 4635 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
1,1-Dichloroethylene 4640 Volatiles - Low Level (Solids)	µg/Kg	93.73	16.77	91.15	19.98	93.73	16.77	101
cis-1,2-Dichloroethylene 4645 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
1,2-Dichloropropane 4655 Volatiles - Low Level (Solids)	µg/Kg	164.94	21.49	164.14	19.11	162.70	16.98	172
cis-1,3-Dichloropropene 4680 Volatiles - Low Level (Solids)	µg/Kg	88.33	12.08	87.64	11.18	88.33	12.08	102
trans-1,3-Dichloropropene 4685 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
trans-1,2-Dichloroethylene 4700 Volatiles - Low Level (Solids)	µg/Kg	152.10	26.14	151.82	23.08	152.10	26.14	170
Ethylbenzene 4765 Volatiles - Low Level (Solids)	µg/Kg	187.18	26.92	188.81	27.60	189.88	23.25	189
Hexachlorobutadiene 4835 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
2-Hexanone 4860 Volatiles - Low Level (Solids)	µg/Kg	285.30	96.19	283.36	104.26	285.30	96.19	236
Isopropylbenzene 4900 Volatiles - Low Level (Solids)	µg/Kg	143.58	25.02	143.68	22.86	143.58	25.02	132
Methyl bromide (Bromomethane) 4950 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00

Volatiles on Soil - Low Level

SPE-002-L

Study Lot 013067
Mfg Lot 013067

(continued)	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Methyl chloride (Chloromethane) 4960 Volatiles - Low Level (Solids)	µg/Kg	58.38	11.69	55.80	13.63	58.38	11.69	142
Methylene chloride (Dichloromethane) 4975 Volatiles - Low Level (Solids)	µg/Kg	170.64	28.95	151.67	29.91	152.58	30.01	179
4-Methyl-2-pentanone (MIBK) 4995 Volatiles - Low Level (Solids)	µg/Kg	166.92	30.21	189.10	45.76	179.50	38.06	176
Methyl tert-butyl ether (MTBE) 5000 Volatiles - Low Level (Solids)	µg/Kg	82.71	15.69	79.56	16.93	85.70	9.68	85.2
Naphthalene 5005 Volatiles - Low Level (Solids)	µg/Kg	77.72	10.51	74.18	14.64	77.72	10.51	84.9
Styrene 5100 Volatiles - Low Level (Solids)	µg/Kg	53.86	5.45	51.32	11.42	53.86	5.45	51.0
1,1,1,2-Tetrachloroethane 5105 Volatiles - Low Level (Solids)	µg/Kg	166.27	19.23	168.71	24.61	165.67	11.23	166
1,1,2,2-Tetrachloroethane 5110 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
Tetrachloroethylene (Perchloroethylene) 5115 Volatiles - Low Level (Solids)	µg/Kg	71.29	12.56	74.26	11.18	73.98	11.42	75.5
Toluene 5140 Volatiles - Low Level (Solids)	µg/Kg	66.43	9.40	67.45	8.03	67.67	8.25	67.1
1,2,4-Trichlorobenzene 5155 Volatiles - Low Level (Solids)	µg/Kg	132.34	17.59	130.54	17.93	132.34	17.59	136
1,1,1-Trichloroethane 5160 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
1,1,2-Trichloroethane 5165 Volatiles - Low Level (Solids)	µg/Kg	160.93	21.58	164.25	22.44	163.98	23.40	165
Trichloroethene (Trichloroethylene) 5170 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
Trichlorofluoromethane 5175 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
1,2,3-Trichloropropane 5180 Volatiles - Low Level (Solids)	µg/Kg	44.61	10.17	44.09	8.92	44.61	10.17	46.2
1,2,4-Trimethylbenzene 5210 Volatiles - Low Level (Solids)	µg/Kg	47.16	5.91	47.37	5.72	47.16	5.91	46.1
1,3,5-Trimethylbenzene 5215 Volatiles - Low Level (Solids)	µg/Kg	103.33	12.65	91.30	33.66	103.33	12.65	100
Vinyl acetate 5225 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
Vinyl chloride 5235 Volatiles - Low Level (Solids)	µg/Kg	104.88	25.34	104.64	23.27	104.88	25.34	128
m+p-Xylene 5240 Volatiles - Low Level (Solids)	µg/Kg	103.58	17.73	93.22	31.75	108.45	9.43	105
o-Xylene 5250 Volatiles - Low Level (Solids)	µg/Kg	48.35	8.82	52.02	6.08	52.31	6.75	48.4
Xylene, total 5260 Volatiles - Low Level (Solids)	µg/Kg	167.02	27.95	152.84	25.84	161.37	17.42	170
Di-isopropylether (DIPE) 9375 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00

TCLP Metals in Soil

SPE-005

Study Lot 000718
Mfg Lot 000718

	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Arsenic, As 1010 TCLP Metals	mg/L	3.14	0.41	3.16	0.41	3.14	0.41	3.20
Barium, Ba 1015 TCLP Metals	mg/L	2.13	0.27	2.12	0.27	2.13	0.18	2.30
Cadmium, Cd 1030 TCLP Metals	mg/L	13.10	0.86	13.07	1.18	13.06	0.56	13.0
Chromium, Cr (total) 1040 TCLP Metals	mg/L	0.28	0.10	0.39	0.24	0.28	0.10	0.888
Lead, Pb 1075 TCLP Metals	mg/L	4.87	1.32	4.93	1.26	4.87	1.32	5.20
Mercury, Hg 1095 TCLP Metals	mg/L	1.40	0.50	1.41	0.45	1.40	0.50	1.60
Selenium, Se 1140 TCLP Metals	mg/L	7.31	0.73	7.73	0.91	7.31	0.51	7.80

TCLP Metals in Soil
SPE-005

Study Lot 000718
Mfg Lot 000718

(continued)	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Silver, Ag 1150 TCLP Metals	mg/L	0.03	0.01	0.03	0.01	0.03	0.01	0.0350
Extraction Fluid 1311 TCLP Metals		1.00	0.00					1.00

Corrosivity - Soil
SPE-023

Study Lot 013026
Mfg Lot 013026

	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
pH 1900 Miscellaneous Analytes	Units	5.88	0.20	5.85	0.27	5.83	0.28	5.88

Flash Point
SPE-029

Study Lot 013068
Mfg Lot 013068

	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Ignitability (Flashpoint) 1780 Miscellaneous Analytes	°F	189.00	5.67	188.99	5.56	189.08	7.90	189

Uranium in Soil
SPE-071

Study Lot 013025
Mfg Lot 013025

	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Uranium, U 3035 Trace Metals	mg/Kg	239.00	23.90	252.25	67.44	219.18	20.55	239

Program analyte accrediting footnotes
- [1] NELAC
- [2] EPA
- [3] Other
- [4] A2LA
- [5] NELAC Experimental

PERFORMANCE EVALUATION

First Choice for Quality | RTC

Quarterly Study

LPTP08-S3

30-Jul-2008 through 12-Sep-2008

RT1014
RTC Labcode

WY00002
US EPA Labcode

Energy Labs
Jim Yocum
PO Box 3258
Casper WY 82602

Thank you for participating in study LPTP08-S3. Additional information about this study may be found online at www.rt-corp.com. If you have any questions or comments about this study please contact me.

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This report may contain data that are not covered by the A2LA accreditation.

Sincerely,

Christopher Rucinski
Quality Director

2931 Soldier Springs Road
Laramie, WY 82070
(307) 742-5452
www.rt-corp.com

ACCREDITED
Certificate # 2122.01

Dataset

LPTP08-S3 Set 1

Accreditors

Evaluations of this dataset will be sent to the accreditor(s) listed below using your laboratory's labcode listed above each accrediting agency. If any of the information listed below is incorrect, please contact RTC immediately.

Accrediting Labcode WY00002
Florida Dept. of Health

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Jacksonville FL 32231
UNITED STATES

Accrediting Labcode WY00002
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Department of Regulation & Licensure

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UNITED STATES

Accrediting Labcode WY00002
Nevada Division of Env. Protection

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UNITED STATES

Accrediting Labcode T104704181-05-TX
Texas CEQ

384 Frank Jamison
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PO Box 13087 (MC-176)
Austin TX 78711-3087
UNITED STATES

Accrediting Labcode WY00002
Utah Bureau of Laboratory Improvement

215 Kristin Brown
46 N. Medical Drive
Salt Lake City UT 84113-1105
UNITED STATES

Miscellaneous Analytes

Analysis
EPA 1010 (1986)
Auto Analyzer

Method Number 10116606
Technology Code: AUTO

	ResultUnits	Accept / Warn	Z	Evaluation
Ignitability (Flashpoint, °F) [1, 4] 1780 / 029 - Lot 013616	138°F	130 to 164 136 to 158	-1.59	**Acceptable**

Miscellaneous Analytes (continued)

Analysis
EPA 9045C 3 (1995)
Ion Selective Electrode

Method Number 10198400
Technology Code: ISE

	ResultUnits	Accept / Warn	Z	Evaluation
pH [1, 4] 1900 / 023 - Lot 013535	6.38Units	5.90 to 7.10 6.10 to 6.90	-0.60	**Acceptable**

TCLP Metals

Analysis
EPA 6010 (1986)
Atomic Emission - Inductvely Coupled Plasma Spectrometry

Method Number 10155201
Technology Code: ICP-AES

	ResultUnits	Accept / Warn	Z	Evaluation
Extraction Fluid [4] 1311 / 005 - Lot 000962	Fluid #1	2.00 to 2.00		**Not Acceptable**

Analysis
EPA 6010B (1996)
Atomic Emission - Inductvely Coupled Plasma Spectrometry

Method Number 10155609
Technology Code: ICP-AES

	ResultUnits	Accept / Warn	Z	Evaluation
Arsenic, As [4] 1010 / 005 - Lot 000962	3.1mg/L	1.28 to 9.46	-1.67	**Acceptable**
Barium, Ba [4] 1015 / 005 - Lot 000962	20mg/L	12.3 to 26.1	0.35	**Acceptable**
Cadmium, Cd [4] 1030 / 005 - Lot 000962	26mg/L	14.1 to 84.2	-1.97	**Acceptable**
Chromium, Cr (total) [4] 1040 / 005 - Lot 000962	1.0mg/L	0.00 to 4.30	-0.74	**Acceptable**
Lead, Pb [4] 1075 / 005 - Lot 000962	<0.5mg/L	0.00 to 4.64		**Acceptable**
Selenium, Se [4] 1140 / 005 - Lot 000962	1.2mg/L	1.32 to 2.33	-3.69	**Not Acceptable**
Silver, Ag [4] 1150 / 005 - Lot 000962	<0.5mg/L	0.00 to 0.5		**Acceptable**

Analysis
EPA 7470A 1 (1994)
Atomic Absorption - Cold Vapor Spectrometry

Method Number 10165807
Technology Code: CVAAS

	ResultUnits	Accept / Warn	Z	Evaluation
Mercury, Hg [4] 1095 / 005 - Lot 000962	2.2mg/L	0.128 to 2.79	1.67	**Acceptable**

Trace Metals

Analysis
EPA 6020 (1994)
Mass Spectrometry - Inductively Coupled Plasma

Method Number 10156000
Technology Code: ICP-MS

Trace Metals (continued)

Analysis
EPA 6020 (1994)
Mass Spectrometry - Inductively Coupled Plasma

(continued)
Method Number 10156000
Technology Code: ICP-MS

	ResultUnits	Accept / Warn	Z	Evaluation
Aluminum, Al [1,4] 1000 / 001 - Lot 013545	12600mg/Kg	1370 to 29600	0.15	**Acceptable**
Antimony, Sb [1,4] 1005 / 001 - Lot 013545	41.8mg/Kg	0.00 to 170 0.00 to 134	-0.59	**Acceptable**
Arsenic, As [1,4] 1010 / 001 - Lot 013545	136mg/Kg	92.4 to 171 105 to 158	0.31	**Acceptable**
Barium, Ba [1,4] 1015 / 001 - Lot 013545	562mg/Kg	366 to 617 408 to 575	1.67	**Acceptable**
Beryllium, Be [1,4] 1020 / 001 - Lot 013545	203mg/Kg	163 to 267 180 to 250	-0.69	**Acceptable**
Boron, B [4,5] 1025 / 001 - Lot 013545	157mg/Kg	90.3 to 188	1.10	**Acceptable**
Cadmium, Cd [1,4] 1030 / 001 - Lot 013545	61.2mg/Kg	41.4 to 71.9 46.5 to 66.8	0.91	**Acceptable**
Chromium, Cr (total) [1,4] 1040 / 001 - Lot 013545	334mg/Kg	214 to 388 243 to 359	1.14	**Acceptable**
Cobalt, Co [1,4] 1050 / 001 - Lot 013545	124mg/Kg	80.5 to 136 89.7 to 127	1.73	**Acceptable**
Copper, Cu [1,4] 1055 / 001 - Lot 013545	65.7mg/Kg	44.4 to 77.7 50.0 to 72.1	0.83	**Acceptable**
Lead, Pb [1,4] 1075 / 001 - Lot 013545	355mg/Kg	238 to 389 263 to 364	1.63	**Acceptable**
Manganese, Mn [1,4] 1090 / 001 - Lot 013545	727mg/Kg	324 to 984	0.66	**Acceptable**
Molybdenum, Mo [1,4] 1100 / 001 - Lot 013545	75.5mg/Kg	45.8 to 89.2 52.9 to 89.2	1.17	**Acceptable**
Nickel, Ni [1,4] 1105 / 001 - Lot 013545	220mg/Kg	147 to 252 165 to 234	1.21	**Acceptable**
Selenium, Se [1,4] 1140 / 001 - Lot 013545	312mg/Kg	212 to 397 243 to 366	0.26	**Acceptable**
Silver, Ag [1,4] 1150 / 001 - Lot 013545	100mg/Kg	54.7 to 108 63.5 to 98.9	2.13	**Acceptable**
Strontium, Sr [4] 1160 / 001 - Lot 013545	139mg/Kg	14.1 to 234	0.41	**Acceptable**
Thallium, Tl [1,4] 1165 / 001 - Lot 013545	88.5mg/Kg	46.6 to 96.3 54.9 to 88.0	2.07	**Acceptable**
Tin, Sn [1,4] 1175 / 001 - Lot 013545	123mg/Kg	52.4 to 162	0.87	**Acceptable**
Titanium, Ti [4] 1180 / 001 - Lot 013545	262mg/Kg	100 to 466	-0.27	**Acceptable**
Vanadium, V [1,4] 1185 / 001 - Lot 013545	348mg/Kg	239 to 388 264 to 363	1.37	**Acceptable**

Trace Metals (continued)

Analysis
EPA 6020 (1994)
Mass Spectrometry - Inductively Coupled Plasma

(continued)
Method Number 10156000
Technology Code: ICP-MS

	ResultUnits	Accept / Warn	Z	Evaluation
Zinc, Zn [1,4] 1190 / 001 - Lot 013545	257mg/Kg	179 to 326 203 to 301	0.20	**Acceptable**
Uranium, U [4] 3035 / 071 - Lot 013547	204mg/Kg	138 to 256 158 to 236	0.36	**Acceptable**

Analysis
EPA 7471A 1 (1994)
Atomic Absorption - Cold Vapor Spectrometry

Method Number 10166208
Technology Code: CVAAS

	ResultUnits	Accept / Warn	Z	Evaluation
Mercury, Hg [1,4] 1095 / 001 - Lot 013545	20mg/Kg	12.8 to 37.1 16.9 to 33.0	-1.24	**Acceptable**

Volatiles - Low Level (Solids)

Analysis
EPA 8260B 2 (1996)
Gas Chromatography - Mass Spectrometry

Method Number 10184802
Technology Code: GC-MS

	ResultUnits	Accept / Warn	Z	Evaluation
Acetone [1,4] 4315 / 002-L - Lot 013612	1600µg/Kg	0.00 to 1060	5.39	**Not Acceptable**
Acetonitrile [4] 4320 / 002-L - Lot 013612	<20µg/Kg	0.00 to 40		**Acceptable**
Acrolein (Propenal) [4] 4325 / 002-L - Lot 013612	<20µg/Kg	0.0 to 0.0		**Acceptable**
T-amylmethylether (TAME) [4] 4370 / 002-L - Lot 013612	<2.0µg/Kg	0.0 to 0.0		**Acceptable**
Benzene [1,4] 4375 / 002-L - Lot 013612	62µg/Kg	42.1 to 99.0 51.6 to 89.5	-0.90	**Acceptable**
Bromobenzene [4,5] 4385 / 002-L - Lot 013612	57µg/Kg	25.1 to 72.5	1.04	**Acceptable**
Bromodichloromethane [1,4] 4395 / 002-L - Lot 013612	77µg/Kg	54.3 to 118 64.8 to 107	-0.85	**Acceptable**
Bromoform [1,4] 4400 / 002-L - Lot 013612	<2.0µg/Kg	0.0 to 0.0 0.0 to 0.0		**Acceptable**
2-Butanone (Methyl ethyl ketone, MEK) [1,4] 4410 / 002-L - Lot 013612	250µg/Kg	18.6 to 579	0.03	**Acceptable**
Carbon disulfide [4] 4450 / 002-L - Lot 013612	<2.0µg/Kg	0.0 to 0.0		**Acceptable**
Carbon tetrachloride [1,4] 4455 / 002-L - Lot 013612	140µg/Kg	77.5 to 234 104 to 208	-0.61	**Acceptable**
Chlorobenzene [1,4] 4475 / 002-L - Lot 013612	180µg/Kg	73.4 to 180 91.1 to 162	2.99	**Acceptable**

Volatiles - Low Level (Solids) (continued)

Analysis
EPA 8260B 2 (1996)
Gas Chromatography - Mass Spectrometry

(continued)
Method Number 10184802
Technology Code: GC-MS

	Result	Units	Accept / Warn	Z	Evaluation
Chloroethane [4,5] 4485 / 002-L - Lot 013612	<2.0	µg/Kg	0.0 to 0.0		Acceptable
Chloroform [1,4] 4505 / 002-L - Lot 013612	54	µg/Kg	27.9 to 66.8 34.4 to 60.3	1.02	Acceptable
1,2-Dibromo-3-chloropropane (DBCP) [4,5] 4570 / 002-L - Lot 013612	56	µg/Kg	30.9 to 121	-1.32	Acceptable
Dibromochloromethane [1,4] 4575 / 002-L - Lot 013612	42	µg/Kg	31.1 to 75.2 38.4 to 67.9	-1.52	Acceptable
1,2-Dibromoethane (EDB, Ethylene dibromide) [4,5] 4585 / 002-L - Lot 013612	110	µg/Kg	52.6 to 157	0.29	Acceptable
Dibromomethane [4] 4595 / 002-L - Lot 013612	150	µg/Kg	68.3 to 245	-0.24	Acceptable
1,2-Dichlorobenzene [1,4] 4610 / 002-L - Lot 013612	240	µg/Kg	90.7 to 264 120 to 235	2.19	Acceptable
1,3-Dichlorobenzene [1,4] 4615 / 002-L - Lot 013612	230	µg/Kg	68.4 to 257 99.8 to 226	2.13	Acceptable
1,4-Dichlorobenzene [1,4] 4620 / 002-L - Lot 013612	91	µg/Kg	22.4 to 91.9 34.0 to 80.3	2.92	Acceptable
Dichlorodifluoromethane [4,5] 4625 / 002-L - Lot 013612	<2.0	µg/Kg	0.0 to 0.0		Acceptable
1,1-Dichloroethane [1,4] 4630 / 002-L - Lot 013612	51	µg/Kg	25.8 to 67.6 32.7 to 60.6	0.62	Acceptable
1,2-Dichloroethane [1,4] 4635 / 002-L - Lot 013612	190	µg/Kg	96.5 to 231 119 to 208	1.16	Acceptable
1,1-Dichloroethylene [4,5] 4640 / 002-L - Lot 013612	<2.0	µg/Kg	0.0 to 0.0		Acceptable
cis-1,2-Dichloroethylene [4,5] 4645 / 002-L - Lot 013612	170	µg/Kg	73.9 to 232	0.64	Acceptable
1,2-Dichloropropane [1,4] 4655 / 002-L - Lot 013612	190	µg/Kg	99.9 to 228 121 to 207	1.21	Acceptable
cis-1,3-Dichloropropene [4,5] 4680 / 002-L - Lot 013612	<2.0	µg/Kg	0.0 to 0.0		Acceptable
trans-1,3-Dichloropropene [4,5] 4685 / 002-L - Lot 013612	170	µg/Kg	101 to 231	0.18	Acceptable
trans-1,2-Dichloroethylene [4,5] 4700 / 002-L - Lot 013612	76	µg/Kg	37.3 to 117	-0.07	Acceptable
Ethylbenzene [1,4] 4765 / 002-L - Lot 013612	78	µg/Kg	37.0 to 99.0 47.4 to 88.7	0.97	Acceptable
Hexachlorobutadiene [1,4] 4835 / 002-L - Lot 013612	<2.0	µg/Kg	0.0 to 0.0 0.0 to 0.0		Acceptable
2-Hexanone [4,5] 4860 / 002-L - Lot 013612	290	µg/Kg	17.8 to 614	-0.26	Acceptable

Volatiles - Low Level (Solids) (continued)

Analysis
EPA 8260B 2 (1996)
Gas Chromatography - Mass Spectrometry

(continued)
Method Number 10184802
Technology Code: GC-MS

	ResultUnits	Accept / Warn	Z	Evaluation
Isopropylbenzene [4, 5] 4900 / 002-L - Lot 013612	130µg/Kg	73.9 to 173	0.36	**Acceptable**
Methyl bromide (Bromomethane) [4, 5] 4950 / 002-L - Lot 013612	54µg/Kg	3.58 to 166	-1.14	**Acceptable**
Methyl chloride (Chloromethane) [4, 5] 4960 / 002-L - Lot 013612	82µg/Kg	40.4 to 209	-1.53	**Acceptable**
Methylene chloride (Dichloromethane) [1, 4] 4975 / 002-L - Lot 013612	<2.0µg/Kg	0.0 to 0.0 0.0 to 0.0		**Acceptable**
4-Methyl-2-pentanone (MIBK) [1, 4] 4995 / 002-L - Lot 013612	89µg/Kg	60.6 to 209 85.4 to 185	-1.85	**Acceptable**
Methyl tert-butyl ether (MTBE) [1, 4] 5000 / 002-L - Lot 013612	14µg/Kg	15.2 to 62.5 23.1 to 54.6	-3.16	**Not Acceptable**
Naphthalene [1, 4] 5005 / 002-L - Lot 013612	83µg/Kg	61.6 to 168	-1.80	**Acceptable**
Styrene [4, 5] 5100 / 002-L - Lot 013612	210µg/Kg	104 to 236	1.81	**Acceptable**
1,1,1,2-Tetrachloroethane [1, 4] 5105 / 002-L - Lot 013612	47µg/Kg	31.8 to 70.0 38.2 to 63.6	-0.61	**Acceptable**
1,1,2,2-Tetrachloroethane [1, 4] 5110 / 002-L - Lot 013612	110µg/Kg	51.5 to 146 67.3 to 130	0.71	**Acceptable**
Tetrachloroethylene (Perchloroethylene) [1, 4] 5115 / 002-L - Lot 013612	<2.0µg/Kg	0.0 to 0.0 0.0 to 0.0		**Acceptable**
Toluene [1, 4] 5140 / 002-L - Lot 013612	160µg/Kg	83.0 to 202 103 to 182	0.85	**Acceptable**
1,2,4-Trichlorobenzene [1, 4] 5155 / 002-L - Lot 013612	75µg/Kg	25.6 to 127	-0.08	**Acceptable**
1,1,1-Trichloroethane [1, 4] 5160 / 002-L - Lot 013612	93µg/Kg	51.8 to 132 65.2 to 119	0.08	**Acceptable**
1,1,2-Trichloroethane [1, 4] 5165 / 002-L - Lot 013612	160µg/Kg	76.7 to 180 93.9 to 163	1.86	**Acceptable**
Trichloroethene (Trichloroethylene) [1, 4] 5170 / 002-L - Lot 013612	150µg/Kg	62.7 to 174 81.2 to 155	1.73	**Acceptable**
Trichlorofluoromethane [4, 5] 5175 / 002-L - Lot 013612	150µg/Kg	60.6 to 182	1.44	**Acceptable**
1,2,3-Trichloropropane [1, 4] 5180 / 002-L - Lot 013612	<2.0µg/Kg	0.0 to 0.0		**Acceptable**
1,2,4-Trimethylbenzene [4] 5210 / 002-L - Lot 013612	40µg/Kg	25.3 to 68.0	-0.93	**Acceptable**
1,3,5-Trimethylbenzene [4] 5215 / 002-L - Lot 013612	37µg/Kg	21.3 to 61.4	-0.64	**Acceptable**
Vinyl acetate [4] 5225 / 002-L - Lot 013612	<2.0µg/Kg	0.0 to 0.0		**Acceptable**

Volatiles - Low Level (Solids) (continued)

Analysis
EPA 8260B 2 (1996)
Gas Chromatography - Mass Spectrometry

(continued)
Method Number 10184802
Technology Code: GC-MS

	Result Units	Accept / Warn	Z	Evaluation
Vinyl chloride [4, 5] 5235 / 002-L - Lot 013612	37µg/Kg	19.2 to 110	-1.82	**Acceptable**
m+p-Xylene [4] 5240 / 002-L - Lot 013612	140µg/Kg	61.0 to 187 82.0 to 166	0.76	**Acceptable**
o-Xylene [4] 5250 / 002-L - Lot 013612	86µg/Kg	30.0 to 98.3 41.4 to 86.9	1.91	**Acceptable**
Xylene, total [1, 4] 5260 / 002-L - Lot 013612	226µg/Kg	93.2 to 280 124 to 249	1.25	**Acceptable**
Di-isopropylether (DIPE) [4] 9375 / 002-L - Lot 013612	<2.0µg/Kg	0.0 to 0.0		**Acceptable**

Group Analysis Summary

Acceptable 57 / 59
Score 96.6% - **(Acceptable)**

End of LPTP08-S3 Set 1

Dataset

LPTP08-S3 Set 2

Accreditors

Evaluations of this dataset will be sent to the accreditor(s) listed below using your laboratory's labcode listed above each accrediting agency. If any of the information listed below is incorrect, please contact RTC immediately.

Accrediting Labcode WY00002
Florida Dept. of Health

229 Stephen Arms
PO Box 210
1217 Pearl Street
Jacksonville FL 32231
UNITED STATES

Accrediting Labcode WY00002
Nebraska Health and Human Services System
Department of Regulation & Licensure
504 Sandra Irons
State Certification Officer
3701 S. 14th Street
Lincoln NE 68502
UNITED STATES

Accrediting Labcode WY00002
Nevada Division of Env. Protection

118 Donald Lafara
901 S. Stewart Street
Ste. 4001
Carson City NV 89701-5249
UNITED STATES

Accrediting Labcode T104704181-05-TX
Texas CEQ

384 Frank Jamison
Quality Assurance/Laboratory Accreditation
PO Box 13087 (MC-176)
Austin TX 78711-3087
UNITED STATES

Accrediting Labcode WY00002
Utah Bureau of Laboratory Improvement

215 Kristin Brown
46 N. Medical Drive
Salt Lake City UT 84113-1105
UNITED STATES

Trace Metals

Analysis
EPA 6010B (1996)
Atomic Emission - Inductvely Coupled Plasma Spectrometry

Method Number 10155609
Technology Code: ICP-AES

	ResultUnits	Accept / Warn	Z	Evaluation
Aluminum, Al [1, 4] 1000 / 001 - Lot 013545	12900mg/Kg	1370 to 29600	0.20	**Acceptable**

Trace Metals (continued)

Analysis
EPA 6010B (1996)
Atomic Emission - Inductvely Coupled Plasma Spectrometry

(continued)
Method Number 10155609
Technology Code: ICP-AES

	ResultUnits	Accept / Warn	Z	Evaluation
Arsenic, As 1, 4 1010 / 001 - Lot 013545	131mg/Kg	92.4 to 171 105 to 158	-0.08	**Acceptable**
Barium, Ba 1, 4 1015 / 001 - Lot 013545	507mg/Kg	366 to 617 408 to 575	0.36	**Acceptable**
Beryllium, Be 1, 4 1020 / 001 - Lot 013545	227mg/Kg	163 to 267 180 to 250	0.69	**Acceptable**
Boron, B 4, 5 1025 / 001 - Lot 013545	146mg/Kg	90.3 to 188	0.43	**Acceptable**
Cadmium, Cd 1, 4 1030 / 001 - Lot 013545	59mg/Kg	41.4 to 71.9 46.5 to 66.8	0.47	**Acceptable**
Calcium, Ca 1, 4 1035 / 001 - Lot 013545	8010mg/Kg	5790 to 9700 6440 to 9050	0.40	**Acceptable**
Chromium, Cr (total) 1, 4 1040 / 001 - Lot 013545	312mg/Kg	214 to 388 243 to 359	0.38	**Acceptable**
Cobalt, Co 1, 4 1050 / 001 - Lot 013545	114mg/Kg	80.5 to 136 89.7 to 127	0.65	**Acceptable**
Copper, Cu 1, 4 1055 / 001 - Lot 013545	63mg/Kg	44.4 to 77.7 50.0 to 72.1	0.34	**Acceptable**
Iron, Fe 1, 4 1070 / 001 - Lot 013545	11700mg/Kg	2850 to 19100 5560 to 16400	0.26	**Acceptable**
Lead, Pb 1, 4 1075 / 001 - Lot 013545	347mg/Kg	238 to 389 263 to 364	1.31	**Acceptable**
Lithium, Li 4 1080 / 001 - Lot 013545	145mg/Kg	12.7 to 253	0.54	**Acceptable**
Magnesium, Mg 1, 4 1085 / 001 - Lot 013545	10400mg/Kg	7470 to 12300 8280 to 11500	0.60	**Acceptable**
Manganese, Mn 1, 4 1090 / 001 - Lot 013545	703mg/Kg	324 to 984	0.45	**Acceptable**
Molybdenum, Mo 1, 4 1100 / 001 - Lot 013545	67mg/Kg	45.8 to 89.2 52.9 to 89.2	-0.03	**Acceptable**
Nickel, Ni 1, 4 1105 / 001 - Lot 013545	210mg/Kg	147 to 252 165 to 234	0.63	**Acceptable**
Potassium, K 1, 4 1125 / 001 - Lot 013545	18300mg/Kg	13200 to 24400 15100 to 22500	-0.27	**Acceptable**
Selenium, Se 1, 4 1140 / 001 - Lot 013545	323mg/Kg	212 to 397 243 to 366	0.62	**Acceptable**
Silicon, Si 4 1145 / 001 - Lot 013545	1150mg/Kg	0.00 to 4690	1.27	**Acceptable**
Silver, Ag 1, 4 1150 / 001 - Lot 013545	87mg/Kg	54.7 to 108 63.5 to 98.9	0.66	**Acceptable**
Sodium, Na 1, 4 1155 / 001 - Lot 013545	1420mg/Kg	977 to 2110 1170 to 1920	-0.63	**Acceptable**

Trace Metals (continued)

Analysis
EPA 6010B (1996)
Atomic Emission - Inductvely Coupled Plasma Spectrometry

(continued)
Method Number 10155609
Technology Code: ICP-AES

	ResultUnits	Accept / Warn	Z	Evaluation
Strontium, Sr [4] 1160 / 001 - Lot 013545	132mg/Kg	14.1 to 234	0.22	**Acceptable**
Thallium, Tl [1, 4] 1165 / 001 - Lot 013545	78mg/Kg	46.6 to 96.3 54.9 to 88.0	0.80	**Acceptable**
Tin, Sn [1, 4] 1175 / 001 - Lot 013545	116mg/Kg	52.4 to 162	0.49	**Acceptable**
Titanium, Ti [4] 1180 / 001 - Lot 013545	285mg/Kg	100 to 466	0.12	**Acceptable**
Vanadium, V [1, 4] 1185 / 001 - Lot 013545	341mg/Kg	239 to 388 264 to 363	1.09	**Acceptable**
Zinc, Zn [1, 4] 1190 / 001 - Lot 013545	258mg/Kg	179 to 326 203 to 301	0.25	**Acceptable**
Phosphorus, P [4] 1715 / 001 - Lot 013545	348mg/Kg	0.00 to 385	2.48	**Acceptable**

End of LPTP08-S3 Set 2

Sample Information

Metals in Soil

SPE-001

Study Lot 013545
Mfg Lot 013545

	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Aluminum, Al 1000 Trace Metals	mg/Kg	11,700.00	5,900.00	13,700.0	9,180.00	11,700.0	5,900.00	13700 ± 21.7
Antimony, Sb 1005 Trace Metals	mg/Kg	62.70	35.70	117.00	354.00	62.70	28.90	141 ± 0.721
Arsenic, As 1010 Trace Metals	mg/Kg	132.00	13.10	127.00	22.30	132.00	13.70	154 ± 0.784
Barium, Ba 1015 Trace Metals	mg/Kg	492.00	41.80	502.00	140.00	492.00	46.20	502 ± 2.56
Beryllium, Be 1020 Trace Metals	mg/Kg	215.00	17.40	211.00	42.40	215.00	20.90	239 ± 1.22
Boron, B 1025 Trace Metals	mg/Kg	139.00	16.30	148.00	37.70	139.00	16.30	167 ± 0.852
Cadmium, Cd 1030 Trace Metals	mg/Kg	56.60	5.07	78.10	112.00	56.60	5.60	69.8 ± 0.356
Calcium, Ca 1035 Trace Metals	mg/Kg	7,750.00	653.00	8,810.00	6,810.00	7,750.00	698.00	7670 ± 39.1
Chromium, Cr (total) 1040 Trace Metals	mg/Kg	301.00	29.00	300.00	26.30	301.00	26.80	328 ± 1.67
Cobalt, Co 1050 Trace Metals	mg/Kg	108.00	9.23	104.00	18.20	108.00	9.34	121 ± 0.619
Copper, Cu 1055 Trace Metals	mg/Kg	61.10	5.54	81.70	146.00	61.10	5.52	59.0 ± 0.25
Iron, Fe 1070 Trace Metals	mg/Kg	11,000.00	2,710.00	11,000.0	2,860.00	11,000.0	1,430.00	10700 ± 49.5
Lead, Pb 1075 Trace Metals	mg/Kg	314.00	25.20	313.00	34.10	314.00	35.80	334 ± 1.7
Lithium, Li 1080 Trace Metals	mg/Kg	121.00	44.10	127.00	47.30	121.00	44.10	127
Magnesium, Mg 1085 Trace Metals	mg/Kg	9,910.00	813.00	9,840.00	1,470.00	9,910.00	1,180.00	11000 ± 56.1
Manganese, Mn 1090 Trace Metals	mg/Kg	654.00	110.00	631.00	133.00	654.00	110.00	735 ± 3.75
Mercury, Hg 1095 Trace Metals	mg/Kg	25.00	4.04	24.20	5.01	25.00	3.68	29.1 ± 0.148
Molybdenum, Mo 1100 Trace Metals	mg/Kg	67.20	7.12	65.60	10.80	67.20	8.62	81.1 ± 0.414
Nickel, Ni 1105 Trace Metals	mg/Kg	199.00	17.40	200.00	27.50	199.00	20.00	191 ± 0.875
Potassium, K 1125 Trace Metals	mg/Kg	18,800.00	1,860.00	18,300.0	3,680.00	18,800.0	2,510.00	20400 ± 104
Selenium, Se 1140 Trace Metals	mg/Kg	304.00	30.80	302.00	74.50	304.00	34.60	358 ± 1.82
Silicon, Si 1145 Trace Metals	mg/Kg	577.00	451.00	937.00	881.00	577.00	451.00	4260 ± 21.7
Silver, Ag 1150 Trace Metals	mg/Kg	81.20	8.84	75.80	17.00	81.20	7.66	89.4 ± 0.456
Sodium, Na 1155 Trace Metals	mg/Kg	1,540.00	189.00	1,570.00	226.00	1,540.00	214.00	1590 ± 8.09
Strontium, Sr 1160 Trace Metals	mg/Kg	124.00	36.60	141.00	95.20	124.00	36.60	141 ± 0.401
Thallium, Tl 1165 Trace Metals	mg/Kg	71.40	8.28	70.40	11.90	71.40	11.90	85.7 ± 0.437
Tin, Sn 1175 Trace Metals	mg/Kg	107.00	18.30	188.00	275.00	107.00	18.30	121 ± 0.619
Titanium, Ti 1180 Trace Metals	mg/Kg	278.00	59.40	277.00	79.80	278.00	59.40	424 ± 2.16
Vanadium, V 1185 Trace Metals	mg/Kg	314.00	24.80	304.00	68.20	314.00	38.60	320 ± 1.63
Zinc, Zn 1190 Trace Metals	mg/Kg	252.00	24.40	276.00	202.00	252.00	15.50	273 ± 1.39
Phosphorus, P 1715 Trace Metals	mg/Kg	173.00	70.50	2,250.00	7,160.00	173.00	70.50	94.0 ± 0.479

Volatiles on Soil - Low Level

SPE-002-L

Study Lot 013612
Mfg Lot 013612

ACCREDITED Certificate # 2122.01

RTC

Volatiles on Soil - Low Level

SPE-002-L

Study Lot 013612
Mfg Lot 013612

	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Acetone 4315 Volatiles - Low Level (Solids)	µg/Kg	381.00	226.00	459.00	330.00	381.00	226.00	381 ± 3.69
Acetonitrile 4320 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
Acrolein (Propenal) 4325 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
T-amylmethylether (TAME) 4370 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
Benzene 4375 Volatiles - Low Level (Solids)	µg/Kg	70.50	9.49	71.50	9.91	71.50	11.20	71.7 ± 0.695
Bromobenzene 4385 Volatiles - Low Level (Solids)	µg/Kg	48.80	7.90	49.10	7.02	48.80	7.90	47.5 ± 0.461
Bromodichloromethane 4395 Volatiles - Low Level (Solids)	µg/Kg	86.00	10.60	82.80	9.24	82.80	10.90	84.9 ± 0.823
Bromoform 4400 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
2-Butanone (Methyl ethyl ketone, MEK) 4410 Volatiles - Low Level (Solids)	µg/Kg	247.00	111.00	298.00	154.00	247.00	111.00	186 ± 1.8
Carbon disulfide 4450 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
Carbon tetrachloride 4455 Volatiles - Low Level (Solids)	µg/Kg	156.00	26.20	160.00	22.00	161.00	22.90	159 ± 1.54
Chlorobenzene 4475 Volatiles - Low Level (Solids)	µg/Kg	127.00	17.70	132.00	15.50	131.00	14.10	130 ± 1.26
Chloroethane 4485 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
Chloroform 4505 Volatiles - Low Level (Solids)	µg/Kg	47.40	6.48	49.70	7.72	49.70	8.22	47.2 ± 0.458
1,2-Dibromo-3-chloropropane (DBCP) 4570 Volatiles - Low Level (Solids)	µg/Kg	75.80	15.00	86.70	33.10	75.80	15.00	78.3 ± 0.759
Dibromochloromethane 4575 Volatiles - Low Level (Solids)	µg/Kg	53.20	7.35	54.70	8.48	54.10	8.86	53.6 ± 0.52
1,2-Dibromoethane (EDB, Ethylene dibromide) 4585 Volatiles - Low Level (Solids)	µg/Kg	105.00	17.40	106.00	16.30	105.00	17.40	103 ± 1
Dibromomethane 4595 Volatiles - Low Level (Solids)	µg/Kg	157.00	29.50	158.00	26.60	157.00	29.50	151 ± 1.46
1,2-Dichlorobenzene 4610 Volatiles - Low Level (Solids)	µg/Kg	177.00	28.80	192.00	22.40	193.00	22.20	187 ± 1.81
1,3-Dichlorobenzene 4615 Volatiles - Low Level (Solids)	µg/Kg	163.00	31.40	176.00	21.00	176.00	19.60	174 ± 1.69
1,4-Dichlorobenzene 4620 Volatiles - Low Level (Solids)	µg/Kg	57.10	11.60	71.10	10.10	70.10	10.40	64.6 ± 0.627
Dichlorodifluoromethane 4625 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
1,1-Dichloroethane 4630 Volatiles - Low Level (Solids)	µg/Kg	46.70	6.97	46.80	7.87	46.60	7.89	46.4 ± 0.45
1,2-Dichloroethane 4635 Volatiles - Low Level (Solids)	µg/Kg	164.00	22.40	170.00	19.70	170.00	22.30	167 ± 1.62
1,1-Dichloroethylene 4640 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
cis-1,2-Dichloroethylene 4645 Volatiles - Low Level (Solids)	µg/Kg	153.00	26.40	152.00	22.40	153.00	26.40	159 ± 1.54
1,2-Dichloropropane 4655 Volatiles - Low Level (Solids)	µg/Kg	164.00	21.40	172.00	15.80	172.00	17.90	171 ± 1.66
cis-1,3-Dichloropropene 4680 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
trans-1,3-Dichloropropene 4685 Volatiles - Low Level (Solids)	µg/Kg	166.00	21.70	165.00	19.80	166.00	21.70	166 ± 1.61
trans-1,2-Dichloroethylene 4700 Volatiles - Low Level (Solids)	µg/Kg	76.90	13.20	73.80	18.50	76.90	13.20	71.1 ± 0.689
Ethylbenzene 4765 Volatiles - Low Level (Solids)	µg/Kg	68.00	10.30	72.50	8.38	72.10	9.04	68.1 ± 0.66
Hexachlorobutadiene 4835 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
2-Hexanone 4860 Volatiles - Low Level (Solids)	µg/Kg	316.00	99.40	323.00	90.80	316.00	99.40	316 ± 3.07
Isopropylbenzene 4900 Volatiles - Low Level (Solids)	µg/Kg	124.00	16.60	123.00	14.80	124.00	16.60	113 ± 1.09

Volatiles on Soil - Low Level

SPE-002-L
Study Lot 013612
Mfg Lot 013612

(continued)	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Methyl bromide (Bromomethane) 4950 Volatiles - Low Level (Solids)	µg/Kg	84.70	27.00	85.40	27.80	84.70	27.00	122 ± 1.19
Methyl chloride (Chloromethane) 4960 Volatiles - Low Level (Solids)	µg/Kg	125.00	28.10	118.00	39.20	125.00	28.10	165 ± 1.6
Methylene chloride (Dichloromethane) 4975 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
4-Methyl-2-pentanone (MIBK) 4995 Volatiles - Low Level (Solids)	µg/Kg	135.00	24.80	156.00	31.20	157.00	36.40	142 ± 1.38
Methyl tert-butyl ether (MTBE) 5000 Volatiles - Low Level (Solids)	µg/Kg	38.90	7.88	39.50	11.30	38.30	9.06	37.4 ± 0.363
Naphthalene 5005 Volatiles - Low Level (Solids)	µg/Kg	115.00	17.80	116.00	17.10	115.00	17.80	107 ± 1.04
Styrene 5100 Volatiles - Low Level (Solids)	µg/Kg	170.00	22.10	170.00	19.80	170.00	22.10	161 ± 1.56
1,1,1,2-Tetrachloroethane 5105 Volatiles - Low Level (Solids)	µg/Kg	50.90	6.36	51.50	4.92	51.80	5.26	49.7 ± 0.482
1,1,2,2-Tetrachloroethane 5110 Volatiles - Low Level (Solids)	µg/Kg	98.80	15.80	106.00	21.60	101.00	11.20	100 ± 0.973
Tetrachloroethylene (Perchloroethylene) 5115 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
Toluene 5140 Volatiles - Low Level (Solids)	µg/Kg	143.00	19.90	144.00	18.30	144.00	20.10	144 ± 1.4
1,2,4-Trichlorobenzene 5155 Volatiles - Low Level (Solids)	µg/Kg	76.40	16.90	77.10	16.10	76.40	16.90	73.1 ± 0.709
1,1,1-Trichloroethane 5160 Volatiles - Low Level (Solids)	µg/Kg	91.90	13.30	92.90	11.70	93.60	11.40	92.5 ± 0.897
1,1,2-Trichloroethane 5165 Volatiles - Low Level (Solids)	µg/Kg	128.00	17.20	138.00	19.90	138.00	22.40	131 ± 1.27
Trichloroethene (Trichloroethylene) 5170 Volatiles - Low Level (Solids)	µg/Kg	118.00	18.50	123.00	15.40	122.00	17.90	122 ± 1.18
Trichlorofluoromethane 5175 Volatiles - Low Level (Solids)	µg/Kg	121.00	20.20	121.00	20.10	121.00	20.20	150 ± 1.45
1,2,3-Trichloropropane 5180 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
1,2,4-Trimethylbenzene 5210 Volatiles - Low Level (Solids)	µg/Kg	46.60	7.11	48.10	8.22	46.60	7.11	44.7 ± 0.433
1,3,5-Trimethylbenzene 5215 Volatiles - Low Level (Solids)	µg/Kg	41.30	6.70	42.30	7.45	41.30	6.70	40.2 ± 0.39
Vinyl acetate 5225 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
Vinyl chloride 5235 Volatiles - Low Level (Solids)	µg/Kg	64.50	15.10	64.90	15.10	64.50	15.10	88.7 ± 0.86
m+p-Xylene 5240 Volatiles - Low Level (Solids)	µg/Kg	124.00	21.00	129.00	23.10	135.00	13.40	126 ± 1.22
o-Xylene 5250 Volatiles - Low Level (Solids)	µg/Kg	64.20	11.40	71.90	8.21	72.00	10.20	64.6 ± 0.627
Xylene, total 5260 Volatiles - Low Level (Solids)	µg/Kg	187.00	31.10	211.00	54.70	200.00	25.70	190 ± 1.85
Di-isopropylether (DIPE) 9375 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00

TCLP Metals in Soil

SPE-005
Study Lot 000962
Mfg Lot 000962

	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Arsenic, As 1010 TCLP Metals	mg/L	5.37	1.36	5.31	1.22	5.37	1.36	5.37
Barium, Ba 1015 TCLP Metals	mg/L	19.20	2.29	19.10	2.09	19.20	2.29	19.2
Cadmium, Cd 1030 TCLP Metals	mg/L	49.10	11.70	48.40	10.50	49.10	11.70	49.1
Chromium, Cr (total) 1040 TCLP Metals	mg/L	1.65	0.88	1.73	0.86	1.65	0.88	1.65
Lead, Pb 1075 TCLP Metals	mg/L	1.51	1.04	1.57	0.95	1.51	1.04	1.51
Mercury, Hg 1095 TCLP Metals	mg/L	1.46	0.44	1.50	0.49	1.46	0.44	1.46

TCLP Metals in Soil
SPE-005

Study Lot 000962
Mfg Lot 000962

(continued)	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Selenium, Se 1140 TCLP Metals	mg/L	1.82	0.17	1.79	0.21	1.82	0.17	1.82
Silver, Ag 1150 TCLP Metals	mg/L	0.00	0.00	0.06	0.07	0.00	0.00	0.00
Extraction Fluid 1311 TCLP Metals		2.00	0.00					2.00

Corrosivity - Soil
SPE-023

Study Lot 013535
Mfg Lot 013535

	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
pH 1900 Miscellaneous Analytes	Units	6.50	0.20	6.44	0.20	6.35	0.08	6.50 ± 0.033

Flash Point
SPE-029

Study Lot 013616
Mfg Lot 013616

	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Ignitability (Flashpoint, °F) 1780 Miscellaneous Analytes	°F	147.00	5.67	145.00	8.40	147.00	4.62	147 ± 1.41

Uranium in Soil
SPE-071

Study Lot 013547
Mfg Lot 013547

	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Uranium, U 3035 Trace Metals	mg/Kg	197.00	19.70					197

rogram analyte accrediting footnotes

[1] NELAC
[2] EPA
[3] Other
[4] A2LA
[5] NELAC Experimental

PERFORMANCE EVALUATION

First Choice for Quality | RTC

Off-study
LPTP08-4-17

6-Oct-2008 through 18-Nov-2008

RT1014
RTC Labcode

WY00002
US EPA Labcode

Energy Labs
Jim Yocum
PO Box 3258
Casper WY 82602

Thank you for participating in study LPTP08-4-17. Additional information about this study may be found online at www.rt-corp.com. you have any questions or comments about this study please contact me.

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This report may contain data that are not covered by the A2LA accreditation.

Sincerely,

Christopher Rucinski
Quality Director

2931 Soldier Springs Road
Laramie, WY 82070
(307) 742-5452
www.rt-corp.com

ACCREDITED
Certificate # 2122.01

Dataset

LPTP08-4-17 MU 1

Accreditors

Evaluations of this dataset will be sent to the accreditor(s) listed below using your laboratory's labcode listed above each accrediting agency. If any of the information listed below is incorrect, please contact RTC immediately.

Accrediting Labcode WY00002
Florida Dept. of Health

229 Stephen Arms
PO Box 210
1217 Pearl Street
Jacksonville FL 32231
UNITED STATES

Accrediting Labcode WY00002
Nebraska Health and Human Services System
Department of Regulation & Licensure
504 Sandra Irons
State Certification Officer
3701 S. 14th Street
Lincoln NE 68502
UNITED STATES

Accrediting Labcode WY00002
Nevada Division of Env. Protection

118 Donald Lafara
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Carson City NV 89701-5249
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Accrediting Labcode T104704181-05-TX
Texas CEQ

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UNITED STATES

Accrediting Labcode WY00002
Utah Bureau of Laboratory Improvement

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Salt Lake City UT 84114-2109
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TCLP Metals

Analysis
EPA 6010B (1996)
Atomic Emission - Inductvely Coupled Plasma Spectrometry

Method Number 10155609
Technology Code: ICP-AES

	Result Units	Assigned Value	Accept.	Z	Evaluation

TCLP Metals (continued)

Analysis
EPA 6010B (1996)
Atomic Emission - Inductvely Coupled Plasma Spectrometry

(continued)
Method Number 10155609
Technology Code: ICP-AES

	Result Units	Assigned Value	Accept.	Z	Evaluation
Selenium, Se [4] 1140 / 005 - Lot 000162 /Analyst: cp/ Analysis Date: 11/17/08	**<0.1** mg/L	0.00	0.00 to 0.0386		**Acceptable**

Volatiles - Low Level (Solids)

Analysis
EPA 8260B 2 (1996)
Gas Chromatography - Mass Spectrometry

Method Number 10184802
Technology Code: GC-MS

	Result Units	Assigned Value	Accept.	Z	Evaluation
Acetone [1, 4] 4315 / 002-L - Lot 012232 /Analyst: jlr/ Analysis Date: 11/13/08	**260** µg/Kg	268.00	0.00 to 795	-0.05	**Acceptable**
Methyl tert-butyl ether (MTBE) [1, 4] 5000 / 002-L - Lot 012232 /Analyst: jlr/ Analysis Date: 11/13/08	**98** µg/Kg	105.00	46.3 to 165	-0.36	**Acceptable**

End of LPTP08-4-17 MU 1

Dataset

LPTP08-4-17 MU 2

Accreditors

Evaluations of this dataset will be sent to the accreditor(s) listed below using your laboratory's labcode listed above each accrediting agency. If any of the information listed below is incorrect, please contact RTC immediately.

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Department of Regulation & Licensure
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State Certification Officer
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Texas CEQ

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Austin TX 78711-3087
UNITED STATES

Accrediting Labcode WY00002
Utah Bureau of Laboratory Improvement

215 Kristin Brown
PO Box 142109
Salt Lake City UT 84114-2109
UNITED STATES

TCLP Metals

Analysis
EPA 6020 (1994)
Mass Spectrometry - Inductively Coupled Plasma

Method Number 10156000
Technology Code: ICP-MS

	Result Units	Assigned Value	Accept.	Z	Evaluation

TCLP Metals (continued)

Analysis
EPA 6020 (1994)
Mass Spectrometry - Inductively Coupled Plasma

(continued)
Method Number 10156000
Technology Code: ICP-MS

	Result Units	Assigned Value	Accept.	Z	Evaluation
Selenium, Se [4] 1140 / 005 - Lot 000162 /Analyst: sml/ Analysis Date: 11/4/08	**<0.1** mg/L	0.00	0.00 to 0.0386		**Acceptable**

End of LPTP08-4-17 MU 2

Sample Information

Volatiles on Soil - Low Level
SPE-002-L / Lot {EncryptedLotCode}

	Units	Assigned Value	Study Mean	Study Std. Dev.	Gravimetric Value
Acetone 4315 Volatiles - Low Level (Solids)	µg/Kg	268.00	268.00	176.00	173
Methyl tert-butyl ether (MTBE) 5000 Volatiles - Low Level (Solids)	µg/Kg	105.00	108.00	16.70	110

TCLP Metals in Soil
SPE-005 / Lot {EncryptedLotCode}

	Units	Assigned Value	Study Mean	Study Std. Dev.	Gravimetric Value
Selenium, Se 1140 TCLP Metals	mg/L	0.00	0.00	0.01	0.0100

Definitions:

Assigned Value: Value attributed to a particular quantity and accepted, sometimes by convention, as having an uncertainty appropriate for a give purpose. See ISO Guide 43 for additional information.

Accept. Window: The range of values that constitute acceptable performance for a laboratory participation in this PT study.

Z: A Z-Score tells how a single data point compares to normal data. A Z-Score says not only whether a point was above or below average, but how unusual the measurement is. Generally, a method result with a Z-Score less than |2| is considered to be in control, a Z-Score between |2| and |3| is considered 'Questionable', but still within control and a Z greater than |3| is considered not acceptable and the method is out of control.

Study Mean: Statistical study mean calculated using a robust statisitical model (RTC employs the 'Biweight Program'). Robust statistical techniques to minimize the influence that extreme results can have on estimates of the mean and standard deviation NOTE - These techniques assign less weight to extreme results, rather than eliminate them from a data set.

Study Std. Dev.: Standard deviation calculated from study data using robust statisicals (Biweight).

Gravimetric Value: The prepared to value, determined by gravimetric means. The uncertainty associated to this value is standard uncertainty and based on RTC's gravimetric tolerances.

Program analyte accrediting footnotes
- 1 NELAC
- 2 EPA
- 3 Other
- 4 A2LA
- 5 NELAC Experimental

PERFORMANCE EVALUATION

First Choice for Quality | RTC

Quarterly Study

LPTP09-S1

11-Feb-2009 through 27-Mar-2009

RT1014
RTC Labcode

WY00002
US EPA Labcode

Energy Laboratories
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PO BOX 3258
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Thank you for participating in study LPTP09-S1. Additional information about this study may be found online at www.rt-corp.com. If you have any questions or comments about this study please contact me.

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Sincerely,

Christopher Rucinski
Quality Director

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ACCREDITED
Certificate # 2122.01

Dataset

LPTP09-S1_Set_1

Accreditors

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UNITED STATES

Accrediting Labcode WY00002
Wyoming DEQ
Water Quality Division
206 Edward Mock
122 W. 25th Street
Cheyenne WY 82002
UNITED STATES

Miscellaneous Analytes

Analysis
EPA 1010 (1986)

Method Number 10116606

	Result Units	Assigned Value	Accept.	Z	Evaluation
Ignitability (Flashpoint, °F) 1, 4 1780 / 029 - Lot 014525 /Analyst: ph/ Analysis Date: 2/23/09	**>140** °F	170.00	153 to 187		**Acceptable**

Analysis
EPA 6010B (1996)

Method Number 10155609

	Result Units	Assigned Value	Accept.	Z	Evaluation
Silica as SiO_2 4 1990 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**848** mg/Kg	1,050.00	0.00 to 3720	-0.23	**Acceptable**

Analysis
EPA 9045C 3 (1995)

Method Number 10198400

	Result Units	Assigned Value	Accept.	Z	Evaluation
pH 1, 4 1900 / 023 - Lot 014434 /Analyst: cm/ Analysis Date: 2/20/09	**7.29** Units	7.35	6.75 to 7.95	-0.30	**Acceptable**

TCLP Metals

Analysis
EPA 6010 (1986)

Method Number 10155201

	Result Units	Assigned Value	Accept.	Z	Evaluation
Extraction Fluid 4 1311 / 005 - Lot 001951 /Analyst: dcj/ Analysis Date: 2/19/09	**1**	1.00	1.00 to 1.00		**Acceptable**

Analysis
EPA 6010B (1996)

Method Number 10155609

	Result Units	Assigned Value	Accept.	Z	Evaluation
Arsenic, As 4 1010 / 005 - Lot 001951 /Analyst: rdw/ Analysis Date: 3/26/09	**6.3** mg/L	5.83	3.82 to 7.84	0.70	**Acceptable**
Barium, Ba 4 1015 / 005 - Lot 001951 /Analyst: rdw/ Analysis Date: 3/26/09	**<10.0** mg/L	0.58	0.233 to 0.926		**Acceptable**
Beryllium, Be 4 1020 / 005 - Lot 001951 /Analyst: rdw/ Analysis Date: 3/26/09	**<0.50** mg/L	0.00	0.0 to 0.0		**Acceptable**
Cadmium, Cd 4 1030 / 005 - Lot 001951 /Analyst: rdw/ Analysis Date: 3/26/09	**6.2** mg/L	5.55	4.16 to 6.95	1.40	**Acceptable**
Chromium, Cr (total) 4 1040 / 005 - Lot 001951 /Analyst: rdw/ Analysis Date: 3/26/09	**0.60** mg/L	0.43	0.195 to 0.655	2.28	**Acceptable**

TCLP Metals (continued)

Analysis
EPA 6010B (1996)

(continued)
Method Number 10155609

	Result Units	Assigned Value	Accept.	Z	Evaluation
Copper, Cu 4 1055 / 005 - Lot 001951 /Analyst: rdw/ Analysis Date: 3/26/09	**0.48** mg/L	0.39	0.260 to 0.517	2.14	**Acceptable**
Lead, Pb 4 1075 / 005 - Lot 001951 /Analyst: rdw/ Analysis Date: 3/26/09	**1.50** mg/L	1.40	0.762 to 2.05	0.47	**Acceptable**
Molybdenum, Mo 4 1100 / 005 - Lot 001951 /Analyst: rdw/ Analysis Date: 3/26/09	**<0.10** mg/L	0.00	0.0 to 0.0		**Acceptable**
Nickel, Ni 4 1105 / 005 - Lot 001951 /Analyst: rdw/ Analysis Date: 3/26/09	**3.33** mg/L	2.95	2.27 to 3.63	1.67	**Acceptable**
Selenium, Se 4 1140 / 005 - Lot 001951 /Analyst: rdw/ Analysis Date: 3/26/09	**5.20** mg/L	4.37	2.54 to 6.20	1.36	**Acceptable**
Silver, Ag 4 1150 / 005 - Lot 001951 /Analyst: rdw/ Analysis Date: 3/26/09	**<0.50** mg/L	0.03	0.00 to 0.0723		**Acceptable**
Zinc, Zn 4 1190 / 005 - Lot 001951 /Analyst: rdw/ Analysis Date: 3/26/09	**2.24** mg/L	1.96	1.35 to 2.58	1.37	**Acceptable**

Analysis
EPA 7470A 1 (1994)

Method Number 10165807

	Result Units	Assigned Value	Accept.	Z	Evaluation
Mercury, Hg 4 1095 / 005 - Lot 001951 /Analyst: jp/ Analysis Date: 2/26/09	**0.120** mg/L	0.13	0.0258 to 0.232	-0.26	**Acceptable**

Trace Metals

Analysis
EPA 6010B (1996)

Method Number 10155609

	Result Units	Assigned Value	Accept.	Z	Evaluation
Boron, B 4, 5 1025 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**122** mg/Kg	135.00	85.0 to 185	-0.78	**Acceptable**
Calcium, Ca 1, 4 1035 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**5360** mg/Kg	4,670.00	3390 to 5960	1.61	**Acceptable**
Iron, Fe 1, 4 1070 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**5750** mg/Kg	5,190.00	0.00 to 11400	0.27	**Acceptable**
Lithium, Li 4 1080 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**105** mg/Kg	97.10	67.1 to 127	0.79	**Acceptable**
Magnesium, Mg 1, 4 1085 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**2010** mg/Kg	1,940.00	1140 to 2740	0.26	**Acceptable**

Trace Metals (continued)

Analysis
EPA 6010B (1996)

(continued)
Method Number 10155609

	Result Units	Assigned Value	Accept.	Z	Evaluation
Potassium, K 1, 4 1125 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**3790** mg/Kg	3,590.00	2300 to 4880	0.47	**Acceptable**
Silicon, Si 4 1145 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**396** mg/Kg	443.00	0.00 to 1880	-0.10	**Acceptable**
Sodium, Na 1, 4 1155 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**951** mg/Kg	1,050.00	616 to 1480	-0.69	**Acceptable**
Phosphorus, P 4 1715 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**190** mg/Kg	180.00	9.21 to 350	0.18	**Acceptable**

Analysis
EPA 6020 (1994)

Method Number 10156000

	Result Units	Assigned Value	Accept.	Z	Evaluation
Aluminum, Al 1, 4 1000 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**8660** mg/Kg	10,000.00	314 to 23700	-0.30	**Acceptable**
Antimony, Sb 1, 4 1005 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**70.2** mg/Kg	84.80	0.00 to 221	-0.32	**Acceptable**
Arsenic, As 1, 4 1010 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**78.5** mg/Kg	70.60	48.0 to 93.2	1.05	**Acceptable**
Barium, Ba 1, 4 1015 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**186** mg/Kg	168.00	122 to 213	1.18	**Acceptable**
Beryllium, Be 1, 4 1020 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**71.5** mg/Kg	69.00	50.8 to 87.1	0.41	**Acceptable**
Cadmium, Cd 1, 4 1030 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**241** mg/Kg	215.00	158 to 273	1.36	**Acceptable**
Chromium, Cr (total) 1, 4 1040 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**213** mg/Kg	183.00	129 to 237	1.67	**Acceptable**
Cobalt, Co 1, 4 1050 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**132** mg/Kg	118.00	87.9 to 148	1.39	**Acceptable**
Copper, Cu 1, 4 1055 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**211** mg/Kg	178.00	134 to 221	2.28	**Acceptable**
Lead, Pb 1, 4 1075 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**102** mg/Kg	84.90	59.1 to 111	1.99	**Acceptable**
Manganese, Mn 1, 4 1090 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**552** mg/Kg	546.00	369 to 724	0.10	**Acceptable**
Molybdenum, Mo 1, 4 1100 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**70.8** mg/Kg	63.00	42.8 to 83.3	1.16	**Acceptable**

Trace Metals (continued)

Analysis
EPA 6020 (1994)

(continued)
Method Number 10156000

	Result Units	Assigned Value	Accept.	Z	Evaluation
Nickel, Ni 1, 4 1105 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**278** mg/Kg	232.00	172 to 292	2.30	**Acceptable**
Selenium, Se 1, 4 1140 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**75.2** mg/Kg	70.80	44.1 to 97.5	0.49	**Acceptable**
Silver, Ag 1, 4 1150 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**86.7** mg/Kg	72.50	48.7 to 96.4	1.79	**Acceptable**
Strontium, Sr 4 1160 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**209** mg/Kg	195.00	138 to 252	0.73	**Acceptable**
Thallium, Tl 1, 4 1165 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**201** mg/Kg	164.00	113 to 216	2.15	**Acceptable**
Tin, Sn 1, 4 1175 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**222** mg/Kg	182.00	111 to 253	1.69	**Acceptable**
Titanium, Ti 4 1180 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**139** mg/Kg	123.00	2.94 to 360	0.40	**Acceptable**
Vanadium, V 1, 4 1185 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**270** mg/Kg	237.00	177 to 297	1.65	**Acceptable**
Zinc, Zn 1, 4 1190 / 001 - Lot 014432 /Analyst: sml/ Analysis Date: 2/19/09	**754** mg/Kg	656.00	483 to 829	1.70	**Acceptable**
Uranium, U 4 3035 / 071 - Lot 014437 /Analyst: sml/ Analysis Date: 2/19/09	**233** mg/Kg	247.00	173 to 321	-0.57	**Acceptable**

Analysis
EPA 7471A 1 (1994)

Method Number 10166208

	Result Units	Assigned Value	Accept.	Z	Evaluation
Mercury, Hg 1, 4 1095 / 001 - Lot 014432 /Analyst: jp/ Analysis Date: 3/16/09	**6.4** mg/Kg	13.40	6.90 to 20.0	-3.21	**Not Acceptable**

Volatiles - Low Level (Solids)

Analysis
EPA 8260B 2 (1996)

Method Number 10184802

	Result Units	Assigned Value	Accept.	Z	Evaluation
Acetone 1, 4 4315 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**280** µg/Kg	293.00	0.00 to 739	-0.09	**Acceptable**
Acetonitrile 4 4320 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**<20** µg/Kg	0.00	0.0 to 0.0		**Acceptable**

Volatiles - Low Level (Solids) (continued)

Analysis
EPA 8260B 2 (1996)

(continued)
Method Number 10184802

	Result Units	Assigned Value	Accept.	Z	Evaluation
Acrolein (Propenal) 4 4325 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**<20** µg/Kg	0.00	0.0 to 0.0		**Acceptable**
T-amylmethylether (TAME) 4 4370 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**<2.0** µg/Kg	0.00	0.0 to 0.0		**Acceptable**
Benzene 1, 4 4375 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**130** µg/Kg	145.00	88.8 to 201	-0.81	**Acceptable**
Bromobenzene 4, 5 4385 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**150** µg/Kg	155.00	110 to 199	-0.34	**Acceptable**
Bromodichloromethane 1, 4 4395 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**<2.0** µg/Kg	0.00	0.0 to 0.0		**Acceptable**
Bromoform 1, 4 4400 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**130** µg/Kg	167.00	85.4 to 249	-1.36	**Acceptable**
2-Butanone (Methyl ethyl ketone, MEK) 1, 4 4410 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**200** µg/Kg	291.00	0.00 to 653	-0.75	**Acceptable**
Carbon disulfide 4 4450 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**<2.0** µg/Kg	0.00	0.0 to 0.0		**Acceptable**
Carbon tetrachloride 1, 4 4455 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**120** µg/Kg	164.00	81.4 to 246	-1.60	**Acceptable**
Chlorobenzene 1, 4 4475 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**160** µg/Kg	168.00	97.6 to 238	-0.34	**Acceptable**
Chloroethane 4, 5 4485 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**<2.0** µg/Kg	0.00	0.0 to 0.0		**Acceptable**
2-Chloroethyl vinyl ether 4 4500 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**<2.0** µg/Kg	0.00	0.0 to 0.0		**Acceptable**
Chloroform 1, 4 4505 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**54** µg/Kg	67.70	40.5 to 95.0	-1.51	**Acceptable**
1,2-Dibromo-3-chloropropane (DBCP) 4, 5 4570 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**<2.0** µg/Kg	95.40	57.6 to 133		**Not Acceptable**
Dibromochloromethane 1, 4 4575 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**103** µg/Kg	143.00	88.1 to 198	-2.19	**Acceptable**
1,2-Dibromoethane (EDB, Ethylene dibromide) 4, 5 4585 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**160** µg/Kg	179.00	125 to 233	-1.06	**Acceptable**
Dibromomethane 4 4595 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**<2.0** µg/Kg	0.00	0.0 to 0.0		**Acceptable**
1,2-Dichlorobenzene 1, 4 4610 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**170** µg/Kg	169.00	86.3 to 251	0.04	**Acceptable**

Volatiles - Low Level (Solids) (continued)

Analysis
EPA 8260B 2 (1996)

(continued)
Method Number 10184802

	Result Units	Assigned Value	Accept.	Z	Evaluation
1,3-Dichlorobenzene 1, 4 4615 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**56** µg/Kg	55.40	21.7 to 89.2	0.05	**Acceptable**
1,4-Dichlorobenzene 1, 4 4620 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**87** µg/Kg	77.50	30.3 to 125	0.61	**Acceptable**
Dichlorodifluoromethane 4, 5 4625 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**<2.0** µg/Kg	0.00	0.0 to 0.0		**Acceptable**
1,1-Dichloroethane 1, 4 4630 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**120** µg/Kg	153.00	86.5 to 219	-1.49	**Acceptable**
1,2-Dichloroethane 1, 4 4635 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**100** µg/Kg	125.00	73.6 to 176	-1.46	**Acceptable**
1,1-Dichloroethylene 4, 5 4640 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**79** µg/Kg	86.00	41.1 to 131	-0.47	**Acceptable**
cis-1,2-Dichloroethylene 4, 5 4645 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**100** µg/Kg	125.00	67.7 to 181	-1.32	**Acceptable**
1,2-Dichloropropane 1, 4 4655 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**91** µg/Kg	105.00	63.9 to 146	-1.02	**Acceptable**
cis-1,3-Dichloropropene 4, 5 4680 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**50** µg/Kg	56.40	33.1 to 79.7	-0.82	**Acceptable**
trans-1,3-Dichloropropene 4, 5 4685 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**130** µg/Kg	166.00	74.5 to 257	-1.18	**Acceptable**
trans-1,2-Dichloroethylene 4, 5 4700 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**62** µg/Kg	78.00	41.0 to 115	-1.30	**Acceptable**
Ethylbenzene 1, 4 4765 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**120** µg/Kg	114.00	64.0 to 165	0.36	**Acceptable**
Hexachlorobutadiene 1, 4 4835 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**<2.0** µg/Kg	0.00	0.0 to 0.0		**Acceptable**
2-Hexanone 4, 5 4860 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**180** µg/Kg	372.00	0.00 to 770	-1.44	**Acceptable**
Isopropylbenzene 4, 5 4900 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**76** µg/Kg	69.30	44.2 to 94.5	0.80	**Acceptable**
Methyl bromide (Bromomethane) 4, 5 4950 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**12** µg/Kg	25.30	0.00 to 53.3	-1.43	**Acceptable**
Methyl chloride (Chloromethane) 4, 5 4960 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**36** µg/Kg	59.40	10.7 to 108	-1.44	**Acceptable**
Methylene chloride (Dichloromethane) 1, 4 4975 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**65** µg/Kg	85.00	41.0 to 129	-1.36	**Acceptable**

Volatiles - Low Level (Solids) (continued)

Analysis
EPA 8260B 2 (1996)

(continued)
Method Number 10184802

	Result Units	Assigned Value	Accept.	Z	Evaluation
4-Methyl-2-pentanone (MIBK) 1, 4 4995 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**130** µg/Kg	209.00	103 to 315	-2.23	**Acceptable**
Methyl tert-butyl ether (MTBE) 1, 4 5000 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**26** µg/Kg	38.50	15.0 to 61.9	-1.60	**Acceptable**
Naphthalene 1, 4 5005 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**88** µg/Kg	159.00	40.5 to 278	-1.79	**Acceptable**
Styrene 4, 5 5100 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**110** µg/Kg	135.00	82.8 to 187	-1.44	**Acceptable**
1,1,1,2-Tetrachloroethane 1, 4 5105 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**67** µg/Kg	77.40	49.5 to 105	-1.12	**Acceptable**
1,1,2,2-Tetrachloroethane 1, 4 5110 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**120** µg/Kg	130.00	68.5 to 192	-0.49	**Acceptable**
Tetrachloroethylene (Perchloroethylene) 1, 4 5115 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**47** µg/Kg	46.60	21.8 to 71.4	0.05	**Acceptable**
Toluene 1, 4 5140 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**85** µg/Kg	89.20	51.6 to 127	-0.34	**Acceptable**
1,2,4-Trichlorobenzene 1, 4 5155 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**24** µg/Kg	86.50	41.2 to 132	-4.14	**Not Acceptable**
1,1,1-Trichloroethane 1, 4 5160 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**<2.0** µg/Kg	0.00	0.0 to 0.0		**Acceptable**
1,1,2-Trichloroethane 1, 4 5165 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**110** µg/Kg	121.00	72.1 to 169	-0.68	**Acceptable**
Trichloroethene (Trichloroethylene) 1, 4 5170 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**<2.0** µg/Kg	0.00	0.0 to 0.0		**Acceptable**
Trichlorofluoromethane 4, 5 5175 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**120** µg/Kg	162.00	67.4 to 257	-1.33	**Acceptable**
1,2,3-Trichloropropane 1, 4 5180 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**75** µg/Kg	77.90	36.0 to 120	-0.21	**Acceptable**
1,2,4-Trimethylbenzene 4 5210 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**140** µg/Kg	150.00	77.8 to 223	-0.41	**Acceptable**
1,3,5-Trimethylbenzene 4 5215 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**70** µg/Kg	71.40	42.3 to 101	-0.14	**Acceptable**
Vinyl acetate 4 5225 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**<2.0** µg/Kg	0.00	0.0 to 0.0		**Acceptable**
Vinyl chloride 4, 5 5235 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**<2.0** µg/Kg	0.00	0.0 to 0.0		**Acceptable**

Volatiles - Low Level (Solids) (continued)

Analysis
EPA 8260B 2 (1996)

(continued)
Method Number 10184802

	Result Units	Assigned Value	Accept.	Z	Evaluation
m+p-Xylene 4 5240 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**91** µg/Kg	85.30	41.0 to 130	0.39	**Acceptable**
o-Xylene 4 5250 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**97** µg/Kg	90.80	43.8 to 138	0.39	**Acceptable**
Xylene, total 1, 4 5260 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**190** µg/Kg	175.00	87.2 to 262	0.51	**Acceptable**
Di-isopropylether (DIPE) 4 9375 / 002-L - Lot 014499 /Analyst: wen/ Analysis Date: 3/5/09	**<2.0** µg/Kg	0.00	0.0 to 0.0		**Acceptable**

Group Analysis Summary

Acceptable 58 / 60
Score 96.7% - **(Acceptable)**

End of LPTP09-S1_Set_1

Dataset

LPTP09-S1_Set_2

Accreditors

Evaluations of this dataset will be sent to the accreditor(s) listed below using your laboratory's labcode listed above each accrediting agency. If any of the information listed below is incorrect, please contact RTC immediately.

Accrediting Labcode WY00002
Florida Dept. of Health

229 Stephen Arms
PO Box 210
1217 Pearl Street
Jacksonville FL 32231
UNITED STATES

Accrediting Labcode WY00002
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Department of Regulation & Licensure
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Accrediting Labcode WY00002
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Accrediting Labcode T104704181-05-TX
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Accrediting Labcode WY00002
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206 Edward Mock
122 W. 25th Street
Cheyenne WY 82002
UNITED STATES

Trace Metals

Analysis
EPA 6010B (1996)

Method Number 10155609

	Result Units	Assigned Value	Accept.	Z	Evaluation
Aluminum, Al 1, 4 1000 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**9720** mg/Kg	10,000.00	314 to 23700	-0.06	**Acceptable**
Antimony, Sb 1, 4 1005 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**60** mg/Kg	84.80	0.00 to 221	-0.55	**Acceptable**
Arsenic, As 1, 4 1010 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**68** mg/Kg	70.60	48.0 to 93.2	-0.35	**Acceptable**
Barium, Ba 1, 4 1015 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**180** mg/Kg	168.00	122 to 213	0.79	**Acceptable**
Beryllium, Be 1, 4 1020 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**67.8** mg/Kg	69.00	50.8 to 87.1	-0.20	**Acceptable**
Cadmium, Cd 1, 4 1030 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**239** mg/Kg	215.00	158 to 273	1.26	**Acceptable**
Chromium, Cr (total) 1, 4 1040 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**200** mg/Kg	183.00	129 to 237	0.94	**Acceptable**
Cobalt, Co 1, 4 1050 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**130** mg/Kg	118.00	87.9 to 148	1.19	**Acceptable**
Copper, Cu 1, 4 1055 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**198** mg/Kg	178.00	134 to 221	1.38	**Acceptable**
Lead, Pb 1, 4 1075 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**92** mg/Kg	84.90	59.1 to 111	0.83	**Acceptable**
Manganese, Mn 1, 4 1090 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**529** mg/Kg	546.00	369 to 724	-0.29	**Acceptable**
Molybdenum, Mo 1, 4 1100 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**70** mg/Kg	63.00	42.8 to 83.3	1.04	**Acceptable**
Nickel, Ni 1, 4 1105 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**253** mg/Kg	232.00	172 to 292	1.05	**Acceptable**
Selenium, Se 1, 4 1140 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**66** mg/Kg	70.80	44.1 to 97.5	-0.54	**Acceptable**
Silver, Ag 1, 4 1150 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**79** mg/Kg	72.50	48.7 to 96.4	0.82	**Acceptable**
Strontium, Sr 4 1160 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**202** mg/Kg	195.00	138 to 252	0.37	**Acceptable**
Thallium, Tl 1, 4 1165 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**169** mg/Kg	164.00	113 to 216	0.29	**Acceptable**
Tin, Sn 1, 4 1175 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**199** mg/Kg	182.00	111 to 253	0.72	**Acceptable**

Trace Metals (continued)

Analysis
EPA 6010B (1996)

(continued)
Method Number 10155609

	Result Units	Assigned Value	Accept.	Z	Evaluation
Titanium, Ti 4 1180 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**140** mg/Kg	123.00	2.94 to 360	0.43	**Acceptable**
Vanadium, V 1, 4 1185 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**251** mg/Kg	237.00	177 to 297	0.70	**Acceptable**
Zinc, Zn 1, 4 1190 / 001 - Lot 014432 /Analyst: cp/ Analysis Date: 2/19/09	**735** mg/Kg	656.00	483 to 829	1.37	**Acceptable**

Volatiles - Low Level (Solids)

Analysis
EPA 8021B 2 (1996)

Method Number 10174808

	Result Units	Assigned Value	Accept.	Z	Evaluation
Benzene 1, 4 4375 / 002-L - Lot 014499 /Analyst: jlr/ Analysis Date: 2/20/09	**95** µg/Kg	145.00	88.8 to 201	-2.69	**Acceptable**
Ethylbenzene 1, 4 4765 / 002-L - Lot 014499 /Analyst: jlr/ Analysis Date: 2/20/09	**79** µg/Kg	114.00	64.0 to 165	-2.08	**Acceptable**
Methyl tert-butyl ether (MTBE) 1, 4 5000 / 002-L - Lot 014499 /Analyst: jlr/ Analysis Date: 2/20/09	**130** µg/Kg	38.50	15.0 to 61.9	11.72	**Not Acceptable**
Naphthalene 1, 4 5005 / 002-L - Lot 014499 /Analyst: jlr/ Analysis Date: 2/20/09	**110** µg/Kg	159.00	40.5 to 278	-1.24	**Acceptable**
Toluene 1, 4 5140 / 002-L - Lot 014499 /Analyst: jlr/ Analysis Date: 2/20/09	**70** µg/Kg	89.20	51.6 to 127	-1.54	**Acceptable**
m+p-Xylene 4 5240 / 002-L - Lot 014499 /Analyst: jlr/ Analysis Date: 2/20/09	**64.6** µg/Kg	85.30	41.0 to 130	-1.40	**Acceptable**
o-Xylene 4 5250 / 002-L - Lot 014499 /Analyst: jlr/ Analysis Date: 2/20/09	**64.9** µg/Kg	90.80	43.8 to 138	-1.65	**Acceptable**
Xylene, total 1, 4 5260 / 002-L - Lot 014499 /Analyst: jlr/ Analysis Date: 2/20/09	**129.5** µg/Kg	175.00	87.2 to 262	-1.56	**Acceptable**

End of LPTP09-S1_Set_2

Sample Information

Metals in Soil

SPE-001 / Lot {EncryptedLotCode}

	Units	Assigned Value	Study Mean	Study Std. Dev.	Gravimetric Value
Aluminum, Al 1000 Trace Metals	mg/Kg	10000.00	10,000.0	4,540.00	3140 ± 16
Antimony, Sb 1005 Trace Metals	mg/Kg	84.80	84.80	53.10	185 ± 0.94
Arsenic, As 1010 Trace Metals	mg/Kg	70.60	70.60	7.84	79.6 ± 0.41
Barium, Ba 1015 Trace Metals	mg/Kg	168.00	168.00	20.60	123 ± 0.63
Beryllium, Be 1020 Trace Metals	mg/Kg	69.00	69.00	4.69	71.8 ± 0.37
Boron, B 1025 Trace Metals	mg/Kg	135.00	135.00	12.90	157 ± 0.8
Cadmium, Cd 1030 Trace Metals	mg/Kg	215.00	215.00	19.20	254 ± 1.3
Calcium, Ca 1035 Trace Metals	mg/Kg	4670.00	4,670.00	510.00	4010 ± 20.4
Chromium, Cr (total) 1040 Trace Metals	mg/Kg	183.00	183.00	16.00	180 ± 0.92
Cobalt, Co 1050 Trace Metals	mg/Kg	118.00	118.00	10.40	125 ± 0.64
Copper, Cu 1055 Trace Metals	mg/Kg	178.00	178.00	15.00	156 ± 0.8
Iron, Fe 1070 Trace Metals	mg/Kg	5190.00	5,190.00	675.00	2100 ± 10.7
Lead, Pb 1075 Trace Metals	mg/Kg	84.90	84.90	7.60	84.0 ± 0.43
Lithium, Li 1080 Trace Metals	mg/Kg	97.10	97.10	10.00	99.2 ± 0.51
Magnesium, Mg 1085 Trace Metals	mg/Kg	1940.00	1,940.00	240.00	1820 ± 9.3
Manganese, Mn 1090 Trace Metals	mg/Kg	546.00	546.00	59.30	576 ± 2.94
Mercury, Hg 1095 Trace Metals	mg/Kg	13.40	13.40	1.37	15.1 ± 0.08
Molybdenum, Mo 1100 Trace Metals	mg/Kg	63.00	63.00	6.86	73.1 ± 0.37
Nickel, Ni 1105 Trace Metals	mg/Kg	232.00	232.00	19.90	236 ± 1.2
Potassium, K 1125 Trace Metals	mg/Kg	3590.00	3,590.00	472.00	3260 ± 16.6
Selenium, Se 1140 Trace Metals	mg/Kg	70.80	70.80	6.48	83.0 ± 0.42
Silicon, Si 1145 Trace Metals	mg/Kg	443.00	443.00	480.00	790 ± 4.03
Silver, Ag 1150 Trace Metals	mg/Kg	72.50	72.50	7.00	76.3 ± 0.39
Sodium, Na 1155 Trace Metals	mg/Kg	1050.00	1,050.00	144.00	990 ± 5.05
Strontium, Sr 1160 Trace Metals	mg/Kg	195.00	195.00	36.20	133 ± 0.68
Thallium, Tl 1165 Trace Metals	mg/Kg	164.00	164.00	14.40	182 ± 0.93
Tin, Sn 1175 Trace Metals	mg/Kg	182.00	182.00	16.10	193 ± 0.99
Titanium, Ti 1180 Trace Metals	mg/Kg	123.00	123.00	40.00	202 ± 1.03
Vanadium, V 1185 Trace Metals	mg/Kg	237.00	237.00	14.00	220 ± 1.12
Zinc, Zn 1190 Trace Metals	mg/Kg	656.00	656.00	57.20	700 ± 3.57
Phosphorus, P 1715 Trace Metals	mg/Kg	180.00	180.00	56.80	87.2 ± 0.44
Silica as SiO_2 1990 Miscellaneous Analytes	mg/Kg	1050.00	1,050.00	889.00	1050

VOAs in Soil - Low Level

SPE-002-L / Lot {EncryptedLotCode}

	Units	Assigned Value	Study Mean	Study Std. Dev.	Gravimetric Value
Acetone 4315 Volatiles - Low Level (Solids)	µg/Kg	293.00	293.00	148.00	185 ± 1.8
Acetonitrile 4320 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00
Acrolein (Propenal) 4325 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00
T-amylmethylether (TAME) 4370 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00
Benzene 4375 Volatiles - Low Level (Solids)	µg/Kg	145.00	144.00	13.60	147 ± 1.42
Bromobenzene 4385 Volatiles - Low Level (Solids)	µg/Kg	155.00	155.00	14.80	154 ± 1.49
Bromodichloromethane 4395 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00
Bromoform 4400 Volatiles - Low Level (Solids)	µg/Kg	167.00	171.00	18.30	168 ± 1.63
2-Butanone (Methyl ethyl ketone, MEK) 4410 Volatiles - Low Level (Solids)	µg/Kg	291.00	291.00	121.00	234 ± 2.27
Carbon disulfide 4450 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00
Carbon tetrachloride 4455 Volatiles - Low Level (Solids)	µg/Kg	164.00	161.00	24.30	167 ± 1.62
Chlorobenzene 4475 Volatiles - Low Level (Solids)	µg/Kg	168.00	175.00	14.20	172 ± 1.67
Chloroethane 4485 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00
2-Chloroethyl vinyl ether 4500 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00
Chloroform 4505 Volatiles - Low Level (Solids)	µg/Kg	67.70	65.80	7.99	67.6 ± 0.66
1,2-Dibromo-3-chloropropane (DBCP) 4570 Volatiles - Low Level (Solids)	µg/Kg	95.40	95.40	12.60	94.7 ± 0.92
Dibromochloromethane 4575 Volatiles - Low Level (Solids)	µg/Kg	143.00	142.00	17.30	144 ± 1.4
1,2-Dibromoethane (EDB, Ethylene dibromide) 4585 Volatiles - Low Level (Solids)	µg/Kg	179.00	179.00	18.00	173 ± 1.68
Dibromomethane 4595 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00
1,2-Dichlorobenzene 4610 Volatiles - Low Level (Solids)	µg/Kg	169.00	180.00	22.70	178 ± 1.73
1,3-Dichlorobenzene 4615 Volatiles - Low Level (Solids)	µg/Kg	55.40	61.50	9.97	60.3 ± 0.58
1,4-Dichlorobenzene 4620 Volatiles - Low Level (Solids)	µg/Kg	77.50	90.40	8.91	87.8 ± 0.85
Dichlorodifluoromethane 4625 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00
1,1-Dichloroethane 4630 Volatiles - Low Level (Solids)	µg/Kg	153.00	150.00	14.20	152 ± 1.47
1,2-Dichloroethane 4635 Volatiles - Low Level (Solids)	µg/Kg	125.00	124.00	16.30	127 ± 1.23
1,1-Dichloroethylene 4640 Volatiles - Low Level (Solids)	µg/Kg	86.00	86.00	15.00	89.6 ± 0.87
cis-1,2-Dichloroethylene 4645 Volatiles - Low Level (Solids)	µg/Kg	125.00	125.00	19.00	128 ± 1.24
1,2-Dichloropropane 4655 Volatiles - Low Level (Solids)	µg/Kg	105.00	112.00	7.25	109 ± 1.05
cis-1,3-Dichloropropene 4680 Volatiles - Low Level (Solids)	µg/Kg	56.40	56.40	7.76	55.5 ± 0.54
trans-1,3-Dichloropropene 4685 Volatiles - Low Level (Solids)	µg/Kg	166.00	166.00	30.40	164 ± 1.59
trans-1,2-Dichloroethylene 4700 Volatiles - Low Level (Solids)	µg/Kg	78.00	78.00	12.30	77.8 ± 0.75
Ethylbenzene 4765 Volatiles - Low Level (Solids)	µg/Kg	114.00	117.00	13.30	115 ± 1.11
Hexachlorobutadiene 4835 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00
2-Hexanone 4860 Volatiles - Low Level (Solids)	µg/Kg	372.00	372.00	133.00	301 ± 2.92

VOAs in Soil - Low Level

SPE-002-L / Lot {EncryptedLotCode}

(continued)

	Units	Assigned Value	Study Mean	Study Std. Dev.	Gravimetric Value
Isopropylbenzene 4900 Volatiles - Low Level (Solids)	µg/Kg	69.30	69.30	8.39	64.8 ± 0.63
Methyl bromide (Bromomethane) 4950 Volatiles - Low Level (Solids)	µg/Kg	25.30	25.30	9.31	157 ± 1.52
Methyl chloride (Chloromethane) 4960 Volatiles - Low Level (Solids)	µg/Kg	59.40	59.40	16.20	173 ± 1.68
Methylene chloride (Dichloromethane) 4975 Volatiles - Low Level (Solids)	µg/Kg	85.00	79.50	11.90	88.1 ± 0.85
4-Methyl-2-pentanone (MIBK) 4995 Volatiles - Low Level (Solids)	µg/Kg	209.00	218.00	70.70	209 ± 2.03
Methyl tert-butyl ether (MTBE) 5000 Volatiles - Low Level (Solids)	µg/Kg	38.50	35.70	5.26	37.0 ± 0.36
Naphthalene 5005 Volatiles - Low Level (Solids)	µg/Kg	159.00	159.00	39.60	169 ± 1.64
Styrene 5100 Volatiles - Low Level (Solids)	µg/Kg	135.00	135.00	17.40	131 ± 1.27
1,1,1,2-Tetrachloroethane 5105 Volatiles - Low Level (Solids)	µg/Kg	77.40	77.70	9.81	76.4 ± 0.74
1,1,2,2-Tetrachloroethane 5110 Volatiles - Low Level (Solids)	µg/Kg	130.00	132.00	15.70	132 ± 1.28
Tetrachloroethylene (Perchloroethylene) 5115 Volatiles - Low Level (Solids)	µg/Kg	46.60	47.90	7.67	49.6 ± 0.48
Toluene 5140 Volatiles - Low Level (Solids)	µg/Kg	89.20	86.30	12.20	90.1 ± 0.87
1,2,4-Trichlorobenzene 5155 Volatiles - Low Level (Solids)	µg/Kg	86.50	86.50	15.10	86.1 ± 0.84
1,1,1-Trichloroethane 5160 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00
1,1,2-Trichloroethane 5165 Volatiles - Low Level (Solids)	µg/Kg	121.00	126.00	12.90	123 ± 1.19
Trichloroethene (Trichloroethylene) 5170 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00
Trichlorofluoromethane 5175 Volatiles - Low Level (Solids)	µg/Kg	162.00	162.00	31.60	169 ± 1.64
1,2,3-Trichloropropane 5180 Volatiles - Low Level (Solids)	µg/Kg	77.90	77.90	14.00	82.7 ± 0.8
1,2,4-Trimethylbenzene 5210 Volatiles - Low Level (Solids)	µg/Kg	150.00	150.00	24.10	145 ± 1.4
1,3,5-Trimethylbenzene 5215 Volatiles - Low Level (Solids)	µg/Kg	71.40	71.40	9.71	67.7 ± 0.66
Vinyl acetate 5225 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00
Vinyl chloride 5235 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00
m+p-Xylene 5240 Volatiles - Low Level (Solids)	µg/Kg	85.30	83.70	14.10	86.3 ± 0.837
o-Xylene 5250 Volatiles - Low Level (Solids)	µg/Kg	90.80	89.70	12.50	91.9 ± 0.89
Xylene, total 5260 Volatiles - Low Level (Solids)	µg/Kg	175.00	184.00	21.00	178 ± 1.73
Di-isopropylether (DIPE) 9375 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00

TCLP Metals in Soil

SPE-005 / Lot {EncryptedLotCode}

	Units	Assigned Value	Study Mean	Study Std. Dev.	Gravimetric Value
Arsenic, As 1010 TCLP Metals	mg/L	5.83	5.83	0.67	6.87
Barium, Ba 1015 TCLP Metals	mg/L	0.58	0.58	0.12	0.571
Beryllium, Be 1020 TCLP Metals	mg/L	0.00			0.00
Cadmium, Cd 1030 TCLP Metals	mg/L	5.55	5.55	0.47	5.66
Chromium, Cr (total) 1040 TCLP Metals	mg/L	0.43	0.43	0.08	0.465

TCLP Metals in Soil

SPE-005 / Lot {EncryptedLotCode}

(continued)	Units	Assigned Value	Study Mean	Study Std. Dev.	Gravimetric Value
Copper, Cu 1055 TCLP Metals	mg/L	0.39	0.39	0.04	0.500
Lead, Pb 1075 TCLP Metals	mg/L	1.40	1.40	0.21	1.55
Mercury, Hg 1095 TCLP Metals	mg/L	0.13	0.13	0.03	0.109
Molybdenum, Mo 1100 TCLP Metals	mg/L	0.00			0.00
Nickel, Ni 1105 TCLP Metals	mg/L	2.95	2.95	0.23	3.50
Selenium, Se 1140 TCLP Metals	mg/L	4.37	4.37	0.61	3.85
Silver, Ag 1150 TCLP Metals	mg/L	0.03	0.03	0.02	0.0227
Zinc, Zn 1190 TCLP Metals	mg/L	1.96	1.96	0.20	2.00
Extraction Fluid 1311 TCLP Metals		1.00			1.00

Corrosivity - Soil

SPE-023 / Lot {EncryptedLotCode}

	Units	Assigned Value	Study Mean	Study Std. Dev.	Gravimetric Value
pH 1900 Miscellaneous Analytes	Units	7.35	7.34	0.08	7.35 ± 0.039

Flash Point

SPE-029 / Lot {EncryptedLotCode}

	Units	Assigned Value	Study Mean	Study Std. Dev.	Gravimetric Value
Ignitability (Flashpoint, °F) 1780 Miscellaneous Analytes	°F	170.00	169.00	6.73	170 ± 1.6

Uranium in Soil

SPE-071 / Lot {EncryptedLotCode}

	Units	Assigned Value	Study Mean	Study Std. Dev.	Gravimetric Value
Uranium, U 3035 Trace Metals	mg/Kg	247.00	231.00	1.75	247 ± 1.26

Definitions:

Assigned Value: Value attributed to a particular quantity and accepted, sometimes by convention, as having an uncertainty appropriate for a give purpose. See ISO Guide 43 for additional information.

Accept. Window: The range of values that constitute acceptable performance for a laboratory participation in this PT study.

Z: A Z-Score tells how a single data point compares to normal data. A Z-Score says not only whether a point was above or below average, but how unusual the measurement is. Generally, a method result with a Z-Score less than |2| is considered to be in control, a Z-Score between |2| and |3| is considered 'Questionable', but still within control and a Z greater than |3| is considered not acceptable and the method is out of control.

Study Mean: Statistical study mean calculated using a robust statisitical model (RTC employs the 'Biweight Program'). Robust statistical techniques to minimize the influence that extreme results can have on estimates of the mean and standard deviation NOTE - These techniques assign less weight to extreme results, rather than eliminate them from a data set.

Study Std. Dev.: Standard deviation calculated from study data using robust statisicals (Biweight).

Gravimetric Value: The prepared to value, determined by gravimetric means. The uncertainty associated to this value is standard uncertainty and based on RTC's gravimetric tolerances.

Program analyte accrediting footnotes

[1] NELAC
[2] EPA
[3] Other
[4] A2LA
[5] NELAC Experimental

PERFORMANCE EVALUATION

First Choice for Quality | RTC

Off-study
LPTP09-2-186

4-May-2009 through 3-Jun-2009

RT1014
RTC Labcode

WY00002
US EPA Labcode

Energy Laboratories
Steven Carlston
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Thank you for participating in study LPTP09-2-186. Additional information about this study may be found online at www.rt-corp.com If you have any questions or comments about this study please contact me.

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Sincerely,

Christopher Rucinski
Quality Director

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ACCREDITED
Certificate # 2122.01

Dataset

LPTP09-2-186_Set_1

Accreditors

Evaluations of this dataset will be sent to the accreditor(s) listed below using your laboratory's labcode listed above each accrediting agency. If any of the information listed below is incorrect, please contact RTC immediately.

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Trace Metals

Analysis
EPA 7471A 1 (1994)

Method Number 10166208

Trace Metals (continued)

Analysis
EPA 7471A 1 (1994)

(continued)
Method Number 10166208

	Result Units	Assigned Value	Accept.	Z	Evaluation
Mercury, Hg 1, 4 1095 / 001 - Lot 012741 /Analyst: jp/ Analysis Date: 5/29/09	**28.2** mg/Kg	24.70	12.7 to 36.7	0.88	**Acceptable**

Volatiles - Low Level (Solids)

Analysis
EPA 8260B 2 (1996)

Method Number 10184802

	Result Units	Assigned Value	Accept.	Z	Evaluation
1,2-Dibromo-3-chloropropane (DBCP) 4, 5 4570 / 002-L - Lot 014100 /Analyst: jlr/ Analysis Date: 5/19/09	**37.7** µg/Kg	54.40	7.82 to 101	-1.08	**Acceptable**
1,2,4-Trichlorobenzene 1, 4 5155 / 002-L - Lot 014100 /Analyst: jlr/ Analysis Date: 5/19/09	**42.0** µg/Kg	55.50	22.5 to 88.6	-1.23	**Acceptable**

End of LPTP09-2-186_Set_1

Dataset

LPTP09-2-186_Set_2

Accreditors

Evaluations of this dataset will be sent to the accreditor(s) listed below using your laboratory's labcode listed above each accrediting agency. If any of the information listed below is incorrect, please contact RTC immediately.

Accrediting Labcode WY00002
Colorado Dept. of Public Health & Environment

451 Ben Chouaf
Certifcation Officer
8100 Lowry Boulevard
Denver CO 80230-6928
UNITED STATES

Accrediting Labcode WY00002
Florida Dept. of Health

229 Stephen Arms
PO Box 210
1217 Pearl Street
Jacksonville FL 32231
UNITED STATES

Accrediting Labcode WY00002
Idaho Bureau of Laboratories

346 Renea Anglin
Chemistry Program
2220 Old Penitentiary Road
Boise ID 83712
UNITED STATES

Accrediting Labcode WY00002
Montana Dept. of Public Health & Human Services
Environmental Laboratory Services

235 Judy Halm
PO Box 4369
Helena MT 59604-4369
UNITED STATES

Accrediting Labcode WY00002
Nebraska Health and Human Services System
Department of Regulation & Licensure

504 Sandra Irons
State Certification Officer
3701 S. 14th Street
Lincoln NE 68502
UNITED STATES

Accrediting Labcode WY00002
Nevada Division of Env. Protection

118 Donald Lafara
901 S. Stewart Street
Ste. 4001
Carson City NV 89701-5249
UNITED STATES

Accrediting Labcode E87641
New Mexico Environmental Department

275 Oneva Rivera
Laboratory Certification Coordinator - WS
Drinking Water Bureau
525 Camino de los Marquez Ste. #4
Santa Fe NM 87502-6110
UNITED STATES

Accrediting Labcode WY00002
South Dakota DENR

364 Mike Smith
Health Lab
Joe Foss Building - Chemistry
523 E. Capital
Pierre SD 57501-3181
UNITED STATES

Accrediting Labcode T104704181-05-TX
Texas CEQ

384 Frank Jamison
Quality Assurance/Laboratory Accreditation
PO Box 13087 (MC-176)
Austin TX 78711-3087
UNITED STATES

Accrediting Labcode WY00002
USEPA Region VIII

217 Jim Gindelberger
1595 Wynkoop Street
Denver CO 80202-1129
UNITED STATES

Accrediting Labcode WY00002
Utah Bureau of Laboratory Improvement

215 Kristin Brown
PO Box 142109
Salt Lake City UT 84114-2109
UNITED STATES

Accrediting Labcode WY00002
Wyoming DEQ
Water Quality Division
206 Edward Mock
122 W. 25th Street
Cheyenne WY 82002
UNITED STATES

Volatiles - Low Level (Solids)

Analysis
EPA 8021B 2 (1996)

Method Number 10174808

Volatiles - Low Level (Solids) (continued)

Analysis
EPA 8021B 2 (1996)

(continued)
Method Number 10174808

	Result Units	Assigned Value	Accept.	Z	Evaluation
Methyl tert-butyl ether (MTBE) 1, 4 5000 / 002-L - Lot 014100 /Analyst: jlr/ Analysis Date: 5/9/09	**<200** µg/Kg	74.70	31.9 to 118		**Acceptable**

End of LPTP09-2-186_Set_2

Sample Information

Metals in Soil

SPE-001 / Lot {EncryptedLotCode}

	Units	Assigned Value	Study Mean	Study Std. Dev.	Gravimetric Value
Mercury, Hg 1095 Trace Metals	mg/Kg	24.70	24.70	3.49	31.0

VOAs in Soil - Low Level

SPE-002-L / Lot {EncryptedLotCode}

	Units	Assigned Value	Study Mean	Study Std. Dev.	Gravimetric Value
1,2-Dibromo-3-chloropropane (DBCP) 4570 Volatiles - Low Level (Solids)	µg/Kg	54.40	54.40	15.50	55.1 ± 0.53
Methyl tert-butyl ether (MTBE) 5000 Volatiles - Low Level (Solids)	µg/Kg	74.70	77.00	14.80	76.5 ± 0.74
1,2,4-Trichlorobenzene 5155 Volatiles - Low Level (Solids)	µg/Kg	55.50	55.50	11.00	57.0 ± 0.55

Definitions:

Assigned Value: Value attributed to a particular quantity and accepted, sometimes by convention, as having an uncertainty appropriate for a give purpose. See ISO Guide 43 for additional information.

Accept. Window: The range of values that constitute acceptable performance for a laboratory participation in this PT study.

Z: A Z-Score tells how a single data point compares to normal data. A Z-Score says not only whether a point was above or below average, but how unusual the measurement is. Generally, a method result with a Z-Score less than |2| is considered to be in control, a Z-Score between |2| and |3| is considered 'Questionable', but still within control and a Z greater than |3| is considered not acceptable and the method is out of control.

Study Mean: Statistical study mean calculated using a robust statisitical model (RTC employs the 'Biweight Program'). Robust statistical techniques to minimize the influence that extreme results can have on estimates of the mean and standard deviation NOTE - These techniques assign less weight to extreme results, rather than eliminate them from a data set.

Study Std. Dev.: Standard deviation calculated from study data using robust statisicals (Biweight).

Gravimetric Value: The prepared to value, determined by gravimetric means. The uncertainty associated to this value is standard uncertainty and based on RTC's gravimetric tolerances.

Program analyte accrediting footnotes

[1] NELAC
[2] EPA
[3] Other
[4] A2LA
[5] NELAC Experimental

PERFORMANCE EVALUATION

First Choice for Quality | RTC

Off-study
LPTP09-2-217

20-May-2009 through 28-May-2009

RT1014
RTC Labcode

WY00002
US EPA Labcode

Energy Laboratories
Steven Carlston
PO BOX 3258
Casper WY 82602-3258

Thank you for participating in study LPTP09-2-217. Additional information about this study may be found online at www.rt-corp.com If you have any questions or comments about this study please contact me.

This report shall not be reproduced except in full, without written approval of the laboratory. RTC is accredited by A2LA to perform PT programs for the scope of accreditation under A2LA certificate 2122.01.A laboratory may not claim endorsement by A2LA or any other federal agency.

This report may contain data that are not covered by the A2LA accreditation.

Sincerely,

Christopher Rucinski
Quality Director

2931 Soldier Springs Road
Laramie, WY 82070
(307) 742-5452
www.rt-corp.com

ACCREDITED
Certificate # 2122.01

Dataset

LPTP09-2-217_Set_1

Accreditors

Evaluations of this dataset will be sent to the accreditor(s) listed below using your laboratory's labcode listed above each accrediting agency. If any of the information listed below is incorrect, please contact RTC immediately.

Accrediting Labcode WY00002
Colorado Dept. of Public Health & Environment

451 Ben Chouaf
Certifcation Officer
8100 Lowry Boulevard
Denver CO 80230-6928
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Accrediting Labcode WY00002
Florida Dept. of Health

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PO Box 210
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Jacksonville FL 32231
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Accrediting Labcode WY00002
Idaho Bureau of Laboratories

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2220 Old Penitentiary Road
Boise ID 83712
UNITED STATES

Accrediting Labcode WY00002
Montana Dept. of Public Health & Human Services
Environmental Laboratory Services

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PO Box 4369
Helena MT 59604-4369
UNITED STATES

Accrediting Labcode WY00002
Nebraska Health and Human Services System
Department of Regulation & Licensure

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State Certification Officer
3701 S. 14th Street
Lincoln NE 68502
UNITED STATES

Accrediting Labcode WY00002
Nevada Division of Env. Protection

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901 S. Stewart Street
Ste. 4001
Carson City NV 89701-5249
UNITED STATES

Accrediting Labcode E87641
New Mexico Environmental Department

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Drinking Water Bureau
525 Camino de los Marquez Ste. #4
Santa Fe NM 87502-6110
UNITED STATES

Accrediting Labcode T104704181-05-TX
Texas CEQ

384 Frank Jamison
Quality Assurance/Laboratory Accreditation
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Austin TX 78711-3087
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Accrediting Labcode WY00002
USEPA Region VIII

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1595 Wynkoop Street
Denver CO 80202-1129
UNITED STATES

Accrediting Labcode WY00002
Utah Bureau of Laboratory Improvement

215 Kristin Brown
PO Box 142109
Salt Lake City UT 84114-2109
UNITED STATES

Accrediting Labcode WY00002
Wyoming DEQ
Water Quality Division
206 Edward Mock
122 W. 25th Street
Cheyenne WY 82002
UNITED STATES

Miscellaneous Analytes

Analysis
EPA 9095A (1996) — Method Number 10204203

	Result Units	Assigned Value	Accept.	Z	Evaluation
Free liquid 1745 / 075 - Lot 015091 /Analyst: cm/ Analysis Date: 5/27/09	**FAIL** mL	10.00	5.50 to 14.5		**Acceptable**

End of LPTP09-2-217_Set_1

Sample Information

ree Liquids in Paint
SPE-075 / Lot {EncryptedLotCode}

	Units	Assigned Value	Study Mean	Study Std. Dev.	Gravimetric Value
Free liquid 1745 Miscellaneous Analytes	mL	10.00			10.0

Definitions:

Assigned Value: Value attributed to a particular quantity and accepted, sometimes by convention, as having an uncertainty appropriate for a give purpose. See ISO Guide 43 for additional information.

Accept. Window: The range of values that constitute acceptable performance for a laboratory participation in this PT study.

Z: A Z-Score tells how a single data point compares to normal data. A Z-Score says not only whether a point was above or below average, but how unusual the measurement is. Generally, a method result with a Z-Score less than |2| is considered to be in control, a Z-Score between |2| and |3| is considered 'Questionable', but still within control and a Z greater than |3| is considered not acceptable and the method is out of control.

Study Mean: Statistical study mean calculated using a robust statisitical model (RTC employs the 'Biweight Program'). Robust statistical techniques to minimize the influence that extreme results can have on estimates of the mean and standard deviation NOTE - These techniques assign less weight to extreme results, rather than eliminate them from a data set.

Study Std. Dev.: Standard deviation calculated from study data using robust statisicals (Biweight).

Gravimetric Value: The prepared to value, determined by gravimetric means. The uncertainty associated to this value is standard uncertainty and based on RTC's gravimetric tolerances.

rogram analyte accrediting footnotes
- 1 NELAC
- 2 EPA
- 3 Other
- 4 A2LA
- 5 NELAC Experimental

RESPONSE TO TR_RAIS FROM ERG

From: Dave Blaida [dblaida@energylab.com]
Sent: Monday, July 26, 2010 8:59 AM
To: Mike Schierman
Subject: RE:
Mike,
My responses below.
Gross gamma is placed in our reports as a "placeholder", in short a way to show all the gammas when summed together. Since no other gammas were analyzed except bismuth 214/radium 226 the gross gamma radium 226 and the gross gamma would be identical on the report. Hopefully this will explain your concerns. If any further questions feel free to contact me.
Regards,
Dave Blaida
307.995.3207 direct
-----Original Message-----
From: Mike Schierman [mailto:MikeSchierman@ergoffice.com]
Sent: Sunday, July 25, 2010 16:46
To: dblaida@energylab.com
Subject: FW:

David,

Please see the email I sent to Linda Larson of the Rapid City office. I received an out of office message stating she will be gone until August 6th. I was hoping you could help me prior to that.

Thanks

Mike Schierman, CHP
Senior Health Physicist
ERG
Environmental Restoration Group, Inc.
8809 Washington St. NE
Suite 150
Albuquerque, NM 87113
phone: (505) 298-4224
fax: (505) 797-1404

check us out at: http://www.ERGoffice.com

-----Original Message-----
From: Mike Schierman
Sent: Sunday, July 25, 2010 4:42 PM
To: 'llarson@energylab.com'
Subject:

Hi Linda,

We have received comments from the NRC regarding data collected at the Dewey-Burdock. Some of these involved chemical methods used by ELI and I have been able to respond to most of them. One I cannot respond is below. Could you please have the folks in Casper address this comment. We want to get all responses completed by the end of the month. Attached is the data specific to the question.

"Laboratory analytical reports for Ra-226 soil sample analyses are located in Appendix 2.9-A of the TR. It is not clear what type of gamma analysis was performed on the soil samples to determine the Ra-226 concentration.[Dave Blaida] EPA 901.1 is reference method. Closed can gamma analysis per a three(3) inch can filled with about 150-200 grams of soil. Soil is dried, ground, split. canned and taped. For example, the testing method for sample R07100004-003 (SMA-B03) is annotated as "Gross Gamma" on the Analytical Summary Report, but the results are listed as "Ra-226 Gamma" on the Laboratory Analytical Report.[Dave Blaida] The results are listed as radium 226 gamma which is ascertained by measuring the 609 kev peak of bismuth 214. Far and away the best photo peak to use since it's branching ratio(relative strength) is higher than any other pertinent energies. The radium 226 photo peak cannot be used due to it's overlap with the uranium 235 photo peak. Lead 214 has two(2) quantifiable energies at 295 and 352 kev that are used by some but bismuth 214 is cleaner with less background issues relating to Compton scatter. Consistent with Regulatory Guide 4.14, please provide laboratory documentation that specifies the photopeak energies used to determine the Ra-226 activity of the soil samples as reported in the Laboratory Analytical Report."

Thanks for your help.

Mike Schierman, CHP
Senior Health Physicist
ERG
Environmental Restoration Group, Inc.
8809 Washington St. NE
Suite 150
Albuquerque, NM 87113
phone: (505) 298-4224
fax: (505) 797-1404

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ENERGY LABORATORIES, INC. * 2821 Plant St * Rapid City, SD 57702
Toll Free 888.672.1225 * 605.342.1225 * FAX 605.342.1397 * rapid_city@energylab.com

LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060341-001
Client Sample ID: DewBurd CHR05S

Report Date: 08/28/08
Collection Date: 06/17/08 10:40
Date Received: 06/18/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	1.7	pCi/g-dry	U			1	E909.0M	07/15/08 08:30/eli-c
Lead 210 precision (±)	2.0	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Lead 210 MDC	3.3	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Radium 226	2.1	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 precision (±)	0.2	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Thorium 230	1.9	pCi/g-dry		0.1		1	E907.0	07/14/08 21:06/eli-c
Thorium 230 precision (±)	0.4	pCi/g-dry				1	E907.0	07/14/08 21:06/eli-c
TOTAL METALS ANALYSES								
Uranium	6.2	mg/kg-dry		0.50		10	SW6020	07/07/08 22:23/eli-c
Uranium, Activity	4.2	pCi/g-dry		0.34		10	SW6020	07/07/08 22:23/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060341-002
Client Sample ID: Dew Burd BVC01S

Report Date: 08/28/08
Collection Date: 06/17/08 11:00
Date Received: 06/18/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	0.5	pCi/g-dry	U			1	E909.0M	07/15/08 08:30/eli-c
Lead 210 precision (±)	2.0	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Lead 210 MDC	3.3	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Radium 226	1.3	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 precision (±)	0.2	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Thorium 230	0.8	pCi/g-dry		0.1		1	E907.0	07/16/08 09:00/eli-c
Thorium 230 precision (±)	0.2	pCi/g-dry				1	E907.0	07/16/08 09:00/eli-c
TOTAL METALS ANALYSES								
Uranium	2.0	mg/kg-dry		0.50		10	SW6020	07/07/08 22:37/eli-c
Uranium, Activity	1.4	pCi/g-dry		0.34		10	SW6020	07/07/08 22:37/eli-c

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QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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Toll Free 888.672.1225 * 605.342.1225 * FAX 605.342.1397 * rapid_city@energylab.com

LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060341-003
Client Sample ID: DewBurd CHR01S

Report Date: 08/28/08
Collection Date: 06/17/08 11:35
Date Received: 06/18/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	0.2	pCi/g-dry	U			1	E909.0M	07/15/08 08:30/eli-c
Lead 210 precision (±)	2.0	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Lead 210 MDC	3.3	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Radium 226	1.0	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 precision (±)	0.2	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Thorium 230	0.6	pCi/g-dry		0.1		1	E907.0	07/14/08 21:06/eli-c
Thorium 230 precision (±)	0.2	pCi/g-dry				1	E907.0	07/14/08 21:06/eli-c
TOTAL METALS ANALYSES								
Uranium	1.7	mg/kg-dry		0.50		10	SW6020	07/07/08 22:43/eli-c
Uranium, Activity	1.2	pCi/g-dry		0.34		10	SW6020	07/07/08 22:43/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

ENERGY LABORATORIES, INC. * 2821 Plant St * Rapid City, SD 57702
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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060341-004
Client Sample ID: DewBurd BVC04S

Report Date: 08/28/08
Collection Date: 06/17/08 12:17
Date Received: 06/18/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	1.9	pCi/g-dry	U			1	E909.0M	07/15/08 08:30/eli-c
Lead 210 precision (±)	2.1	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Lead 210 MDC	3.4	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Radium 226	1.5	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 precision (±)	0.2	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Thorium 230	0.7	pCi/g-dry		0.1		1	E907.0	07/14/08 21:06/eli-c
Thorium 230 precision (±)	0.2	pCi/g-dry				1	E907.0	07/14/08 21:06/eli-c
TOTAL METALS ANALYSES								
Uranium	2.0	mg/kg-dry		0.50		10	SW6020	07/07/08 22:50/eli-c
Uranium, Activity	1.3	pCi/g-dry		0.34		10	SW6020	07/07/08 22:50/eli-c

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RL - Analyte reporting limit.
QCL - Quality control limit.
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MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060341-005
Client Sample ID: DewBurd PSC01S

Report Date: 08/28/08
Collection Date: 06/17/08 12:50
Date Received: 06/18/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	4.7	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Lead 210 precision (±)	2.1	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Lead 210 MDC	3.3	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Radium 226	2.9	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 precision (±)	0.3	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Thorium 230	2.0	pCi/g-dry		0.1		1	E907.0	07/14/08 21:06/eli-c
Thorium 230 precision (±)	0.5	pCi/g-dry				1	E907.0	07/14/08 21:06/eli-c
TOTAL METALS ANALYSES								
Uranium	3.9	mg/kg-dry		0.50		10	SW6020	07/07/08 22:57/eli-c
Uranium, Activity	2.6	pCi/g-dry		0.34		10	SW6020	07/07/08 22:57/eli-c

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Toll Free 888.672.1225 * 605.342.1225 * FAX 605.342.1397 * rapid_city@energylab.com

LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060341-006
Client Sample ID: DewBurd SUB04S

Report Date: 08/28/08
Collection Date: 06/17/08 14:10
Date Received: 06/18/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	1.2	pCi/g-dry	U			1	E909.0M	07/15/08 08:30/eli-c
Lead 210 precision (±)	2.0	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Lead 210 MDC	3.3	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Radium 226	2.5	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 precision (±)	0.2	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Thorium 230	0.9	pCi/g-dry		0.1		1	E907.0	07/14/08 21:06/eli-c
Thorium 230 precision (±)	0.2	pCi/g-dry				1	E907.0	07/14/08 21:06/eli-c
TOTAL METALS ANALYSES								
Uranium	6.5	mg/kg-dry		0.50		10	SW6020	07/07/08 23:03/eli-c
Uranium, Activity	4.4	pCi/g-dry		0.34		10	SW6020	07/07/08 23:03/eli-c

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MCL - Maximum contaminant level.
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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060341-007
Client Sample ID: DewBurd PSC02S

Report Date: 08/28/08
Collection Date: 06/17/08 15:30
Date Received: 06/18/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	1.2	pCi/g-dry	U			1	E909.0M	07/15/08 08:30/eli-c
Lead 210 precision (±)	2.0	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Lead 210 MDC	3.3	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Radium 226	0.6	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Thorium 230	0.4	pCi/g-dry		0.1		1	E907.0	07/14/08 21:06/eli-c
Thorium 230 precision (±)	0.1	pCi/g-dry				1	E907.0	07/14/08 21:06/eli-c
TOTAL METALS ANALYSES								
Uranium	1.1	mg/kg-dry		0.50		10	SW6020	07/07/08 23:31/eli-c
Uranium, Activity	0.76	pCi/g-dry		0.34		10	SW6020	07/07/08 23:31/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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Toll Free 888.672.1225 * 605.342.1225 * FAX 605.342.1397 * rapid_city@energylab.com

QA/QC Summary Report

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)

Report Date: 08/28/08
Work Order: R08060341

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E903.0									Batch: C_18954
Sample ID: C08061146-004AMS	Sample Matrix Spike				Run: SUB-C104563				07/16/08 15:36
Radium 226	7.7	pCi/g-dry		100	70	130			
Sample ID: C08061146-004AMSD	Sample Matrix Spike Duplicate				Run: SUB-C104563				07/16/08 15:36
Radium 226	8.7	pCi/g-dry		125	70	130	12	20.9	
Sample ID: LCS-18954	Laboratory Control Sample				Run: SUB-C104563				07/16/08 15:36
Radium 226	0.017	pCi/g-dry		117	70	130			
Sample ID: MB-18954	Method Blank				Run: SUB-C104563				07/16/08 15:36
Radium 226	-0.002	pCi/g-dry							U
Method: E907.0									Batch: C_R104773
Sample ID: C08061133-004AMS	Sample Matrix Spike				Run: SUB-C104773				07/14/08 21:06
Thorium 230	7.06	pCi/g-dry	0.10	101	70	130			
Sample ID: C08061133-004AMSD	Sample Matrix Spike Duplicate				Run: SUB-C104773				07/14/08 21:06
Thorium 230	8.02	pCi/g-dry	0.10	124	70	130	13	30	
Sample ID: LCS-18954	Laboratory Control Sample				Run: SUB-C104773				07/15/08 12:58
Thorium 230	0.0531	pCi/g-dry	0.10	119	70	130			
Sample ID: MB-18954	Method Blank				Run: SUB-C104773				07/15/08 12:58
Thorium 230	0.0003	pCi/g-dry							U
Method: E909.0M									Batch: C_18954
Sample ID: R08060341-006A	Sample Matrix Spike				Run: SUB-C105490				07/15/08 08:30
Lead 210	47.2	pCi/g-dry		81	70	130			
Sample ID: R08060341-006A	Sample Matrix Spike Duplicate				Run: SUB-C105490				07/15/08 08:30
Lead 210	40.6	pCi/g-dry		70	70	130	15	30	
Sample ID: MB-R105490	Method Blank				Run: SUB-C105490				07/15/08 08:30
Lead 210	0.002	pCi/g-dry							U
Sample ID: LCS-R105490	Laboratory Control Sample				Run: SUB-C105490				07/15/08 08:30
Lead 210	0.111	pCi/g-dry		93	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

U - Not detected at minimum detectable concentration

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QA/QC Summary Report

Client: RESPEC Inc **Report Date:** 08/28/08
Project: Edgemont (Soils/Air filters) **Work Order:** R08060341

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020									Batch: C_18973
Sample ID: MB-18973	Method Blank				Run: SUB-C103823				07/07/08 22:10
Uranium	2E-05	mg/kg-dry	1E-06						
Sample ID: LCS3-18973	Laboratory Control Sample				Run: SUB-C103823				07/07/08 22:16
Uranium	1.8	mg/kg-dry	1.5	105	87.9	127			
Sample ID: C08061115-013AMS3	Sample Matrix Spike				Run: SUB-C103823				07/08/08 01:25
Uranium	26	mg/kg-dry	0.50	104	75	125			
Sample ID: C08061115-013AMSD3	Sample Matrix Spike Duplicate				Run: SUB-C103823				07/08/08 01:32
Uranium	27	mg/kg-dry	0.50	110	75	125	5.3	20	

Qualifiers:

RL - Analyte reporting limit. ND - Not detected at the reporting limit.

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

PLEASE PRINT- Provide as much information as possible.

Company Name: RESPEC	Project Name, PWS, Permit, Etc. Power Tech Dewey Burdock	Sample Origin State:	EPA/State Compliance: Yes ☐ No ☐
Report Mail Address:	Contact Name: Phone/Fax: cory.foreman@respec.com	Email:	Sampler: (Please Print) Eric Krantz
Invoice Address:	Invoice Contact & Phone:	Purchase Order:	Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

☐ DW ☐ A2LA
☐ GSA ☐ EDD/EDT(Electronic Data)
☐ POTW/WWTP Format: ______
☐ State: ______ ☐ LEVEL IV
☐ Other: ______ ☐ NELAC

Number of Containers / Sample Type: A W S V B O / Air Water Soils/Solids Vegetation Bioassay Other

ANALYSIS REQUESTED: As Per Quote

SEE ATTACHED

Normal Turnaround (TAT)

RUSH

Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page

Comments: all sediment samples

Shipped by:

Cooler ID(s):

Receipt Temp 4.2 °C

On Ice: Yes No

Custody Seal Y N

Intact Y N

Signature Match Y N

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Comments	LABORATORY USE ONLY
1	DewBurd CHR05s	6/17/08	10:40	S	Chey R. @ Marietta sediment	B08060341-001A
2	DewBurd BVC01s	6/17/08	11:00	S	Beaver Cr @ Anderson sediment	002A
3	DewBurd CHR01s	6/17/08	11:35	S	Chey @ Anderson sediment	003A
4	DewBurd BVC04s	6/17/08	12:17	S	Beaver Cr @ USGS sediment	004A
5	DewBurd PSC01s	6/17/08	12:50	S	Pass Cr. Spencer sediment	005A
6	DewBurd SUS04s	6/17/08	14:10	S	Cottonwood pond sediment	006A
7	DewBurd PSC02s	6/17/08	15:30	S	Pass Cr U/S sediment	007A
8						
9						
10						

Custody Record MUST be Signed

Relinquished by (print)	Date/Time	Signature	Received by (print)	Date/Time	Signature
Eric Krantz	6/12/08 0620	[signature]	Matt Stoltenberg	6-18-08 06:30	[signature]
Matt Stoltenberg	6/12/08 8:50	[signature]	Steve Froiland	6-18-08 8:50	[signature]

Sample Disposal: Return to Client: ______ Lab Disposal: ______

Received by Laboratory: Date/Time: Signature:

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.
Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

ENERGY LABORATORIES, INC. * 2821 Plant St * Rapid City, SD 57702
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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060358-001
Client Sample ID: DewBurd SUB01S

Report Date: 08/28/08
Collection Date: 06/18/08 12:05
Date Received: 06/19/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	0.5	pCi/g-dry	U			1	E909.0M	07/15/08 08:30/eli-c
Lead 210 precision (±)	2.0	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Lead 210 MDC	3.4	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Radium 226	1.2	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 precision (±)	0.2	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Thorium 230	0.7	pCi/g-dry		0.1		1	E907.0	07/14/08 21:06/eli-c
Thorium 230 precision (±)	0.2	pCi/g-dry				1	E907.0	07/14/08 21:06/eli-c
TOTAL METALS ANALYSES								
Uranium	2.2	mg/kg-dry		0.50		10	SW6020	07/19/08 08:23/eli-c
Uranium, Activity	1.5	pCi/g-dry		0.34		10	SW6020	07/19/08 08:23/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060358-002
Client Sample ID: DewBurd SUB02S

Report Date: 08/28/08
Collection Date: 06/18/08 13:15
Date Received: 06/19/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	2.8	pCi/g-dry	U			1	E909.0M	07/15/08 08:30/eli-c
Lead 210 precision (±)	2.1	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Lead 210 MDC	3.3	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Radium 226	3.9	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 precision (±)	0.3	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/16/08 13:33/eli-c
Thorium 230	2.9	pCi/g-dry		0.1		1	E907.0	07/14/08 21:06/eli-c
Thorium 230 precision (±)	0.7	pCi/g-dry				1	E907.0	07/14/08 21:06/eli-c
TOTAL METALS ANALYSES								
Uranium	18	mg/kg-dry		0.50		10	SW6020	07/19/08 08:36/eli-c
Uranium, Activity	12	pCi/g-dry		0.34		10	SW6020	07/19/08 08:36/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060358-003
Client Sample ID: DewBurd SUB03S

Report Date: 08/28/08
Collection Date: 06/18/08 14:10
Date Received: 06/19/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	3.9	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Lead 210 precision (±)	2.1	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Lead 210 MDC	3.3	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Radium 226	4.1	pCi/g-dry				1	E903.0	07/16/08 15:36/eli-c
Radium 226 precision (±)	0.3	pCi/g-dry				1	E903.0	07/16/08 15:36/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/16/08 15:36/eli-c
Thorium 230	2.1	pCi/g-dry		0.1		1	E907.0	07/14/08 21:06/eli-c
Thorium 230 precision (±)	0.6	pCi/g-dry				1	E907.0	07/14/08 21:06/eli-c
TOTAL METALS ANALYSES								
Uranium	7.2	mg/kg-dry		0.50		10	SW6020	07/19/08 08:43/eli-c
Uranium, Activity	4.8	pCi/g-dry		0.34		10	SW6020	07/19/08 08:43/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060358-004
Client Sample ID: DewBurd SUB05S

Report Date: 08/28/08
Collection Date: 06/18/08 15:15
Date Received: 06/19/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	4.2	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Lead 210 precision (±)	2.1	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Lead 210 MDC	3.3	pCi/g-dry				1	E909.0M	07/15/08 08:30/eli-c
Radium 226	4.2	pCi/g-dry				1	E903.0	07/16/08 15:36/eli-c
Radium 226 precision (±)	0.3	pCi/g-dry				1	E903.0	07/16/08 15:36/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/16/08 15:36/eli-c
Thorium 230	2.4	pCi/g-dry		0.1		1	E907.0	07/14/08 21:06/eli-c
Thorium 230 precision (±)	0.5	pCi/g-dry				1	E907.0	07/14/08 21:06/eli-c
TOTAL METALS ANALYSES								
Uranium	8.5	mg/kg-dry		0.50		10	SW6020	07/19/08 09:17/eli-c
Uranium, Activity	5.7	pCi/g-dry		0.34		10	SW6020	07/19/08 09:17/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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QA/QC Summary Report

Client: RESPEC Inc | **Report Date:** 08/28/08
Project: Edgemont (Soils/Air filters) | **Work Order:** R08060358

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E903.0									Batch: C_18954
Sample ID: C08061146-004AMS	Sample Matrix Spike				Run: SUB-C104563				07/16/08 15:36
Radium 226	7.7	pCi/g-dry		100	70	130			
Sample ID: C08061146-004AMSD	Sample Matrix Spike Duplicate				Run: SUB-C104563				07/16/08 15:36
Radium 226	8.7	pCi/g-dry		125	70	130	12	20.9	
Sample ID: LCS-18954	Laboratory Control Sample				Run: SUB-C104563				07/16/08 15:36
Radium 226	0.017	pCi/g-dry		117	70	130			
Sample ID: MB-18954	Method Blank				Run: SUB-C104563				07/16/08 15:36
Radium 226	-0.002	pCi/g-dry							U
Method: E907.0									Batch: C_R104773
Sample ID: C08061133-004AMS	Sample Matrix Spike				Run: SUB-C104773				07/14/08 21:06
Thorium 230	7.06	pCi/g-dry	0.10	101	70	130			
Sample ID: C08061133-004AMSD	Sample Matrix Spike Duplicate				Run: SUB-C104773				07/14/08 21:06
Thorium 230	8.02	pCi/g-dry	0.10	124	70	130	13	30	
Sample ID: LCS-18954	Laboratory Control Sample				Run: SUB-C104773				07/15/08 12:58
Thorium 230	0.0531	pCi/g-dry	0.10	119	70	130			
Sample ID: MB-18954	Method Blank				Run: SUB-C104773				07/15/08 12:58
Thorium 230	0.0003	pCi/g-dry							U
Method: E909.0M									Batch: C_18954
Sample ID: R08060341-006A	Sample Matrix Spike				Run: SUB-C105490				07/15/08 08:30
Lead 210	47.2	pCi/g-dry		81	70	130			
Sample ID: R08060341-006A	Sample Matrix Spike Duplicate				Run: SUB-C105490				07/15/08 08:30
Lead 210	40.6	pCi/g-dry		70	70	130	15	30	
Sample ID: MB-R105490	Method Blank				Run: SUB-C105490				07/15/08 08:30
Lead 210	0.002	pCi/g-dry							U
Sample ID: LCS-R105490	Laboratory Control Sample				Run: SUB-C105490				07/15/08 08:30
Lead 210	0.111	pCi/g-dry		93	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

U - Not detected at minimum detectable concentration

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QA/QC Summary Report

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)

Report Date: 08/28/08
Work Order: R08060358

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**									Batch: C_18974
Sample ID: **MB-18974**	Method Blank				Run: SUB-C103886				07/08/08 15:05
Uranium	5E-06	mg/kg-dry	1E-06						
Sample ID: **LCS3-18974**	Laboratory Control Sample				Run: SUB-C103886				07/08/08 15:11
Uranium	1.7	mg/kg-dry	0.50	99	87.9	127			
Sample ID: **C08061115-022A MS3**	Sample Matrix Spike				Run: SUB-C104503				07/19/08 09:58
Uranium	31	mg/kg-dry	0.50	119	75	125			
Sample ID: **C08061115-022A MSD3**	Sample Matrix Spike Duplicate				Run: SUB-C104503				07/19/08 10:04
Uranium	26	mg/kg-dry	0.50	118	75	125	17	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

PLEASE PRINT- Provide as much information as possible.

Company Name: RESPEC	Project Name, PWS, Permit, Etc. Powertech Dewey Burdock	Sample Origin State:	EPA/State Compliance: Yes ☐ No ☐
Report Mail Address:	Contact Name: Phone/Fax: cory.foreman@respec.com	Email:	Sampler: (Please Print) Eric Krantz
Invoice Address:	Invoice Contact & Phone:	Purchase Order:	Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

☐ DW ☐ A2LA
☐ GSA ☐ EDD/EDT (Electronic Data)
☐ POTW/WWTP Format: ________
☐ State: ________ ☐ LEVEL IV
☐ Other: ________ ☐ NELAC

Number of Containers Sample Type: A W S V B O Air Water Soils/Solids Vegetation Bioassay Other

ANALYSIS REQUESTED: As per Quote

SEE ATTACHED

Normal Turnaround (TAT)

RUSH

Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page

Comments: All sediment

Shipped by:

Cooler ID(s):

Receipt Temp 3.9 °C

On Ice: (Yes) No

Custody Seal Y N

Intact Y N

Signature Match Y N

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Comments	LABORATORY USE ONLY
1	DewBurd Sub 01s	6/18/08	12:05	S	Doran Ranch	B08060358-001A
2	DewBurd Sub 02s	6/18/08	13:15	S	Triangle 1.7	002A
3	DewBurd Sub 03s	6/18/08	14:10	S	N-cluster Pond	003A
4	DewBurd Sub 05s	6/18/08	15:15	S	weather station upstream	004A
5						
6						
7						
8						
9						
10						

Custody Record MUST be Signed

Relinquished by (print): Eric Krantz	Date/Time: 6/19/08 11:00	Signature: [signature]	Received by (print): Steve Froiland	Date/Time: 6-19-08 1100	Signature: [signature]
Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
Sample Disposal: Return to Client:	Lab Disposal:		Received by Laboratory:	Date/Time:	Signature:

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.
Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

Page ____ of ____

PLEASE PRINT, provide as much information as possible. Refer to corresponding notes on reverse side.

Company Name: LOWER BRULE SIOUX TRIBE	Project Name, PWS #, Permit #, Etc.: WATER QUALITY PROGRAM
Report Mail Address: 187 OYATE CIRCLE LOWER BRULE S.D. 57548	Contact Name, Phone, Fax, E-mail: 605-473-0163 GEORGE HONEYWELL — Sampler Name if other than Contact: GALEN GRASSROPE
Invoice Address: SAA	Invoice Contact & Phone #: SAA — Purchase Order #: — ELI Quote #:

Report Required For: POTW/WWTP ☐ DW ☐ Other ____

Special Report Formats - ELI must be notified prior to sample submittal for the following:
NELAC ☐ A2LA ☐ Level IV ☐
Other ____
EDD/EDT ☐ Format ____

ANALYSIS REQUESTED: TOTAL P+N — SEE ATTACHED — Normal Turnaround (TAT) — RUSH Turnaround (TAT)

Notify ELI prior to RUSH sample submittal for additional charges and scheduling

Shipped by: ____
Cooler ID(s): ____
Receipt Temp 8.8 °C
Custody Seal Y N
Intact Y N
Signature Match Y N

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX (Number of Containers, Sample Type: A W S V B O Air Water Soils/Solids Vegetation Bioassay Other)	TOTAL P+N	SEE ATTACHED	Normal TAT	RUSH TAT	Comments	Lab ID (LABORATORY USE ONLY)
1 CLARK RANCH MW ONE	6-17-08	12:25 PM	W-1	X				MW 1	B08060358-001A
2									
3									
4									
5									
6									
7									
8									
9									
10									

Custody Record MUST be Signed

Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
GALEN GRASSROPE	6-18-08 2:58	[signature]	Steve Froiland	6-19-08 1100	[signature]

Sample Disposal: Return to client: ____ Lab Disposal: ____

LABORATORY USE ONLY
Sample Type: ____ # of fractions ____

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.

Visit our web site at *www.energylab.com* for additional information, downloadable fee schedule, forms, & links.

ENERGY LABORATORIES, INC. * 2821 Plant St * Rapid City, SD 57702
Toll Free 888.672.1225 * 605.342.1225 * FAX 605.342.1397 * rapid_city@energylab.com

LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060402-001
Client Sample ID: DewBurd SUB08S

Report Date: 08/28/08
Collection Date: 06/23/08 12:25
Date Received: 06/24/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	0.6	pCi/g-dry	U			1	E909.0M	07/16/08 09:30/eli-c
Lead 210 precision (±)	2.1	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Lead 210 MDC	3.4	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Radium 226	0.6	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Thorium 230	0.4	pCi/g-dry		0.1		1	E907.0	07/15/08 13:01/eli-c
Thorium 230 precision (±)	0.1	pCi/g-dry				1	E907.0	07/15/08 13:01/eli-c
TOTAL METALS ANALYSES								
Uranium	1.2	mg/kg-dry		0.50		10	SW6020	07/14/08 09:43/eli-c
Uranium, Activity	0.80	pCi/g-dry		0.34		10	SW6020	07/14/08 09:43/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060402-002
Client Sample ID: DewBurd SUB09S

Report Date: 08/28/08
Collection Date: 06/23/08 12:55
Date Received: 06/24/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	1.5	pCi/g-dry	U			1	E909.0M	07/16/08 09:30/eli-c
Lead 210 precision (±)	2.0	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Lead 210 MDC	3.3	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Radium 226	1.0	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Radium 226 precision (±)	0.2	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Thorium 230	0.7	pCi/g-dry		0.1		1	E907.0	07/15/08 13:01/eli-c
Thorium 230 precision (±)	0.2	pCi/g-dry				1	E907.0	07/15/08 13:01/eli-c
TOTAL METALS ANALYSES								
Uranium	2.4	mg/kg-dry		0.50		10	SW6020	07/14/08 09:51/eli-c
Uranium, Activity	1.6	pCi/g-dry		0.34		10	SW6020	07/14/08 09:51/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060402-003
Client Sample ID: DewBurd SUB06S

Report Date: 08/28/08
Collection Date: 06/23/08 13:50
Date Received: 06/24/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	9.6	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Lead 210 precision (±)	2.2	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Lead 210 MDC	3.4	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Radium 226	8.6	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Radium 226 precision (±)	0.4	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Thorium 230	7.8	pCi/g-dry		0.1		1	E907.0	07/15/08 13:01/eli-c
Thorium 230 precision (±)	1.6	pCi/g-dry				1	E907.0	07/15/08 13:01/eli-c
TOTAL METALS ANALYSES								
Uranium	37	mg/kg-dry		0.50		10	SW6020	07/14/08 09:55/eli-c
Uranium, Activity	25	pCi/g-dry		0.34		10	SW6020	07/14/08 09:55/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060402-004
Client Sample ID: DewBurd SUB07S

Report Date: 08/28/08
Collection Date: 06/23/08 14:35
Date Received: 06/24/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	0.6	pCi/g-dry	U			1	E909.0M	07/16/08 09:30/eli-c
Lead 210 precision (±)	2.0	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Lead 210 MDC	3.3	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Radium 226	0.7	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Thorium 230	0.5	pCi/g-dry		0.1		1	E907.0	07/21/08 21:23/eli-c
Thorium 230 precision (±)	0.2	pCi/g-dry				1	E907.0	07/21/08 21:23/eli-c
TOTAL METALS ANALYSES								
Uranium	1.7	mg/kg-dry		0.50		10	SW6020	07/14/08 09:59/eli-c
Uranium, Activity	1.1	pCi/g-dry		0.34		10	SW6020	07/14/08 09:59/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060402-005
Client Sample ID: DewBurd SUB11S

Report Date: 08/28/08
Collection Date: 06/23/08 15:15
Date Received: 06/24/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	2.1	pCi/g-dry	U			1	E909.0M	07/16/08 09:30/eli-c
Lead 210 precision (±)	2.1	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Lead 210 MDC	3.4	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Radium 226	0.8	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Thorium 230	0.5	pCi/g-dry		0.1		1	E907.0	07/15/08 13:01/eli-c
Thorium 230 precision (±)	0.2	pCi/g-dry				1	E907.0	07/15/08 13:01/eli-c
TOTAL METALS ANALYSES								
Uranium	2.7	mg/kg-dry		0.50		10	SW6020	07/14/08 10:04/eli-c
Uranium, Activity	1.8	pCi/g-dry		0.34		10	SW6020	07/14/08 10:04/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060402-006
Client Sample ID: DewBurd UNT01S

Report Date: 08/28/08
Collection Date: 06/23/08 16:00
Date Received: 06/24/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	2.2	pCi/g-dry	U			1	E909.0M	07/16/08 09:30/eli-c
Lead 210 precision (±)	2.1	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Lead 210 MDC	3.4	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Radium 226	0.8	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Thorium 230	0.5	pCi/g-dry		0.1		1	E907.0	07/16/08 11:48/eli-c
Thorium 230 precision (±)	0.2	pCi/g-dry				1	E907.0	07/16/08 11:48/eli-c
TOTAL METALS ANALYSES								
Uranium	2.0	mg/kg-dry		0.50		10	SW6020	07/14/08 10:08/eli-c
Uranium, Activity	1.4	pCi/g-dry		0.34		10	SW6020	07/14/08 10:08/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060402-007
Client Sample ID: DewBurd SUB10S

Report Date: 08/28/08
Collection Date: 06/23/08 16:30
Date Received: 06/24/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	1.5	pCi/g-dry	U			1	E909.0M	07/16/08 09:30/eli-c
Lead 210 precision (±)	2.1	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Lead 210 MDC	3.4	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Radium 226	0.8	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Thorium 230	0.7	pCi/g-dry		0.1		1	E907.0	07/15/08 13:01/eli-c
Thorium 230 precision (±)	0.3	pCi/g-dry				1	E907.0	07/15/08 13:01/eli-c
TOTAL METALS ANALYSES								
Uranium	1.5	mg/kg-dry		0.50		10	SW6020	07/14/08 10:12/eli-c
Uranium, Activity	1.0	pCi/g-dry		0.34		10	SW6020	07/14/08 10:12/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08060402-008
Client Sample ID: DewBurd BEN01S

Report Date: 08/28/08
Collection Date: 06/23/08 17:30
Date Received: 06/24/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	2.3	pCi/g-dry	U			1	E909.0M	07/16/08 09:30/eli-c
Lead 210 precision (±)	2.1	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Lead 210 MDC	3.4	pCi/g-dry				1	E909.0M	07/16/08 09:30/eli-c
Radium 226	0.6	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	07/21/08 14:30/eli-c
Thorium 230	0.6	pCi/g-dry		0.1		1	E907.0	07/15/08 13:01/eli-c
Thorium 230 precision (±)	0.2	pCi/g-dry				1	E907.0	07/15/08 13:01/eli-c
TOTAL METALS ANALYSES								
Uranium	1.8	mg/kg-dry		0.50		10	SW6020	07/14/08 10:28/eli-c
Uranium, Activity	1.2	pCi/g-dry		0.34		10	SW6020	07/14/08 10:28/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

ENERGY LABORATORIES, INC. * 2821 Plant St * Rapid City, SD 57702
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QA/QC Summary Report

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)

Report Date: 08/28/08
Work Order: R08060402

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E903.0									Batch: C_R104615
Sample ID: LCS-18998	Laboratory Control Sample				Run: SUB-C104615				07/21/08 14:30
Radium 226	0.016	pCi/g-dry		111	70	130			
Sample ID: MB-18998	Method Blank				Run: SUB-C104615				07/21/08 16:28
Radium 226	-0.002	pCi/g-dry							U
Sample ID: C08061348-003AMS	Sample Matrix Spike				Run: SUB-C104615				07/21/08 16:28
Radium 226	10	pCi/g-dry		99	70	130			
Sample ID: C08061348-003AMSD	Sample Matrix Spike Duplicate				Run: SUB-C104615				07/21/08 16:28
Radium 226	10	pCi/g-dry		101	70	130	1.6	22	
Method: E907.0									Batch: C_18998
Sample ID: C08061293-016CMS	Sample Matrix Spike				Run: SUB-C104873				07/15/08 19:31
Thorium 230	6.15	pCi/g-dry	0.10	89	70	130			
Sample ID: C08061293-016CMSD	Sample Matrix Spike Duplicate				Run: SUB-C104873				07/15/08 19:31
Thorium 230	6.71	pCi/g-dry	0.10	113	70	130	8.8	30	
Sample ID: LCS-18998	Laboratory Control Sample				Run: SUB-C104873				07/15/08 19:31
Thorium 230	0.0576	pCi/g-dry	0.10	118	70	130			
Sample ID: MB-18998	Method Blank				Run: SUB-C104873				07/15/08 19:31
Thorium 230	0.0007	pCi/g-dry							U
Method: E907.0									Batch: C_R104911
Sample ID: C08061293-042CMS	Sample Matrix Spike				Run: SUB-C104911				07/21/08 21:23
Thorium 230	4.10	pCi/g-dry	0.10	106	70	130			
Sample ID: C08061293-042CMSD	Sample Matrix Spike Duplicate				Run: SUB-C104911				07/21/08 21:23
Thorium 230	3.62	pCi/g-dry	0.10	88	70	130	13	30	
Sample ID: LCS-19053	Laboratory Control Sample				Run: SUB-C104911				07/21/08 21:23
Thorium 230	0.0546	pCi/g-dry	0.10	114	70	130			
Sample ID: MB-19053	Method Blank				Run: SUB-C104911				07/21/08 21:23
Thorium 230	0.0006	pCi/g-dry							U

Qualifiers:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

ND - Not detected at the reporting limit.

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QA/QC Summary Report

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)

Report Date: 08/28/08
Work Order: R08060402

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E909.0M									Batch: C_R105493
Sample ID: C08061062-003AMS	Sample Matrix Spike				Run: SUB-C105493				07/16/08 09:30
Lead 210	0.0010	uCi/kg		82	70	130			
Sample ID: C08061062-003AMSD	Sample Matrix Spike Duplicate				Run: SUB-C105493				07/16/08 09:30
Lead 210	0.0012	uCi/kg		96	70	130	14	30	
Sample ID: MB-R105493	Method Blank				Run: SUB-C105493				07/16/08 09:30
Lead 210	0.002	pCi/g-dry							U
Sample ID: LCS-R105493	Laboratory Control Sample				Run: SUB-C105493				07/16/08 09:30
Lead 210	0.113	pCi/g-dry		94	70	130			
Method: SW6020									Batch: C_18986
Sample ID: MB-18986	Method Blank				Run: SUB-C104200				07/14/08 09:22
Uranium	2E-05	mg/kg-dry	1E-06						
Sample ID: LCS3-18986	Laboratory Control Sample				Run: SUB-C104200				07/14/08 09:39
Uranium	1.7	mg/kg-dry	0.50	99	87.9	127			
Sample ID: C08061293-016BMS3	Sample Matrix Spike				Run: SUB-C104200				07/14/08 11:37
Uranium	30	mg/kg-dry	0.50	101	75	125			
Sample ID: C08061293-016BMSD3	Sample Matrix Spike Duplicate				Run: SUB-C104200				07/14/08 11:41
Uranium	33	mg/kg-dry	0.50	111	75	125	6.7	20	

Qualifiers:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

ND - Not detected at the reporting limit.

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

Page 1 of 1

PLEASE PRINT- Provide as much information as possible.

Company Name: RESPEC	Project Name, PWS, Permit, Etc. Powertech Dewey Burdock	Sample Origin State: SD	EPA/State Compliance: Yes ☐ No ☐
Report Mail Address:	Contact Name: Phone/Fax: cory.foreman@respec.com	Email:	Sampler: (Please Print) Eric Krantz
Invoice Address:	Invoice Contact & Phone:	Purchase Order:	Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

☐ DW ☐ A2LA
☐ GSA ☐ EDD/EDT (Electronic Data)
☐ POTW/WWTP Format: ____
☐ State: ____ ☐ LEVEL IV
☐ Other: ____ ☐ NELAC

Number of Containers
Sample Type: A W S V B O
Air Water Soils/Solids Vegetation Bioassay Other

ANALYSIS REQUESTED: As Per Quote

SEE ATTACHED

Normal Turnaround (TAT)

RUSH

Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page

Comments: All Sediment

Shipped by:
Cooler ID(s):
Receipt Temp 6 °C
On Ice: Yes No
Custody Seal Y N
Intact Y N
Signature Match Y N

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX		LABORATORY USE ONLY
1	DewBurd Sub08s	6/23/08	12:25	S	Sundance Pond W	B08060402-001
2	Dew Burd Sub09s	6/23/08	12:55	S	Sundance Pond E.	002
3	DewBurd Sub06s	6/23/08	13:50	S	Darrow Pit	003
4	DewBurd Sub07s	6/23/08	14:35	S	Daniel Ranch N.	004
5	Dew Burd Sub 11s	6/23/08	15:15	S	Daniel Ranch S.	005
6	Dew Burd UNT01s	6/23/08	16:00	S	Unknown Trib	006
7	Dew Burd Sub10s	6/23/08	16:30	S	Narrow dam road [illegible]	007
8	Dew burd BEN01s	6/23/08	17:30	S	Bennet Canyon Trib	008
9						
10						

Custody Record MUST be Signed

Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
Eric Krantz	6/24/08 0545	[signature]	J. Hartman	6/24/08 800	Hartman
Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
Sample Disposal: Return to Client: ____ Lab Disposal: ____			Received by Laboratory:	Date/Time:	Signature:

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report. Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-001
Client Sample ID: DewBurd BEN01S

Report Date: 10/23/08
Collection Date: 08/21/08 09:02
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	2.0	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	0.6	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 MDC	0.08	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Thorium 230	0.5	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.02	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	2.4	mg/kg-dry		0.50		10	SW6020	09/07/08 02:16/eli-c
Uranium, Activity	1.6	pCi/g-dry		0.34		10	SW6020	09/07/08 02:16/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-002
Client Sample ID: DewBurd UNT01S

Report Date: 10/23/08
Collection Date: 08/21/08 09:23
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	1.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	0.7	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 MDC	0.09	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Thorium 230	1.0	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.03	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	2.5	mg/kg-dry		0.50		10	SW6020	09/07/08 02:27/eli-c
Uranium, Activity	1.7	pCi/g-dry		0.34		10	SW6020	09/07/08 02:27/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-003
Client Sample ID: DewBurd SUB10S

Report Date: 10/23/08
Collection Date: 08/21/08 09:38
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	0.9	pCi/g-dry	U			1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	0.6	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 MDC	0.09	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Thorium 230	0.7	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.03	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	2.1	mg/kg-dry		0.50		10	SW6020	09/07/08 02:32/eli-c
Uranium, Activity	1.4	pCi/g-dry		0.34		10	SW6020	09/07/08 02:32/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-004
Client Sample ID: DewBurd SUB11S

Report Date: 10/23/08
Collection Date: 08/21/08 09:56
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	1.5	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	0.6	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 MDC	0.08	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Thorium 230	0.8	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.03	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	1.8	mg/kg-dry		0.50		10	SW6020	09/07/08 02:37/eli-c
Uranium, Activity	1.2	pCi/g-dry		0.34		10	SW6020	09/07/08 02:37/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-005
Client Sample ID: DewBurd SUB07S

Report Date: 10/23/08
Collection Date: 08/21/08 10:09
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	1.9	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	0.4	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 MDC	0.1	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Thorium 230	0.9	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.03	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	2.2	mg/kg-dry		0.50		10	SW6020	09/07/08 02:43/eli-c
Uranium, Activity	1.5	pCi/g-dry		0.34		10	SW6020	09/07/08 02:43/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-006
Client Sample ID: DewBurd SUB06S

Report Date: 10/23/08
Collection Date: 08/21/08 10:36
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	4.0	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	5.2	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 precision (±)	0.3	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 MDC	0.09	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Thorium 230	5.9	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.07	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	32	mg/kg-dry		0.50		10	SW6020	09/07/08 02:48/eli-c
Uranium, Activity	22	pCi/g-dry		0.34		10	SW6020	09/07/08 02:48/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-007
Client Sample ID: DewBurd SUB05S

Report Date: 10/23/08
Collection Date: 08/21/08 10:46
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	2.8	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	3.0	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 precision (±)	0.2	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 MDC	0.09	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Thorium 230	2.3	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.04	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	6.0	mg/kg-dry		0.50		10	SW6020	09/07/08 03:15/eli-c
Uranium, Activity	4.0	pCi/g-dry		0.34		10	SW6020	09/07/08 03:15/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-008
Client Sample ID: DewBurd SUB03S

Report Date: 10/23/08
Collection Date: 08/21/08 10:56
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	3.2	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	1.1	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 precision (±)	0.2	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 MDC	0.09	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Thorium 230	1.9	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.04	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	4.2	mg/kg-dry		0.50		10	SW6020	09/07/08 03:20/eli-c
Uranium, Activity	2.8	pCi/g-dry		0.34		10	SW6020	09/07/08 03:20/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-009
Client Sample ID: DewBurd SUB04S

Report Date: 10/23/08
Collection Date: 08/21/08 11:09
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	2.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	0.7	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Radium 226 MDC	0.09	pCi/g-dry				1	E903.0	09/22/08 16:06/eli-c
Thorium 230	1.8	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.04	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	5.1	mg/kg-dry		0.50		10	SW6020	09/07/08 03:25/eli-c
Uranium, Activity	3.4	pCi/g-dry		0.34		10	SW6020	09/07/08 03:25/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-010
Client Sample ID: DewBurd PSC01S

Report Date: 10/23/08
Collection Date: 08/21/08 11:24
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	4.0	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	1.8	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 precision (±)	0.2	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 MDC	0.08	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Thorium 230	4.1	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.06	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	6.5	mg/kg-dry		0.50		10	SW6020	09/07/08 03:30/eli-c
Uranium, Activity	4.4	pCi/g-dry		0.34		10	SW6020	09/07/08 03:30/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-011
Client Sample ID: DewBurd CHR05S

Report Date: 10/23/08
Collection Date: 08/21/08 13:13
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	1.3	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	0.6	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 MDC	0.09	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Thorium 230	0.5	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.02	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	1.2	mg/kg-dry		0.50		10	SW6020	09/07/08 03:36/eli-c
Uranium, Activity	0.85	pCi/g-dry		0.34		10	SW6020	09/07/08 03:36/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-012
Client Sample ID: DewBurd BVC01S

Report Date: 10/23/08
Collection Date: 08/21/08 13:36
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	2.6	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	0.6	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 MDC	0.09	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Thorium 230	1.2	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.03	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	2.0	mg/kg-dry		0.50		10	SW6020	09/07/08 03:41/eli-c
Uranium, Activity	1.3	pCi/g-dry		0.34		10	SW6020	09/07/08 03:41/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-013
Client Sample ID: DewBurd CHR01S

Report Date: 10/23/08
Collection Date: 08/21/08 13:52
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	1.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.6	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	0.9	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 MDC	0.09	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Thorium 230	1.4	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.03	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	2.7	mg/kg-dry		0.50		10	SW6020	09/07/08 03:46/eli-c
Uranium, Activity	1.8	pCi/g-dry		0.34		10	SW6020	09/07/08 03:46/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES, INC. * 2821 Plant St * Rapid City, SD 57702
Toll Free 888.672.1225 * 605.342.1225 * FAX 605.342.1397 * rapid_city@energylab.com

LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-014
Client Sample ID: DewBurd BVC04S

Report Date: 10/23/08
Collection Date: 08/21/08 14:23
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	1.8	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	1	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 MDC	0.09	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Thorium 230	1	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.03	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	2.0	mg/kg-dry		0.50		10	SW6020	09/07/08 03:51/eli-c
Uranium, Activity	1.3	pCi/g-dry		0.34		10	SW6020	09/07/08 03:51/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-015
Client Sample ID: DewBurd SUB09S

Report Date: 10/23/08
Collection Date: 08/21/08 15:01
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	1.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	0.6	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 MDC	0.09	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Thorium 230	0.9	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.03	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	2.3	mg/kg-dry		0.50		10	SW6020	09/07/08 03:57/eli-c
Uranium, Activity	1.6	pCi/g-dry		0.34		10	SW6020	09/07/08 03:57/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-016
Client Sample ID: DewBurd SUB08S

Report Date: 10/23/08
Collection Date: 08/21/08 15:12
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	1.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	0.4	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 MDC	0.09	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Thorium 230	0.8	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.02	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	1.9	mg/kg-dry		0.50		10	SW6020	09/07/08 04:23/eli-c
Uranium, Activity	1.3	pCi/g-dry		0.34		10	SW6020	09/07/08 04:23/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-017
Client Sample ID: DewBurd SUB02S

Report Date: 10/23/08
Collection Date: 08/21/08 15:31
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	3.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	1.3	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 precision (±)	0.2	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 MDC	0.09	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Thorium 230	6.8	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.07	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	19	mg/kg-dry		0.50		10	SW6020	09/07/08 04:29/eli-c
Uranium, Activity	13	pCi/g-dry		0.34		10	SW6020	09/07/08 04:29/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-018
Client Sample ID: DewBurd SUB01S

Report Date: 10/23/08
Collection Date: 08/21/08 15:55
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	1	pCi/g-dry	U			1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.7	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	1.1	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 MDC	0.09	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Thorium 230	1	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.03	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	3.3	mg/kg-dry		0.50		10	SW6020	09/07/08 04:34/eli-c
Uranium, Activity	2.2	pCi/g-dry		0.34		10	SW6020	09/07/08 04:34/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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LABORATORY ANALYTICAL REPORT

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)
Lab ID: R08080356-019
Client Sample ID: DewBurd PSC02S

Report Date: 10/23/08
Collection Date: 08/21/08 16:16
Date Received: 08/21/08
Matrix: SEDIMENT

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	0.4	pCi/g-dry	U			1	E909.0M	10/10/08 09:17/eli-c
Lead 210 precision (±)	0.6	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Lead 210 MDC	1.1	pCi/g-dry				1	E909.0M	10/10/08 09:17/eli-c
Radium 226	0.4	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 precision (±)	0.1	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Radium 226 MDC	0.09	pCi/g-dry				1	E903.0	09/22/08 17:42/eli-c
Thorium 230	0.4	pCi/g-dry		0.1		1	E907.0	09/26/08 14:00/eli-c
Thorium 230 precision (±)	0.02	pCi/g-dry				1	E907.0	09/26/08 14:00/eli-c
TOTAL METALS ANALYSES								
Uranium	1.0	mg/kg-dry		0.50		10	SW6020	09/07/08 04:39/eli-c
Uranium, Activity	0.71	pCi/g-dry		0.34		10	SW6020	09/07/08 04:39/eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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QA/QC Summary Report

Client: RESPEC Inc **Report Date:** 10/23/08
Project: Edgemont (Soils/Air filters) **Work Order:** R08080356

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E903.0									Batch: C_19745
Sample ID: R08080356-019A	Sample Matrix Spike				Run: SUB-C108008				09/22/08 19:17
Radium 226	4.3	pCi/g-dry		103	70	130			
Sample ID: R08080356-019A	Sample Matrix Spike Duplicate				Run: SUB-C108008				09/22/08 19:17
Radium 226	4.6	pCi/g-dry		111	70	130	8.1	23.1	
Sample ID: LCS-19745	Laboratory Control Sample				Run: SUB-C108008				09/22/08 19:17
Radium 226	0.016	pCi/g-dry		112	70	130			
Sample ID: MB-19745	Method Blank				Run: SUB-C108008				09/22/08 19:17
Radium 226	-0.001	pCi/g-dry							U
Method: E907.0									Batch: C_19745
Sample ID: R08080356-019A	Sample Matrix Spike				Run: SUB-C109045				09/26/08 14:00
Thorium 230	2.14	pCi/g-dry	0.10	153	70	130			S
- Spike response is outside of the acceptance range for this analysis. Since the LCS and the RPD for the MS MSD pair are acceptable, the response is considered to be matrix related. The batch is approved.									
Sample ID: R08080356-019A	Sample Matrix Spike Duplicate				Run: SUB-C109045				09/26/08 14:00
Thorium 230	1.85	pCi/g-dry	0.10	128	70	130	15	30	
Sample ID: LCS-19745	Laboratory Control Sample				Run: SUB-C109045				09/26/08 14:00
Thorium 230	0.0285	pCi/g-dry	0.10	123	70	130			
Sample ID: MB-19745	Method Blank				Run: SUB-C109045				09/26/08 14:00
Thorium 230	-0.001	pCi/g-dry							U
Method: E909.0M									Batch: C_19745
Sample ID: R08080356-019A	Sample Matrix Spike				Run: SUB-C109410				10/10/08 09:17
Lead 210	27.8	pCi/g-dry		102	70	130			
Sample ID: R08080356-019A	Sample Matrix Spike Duplicate				Run: SUB-C109410				10/10/08 09:17
Lead 210	21.8	pCi/g-dry		74	70	130	24	30	
Sample ID: MB-19745	Method Blank				Run: SUB-C109410				10/10/08 09:17
Lead 210	ND	pCi/g-dry							U
Sample ID: LCS-19745	Laboratory Control Sample				Run: SUB-C109410				10/10/08 09:17
Lead 210	0.116	pCi/g-dry		100	70	130			

Qualifiers:

RL - Analyte reporting limit.
S - Spike recovery outside of advisory limits.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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QA/QC Summary Report

Client: RESPEC Inc
Project: Edgemont (Soils/Air filters)

Report Date: 10/23/08
Work Order: R08080356

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020									Batch: C_19668
Sample ID: MB-19668	Method Blank				Run: SUB-C107115				09/07/08 02:06
Uranium	0.004	mg/kg-dry	4E-05						
Sample ID: LCS1-19668	Laboratory Control Sample				Run: SUB-C107115				09/07/08 02:11
Uranium	110	mg/kg-dry	0.50	111	91	133			
Sample ID: R08080356-019A	Sample Matrix Spike				Run: SUB-C107115				09/07/08 04:44
Uranium	20	mg/kg-dry	0.50	124	75	125			
Sample ID: R08080356-019A	Sample Matrix Spike Duplicate				Run: SUB-C107115				09/07/08 04:50
Uranium	18	mg/kg-dry	0.50	129	75	125	11	20	S

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

PLEASE PRINT- Provide as much information as possible.

Company Name: RESPEC	Project Name, PWS, Permit, Etc. Powertech Dewey Burdock	Sample Origin State:	EPA/State Compliance: Yes ☐ No ☐
Report Mail Address:	Contact Name: Phone/Fax: cory.foreman@respec.com	Email:	Sampler: (Please Print) Eric Krantz
Invoice Address:	Invoice Contact & Phone:	Purchase Order:	Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

☐ DW ☐ A2LA
☐ GSA ☐ EDD/EDT(Electronic Data)
☐ POTW/WWTP Format: ______
☐ State: ______ ☐ LEVEL IV
☐ Other: ______ ☐ NELAC
2008

Number of Containers / Sample Type: A W S V B O / Air Water Soils/Solids Vegetation Bioassay Other

ANALYSIS REQUESTED: As Per Quote

SEE ATTACHED

Normal Turnaround (TAT)

RUSH

Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page

Comments: All sediment

Shipped by:
Cooler ID(s):
Receipt Temp 19.6 °C
On Ice: Yes No
Custody Seal Y N
Intact Y N
Signature Match Y N

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Comments	LABORATORY USE ONLY
1 DewBurd BEN01s	8/21	0902	S	Beaver Canyon	K08080356-001A
2 DewBurd ~~BEN~~ UNT01s	8/21	0923	S	Unnamed Trib	002A
3 DewBurd Sub10s	8/21	0938	S	Sub 10	003A
4 DewBurd Sub11s	8/21	0956	S	Sub 11	004A
5 DewBurd Sub07s	8/21	1009	S	Sub 7	005A
6 DewBurd Sub06s	8/21	1036	S	Dam PIT	006A
7 DewBurd Sub05s	8/21	1046	S	below Dam	007A
8 DewBurd Sub03s	8/21	1056	S		008A
9 DewBurd Sub04s	8/21	1109	S	met station	009A
10 DewBurd PSC01s	8/21	1124	S	PassCr. d/s	010A

Custody Record MUST be Signed

Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
Eric Krantz	8/21/08 18:45	[signature]	Steve Friesland	8-21-08 1845	[signature]
Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
Sample Disposal: Return to Client:	Lab Disposal:		Received by Laboratory:	Date/Time:	Signature:

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.
Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

PLEASE PRINT- Provide as much information as possible.

Company Name: RESPEC	Project Name, PWS, Permit, Etc. Powertech Dewey Burdock	Sample Origin State:	EPA/State Compliance: Yes ☐ No ☐
Report Mail Address:	Contact Name: Phone/Fax: cory.foreman@respec.com	Email:	Sampler: (Please Print) Eric Krantz
Invoice Address:	Invoice Contact & Phone:	Purchase Order:	Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

- ☐ DW
- ☐ GSA
- ☐ POTW/WWTP
- ☐ State: ___
- ☐ Other: ___
- ☐ A2LA
- ☐ EDD/EDT (Electronic Data) Format: ___
- ☐ LEVEL IV
- ☐ NELAC

2008

Number of Containers Sample Type: A W S V B O Air Water Soils/Solids Vegetation Bioassay Other

ANALYSIS REQUESTED

SEE ATTACHED

Normal Turnaround (TAT)

RUSH

Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page

Comments:

Shipped by:

Cooler ID(s):

Receipt Temp 19.6 °C

On Ice: Yes No

Custody Seal Y N

Intact Y N

Signature Match Y N

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Comments	LABORATORY USE ONLY
1	DewBurdCHR05s	8/21	13:13	S	Chey @ Marietta	B08080356-011A
2	DewBurdBVC01s	8/21	13:36	S	Beaver Cr @ Burdock	012A
3	DewBurdCHR01s	8/21	13:52	S	Chey @ Andersons	013A
4	DewBurdBVC04s	8/21	14:23	S	Beaver Cr @ USGS wy	014A
5	DewBurdSub09s	8/21	15:01	S		015A
6	DewBurdSub08s	8/21	15:12	S		016A
7	DewBurdSub02s	8/21	15:31	S	Triangle Pits	017A
8	DewBurdSub01s	8/21	15:55	S	Dixon Ranch	018A
9	DewBurdPSC02s	8/21	16:16	S	Pass G. 4/1	019A
10						

Custody Record MUST be Signed

Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
Eric Krantz	8/21/08 1845	[signature]	Steve Froiland	8-21-08 1845	[signature]
Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
Sample Disposal: Return to Client: ___ Lab Disposal: ___			Received by Laboratory:	Date/Time:	Signature:

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report. Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

Process and Equipment 3.1

TR RAI-3.1-1

The applicant provides only a general commitment to have instrumentation, alarms and controls to monitor production, injection and waste flows. Description of the instrumentation, alarms and controls are inadequate to allow the staff to understand how the applicant will ensure safe operations and timely detection of releases or spills. Please provide a more in-depth description of the instrumentation, alarms and controls to ensure timely detection of any unanticipated release or spill, and frequency of inspection of these and other items included in spill prevention SOP(s).

Response TR RAI-3.1-1 (TR Section 3.1.3.1, Section 3.1.4, Section 3.2.12 and Section 4.1.2)

Procedures to address potential spills will be the responsibility of the Health, Safety and Environment department; engineers and operations supervisors will assist in development of procedures. The SERP will review the procedures for effectiveness. Procedures developed will implement appropriate protocols to handle potential spills of radioactive materials.

The plant facilities and equipment at the PA will consist of standard design, construction, and materials for uranium in-situ recovery extraction. Powertech (USA) intends to install automated control and data recording systems within the plants to augment the oversight provided by the operators. Most of the automated devices will be programmed to control operating parameters according to pre-determined schedules and pre-set operating ranges. The automated systems will include alarms and shutoffs to prevent overflow and overpressure situations and provide centralized monitoring of the process variables.

Leak detection will be performed by daily visual inspection of all above-ground pipe, connections, and fittings by field personnel during their daily site visits. Operating pressures of all injection wells, recovery wells, and associated buried piping systems will also be monitored during these visits. In addition, the pressure and flow in each line will be monitored. Should pressure/flow fluctuate outside of normal operating ranges, the affected line will be shut down.

External and internal shutdown controls will be installed in the header houses for operator safety and spill control. The external and internal shutdown controls are designed for automatic and remote shut down of the header house electrical power supply. The external shutdown will consist of an electrical disconnect switch located on the outside of the header house or at the transformer pole which will, when activated, shut down all electrical power to the header house. The result of this method is to shutdown all electrical power to the header house and to mitigate potential electrical hazards while de-energizing the operating equipment including the production pumps. The header house sumps will also be equipped with level sensors so that if the water level approaches the full level, the switch will cause immediate shutdown of the production well pumps. This will prevent leaks from production wells. A flashing alarm light will activate outside the building to indicate the sump shut-down switch has tripped. When production flow is stopped for an emergency condition, the injection flow is automatically stopped as a result. An operator will then inspect the troubled component and determine the source of the problem. The troubled component will then be repaired, tested, and returned to service, as appropriate, and preventative measures will be implemented to prevent a recurrence.

Piping system leaks are the most common source of surface releases that occur at an in situ facility. Generally these spills are small due to engineering controls set up to detect changes in pressure within the piping systems. Operators are alerted via an alarm system when pressure changes occur. Well field piping systems are constructed of PVC or high density polyethylene (HDPE) materials. All pipelines will be pressure tested at operating pressures before put into use. No additional stress is placed on the buried pipes so it is improbable a break would occur. The underground portions of the pipes are protected from vehicles and exposed pipes only occur at the wellheads and header houses. Trunkline flows and wellhead pressures will be monitored for process control. Spill response is specifically addressed in the Emergency Response Procedures.

TR RAI-3.1-2

The applicant reports that the depth to mineralized zones primarily in the eastern portions of the proposed licensed area may be less than 100 feet with a saturated thickness significantly less. Operations performed under unconfined conditions and/or limited potentiometric head differ from those performed under confined conditions. The applicant has not provided sufficient information to allow the staff to assess the manner in which ISR under unconfined conditions or limited potentiometric head will affect operations. Please provide information that demonstrates the effects of such hydraulic conditions on the proposed operations.

Response TR_RAI-3.1-2 (ER_RAI Response WR-3.1 and WR-3.2)

The approximate boundaries of unconfined zones in the Fall River and Lakota aquifers are depicted in ER_RAI Figure WR-3.1 and ER_RAI Figure WR-3.2, respectively. For the initially proposed well fields, Burdock Well Field 1, and Dewey Well Field 1, conditions are well confined with water levels several hundred feet above the top of each aquifer; confined conditions were confirmed in aquifer pump tests.

Powertech (USA) plans for ISL operations within potentially unconfined portions of aquifers are limited to the eastern side of the project in portions of Burdock Mine Unit II and Burdock Mine Unit IV in the Lakota Formation. Though ore bodies are present in unconfined portions of the Fall River aquifer on the eastern side of the permit area, Powertech (USA) does not propose to mine in those Fall River ore bodies in this license application. Furthermore, Powertech (USA) has limited its proposed operations in the Fall River Formation to the Dewey portion of the project.

Criteria and designs of ISL operations for unconfined portions of aquifers are expected to be similar to those described for confined ISL operations. However, Powertech (USA) intends to only develop the mine units after more detailed collection and evaluation of hydrogeological data at those locations including installation of additional wells for more detailed mapping of the potentiometric surface and additional aquifer pumping tests to determine aquifer properties in the potentially unconfined conditions. Operation of the ISL mining activities will be conditional upon additional ore body delineation and additional hydrogeological investigations. Upon completion of these activities Powertech (USA) will present the operational design and plan of the mine units for review and approval by NRC and other appropriate agencies.

<u>*TR RAI-3.1-3*</u>

The applicant's general schedule did not provide a timetable for restoration of individual well fields. This detailed information as well as other information such as the requirement for NRC notification of the termination of principal activities or an alternate schedule, needs to be included in the TR consistent with Section 3.1.1 (4) of NUREG-1569 and in accordance with requirements of 10 CFR 40.42. Please address this comment.

<u>**Response TR RAI-3.1-3 (TR Section 6.1.4 and Figure 6.1-1)**</u>

The Applicant's proposed schedule of operations, showing a timetable for restoration of individual well fields, is included in the response to TR-RAI-6.1-11. The Applicant will notify the NRC in writing, in accordance with 10 CFR 40.42, within 60 days of the cessation of recovery operations in any individual well field.

TR RAI-3.1-4

Experience with existing ISR facilities has shown that a facility may delay restoration after the end of production. However, during any restoration delay, the hydraulic control for a well field must be maintained. Therefore, please include information regarding the manner in which hydraulic control will be maintained throughout the life of a well field, from the first injection of lixiviant to the end of restoration.

Response TR RAI-3.1-4 (TR Section 3.1.3.1)

Water levels will be monitored and monitoring samples will be collected on the basis of twice per month for each well field in operation through production and restoration phases. This data will be collected from all monitoring wells associated with each well field including the production zone ring, overlying and underlying monitor wells. If there is any period of between production and restoration phases monitoring will continue during this time as well. For each well field, this monitoring activity will continue until restoration phase for that well field is fully completed. Pumping or operation of well field patterns with a bleed will be performed as needed to maintain water levels in the monitor rings below initial baseline conditions until the restoration phase is complete. This activity may be sporadic or continuous.

TR RAI-3.1-5

On Page 3-14, the applicant uses the term "leachate" in lieu of "lixiviant." Please include a definition of leachate if it is to be used in the TR.

Response TR RAI-3.1-5 (TR Section 3.1.3)

The use of the term "leachate" in TR Section 3.1.3, on page 3-14, has been replaced with the word "lixiviant".

TR RAI-3.1-6

On Supplemental Exhibit 3.1-1, it is difficult to distinguish several features including the black lines (Fault or PAA Boundary) or blue Lines (Perennial and Ephemeral Streams). Please modify the exhibit accordingly.

Response TR RAI-3.1-6 (Supplemental Exhibit 3.1-1 Revised)

The labeled black lines depicting the Dewey Fault Zone has been modified by the addition of one label to the northernmost fault line and by adjusting the original label near the northernmost fault line, also a label was added directly beneath the southernmost fault line within the map. The Dewey Fault Zone is located north of the PAA as depicted in SR_Exhibit 2.2-1. The blue line depicting ephemeral streams was dotted and dashed; the line representing ephemeral streams has been modified with greater spacing between the dashes and lightened up. The line depicting perennial streams has been darkened and remains solid in color. The exhibit is now titled "Supplemental Exhibit 3.1-1 Revised".

TR RAI-3.1-7

The total pond area, as shown on Supplemental Exhibit 3.1-2, is 84 acres and the total land application area is 720 acres. The pond area is similar in extent to that discussed in the narrative; however, the land application area differs from the 875 acres discussed in the narrative. Please clarify this apparent discrepancy.

Response TR RAI-3.1-7 (TR Section 3.1.6.1.1 and Section 4.2.2.1.4)

The total pond area, as shown on Supplemental Exhibit 3.1-2, is approximately 71 acres for the Land Application Option. The total land application area available is 760 acres but only 630 acres are expected to be irrigated at any one time during the operation of the project. This discrepancy is due to revision of the land application design. The design described in the SR Appendix B "Pond Design Report" is what is intended for this permit application.

TR RAI-3.1-8

On Supplemental Exhibit 3.1-4, various land application areas overlap outlines of two future mine units. Please confirm the location of the land application areas. If the land application areas overlap proposed well fields, please provide further information regarding the manner in which both the well field and land application areas will be operated.

Response TR RAI-3.1-8 (TR Section 4.2.2.1)

Minimal overlap occurs within the Dewey pivot areas designated for "standby". Please refer to attached figures 4.2-1 and 4.2-2 for details. Production, injection and monitoring wells may be operated (when properly sealed to prevent subsurface contamination and sampling cross-contamination) within actively irrigated pivot areas. The wells will also have sufficient casing above grade to ensure proper access to the wells and that the wells are unaffected during times of irrigation. There are no anticipated issues with operating the pivot areas within this small portion of a well field. Irrigation nozzles are suspended above the well head covers and the supporting wheels of center pivot piping can be positioned to pass between wells. These standby pivot areas are expected to be reserved for use only when the underlying well field is not active and to serve as a contingency to the primary pivot areas.

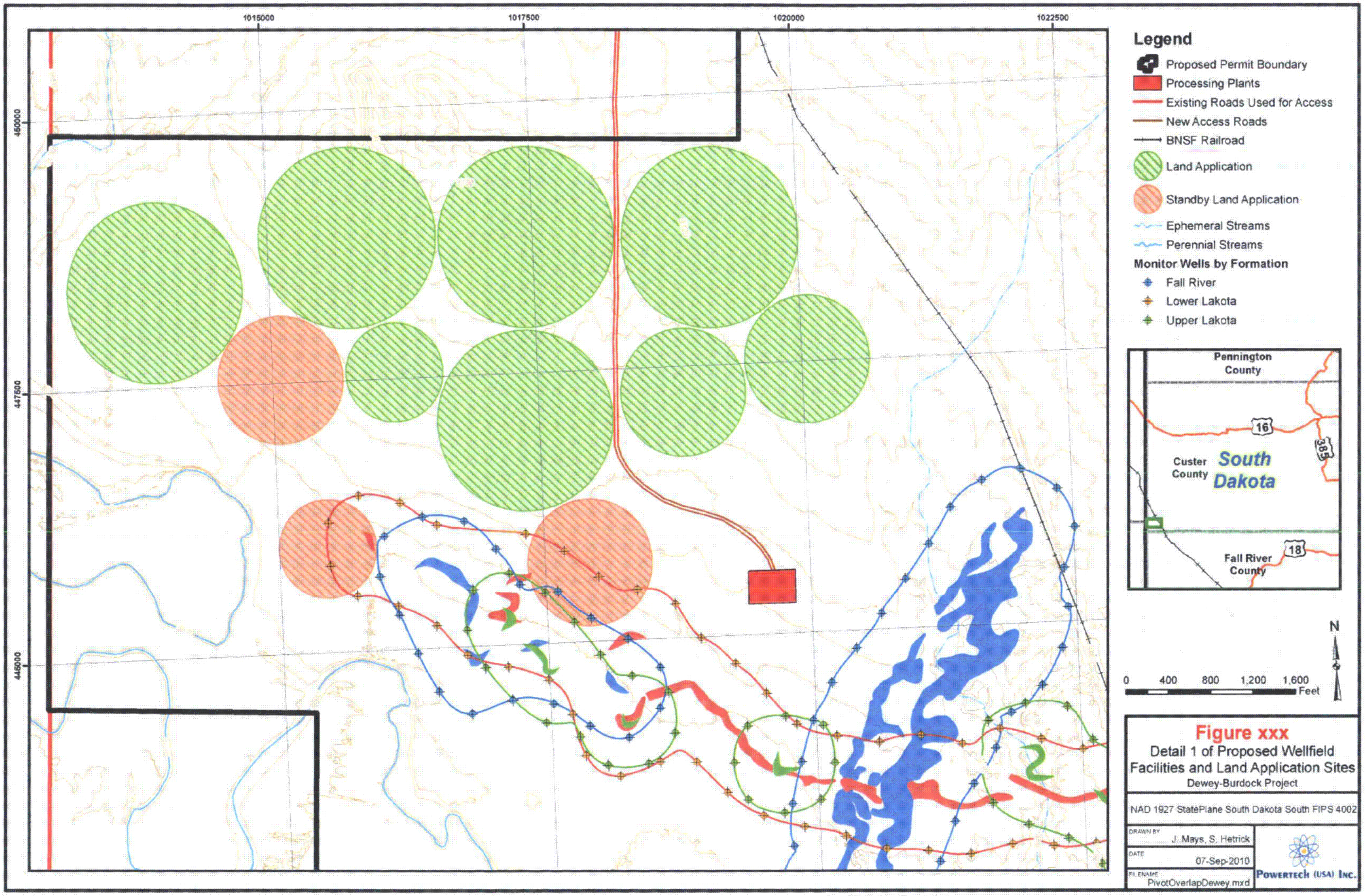


Figure 4.2-1: Dewey Pivot Areas

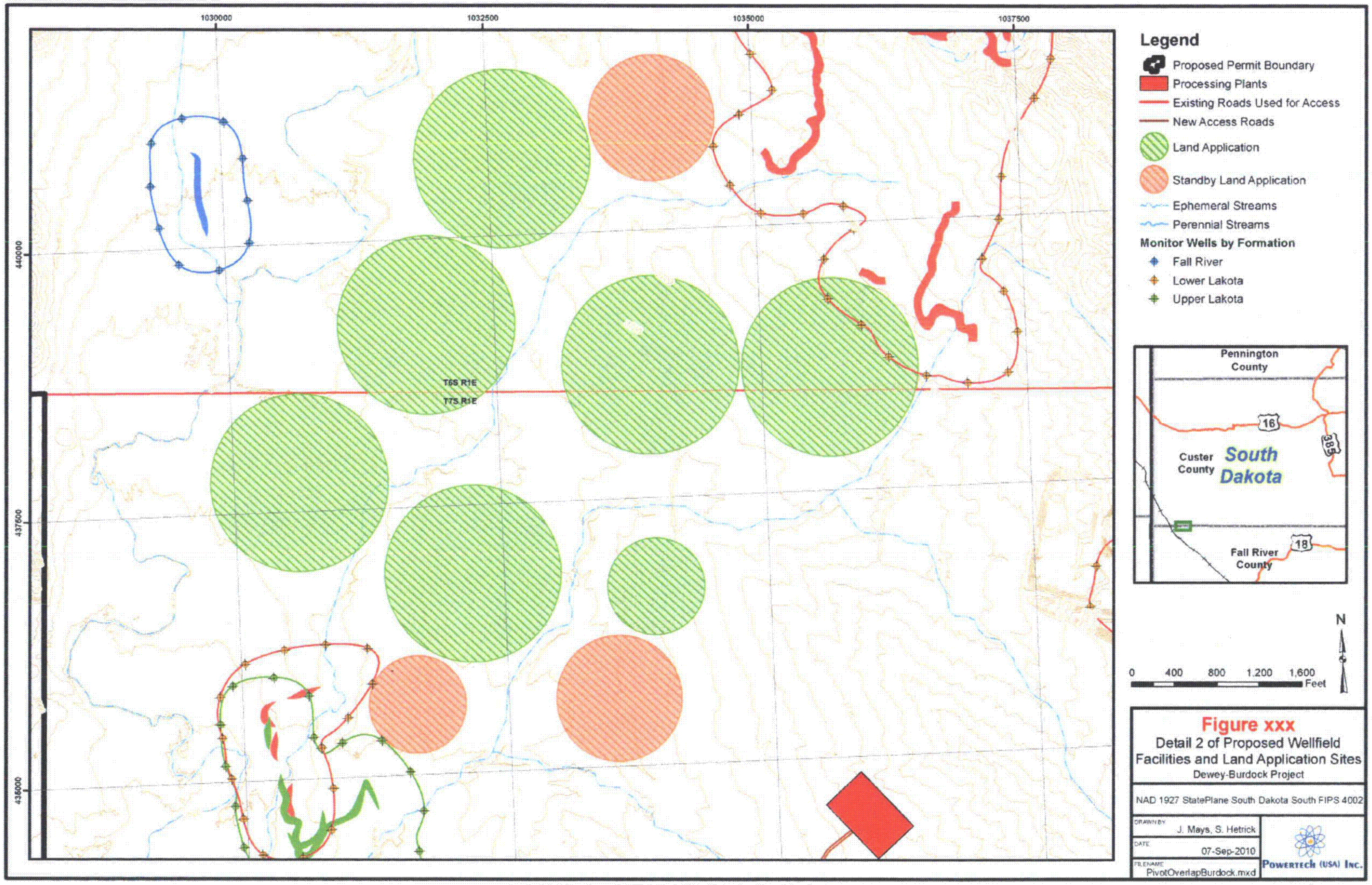


Figure 4.2-2: Burdock Pivot Areas

TR RAI-3.1-9
The application did not include a water balance diagram consistent with the guidance in Section 3.1.2 of NUREG-1569. Please provide a water balance diagram.

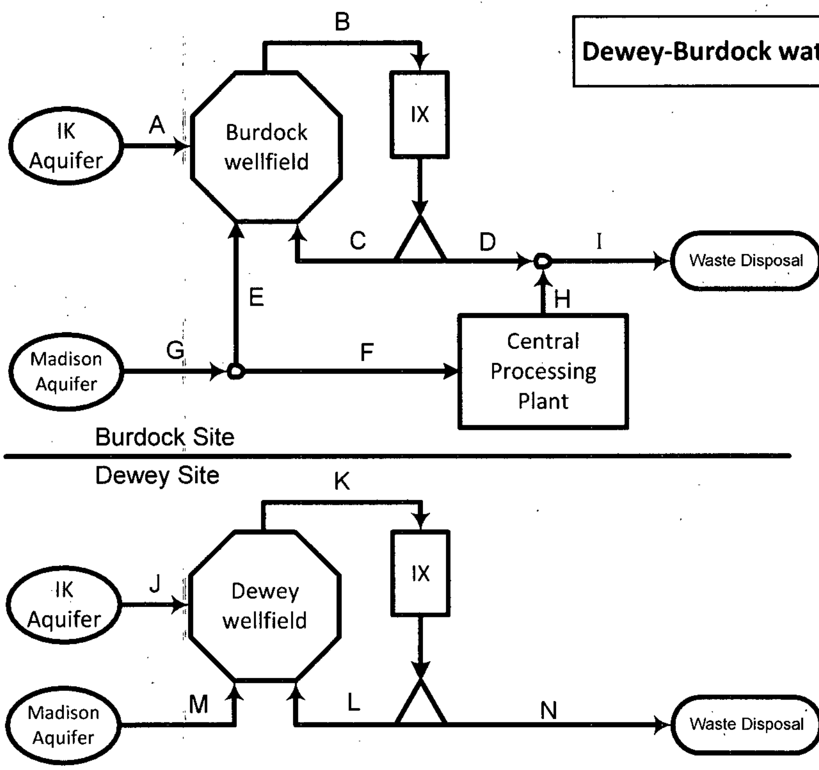
Response TR RAI-3.1-9 (Figure 3.1-7 in TR Section 3.1.5)
The water balances at both the Burdock site and the Dewey site for the recovery phase, the restoration phase with 1% bleed, and the restoration phase with one (1) pore volume of bleed are presented in Figure 3.1-7 (attached). Typical flow rates are provided for both the deep well disposal option, in which the groundwater treatment restoration method is utilized, and the land application disposal option, in which the groundwater sweep restoration method is utilized.

For recovery operations, the water balance flow rates are identical for both disposal options, producing, for a recovery bleed of 0.875 percent of the groundwater extraction rate, approximately 32 gpm of wastewater at the Burdock site and 15 gpm of wastewater at the Dewey site.

With a restoration aquifer bleed rate equal to 1% of the groundwater withdrawal rate, the deep disposal well option produces approximately 80 gpm of wastewater at the Burdock site and 82 gpm at the Dewey site, while the land application disposal option produces approximately 267 gpm and 274 gpm of wastewater at the Burdock and Dewey sites, respectively. Note that these flow rates are mean values estimated over only those periods in which aquifer restoration is to be conducted; periods when no aquifer restoration operations will be conducted are not included in the computation of the average flow rates.

With the alternate restoration aquifer bleed option, consisting of the removal of 1.0 pore volume of Inyan Kara aquifer water during restoration, the deep well disposal option will produce approximately 50 gpm of wastewater at the Burdock site and 45 gpm of wastewater at the Dewey site. With the land application disposal option, these wastewater flow rates will be approximately 167 gpm at the Burdock site and 149 gpm at the Dewey site.

Dewey-Burdock water balance



Stream ID	Description
A	Burd. Aquifer bleed
B	Burd. Extraction composite
C	Burd. Reinjection
D	Burd. Wellfield bleed
E	Burd. Madison Injection
F	Burd. Fresh brine make-up
G	Burd. Madison aquifer
H	Burd. CPP brine
I	Burd. Wastewater
J	Dew. IK Aquifer bleed
K	Dew. Exraction composite
L	Dew. Reinjection
M	Dew. Madison Injection
N	Dew. Wastewater

Water balance flow rates (gal/min)																
Operation phase	Aquifer bleed	Disposal Option	Stream ID													
			A	B	C	D	E	F	G	H	I	J	K	L	M	N
Recovery	0.8750%	DDW	20	2280	2260	20	0	12	12	12	32	15	1720	1705	0	15
		LA	20	2280	2260	20	0	12	12	12	32	15	1720	1705	0	15
Restoration	1.0%	DDW	2.7	267	187	80	77	0	77	0	80	2.7	274	192	79	82
		LA	2.7	267	0	267	264	0	264	0	267	2.7	274	0	271	274
	1.0 PV	DDW	28	167	117	50	22	0	22	0	50	25	149	104	20	45
		LA	28	167	0	167	139	0	139	0	167	25	149	0	124	149

Figure 3.1-7: Water Balances for the Dewey-Burdock Project

Gaseous and Airborne Particulates 4.1

TR RAI-4.1-1

In Section 4.1.1, the applicant states that exhausting radon gas outside the plant minimizes employee airborne exposure. Please evaluate the following scenarios under your As Low As Is Reasonably Achievable (ALARA) program that will address the requirements of 10 CFR 40, Appendix A, Criterion 8, and 10 CFR 20.1101(b) and the recommendations in NUREG-1569, Acceptance Criterion 4.1.3(5).

TR RAI-4.1-1(a)

a. ***Please provide an analysis that includes exposure to employees in areas outside the plant***

Response TR RAI-4.1(a) (TR Section 4.1.1)

Consistent with 10 CFR 40, Appendix A, Criterion 8 and as described in Section 4.1.1 of the TR, Powertech (USA) has committed to using emission controls to keep occupational and public doses to levels which are As Low As Is Reasonably Achievable (ALARA). Section 4.1.1 of the TR also describes how monitoring results of emission control systems will be used to adjust emission controls and monitoring programs to ensure effluent levels are ALARA.

The most effective methods to ensure worker exposure to radon-222 progeny and that *operations are conducted in a manner that releases are ALARA* (NUREG 1569 4.1.3(5) include:

- Plant design, construction and use of materials that are proven to ensure exposure is ALARA, especially in areas where an actual potential risk may exist; see TR_Section 3.2.5.1. The use of vacuum dryers, installation of a HVAC system, separate room for filter press, enclosed conveyors, baghouse filter system, etc. Refer to TR_Section 3.0 for more information regarding the design and operational features of the proposed facilities.

- Commitment within the corporation to design and develop a management program that will include a SERP, employee training programs, implementation of radiation safety controls and monitoring, an audit program and reporting system in order to ensure exposures are ALARA, further demonstrates operations will be conducted in a manner to ensure areas, where a real risk may exist, are safe for workers. See TR_Section 5.0.

By evaluating measurements collected in the workplace, Section 4.2.11.2.1 of NUREG 1910 (NRC, 2009) describes worker exposure to radon-222 decay products for a typical ISR facility to range from 2.5 to 16 percent of the occupational exposure limit of 4 working level months and concludes that doses from normal radon releases from ISR facilities would be expected to have a small impact on workers. Therefore, risk to employees working outside the facilities would be expected to be significantly reduced.

TR RAI-4.1-1(b)
In Section 4.1.1, the applicant states that exhausting radon gas outside the plant minimizes employee airborne exposure. Please evaluate the following scenarios under your As Low As Is Reasonably Achievable (ALARA) program that will address the requirements of 10 CFR 40, Appendix A, Criterion 8, and 10 CFR 20.1101(b) and the recommendations in NUREG-1569, Acceptance Criterion 4.1.3(5).

b. During favorable weather conditions how will open doorways and convection vents affect radon effluent airflow and employee exposure both inside and outside the plant?

Response TR RAI-4.1(b) (TR Section 4.1.1)

During plant operation, measurements of radon emission from the plant ventilation system as well as measurements of radon progeny exposure at occupied areas in and around the plant will be made. With this data, analyses of exposure to employees and radon effluent airflow will be conducted to determine if exposure is (ALARA). Powertech (USA) will implement changes if and when necessary to ensure levels are ALARA. Results of monitoring obtained during initial plant operation will be used to adjust monitoring programs, and upgrade ventilation and/or other effluent control equipment as necessary.

TR RAI- 4.1-2

In Section 4.1.2.2 of the TR, the applicant describes the discharge for the yellowcake drying and packaging system but does not specify where this effluent will discharge. Please specify the discharge location(s) for the yellowcake drying and packaging system.

Response TR RAI-4.1-2 (TR Section 4.1.2 and Section 4.1.2.2)

The system of treating gases emanating from the dryer chamber with bag house filters and water condenser is designed to capture airborne particulates and condense exhaust gases, eliminating uranium releases from drying operations. (NRC-2009, NRC-2003).

TR RAI- 4.1-3

Regulatory Guide 8.30 recommends performing ventilation surveys on a routine basis. Please provide details of a ventilation survey program consistent with Regulatory Guide 8.30 or justification for an alternate program.

Response TR RAI-4.1-3 (TR Section 4.1.2)

Consistent with RG 8.30, a ventilation survey will be conducted daily in areas with airborne radioactivity. The survey will be performed by the radiation safety staff during a daily walk through the facility and will consist of operational checks of ventilation systems, to ensure they are operating effectively.

TR RAI- 4.1-4

Consistent with Regulatory Guide 8.31 and NUREG 1569, Acceptance Criterion 4.1.3(5), demonstrate that radon exhaust vent will be located in a way that ensures compliance with the requirements of 10 CFR 20.1302

Response TR RAI- 4.1-4 (TR Section 4.1.1 and Section 7.3)

Section 7.3 of the TR describes methods used to estimate potential radiological impacts resulting from planned activities to members of the public near the proposed facility. The highest predicted Total Effective Dose Equivalent (TEDE) to a resident is 4.5 mrem per year, which is in compliance with the requirements of 10 CFR §20.1302.

To ensure effluents are As Low As is Reasonably Achievable (ALARA), as described in Section 4.1.1, Powertech (USA) has committed to use sealed pressurized IX vessels to limit routine radon-222 emissions from the CPP or satellite facility to resin transfer operations only. The radon emissions from the resin transfer operation will be exhausted using a dedicated ventilation system and released via a primary release point outside of the facility. The primary release point will be located away from building intakes to prevent introducing exhausted radon back into the facility. The normal HVAC system will also aid in reducing radon-222 and progeny concentrations within the facility. Potential release points as well as general air in the plant will be routinely sampled for radon and progeny to assure concentration levels are maintained ALARA. Results of monitoring obtained during initial plant operation will be used to adjust monitoring programs, and upgrade ventilation and/or other effluent control equipment as necessary.

TR RAI-4.1-5

Consistent with NUREG-1569, Acceptance Criterion 4.1.3(4), evaluate the applicant's effluent control systems under accident conditions and identify any health and safety impacts of system failures and identify contingencies for such occurrences.

Response TR RAI-4.1-5 (TR Section 4.1.3)

As discussed briefly in Section 7.5 of the TR, the NRC has evaluated likely accident scenarios and the associated radiological consequence for a typical ISR facility. This analysis is contained in NUREG/CR-6733, A Baseline Risk-Informed, Performance-Based Approach for In Situ Leach Uranium Extraction Licensees. A series of likely accident scenarios which could occur in the central or satellite processing area were evaluated and included the following:

- Yellowcake thickener failure and spill
- Radon release in enclosed process areas
- Pregnant lixiviant and loaded resin spills
- Yellowcake dryer hazard analysis

The estimated radiological consequence resulting from these accidents ranged from no significant radiological exposures, in the case of the thickener failure and pregnant lixiviant/loaded resin spill, to a significant radiological exposure which could result in doses to workers exceeding those allowed in 10 CFR Part 20. Due to the short term nature of the above scenarios and assuming spills and releases are mitigated promptly, no scenario was expected to result in a significant estimated radiological dose to members of the public.

Given the accident scenarios described above, if effluent controls were operable during and while responding to the accident, they would reduce the potential radiological consequence to the workers involved in the response by reducing airborne radionuclide concentrations. If the effluent controls were not operable because of the accident, this reduction in airborne radionuclide concentrations would not occur and administrative controls and personal protective equipment would play a larger role in minimizing worker doses. During an accident, administrative controls such as standard operating procedures for spill response and cleanup, programs for radiation and occupational monitoring, and training for workers in radiological health and emergency response coupled with personal protective equipment such as respirators, are the best tools to reduce worker doses and will be provided.

Management Control Program 5.2

TR RAI-5.2-1

In Section 5.2.6 of the TR, the applicant discusses its reporting program to satisfy 10 CFR 20.2202. However, it does not appear that the applicant addressed other reporting requirements in 10 CFR 20, Subpart M, as recommended in NUREG-1569, Acceptance Criterion 5.2.3(1). For example, 10 CFR 20.2203(a)(2) addresses reporting requirements for doses found to be in excess of regulatory limits. In addition, 10 CFR 40.60(b)(3) addresses medical treatment at a "medical" facility, not "outside" facility as stated in Section 5.2.6 of the TR. Please provide a reporting program that is consistent with NUREG-1569, Acceptance Criterion 52.3(1).

Response TR RAI-5.2-1

The applicant will implement a reporting program that is designed to comply with all the reporting requirements of the NRC, particularly the reporting requirements of 10 CFR, Subpart M and 10 CFR 40.60. Section 5.2.6 of the TR specifically addresses the reporting requirements for incidents where doses are found to be in excess of regulatory limits. In accordance with 10 CFR 40.60(b)(3), if necessary, medical treatment will be provided at a medical facility. See replacement language below

Consistent with all applicable reporting criteria of Subpart M, such as 10 CFR 20.2202, Powertech (USA) will notify the NRC within 4 hours of any event that could cause a release of licensed material or an exposure to radiation or radioactive materials exceeding the regulatory limits. In addition, notification will be given for *Reportable events* listed in 20.2203(a)(2). Twenty-four hour reporting shall be performed for events listed in 10 CFR Part 40.60 such as the following:

The NRC will be notified within 24 hours of any event that causes:

- An unplanned contamination event, involving licensed material greater than 5 times the lowest annual limit of intake, requiring longer than 24 hours to correct/clean up.
- Equipment necessary for control of radioactive material or radiation fails and there is no adequate redundancy/substitute.
- Medical treatment of an individual with removable contamination at a qualified medical facility.
- An unplanned explosion/fire affecting the integrity of either a container of licensed material greater than 5 times the lowest annual limit of intake or the licensed material itself.

The NRC will be notified within 48 hours of any event in which spills, evaporation pond leaks, or excursions of source material and process chemicals occurred.

TR RAI-5.2-2 (TR Section 5.2.6)

Consistent with NUREG-1569, Acceptance Criteria 5.2.3(13), please include a Land Use Survey in your discussion of the information required to be submitted annually to NRC.

Response TR RAI-5.2-2 (TR Section 5.2.6)

The following reports will be submitted to the NRC at the indicated frequency:

- a SERP report as described in Section 5.2.3;
- a semi-annual effluent and environmental monitoring report as required by 10 CFR 40.65;
- the ALARA audit report detailed in Section 5.3.3;
- a land use survey that describes any changes to the land use surrounding the licensed facility;
- a summary of monitoring data detailed in Section 5.7 and any corrective actions resulting from SERP actions, inspections described in Section 5.3 or reporting triggers described above.

TR RAI-5.2-3

Consistent with NUREG-1569, Acceptance Criteria 5.2.3(6), please include a commitment to administer a cultural resources inventory before engaging in any development activity not previously assessed by NRC, and that any disturbances associated with such development will be completed in compliance with the National Historic Preservation Act, the Archeological Resources Protection Act, and their implementing regulations.

Response TR RAI-5.2-3

Please refer to the response provided in ER RAI CH-3

TR RAI-5.2-4

On page 5-7 of the TR it is stated that "Records of inspections of tailings piles and waste retention systems" will be maintained. Please clarify if there will be tailings piles on the site.

Response TR RAI-5.2-4 (TR Section 5.2.5)

Tailings piles will not be present on the site.

Management and Audit Program 5.3

TR RAI- 5.3-1
ALARA requirements relevant to ISR facilities are codified in 10 CFR 20.1101 and 10 CFR 40, Appendix A, Criterion 8. Please address the following issues related 10 the applicant's ALARA program.

TR RAI- 5.3-1(a)
a. 10 CFR 20.1101(b) specifically addresses dose to members of the public. In Section 5.3.4 of the TR, the applicant does not discuss ALARA measures as it apply to members of the public. Consistent with the regulatory citations above and Regulatory Guide 8.37, please provide additional discussion on the applicant's ALARA program. This discussion should address ALARA goals and reviews related to members of the public.

Response TR RAI-5.3-1(a) (TR Section 5.3)
The company's primary goal of the radiation protection program is to ensure doses to workers and the members of the public are ALARA, according to the requirements in 10 CFR 20.1101(b) which states: "The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA)." The Management and Audit Program is designed to provide quality assurance based upon reviews and evaluations of the effectiveness of radiation protection provided for workers and members of the public. For more information regarding exposures to members of the public see TR Section 2.9.6.

(b) Consistent with Regulatory Guides 8.10 and 8.31, please provide additional information on the applicant's occupational exposure ALARA program. The discussion should evaluate its proposed management and audit program and specifically address those items in Section 1.1, Licensee Management, of Regulatory Guide 8.31 and regulatory position C (1) of Regulatory Guide 8.10 that are not currently addressed in the application.

TR RAI- 5.3-1(b)

ALARA requirements relevant to ISR facilities are codified in 10 CFR 20.1101 and 10 CFR 40, Appendix A, Criterion 8. Please address the following issues related 10 the applicant's ALARA program.

b. ***Consistent with Regulatory Guides 8.10 and 8.31, please provide additional information on the applicant's occupational exposure ALARA program. The discussion should evaluate its proposed management and audit program and specifically address those items in Section 1.1, Licensee Management, of Regulatory Guide 8.31 and regulatory position C(1) of Regulatory Guide 8.10 that are not currently addressed in the application.***

Response TR RAI-5.3-1(b) (TR Section 5.3)

Licensee Management Items in RG-8.31_Section 1.1 are listed below followed by the appropriate TR section where each commitment is made within the respective discussion of the applicable program and/or management schema described.

1. A strong commitment to and continuing support for the development and implementation of the radiation protection and ALARA program;
Addressed in: TR_Section 5.0 pg.5-1 first paragraph

2. Information and policy statements to employees, contractors, and visitors;
Addressed in: TR_Section 5.5 pg.5-13

3. A periodic management audit program that reviews procedural and operational efforts to maintain exposures ALARA;
Addressed in: TR_Section 5.3 begin on pg . 5-9

4. Continuing management evaluation of the radiation safety (health physics) program, its staff, and its allocation of adequate space and money;
Addressed in: TR_Section 5.0 pg.5-1 first paragraph; TR_Section 5.3 begin on pg . 5-9

5. Appropriate briefings and training in radiation safety, including ALARA concepts for all uranium employees in the facility and, when appropriate, for contractors and visitors.
Addressed in: TR_Section 5.5.4 pg. 5-15; TR_Section 5.5 pg.5-13; TR_Section 3.3 begin pg. 3-59; TR_Section 4.2.3 pg. 4-28; TR_Section 5.3.4 pg. 5-11; TR_Section 5.4 pg. 5-12

Powertech (USA) believes the information contained within the application is in line with the general operating philosophies acceptable to the NRC staff as described in RG-8.10. The application strongly supports the management's commitment to maintaining exposures ALARA and reducing exposures when possible. Refer to the following TR_Sections: 4.1.1 Radon; 4.1.2.2 Atmospheric Discharges from the Yellowcake Draying and Packaging System; 5.0 Operations; 5.1 Corporate Organization and Administrative Procedures; 5.1.5 Radiation Safety Officer; 5.2 Management Control Program; 5.3

Management and Audit Program; 5.3.4 Annual Radiation Protection and ALARA Program Audit; 5.5.1 Initial Training; 5.7 Radiation Safety Controls and Monitoring; 6.3.2 Preliminary Radiological Surveys and Contamination Control; 6.4.1.3 Uranium Chemical Toxicity Assessment; 6.4.3 Surface Soil Cleanup Verification and Sampling Plans.

Radiation Safety Training 5.5

TR RAI-5.5-1

Consistent with Regulatory Guide 8.13 and NUREG-1569, Acceptance Criteria 5.5.3(2), please provide the applicant's specific policy on declared pregnant women.

Response TR RAI-5.5-1 (TR Sections 5.7.2.2 and 5.7.4.3)

Applicable limits for declared pregnant workers are the same as adult workers with the exception of the DDE which is 10 percent of the adult limit for the period of gestation.

The dose to the embryo and fetus is calculated as the sum of the deep-dose equivalent of the declared pregnant worker and the dose to the embryo/fetus from radionuclides in the embryo/fetus and the declared pregnant worker. The calculations will be done according the NRC Regulatory Guide 8.36 *"Radiation Dose to the Embryo/Fetus"*.

TR RAI-5.5-2

Consistent with Regulatory Guide 8.31 and NUREG-1569, Acceptance Criteria 5.5.3(1), please provide a proposed training program that includes non-radiological hazards for workers.

Response TR RAI-5.5-2 (TR Section 5.5.1 -5.5.3; Sections 7.2.5.4 and 7.5.1)

Regulatory Guide 8.31_Section 2.5 and NUREG-1569, Acceptance Criteria 5.5.3(1) both address risks of exposure to radiation, the applicant has addressed these components of the training program in TR_Section 5.5.1. TR_Section 5.5.3 Visitor Training addresses radiological and nonradiological training for visitors. TR_Section 5.5.4 Contractor Training addresses type of training appropriate for the work that will be performed by the contractor. See also TR_Section 3.3 (Subparts H and Z). TR_Section 7.2.5.4 commits the applicant to "rigorous safety training".

TR RAI-5.5-3

Consistent with Regulatory Guide 3.46, please provide a copy of the proposed written radiological safety instructions in conformance with 10 CFR 19.12.

Response TR RAI-5.5-3

"Proposed Written Radiological Safety Instructions" are inserted below as Appendix 5.5-A.

Appendix 5.5-A: Proposed Written Radiological Safety Instructions

§ 19.12 Instruction to workers.

(a) All individuals who in the course of employment are likely to receive in a year an occupational dose in excess of 100 mrem (1 mSv) shall be--

(1) Kept informed of the storage, transfer, or use of radiation and/or radioactive material;

(2) Instructed in the health protection problems associated with exposure to radiation and/or radioactive material, in precautions or procedures to minimize exposure, and in the purposes and functions of protective devices employed;

(3) Instructed in, and required to observe, to the extent within the workers control, the applicable provisions of Commission regulations and licenses for the protection of personnel from exposure to radiation and/or radioactive material;

(4) Instructed of their responsibility to report promptly to the licensee any condition which may lead to or cause a violation of Commission regulations and licenses or unnecessary exposure to radiation and/or radioactive material;

(5) Instructed in the appropriate response to warnings made in the event of any unusual occurrence or malfunction that may involve exposure to radiation and/or radioactive material; and

(6) Advised as to the radiation exposure reports which workers may request pursuant to § 19.13.

(b) In determining those individuals subject to the requirements of paragraph (a) of this section, licensees must take into consideration assigned activities during normal and abnormal situations involving exposure to radiation and/or radioactive material which can reasonably be expected to occur during the life of a licensed facility. The extent of these instructions must be commensurate with potential radiological health protection problems present in the work place.

External Radiation Exposure Monitoring Program 5.7.2

TR RAI-5.7.2-1

10 CFR 20.1501(a)(2)(i) states that the licensee shall make or cause to be made surveys that are reasonable under the circumstances to evaluate the magnitude and extent of radiation levels. In section 5.7.2 of the TR, the applicant has not discussed the potential situation when the dose exceeds 5 mrem in 1 hour at 30 cm from a radiation source, or any surface that the radiation penetrates, and whether it will have sufficient instrumentation to measure gamma dose rates in excess of 5 mrem per hour. Consistent with Regulatory Guide 3.46 and NUREG-1569, Acceptance Criterion 5.7.2.3(3), provide a description of survey instrumentation sufficient to measure expected gamma dose rates during operation.

Response TR RAI-5.7.2-1 (TR Section 5.7.2.3)

According to NUREG 1569; Acceptance Criterion 5.7.2.3(3) applies to the proposed external radiation monitors appropriate to the facility operation. It is the applicant's understanding that the NRC's request is specific to Radiation Area; i.e., any accessible area in which an individual could receive a dose equivalent exceeding 5 mrem in 1 hour at 30 cm (1 ft) from the source or from any surface the radiation penetrates.

Areas posted as "radiation areas" will be investigated to determine the source of radiation and will be surveyed for gamma radiation on a quarterly basis as described in RG 8.30. Methods to reduce radiation levels using engineering controls, process adjustments, or maintenance practices will be evaluated once the source of radiation is determined.

The instrumentation used in the external gamma radiation surveys will be portable; battery operated and will have a sensitivity of at least 0.1 milliroentgens per hour (mR/hr) and be able to measure radiation levels as high as 5 mR/hr.

The instrumentation will be calibrated according to the manufacturer's instructions or at least once a year. Operational checks on the instruments will be performed before each daily use. The instruments will be operated according to manufacturer's recommendation.

The instrumentation to be used in the gamma surveys will be portable, and have a low efficiency for detecting gamma radiation. An example is a Ludlum Model 44-9 GM pancake Detector coupled with an appropriate ratemeter/scaler.

TR RAI-5.7.2-2

Regulatory Guide 8.30 recommends establishing action levels for gamma dose rates and dosimeter results. Consistent with Regulatory Guide 8.30, please provide these action levels or justification for an alternate program.

Response TR RAI-5.7.2-2 (TR Section 5.7.2.2.1)

The staff is correct in that RG 8.30 recommends establishment of action levels for each location where the gamma dose rate is periodically measured. However, RG 1569 does not suggest applicants provide gamma dose action levels for application purposes. Powertech (USA) is committed to developing strict radiation safety protocols and gamma dose action levels are included within this commitment. The applicant provides the following justification for an alternate method. Gamma action levels are usually determined after fluctuations of normal operating levels have been established. The action level is usually set just higher than the fluctuation of normal operating levels. The action levels may vary based on background levels; distance from source; type of shielding available within the work area; and type of work. All of which will be considered in the development of gamma dose action levels.

Consistent with RG 8.30, if the action level for any location is exceeded, the RSO will investigate and determine the cause of the exceedance and take corrective action. In an effort to reduce open issues Powertech (USA) commits to an administrative action limit of 500 mrem for external radiation dose. With ALARA ever present in mind, the applicant will strive to reduce exposures and adjust action limits as appropriate (above fluctuating normal levels and below the administrative action limits).

TR RAI-5.7.2-3

Consistent with NUREG-1569, Acceptance Criterion 5.7.2.3(2) and Regulatory Guide 8.34, discuss the applicant's employee monitoring program as it relates to individuals entering a high radiation area.

Response TR RAI-5.7.2-3 (TR Section 5.7.2.2)

High Radiation Area: Any accessible area in which an individual could receive a dose equivalent exceeding 100 mrem in 1 hour at 30 cm (1 ft) from the source or from any surface the radiation penetrates. The existence of a high radiation area occurring within an ISL facility is unlikely.

However unlikely the occurrence may be, if it were necessary for an individual to enter a high radiation area, the individual would be monitored with a personal monitoring device and equipped with a calibrated rate meter and appropriate detector. Any work performed within the area would be limited and performed in such a manner as to only permit the minimum exposure.

The licensee is aware of Subpart G §20.1601 and will have qualified staff present and prepared to implement and utilize monitoring devices and the controls deemed applicable to the specific circumstances and area in order to control access and exposure.

TR RAI-5.7.2-4

Regulatory Guide 3.46 recommends indicating the number and category of personnel that will be included in the external radiation monitoring program. Please provide this information or justification for not including it in the application.

Response TR RAI-5.7.2-4 (TR Section 5.7.2.2)

OSL dosimeters will be utilized quarterly for assessing dose for personnel monitoring for individuals who may potentially exceed 10 percent of the annual occupational limit (10 CFR 20.1201(a)). Powertech (USA) may monitor other workers, although not required, for occupational exposures during the first year of operations to ensure that all workers are receiving less than 10 percent of the 5 rem annual limit; after the first year evaluation, monitoring may be reduced or eliminated at some locations. This decision would be at the discretion of the RSO. Please refer to Figure 5.1-2 "Facility Organizational Structure" for categories and numbers of individuals whom may be monitored within the first year of operation (approximately 90 individuals). The licensee may reduce the categories and number of personnel to those working under the RSO (9), Construction Superintendent (31) and the Production Superintendent (43).

TR RAI-5.7.2-5

Section 5.7.2.1 refers to Figure 5.7-1 for the locations of fixed radiation exposure measurements at the Dewey-Burdock facility. However, Figure 5.7-1 depicts the proposed operational environmental monitoring sites. Please provide the correct figure reference(s).

Response TR RAI-5.7.2-5 (TR Section 5.7.2.3)

TR_Section 5.7.2.3 External Radiation Surveys provides the proposed locations of exposure rate monitors inside and outside the facilities. See Figures 5.7-2 through 5.7-5 of the above mentioned section of the TR.

In-Plant Airborne Radiation Monitoring Program 5.7.3

TR RAI-5.7.3-1

In Section 5.7.3.1 of the TR, the applicant described proposed radon monitoring locations based upon expected radon decay product concentrations. Figures 5.7-6 to 5.7-9 show these locations at the satellite and central processing facilities. However, it is not clear if/how the applicant will evaluate if these proposed locations remain appropriate once operations have started and throughout the operational lifetime of the facilities. Regulatory guides 3.46, 8.25, and 8.30 provide recommendations regarding the location of air samplers. Please address the following in regards to radon decay product monitoring:

TR RAI-5.7.3-1(a)

a. ***Consistent with Regulatory Guide 8.25, please describe how airflow patterns will be established within the facilities and will they be verified throughout the operational lifetime of the facilities.***

Response TR RAI-5.7.3-1(a) (TR Section 5.7.3)

Air flow patterns will be determined based on location of air inlets and air exhausts relative to sources of airborne radioactive materials; neutrally buoyant markers may be utilized to determine air patterns. Air flow patterns for worker areas will also be observed and monitored. If any worker areas are altered in size or location the air flow will be re-evaluated in those areas. If there is any reason to suspect a change in flow or pattern, the area will be evaluated for air flow pattern changes. Radon detectors will be placed near a height of 3 to 6 feet between the source and the area occupied by the workers.

TR RAI-5.7.3-1(b)

In Section 5.7.3.1 of the TR, the applicant described proposed radon monitoring locations based upon expected radon decay product concentrations. Figures 5.7-6 to 5.7-9 show these locations at the satellite and central processing facilities. However, it is not clear if/how the applicant will evaluate if these proposed locations remain appropriate once operations have started and throughout the operational lifetime of the facilities. Regulatory guides 3.46, 8.25, and 8.30 provide recommendations regarding the location of air samplers. Please address the following in regards to radon decay product monitoring:

b. Consistent with Regulatory Guide 8.25, please describe how air sampling locations will be evaluated over time to confirm that their locations are still appropriate.

Response TR RAI-5.7.3-1(b)

See TR_RAI-Response 5.7.3-1(a).

TR RAI-5.7.3-1(c)

In Section 5.7.3.1 of the TR, the applicant described proposed radon monitoring locations based upon expected radon decay product concentrations. Figures 5.7-6 to 5.7-9 show these locations at the satellite and central processing facilities. However, it is not clear if/how the applicant will evaluate if these proposed locations remain appropriate once operations have started and throughout the operational lifetime of the facilities. Regulatory guides 3.46, 8.25, and 8.30 provide recommendations regarding the location of air samplers. Please address the following in regards to radon decay product monitoring:

c. ***Consistent with Regulatory Guide 8.30, please provide a description of your air sampling program during the first year of operations to ensure that the proposed program adequately provides measurements of the concentrations representative of the concentrations to which workers are exposed.***

Response TR RAI-5.7.3-1(c) (TR Section 5.7.3, 5.7.3.1 and 5.7.3.2)

Powertech (USA) will conduct an airborne radiation monitoring program at the project facility which is consistent with the recommendations contained in RG 8.30. The facility will not process ore. However, the facility will precipitate, dry (at low temperatures), and package yellowcake. Therefore, the monitoring program will consist of monitoring radon decay products, as well as airborne particulate monitoring. To ensure that measurements of radon and radon progeny are representative of worker exposures, areas where workers are present often and for extended periods of time will be monitored.

Monitoring of Radon and Radon Decay Products

According to RG 8.30, measurements of radon decay products are a better measure for worker dose than measurements of radon. Therefore, measurements of radon decay products will be made in the facility.

Working level (WL) measurements for radon decay products will be made on a monthly basis in areas where radon decay product concentrations are likely to exceed the LLD 0.03 WL as described in RG 8.30. Figures 5.7-6 to 5.7-9 present the monitoring locations where radon decay products are most likely to exceed 0.03 WL. Additionally, areas where the radon decay product concentration exceeds 0.08 WL, as indicated by the monthly WL measurements, will be measured for radon decay products on a weekly basis. For these areas, investigations will be conducted to determine the source and corrective action will be taken if determined necessary by the RSO. If four consecutive weekly measurements in an area show the concentration of radon daughters to be at or below 0.08 WL, then the frequency of measurements in that area will return to monthly. Areas proximal to radon sources that do not exhibit radon decay product concentrations above 0.03 WL, as indicated by monthly WL measurements, will have WL measurement frequency reduced to quarterly. The time, date, and state of operation of the equipment in the vicinity of the measurement will be recorded.

The measurements will be performed by collecting samples on filter paper with a low-volume air sampler and analyzing the filter paper with an alpha counter using the Modified Kusnetz method described in ANSI N13.8-1973 or an equivalent method. The air sampler and alpha counter will be calibrated at the manufacturers' suggest time interval.

Airborne Particulate Monitoring

During the first year of operation an extensive air particulate program will be implemented in order to evaluate and determine area concentrations of key particulates that workers may be exposed to. Due to the fact there is no ore processing conducted at an ISL facility, the program will be designed to measure areas where workers may be exposed to radiological and non-radiological particulates during the daily work routine specific to ISL operations. Breathing zone and hi-vol monitoring programs are proposed in areas of the CPP where yellowcake is present (Figure 5.7-10). Upon analyzing the results from the air particulate measurements, determinations will be made as to the assurance that process and engineering controls set in place are controlling the concentrations workers may be exposed to. Other precautions will be considered based on the data from the primary monitoring program, such as; access control to some areas, restrictions on working time within a specific area, and the use of PPE for respiratory protection. As stated in TR_Section 5.7.3 and reiterated here: "Powertech (USA) will conduct an airborne radiation monitoring program at the project facility which is consistent with the recommendations contained in RG 8.30".

TR_RAI-5.7.3-2

Consistent with NUREG-1569, Acceptance Criterion 5.7.3.3(2) and Regulatory Guide 8.30, specify the LLD for radon daughter measurements.

Response TR_RAI-5.7.3-2 (TR Section 5.7.3.1)

See TR_RAI-Response 5.7.3-1(c)

TR RAI-5.7.3-3

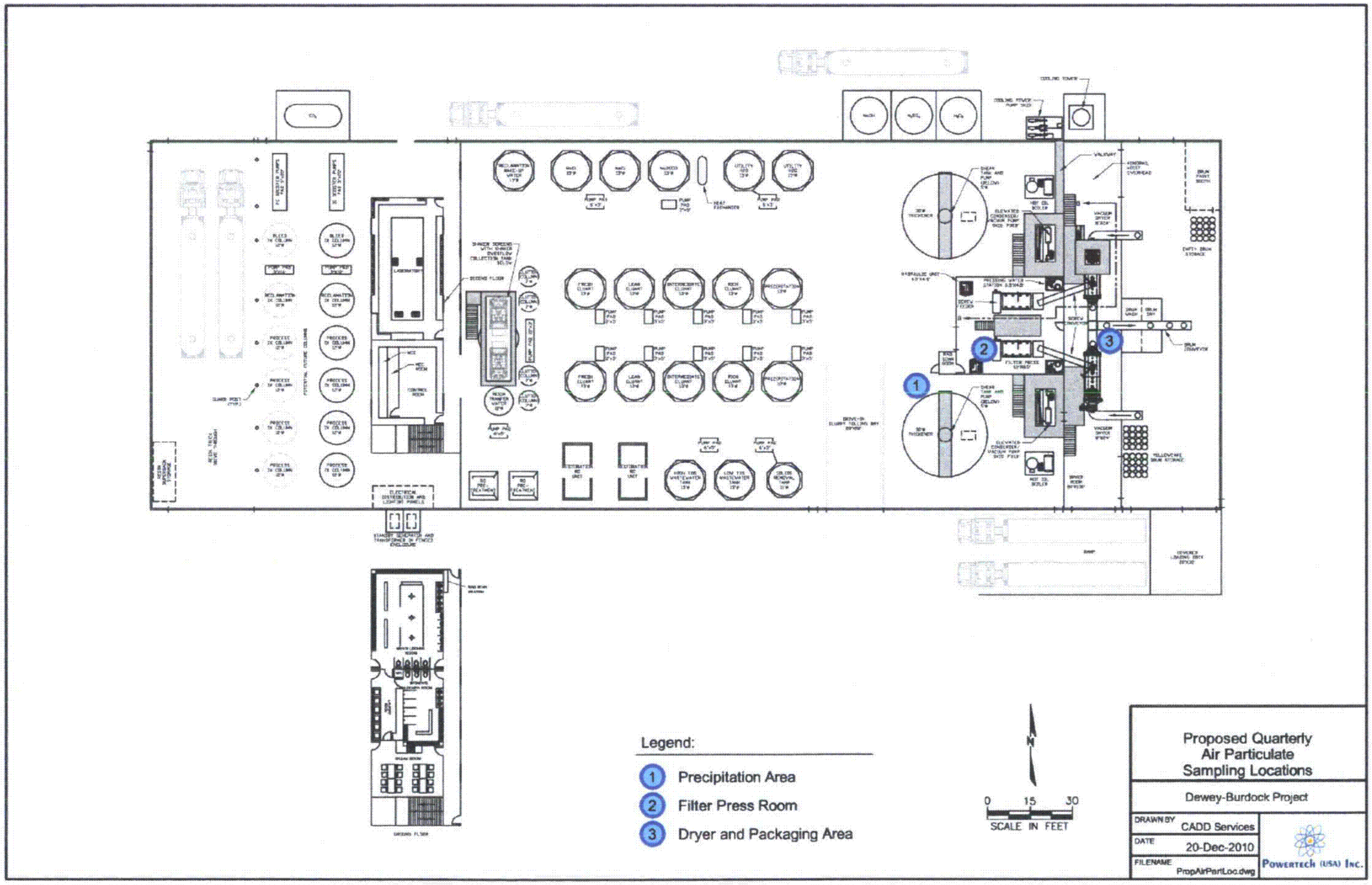
In Section 5.7.3.2 of the TR, the applicant described the proposed airborne particulate monitoring program. Regulatory Guides 3.46, 8.25, and 8.30 provide recommendations regarding the location of air samplers. Please address the following in regards to airborne particulate monitoring:

TR RAI-5.7.3-3(a)

a. ***Consistent with NUREG-1569, Acceptance Criterion 5.7.3(1), please provide facility drawings that depict the facility layout and the location of samplers for airborne particulates.***

Response TR RAI-5.7.3-3(a) (TR Section 5.7.3.2)

Figure 5.7-10 Proposed Air Particulate Sampling Locations



TR RAI-5.7.3-3(b)

In Section 5.7.3.2 of the TR, the applicant described the proposed airborne particulate monitoring program. Regulatory Guides 3.46, 8.25, and 8.30 provide recommendations regarding the location of air samplers. Please address the following in regards to airborne particulate monitoring:

b. Consistent with Regulatory Guide 8.25, please describe how airflow patterns will be established within the facilities and will they be verified throughout the operational lifetime of the facilities?

Response TR RAI-5.7.3-3(b)

See Response TR_RAI – 5.7.3-1(a)

TR RAI-5.7.3-3(c)

In Section 5.7.3.2 of the TR, the applicant described the proposed airborne particulate monitoring program. Regulatory Guides 3.46, 8.25, and 8.30 provide recommendations regarding the location of air samplers. Please address the following in regards to airborne particulate monitoring:

c. ***Consistent with Regulatory Guide 8.25, please describe how air sampling locations will be evaluated over time to confirm that their locations are still appropriate.***

Response TR RAI-5.7.3-3(c) (TR Section 5.7.3.2)

In lieu of weekly 30 minute grab samples specified in RG 8.30, weekly low volume breathing zone samples will be taken from representative workers in airborne radioactivity areas. Breathing zone samples provide a better estimate of airborne particulate concentrations to which workers are exposed, resulting in a more representative estimate of actual intakes. The sensitivity of this method shall be at least 1×10^{-11} μCi / mL.

Breathing zone samples will be taken during non-routine operations with potential for a worker to receive exposure to airborne yellowcake above 1×10^{-10} μCi / mL. The monitoring type and frequency for non-routine tasks will be described in the job-specific RWP as described in Section 5.2.2. The breathing zone samples will be evaluated quarterly to confirm that specified working locations being monitored remain at acceptable working levels.

All air samples will be analyzed for uranium within two working days after sample collection to confirm particulate results remain ALARA.

TR_RAI-5.7.3-3(d)

In Section 5.7.3.2 of the TR, the applicant described the proposed airborne particulate monitoring program. Regulatory Guides 3.46, 8.25, and 8.30 provide recommendations regarding the location of air samplers. Please address the following in regards to airborne particulate monitoring:

d. ***Consistent with Regulatory Guide 8.30, please provide a description of the applicant's air sampling program during the first year of operations to ensure that the proposed program adequately provides measurements of the concentrations representative of the concentrations to which workers are exposed.***

Response TR_RAI-5.7.3-3(d) (TR Section 5.7.3.2)

See Response TR_RAI-5.7.3-1(c)

TR RAI-5.7.3-3(e)

In Section 5.7.3.2 of the TR, the applicant described the proposed airborne particulate monitoring program. Regulatory Guides 3.46, 8.25, and 8.30 provide recommendations regarding the location of air samplers. Please address the following in regards to airborne particulate monitoring:

e. ***Consistent with Regulatory Guide 8.30, please provide a description of the applicant's air sampling program for areas not designated as airborne radioactivity areas.***

Response TR RAI-5.7.3-3(e) (TR Section 5.7.3.2)

With respect to airborne particulate monitoring, a demonstration that the volume of air sampled is accurately known will be performed via one monthly sample for 30 minutes, or five minute weekly grabs via a high-volume air sampler running at 30 cfm. The applicant reserves the right to incorporate one or both of these methods into air sampling procedures depending on which method may be most appropriate for a given space not designated as an airborne radioactivity area.

TR RAI-5.7.3-4

In Section 5.7.3.2 of the TR, the applicant proposed a formula for calculating the lower limit of detection (LLD) for particulate air samples based on the formula for minimum detectable activity (MDA) in Regulatory Guide 8.25. However, recommendations for LLD are specified in Regulatory Guide 8.30 and are based on a different formula (see Appendix B of Regulatory Guide 8.30). Please provide an LLD formula that is consistent with Regulatory Guide 8.30 or a technical justification for an alternate methodology.

Response TR RAI-5.7.3-4 (TR Section 5.7.3-4)

The technical justification for using the LLD equation based on Regulatory Guide 8.25 is contained in NUREG 1400 "Air Sampling in the Workplace" (USNRC, 1993).

We believe the equation in Regulatory Guide 8.30 is incorrect as will be shown below.

Regulatory Guide 8.30 uses the following formula to calculate LLD.

$$LLD = \frac{3 + 4.65 S_b}{3.7x10^4\, EVYe^{-\lambda t}} \quad \textbf{(Equation 1)}$$

where:

LLD =	the lower limit of detection (μCi/ml)
S_b =	the standard deviation of background count rate (counts per second)
$3.7x10^4$ =	the conversion from disintegrations per second to μCi
E =	the counting efficiency (counts per disintegration)
V =	the sample volume (ml)
Y =	the fractional radiochemical yield if applicable
λ =	the decay constant for the particular radionuclide
t =	the elapsed time between sample collection and counting

When performing gross alpha counts on a filter for natural uranium, all counts above background are assumed to be from natural uranium. Thus, the Y variable in the above equation is not applicable and the exponential term in the denominator goes to 1 due to the long effective half life of natural uranium. The Equation 1 can then be simplified to the following:

$$LLD = \frac{3 + 4.65 S_b}{3.7x10^4\, EV} \quad \textbf{(Equation 2)}$$

S_b is the standard deviation of background count rate (counts per second) and is calculated using Equation 3.0.

$$S_b = \frac{\sqrt{R_b T_S \left(1 + \frac{T_S}{T_b}\right)}}{T_S} \quad \text{(Equation 3)}$$

where:

S_b =	the standard deviation of background count rate (counts per second)
T_s =	the gross counting time or sample counting time (s)
T_b =	the background counting time (s)
R_b =	the background count rate

The equation proposed in the application to calculate LLD for uranium concentrations in air is shown in Equation 4.

$$S_b = \frac{2.71 + 3.29\sqrt{R_b T_S \left(1 + \frac{T_S}{T_b}\right)}}{VEKT_S} \quad \text{(Equation 4)}$$

where:

S_b =	the standard deviation of background count rate (counts per second)
T_s =	the gross counting time or sample counting time (s)
T_b =	the background counting time (s)
R_b =	the background count rate
K =	the conversion from disintegrations per second to µCi (3.7×10^4)
E =	the counting efficiency (counts per disintegration)
V =	the sample volume (ml)

Substituting the variable S_b for the standard deviation of background count rate into Equation 4 yields Equation 5 below.

$$LLD = \frac{2.71 + 3.29 S_b}{KEV} \quad \text{(Equation 5)}$$

A special case of S_b where the background counting time (T_s) equals the sample counting time (T_b) results in the following relationship (Equation 6) for S_b:

$$S_b = \frac{\sqrt{R_b T_S}}{T_S}\sqrt{2} \text{ or } 1.41\frac{\sqrt{R_b T_S}}{T_S} \quad \text{(Equation 6)}$$

Substituting Equation 6 into Equation 5 results in Equation 7

$$LLD = \frac{2.71 + 4.65\sqrt{R_b T_S}}{VEKT_S} \qquad \textbf{(Equation 7)}$$

A more rigorous formulation for extreme low-level counting using the exact Poisson distribution was given in Currie, 1972. Here, 2.71 (the Poisson-Normal approximation) is replaced by the exact Poisson value of 3.

Using this value, Equation 7 becomes:

$$LLD = \frac{3 + 4.65\sqrt{R_b T_S}}{VEKT_S} \qquad \textbf{(Equation 8)}$$

We believe Equation 8 should be used in the simplified case where the background counting time is equal to the sample counting time if the exact Poisson distribution is used. The effect of using 2.71 versus 3 on the LLD is small and we believe either is appropriate in estimating the LLD for air concentrations. Equation 8 is similar to Equation 2 (the simplified Regulatory Guide 8.30 equation) in form but accurately addresses S_b while Equation 2 does not accurately address S_b.

References for 5.7.3-4

NRC 1993. NUREG 1400, *Air Sampling in the Workplace, Final Report.* September

L.A Currie, *The Measurement of Environmental Levels of Rare Gas Nuclides and the Treatment of Very Low-Level Counting Data.* IEEE Trans. Nucl. Sci. NS19 (1), 119-126 (1972)

TR RAI-5.7.3-5

Regulatory Guide 8.30 recommends establishing an action level for each sampling location that will result in an investigation of the cause of the elevated concentration. Consistent with Regulatory Guide 8.30, please provide action for each sampling location or justification for an alternate program.

Response TR RAI-5.7.3-5 (TR Section 5.7.2.2.1)

A facility action level of 25% of the DAC for soluble natural uranium and 0.08 WL for radon-222 with daughters present will be established. If an airborne uranium sample exceeds the action level for soluble uranium or radon-222, the RSO will investigate the cause and increase the sampling frequency to weekly until the radon daughter concentration levels do not exceed the action level.

An administrative action level will be set at 130 DAC-hours for exposure to insoluble uranium, and/or radon daughters for any calendar quarter. If the action level is exceeded, the RSO will initiate an investigation into the cause of the occurrence, determine any corrective actions that will reduce future exposures, and document the corrective actions taken. Results of the investigation will be reported to management.

The results of the bioassay program also will be used to evaluate the adequacy of the respiratory protection program at the facility. An abnormally high urinalysis will be investigated both to determine the cause of the high result, and determine if the exposure records adequately reflected that such an exposure may have actually occurred.

TR_RAI-5.7.3-6

In Sections 4.1.2 and 5.7.3.2 of the TR, the applicant states that yellowcake produced at the facility should be considered "soluble" with respect to occupational radiation exposure based on footnotes in 10 CFR 20, Appendix B. NRC staff is unaware of any footnotes making this statement. This terminology is outdated and is no longer relevant to 10 CFR 20, Appendix B, occupational radiation exposure limits. It also appears to be inconsistent with NRC guidance given at the November 2009 uranium recovery workshop held in Denver, CO (ML09351 0162). In regards to the applicant's airborne particulate monitoring program, please provide the following information:

TR_RAI-5.7.3-6(a)

a. Provide a specific reference in 10 CFR 20 that describes hydrogen peroxide precipitated yellowcake as "soluble" for radiation protection purposes.

Response TR_RAI-5.7.3-6(a) (TR Section 4.1.2)

(a) Clarification: TR_Section 4.1.2 is referring to uranyl peroxide (yellowcake) as soluble in body fluids with respect to drying temperature during processing. TR_Section 5.7.3.2 basically quotes the current regulation ISL licensees are bound to comply with.

Although aspects of solubility were discussed within a power point presented at the November 2009 uranium workshop, there is no specific action items listed in ML093510816 concerning the occupational radiation exposure limits. There are specific areas of concern identified for contamination (items 3 and 4); the action by the NRC was a determination that RG 8.30 would be the standard until it is revised in dealing with contamination control limits and personnel contamination limits. It seems only logical that applicants would follow this same guidance in RG 8.30 regarding occupational radiation exposure until RG 8.30 is revised, vetted, and approved by the Commission. In addition, there are many TR_RAIs that specifically request that responses are consistent with RG 8.30 regarding the in-plant airborne radiation monitoring program (see TR_RAIs in section 5.7.3).

The applicant refers the reviewer to RG 8.30 Section 2.2 "new process uranyl peroxide" or UO_4 as described in TR_Section 3.2.5. This discussion relates to yellowcake dried at low temperatures of less than 400 °C (this includes uranyl peroxide) being more soluble in body fluids than yellowcake dried at higher temperatures. "For purposes of compliance with 10 CFR Part 20, yellowcake undried or dried at low temperature should be classified as soluble" (RG 8.30; section 2.2).

10 CFR § 20.1201(e) In addition to the annual dose limits, the licensee shall limit the soluble uranium intake by an individual to 10 milligrams in a week in consideration of chemical toxicity (see footnote 3 of appendix B to part 20).

The applicant would direct the reviewer's attention to the footnotes referred to in 10 CFR Part 20 Appendix B below.

[3] For soluble mixtures of U-238, U-234, and U-235 in air, chemical toxicity may be the limiting factor (see § 20.1201(e)). If the percent by weight (enrichment) of U-235 is not greater than 5, the concentration value for a 40-hour workweek is 0.2 milligrams uranium per cubic meter of air average. For any enrichment, the product of the average concentration and time of exposure during a 40-hour workweek shall not exceed 8E-3 (SA) µCi-hr/ml, where SA is the specific activity of the uranium inhaled. The specific activity for natural uranium is 6.77E-7 curies per gram U. The specific activity for other mixtures of U-238, U-235, and U-234, if not known, shall be:

SA = 3.6E-7 curies/gram U for U-depleted

SA = [0.4 + 0.38 (enrichment) + 0.0034 (enrichment)^2] E-6 , enrichment $\geq$ 0.72

where enrichment is the percentage by weight of U-235, expressed as percent.

NOTE:

1. If the identity of each radionuclide in a mixture is known but the concentration of one or more of the radionuclides in the mixture is not known, the DAC for the mixture shall be the most restrictive DAC of any radionuclide in the mixture.
2. If the identity of each radionuclide in the mixture is not known, but it is known that certain radionuclides specified in this appendix are not present in the mixture, the inhalation ALI, DAC, and effluent and sewage concentrations for the mixture are the lowest values specified in this appendix for any radionuclide that is not known to be absent from the mixture; or

	Table 1 Occupational Values			**Table 2 Effluent Concentrations**		**Table 3 Releases to Sewers**
	Col. 1	**Col. 2**	**Col. 3**	**Col. 1**	**Col. 2**	**Monthly Average Concentration (uCi/ml)**
	Oral Ingestion	**Inhalation**		**Air (uCi/ml)**	**Water (uCi/ml)**	
Radionuclide		**ALI**	**DAC**			

	ALI (μCi)	(μCi)	(μCi/ml)			
If it is known that Ac-227-D and Cm-250-W are not present	-	7E-4	3E-13	-	-	-
If, in addition, it is known that Ac-227-W,Y, Th-229-W,Y, Th-230-W, Th-232-W,Y, Pa-231-W,Y, Np-237-W, Pu-239-W, Pu-240-W, Pu-242-W, Am-241-W, Am-242m-W, Am-243-W, Cm-245-W, Cm-246-W, Cm-247-W, Cm-248-W, Bk-247-W, Cf-249-W, and Cf-251-W are not present	-	7E-3	3E-12	-	-	-
If, in addition, it is known that Sm-146-W, Sm-147-W, Gd-148-D,W, Gd-152-D,W, Th-228-W,Y, Th-230-Y, U-232-Y, U-233-Y, U-234-Y, U-235-Y, U-236-Y, U-238-Y, Np-236-W, Pu-236-W,Y, Pu-238-W,Y, Pu-239-Y, Pu-240-Y, Pu-242-Y, Pu-244-W,Y, Cm-243-W, Cm-244-W, Cf-248-W, Cf-249-Y, Cf-250-W,Y, Cf-251-Y, Cf-252-W,Y, and Cf-254-W,Y are not present	-	7E-2	3E-11	-	-	-
If, in addition, it is known that Pb-210-D, Bi-210m-W, Po-210-D,W, Ra-223-W, Ra-225-W, Ra-226-W, Ac-225-D,W,Y, Th-227-W,Y, U-230-D,W,Y, U-232-D,W, Pu-241-W, Cm-240-W, Cm-242-W, Cf-248-Y, Es-254-W, Fm-257-W, and Md-258-W are not present	-	7E-1	3E-10	-	-	-
If, in addition, it is known that Si-32-Y, Ti-44-Y, Fe-60-D, Sr-90-Y, Zr-93-D, Cd-113m-D, Cd-113-D, In-115-D,W, La-138-D, Lu-176-W, Hf-178m-D,W, Hf-182-D,W, Bi-210m-D, Ra-224-W, Ra-228-W, Ac-226-D,W,Y, Pa-230-W,Y, U-233-D,W, U-234-D,W, U-235-D,W, U-236-D,W, U-238-D,W, Pu-241-Y, Bk-249-W, Cf-253-W,Y, and Es-253-W are not present	-	7E+0	3E-9	-	-	-
If it is known that Ac-227-D,W,Y, Th-229-W,Y, Th 232-W,Y, Pa-231-W,Y, Cm-248-W, and Cm-250-W are not present	-	-	-	1E-14	-	-
If, in addition, it is known that Sm-146-W, Gd-148-D,W, Gd-152-D, Th-228-W,Y, Th-230-W,Y,U-232-Y, U233-Y, U-235-Y, u-236-Y, U238-Y, U-Nat-Y, Mp-236-W, Mp-237-W, Pu-236-W,Y, Pu-238-W,Y, Pu-239-W,Y, Pu-240-W,Y, Pu-242-W,Y, Pu-244-W,Y, Am-241-W, Am-242m-W, Am-243-W, Cm-243-W, Cm-244-W, Cm-245-W, Cm-246-W, Cm-247-W, Bk-247-W, Cf-249-W,Y, Cf-250-W,Y, Cf-251-W,Y, Cf-252-W,Y, and Cf-254-W,Y are not present	-	-	-	1E-13	-	-
If, in addition, it is known that Sm-147-W, Gd-152-W, Pb-210-D, Bi-210m-W, Po-210-D,W, Ra-223-W, Ra-225-W, Ra-226-W, Ac-225-D,W,Y, Th-227-W,Y, U-230-D,W,Y, U-232-D,W, U-Nat-W, Pu-241-W, Cm-240-W, Cm-242-W, Cf-248-W,Y, Es-254-W, Fm-257-W, and Md-258-W are not present	-	-	-	1E-12	-	-
If, in addition it is known that Fe-60, Sr-90, Cd-113m, Cd-113, In-115, I-129, Cs-134, Sm-145, Sm-147, Gd-148, Gd-152, Hg-194 (organic), Bi-210m, Ra-223, Ra-224, Ra-225, Ac-225, Th-228,	-	-	-	-	1E-6	1E-5

Th-230, U-233, U-234, U-235, U-236, U-238, U-Nat, Cm-242, Cf-248, Es-254, Fm-257, and Md-258 are not present						

This approach is also consistent with recent applications; three examples are provided below:

- Lost Creek Project; *(ML090080451)*
- Uranium One (ML0820527)
- Uranerz Energy Corporation (ML102650539)

The reviewer gives no justification for the statement "This terminology is outdated and is no longer relevant to 10 CFR 20, Appendix B, occupational radiation exposure limits". The referenced footnotes are an extension of 10 CFR PART 20 Appendix B.

To address the comment of the term "guidance" applied to the uranium workshop of November 2009: Powertech (USA) (USA) is bound by the law to comply with 10 CFR Part 20 and BMPs; in conjunction the applicant is utilizing RG 8.30 as guidance due to the following facts: 10 CFR Part 20 is the active regulation by which the standards for protection against ionizing radiation resulting from ISL activities under licenses issued by the NRC. These regulations are issued under the Atomic Energy Act which ISL operators are obligated to comply with. RG 8.30 was written and vetted through the public and commission processes in order to provide industry with methods and techniques acceptable to the NRC. RG 8.30 represent the most current guidance that has been through the complete evaluating and vetting processes that are in line with the current NRC regulations.

TR RAI-5.7.3-6(b)

In Sections 4.1.2 and 5.7.3.2 of the TR, the applicant states that yellowcake produced at the facility should be considered "soluble" with respect to occupational radiation exposure based on footnotes in 10 CFR 20, Appendix B. NRC staff is unaware of any footnotes making this statement. This terminology is outdated and is no longer relevant to 10 CFR 20, Appendix B, occupational radiation exposure limits. It also appears to be inconsistent with NRC guidance given at the November 2009 uranium recovery workshop held in Denver, CO (ML09351 0162). In regards to the applicant's airborne particulate monitoring program, please provide the following information:

- ***b. Regarding the determination of the inhalation classification of yellowcake produced at the Dewey-Burdock facility, provide an air particulate monitoring program consistent with guidance given at the November 2009 uranium recovery workshop held in Denver, CO (ML093510162) or a technical justification for an alternate methodology.***

Response TR RAI-5.7.3-6(b) (TR Section 5.7.4.1)

See TR_Section 5.7.4.1 "Internal Exposure" intake or concentration of radioactive material in air will be compared to the ALI or the DAC value regarding a solubility classification "D" specified in 10 CFR Part 20 Appendix B (Table1 Occupational Values).

TR RAI-5.7.3-7

In Section 5.7.3.2 of the TR, the applicant described its monitoring program for determining compliance with 10 CFR 20.1201(e) (weekly soluble uranium intake). However, it is not clear how the applicant's ALARA program will be applied to this limit. Please provide the ALARA goal for uranium intake.

Response TR RAI-5.7.3-7 (TR Section 5.7.3.2)

Primary ALARA goal at the Dewey-Burdock facility for uranium intake will be initially set to the DAC and ALI values presented in Table 1 of Appendix B to 10 CFR Part 20. In addition, Powertech (USA) will also set as a primary ALARA goal to limit the soluble uranium intake by an individual to 10 milligrams in a week in consideration of chemical toxicity (see footnote 3 of Appendix B to 10 CFR Part 20). After review of the first in-house ALARA audit, necessary and cost effective modifications will be made to the ALARA program in order to further reduce exposures.

TR RAI-5.7.3-8
The applicant did not demonstrate that respiratory protection will be routinely used for operations within drying and packaging areas and did not identify the criteria for determining when respirators will be required for special jobs emergency or situations. Consistent with NUREG-1569, Acceptance Criterion 5.7.3(6), please evaluate the applicant's respiratory program and provide this information.

Response TR RAI-5.7.3-8 (TR Section 5.7.3.3)

PPE in the form of respiratory protective equipment will be mandatory for workers in areas where safeguards may not be adequate to maintain regulated exposure levels to airborne radioactive and/or toxic materials. This protection program will be carried out in accordance with RG 8.15 and RG 8.31 and will be administered by the RSO. The work areas that may have the potential for overexposure are limited to the drying and packaging areas under normal operating conditions.

Criteria for determining when respirators will be required for special job situations or a credible emergency are summarized here.

The use of respiratory protection devices will be contemplated only after other measures to limit intake have been considered (10 CFR § 20.1701). If the ALARA evaluation determines process and/or engineering controls are not practical, the licensee will increase monitoring and limit intake by controlling access, and exposure time; if determined the use of respirators will optimize the sum of internal dose and other potential risk, use of a respirator will be implemented in order to keep TEDE ALARA (RG 8.15, 1999). The level of detail addressed during a TEDE ALARA evaluation will be dictated by the potential radiological and physical risk that may be associated with the special job or emergency.

Exposure Calculations 5.7.4

TR RAI-5.7.4-1

In Section 5.7.4.2 of the TR, the applicant has not provided sufficient information regarding the internal dose calculation. Please provide the following information:

TR RAI-5.7.4-1(a)

a. Consistent with Regulatory Guide 3.46 and NUREG-1569, Acceptance Criterion 5.7.4.3(1), provide methodologies to calculate the intake of natural uranium by personnel in work areas where airborne radioactive materials could exist.

Response TR RAI-5.7.4-1(a)

If the intake due to inhalation of natural uranium by personnel in work areas where airborne radioactive materials could exist is needed, it will be determined using the following formula:

$$I_u = BR \sum_{i=1}^{n} X_i \times t_i \times \frac{1}{PF}$$

Where:

I_u	=	Intake of natural uranium for the monitoring period (µg or µCi)
X_i	=	The average air concentration of natural uranium in breathing zone during exposure period (i) (µg or µCi per milliliter)
BR	=	Breathing rate of the worker ($2.0\text{x}10^4$ milliliters per minute).
t_i	=	Time of exposure period (i)(minutes).
PF	=	The protection factor based on type of respiratory protection
n	=	Number of exposure periods during monitoring period

__TR RAI-5.7.4-1(b)__
In Section 5.7.4.2 of the TR, the applicant has not provided sufficient information regarding the internal dose calculation. Please provide the following information:

b. Consistent with Regulatory Guide 3.46 and NUREG-1569, Acceptance Criterion 5.7.4.3(5), provide exposure calculations for natural uranium for routine operations, non-routine operations, maintenance, and cleanup activities that are consistent with NRC Regulatory Guides 8.30 and 8.34.

Response TR RAI-5.7.4-1(b)
RG 3.46, Section 5.7.4 suggests describing the proposed procedure to determine the intake of radioactive materials by personnel in work areas where airborne radioactive materials could exist. This includes those exposures incurred during appropriate routine activities, non-routine operations, maintenance, and cleanup activities. The acceptance criteria in NUREG-1569 (Section 5.7.4.3 (2)) for exposure calculations for natural uranium are consistent with RG 8.30, Section C-3. Section 5.7.4.1 of the TR commits to performing calculations of the committed effective dose equivalents (CEDEs) using one of two methods described in RG 8.30, Section C. These two methods are described as follows:

Method 1: Use of Stochastic Inhalation ALIs from 10 CFR 20

The CEDE for each radionuclide may be calculated using the estimated radionuclide intake, by Equation 2 of RG 8.30 as follows:

$$H_{i,E} = \frac{5I_i}{ALI_{i,E}} \qquad \text{Equation 2}$$

where:
$H_{i,E}$ = CEDE from radionuclide i (rems)
I_i = Intake of radionuclide I by inhalation during the calendar year (µCi). If multiple intakes occurred during the year, is the sum of all intakes
$ALI_{i,E}$ = Value of the stochastic inhalation ALI (based on the CEDE) from Column 2 of Table 1 in Appendix B to Part 20 (µCi)
5 = CEDE from intake of 1 ALI (rems) The intake of natural uranium will be determined using the equation listed above in response (a).

Method 2: Use of DACs from 10 CFR 20
The CEDE may be calculated from exposures expressed in terms of DAC-hours. Equation 4 of RG 8.30 demonstrates how the committed effective dose equivalent may be calculated from exposures expressed in terms of DAC-hours.

$$H_{i,E} = \frac{5 C_i t}{2000 DAC_{stoc,i}}$$ Equation 4

where

$H_{i,E}$ = Committed effective dose equivalent from radionuclide i (rems)

C_i = The airborne concentration of radionuclide i to which the worker is exposed (microcuries/ml)

t = The duration of the exposure (hours)

2000 = The number of hours in a work year

5 = Committed effective dose equivalent from annual intake of 1 ALI or 2000 DAC-hours (rems)

Exposures to airborne natural uranium will be compared to the stochastic ALI or DAC for the "D" class of natural uranium from Table 1 of 10 CFR 20, Appendix B.

These methods will be used in non-routine operations, maintenance, and cleanup activities as well as during routine activities where appropriate. For non-routine operations involving an accident scenario, the worker breathing rate assumed in each of the above methods may not be appropriate. Alternate methods to evaluate exposure to natural uranium not contained in RGs 8.30 or 8.34 will be submitted to the NRC for review and approval prior to use.

TR RAI-5.7.4-1(c)

In Section 5.7.4.2 of the TR, the applicant has not provided sufficient information regarding the internal dose calculation. Please provide the following information:

c. ***Consistent with NUREG-1569, Acceptance Criterion 5.7.4.3(6), discuss parameters used in exposure calculations for radon daughters and natural uranium to ensure they are representative of conditions at the site by taking in to account the maximum production capacity.***

Response TR RAI-5.7.4-1(c)

The parameters used to evaluate inhalation exposure to radon-222 decay products described in Section 5.7.4.2 of the TR and to natural uranium described above are representative of the conditions of the site as they relate to the maximum production capacity.

<u>*TR RAI-5.7.4-2*</u>

In Section 5.7.4.2 of the TR, the applicant did not appear to address the possibility of various radionuclides that may be present in air. According to 10 CFR 20.1204(f), if the identity of each radionuclide in a mixture is known, but the concentration of one or more of the radionuclides in the mixture is not known, the DAC for the mixture must be the most restrictive DAC of any radionuclide in the mixture. Please demonstrate how exposure calculations will take into account the possibility of a mixture of radionuclides in air.

<u>**Response TR RAI-5.7.4-2**</u>

Considering the anticipated concentrations in air, we expect to have only natural uranium in air, not a mixture of radionuclides. Air samples will be analyzed in general using gross alpha measurements and potentially via alpha spectroscopy. Knowing the concentrations of long-lived alpha emitting radionuclides for various processes, we expect there to be no unknown mixtures of radionuclides in air.

If encountered, exposure calculations will account for mixtures in air using the unity rule as follows:

$$\frac{C_{Th-230}}{DAC_{Th-230}} + \frac{C_{U-nat}}{DAC_{U-nat}} + \frac{C_{Ra-226}}{DAC_{Ra-226}} > 1$$

Where:
C = airborne concentration, μCi/ml
DAC = derived air concentration, μCi/ml

The DAC for the mixture will be exceeded if the sum of fractions exceeds unity.

__TR RAI-5.7.4-3__

According to 10 CFR 20.1201(e), in addition to the annual dose limits the licensee shall limit the soluble uranium intake by an individual to 10 milligrams in a week in consideration of chemical toxicity. The applicant has mentioned this in the TR but still needs to describe how it will monitor and keep records of this requirement.

__Response TR RAI-5.7.4-3__

Analysis of air filters using gross alpha and alpha spectroscopy methods will yield known concentrations of uranium, 100 percent of which will be converted to mass as follows.

The TR states in Section 5.7.3.2, "the product of the average concentration and time of exposure during a 40-hour workweek shall not exceed 8E-3 (SA) µCi-hr/ml, where SA is the specific activity of the uranium inhaled."

When the limit in the footnotes is divided by 40 hours and the specific activity of natural uranium (6.77E-7 Ci/g) is taken into account, the 40-hr time-weighted average uranium concentration limit is 1×10^{-10} µCi/mL. This limit is consistent with the soluble uranium intake limit of 10 mg/week specified in 10 CFR 20.1201.2(e).

All measurements and calculations will be done and recorded using standard operating procedures. Typically, airborne particulate concentrations are recorded on an airborne particulate monitoring form, which includes lapel or high-volume air sampling flow rates and time of operation, gross alpha measurements, and associated calculations,

Records will be maintained in accordance with TR Section 5.2.5.

TR RAI-5.7.4-4

NUREG-1569, Acceptance Criterion 5.7.4.3(4) recommends that guidance for prenatal radiation exposure be consistent with Regulatory Guide 8.13. Please provide a description of the applicant's prenatal radiation exposure program that is consistent with Regulatory Guide 8.13.

Response TR RAI-5.7.4-4

RG 8.13, Revision 3, *Instruction Concerning Prenatal Radiation Exposure* (NRC, 1999) is intended to provide information to pregnant women, and other personnel, to help them make decisions regarding radiation exposure during pregnancy, as stated in Section A of the document. Section 5.5.1 of the TR commits to providing this information to workers as appropriate. Section 5.7.4 of the TR specifically addresses exposure calculations. It is unclear what information contained in RG 8.13 is applicable to this section.

TR RAI-5.7.4-5

NUREG-1569, Acceptance Criterion 5.7.4.3(8) recommends that all reporting and record keeping of worker doses is done in conformance with Regulatory Guide 8.7 and 10 CFR 20.2103. Please provide a description of the applicant's reporting and record keeping of worker doses that is consistent with Regulatory Guide 8.7 and in conformance with 10 CFR 20.2103 or provide the location for this information in the TR.

Response TR RAI-5.7.4-5

Section 5.2.6 of the TR conforms to the requirements of 10 CFR §20.2103.

In addition, Section 5.7.2.2 states that external doses received by monitored personnel above 10 percent of the applicable limits will be reported on NRC Form 5 or in a format which contains all the information listed on NRC Form 5. This same commitment is not specifically mentioned in the internal dose reporting but is intended.

TR RAI-5.7.4-6

NUREG-1569, Acceptance Criterion 5.7.4.3(7) recommends providing an estimate of airborne uranium concentrations that addresses the maximum production capacity requested in the application and the anticipated efficiencies of airborne particulate control systems discussed in the TR. The staff is unable able to locate this information within the TR; therefore, please provide it to the staff.

Response TR RAI-5.7.4-6

The estimate of the airborne uranium concentrations either within a facility or at locations outside of the facility is directly related to the efficiency of the airborne particulate control systems. Section 4.1.2.1 of the TR describes the control systems for the significant sources of airborne particulates at the facility and concludes that uranium will not be discharged. The NRC concluded similarly in Section 2.2.3 of NUREG/CR-6733 for a typical ISR facility (NRC, 2001).

Section 2.8.4 of NUREG/CR-6733 also states that historic occupational air sampling results from ISR facilities indicate that airborne radiation levels are well below 25 percent of the derived air concentration for uranium. We assume this is for Class D natural uranium.

Section 2.8.5 of NUREG/CR-6733 also states that results from environmental monitoring programs are far below regulatory limits. It is expected that this proposed ISR facility would operate within these expected parameters.

Bioassay Program 5.7.5

TR RAI-5.7.5-1

In Section 5.7.5 of the TR, the applicant has not specified the inhalation class for the airborne uranium that will be used to evaluate the bioassay program. Regulatory Guide 8.22 recommends that for exposures to Class W or Y materials alone, in vivo lung counts or alternate sampling times and action levels should be considered. Without a technical justification of the inhalation class for the uranium that could be encountered during operations, NRC staff cannot conclude that performing urinalysis alone is consistent with Regulatory Guide 8.22. Please provide a technical justification for relying on urinalysis as a primary bioassay technique.

Response TR RAI-5.7.5-1

The applicant's response to TR_RAI 5.7.3-6(a) establishes that yellowcake dried at low temperatures (less than 400°C) is considered to be soluble. Regulatory Guide 8.22 states, "Urinalysis should be performed to monitor exposures to uranium in ore dust as well as in yellowcake as they clear from the kidney before elimination renders them undetectable. It also says that in vivo thorax measurements should be made to detect the presence of the more insoluble yellowcake and uranium in ore dust when air sampling results indicate an exposure exceeding that resulting from exposure to such materials at an average concentration of 10^{-10} µCi/mL in one calendar quarter. Thus, with the solubility established, the key technical prerequisite for monitoring uranium uptake using urinalysis, the applicant believes its proposed use of urinalysis as a primary bioassay technique to be justified.

TR RAI-5.7.5-2

Consistent with Regulatory Guide 8.9 and NUREG-1569, Acceptance Criterion 5.7.5.3(1), please demonstrate the manner in which an uptake will be converted to a dose assigned to the individual for compliance with 10 CFR 20 Subpart C.

Response TR RAI-5.7.5-2

Powertech (USA) will use the following in converting uptake to a dose. Section 2.3 of Regulatory Guide 8.9 - Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program, Revision 1, July 1993, provides guidance for determining uranium uptake. Section 4.3 of RG 8.9 discusses intake retention and excretion fractions for calculating intakes. Regulatory Guide 8.34, "Monitoring Criteria and Methods To Calculate Occupational Radiation Doses" contains additional guidance on determining doses based on calculated intakes once the intake is determined. Reg Guide 8.34 also contains an example of the calculation of occupational doses based on intake.

TR RAI-5.7.5-3

Consistent with NUREG-1569, Acceptance Criterion 5.7.5.3(2), and Regulatory Guide 3.46, the number and category of personnel involved in the bioassay program should be identified in the application. Please provide this information or indicate where it can be found in the application.

Response TR RAI-5.7.5-3

Consistent with NUREG-1569, Acceptance Criterion 5.7.5.3(2) and Regulatory Guide 3.46, the applicant provided the number and category of its projected facility workers on the Organizational Structure Figure 5.1-2. Specific to the bioassay program would be the mechanics and general maintenance workers (7) and the dryer operators (2), for a total of 9 personnel.

TR RAI-5.7.5-4

Consistent with Regulatory Guide 8.22 and NUREG-1569, Acceptance Criterion 5.7.5.3(1), the applicant should specify the actions that will be taken when positive bioassay results are confirmed.

Response TR RAI-5.7.5-4

Consistent with Regulatory Guide 8.22, the applicant will follow the corrective actions outlined on Table 1 of Regulatory Guide 8.22. If a monthly urinalysis is less than 15 µg/L uranium, no action will be taken. If the monthly urinalysis is 15 to 35 µg/L uranium, the cause of the elevated uranium will be identified and corrected, a determination will be made as to the potential for other workers exposure and bioassays conducted as necessary, work assignment limitations will be considered, and respiratory protection will be considered as appropriate. Uranium confinement controls will be also be considered for possible improvements. If the amount of uranium detected in a monthly urinalysis is greater than 35 µg/L, and has been confirmed in two consecutive specimens, then the actions mentioned above will taken. Additionally, the urine specimen will be tested for albuminuria, and an in vivo count may be obtained. Work restrictions will be considered for affected employees until urinary concentrations are below 15 ug/L uranium and laboratory tests for albuminuria are negative. Further uranium confinement controls or respiratory protection requirements will also be considered. NRC will be notified as required.

TR RAI-5.7.5-5

NUREG-1569, Acceptance Criterion 5.7.5.3(5) recommends that all reporting and record keeping be done in conformance with 10 CFR 20, Subpart L and Subpart M. Please provide a description of the applicant's reporting and record keeping that is in conformance with10 CFR Subpart L and Subpart M or provide the location in the TR where this can be found.

Response TR RAI-5.7.5-5

Consistent with Acceptance Criterion 5.7.6.3(5) of NUREG-1569, the applicant will conduct its record keeping and reporting in accordance with 10 CFR 20 Subparts L and M. The applicant describes its record keeping and reporting program in TR Sections 5.2.5 and 5.2.6. Additionally, the applicant has provided additional discussion regarding record keeping and reporting in the Responses to TR RAI 5.2-1, TR RAI 5.7.4-5 and TR RAI 5.7.6-7.

Contamination Control Program 5.7.6

TR RAI-5.7.6-1

In Sections 5.7.2.3 and 5.7.6.3 of the TR, the applicant addressed beta-gamma monitoring but did not address beta-gamma contamination monitoring for personnel. Please provide details on limits and action levels for personnel with beta-gamma contamination.

Response TR RAI-5.7.6-1

Most uranium recovery facility workers receive external gamma radiation doses of less than 1 rem per year (RG 8.30). With ISL facilities there is no ore and no crushing and grinding circuits to pose a risk of exposure to beta-gamma radiation from those sources. The most likely sources of beta-gamma radiation are radium removal and yellowcake storage where uranium may be stored long enough to allow the buildup of the thorium-234 and protactinium-234. Since it will be a new facility, a gamma radiation survey will be performed shortly after commencement of operations at Dewey-Burdock. If the survey reveals any areas accessible to personnel where the gamma exposure rates are high enough that a major portion of the body of an individual could receive a dose in excess of 0.005 rem in an hour at 12 inches from the source, or from any surface that the radiation penetrates, the area will be designated a "radiation area," as defined in 10 CFR 20.1003. "Few UR facilities will have radiation dose rates this high, but such dose rates have been found where radium-226 builds up in part of the circuit."(RG 8.30)

Personnel monitoring for beta-gamma radiation and recording of monitoring results would be required for any individual likely to exceed 10 percent of the limits stated in the radiation dose limits for occupationally exposed adults (10CFR20.1201). As recommended in RG 8.30, if the situation were to exist, beta surveys of specific operations that involve direct handling of large quantities of aged yellowcake would be conducted. Beta dose rates would be measured very close to the surface, similar to alpha monitoring. If contamination is detected on personnel, the decontamination procedure would be performed and verification would be made and documented in the same process described for alpha monitoring of personnel.

TR RAI-5.7.6-2

In Section 5.7.6.2 of the TR, the applicant refers to personnel contamination as "surface" contamination. Please clarify that personnel will be monitored for skin and clothing contamination.

Response TR RAI-5.7.6-2

The statements in TR Section 5.7.6.2 indicate that personnel will be monitored for skin and clothing contamination.

TR RAI-5.7.6-3

In Section 5.7.6.2 of the TR, the applicant states those actions to be followed for personnel with skin and clothing contamination levels detected above background. Please provide information on who will conduct skin decontaminations and who will verify that background levels have been achieved after contamination has been detected.

Response TR RAI-5.7.6-3

The individual(s) with skin contamination will conduct self-decontamination if physically able to do so. If necessary, the RSO, the Radiation Safety Technician (RST) or a qualified and trained radiation worker will conduct the skin decontamination and verify that background levels have been achieved.

TR RAI- 5.7.6-4

In Section 5.7.6 of the TR, the applicant states that work will be restricted in areas where "uranium work" is performed with surface contamination levels above those specified. Please clarify whether areas will be classified as restricted based on surface contamination levels alone or if certain types of work will dictate what constitutes a restricted area. If it is the type of work, please specify what constitutes "uranium work."

Response TR RAI-5.7.6-4

Areas will be classified as restricted based on the potential for undue risks to workers from exposure to radiation and radioactive materials (10 CFR Part 20). This potential for undue risks from radiation exposure encompasses airborne radiation as well as radioactive materials on surfaces, as it is unusual to find one without the other. The type of work being performed does not dictate what constitutes a restricted area. "Uranium work" is simply a generic term for work at the facility. For further discussion regarding restricted area, see the response to TR RAI 2.9-1.

__TR RAI-5.7.6-5__

The applicant addressed beta-gamma contamination monitoring for equipment but did not address beta-gamma contamination monitoring for area surveys. Please provide details on limits and action levels for areas with beta-gamma contamination.

__Response TR RAI-5.7.6-5__

The limits established for alpha and beta-gamma radiation shall apply independently where surface contamination by both alpha and beta-gamma radiation exists. Beta contamination surveys would be performed in those areas of operations that involve direct handling of large quantities of aged yellowcake (refer to Response TR_RAI-CCP-5.7.6-1). Unrestricted area surveys will be conducted once a week (areas where food is allowed, change rooms, and offices). The total beta/gamma contamination limit for these surveys is 1000 dpm/100cm^2. After facilities have been built, each area will be monitored and a background level established. After background has been established the action levels for each area will be determined. The beta/gamma surveys for contamination within controlled areas (i.e. well fields) will be conducted once per month; the limit for these surveys is 1000 dpm/100cm^2. (Refer to TR Section 5.7.6.1, 5th para.)

TR RAI-5.7.6-6

Consistent with Regulatory Guide 8.31, specify the staff that will perform the surveys of items leaving the restricted areas.

Response TR RAI-5.7.6-6

Radiation surveys of material leaving the restricted areas will be conducted by the Radiation Safety Officer (RSO), the Radiation Safety Technician (RST), or a qualified and trained radiation worker under the supervision of the RSO.

TR RAI-5.7.6-7

Consistent with NUREG-1569, Acceptance Criterion 5.7.6.3(5), please describe the applicant's reporting and record keeping program related to its contamination control program or indicate where this can be found in the application.

Response TR RAI-5.7.6-7

Consistent with NUREG-1569, Acceptance Criterion 5.7.6.3(5), Powertech (USA) will record and maintain information and data as required by 10 CFR Part 20, Subpart L and Subpart M. The applicant addressed its record keeping and reporting functions in TR Sections 5.2.5 Record keeping and 5.2.6 Reporting (pp.5-7 to 5-9). In addition, recordkeeping and reporting are addressed in TR Section 5.3 Management and Audit Program, particularly 5.3.4 Annual Radiation Protection and ALARA Program Audit (p. 5-10). As contamination control is a primary focus of the radiation protection program, reporting and record keeping for this purpose are considered inherent to the overall radiation protection effort. However, in order to avoid confusion, the applicant will follow the protocols specified in 10 CFR Part 20, §2101, General Provisions. These are:

- Use the units of curie, rad, rem (including multiples and subdivisions)
- Show units of all quantities on records
- Use the International System of units (SI) in addition to the units of curie, rad and rem, as necessary for shipment manifests
- Make clear distinction among the quantities for dose entered on records, i.e., TEDE, lens dose equivalent, CEDE, shallow or deep dose equivalent

TR RAI-5.7.6-8
Consistent with NUREG-1569, Acceptance Criterion 5.7.6.3(6), please describe the applicant's approach for applying covering material to contaminated surfaces.

Response TR RAI-5.7.6-8
Consistent with NUREG-1569, Acceptance Criterion 5.7.6.3(6), the applicant will make a reasonable effort to minimize any radioactive contamination before the use of any covering. The applicant will not cover radioactivity on equipment or other surfaces with paint, plating, or other covering material unless contamination levels, as determined by a radioactivity survey and properly documented, are below the limits specified in Enclosure 2 to Policy and Guidance Directive FC-83-23, as updated (NRC, May 28, 2010, P.41, Section 6.3, Item #2).

TR RAI-5.7.6-9

Consistent with NUREG-1569, Acceptance Criterion 5.7.63(7), please describe the applicant's procedures for determining the radioactivity of interior surfaces of pipes, drain lines, duct work or similar items.

Response TR RAI-5.7.6-9

Consistent with NUREG-1569, Acceptance Criterion 5.7.6.3(7), the radioactivity of the interior surfaces of pipes, drain lines, or duct work will be determined by making radioactivity measurements at all accessible traps, drains and other appropriate access points that would likely be representative of the radioactivity on the interior of the pipes, drain lines or duct work.

Airborne Effluent and Environmental Monitoring Program 5.7.7

TR RAI-5.7.7-1
In its discussion of radon stacks in Section 4.1.1 of the TR, the applicant stated that it will routinely sample potential release points for radon daughters to assure that concentrations of radon and daughters are maintained ALARA. Please address the following issues related to this statement.

TR RAI-5.7.7-1(a)

a. Please describe the frequency of sampling of radon stacks.

Response TR RAI-5.7.7-1(a)
Refer to TR Section 4.1.1 page 4-2 paragraph 2; points of release (e.g., stacks, roof vents)"will be sampled quarterly".

TR RAI-5.7.7-1(b)

In its discussion of radon stacks in Section 4.1.1 of the TR, the applicant stated that it will routinely sample potential release points for radon daughters to assure that concentrations of radon and daughters are maintained ALARA Please address the following issues related to this statement.

- ***b.*** ***Consistent with Regulatory Guides 8.31 and 8.37 and NUREG-1569, Acceptance Criterion 4.1.3(5), please discuss the manner in which concentrations of radon and daughters will be determined to be ALARA under the applicant's radiation protection program.***

Response TR RAI-5.7.7-1(b)

1. Operating philosophies in RG 8.10 will be implemented
2. Refer to TR Section 4.1 "Gaseous and Airborne Particulates" where it discusses airborne effluent and environmental monitoring programs that are in line with RG 8.30
3. Refer to TR Section 4.1.1 "Radon" and Section 5.7.3.1 "Monitoring of Radon and Radon Decay Products" where Working Level measurements for decay product is discussed
4. Refer to TR Section 5.0 for a detailed description of the radon and radon progeny monitoring program
5. Refer to TR Section 5.7.1 "Effluent Control Techniques" where sampling of emissions of concern are discussed
6. Refer to TR Section 5.7.4.2 "Radon Decay Production Exposure" discuss how the exposure calculations will be performed

Throughout the application Powertech (USA) demonstrates through commitments of implementing management controls, engineering controls, radiation safety training, radon monitoring and sampling, and auditing programs, that there are several avenues involved in which concentrations of radon and radon progeny will be determined to be ALARA. The auditing programs such as the ALARA audit will ensure that Powertech (USA) utilizes the above means to upgrade the protocols in order to keep the facility radon and progeny exposures ALARA.

<u>TR RAI-5.7.7-2</u>

The applicant shows the air particulate sampling locations in Figure 5 7-10 of the TR. As discussed in previous comments (See Sections 2.5 and 2.9), the applicant did not provide an annual wind rose or address the criteria in Regulatory Guide 4.14 relating to air sampling locations. Please provide sufficient data for NRC staff to evaluate the placement of operational air particulate and radon sampling stations.

<u>Response TR RAI-5.7.7-2</u>

See Response to TR_RAI 2.9-1 and Appendix 2.5-C of the TR.

TR RAI-5.7.7-3

In Section 5.7.7.1 of the TR, the applicant stated that the filters from air samplers operating continuously will be analyzed quarterly for natural uranium, thorium-230, radium-226, and lead-210. Regulatory Guide 4.14 recommends a weekly filter change, or more frequently as required by dust loading and analysis of quarterly composite of the weekly sample. Please explain the manner in which the applicant's air sampling procedures are consistent with Regulatory Guide 4.14 and NUREG1569, Acceptance Criterion 5.7.7.3(1).

Response TR RAI-5.7.7-3

See also, Response to TR_RAI-2.9-2 for determining the frequency of filter collection and why the airborne sampling procedures are not only consistent with RG 4.14, but exceed the guidance. If the dust load is large enough that flow rates cannot be adjusted to compensate appropriately, the filters will be changed out more frequently during high dust loading periods. During low dust loading, filters will be replaced less frequently. The frequency will be at least weekly and the samples will be sent to the laboratory for analysis as a quarterly composite.

TR RAI-5.7.7-4

Consistent with Regulatory Guide 4.14, operational air sampling locations should be the same as those for preoperational air samples. Please provide information that confirms that placement of operational air sampling locations is consistent with Regulatory Guide 4.14 or justification for an alternate methodology.

Response TR_RAI-5.7.7-4

See Response to TR_RAI-2.9-1 and TR Section 5.7.7.1 "Air Monitoring" where locations of air monitoring stations and analysis are discussed relevant to RG 4.14.

TR RAI-5.7.7-5

Regulatory Guide 4.14, Table 2, suggests that radon sampling be conducted at five or more locations using the same locations as stated for air particulate sampling. Please provide information that confirms that placement of operational air sampling locations is consistent with Regulatory Guide 4.14 or justification for an alternate methodology.

Response TR RAI-5.7.7-5

See Response to: TR_RAI-2.9-1 and TR Section 5.7.7.1 "Air Monitoring"

TR RAI-5.7.7-6

In Section 5.7.7.1 of the TR, the applicant stated passive track-etch detectors will be deployed at each station for monitoring radon-222 on a quarterly basis. Regulatory Guide 4.14 recommends analysis for Rn-222 on a monthly basis. Please explain the manner in which the applicant's radon sampling procedures are consistent with Regulatory Guide 4.14 and NUREG-1569, Acceptance Criterion 5.7.7.3(1).

Response TR RAI-5.7.7-6

RG 4.14 states "Samples should be collected continuously, or for at least one week per month, for analysis of radon-222. The sampling locations should be the same as those for the continuous air particulate samples". The applicant will sample with passive track-etch detectors deployed at each designated station for monitoring radon-222 analyzed on a monthly basis.

TR RAI-5.7.7-7

Figure 5.7-10 does not indicate locations of radon monitors. Consistent with Regulatory Guide 4.14 and NUREG-1569, Acceptance Criterion 5.7.7.3(2), please provide this information.

Response TR RAI-5.7.7-7

Figure 5.7-6, Figure 5.7-7, Figure 5.7-8, and Figure 5.7-9 show the designated radon monitoring locations.

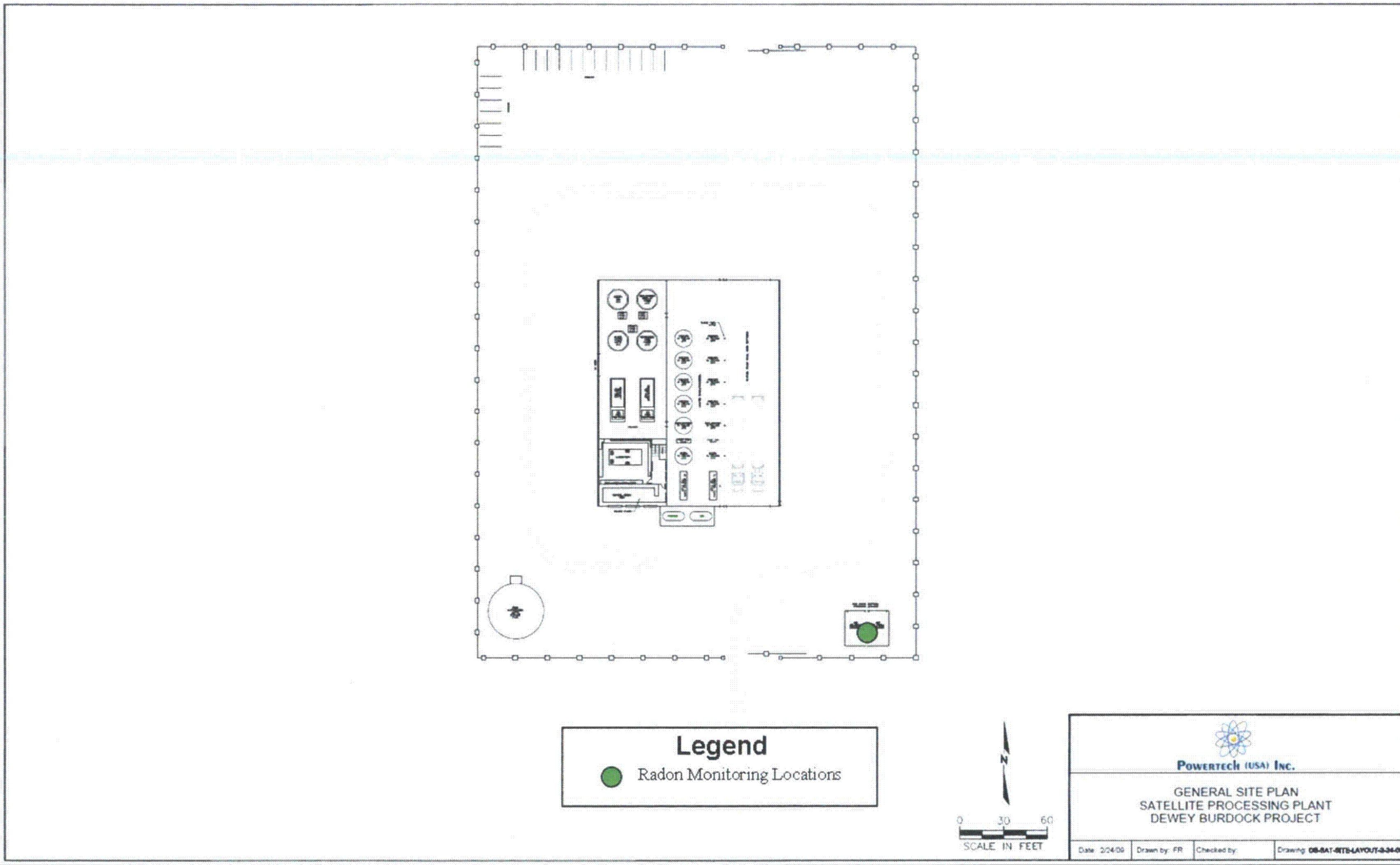


Figure 0-1: Locations of Radon Decay Product (Radon) Monitors on-site of Satellite Facility, Outside the Satellite Facility

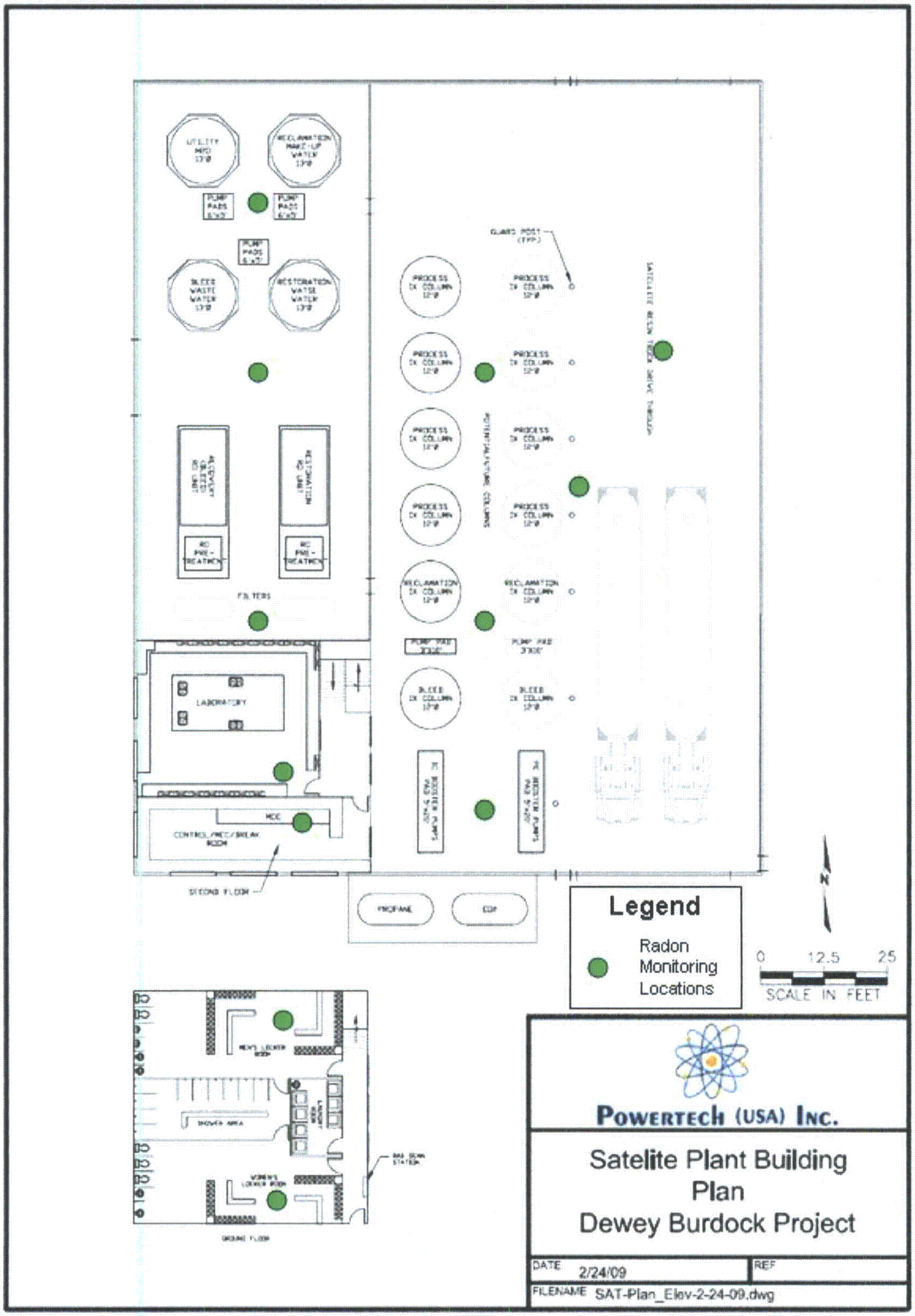


Figure 0-2: Locations of Radon Decay Product (Radon) Monitors in Satellite Facility

POWERTECH (USA) INC.

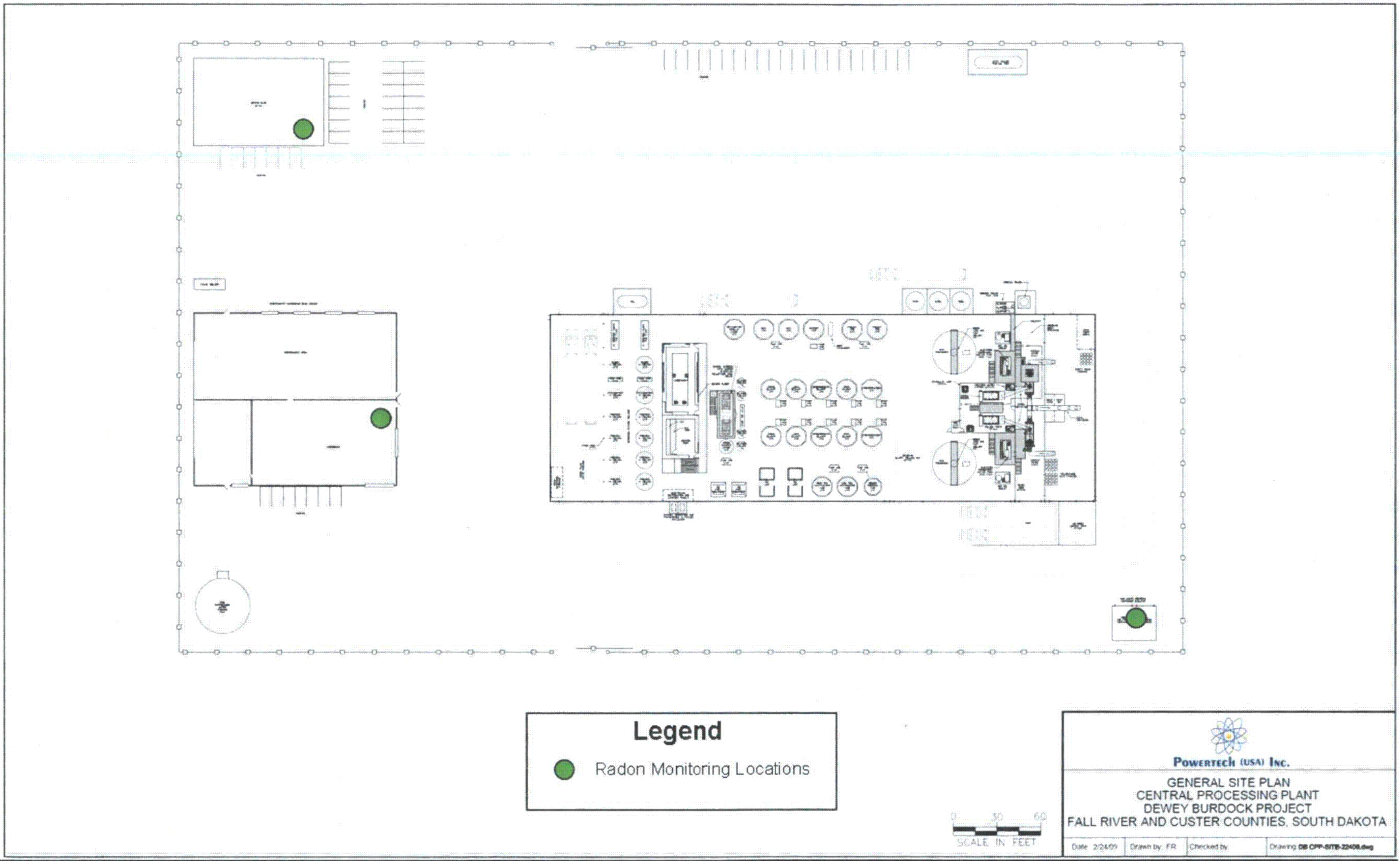


Figure 0-3: Locations of Radon Decay Product (Radon) Monitors on-site of Central Processing Facility, Outside the Central Processing Facility

POWERTECH (USA) INC.

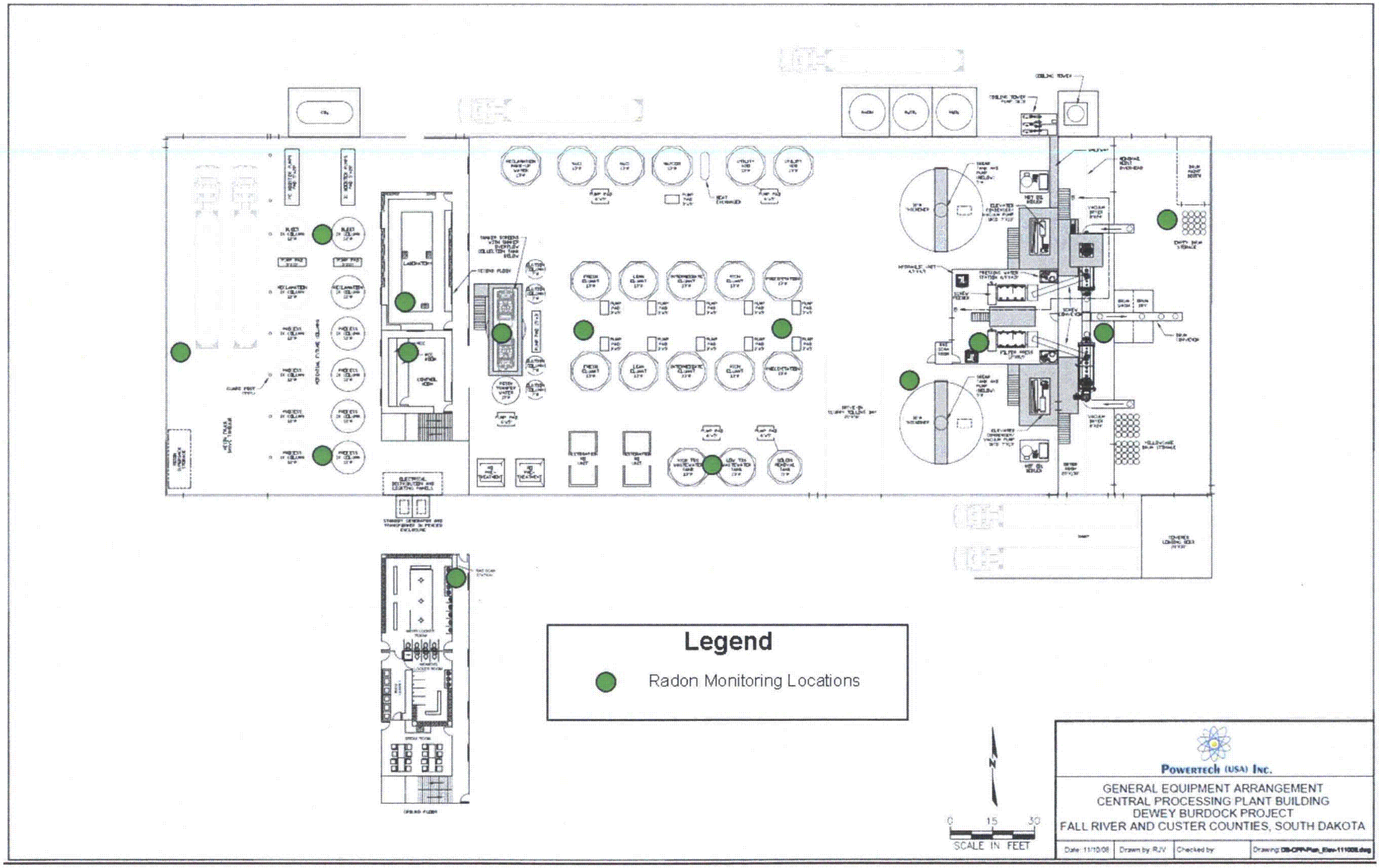


Figure 0-4: Locations of Radon Decay Product (Radon) Monitors in Central Processing Facility

TR RAI-5.7.7-8

As discussed above, NRC staff does not have enough data to fully evaluate the placement of the air particulate samplers consistent with Regulatory Guide 4.14. Since Regulatory Guide 4.14 recommends annual soil sampling at the air monitoring station locations, staff is requesting additional information to evaluate the proposed soil sampling locations described in 5.7.7.3 of the TR. Please provide information that confirms that placement of operational air sampling locations is consistent with Regulatory Guide 4.14 or justification for an alternate methodology.

Response TR RAI-5.7.7-8

See Table 2.9-1 item (F) for soil sampling locations consistent with RG 4.14.

TR RAI-5.7.7-9

Regulatory Guide 4.14 provides recommendations for collecting and analyzing sediment samples during operations. The applicant did not discuss sediment sampling during operations in Section 5.7.7 of the TR. Consistent with Regulatory Guide 4.14 and NUREG-1569, Acceptance Criterion 5.7.7.3(1), provide an operational sediment sampling program or justification of an alternate methodology.

Response TR RAI-5.7.7-9

The first year stream sediment sampling plan will include four sediment sampling locations. The following describes the locations and depicts the proposed stream sediment monitoring locations in Figure 5.7-11 and coordinates in Table 5.7-1. The locations will be sampled annually and analyzed for natural uranium, thorium-230, radium-226, lead-210 and polonium-210. If a major precipitation event occurs, sediment sampling will be conducted in addition to the annual sampling regimen. In the case of an extended period of low flow, sediment sampling will be conducted in addition to the annual sampling regimen.

Table: 5.7-1 Proposed Operational Stream Sediment Sampling Locations

Proposed Operational Sediment Sampling Locations NAD 27, South Dakota State Plane South (feet)		
Station Name	**X Coordinate**	**Y Coordinate**
PSC02	1,034,322.75675	452,562.56253
LA-01	1,022,349.06810	442,052.29287
Onsite	1,028,583.77446	431,913.05462
BVC01	1,021,472.23291	428,715.22046
CHR/BVC	1,029,024.34117	418,291.51034
PSC02	1,034,322.75675	452,562.56253

TR RAI-5.7.7-10

Regulatory Guide 4.14 provides recommendations for collecting and analyzing food samples during operations. Consistent with Regulatory Guide 4.14 and NUREG1569, Acceptance Criterion 5.7. 7.3(1), the applicant should evaluate baseline radionuclide concentrations in local food within 3 km of the site. See related issues in Section 2.9 of this RAI. Please address the following issues.

TR RAI-5.7.7-10(a)

a. The applicant has identified fish, livestock, poultry, and their products, but has not adequately analyzed the need for collecting and analyzing these food sources.

Response TR RAI-5.7.7-10(a)

See responses TR_RAI-2.9-11 through 2.9-14 and TR_RAI-2.9-21. First year operational vegetation, food and fish sampling program will meet or exceed the applicable guidance in Section 2.1.4 of RG 4.14. Vegetation, food and fish collected will be analyzed for uranium (natural), thorium-230, radium-226, lead-210 and polonium-210. Vegetation of forage sampling will be carried out if dose calculations indicate that the ingestion pathway from grazing animals is a potentially significant exposure pathway (e.g., exceeds 5% of the applicable radiation protection standard) (RG 4.14).

TR RAI-5.7.7-10(b)

Regulatory Guide 4.14 provides recommendations for collecting and analyzing food samples during operations. Consistent with Regulatory Guide 4.14 and NUREG1569, Acceptance Criterion 5.7. 7.3(1), the applicant should evaluate baseline radionuclide concentrations in local food within 3 km of the site. See related issues in Section 2.9 of this RAI. Please address the following issues.

b. The applicant has identified game animals (pronghorn, wild turkey, etc.) but has not adequately analyzed the need for collecting and analyzing these food sources.

Response TR RAI-5.7.7-10(b)

See response TR_RAI-2.9-14.

TR RAI-5.7.7-10(c)

Regulatory Guide 4.14 provides recommendations for collecting and analyzing food samples during operations. Consistent with Regulatory Guide 4.14 and NUREG1569, Acceptance Criterion 5.7. 7.3(1), the applicant should evaluate baseline radionuclide concentrations in local food within 3 km of the site. See related issues in Section 2.9 of this RAI. Please address the following issues.

c. The applicant has not adequately analyzed the need for collecting and analyzing crops including local vegetable gardens.

Response TR_RAI-5.7.7-10(c)

See response TR_RAI-2.9-12

TR RAI-5.7.7-11

In Section 5.7.7.2 of the TR, the applicant stated that samples of vegetation will be collected three times during the grazing season at each air monitoring station presented on Figure 5.7-10. Regulatory Guide 4.14 provides recommendations on where to sample for vegetation. Consistent with Regulatory Guide 4.14 and NUREG-1569. Acceptance Criterion 5.7. 7.3(1), provide sufficient information for NRC staff to evaluate the adequacy of vegetation sampling locations.

Response TR RAI-5.7.7-11

Forage vegetation, when sampled, will be collected in grazing areas in three different sectors having the highest predicted airborne radionuclide concentrations due to production facilities and prevailing wind patterns.

TR RAI-5.7.7-12

Regulatory Guide 4.14 provides recommendations for an operational direct radiation monitoring program. The applicant did not address an operational direct radiation monitoring program in section 5.7.7 of the TR. Consistent with Regulatory Guide 4.14 and NUREG-1569, Acceptance Criterion 5.7.7.3(1), provide an operational direct radiation monitoring program or provide justification for an alternate methodology.

Response TR RAI-5.7.7-12

During operations the direct radiation monitoring plan will include the use of Environmental and Personal TLD/OSL badges, properly calibrated portable survey instruments, and monitoring the air particulate locations on a quarterly basis.

TR RAI-5.7.7-13

It is not clear from the applicant's description of its airborne effluent and environmental monitoring program the manner in which it will account for and verify, by surveys and/or monitoring, the occupational dose (gaseous and particulate) received throughout the entire Permit Area. Please provide an airborne effluent and environmental monitoring program that complies with 10 CFR 20.1501.

Response TR RAI-5.7.7-13

The applicant proposes to account for and verify occupational dose within the licensed areas by implementation of the following:

- TR Section 4.0 Describes the airborne monitoring program consistent with RG 8.30 and 10 CFR 20.1501
- TR Section 5.7 (in total) describes the active and passive methods to ensure (account for and verify) occupational and public doses will be ALARA.
- See Response to TR_RAIs – 2.9
- See Response to TR_RAIs – 5.7.7

TR RAI-5.7.7-14

Consistent with 10 CFR 20.1302 and NUREG-1736, it is not clear that the applicant has evaluated the member(s) of the public likely to receive the highest exposure from licensed operations. Please provide an airborne effluent and environmental monitoring program that complies with 10 CFR 20.1302.

Response TR RAI-5.7.7-14

Clarification: The applicant has thoroughly evaluated potential receptors within the PAA by utilizing site-specific radionuclide release estimates, meteorological and population data, and other parameters to model, via MILDOS-AREA, the potential radiological impacts to human and environmental receptors (e.g. air and soil). The estimated radiological impacts resulting from routine site operational activities will be compared to applicable public dose limits as well as naturally occurring background levels.

A description of the "Potential Radiological Effects" to both the environment and humans is in Section 7.3 of the TR. Potential exposure pathways are discussed in TR Section 7.3.1; also for the reviewer's consideration are the Appendices 7.3-A and 7.3-B (MILDOS-AREA SIMULATION FOR LAND APPLICATION and MILDOS SIMULATION FOR WASTE DISPOSAL WELL). Also, see Figure 7.3-1 for a depiction of human exposure pathways that were evaluated.

See also TR Section 7.3.3 for a description of how the total effective dose equivalent (TEDE) to nearby residents in the region and at the facility boundaries was estimated using MILDOS-AREA. The parameters used to estimate releases are provided in Table 7.3-1.

For source term estimate evaluation of natural Uranium, Pb-210, Ra-226, Th-230 and see TR Section 7.3.3.1; see section 7.3.3.2 for discussion on evaluations of source term estimates for Rn-222.

The receptors and their respective locations utilized in the evaluation are presented in TR Section 7.3.3.3.

TR Section 7.3.3.6 describes the predicted TEDE to the population from one year of operation at the PAA.

See TR Section 7.3.3.8 for a discussion on the evaluation and results of RESRAD Version 6.4 model. This model was used to calculate the maximum annual dose rate from the land application processes (Radiological and Non-radiological). This program was developed by Argonne National Laboratory to (in part) calculate radiation dose to an on-site resident (a maximally exposed individual or a member of a critical population group.

There is no indication from the evaluation that any member of the public would receive 0.1 rem/yr (100 mrem). In fact the data indicate the highest TEDE to be 0.012 rem/yr (12 mrem) located at the Boundary - SF – NNW (TR Table 7.3-5 Revised in Vol. II Vol. II TR_RAI Response Pages).

<u>TR RAI-5.7.7-15</u>

The applicant did not discuss how radon progeny will be factored into analyzing potential public dose from operations. Concentration values given in 10 CFR 20, Appendix S, Table 2, are based on radionuclide concentrations inhaled or ingested. The radon progeny, if present, will be the principal contributor to radiation dose in most practical radon exposure situations and need to be considered in any dose assessment. Please provide a description of the applicant's monitoring program that will account for public exposure to radon daughters.

<u>Response TR RAI-5.7.7-15</u>

Locations of air monitoring stations are shown in Figure 5.7-10. Passive track-etch detectors will be deployed at each station for monitoring radon-222 on a quarterly basis. The maximum LLDs for the analyses will be consistent with the recommendations of RG 4.14.

This section has described the use of the available technology for detection of radon and radon progeny. The passive track-etch detectors will be utilized during operational environmental monitoring. At least four of the AMS stations utilized for baseline characterization will be selected for operational monitoring; this meets the suggested monitoring in RG 4.14 (upwind, downwind, nearest neighbor, and control). The four AMS stations will be equipped with a track-etch detector; see figure 5.7-11 below. The track-etch detectors are designed to measure the average radon concentration at the particular location for the period of deployment. The alpha-track detector is designed with a radiosensitive element that records alpha particle emissions from natural radioactive decay of radon. The values reported will provide the basis for calculating the average radon concentration; these detectors are not fitted with a thoron proof filter, therefore, radon progeny is also detected.

The committed effective dose equivalent (CEDE) is quantifiable (to account for public exposure) by utilizing the following equation:

$$\text{CEDE (mrem/yr)} = \frac{0.2\ \text{pCi/L}\left(\frac{\text{WL}}{100\ \text{pCi/L}}\right)(8760\ \text{hrs/yr})(0.7)(500\ \text{mrem/WLM})}{170\ \text{hrs/mo}} = 36\ \text{mrem/yr}$$

where:

0.2 pCi/L represent the recommended LLD (RG 4.14, 1980)

0.7 represents the assumed outdoor radon equilibrium ratio (NRCP Report No. 78, 1984)

500 mrem/WLM (ICRP 65, 1994)

36 mrem/yr represents the LLD measured by the current available technology

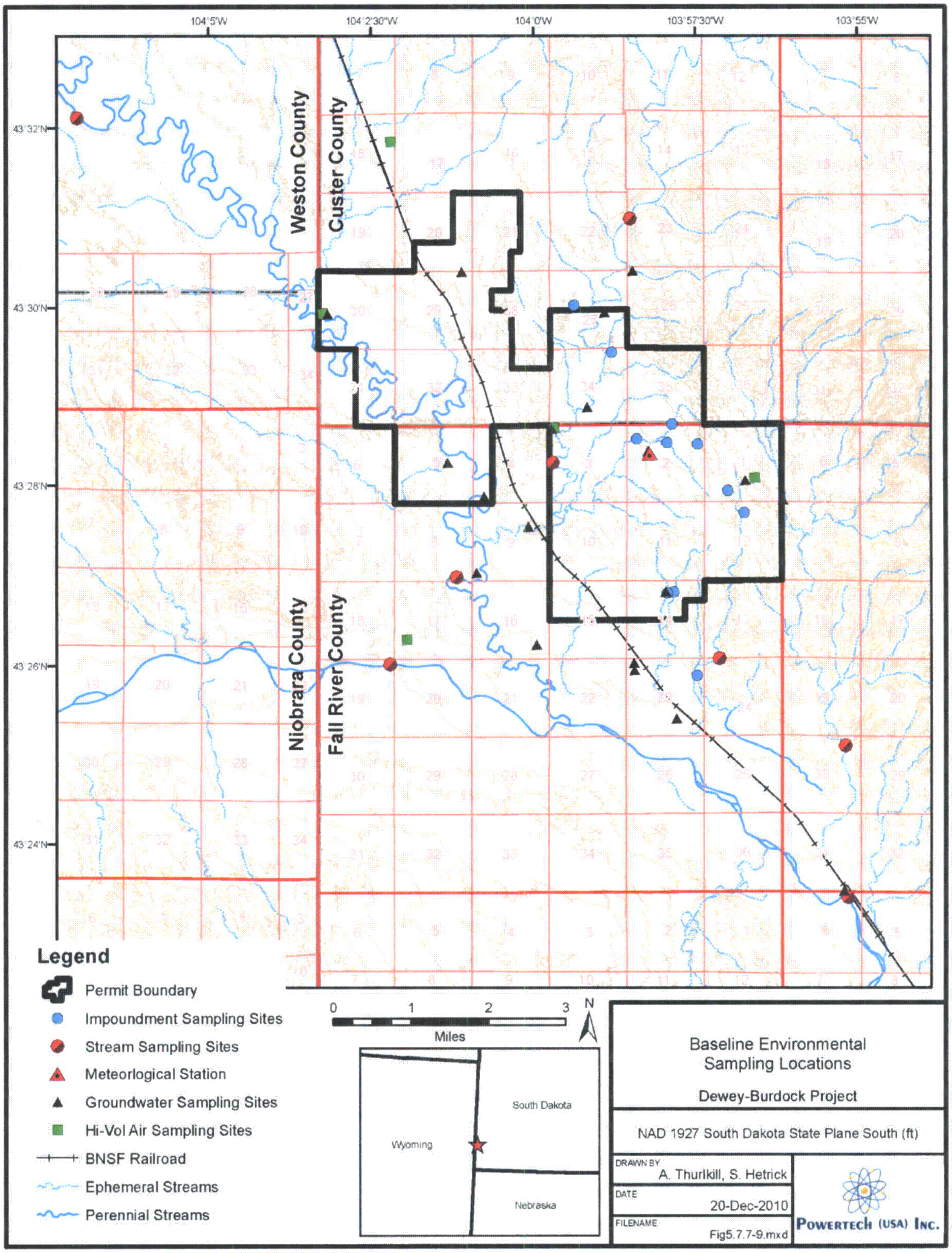


Figure 5.7-11: Operational Environmental Monitoring Sites

TR RAI-5.7.7-16

10 CFR 40.65 requires a report that specifies the quantity of each of the principal radionuclides released to unrestricted areas. It is not clear from the applicant's description of its airborne effluent and environmental monitoring program how it will account for and verify, by surveys and/or monitoring, the quantity of these radionuclides from all point and diffuse sources (e.g., uranium escaping the central processing plant) from its operations.

Response TR RAI-5.7.7-16

The environmental monitoring concerning the release of radon (the principal radionuclide potentially released) from process operations will be estimated using the source term method described in TR Section 7.3 and in "Methods for Estimating Radioactive and Toxic Airborne Source Terms for Uranium Milling Operations" (RG 3.59). The results will be reported in the semi-annual effluent reports required by 10 CFR § 40.65. See Figures 5.7-6 to 5.7-9 for radon monitoring locations from point and diffuse sources.

The air particulates are monitored by Hi-Vol samplers at locations shown on Figure 5.7-11. These monitoring locations would detect radionuclides that may be released to the unrestricted area .

TR RAI-5.7.7-17

The applicant stated that the LLD for biota and surface soil monitoring will be consistent with the recommendations in Regulatory Guide 4.14 unless matrix interferences prohibit attainment of these values. Regulatory Guide 4.14 allows for alternate proposals to the preoperational and operational monitoring programs, as long as the two programs remain compatible. Please provide more information regarding the proposed LLD for biota and surface soil monitoring that demonstrate that these values will be consistent with Regulatory Guide 4.14 and that the preoperational and operational monitoring programs will remain compatible.

Response TR RAI-5.7.7-17

Other than atypical matrix interferences, The LLD values should be consistent with recommended values in RG 4.14. Since the LLD is a function of sample volume, counting efficiency, radiochemical yield, etc., there may be circumstances where the minimum volume or mass is not attainable due to naturally occurring circumstances (i.e. drought, or flooding event) beyond the control of the operator. Also, the ability to analyze for the radionuclide of concern may be inhibited given the presence of another radionuclide in high concentrations within the sample i.e., U-235 in high concentrations inhibiting the analysis of Ra -226.

Powertech (USA) will develop, implement and maintain monitoring and quality assurance – quality control programs that ensure consistency for purposes of comparison of data results within and between phases of well field baseline, operations and restoration and reclamation activities. Powertech (USA) commits to utilizing well trained field personnel and working closely with laboratory personnel in order to ensure LLDs are consistent with NRC guidence in RG 4.14.

Ground-Water and Surface-Water Monitoring Programs 5.7.8

TR RAI-5.7.8-1
Regulatory Guide 4.14 recommends the surface water samples be analyzed for dissolved and suspended natural uranium, Ra-226, Th-230, Pb-210 and Po-210. Consistent with Regulatory Guide 4.14 and NUREG-1569, Acceptance Criterion 5.7.7.3(1), provide an operational surface water sampling and analysis program that addresses these analyses or technical justification for an alternate program.

Response TR RAI-5.7.8-1
It is the applicant's understanding from NUREG-1569, Acceptance Criteria 5.7.7.3 – 3, the airborne effluent and environmental monitoring program includes: radon in air, air particulates, surface soils, subsurface soils, vegetation, direct radiation, and sediment in accordance with RG 4.14.

The operational surface water sampling and analysis program will include the analysis of dissolved and suspended natural uranium, Ra-226, Th-230, Pb-210 and Po-210, consistent with Regulatory Guide 4.14 and NUREG-1569, Acceptance Criterion 5.7.7.3(1).

TR RAI-5.7.8-2

In 10 CFR 40, Appendix A, Criterion 7, NRC requires an operational monitoring program that can be used to evaluate environmental impacts of operation and to detect potential long-term effects, among other things. Regulatory Guide 4.14 provides guidance on surface water sampling, including impoundments and surface waters passing through the mill site. In Section 2.7.3.1 of the TR the applicant identified 48 surface water impoundments.

However, in Section 5.7.8 of the TR, the applicant identified only 11 impoundments in its operational surface water monitoring program as shown on Figure 5.7-10 of the TR. In addition, the applicant has not identified sampling locations for Beaver Creek which passes through the mill site. The applicant should analyze all surface water features in accordance with Regulatory Guide 4.14 criteria, including offsite water features that could be impacted from operations, or provide a justification for an alternate methodology that complies with 10 CFR 40, Appendix A, Criterion 7.

Response TR RAI-5.7.8-2

With regard to the first part of this question, please refer to the following responses: TR_RAI-2.7-18 and Response TR_RAI-2.9-43a

The applicant has further analyzed all surface water features in accordance with RG 4.14 and 10 CFR, Appendix A, Criterion 7. As a result the applicant is presenting TR Figure 5.7-11 in support of a modified surface water monitoring plan.

Powertech (USA) Inc.

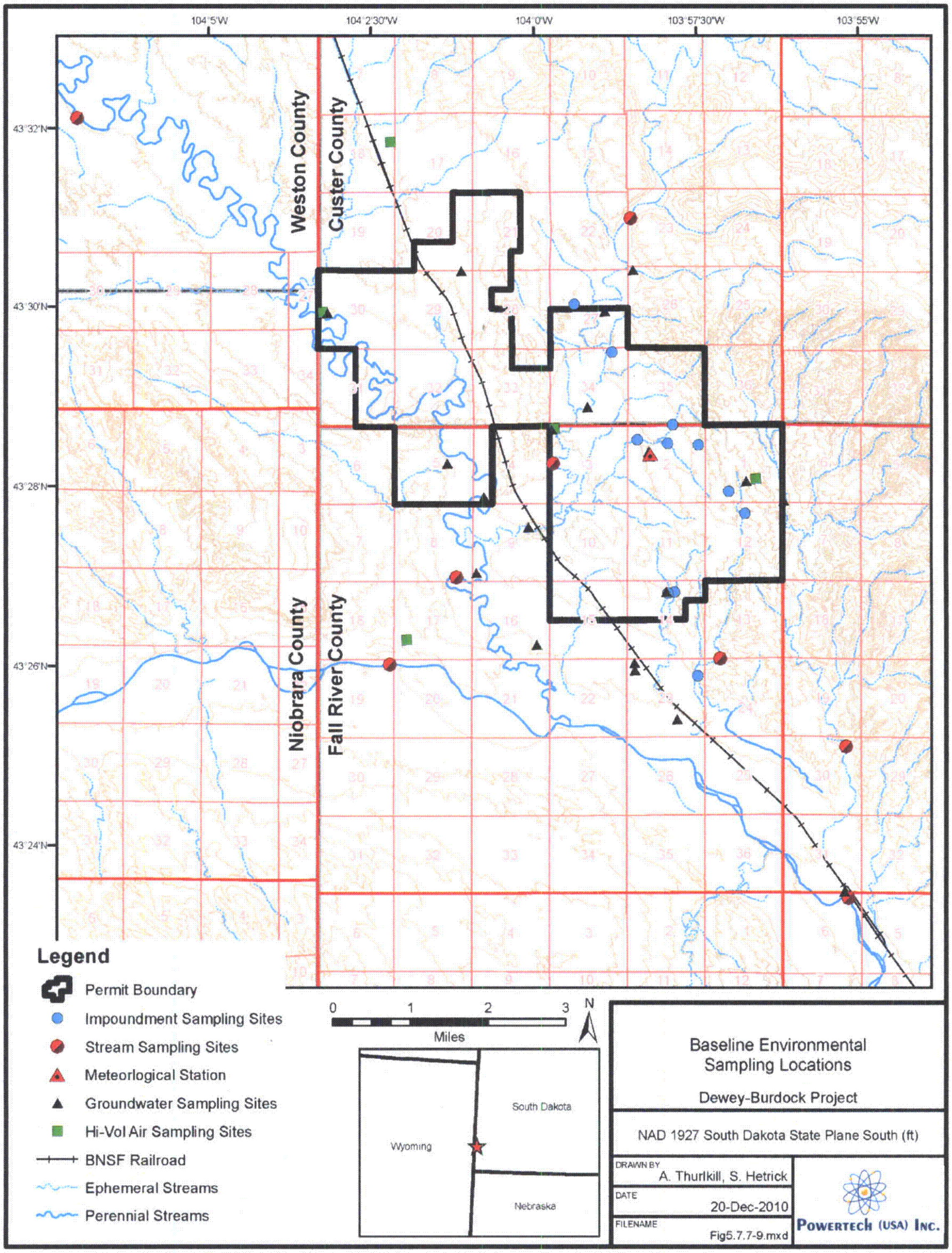


Figure 5.7-11: Operational Environmental Sampling Locations

The locations are proposed for the construction phase and first year of operations. The proposed locations are based on some existing monitoring locations developed during site characterization to the extent the locations meet the stated objectives in 10 CFR Part 20 , Appendix A, Criterion 7. To further comply, three new stations have been added (LA-01, Onsite, and CHR/BVC). Station PSC01 has been replaced with the "Onsite" station located at the confluence of Pass Creek and ephemeral drainages near the project boundary.

Table: 5.7-1 Proposed Operational Stream Sediment Sampling Locations

Proposed Operational Sediment Sampling Locations NAD 27, South Dakota State Plane South (feet)		
Station Name	**X Coordinate**	**Y Coordinate**
PSC02	1,034,322.75675	452,562.56253
LA-01	1,022,349.06810	442,052.29287
Onsite	1,028,583.77446	431,913.05462
BVC01	1,021,472.23291	428,715.22046
CHR/BVC	1,029,024.34117	418,291.51034
PSC02	1,034,322.75675	452,562.56253

The applicant believes this to be compendious of a more detailed program that will be summarized quarterly and submitted to NRC semiannually pursuant to § 40.65 of 10 CFR.

TR RAI-5.7.8-3

Table 2.7.3-1 in NUREG 1569 provides a list of acceptable constituents for monitoring at in situ recovery facilities. Alternatively, applicants may propose a list of constituents that is tailored to a particular location. In such cases, sufficient technical bases must be provided to demonstrate the acceptability of the selected constituent list." With respect to the list of RAIs, the staff requests the following information.

TR RAI-5.7.8-3(a)

a. Table 6.1.1 in the TR provided a proposed list of baseline water quality parameters for well fields. NRC staff notes this list did not include constituents consistent with the above-referenced Table 2.7.3-1. Please provide justification for excluding constituents listed in Table 2.7.3-1 from the proposed baseline sampling, consistent with the guidelines in Section 5.7.8.3 of NUREG-1569.

Response TR RAI-5.7.8-3(a)

Table 6.1-1.1: Baseline Water Quality Parameter List

Test Analyte/Parameter	Units	Method
	Physical Properties	
pH ≠	pH Units	A4500-H B
Total Dissolved Solids (TDS) +	mg/L	A2540 C
Conductivity	µmhos/cm	A2510B
	Common Elements and Ions	
Alkalinity (as $CaCO_3$)	mg/L	A2320 B
Anion/Cation Balance		A1030 E
Bicarbonate Alkalinity (as $CaCO_3$)	mg/L	A2320 B (as HCO3)
Calcium	mg/L	E200.7
Carbonate Alkalinity (as $CaCO_3$)	mg/L	A2320 B
Chloride	mg/L	A4500-Cl B; E300.0
Magnesium	mg/L	E200.7
Nitrate, NO_3- (as Nitrogen)	mg/L	E300.0
Potassium	mg/L	E200.7
Sodium	mg/L	E200.7
Sulfate	mg/L	A4500-SO4 E; E300.0
	Trace and Minor Elements	
Arsenic, As	mg/L	E200.8
Barium, Ba	mg/L	E200.8
Boron, B	mg/L	E200.7
Cadmium, Cd	mg/L	E200.8
Chromium, Cr	mg/L	E200.8
Copper, Cu	mg/L	E200.8
Fluoride	mg/L	E300.0
Iron, Fe	mg/L	E200.7
Lead, Pb	mg/L	E200.8
Manganese, Mn	mg/L	E200.8

Test Analyte/Parameter	Units	Method
Mercury, Hg	mg/L	E200.8
Molybdenum, Mo	mg/L	E200.8
Nickel, Ni	mg/L	E200.8
Selenium, Se	mg/L	E200.8, A3114 B
Silver, Ag	mg/L	E200.8
Uranium, U	mg/L	E200.7_8
Vanadium, V	mg/L	E200.7, E200.8
Zinc, Zn	mg/L	E200.8
Radiological Parameters		
Gross Alpha††	pCi/L	E900.0
Gross Beta	pCi/L	E900.0
Radium, Ra-226§	pCi/L	E903.0

*Analyte list based on U.S. Nuclear Regulatory Commission (NRC). NUREG-1569, "Standard Review Plan for In-Situ Leach Uranium Extraction License Applications--Final Report." Table 2.7.3-1. Washington, DC: NRC. June 2003. The licensee may provide the rationale for the exclusion of water quality indicators\parameters in a license application or amendment request if operational experience or site-specific data demonstrate that concentrations of constituents such as radium-228 are not significantly affected by in situ leach operations.

ǂ Field and Laboratory

+ Laboratory only

††Excluding radon, radium, and uranium

§ If initial analysis indicates presence of Th-232, then Ra-228 will be considered within the baseline sampling program or an alternative may be proposed.

TR RAI-5.7.8-3(b)

Table 2.7.3-1 in NUREG 1569 provides a list of acceptable constituents for monitoring at in situ recovery facilities. Alternatively, applicants may propose a list of constituents that is tailored to a particular location. In such cases, sufficient technical bases must be provided to demonstrate the acceptability of the selected constituent list." With respect to the list of RAIs, the staff requests the following information.

b. Consistent with Section 5.8.7.3 of NUREG-1569, the applicant did not include information on the statistic methods that would be employed to establish baseline or background levels. For example, the applicant did not define whether or not the baseline levels for the production zone will be based on a well field average or well-by-well basis, methods to identify and exclude outliers, or other methods that may be appropriate for establishing background levels in all aquifers. The staff cannot determine if the applicant will be able to appropriately define baseline levels for a well field without this information. Please provide the above-referenced information.

Response TR RAI-5.7.8-3(b)

The subset of production-zone wells identified for baseline sampling described in TR Section 3.1.3 will be sampled four times for baseline characterization prior to production operations with a minimum of fourteen (14) days between consecutive samplings. The first and second sampling events will include analyses for all groundwater parameters identified in Table 6.1-1. The third and fourth sampling events will be analyzed for a reduced list of parameters as defined by the results of the previous sample events; if certain elements are not detected during the first and second sampling events, then those elements will not be analyzed during the third and fourth sample events. All monitor wells will also be sampled during the four baseline sampling events and analyzed for the UCL indicator parameters; the water level in the monitor wells will also be recorded at each sampling event.

The collective well field data from the baseline sampling will be separated by hydrogeologic unit and examined for spatial heterogeneity; this will normally result in at least four separate zones of wells among those wells so sampled: i) Production-zone wells located within the ore body to be mined that will be used to determine the restoration target values (RTV) for the production zone aquifer, ii) monitoring ring wells, iii) overlying zone wells, if any, and iv) underlying zone wells in the underlying aquifer, if any.

The collective data within each zone will then be examined for possible outliers on a parameter by parameter basis. An outlier is a single non-repeating value that lies far above or below the rest of the sample values for that parameter. Outliers will be corrected if possible, as for example, if the outlier was a result of a transcription or other identifiable error. A data value will be deemed to be an outlier and removed from the data if it lies outside of the mean value, plus or minus three standard deviations, of all values of that parameter within the zone or sub-zone, where said mean and standard deviation are computed without using the suspected outlier.

Following removal of outliers, if any, the data within each zone or sub-zone will be analyzed by statistical methods to determine the restoration target values (RTVs) and upper control limits for excursion detection, as appropriate to that zone or sub-zone.

The target restoration goal (TRG) for each monitored constituent will be the mean value as determined from a statistical analysis of the preoperational baseline sampling data.

TR RAI-5.7.8-4

In addition to the uncertainty that staff noted in the last RAI within the Hydrology Section, NRC staff is uncertain of the potential for operations to create or enhance a potential migration of constituents of concern from mine pit areas at or near well fields in the license area to the underlying Fall River aquifer. Please demonstrate whether this scenario may potentially occur and if so, please clarify whether the well field groundwater monitor locations will provide satisfactory coverage of the Fall River water-bearing zone beneath appropriate areas at or near the mine pit areas. This information is necessary for staff to understand the potential impacts of the operations on water resources and to assess the manner in which the Dewey-Burdock operations will be protective of human health and the environment.

Response TR RAI-5.7.8-4

By inspection of the cross-section B-B' in ER_RAI_Exhibit WR-2.4, it can be seen that any changes to the confined Fall River potentiometric surface in the production area should not affect the outcrop area where the water table(s) associated with any surface water bodies would either be above the potentiometric surface, or perhaps absent where surface water is absent. Therefore, there is little potential for any increase in migration (transport) in the Fall River Aquifer from the surface-outcrop toward the center of drawdown in the Burdock well field area due to project operations. (ER_RAI-WR2.2)

Powertech (USA) has excluded ISR activities within ore bodies in the Fall River aquifer in the eastern portion of the Burdock area. Proximity of expected ISR activities in the Fall River aquifer is not expected to enhance migration of constituents of concern from mine pit areas or near well fields which are located at distance from these well field areas.

With the exception of the Triangle Mine, the base of each mine pit area in the PAA is above the top of the groundwater surface of the Fall River aquifer. After more detailed evaluation of Burdock Well Field 10, a monitoring plan, if the evaluation deems it necessary, will be provided in the well field hydrologic data package for that well field. Unconfined conditions at the Triangle Mine are expected to minimize the potential impact of migration to Burdock Well Field 10.

TR RAI-5.7.8-5

Section 5.7.8.3 of NUREG-1569 suggests that for large well fields, it may not be practical to sample one production/injection well per acre. However, baseline sampling should not occur at a density less than one per 4 acres." Section 3.2 of the TR Supplement states, "A minimum of eight baseline water quality wells will be installed in the ore zone in the planned well field area." The staff is not certain that this statement is consistent with current guidance. Please clarify that the sampling densities are consistent with the NRC's guidance or provide additional justification for an alternate density.

Response TR RAI-5.7.8-5

Within each production well field a subset of wells to be utilized as production wells will be identified for baseline water quality sampling. The subset of these wells will consist of at least one (1) well per four (4) acres of mine unit, except if the total number of such monitor wells in a well field is less than six (6), then additional wells may be added to the subset to attain either a representative subset of six (6) wells or a maximum well density of 1 well per acre, whichever is less.

TR RAI-5.7.8-6

Section 5.7.8.3 of NUREG-1569 states, "Baseline sampling programs should provide enough data to adequately evaluate natural spatial and temporal variations in pre-operational water quality. At least four independent sets of samples should be collected, with adequate time between sets to represent any pre-operational temporal variations." Consistent with Section 5.7.8.3 of NUREG-1569, please specify the number of baseline sample sets that will be collected and the time between sets to represent any pre-operational temporal variations.

Response TR RAI-5.7.8-6 (TR Section 5.7.8.1)

Baseline sampling will consist of four sample events with a minimum of fourteen (14) days between consecutive samplings.

TR RAI-5.7.8-7

In Section 5.2.7 of the TR Supplement, the applicant states "Powertech (USA)'s management has always used Chlorides, Sulfate and Uranium as Upper Control Limit Parameters. Sometimes Total Dissolved Solids is used. Powertech (USA) also uses pressure measurements in the monitor wells to detect the potential for excursions. These parameters were selected for the following reasons."

TR RAI-5.7.8-7(a)

a. Please clearly specify excursion indicator constituents proposed for the Dewey-Burdock site.

Response TR RAI-5.7.8-7(a)

Powertech proposes to use the following UCL parameters for early warning of potential excursions:

Chloride, Conductivity and Total Alkalinity

TR RAI-5.7.8-7(b)

In Section 5.2.7 of the TR Supplement, the applicant states "Powertech (USA)'s management has always used Chlorides, Sulfate and Uranium as Upper Control Limit Parameters. Sometimes Total Dissolved Solids is used. Powertech (USA) also uses pressure measurements in the monitor wells to detect the potential for excursions. These parameters were selected for the following reasons."

b. Section 5.2.7.2 of the TR Supplement states, "Since there is always pyrite (iron sulfide, a reduced mineral) present in uranium roll front deposits (it is the reason the uranium is there), an increase in sulfate means that there is oxygenated water moving in sufficient volume to change the sulfate levels." The staff notes that the oxygenated portion of the lixiviant tends to be consumed relatively quickly. Therefore, it is unclear if sulfate will sufficiently serve the early warning function that UCL parameters should.

Response TR RAI-5.7.8-7(b)

Sulfate will not be proposed as a UCL parameter as this constituent is known to increase across the Dewey-Burdock PAA.

TR RAI-5.7.8-7(c)

In Section 5.2.7 of the TR Supplement, the applicant states "Powertech (USA)'s management has always used Chlorides, Sulfate and Uranium as Upper Control Limit Parameters. Sometimes Total Dissolved Solids is used. Powertech (USA) also uses pressure measurements in the monitor wells to detect the potential for excursions. These parameters were selected for the following reasons."

c. ***Section 5.2.7.4 of the TR Supplement states, "Total Dissolved Solids (TDS) indicates the increase primarily in chlorides and sulfates when it is used as a UCL. ... Powertech's opinion that total dissolved solids is not sufficiently specific to be useful." The applicant's statement appears to imply that total dissolved solids may not be a good excursion indicator. Staff notes that conductivity, which is correlated to total dissolved solids, is generally considered to be a good excursion indicator (Staub, 1986; Deutsch, 1985). Please for provide site-specific justification for the use of total dissolved solids or its related parameter, conductivity at the project site.***

Response TR RAI-5.7.8-7(c)

Lixiviant mixtures typically contain higher TDS than native groundwater and therefore have a higher specific conductivity. For this reason conductivity is very useful for detecting potential excursions early.

TR RAI-5.7.8-7(d)

In Section 5.2.7 of the TR Supplement, the applicant states "Powertech (USA)'s management has always used Chlorides, Sulfate and Uranium as Upper Control Limit Parameters. Sometimes Total Dissolved Solids is used. Powertech (USA) also uses pressure measurements in the monitor wells to detect the potential for excursions. These parameters were selected for the following reasons."

d. Section 5.2.7.3 of the TR Supplement states, "The uranium is selected because it is a uranium mine and this is the primary change that is made to the groundwater that is an adverse change. The uranium is not very mobile as it is insoluble in the reduced state and must be oxidized to be soluble and must have the correct pH at any oxidation level as well as sufficient carbonate ion in solution." The applicant's statement appears to imply that uranium may not be a good excursion indicator. Please further evaluate the use of uranium as an excursion indicator constituent. Consistent with Section 5.8.7.3 of NUREG 1569, this evaluation should consider that excursion indicator constituents are intended to provide early warning that leaching solutions are moving away from the well fields and that groundwater outside the monitor well ring may be threatened. Please provide information that addresses the above-referenced comments.

Response TR RAI-5.7.8-7(d)

The applicant does not propose to use uranium as a UCL parameter for detection of potential excursions. Chloride, conductivity and total alkalinity are sufficient to monitor for potential excursions.

TR RAI-5.7.8-8

Section 2.7.8.3 of NUREG 1569 states, "Upper control limits for a specific excursion indicator should be determined on a statistical basis to account for likely spatial and temporal concentration variations within the mineralized zone.... " NRC staff notes that the application does not provide this information. Consistent with Section 2.7.8.3 of NUREG 1569, please describe the method that will be used to establish upper control limits.

Response TR RAI-5.7.8-8

All monitor wells will be sampled during the four baseline sampling events, with a minimum of fourteen (14) days between consecutive samplings, and analyzed for the UCL indicator parameters; the water level in the monitor wells will also be recorded at each sampling event.

The collective well field data from the baseline sampling will be separated by hydrogeologic unit and examined for spatial heterogeneity; this will normally result in at least four separate zones of wells among those wells so sampled: i) Production-zone wells located within the ore body to be mined that will be used to determine the restoration target values (RTV) for the production zone aquifer, ii) monitoring ring wells, iii) overlying zone wells, if any, and iv) underlying zone wells in the underlying aquifer.

The collective data within each zone will then be examined for possible outliers on a parameter by parameter basis. An outlier is a single non-repeating value that lies far above or below the rest of the sample values for that parameter. Outliers will be corrected if possible, as for example if the outlier was a result of a transcription or other identifiable error. A data value will be deemed to be an outlier and removed from the data if it lies outside of the mean value, plus or minus three standard deviations, of all values of that parameter within the zone or sub-zone, where said mean and standard deviation are computed without using the suspected outlier.

Upper control limits for each monitoring zone will be set at the baseline mean concentration plus five standard deviations for each excursion indicator. However, some aquifers exhibit low chloride concentration with a narrow statistical distribution; therefore, chloride, the greater of the mean plus five standard deviations or the mean plus 15 mg/L will be used as the upper control limit. (NRC, 2003, §5.7.8.3(2))

TR RAI-5.7.8-9

On page 3-8 of the TR. the applicant states that the perimeter wells will be screened across the "entire mineralized zone" and for internal monitoring wells, across the overlying or underlying aquifers where the greatest potential for vertical excursions may occur. The proposed screening of the perimeter monitoring wells is consistent with guidance in NUREG-1569 (page 5-42); however, guidance in NUREG-1569 also indicates that the applicant should describe the process for determining the screened horizon. The staff is uncertain of the rationale and details that the applicant will use for determining screened horizon or well placement. For example, the staff is unclear whether the entire mineralized zone means horizons within the Lakota or Fall River aquifers (e.g., F11, F12 or F13) or the entire aquifer. The applicant should provide justification for screening a monitor well across the entire overlying or underlying aquifer. Finally, the applicant does not define how the "greatest potential for an excursion" is to be determined. Please provide information that addresses the above-referenced comments.

Response TR RAI-5.7.8-9

The screen interval for perimeter production zone monitor wells will be the entire hydrogeologic unit. Similarly, overlying and underlying wells will be screened across the entire hydrogeologic unit which either overlies or underlies the production zone hydrogeologic unit. These screened intervals are determined by mapping of these hydrogeologic units and the aquitards between them after delineation drilling of each well field. This mapping and monitor well design will be presented in a hydrogeologic package for each well field for review by the SERP and NRC prior to operation. In all cases, screens will be installed to be fully penetrating the hydrogeologic unit to be monitored; in other words, fully screened across the entire hydrogeologic unit between the aquitards above and below which confine it.

Non-production zone wells are screened across the entire overlying or underlying hydrogeologic unit to avoid missing any excursions traveling below or above the screened interval.

In some cases, a single hydrogeologic unit may contain multiple smaller ore bodies, which may be vertically stacked. Perimeter production zone monitor wells will be screened across this hydrogeologic unit and these multiple ore bodies which will be treated as a single production zone for determining the horizontal distance to the perimeter production zone monitor well ring. This will only be done when there are no confining layers between the ore bodies and when the permeable sand unit which contains the multiple ore bodies behaves as a single hydrogeologic unit. There are currently four hydrogeologic units within the Dewey Burdock project area which contain ore bodies: Lower Fall River, Upper Chilson, Middle Chilson, and Lower Chilson. Often, the Middle and Lower Chilson will behave as a single hydrogeologic unit. These are detailed in the Type Logs depicted in TR Figure 2.7-12 and TR Figure 2.7-13 for the first well fields at Dewey and Burdock, respectively.

"Greatest Potential for Excursion" is defined as locations where excursions are most probable to occur. In determining this, the following criteria apply:

1.) Overlying wells need to detect vertical excursions. These excursions are primarily caused by injection well casing leaks and thus wells are placed within the pattern areas containing injection wells and in sufficient density to monitor the hydrogeologic units immediately above where injection occurs.

2.) Any places where the confining layers immediately above or below the production well field area are partially absent or thinning such that the aquitard may lose its confining capacity may have additional non-production zone monitoring wells installed.

TR RAI-5.7.8-10

On Page 3-14 of the Technical Report, the applicant proposes for the perimeter monitoring ring to be 400 feet from the production well field, with a minimum spacing of 400 feet between wells of a spacing that ensures a 70 degree angle. The applicant references three NUREG guidance documents on the proposed spacing but does not justify the spacing based on site-specific hydrogeological and geochemical conditions. Please provide the appropriate justification.

Response TR RAI-5.7.8-10

In this application, the spacing of perimeter production zone monitor well rings will be at a maximum distance of 400 feet from the pattern area, and is based upon standard monitoring practices with proven operational history in ISR. However, included in Appendix 6.6-B,("Numerical Modeling of Groundwater Conditions Related to In situ Recovery at the Dewey –Burdock Uranium Project, South Dakota" by Petrotek, November 2010) a justification is provided of the monitor ring spacing based upon a rigorous numerical model. This justification demonstrates that the spacing is adequate to detect an excursion and that an excursion can be controlled at the monitor ring.

TR RAI-5.7.8-11

Exhibit 3.1-6 and Exhibit 3.1-7 of the TR Supplement show perimeter monitoring wells farther than 400 feet from several of the proposed production areas. For example, the perimeter monitoring wells shown in Exhibit 3.1-7 are approximately 400 feet from the proposed production in the L2 horizon, but up to approximately 1,400 feet from the proposed production at the L3 horizon. Please justify the variation in well spacings.

Response TR RAI-5.7.8-11

Both the L2 and L3 ore bodies exist within the Lower Chilson sand unit. Vertical separation between these ore bodies is relatively minor of approximately 10 ft as shown in cross sections presented in TR Exhibit 2.7-1a. The monitor ring that encompasses both the L2 and L3 will be screened across the full thickness of the Lower Chilson sand unit which has an estimated average thickness of 65 ft. Even though L2 and L3 ore horizons are produced with separate systems of wells they are treated as a single production zone for monitoring purposes. The monitor ring is a maximum of 400 feet horizontally from this single production zone.

TR RAI-5.7.8-12

On Page 3-16 of the Technical Report, the applicant states that additional wells will be completed in any aquifers overlying the first aquifer overlying the production zone. However, the applicant does not provide the methods to be used to determine what constitutes an overlying aquifer. Please provide the methods to be used to determine what constitutes an overlying aquifer.

Response TR RAI-5.7.8-12

The term overlying aquifer refers to a hydrogeologic unit(s) above the production zone hydrogeologic unit. The first overlying hydrogeologic unit is immediately overlying and separated by an aquitard from the production zone hydrogeologic unit. There may be more than one overlying aquifer or hydrogeologic unit in each of the well fields included in the PA. All of these overlying aquifers or overlying hydrogeologic units are defined by being separated by aquitards from each other. The two terms aquifer and hydrogeologic unit are considered equivalent when describing well field operations in the PA.

The first overlying aquifer or hydrogeologic unit will be monitored with non-production zone monitor wells designated with the well name prefix of MO, and will have a density of 1 well per every 4 acres of well field pattern area. Subsequent overlying aquifers or hydrogeologic units will be monitored with the designation of MO2, MO3, etc., increasing the number in the name as they proceed away from the production zone. These additional hydrogeologic units starting from the second overlying unit upward will be monitored separately, each with their own set of non-production zone monitor wells at a density of 1 well per every 8 acres of well field pattern area.

TR Figure 2.7-12 shows the overlying units for the first proposed well field at Dewey, in which production will be from the Lower Fall River. The only overlying aquifer or hydrogeologic unit is the Upper Fall River. Overlying non-production zone monitor well density is proposed at 1 well per every 4 acres as this is the first and only overlying hydrogeologic unit, with wells designated MO.

TR Figure 2.7-13 shows the overlying units for the first proposed well field at Burdock, in which production will be from the Lower Chilson. For Burdock, the overlying aquifers or hydrogeologic units consist of the Middle Chilson, the Upper Chilson, the Lower Fall River, and the Upper Fall River. The Middle Chilson, being the first overlying hydrogeologic unit, will be monitored with non-production zone monitor wells (MO) at a density of 1 per every 4 acres. The Upper Chilson, the Lower Fall River, and Upper Fall River, will also be monitored as overlying hydrogeologic units with each one having its own set of non-production zone monitor wells at a density of 1 per 8 acres of well field pattern area. The non-production zone wells in the second, third, and fourth overlying units are designated MO2 (Upper Chilson), MO3 (Lower Fall River), and MO4, (Upper Fall River).

In some cases, the production zone of another well field will be in the immediately overlying hydrogeologic unit. Monitoring for all hydrogeologic units will be continued in the same fashion as described with the exception that the overlying monitor wells will be excluded from the area within the perimeter monitor ring of an immediately overlying well field. However, outside of the area within the overlying perimeter monitoring ring, overlying wells will be placed within the same hydrogeologic unit as the overlying well field, though only directly above the production zone of the well field being mined..

During the ongoing development and restoration phases of the well fields the use of non-production zone MO wells may change. If there is no well field in the first overlying hydrogeologic unit during initial development of a well field, the MO wells will be placed across the entire well field area for initial monitoring for excursions. When a second well field is subsequently developed in the immediately overlying hydrogeologic unit, then some of the MO wells for the preceding well field will be within the production zone of the second well field. Any MO wells associated with the first underlying well field and within the perimeter monitor well ring of the second overlying well field will not be used for excursion monitoring once injection activities begin in the second well field.

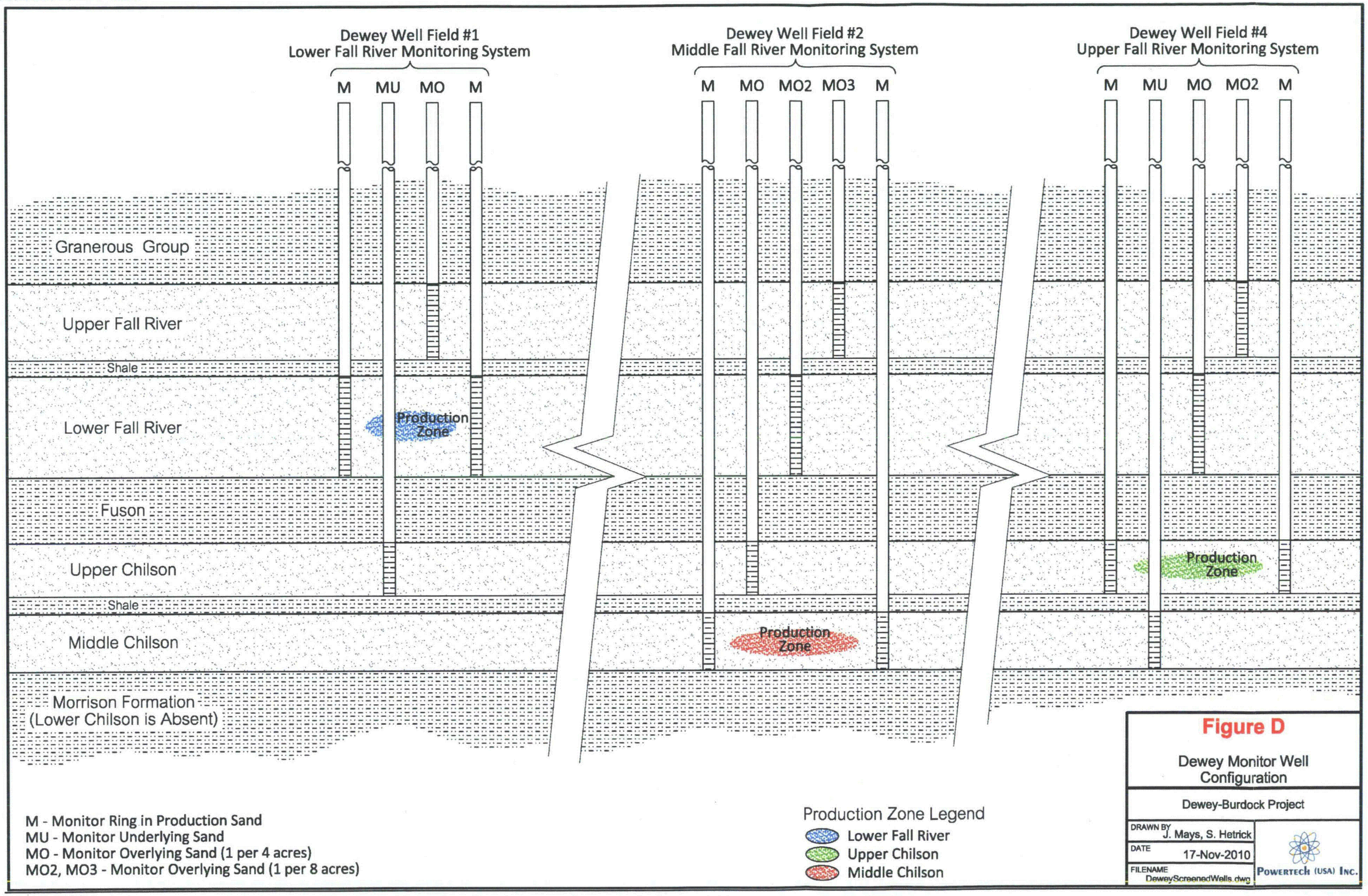
The attached Figure B shows the monitoring configuration of a production zone in the Upper Chilson in the Burdock area, Burdock well field #2. When this second production zone is developed, there is expected to be some MO2 wells associated with the first well field developed in the Lower Chilson within its perimeter monitor ring. When injection is started, use of these wells for monitoring will cease. However, all other monitor wells for the Upper Fall River, Lower Fall River, Upper Chilson, and Middle Chilson associated with the Burdock well field #1 will remain in use.

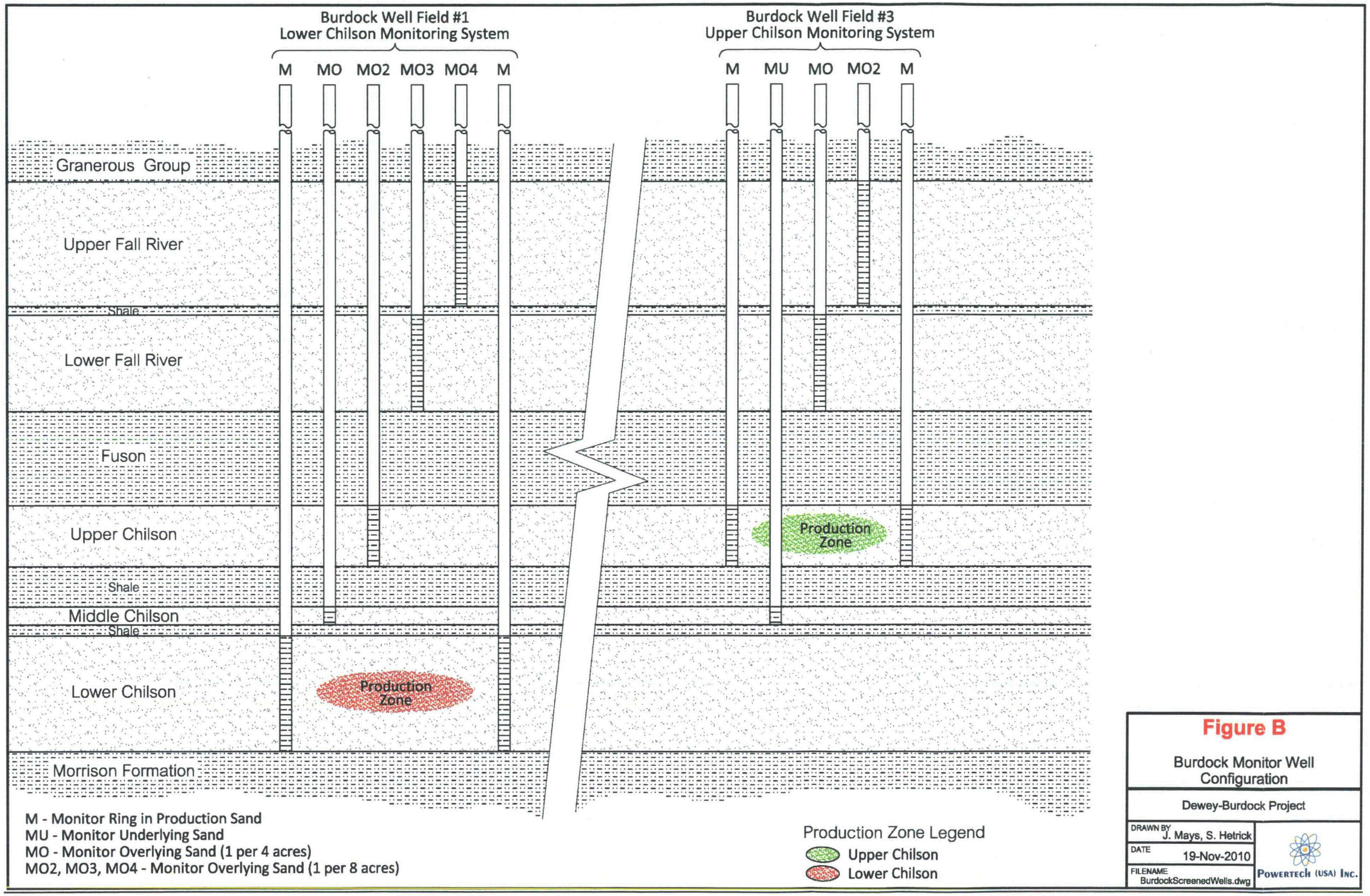
The attached Figure D shows the monitoring configuration of two associated additional productions zones, Upper Chilson and Lower Chilson, underlying the initially-developed Dewey well field #1 in the Lower Fall River. In these cases, where the production zone is already present in the immediately overlying aquifer, MO wells associated with the underlying well field in the Upper Chilson, Dewey well field #4 will not be installed within the perimeter monitor ring of the well field #1. However, outside of the perimeter monitor ring for Dewey well field #1 there will be MO wells associated with Dewey Well field #4. Additionally, MO2 wells associated with the underlying well field in the Lower Chilson, Dewey Well Field #2, will not be installed within the perimeter monitor ring of the overlying Dewey Well field #4. However, outside of the monitor ring for the well field in the Upper Chilson there will be MO2 wells associated for the Dewey Well field #2 within the Upper Chilson. Additional the same pattern will follow for MO3 wells associated with Dewey Well field #2, which will be excluded only within the perimeter monitor ring for Dewey well field #1.

It should be noted that if the Middle and Lower Chilson become a single hydrogeologic unit then these are treated as one unit for purposes of monitoring. If they are separate units within the entire area of the perimeter monitor ring of the well field, than they will be treated as separate hydrogeologic units and monitored separately.

Development of each well field monitoring system will be included in the hydrogeologic data packages presented for review prior to the start of injection.

Powertech (USA) Inc.





Burdock Well Field #1
Lower Chilson Monitoring System
M MO MO2 MO3 MO4 M
Burdock Well Field #3
Upper Chilson Monitoring System
M MU MO MO2 M
Granerous Group
Upper Fall River
Shale
Lower Fall River
Fuson
Upper Chilson
Shale
Middle Chilson
Shale
Lower Chilson
Morrison Formation
Production Zone
Production Zone
M - Monitor Ring in Production Sand
MU - Monitor Underlying Sand
MO - Monitor Overlying Sand (1 per 4 acres)
MO2, MO3, MO4 - Monitor Overlying Sand (1 per 8 acres)
Production Zone Legend
Upper Chilson
Lower Chilson
Figure B
Burdock Monitor Well Configuration
Dewey-Burdock Project
DRAWN BY J. Mays, S. Hetrick
DATE 19-Nov-2010
FILENAME BurdockScreenedWells.dwg
Powertech (USA) Inc.

TR RAI-5.7.8-13

On Page 3-16 of the Technical Report, the applicant indicates that monitoring wells will be completed in the underlying aquifer at a minimum of one well per four acres, but further states that wells will not be completed below the Lakota Formation due to the thickness and relatively impermeable nature of the underlying Morrison Formation. These statements appear to be contradictory in nature, unless the Lakota is considered to be the lower aquifer for a specific well field. Please provide clarification of the proposed monitoring of the lower aquifer, in particular, areas in which the applicant does not propose any monitoring wells in the lower aquifer.

Response TR RAI-5.7.8-13

The proposed location of underlying non-production zone wells is depicted in detail in Figure B and Figure D in TR-RAI-5.7.8-12. Underlying wells are named with the prefix MU. Underlying wells are installed only in the first hydrogeologic unit below the production zone hydrogeologic unit and separated by an aquitard. The proposed density of the wells is 1 MU well per four acres of pattern area.

There will be some instances where a producing well field will be in the underlying hydrogeologic unit of an overlying well field. In these instances, MU wells associated with the overlying well field will not be installed within the perimeter monitor ring of the underlying well field. However, these MU wells will be installed directly below the overlying well field pattern area which is vertically outside of the perimeter monitor ring of the underlying well field.

Only in case where the production zone is in the lower most hydrogeologic unit and bounded below by the Morrison, no underlying non-production zone MU wells will be installed. An example of this is provided in Figure B, where Burdock Well field 1 is in the Lower Chilson. Another example is shown in figure D, where Dewey Well field 2 is in the Middle Chilson.

TR RAI-5.7.8-14

NRC staff notes that Section 3.1 of the TR and Section 3.0 of the TR Supplement provides limited information concerning well field test procedures. NUREG-1569, Section 5.783 states, "The applicant establishes well field test procedures. Once a well field is installed, it should be tested to establish that the production and injection wells are hydraulically connected to the perimeter horizontal excursion monitor wells and are hydraulically isolated from the vertical excursion monitor wells. Such testing will serve to confirm the performance of the monitoring system and will verify the validity of the site conceptual model reviewed in Section 2 of this standard review plan. The reviewer should verify that well field test approaches have sound technical bases. Test approaches typically consist of a pumping test that subjects the well field to a sustained maximum withdrawal rate while monitoring the perimeter and vertical excursion wells for drawdown. The test should continue until the effects of pumping can be clearly seen via drawdown in the perimeter monitor wells. Typically, about 0.3 m [1 ft] of drawdown in the perimeter monitor wells will verify hydraulic connection, but the amount may vary because of the distance from the pumping wells, pumping rates, and hydraulic conductivity. To investigate vertical confinement or hydraulic isolation between the production zone and upper and lower aquifers, water levels in upper or lower aquifers may also be monitored during the pumping tests." Consistent with NUREG 1569, Section 5.7.8.3, please further describe well field test procedures that will be used.

Response TR RAI-5.7.8-14

Well Field Test Procedures

Once the monitoring system for a well field is installed, a pump test or tests will be conducted to establish the hydrogeologic connection of the perimeter monitor ring and the production zone or zones within it. It will also be used to determine the extent of hydrogeologic isolation between overlying and underlying hydrogeologic units. At a minimum, pump tests will be conducted by pumping of a single well centrally within the production zone such that a significant response can be measured in the perimeter monitoring ring. This response is typically expected to be a minimum of 1 foot of drawdown in the perimeter production zone monitor ring; though, if necessary a smaller response will be justified as significant based upon site specific conditions. Multiple pump tests may be necessary if the well field encompasses a large distance across and if sufficient hydrogeologic response cannot be obtained across the full extent of the proposed perimeter production zone monitoring ring in a single test. The flow rate of the pump test will be well field specific and based upon the maximum estimated production bleed rate from that well field. Intent of the test will be characterization of the hydrogeologic properties and demonstration of confinement (or lack thereof) in the production zone hydrogeologic unit. Response will also be measured in non-production zone monitor wells in the first hydrogeologic unit immediately overlying and the first hydrogeologic unit immediately underlying the production zone hydrogeologic unit. For purposes of gathering baseline water quality data and confirmation of hydrogeological conditions, pump testing will be conducted with a full monitoring system in place. All pump test data and results will be included in Well field Hydrogeologic Data packages.

Upon completion of all field data collection, the Well field Hydrogeologic Data Package is assembled and submitted to NRC and DENR for review. In accordance with NRC Performance Based Licensing requirements, the Well field Hydrogeologic Data Package is reviewed by a Safety and Environmental Review Panel (SERP) to ensure that the results of the hydrologic testing and the planned mining activities are consistent with technical requirements and achieve any requirement stated in NRC regulations or in the NRC license. A written SERP evaluation will evaluate safety and environmental concerns and demonstrate compliance with applicable NRC license requirements. The written SERP evaluation will be maintained at the site.

The Well field Hydrogeologic Data Package contains the following:

1. A description of the proposed mine unit (location, extent, etc.).
2. A map(s) showing the proposed production patterns and locations of all monitor wells.
3. Geologic cross-sections and cross-section location maps.
4. Isopach maps of the Production Zone sand, overlying confining unit and underlying confining unit.
5. Discussion of how the hydrogeologic test was performed, including well completion reports.
6. Discussion of the results and conclusions of the hydrogeologic test including pump test raw data, drawdown match curves, potentiometric surface maps, water level graphs, drawdown maps and when appropriate, directional transmissivity data and graphs.
7. Sufficient information to show that wells in the monitor well ring are in adequate communication with the production patterns.
8. Baseline water quality information including proposed UCLs for monitor wells and average production zone/restoration target values.
9. Any other information pertinent to the proposed well field area tested will be included and discussed.

TR RAI-5.7.8-15

Consistent with NUREG-1569, NRC staff notes that the excursion monitoring program does not contain the monitoring frequency and the criteria for determining when an excursion has occurred. NUREG-1569 states, "The applicant defines operational approaches for the monitoring program. The monitoring program must indicate which wells will be monitored for excursion indicators, the monitoring frequency, and the criteria for determining when an excursion has occurred. An acceptable excursion monitoring program should indicate that all monitor wells will be sampled for excursion indicators at least every 2 weeks during in situ recovery operations. An excursion is deemed to have occurred if two or more excursion indicators in any monitor well exceed their upper control limits. A verification sample must be taken within 48 hours after results of the first analyses were received. If the second sample does not indicate that upper control limits were exceeded, a third sample must be taken within 48 hours after the second set of sampling data was acquired. If neither the second nor the third sample indicates that upper control limits are exceeded, the first sample is considered in error, and the well is removed from excursion status. If either the second or third sample contains indicators above upper control limits, an excursion is confirmed, the well is placed in excursion status, and corrective action must be initiated." Please provide the above-referenced information.

Response TR RAI-5.7.8-15

All monitor wells will be sampled for excursion indicators at least every two weeks during in situ recovery operations.

(TR Section 3.1.3.1.2.1 submitted Dec-10) The monitoring program for excursion detection has been designed to comply with NRC guidance of NUREG-1569, §5.7.8.3(5) (NRC, 2003). An excursion will be deemed to have occurred if two or more excursion indicators in any monitor well exceed their upper control limits. A verification sample will be taken within 48 hours after results of the first analyses are received. If the results of the verification sampling are not complete within 30 days of the initial sampling event, then the excursion will be considered confirmed for the purpose of meeting the reporting requirements described below. If the excursion is not confirmed by the verification sample, a third sample will be taken within 48 hours after the second set of sampling data are received. If neither the second nor the third sample confirms the excursion by two indicators exceeding their upper control limits, the first sample will be considered to have been in error, and the well will be removed from excursion status. If either the second or third sample exhibits two or more indicators above their upper control limits, an excursion will be confirmed, the well will be placed in confirmed excursion status, and corrective action will be initiated.

TR RAI-5.7.8-16

NRC staff notes that corrective action and notification plans were not provided consistent with Section 5.7.8.3 of NUREG -569, which states, "The excursion monitoring operational procedures must also include corrective action and notification plans in the event of an excursion...." Please provide the above referenced information.

Response TR RAI-5.7.8-16

Corrective action to retrieve an excursion will include adjusting the flow rates of the pumping and injection wells to increase the aquifer bleed in the area of the excursion. The sampling frequency will be increased to weekly. The NRC will be notified within 24 hours by telephone and within 7 days in writing from the time an excursion is verified. A written report describing the excursion event, corrective actions taken and the corrective action results will be submitted to NRC within 60 days of the excursion confirmation.

If wells are still on excursion status when the report is submitted, the report will also contain a schedule for submittal of future reports describing the excursion event, corrective actions taken, and results obtained. In the case of vertical excursions, the report will contain a projected date when characterization of the extent of the vertical excursion will be completed. In the event an excursion is not corrected within 60 days of confirmation, the PA will either terminate injection of lixiviant within the well field or provide an increase to the reclamation surety in an amount that is agreeable to NRC and that will cover the expected full cost of correcting and cleaning up the excursion.

TR RAI-5.7.8-17

Section 5.7.8 of the TR states, "Quarterly samples will be collected from drinking water and livestock wells, included in the groundwater sampling sites as shown in Figure 5.7-10." This statement implies there are more proposed well sampling locations than what is shown in Figure 5.7-8. NRC staff notes that numerous Inyan Kara wells in Appendix 2.2-A are close to well fields within the license boundary and are not included in Figure 5.7-10. Please specify all water well sampling locations.

Response TR RAI-5.7.8-17

All well sampling locations are depicted on attached TR Figure 2.7-19.

The application identifies the referenced Figure 5.7-8 as *"Locations of Radon Decay Product (Radon) Monitors on-site of Central Processing Facility, Outside the Central Processing Facility"*. The applicant does not understand the relevance of the statement and associated Figure 5.7-8 reference.

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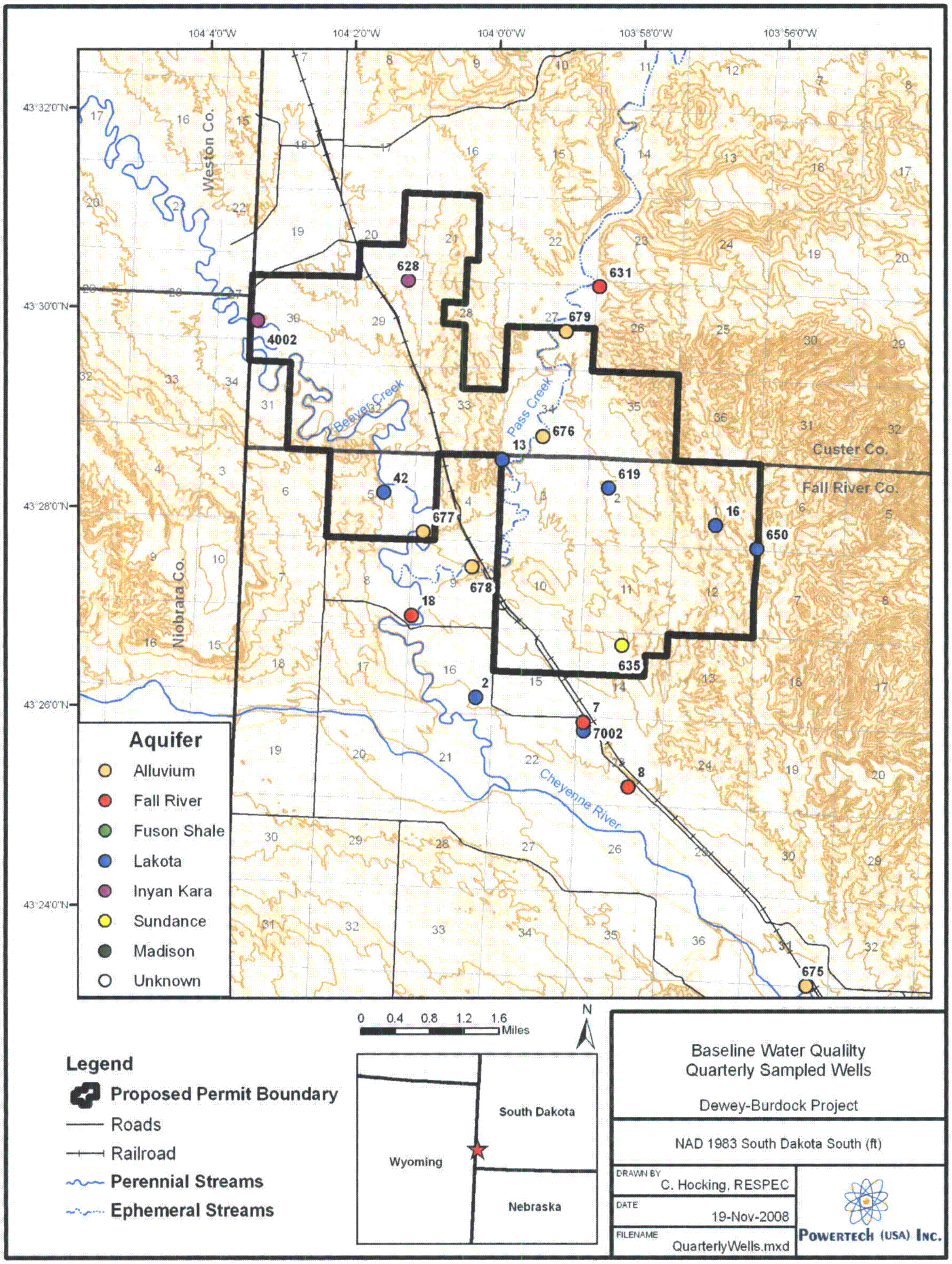

Figure 2.7-19: Operational Groundwater Quality Quarterly Sampled Wells

TR RAI-5.7.8-18

Section 5.7.8.3 of NUREG 1569 states, "Any surface-water body that lies within the proposed license boundary should be sampled at upstream and downstream locations, both before and during operations. The pre-operational data should be collected on a seasonal basis for a minimum of 1 year before in situ ***leach operations."***

TR RAI-5.7.8-18(a)

a. NRC staff notes that surface water sampling locations indicated in Section 5.7.8 and Figure 5.7-10 of the TR do not include an upstream location for Beaver Creek and a downstream location for Pass Creek where it exits the site. Consistent with Section 5.7.8.3 of NUREG 1569, please include the above-referenced surface water sampling locations.

Response TR RAI-5.7.8-18(a)

The attached TR Figure 5.7-11 shows all environmental monitoring sites. The scale of the map has been adjusted to depict all surface water sampling locations upstream of PAA and downstream of PAA.

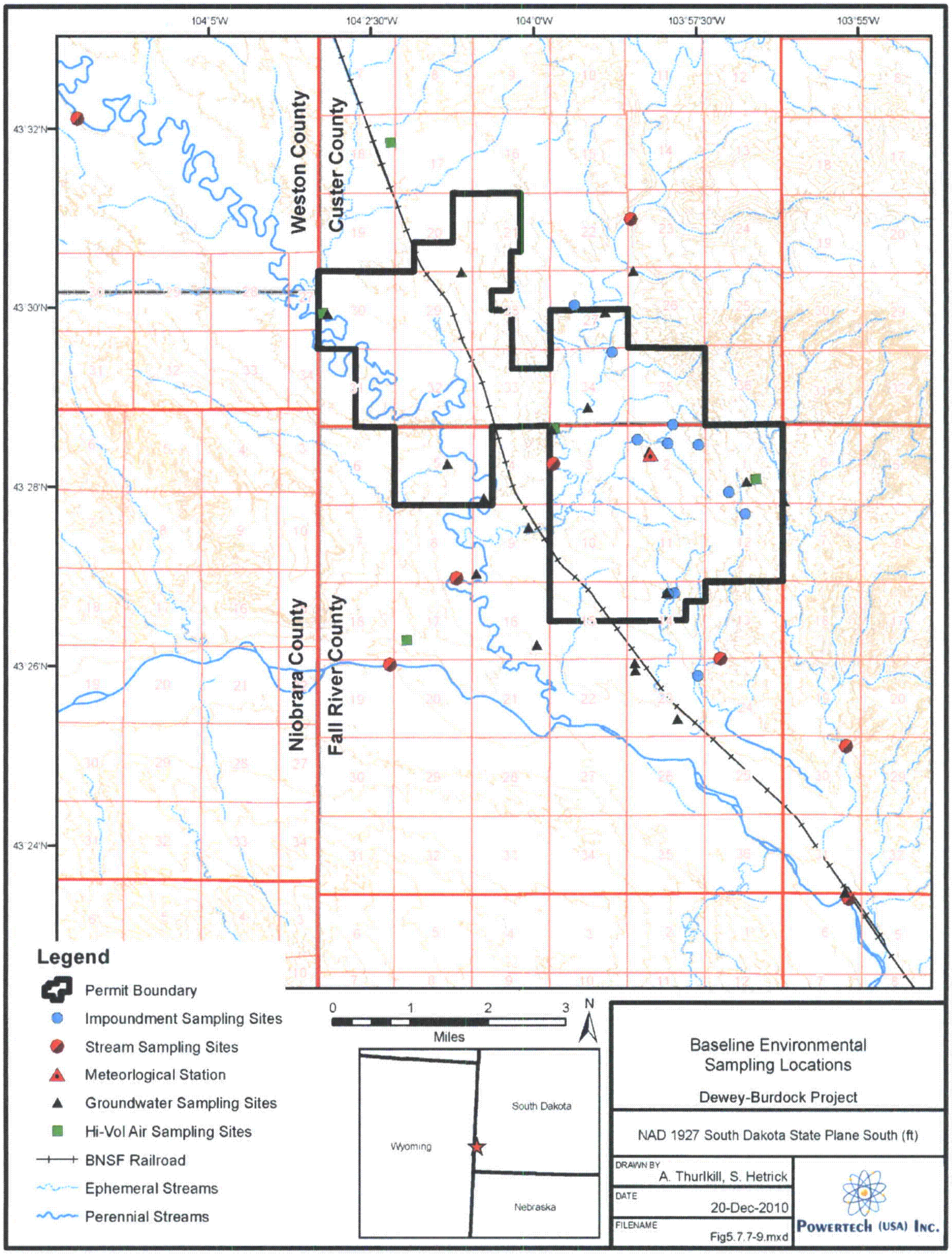

Figure 5.7-11: Operational Environmental Monitoring Sites

TR RAI-5.7.8-18(b)

Section 5.7.8.3 of NUREG 1569 states, "Any surface-water body that lies within the proposed license boundary should be sampled at upstream and downstream locations, both before and during operations. The pre-operational data should be collected on a seasonal basis for a minimum of 1 year before in situ ***leach operations."***

b. NRC staff notes that the application did not include a commitment to collecting pre-operational data on a seasonal basis for a minimum of 1 year before in situ recovery operations. Consistent with Section 5.7.8.3 of NUREG 1569, please commit to collecting pre-operational data on a seasonal basis for a minimum of 1 year before in situ recovery operations.

Response TR RAI-5.7.8-18(b)

The applicant commits to completing, on a seasonal basis for a one year period, pre-operational data collection on the stream sampling sites indicated on Figure 5.7-11, included in the response to TR_RAI-5.7.8-18(a),in accordance with Section 5.7.8.3 of NUREG-1569.

TR RAI-5.7.8-19

NRC staff notes that the application does not provide a description of proposed surface water and water well sampling methods and paramenters that will be measured and analylically analyzed in surface water samples and water well samples. Please provide this information. This information is necessary for staff to assess the manner in which the Dewey-Burdock project activities will be protective of human health and the environment.

Response TR RAI-5.7.8-19

There are three phases of groundwater and surface water monitoring:

1. Pre-application (baseline site characterization)
2. Pre-operational (site-wide characterization)
3. Operational (includes well field baseline)
4. Restoration (includes restoration and stability)

Pre-application is conducted as part of site characterization addressed within TR Section 2.0. TR Section 5.0 addresses pre-operational and operational groundwater and surface water monitoring during production/operational phase of the proposed project. TR Section 6.0 addresses the restoration phase.

Surface water sampling methods and locations will be the same as the methods utilized for baseline characterization (Locations are shown in Figure 5.7-11, included in the Response to TR_RAI-5.7.8-18(a)); see TR Section 2.7.3.1.1 for "Sample Collection and Analysis Methods".

Groundwater sampling methods will be the same as the methods utilized for baseline characterization. Static water level measured before collection; when possible pressure of free flowing wells were measured with a 15 or 30 psi NIST pressure gauge; the well was shut in and pressure allowed to stabilized before reading was recorded. Wells with subsurface water levels were measured with an electric water level tape.

Three casing volumes were purged (or until formation flow was induced) and the temperature, pH and conductivity were stabilized before collection of the groundwater sample. Free flowing wells were assumed to represent formation water; a spot check of stabilization parameters was recorded at the time of sample collection (TR Section 2.7.4 References).

Acceptable analytical methods will be performed during operational monitoring as in baseline characterization; see attached TR Table 2.7-24 and TR Table 2.7-32 for surface water and groundwater respectively.

Table 2.9-24: Number of Surface Water Samples Collected, Analytical Method, and PQL by Constituent

Constituent, Unit	Number of Samples Analyzed	Analytical Method	PQL[1]
Microbiological			
Bacteria, Fecal Coliform (cfu/100ml)	81	A9222 D	2
Major Anions and Cations			
Anions (meq/L)	81	A1030 E	
Bicarbonate as HCO3 (mg/L)	81	A2320 B	5
Carbonate as CO3 (mg/L)	81	A2320 B	5
Sulfate (mg/L)	81	E300.0	36
Chloride (mg/L)	82	E300.0	1
Fluoride (mg/L)	81	E300.0	0.1
Nitrogen, Nitrate as N (mg/L)	81	E300.0	0.1
Cations (meq/L)	81	A1030 E	
Ammonia as N (mg/L)	61	A4500-NH3 G	1
Sodium-Dissolved (mg/L)	66	E200.7	0.8
Calcium-Dissolved (mg/L)	66	E200.7	0.5
Magnesium-Dissolved (mg/L)	66	E200.7	0.5
Potassium-Dissolved (mg/L)	66	E200.7	0.5
Silica-Dissolved (mg/L)	66	E200.7	0.5
General Water Quality Indicators			
Alkalinity-Total as CaCO3 (mg/L)	81	A2320 B	5
Anion/Cation Balance (± 5) (%)	81	A1030 E	
Conductivity @ 25 C (umhos/cm)	81	A2510 B	5
pH	81	A4500-H B	0.01
Sodium Adsorption Ratio (meq/L)	61	calculated	0.1
Solids-Total Dissolved TDS (mg/L)	81	A2540 C	5
Solids-Total Dissolved, Calc. (mg/L)	81	A1030 E	5
TDS Balance (0.80 - 1.20) (dec.%)	81	A1030 E	
Solids-Suspended Sediment SSC (mg/L)	81	D3977	5
Solids-Total Suspended TSS (mg/L)	81	A2540 D	5
Metals, Dissolved			
Aluminum-Dissolved (mg/L)www.	66	E200.7	0.1
Arsenic-Dissolved (mg/L)	66	E200.8	0.001
Barium-Dissolved (mg/L)	66	E200.7	0.1
Boron-Dissolved (mg/L)	66	E200.7	0.1
Cadmium-Dissolved (mg/L)	66	E200.8	0.005
Chromium-Dissolved (mg/L)	66	E200.7	0.05
Copper-Dissolved (mg/L)	66	E200.8	0.01
Iron-Dissolved (mg/L)	66	E200.7	0.03
Lead-Dissolved (mg/L)	66	E200.8	0.001
Manganese-Dissolved (mg/L)	66	E200.7	0.01
Mercury-Dissolved (mg/L)	66	E200.8	0.001
Molybdenum-Dissolved (mg/L)	66	E200.7	0.1
Nickel-Dissolved (mg/L)	66	E200.7	0.05

Constituent, Unit	Number of Samples Analyzed	Analytical Method	PQL[1]
Selenium-Dissolved (mg/L)	66	A3114 B	0.001
Selenium-IV-Dissolved (mg/L)	61	A3114 B	0.001
Selenium-VI-Dissolved (mg/L)	61	A3114 B	0.001
Silver-Dissolved (mg/L)	66	E200.8	0.005
Thorium 232-Dissolved (mg/L)	66	E200.8	0.005
Uranium-Dissolved (mg/L)	70	E200.8	0.003
Vanadium-Dissolved (mg/L)	66	E200.7	0.1
Zinc-Dissolved (mg/L)	66	E200.7	0.01
Metals, Suspended			
Thorium 232-Suspended (mg/L)	81	E200.8	0.001
Uranium-Suspended (mg/L)	81	E200.8	0.0003
Metals, Total			
Aluminum-Total (mg/L)	66	E200.7	0.1
Arsenic-Total (mg/L)	81	E200.8	0.001
Barium-Total (mg/L)	81	E200.7	0.1
Boron-Total (mg/L)	81	E200.7	0.2
Cadmium-Total (mg/L)	81	E200.8	0.005
Calcium-Total (mg/L)	57	E200.7	1
Chromium-Total (mg/L)	81	E200.7	0.05
Chromium-Hexavalent (mg/L)	66	A3500-Cr B	
Chromium-Trivalent (mg/L)	66	calculated	0.01
Copper-Total (mg/L)	81	E200.7	0.01
Iron-Total (mg/L)	81	E200.7	0.03
Lead-Total (mg/L)	81	E200.8	0.001
Magnesium-Total (mg/L)	57	E200.7	0.5
Manganese-Total (mg/L)	81	E200.7	0.01
Mercury-Total (mg/L)	91	E245.1	0.001
Molybdenum-Total (mg/L)	81	E200.7	0.1
Nickel-Total (mg/L)	81	E200.7	0.05
Potassium-Total (mg/L)	57	E200.7	0.5
Selenium-Total (mg/L)	81	A3114 B	0.002
Selenium-IV-Total (mg/L)	66	A3114 B	0.001
Selenium-VI-Total (mg/L)	66	A3114 B	0.001
Silica-Total (mg/L)	57	E200.7	0.5
Silver-Total (mg/L)	81	E200.8	0.005
Sodium-Total (mg/L)	57	E200.7	0.5
Thorium 232-Total (mg/L)	73	E200.8	0.005
Uranium-Total (mg/L)	81	E200.8	0.0003
Vanadium-Total (mg/L)	81	E200.7	0.1
Zinc-Total (mg/L)	81	E200.7	0.01
Radionuclides			
Lead 210-Dissolved (pCi/L)	46	E909.0M	1
Lead 210-Suspended (pCi/L)	46	E909.0M	1
Lead 210-Total (pCi/L)	37	E909.0M	1
Polonium 210-Dissolved (pCi/L)	46	RMO-3008	1

Constituent, Unit	Number of Samples Analyzed	Analytical Method	PQL[1]
Polonium 210-Suspended (pCi/L)	46	RMO-3008	1
Polonium 210-Total (pCi/L)	37	RMO-3008	1
Radium 226-Dissolved (pCi/L)	63	E903.0	0.2
Radium 226-Suspended (pCi/L)	70	E903.0	0.2
Radium 226-Total (pCi/L)	73	E903.0	0.2
Thorium 230-Dissolved (pCi/L)	70	E907.0	0.2
Thorium 230-Suspended (pCi/L)	70	E907.0	0.2
Thorium 230-Total (pCi/L)	61	E907.0	0.2
Gross Alpha-Total (pCi/L)	81	E900.0	1
Gross Beta-Total (pCi/L)	81	E900.0	2
Gross Gamma-Total (pCi/L)	66	E901.1	20

[1]PQL = Practical Quantitation Limit. The concentration that can be reliably measured within specified limits during routine laboratory operating conditions, below which results are reported as "less than reporting limit". The contracting laboratory uses the PQL as the reporting limit.

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Table 2.7-32: Number of Groundwater Samples Collected, Analytical Method, and PQL by Constituent

Constituent, Unit	Number of samples analyzed	Analytical Method	PQL[1]
Major Cations and Anions			
Anions (meq/L)	140	A1030 E	
Bicarbonate as HCO3 (mg/L)	140	A2320 B	5
Carbonate as CO3 (mg/L)	140	A2320 B	5
Sulfate (mg/L)	140	E300.0	36
Chloride (mg/L)	140	E300.0	1
Fluoride (mg/L)	140	E300.0	0.1
Nitrogen, Nitrite as N (mg/L)	140	E300.0	0.1
Nitrogen, Nitrate as N (mg/L)	140	E300.0	0.1
Cations (meq/L)	140	A1030 E	
Ammonia (mg/L)	140	A4500-NH3 G	1
Sodium-Dissolved (mg/L)	140	E200.7	0.8
Calcium-Dissolved (mg/L)	140	E200.7	0.5
Magnesium-Dissolved (mg/L)	140	E200.7	0.5
Potassium-Dissolved (mg/L)	140	E200.7	0.5
Silica-Dissolved (mg/L)	140	E200.7	0.5
General Water Quality Indicators			
Alkalinity-Total as CaCO3 (mg/L)	140	A2320 B	5
Anion/Cation Balance (± 5) (%)	280	A1030 E	
Conductivity @ 25 C (umhos/cm)	140	A2510 B	5
Oxidation-Reduction Potential (mV)	118	A2580 B	
pH	140	A4500-H B	0.01
Sodium Adsorption Ratio (meq/L)	120	Calculation	0.1
Solids-Total Dissolved TDS (mg/L)	140	A2540 C	5
Solids-Total Dissolved, Calc. (mg/L)	140	Calculation	5
TDS Balance (0.80 - 1.20) (dec.%)	140	A1030 E	
Metals, Dissolved			
Aluminum-Dissolved (mg/L)	140	E200.8	0.1
Arsenic-Dissolved (mg/L)	140	E200.8	0.001
Barium-Dissolved (mg/L)	140	E200.8	0.1
Boron-Dissolved (mg/L)	140	E200.7	0.1
Cadmium-Dissolved (mg/L)	140	E200.8	0.005
Chromium-Dissolved (mg/L)	140	E200.8	0.05
Copper-Dissolved (mg/L)	140	E200.8	0.01
Iron-Dissolved (mg/L)	140	E200.7	0.03
Lead-Dissolved (mg/L)	140	E200.8	0.001
Manganese-Dissolved (mg/L)	140	E200.8	0.01
Mercury-Dissolved (mg/L)	140	E200.8	0.001
Molybdenum-Dissolved (mg/L)	140	E200.8	0.1
Nickel-Dissolved (mg/L)	140	E200.8	0.05

Table 2.7-32: Number of Groundwater Samples Collected, Analytical Method, and PQL by Constituent (cont'd)

Constituent, Unit	Number of samples analyzed	Analytical Method	PQL[1]
Selenium-Dissolved (mg/L)	140	A3114 B	0.001
Selenium-IV-Dissolved (mg/L)	118	A3114 B	0.001
Selenium-VI-Dissolved (mg/L)	118	A3114 B	0.001
Silver-Dissolved (mg/L)	140	E200.8	0.005
Thorium 232-Dissolved (mg/L)	140	E200.8	0.005
Uranium-Dissolved (mg/L)	140	E200.8	0.003
Vanadium-Dissolved (mg/L)	140	E200.8	0.1
Zinc-Dissolved (mg/L)	140	E200.8	0.01
Metals, Suspended			
Uranium-Suspended (mg/L)	138	E200.8	0.0003
Metals, Total			
Antimony-Total (mg/L)	95	E200.8	0.003
Arsenic-Total (mg/L)	95	E200.8	0.001
Barium-Total (mg/L)	95	E200.8	0.1
Beryllium-Total (mg/L)	95	E200.8	0.001
Boron-Total (mg/L)	95	E200.7	0.2
Cadmium-Total (mg/L)	95	E200.8	0.005
Chromium-Total (mg/L)	95	E200.8	0.05
Copper-Total (mg/L)	95	E200.8	0.01
Iron-Total (mg/L)	95	E200.7	0.03
Lead-Total (mg/L)	95	E200.8	0.001
Manganese-Total (mg/L)	95	E200.8	0.01
Mercury-Total (mg/L)	163	E200.8	0.001
Molybdenum-Total (mg/L)	95	E200.8	0.1
Nickel-Total (mg/L)	95	E200.8	0.05
Selenium-Total (mg/L)	95	E200.8	0.002
Silver-Total (mg/L)	95	E200.8	0.005
Strontium-Total (mg/L)	95	E200.8	0.1
Thallium-Total (mg/L)	95	E200.8	0.001
Uranium-Total (mg/L)	99	E200.8	0.0003
Zinc-Total (mg/L)	95	E200.8	0.01
Radionuclides			
Gross Alpha-Dissolved (pCi/L)	140	E900.0	1
Gross Beta-Dissolved (pCi/L)	140	E900.0	2
Gross Gamma-Dissolved (pCi/L)	140	E901.1	20
Lead 210-Dissolved (pCi/L)	140	E909.0M	1
Lead 210-Suspended (pCi/L)	138	E909.0M	1
Lead 210-Total (pCi/L)	20	E909.0M	1
Polonium 210-Dissolved (pCi/L)	140	RMO-3008	1
Polonium 210-Suspended (pCi/L)	138	RMO-3008	1

Table 2.7-32: Number of Groundwater Samples Collected, Analytical Method, and PQL by Constituent (conclusion)

Constituent, Unit	Number of samples analyzed	Analytical Method	PQL[1]
Polonium 210-Total (pCi/L)	20	RMO-3008	1
Radium 226-Dissolved (pCi/L)	134	E903.0	0.2
Radium 226-Suspended (pCi/L)	133	E903.0	0.2
Radium 226-Total (pCi/L)	90	E903.0	0.2
Radon 222-Total (pCi/L)	120	D5072-92	100
Thorium 230-Dissolved (pCi/L)	140	E907.0	0.2
Thorium 230-Suspended (pCi/L)	138	E907.0	0.2
Thorium 230-Total (pCi/L)	20	E907.0	0.2

[1]PQL = Practical Quantitation Limit. The concentration that can be reliably measured within specified limits during routine laboratory operating conditions, below which results are reported as "less than reporting limit". The contracting laboratory uses the PQL as the reporting limit.

Quality Assurance 5.7.9

TR RAI-5.7.9

The applicant stated that it will establish a quality assurance program at the facility consistent with the recommendations contained in Regulatory Guide 4.15. However, the applicant did not provide sufficient details of its proposed quality assurance program to allow NRC staff to evaluate the applicant's program. Consistent with Regulatory Guides 3.46, 4.14 and 4.15, and NUREG-1569, Acceptance Criteria 5. 7.9.3(1) and 5.7.9.3(2), provide adequate details of the applicant's quality assurance program to allow NRC staff to evaluate the applicant's quality assurance program for its effluent and environmental programs.

Response TR RAI-5.7.9

The applicant believes it is premature to develop an actual detailed quality assurance program as there is information yet to be developed or obtained that is specific to the site and that will have an affect on the final quality assurance program. The outline shown below in Figure TR_RAI_P&R-16 provides an overview of the quality assurance program that will be developed prior to operation. See also TR Section 5.7.9 "Quality Assurance Program". Also see TR sections 4.2 "Liquid Waste" and 6.2 "Plans and Schedules for Reclaiming Disturbed Lands"

Dewey-Burdock Project
Quality Assurance Program Plan – Draft Outline

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     - 8.1.2 Sample Containers, Preservation and Holding Times
     - 8.1.3 Field Measurements
     - 8.1.4 Decontamination Procedures and Materials
   - 8.2 Occupational Health and Safety Monitoring
9. Radionuclide Analysis
   - 9.1. Onsite Laboratory
   - 9.2. Contract Laboratory
10. Instruments and Equipment
    - 10.1 Calibration
    - 10.2 Maintenance
11. Data Management
    - 11.1 Data Validation
    - 11.2 Qualification of Data
    - 11.3 Anomalous Data
12. Assessment and Oversight
    - 12.1 Review and Improvement
    - 12.2 Assessment and Corrective Actions

Figure TR RAI P&R-16

Plans and Schedules for Groundwater Restoration 6.1

TR RAI-6.1-1

The specific language in the TR of* "consistent with the pre-opera/ional baseline conditions" *and a secondary goal of* "pre-operational ... class *of* use" *is not consistent with NRC regulatory requirements. The regulatory requirements, as documented in RIS-09-05, are Commission-approved background levels, MCLs or ACLs as specified in Criterion 58(5) of Appendix A of 10 CFR Part 40. The primary goals for restoration of the production zone aquifer should be either background levels or MCLS; the secondary goal may be ACLs. However, an application for ACLs must be approved by the Commission. Guidance for preparing an application for ACLs to the Commission is found in various documents (e.g., NUREG-1724, NUREG-1620 and NUREG-1757) but an application must demonstrate that the best management activities have been conducted and that the ACLs are protective of human health and the environment by demonstrating that the levels at the boundary of the exempted aquifer meet the background levels or MCLs. Please revise the language in the TR to be consistent with the above guidance and regulatory requirements.

Response TR RAI-6.1-1

Groundwater restoration at the proposed project site will be performed pursuant to NRC requirements to protect underground sources of drinking water (USDW) adjacent to the site. The primary goal of groundwater restoration at the site will be to return groundwater quality within the exploited production zone and any affected aquifers to within the baseline range of statistical variability for each constituent, or to the maximum contaminant levels (MCLs) as specified in Criterion 5B(5) of Appendix A to 10 CFR Part 40. If, following the application of best practicable technology, the applicant is unable to restore the affected groundwater to these primary standards, the applicant may request application of a secondary standard consisting of returning groundwater quality to alternate concentration levels (ACLs). An application for ACLs must demonstrate that the best management activities have been conducted and that the ACLs are protective of human health and the environment by demonstrating that the levels at the boundary of the exempted aquifer meet the background levels or MCLs. The application for ACLs must be approved as a license amendment by the Nuclear Regulatory Commission.

TR RAI-6.1-2

In the TR, the applicant indicated the target restoration goals (TRGs) will be based on a statistical analysis following ASTM standard 06312 (ASTM, 2001). The reference should be ASTM 06312-98 (Re-approved 2005).) Please address this comment.

Response TR RAI-6.1-2

The corrected citation is:

ASTM D-6312-98 (Re-approved 2005), "Standard Guide for Developing Appropriate Statistical Approaches for Groundwater Detection Monitoring Programs."

TR RAI-6.1-3

Table 6.1-1 of the TR provided a list of baseline water quality parameters and methods that will be used for establishing groundwater TRGs. Within the references for the table, NRC staff requests clarification of the passage "methods that will be used for establishing groundwater TRGs." This reference is to the laboratory analytical methods to be used to determine the concentration of a constituent and not a specific method (e.g., statistical average) for establishing TRGs based on the analytical data. In addition, the footnote in Table 6.1-1 suggests that the parameter list is derived from NUREG-1910. However, a similar table is not identified in NUREG-1910. Staff notes that the list of parameters in Table 6.1-1 is a subset of those recommended in NUREG-1569. Please correct the references in Table 6.1-1 and provide rationale or justification for excluding those other parameters listed in NUREG-1569.

Response TR RAI-6.1-3

Table 6.1-1.1: Baseline Water Quality Parameter List

Test Analyte/Parameter	Units	Method
	Physical Properties	
pH ‡	pH Units	A4500-H B
Total Dissolved Solids (TDS) +	mg/L	A2540 C
Conductivity	µmhos/cm	A2510B
	Common Elements and Ions	
Alkalinity (as $CaCO_3$)	mg/L	A2320 B
Anion/Cation Balance		A1030 E
Bicarbonate Alkalinity (as $CaCO_3$)	mg/L	A2320 B (as HCO3)
Calcium	mg/L	E200.7
Carbonate Alkalinity (as $CaCO_3$)	mg/L	A2320 B
Chloride	mg/L	A4500-Cl B; E300.0
Magnesium	mg/L	E200.7
Nitrate, NO_3- (as Nitrogen)	mg/L	E300.0
Potassium	mg/L	E200.7
Sodium	mg/L	E200.7
Sulfate	mg/L	A4500-SO4 E; E300.0
	Trace and Minor Elements	
Arsenic, As	mg/L	E200.8
Barium, Ba	mg/L	E200.8
Boron, B	mg/L	E200.7
Cadmium, Cd	mg/L	E200.8
Chromium, Cr	mg/L	E200.8
Copper, Cu	mg/L	E200.8
Fluoride	mg/L	E300.0

Test Analyte/Parameter	Units	Method
Iron, Fe	mg/L	E200.7
Lead, Pb	mg/L	E200.8
Manganese, Mn	mg/L	E200.8
Mercury, Hg	mg/L	E200.8
Molybdenum, Mo	mg/L	E200.8
Nickel, Ni	mg/L	E200.8
Selenium, Se	mg/L	E200.8, A3114 B
Silver, Ag	mg/L	E200.8
Uranium, U	mg/L	E200.7_8
Vanadium, V	mg/L	E200.7, E200.8
Zinc, Zn	mg/L	E200.8
Radiological Parameters		
Gross Alpha††	pCi/L	E900.0
Gross Beta	pCi/L	E900.0
Radium, Ra-226§	pCi/L	E903.0

*Analyte list based on U.S. Nuclear Regulatory Commission (NRC). NUREG-1569, "Standard Review Plan for In-Situ Leach Uranium Extraction License Applications--Final Report." Table 2.7.3-1. Washington, DC: NRC. June 2003. The licensee may provide the rationale for the exclusion of water quality indicators\parameters in a license application or amendment request if operational experience or site-specific data demonstrate that concentrations of constituents such as radium-228 are not significantly affected by in situ leach operations.
‡ Field and Laboratory
+ Laboratory only
††Excluding radon, radium, and uranium
§ If initial analysis indicates presence of Th-232, then Ra-228 will be considered within the baseline sampling program or an alternative may be proposed.

<u>TR RAI-6.1-4</u>

The applicant provided a brief discussion of the restoration methods to be used but the discussion is too general and contains several confusing references. The discussion lacks details on the proposed specific restoration methods to be used and how those methods affect the aquifer. The applicant needs to provide a more in-depth discussion on the proposed methods to be used in clear terms. For example, the applicant needs to define "injection sweep method" in more commonly accepted terms (e.g. groundwater transfer, groundwater sweep, groundwater treatment or groundwater recirculation). The methods should be described in sufficient detail for staff to review (i.e., for groundwater treatment, staff needs to consider the volume of waste, clean makeup water, pore volumes and timing). If groundwater treatment is the only restoration method, then the applicant needs to discuss how flaring will be captured by using this method only. Please address this comment.

<u>Response TR RAI-6.1-4</u>

The term "injection sweep" is no longer used.

Restoration will consist of the removal of six pore volumes, measured as flow rate of restoration composite (RC). The net aquifer withdrawal, regardless of the restoration method used, is expected to average one percent (1%) of the nominal 500 gpm RC flow rate.

During aquifer restoration operations, and regardless of the particular method utilized for conducting aquifer restoration operations, all RC will be treated to remove contaminants.

The aquifer restoration method to be utilized depends on the selection of waste water disposal method:

If Class V disposal wells are selected for the disposal of wastewater, then reverse osmosis (RO) technology will be utilized and the method for aquifer restoration will be the "groundwater treatment" method.

If land application is the selected method of waste water disposal, then RO technology will not be utilized and the "groundwater sweep" method will be utilized.

If a combination of both deep disposal wells and land application is utilized for disposal of wastewater, then a combination of both aquifer restoration methods will be utilized.

During aquifer restoration operations, a subset of the total number of well field patterns in a well field will be selected for active restoration operations. During active restoration, RC will be withdrawn from each pattern at a typical flow rate of 20 gpm The number of patterns in active restoration at any time is limited by the total RC flow rate that can be withdrawn and processed. Following the completion of the restoration phase in any pattern, the flow of restoration composite utilized in that pattern will be shifted to another pattern, and this process will continue until groundwater restoration has been completed for all patterns in that well field. Well field patterns not in active restoration, i.e. not yet restored or previously restored, will be maintained under hydraulic control until the well field has successfully met the restoration goals for that well field and the stabilization phase for that well field has begun.

In order to minimize drawdown, Madison aquifer water will be injected as makeup water into well fields undergoing aquifer restoration operations. The amount of Madison aquifer water to be injected during aquifer restoration operations depends on the selection of aquifer restoration method. The use of Madison water is expected to accelerate restoration of the affected aquifer for both the "groundwater treatment" method and the "groundwater sweep" method. The water quality of the Madison is expected to be equivalent to, or better than the baseline conditions of the Inyan Kara aquifer. Madison wells will be drilled within the permit license boundary.

Groundwater Treatment

In the groundwater treatment method, RC is treated by reverse osmosis and the RO reject stream is treated to remove radium and then disposed in Class V injection wells. The RO permeate stream, along with clean makeup water from the Madison aquifer, is reinjected into the well field undergoing restoration operations.

Groundwater Sweep

In the groundwater sweep method, the RC stream is treated to remove radium and disposed by land application, as described in TR Section 6.1.9. Clean makeup water from the Madison aquifer is injected into the well field undergoing restoration operations. In a groundwater sweep, the removal of groundwater causes native groundwater to flow into the ore body, thereby flushing the contaminants from areas that have been affected by the horizontal spreading of the lixiviant, including the flare.

Alternate aquifer bleed option

An alternate to the 1% aquifer bleed is also considered wherein a net aquifer withdrawal of up to one (1) pore volume of groundwater may be utilized to pull back flare. The net mean aquifer withdrawal rates under this alternate bleed option are expected to be less than 60 gpm from the Lakota aquifer and less than 40 gpm from the Fall River aquifer.

TR RAI-6.1-5

The applicant reported expected concentrations for baseline, post-mining, postrestoration and stabilization based on the Crow Butte analog. The applicant indicated that the initial restoration concentrations will be similar to those seen during production but will decline throughout the groundwater treatment process and **"further *via* the natural res/oration process (NUREG/CR-3136. 1983)".** ***The staff suggests that reference to NUREG-3136 be clarified. The reference may be interpreted as NRC-sanctioned restoration method of natural flushing (i.e., restoration is accomplished by discontinued active pumping and allowing groundwater to flow under natural conditions). This is not a NRC-approved method. In fact, the staff will require a statement that the applicant will maintain hydraulic control at all well fields (negative or inward pressure gradient) at all times during production and restoration until stabilization period. Please address this comment.***

Response TR RAI-6.1-5

The reference to NUREG/CR-3136 has been removed.

Water levels will be monitored and samples will be collected on the basis of twice per month for each well field in operation through production and restoration phases. This data will be collected from all monitoring wells associated with each well field including the production zone ring, overlying and underlying monitor wells. If there is any period of between production and restoration phases monitoring will continue during this time as well. For each well field, this monitoring activity will continue until restoration phase for that well field is fully completed. Pumping or operation of well field patterns with a bleed will be performed as needed to maintain water levels in the monitor rings below initial baseline conditions until the restoration phase is complete. This activity may be sporadic or continuous.

TR RAI-6.1-6

The applicant's preferred restoration method is solely groundwater treatment by reverse osmosis with deep well disposal of the brine. This method is preferred due to lower groundwater consumptive use and minimum land disturbance. The applicant needs to discuss the effectiveness of this method and provide appropriate analogues demonstrating the effectiveness of groundwater treatment as the sole restoration process. Please address this comment.

Response TR RAI-6.1-6

The preferred aquifer restoration method is groundwater treatment by reverse osmosis with deep well disposal of the RO reject brine. In this method of aquifer restoration, the removal of restoration composite is balanced by the flow of makeup water from three distinct sources: i) the flow of native (Inyan Kara) groundwater into the well field; ii) the reinjection of RO permeate; and, iii) the injection of Madison aquifer reclamation water. Historical record below indicates the groundwater treatment method is preferred and effective.

> *Results of the effectiveness of groundwater sweep (or lack of it) were clearly demonstrated in the Christensen Ranch Well field Restoration report (CRWR) (COGEMA 2008). Example plots from that report of mean well field water quality at the end of mining, groundwater sweep, RO and stabilization monitoring are attached. Plots of TDS for MU3, MU5 and MU6 (Figures 5-7, 5-8 and 5-7, from the respective Mine Unit Data Packages of the CRWR), indicate minimal improvement following groundwater sweep at MU3 and MU5 and an actual increase at MU6. Following application of RO, the TDS values at MU5 and MU6 decreased to levels below the target Restoration Goal. Uranium increased in MU5 and MU6 following groundwater sweep (Figures 5-12 and 5-13 from the respective Mine Unit Data Packages of the CRWR), and then was significantly lowered during RO. Approximately 1.8. 4.8 and 1.5 PVs of groundwater were removed from MU3, MU5 and MU6, respectively, during groundwater sweep. This water removal was totally consumptive by design, in that none of it was returned to the aquifer.*
>
> *Based on the results, minimal benefit, if any, was derived from this phase of restoration. Eliminating groundwater sweep, an unnecessary, ineffective and consumptive step in the restoration process, will reduce the number of PVs required to reach restoration goals. In some cases, RO was continued longer than necessary or at least longer than any improvements to water quality were occurring. A review of the uranium and conductivity trend plots from the Irigaray recovery wells during restoration (included in the Irigaray Mine Well field Restoration Report (COGEMA 2004) show this to be the case. Figures 4-4 through 4-7 from the Irigaray report show that RO was often continued for several PVs beyond the point that water quality had stabilized. The additional PVs of RO resulted in no direct benefit to aquifer water quality and only resulted in consumptive use of the groundwater resources. RO typically results in disposal of approximately 20 percent of the recovered groundwater with reinjection of the remaining 80 percent following treatment.*
> *Terminating RO once water quality has stabilized will minimize the consumptive use of groundwater and reduce the number of PVs of treatment.* (Uranium One, 2009)

Groundwater treatment via reverse osmosis is well documented as an effective technology:

Ruth R & D Project was a Wyoming pilot test conducted by Uranerz U.S.A., Inc. in the early 1980s. The ore body represented a typical roll front type deposit with uranium below surface ~ 160 meters. Groundwater restoration began in February of 1984. Groundwater sweep started out as the primary restoration method and was terminated due to water consumption issues. The groundwater restoration was accomplished by utilizing reverse osmosis technology. By September 1984 end, TDS was successfully lowered, but a few heavy metals needed to be reduced in concentration after the seven months of restoration efforts. A reductant phase was initiated in November of 1984 and continued for duration of six weeks. This combination of treatment was deemed successful and by the end of December 1984 restoration activities were terminated. At the end of the stability period, regulatory agencies deemed the water quality was stable and aquifer restoration efforts by Uranerz were a success (Catchpole and Kuchelka, 1993).

See also the discussion of how the Crow Butte R&D Project utilized RO and "restored the quality of the groundwater in the mined out well field to a level acceptable to the agencies and, following the successful completion of the six month stability monitoring period, the agencies deemed that Ferret Exploration Company of Nebraska had demonstrated the capability of restoring an aquifer affected by ISL mining operations" (Catchpole and Kuchelka, 1993).

Bison Basin Commercial ISL Uranium Mine is another example of a successful restoration project utilizing RO technology. "This action returned all water quality parameters to levels acceptable to the regulatory agencies and, following the successful completion of a 12 month stability monitoring period, the aquifer was deemed restored. The Bison Basin case represented the first successful aquifer restoration of a commercial sized ISL well field in the United States" (Catchpole and Kuchelka, 1993).

SD DENR demonstrates the state's views on reverse osmosis technology by incorporation of a point system classification for water treatment plants into their administrative rules whereby, a water treatment plant can be awarded "Fifteen points where equipment is provided for treatment of the water by reverse osmosis..."(ARSD 74:21:02:61). ARSD 74:21:02:60 indicates "Fifteen points if reverse osmosis ... is provided as advanced waste treatment".

LAC Minerals (USA), LLC (Richmond Hill Mine), treated about 4.7 million gallons with a reverse osmosis unit and discharged by the end of the 2002. Ground water impacted by acid mine drainage prior to mine reclamation is steadily improving. Monitoring wells generally show decreasing trends in sulfate and metal concentrations and increasing pH. Biological assessments of a creek below the mine show that the stream remains healthy and supports a viable cold water fishery (SD DENR, 2002).

In a Board of minerals and Environment meeting in January 2009, it is important to note that Wharf Resources (USA) Inc. water treatment process included the use of reverse osmosis to account for removal of metals. It is recorded within the meeting minutes that "use of the reverse osmosis unit also made the (surety) calculation more conservative" with regard "Mining Issues" put before the Board (SD Board of Minerals and Environment, 2009).

TR RAI-6.1-7

The application did not include estimates on the pore volume for a well field, porosity or flare factors. The staff needs this information to evaluate the financial assurance calculations and the proposed schedule and water balance for the restoration process. Please provide this information for staff to review.

Response TR RAI-6.1-7

Powertech (USA) proposes use of a flare factor of 1.44 and the restoration estimate of 6 pore volumes of groundwater for its financial assurance. Basis for the flare factor is found in TR Appendix 6.6-B "Numerical Modeling of Groundwater Conditions Related to Insitu Recovery at the Dewey-Burdock Uranium Project, South Dakota" (Petrotek, 2010).

Pore volume and volume required for restoration

Eleven measurements of ore-zone porosity have been made on cores removed from the Lakota and Fall River formation sands. The average of these porosity measurements is 0.30, which is assumed to be the average porosity of the mineralized sands within the project. The mean thickness of the mineralized zones was determined by down-hole radiologic logging to be 4.6 ft.

The formulas for determining the pore volume, including flare, and the volume of restoration composite (RC) to be withdrawn during aquifer restoration operations are as follow:

Pore volume = (well field pattern area) x (thickness) x (porosity) x (flare factor)

RC volume = (pore volume) x (number of pore volumes for aquifer restoration)

The flare factor and number of pore volumes required for aquifer restoration are both a function of the properties of the particular sandstone formations and ore deposits, as well as the operational factors of aquifer bleed rates, the balancing of pattern flow rates, the use of RO during recovery operations and the timeliness of beginning aquifer restoration operations following cessation of recovery operations (Appendix 6.6-B). The total volume of restoration composite withdrawn during aquifer restoration operations is directly proportional to both the flare factor and the number of pore volumes to be withdrawn; thus, there exists a continuum of paired values of the flare factor and the number of restoration pore volumes that produce the same total volume of restoration composite removed during aquifer restoration operations (HRI, 2001). For the Dewey-Burdock Project, the values of the flare factor and the number of pore volumes removed for aquifer restoration are comparable to those that have been recently approved for other in situ recovery sites and that are consistent with the best practicable technology for aquifer restoration.

The overall (volumetric) flare factor for ISR uranium recovery projects has varied from 1.44 at Irigaray/Christianson Ranch (Reference) to 1.95 at Churchrock/Crownpoint (Reference). The overall well field flare factor for the Dewey-Burdock Project is estimated to be 1.44, which is equal to the flare factor in approved permit applications at ISL facilities located nearby in the State of Wyoming. A detailed discussion is provided in Appendix 6.6-B.

The number of pore volumes, including flare, of groundwater to be removed to affect aquifer restoration is estimated to be 6.0. This figure is consistent with the best practicable technology that includes the following operational practices:

(i) Daily balancing of injection and extraction flow rates during production. This flow rate balancing is designed to ensure that a proper aquifer bleed is maintained both at the well field level and also within each five-spot pattern within the well field.

(ii) Timeliness of beginning restoration operations. For any particular well field, aquifer restoration operations will begin as soon as is reasonably possible following the cessation of recovery operations.

(iii) Maintenance of aquifer bleeds. Hydraulic control of well fields through the net withdrawal of the aquifer bleed stream will be continuously maintained from the beginning of recovery operations until the completion of the stability monitoring period following aquifer restoration.

(iv) The use of RO technology. The use of RO with the deep disposal well option of wastewater disposal during the recovery operations, will remove dissolved solids concurrent with the recovery of uranium, effectively conducting a portion of the aquifer restoration operations during the recovery phase of operations.

While the number of pore volumes required for aquifer restoration has historically proven to have been significantly higher for some of the early ISL operations, the methods and timing of restoration likely contributed to these larger numbers as has been documented as follows:

.. the average number of PVs extracted and treated/reinjected/or disposed was 13.6 for Irigaray and 12.4 for Christensen. ...Circumstances at both those ISR projects resulted in increased PVs to achieve restoration goals including the following:

- *Production and restoration were not conducted sequentially, and were plagued with extended periods of shut-in and standby, with delays of up to several years in some cases:"*
- *Groundwater sweep, the initial phase of restoration, was often largely ineffective and in some cases may have exacerbated the problem: and "*
- *RO was continued in some well fields after it was apparent that little improvement in water quality was occurring.*

Restoration was not performed immediately following the completion of production, and in some cases, there were long periods of inactivity during the production and restoration phases. At Irigaray, production was interrupted for a period of almost six years in MU1 through MU5 [Figure 6.1-A (1)]. Similarly, there was a three-year break in production inMU6 through MU9, when the operation was in standby status. Restoration did not commence at MUI through MU3 until a year after production had ended. At MU4 and MU5, restoration operations did not begin until two years following production Restoration commenced shortly after the end of production *at MU6 through MU9. However the project was on standby status between the completion of groundwater sweep and the beginning of the RO phase of production, resulting in a break of one to two years, depending on the MU. Restoration was initiated sooner after the end of production at Christensen Ranch, with the exception of MU3 and MU4. However, there were periods of standby between groundwater sweep and RO treatment/injection of up to a year. These delays between and during production and restoration operations most likely increased the number of PVs required to complete aquifer restoration. (Uranium One, 2009).*

For the financial assurance calculations, the pore volume affected in the first year of production is estimated to be 13 million gallons corresponding to an active well field area of 20 acres. The volume of groundwater to be extracted during groundwater restoration is estimated to be 78 million gallons.

TR RAI-6.1-8

The applicant reported that because lixiviant injection was discontinued during restoration, the groundwater quality will continually improve and the potential for an excursion is greatly reduced. The applicant proposed to monitor the water quality indicators in Table 6.1-1 and water levels once every 60 days in the monitor ring wells, and monitoring wells in the overlying and underlying aquifers. The applicant proposed to contact NRC if wells cannot be monitored within 65 days of the last sampling event. Staff notes that this monitoring plan is for excursion monitoring and not restoration monitoring. The excursion monitoring program should continue during restoration similar to that conducted during operations but will accept a frequency of monitoring greater than once every two weeks. However, should the levels indicate an excursion status for a well during restoration, the applicant must document corrective actions to be undertaken. Please address this comment.

Response TR RAI-6.1-8

During restoration, monitoring wells will be sampled every 60 days and analyzed for the indicator UCL parameters. If the concentration of two of the three excursion indicators exceeds the UCL concentrations during a sampling event, a subsequent sample will be taken within 24 hours and analyzed for the excursion indicators. If the confirmatory sample results are not complete within 30 days then for reporting purposes (described below) the excursion is considered confirmed. If the second sample does not confirm an excursion a third sample will be taken within 48 hours. If two or more excursion indicators of either the second or third samples exceed the UCL concentrations for the excursion indicators, the well in question will be placed on excursion status and corrective action will be taken. The first sample will be considered an error if neither the second or third sample confirm the first sample results.

Corrective Action and Monitoring

Corrective actions following the confirmation of an excursion will include: Sampling frequency will be increased to weekly; pumping rates of production wells in the area of the excursion will increase; the net bleed will be increased; individual wells will be pumped to enhance recovery of mining solutions; and an excursion report will be prepared for NRC. If actions taken are not effective at retrieving the excursion within 60 days, Powertech (USA) will suspend injecting lixiviant into the production zone adjacent to the excursion until the excursion is retrieved and the UCL parameters are not exceeded.

Notification

In the event of an excursion Powertech (USA) will notify the NRC within 24 hours by telephone or email, and in writing within 30 days, and begin corrective actions.

TR RAI-6.1-9

The applicant did not propose a monitoring program to document the effectiveness of the restoration program. The monitoring program should include a detailed description of the monitoring of the mining zone during restoration, including sampling density, parameters, and frequency to substantiate that it will be able to closely monitor and optimize their restoration strategy or to determine whether or not any flare or hot spots have been effectively captured during the restoration process. Please address this comment.

Response TR RAI-6.1-9

During aquifer restoration operations, the mined zone will be monitored on a frequency sufficient to determine the success of restoration, optimize the efficiency of restoration and determine if any areas of the well field need additional attention. At the beginning of restoration, water level will be measured and groundwater analyzed for all parameters listed in Table 6.1-1 for the subset of production zone sampling wells used in baseline. Thereafter, samples will be collected and analyzed for all or selected parameters as needed.

The success of restoration will be demonstrated during the well field stabilization period.

**TR RAI-6.1-10**

The applicant proposed a minimum six month stability monitoring program to demonstrate that the restoration goal has been maintained. The monitoring program includes sampling groundwater at the monitoring ring wells, one every two months for chloride, total alkalinity and conductivity and at the production wells at the beginning, middle and end of the stability parameters for the indicator parameters listed in Table 6.1-1. The applicant proposed to contact NRC if any well cannot be monitored within 65 days of the last sampling event. The staff has determined that this monitoring program is inconsistent with NUREG-1569. The monitoring program should consist of four quarterly events using a full suite of parameters for each sampling event. Furthermore, the applicant needs to discuss statistical methods to be used to determine whether or not a trend is observed or hot spots exist. Please address this comment.

Response TR RAI-6.1-10

A groundwater stability monitoring period will be implemented to show that the restoration goal has been adequately maintained. The stability monitoring period will consist of twelve (12) months with quarterly sampling. The criteria to establish restoration stability will be based on well field averages for water quality.

During the restoration stability period, the following monitoring program will be utilized:

Monitoring wells in the perimeter ring and those wells in the overlying and underlying aquifers will continue to be sampled once every two months for the UCL indicator parameters of chloride, total alkalinity (or bicarbonate), and conductivity. In the event UCL are exceeded during stability monitoring, the well field will, as soon as reasonably possible, be returned to aquifer restoration status, with corrective actions to be taken to reduce the UCL concentration as described in TR Section 3.1.3.1.2.1. The NRC will be contacted if any of the wells cannot be sampled within 65 days of the last sampling event due to unforeseen conditions such as snowstorms, flooding, and equipment malfunctions.

Quarterly, the production-zone wells that were sampled to determine well field baseline will be sampled and analyzed for the water quality parameters listed in Table 6.1-1. The criteria to establish successful stability will be that, for each sampling event, the mean constituent concentration of each water quality parameter will meet the target restoration goal established for that parameter from baseline sampling, as described in TR Section 6.1.1. In addition, the mean and range data from successive tests will be examined for statistical evidence of an oscillating or increasing concentration trend. If either oscillating or increasing trends are confirmed, an evaluation of the cause will be conducted and corrective actions will be taken.

TR RAI-6.1-11

The applicant included a Gant-type chart to depict the proposed restoration schedule in the application. The schedule is based on the entire project rather than individual mine units or well fields. The proposed restoration period encompasses an eight-year time-frame starting at year five. The restoration period overlaps the production, stability monitoring and well field decommissioning elements of the schedule. Also note that should the restoration schedule exceed 24 months for a well field, the applicant will have to request NRC approval of that schedule as an alternate schedule. Please address this comment.

Response TR RAI-6.1-11

The revised well field schedule is shown in attached Figure 6.1-1. As illustrated on this figure, it is expected that the aquifer restoration phase for each well field will be completed in less than two years. Should restoration efforts indicate a period longer than 24 months are necessary for restoration of a particular well field, Powertech (USA) will request NRC approval for the modification as an alternate schedule.

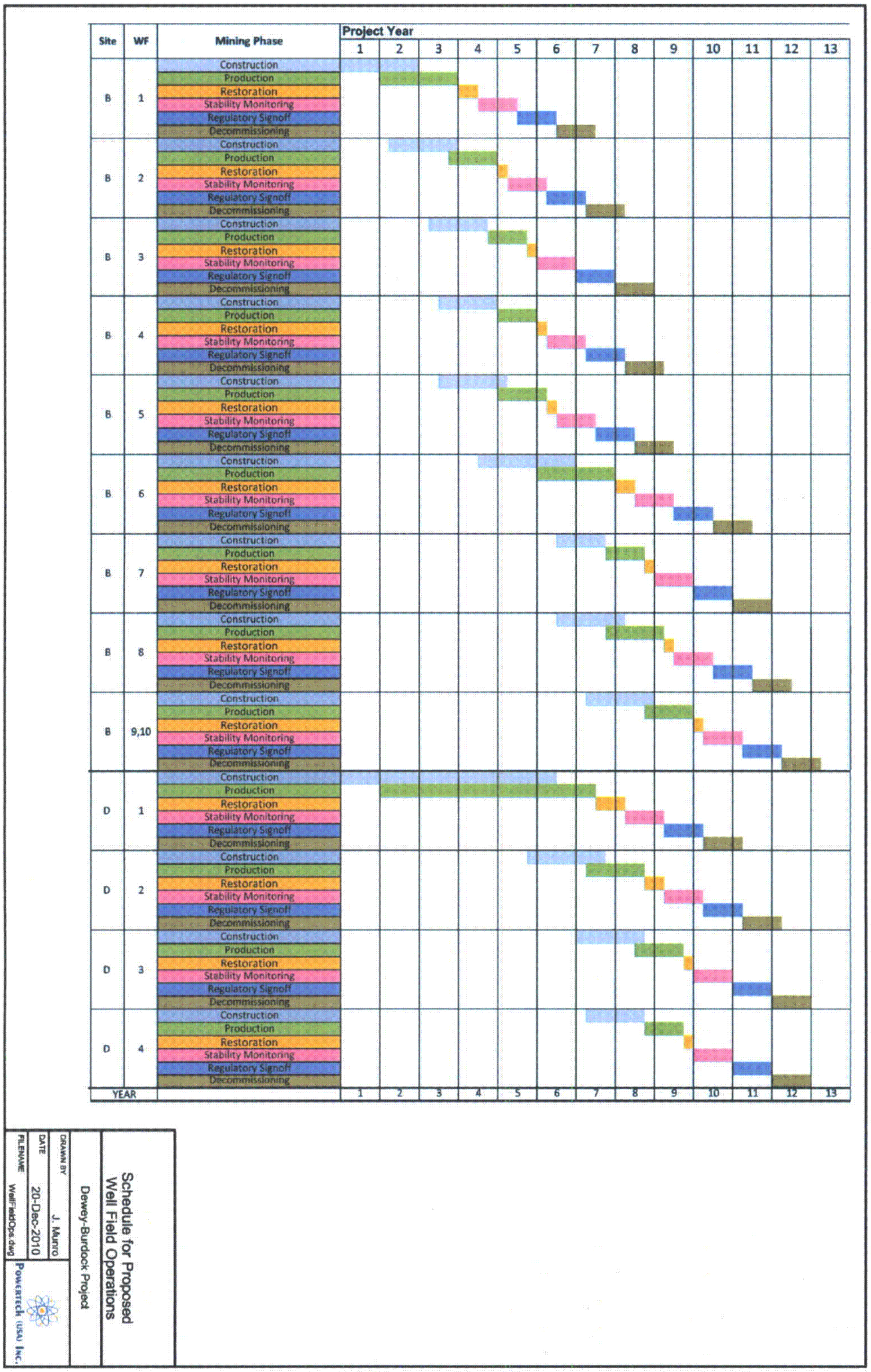

Figure 6.1-1: Schedule for Proposed Well Field Operations

Plans for Reclaiming Disturbed Lands 6.2

TR RAI-6.2-1

Consistent with NUREG-1569, Acceptance Criteria 6.2.3(2), 6.2.3(8) and 6.2.3(9), the applicant should provide additional discussion of the land cleanup program, including:

TR RAI-6.2-1(a)

a. ***The areas that will be focused on during the surveys such as well field surfaces, areas around structures in process and storage areas, on-site transportation routes, historical spill areas, retention ponds, and areas near the deep disposal wells.***

Response TR RAI-6.2-1(a)

Consistent with NUREG-1569, 6.2.1 Areas of Review, the licensee will provide the NRC with maps and data that document the post-operational condition. The areas that will receive the primary focus during the pre-reclamation surveys are well field surfaces - particularly those areas where they may have been historical spills, areas and structures around process facilities, process related storage areas and structures, on-site transportation routes, retention ponds, diversion ditches, and areas near the deep disposal wells. If land application is used as the liquid disposal method, the irrigated areas will be focus areas as well. Sampling methods provided in NUREG-1575 will be used to verify that cleanup criteria have been met.

TR RAI-6.2-1(b)

Consistent with NUREG-1569, Acceptance Criteria 6.2.3(2), 6.2.3(8) and 6.2.3(9), the applicant should provide additional discussion of the land cleanup program, including:

b. Plans for decommissioning non-radiological hazardous constituents as required by 10 CFR Part 40, Appendix A, Criterion 6 (7),

Response: TR RAI-6.2-1(b)

Consistent with NUREG-1569 and 10 CFR Part 40, Appendix A, Criterion 6(7), the applicant will ensure that non-radiological hazards are addressed in the planning and implementation processes of decommissioning and closure. TR Section 1.10 includes a discussion of non-radiological wastes and their disposition at closure. Also, for the land application option, non-radiological cleanup concerns are addressed in TR Section 7.3.3.8.2. Further, responses to ER RAIs WM-3, WM-4, and WM-6.2 also address the decommissioning and disposal of non-radiological materials and constituents.

TR RAI-6.2-1(c)

Consistent with NUREG-1569, Acceptance Criteria 6.2.3(2), 6.2.3(8) and 6.2.3(9), the applicant should provide additional discussion of the land cleanup program, including:

c. ***Demonstration that the actual quality assurance and quality control program will address all aspects of decommissioning.***

Response: TR RAI-6.2-1(c)

The actual quality assurance and quality control program will be finalized after issuance of the license. The applicant is committed to developing a quality assurance and control program that will address all aspects of decommissioning. The proposed outline of that program is found in applicant's response to TR RAI-P&R-16-3, specifically Figure TR_RAI_P&R-16. Item 8, Sampling and Analysis, will address non-radiological as well as radiological parameters. The program will be designed to ensure that the project area is closed in a manner that eliminates or minimizes the need for further maintenance to the extent necessary to prevent threats to human health and the environment.

TR RAI-6.2-2

As discussed in Section 2.9 of this RAI, the applicant has not sufficiently demonstrated that background radiological conditions have been established within the Permit Area. In addition, the applicant has not sufficiently demonstrated the correlation of gamma surveys with Ra-226 (or other radionuclides) concentrations in soil. In Section 6.2.1 of the TR, the applicant stated that baseline soils, vegetation, and radiological data will be used as a guide in evaluating the final reclamation. The following questions pertain to pre-reclamation surveys and planned cleanup activities.

TR RAI-6.2-2(a)

a. ***Consistent with NUREG-1569, Acceptance Criterion 6.2.3(2), please identify instruments and techniques that will be used in the pre-reclamation radiological survey program to identify areas of the site that need to be cleaned up to comply with NRC concentration limits.***

Response: TR RAI-6.2-2(a)

The applicant plans to use identical or similar instruments and techniques for its pre-reclamation radiological survey to identify areas of the site that need to be cleaned up to comply with NRC concentration limits as was used to survey the PAA for background radiological conditions. The instruments used for the background survey are described in Section 2.9 of the TR and includes unshielded Ludlum Model 44-10 2"x 2" sodium iodide (NaI) detectors coupled to Ludlum Model 2221 ratemeter/scalers (set in ratemeter mode) and a Trimble Pro XRS GPS Receiver with Trimble TSCe Datalogger. The techniques to be used during the pre-reclamation radiological survey include putting special emphasis on those areas that are likely to be contaminated, such as diversion ditches, surface impoundments, well field surfaces and structures in process and storage areas. The applicant will also consider results from operational monitoring and any other information that provides insights to areas of expected contamination. Additionally, the applicant will use a sampling grid of 100 m^2 for soil. Guidance for sample size and other techniques provided in NUREG-1575 will be used as reference for the pre-reclamation radiological survey.

TR RAI-6.2-2(b)

As discussed in Section 2.9 of this RAI, the applicant has not sufficiently demonstrated that background radiological conditions have been established within the Permit Area. In addition, the applicant has not sufficiently demonstrated the correlation of gamma surveys with Ra-226 (or other radionuclides) concentrations in soil. In Section 6.2.1 of the TR, the applicant stated that baseline soils, vegetation, and radiological data will be used as a guide in evaluating the final reclamation. The following questions pertain to pre-reclamation surveys and planned cleanup activities.

b. Consistent with NUREG-1569, Acceptance Criterion 6.2.3(3), please describe how pre-reclamation survey results will be used to identify candidate areas for cleanup operations.

Response: TR RAI-6.2-2(b)

Consistent with NUREG-1569, Acceptance Criterion 6.2.3(3), the applicant will use the pre-reclamation survey results to identify candidate areas for cleanup operations. The following general procedures for interpretation of the pre-reclamation survey results will be used to identify areas for cleanup operations:

1.) Pursuant to 10 CFR Part 40, Appendix A, Criterion 6(6), the radium-226 content in soils, averaged over areas of 100 m2, will not exceed the background concentration by more than (i) 5 picocuries per gram (pCi/g) averaged over the first 15 cm (5.9 in) below the surface, and (ii) 15 pCi/g of radium-226 averaged over 15 cm thick layers more than 15 cm below the surface.

2.) The background radionuclide concentrations have been determined using appropriate methods as described in TR Section 2.9. There are two areas of the PAA where the gamma survey recorded levels higher than the majority of the PAA. These are the old abandoned surface mine area in the NE portion of the PAA and a naturally anomalous area in the northern portion of the PAA. These areas may warrant a different background concentration. Should the applicant determine that use of a different background radionuclide concentration is warranted, it will propose one with its final reclamation plan.

3.) For areas that meet the radium cleanup criteria, but that still have elevated thorium-230 levels, the applicant proposes to provide in its final reclamation plan an acceptable cleanup criterion for thorium-230, one that when combined with residual concentrations of radium-226, would result in the radium concentration (both radium residual and from thorium decay) that would meet the radium cleanup standard in 1,000 years.

4.) Likewise, the applicant will propose acceptable criteria for uranium in soil, such as those found in Appendix E of NUREG-1569.

5.) Lastly, the survey method for cleanup operations will be designed to provide 95% confidence that any residual radionuclides on the PAA will be identified and cleaned up. The applicant will apply appropriate statistical tests for analysis of survey data that are described in NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual" (NRC, 2000).

Removal and Disposal of Structures, Waste Material, and Equipment 6.3

TR RAI-6.3-1

It appears that the bullet at the top of page 6-23 should read, "Not salvageable and contaminated below release limits ..." Please clarify this point.

Response: TR RAI-6.3-1

The bullet item at the top of page 6-23 (TR Section 6.3.3 Removal of Process Building and Equipment) should read "Not salvageable and contaminated **below** release limits..."

TR RAI-6.3-2

In Section 6.3.1 of the TR, the applicant references Regulatory Guide 1.86 as the criteria for surface contamination release limits. However, Regulatory Guide 1.86 is for use by nuclear power reactors, while Enclosure 2 to Policy and Guidance Directive FC-83-23 (as updated) is used as the criteria for surface contamination release limits by materials licensees. Please provide the correct reference in the TR.

Response: TR RAI-6.3-2

Surface contamination release limits by materials licensees are those specified in Enclosure 2 to Policy and Guidance Directive FC-82-23 (as updated).

Reference: TR Section 6.3.1, page 6-21

> 6.3.1 Establishment of Surface Contamination Limits
>
> Surface contamination release limits will be adopted from those published in NRC Regulatory Guide 1.86, Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use of Termination of Licenses for Byproduct, Source, or Special Nuclear Material (NRC, 1987), or modeled using RESRAD Build, or equivalent. Powertech (USA) will select the methods by which surface contamination limits will be developed at a later date.

TR RAI-6.3-3

In Section 6.3.2, the applicant describes how materials with potential surface contamination will be treated. Please provide a description of how materials such as concrete exposed to

Response: TR RAI-6.3-3

As stated in the RAI, the applicant describes how materials with potential surface contamination will be treated. Apparently, the reviewer did not understand that "slabs" meant concrete slabs. TR Section 6.3.2 addresses the treatment of concrete slabs as well as other potential surface contamination. In summary, concrete slabs will be surveyed and if found to contain radionuclides in excess of the release limits, they will be broken up and disposed of at a licensed 11e.(2) disposal site. If the survey results indicate that the concrete is not contaminated above release limits, it may be disposed in a permitted landfill, used for fill elsewhere, or, alternatively, may be left in place for use by the landowner if he so requests.

Methodologies for Conducting Post Reclamation and Decommissioning Radiological Surveys 6.4

TR RAI-6.4-1

Consistent with NUREG-1569, Acceptance Criterion 6.4.3(1), please describe the manner in which areas that meet the Ra-226 cleanup criteria but still have elevated Th-230 levels will be addressed.

Response: TR RAI-6.4-1

In areas that meet the radium-226 cleanup criteria post-reclamation but that still have elevated thorium-230 levels, the applicant will propose an acceptable cleanup criteria for thorium-230. Powertech (USA), in its final reclamation plan, which will be submitted 12 months prior to any planned reclamation, may propose a concentration for Th-230 that, when combined with the residual concentration (residual and from thorium decay) that would be present in 1,000 years meeting the radium cleanup standard. In addition, Powertech (USA) will consider other potentially acceptable criteria before selecting and proposing final cleanup criterion for Th-230 in its reclamation plan.

TR RAI-6.4-2

As discussed in Section 2.9 of this RAI, it does not appear that the applicant has sufficiently demonstrated that background radiological conditions have been established within the Permit Area. Consistent with NUREG-1569, Acceptance Criterion 6.4.3(2), please demonstrate that the applicant has sufficiently determined background radionuclide concentrations as described in Section 2.9 of NUREG1569.

Response: TR RAI-6.4-2

Powertech (USA) believes it has sufficiently demonstrated that background radiological conditions have been established within the Permit Area. As noted, Section 2.9 of the RAI addressed the issues raised by NRC staff. Please review the responses to the requests for additional information contained in Section 2.9 for information sufficient to demonstrate that background radiological conditions have been established within the Permit Area.

TR RAI-6.4-3

In Section 6.4.1.2 of the TR, the formula for the unity rule appears with the uranium soil standard formula. It appears that this should be moved to the next paragraph. Please clarify this point.

Response: TR RAI-6.4-3

In TR Section 6.4.1.2, the formula for the unity rule should be moved to the end of the next paragraph, which refers to the unity rule.

TR RAI-6.4-4

In Section 6.4.3 of the TR, the applicant stated that it will evaluate compliance with cleanup criteria in terms of soil concentrations that will be supplemented by field gamma surveys. The applicant will conduct final GPS-based gamma surveys in affected areas and buffer zones. The staff cannot evaluate the comprehensiveness of the soil cleanup verification and sampling plan. Please define more specifically what constitutes affected areas.

Response: TR RAI-6.4-4

Affected areas are those areas that are potentially more likely to be impacted by uranium solutions, dried uranium product (yellowcake) and liquid or solid waste streams that contain uranium or other radionuclides associated with uranium recovery operations. The areas that are potentially most likely to be considered affected areas include well field surfaces - particularly those areas where they may have been historical spills, areas and structures around process facilities, process related storage areas and structures, on-site transportation routes, retention ponds, diversion ditches, and areas near the deep disposal wells. If land application is used as the liquid disposal method, the irrigated areas may be affected areas as well.

TR RAI-6.4-5

The applicant has not provided assurance that the survey method for verification of soil cleanup is designed to provide 95% confidence that the soil units meet the cleanup guidelines. The staff cannot evaluate the effectiveness of the cleanup based on the information provided. Consistent with NUREG-1569, Acceptance Criterion 6.4.3(5), please clarify that the survey method for verification of soil cleanup will be designed to provide 95-percent confidence that the survey units will meet the cleanup guidelines.

Response: TR RAI-6.4-5

Consistent with NUREG-1569, Acceptance Criterion 6.4.3(5), the survey method for verification of soil cleanup will be designed to provide 95% confidence that the survey units will meet the cleanup guidelines.

TR Section 6.4.3 has been revised to reflect this commitment.

TR RAI-6.4-6

In Sections 6.4.2 and 6.4.3 of the TR, the applicant states that it will utilize gamma ray measurements to determine compliance with soil cleanup criteria. However, as discussed in Section 2.9 of this RAI, it does not appear that the applicant has demonstrated the feasibility of relating gamma ray measurements to radium or any other radionuclides. Consistent with NUREG-1569, Acceptance Criteria 6.4.3(1), 6.4.3(3) and 6.4.3(5), please demonstrate that the applicant's methodology for gamma ray surveys for excavation control monitoring and final status surveys will provide 95-percent confidence that the survey units will meet the cleanup guidelines.

Response: TR RAI-6.4-6

As stated in its response to RAI 2.9-38 (a-b) in this response package, the applicant believes it has sufficiently demonstrated the feasibility of relating gamma ray measurements to radium-226 concentrations in soil at the proposed Dewey-Burdock Project. At least 12 months prior to commencing reclamation, the applicant will submit a reclamation plan that will contain descriptions of methodology for both pre-and post-reclamation gamma ray surveys. The gamma ray surveys for excavation control monitoring and final cleanup status will be designed to be consistent with NUREG-1569, Acceptance Criteria 6.4.3(1), 6.4.3(3) and 6.4.3(5), as previously stated in this response package in the response to RAI 6.2-2 (a-b).

TR RAI-6.4-7

Consistent with 10 CFR 40, Appendix A, Criterion 6(6), please discuss how byproduct material containing concentrations of radionuclides other than radium in soil, and surface activity on remaining structures will not result in a total effective dose equivalent (TEDE) exceeding the dose from cleanup of the radium contaminated soil to the benchmark dose and will be at levels which are ALARA. This discussion should describe how the radium benchmark dose will be applied to the surface activity on remaining structures.

Response: TR RAI-6.4-7

By product material containing concentrations of radionuclides, other than radium in soil, and surface activity on remaining structures, will not result in a total effective dose equivalent (TEDE) exceeding the dose from cleanup of radium contaminated soil to the radium benchmark dose, and will be at levels which are ALARA. If more than one residual radionuclide is present in the same 100-square-meter area (soil or structure), the sum of the ratios for each radionuclide of concentration present to the concentration limit will not exceed "1" (unity). A calculation of the potential peak annual TEDE within 1000 years to the average member of the critical group that would result from applying the radium standard (not including radon) on the site will be submitted to NRC for approval. Details will be provided in the decommissioning and reclamation plans to be submitted for review at least 12 months prior to decommissioning activities. The applicant is aware that the use of decommissioning plans with radium benchmark doses which exceed 100 mrem/yr, before application of ALARA, requires the approval of the Commission after consideration of the recommendation of the NRC staff.

TR RAI-6.4-8

The applicant stated that the QAPP will contain recommendations in NRC Regulatory Guide 8.15. The correct reference appears to be Regulatory Guide 4.15. Please address this discrepancy.

Response: TR RAI-6.4-8

The correct reference in this particular instance is Regulatory Guide 4.15.

Section 6.4.4 Quality Assurance has been corrected accordingly.

Appendix 6.6-A

Closure Costs by Year
Dewey Burdock ISL Mine
Powertech (USA), Inc.

Dewey Burdock - Restoration and Reclamation Costs- Deep Well Disposal option

No.		Description	1	2	3	4	5	6	Total
		Project Year	1	2	3	4	5	6	Total
		Operation Phase	Construction	Production	Restoration+ stability		Decommissioning		
		Production (lbs U3O8)	-	1,000,000	2,588	-	-	-	
No.		Description							
1		Facility Decommissioning							
	A	Salvageable Equipment					121,000	121,000	**242,000**
	B	Non-salvageable bldg. & equipment disposal					**335,140**	**335,140**	**670,280**
	C	Byproduct disposal			**4,400**		**239,697**	**239,697**	**483,794**
	D	Restore contaminated areas						**570,300**	**570,300**
2		O&M- GW restoration and stability							-
	A	Method: Groundwater treatment			**442,937**	**442,937**			**885,873**
	B	Method: Groundwater Sweep with Madison Injection							
3		Wellfield relcamation							-
	A	Well plugging & closure					**375,650**	**375,650**	**751,300**
	B	Remove surface equipment & reclaim					**487,525**	**487,525**	**975,050**
4		Radiological Survey and Env. Monitoring						**832,939**	**832,939**
5		Project Management Costs & Miscellaneous			**268,400**	**242,300**	**229,500**	**228,500**	**968,700**
6		Labor incl. 35% overhead			**534,000**	**398,000**	**270,000**	**135,000**	**1,337,000**
7		Contingency @ 15%			**187,460**	**162,485**	**308,777**	**498,863**	**1,157,585**
		Total	-	-	**1,437,197**	**1,245,722**	**2,367,289**	**3,824,614**	**8,874,822**

Closure Costs by Year
Dewey-Burdock ISL Mine
Powertech (USA), Inc.

Dewey Burdock - Restoration and Reclamation Costs- Land Application disposal option									
		Project Year	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
		Operation Phase	**Construction**	**Production**	**Restoration+ stability**		**Decommissioning**		
		Production (lbs U3O8)	**-**	**1,000,000**	**2,588**	**-**	**-**	**-**	
No.	Description								
1	Facility Decommissioning								
	A	Salvageable Equipment					121,000	121,000	**242,000**
	B	Non-salvageable bldg. & equipment disposal					**523,390**	**523,390**	**1,046,780**
	C	Byproduct disposal			**4,400**		**245,068**	**245,068**	**494,535**
	D	Restore contaminated areas						**709,100**	**709,100**
2	O&M- GW restoration and stability								
	A	Method: Groundwater treatment							
	B	Method: Groundwater Sweep with Madison Injection			**271,850**	**271,850**			**543,700**
3	Wellfield relcamation								**-**
	A	Well plugging & closure					**375,650**	**375,650**	**751,300**
	B	Remove surface equipment & reclaim					**487,525**	**487,525**	**975,050**
4	Radiological Survey and Env. Monitoring							**847,039**	**847,039**
5	Project Management Costs & Miscellaneous				**268,400**	**242,300**	**229,500**	**228,500**	**968,700**
6	Labor incl. 35% overhead				**534,000**	**398,000**	**270,000**	**135,000**	**1,337,000**
7	Contingency @ 15%				**161,798**	**136,823**	**337,820**	**550,841**	**1,187,281**
	Total		**-**	**-**	**1,240,448**	**1,048,973**	**2,589,953**	**4,223,112**	**9,102,485**

Notation

Abbrev.	Definition
ac	acres
ac-ft	acre-feet
BSW	Baseline sampling well
CF	Cubic Feet
CPP	Central Processing Plant
d	days
DDW	Deep Disposal Well
est.	Estimated
ft	feet
gpm	US gallons/minute
HH	Header house
IMW	Internal monitor wells
IW	Injection wells
kgal	thousand gallons
kW	KiloWatt
kWh	kiloWatt-hour
L	Liter
LA	Land Application
lb	pounds mass
M#	Million pounds
MET	Meteorological
mg	milligram
Mgal	Million gallons
MW	Monitor wells
MWh	MegaWatt-hour
PMW	Permimeter monitor wells
PV	Pore volumes
PW	Production wells
RC	Restoration Composite
SF	Satellite Facility
U3O8	Uranium Oxide product
WF	Well field
y	year

Operating Assumptions

Dewey Burdock Project

Powertech USA, Inc.

	Description	Quantity	Units
Producton phase parameters			
1	Production objective	1,000,000	lb/y U3O8
2	Ore zone mass per unit area (Total resource/total ore body area)	1.59	lb/sq ft
3	ISR recovery efficiency	0.75	
4	orebody area in active ISL mining (1Mlb/y U3O8/0.75/(1.59 lb/ft^2)	836,050	sq. ft
5	Ratio of Actual pattern area/ ore body area	1.04	
6	Active ISL wellfield area	869,493	sq ft
7	Active ISL wellfield area	20.0	acres
8	Area per pattern , mean	4,450	sq ft/pattern
9	Design Flow rate of Production Composite	4000	gpm
10	Design Flow rate of Production Composite per production well	20	gpm
11	Mean grade of extracted water (ppm U3O8) (design)	60	mg/L U3O8
12	Number of online patterns to meet production goal (active area/(area/pattern))	195	patterns
13	Ratio of Injection wells to Production wells (Design)	2.1	IJ/PW
14	Number of online Injection Wells required to meet objective	411	IW
15	Number of online Production Wells per Header House (Design)	18	PW/HH
16	Number of HH required to meet production objective (PW/18)	11	HH
17	Number of perimeter monitoring wells in Burdock WF#1 and Dewey WF#1	70	PMW
19	Number of overlying internal mon. wels in active production zone @ 1 per 4 ac.	5	MW
20	Numberr of underlying internal monitor wells in active prod. Zone @ 1 per 8 ac.	2	MW
21	Total Number of active Internal Monitoring wells in Burd. WF#1 and Dew. WF#1	7	Int. MWs;
22	Number of Internal Monitoring Wells per HH	1	Int. MW/HH
24	Baseline sampling wells in active production area (1 per 4 acres)	5	BSW
26	length of large (10' wide) pipeline trench	10,000	ft
28	length of medium (5' wide) pipeline trench	5,050	ft
30	length of small (2' wide) pipeline trench installed	2,000	ft
Summary of active wells for production phase			
1	Production wells	195	PW
2	Injection wells	411	IW
3	Perimeter ring wells	70	PMW
4	Internal Monitor wells	7	IMW
5	Baseline sampling wells	5	BSW
6	Header Houses	11	HH
7	Total # Monitoring wells per 1MM lb/y produced during production	77	MW
8	WF access roads	17,000	ft

Operating Assumptions- continued

Description		Quantity	Units
Wellfield equipment in place at end of 1st year production			
1	Total wells to be plugged & abandoned	683	wells
2	Wellhead covers to be heated during GW restoration (PW+ IW + MW)	683	wells
3	Header Houses	11	HH
4	Overhead electric lines	101,000	ft
5	Facility access roads (24')		ft
6	Wellfield access roads (12')		ft
General Aquifer Restoraton Assumptions			
1	Restoration flow rate	500	gpm
2	Restoration operating days	365	day/y
3	Ore zone porosity	0.30	
4	Ore zone thickness	4.6	ft
5	Flare factor, volumetric	1.44	
6	Pore volumes required for restoration	6.0	PV
Restoration Parameters			
1	Pore volume affected in year 1 = (orebody area/1M pounds U3O8 recovered) x thickness x porosity x flare factor	12,924,359	gallons/M# recovered
2	Total volume Restoration composite, including excess wellfield area, for 6 PV.	77,546,156	gallons
3	Months to restore a pattern (6PV @ 20 gpm)	0.5	month
4	Years to restore aquifer for 1M pounds of U3O8 recovered (total vol RC)/500 gpm)	0.30	years
Well plugging Parameters			
1	Mean well depth (Inj., Prod., Monitoring) (Burd.-450', D-600')	525	ft
2	Inside diameter	4.91	inch
3	Volume per foot (for plugging)	0.131	ft^3/ft
4	Volume to be plugged per well	69	ft^3
Pipeline disposal			
1	HDPE pipe density , SG	0.95	
2	void volume in chipped pipe	10%	
Pond solids			
1	Addition rate of barium chloride to restoration composite	20.00	mg/L
2	Percent solids	40%	
3	specific gravity	1.4	
4	Pond sludge density	87.2	lb/CF

Operating Assumptions- continued

Description		Units	Disposal Option	
Flow rates during restoration period (gpm)			**DDW**	**LA**
1	Madison Aquifer water (gpm)	gpm	150	500
2	Wellfield Wastewater to Disposal system (gpm)	gpm	150	500
Pond inventories at beginning of surety period				
1	CPP pond capacity	ac-ft	15.9	36.2
2	CPP pond- 50% capacity	Mgal	3	6
3	Storage ponds- 50% capacity of 8 ponds @ 63.8 ac-ft	Mgal		83
4	Surge ponds- 50% capacity of 2 ponds @ 8.4 ac-ft	Mgal	3	
5	Radium settling & Outlet ponds 100% capacity	Mgal	14	29
6	Total impoundment inventory at beginning of surety period	Mgal	20	118
Wastewater disposal				
1	Volume of Restoration wastewater (Mgal)	Mgal	23	78
2	Total wastewater (Mgal)	Mgal	43	196
3	Volume to Disposal well (Mgal)	Mgal	43	
4	Volume to Land Application (Mgal)	Mgal		196
Madison water required				
1	Volume of Madison water required	Mgal	23	78
Stability Period				
1	Length of stability period		12	
2	Number of sampling events		3	
Pump/motor parameters				
1	Pump efficiency- variable frequency drive		0.90	

Recurring Costs-- Table 2

		Unit	Price
1	**Energy costs**		
	Electrical power	$/kWh	$ 0.07
	Propane	$/gal	$ 2.15
2	**Chemical Costs**	**unit**	**$/unit**
	Hydrogen peroxide - 50% solution	lb	0.30
	Sulfuric acid - 98%	lb	0.135
	Sodium hydroxide - 50% solution	lb	0.145
	Sodium chloride	lb	0.09
	Sodium carbonate	lb	0.135
	Barium chloride -dihydrate	lb	0.67
3	**Well Plugging costs**		
	Cost of plugging mix.	$/ft^3	9.00
	Cost of plugging cement per well	$/well	621.29
	contract labor w/ equipment = 4 crew-hr/well @ $125/hr	$/well	500
	Total plugging cost per well	$/well	1,121
4	**Byproduct Disposal Cost**		
	Transportation to White Mesa, UT (785 miles 1-way) @ $3.55/loaded mile + $1.85/unloaded mile for 30 cubic yard load.	$/cubic yard	140
	11e.(2) Disposal fee, soil-like material	$/cubic yard	150
	11e.(2) Disposal fee, equipment	$/cubic yard	150
5	**Pipeline removal cost**		
	Excavation & pipe removal- from Table 14		
	pipelines ≥ 8"	$/(ft-pipe)	0.533
	pipelines ≥ 3"-6" @ 50% rate of large pipe	$/(ft-pipe)	0.267
	wellfield pipeliens 1"-2" @ 25% rate of large pipe	$/(ft-pipe)	0.133
	Pond Disposal		
	Liner removal and shredding	$/(ft2-liner)	0.05
	Pipe chipping	$/CF	0.15

Operations Summary
Dewey-Burdock Project

O&M During aquifer restoration phase					
Dewey-Burdock Project				Subtotals	
O&M		DDW	LA	DDW	LA
1 Well Field Operations, prorated for length of rest years=	0.30				
General well maintenance		54,000	54,000		
Well MIT- none in first 5 years		0	0		
Replacement of submersible pumps		12,000	12,000		
Header House maintenance		9,000	9,000		
Pipelines & Road maintenance		9,000	9,000		
Subtotal Well field ops				84,000	84,000
2 Capital Equipment					
RO units, RO sump pumps, roll-offs (direct & Indriect)		593,000	70,000		
Subtotal Cap. Equip.				593,000	70,000
3 Pumping costs					
RO pumps		19,900			
Madison aquifer booster		1,700	5,700		
Plant to Radium settling ponds		7,100	32,200		
From Outlet pond to disposal (LA or DDW)		7,100	71,500		
Subtotal Pumping costs				35,800	109,400
4 Facility operation					
Resin replacement		0	0		
Resin transport		300	300		
Electricity		17,000	17,000		
Propane		59000	59000		
maintenance		12,000	12,000		
Subtotal facility ops.				88,300	88,300
5 Chemicals					
For resin elution		2,300	2,300		
For Radium precipitation		2,610	8700		
Subtotal Chemicals				4,910	11,000
6 Groundwater monitoring					
		50000	50000		
Subtotal groundwater monitoring				50,000	50,000

Operations Summary
Dewey-Burdock Project

O&M During aquifer restoration phase				Subtotals	
Dewey-Burdock Project					
O&M		DDW	LA	DDW	LA
7 Disposal well					
Electricity		20,000			
Maintenance		9,863			
	Subtotal Disposal wells			29,863	-
8 Land Application system					
Electricity			96,000		
Maintenance			35,000		
	Subtotal Land Application			-	131,000
Total O&M for Restoration and Stabilization	Totals	885,873	543,700	885,873	543,700
		DDW	LA	DDW	LA

Annual Restoration Operating Costs - Table 3					
Dewey-Burdock Project					
Powertech (USA), Inc.					
	Number	**Quantity**	**Units**	**Rate**	**Cost ($/yr)**
Annual Wellfield costs during aquifer restoration assuming continuous 365-day/y operation					
Wells (per well)					
General well maintenance	1	1	lump sum	300	300
Well Mechanical Integrity Testing (every 5 yr)	1	0			0
Electric utilities:					
Wellhead heaters (0.5kw, 8 hr/day, 180 days/yr)	1	720	kwh	0.070	50
Header House (per HH)					
Flow meter maintenance (2 @$50 ea.) per HH	2	1	ea	50	100
Replacement pressure gauges/switches	20	1	ea	50	1,000
Equip maintenance (@ 2% of new equipment capital)	1	80,000	%	0.02	1,600
Subtotal Maintenance					**2,700**
Electric utilities:					
Bldg heating (5 kw, 180 days/yr)	1	22,000	kwh	0.070	1,500
Instrumentation (1 kw)	1	9,000	kwh	0.070	600
Subtotal Power					**2,100**
Wellfield Maintenance					
# Production (extraction) wells		195	prod wells		
# Injection wells		411	inj wells		
General Well maintenance ($300/well* (PW+IW)/ y)					182,000
Well MIT- none in first 5 years		-			
Replacement of submersible pumps (10%/yr @ 2,000 each)		39,000	$		
# Header houses (per MM # produced)		11.0	HH		
Header House maintenance (# HH x $2700 /HH)			per HH	2,700	29,700
General well field maintenance					
Pipelines		1	lump sum	20,000	20,000
Road maintenance materials (gravel/culverts)		1	lump sum	10,000	10,000
Wireless telemetry and security systems maintenance		1	lump sum	2,000	2,000
Subtotal Maintenance					**32,000**

Restoration Operating Costs
Dewey-Burdock Project

	Number	Quantity	Units	Rate	Cost ($/yr)
	Number	**Quantity**	**Units**	**Rate**	**Cost ($/yr)**
Annual Facility/Plant costs					
Ion exchange resin replacement - DOWEX 21K XLT		0	cu ft	221	0
Utilities:					
Electricity					
PC Booster Pump 250 gpm @ 90' TDH	2	83,000	kwh	0.070	5,800
IC Booster Pump 250 gpm @ 90' TDH	2	83,000	kwh	0.070	5,800
Resin Transfer Pump 100 gpm @ 50' TDH	1	9,180	kwh	0.070	643
Utility Water Pump (300 gpm @ 40' TDH)	1	22,020	kwh	0.070	1,500
RO Unit- included in Deep well disposal option below					
CPP HVAC	1	175	MWh	0.070	12,300
CPP Lighting (0.8 W/ft^2 for 10^4 ft^2	10000	70,000	kwh	0.070	4,900
CPP Instrumentation (2 kw)	1	18,000	kwh	0.070	1,300
Maintenance bldg HVAC	1	87.6	MWh	0.070	6,100
Office bldg HVAC	1	87.6	MWh	0.070	6,100
Satellite faiclity HVAC	1	88	MWh	0.070	6,100
Satellite facility instrumentation	1	18,000	kwh	0.070	1,300
Exterior lighting	1	88	MWh	0.070	6,100
Subtotal annual electric Power					**57,943**
Propane @ 21,600 Btu/gal (gallons from ER)					
CPP/SF space heating	1	77,220	gal/y	2.150	166,000
CPP Thermal fluid heater, prorated for restoration production of U3O8	2.59E-03	14,145	gal/y	2.150	100
Maintenance bldg	1	11,598	gal/y	2.150	24,900
Office bldg	1	4,883	gal/y	2.150	10,500
Subtotal annual Propane					**201,500**
Resin Transport to CPP		6	R/T per yr	50	**300**
Land Application Option Operating cost	**Mgal**	**kWh/kgal**	**kWh**	**$/kWh**	**Lump Sum $**
Land app pumps from pond to pivots (200' TDH) (water vol from Table 1)	196	5.220	1,021,000	0.07	71,470
Days of irrigation	Days				
March 29-May 10	42				
May 11-Sept 24	136				
Sept 25-Oct 31	37				
total available irrigation days per year	215				

Restoration Operating Costs
Dewey-Burdock Project

	Number	Quantity	Units	Rate	Cost ($/yr)
Pivot Irrigation system capacity	# installed	# used	@ gpm	subtotal gpm	
50 acre Pivot- 15 hp drive	5	5	104	520	
25 acre Pivot - 10 hp drive	0	0	52	0	
15 are Pivot- 7.5 hp	0	0	31	0	
total LA rate (gpm)				520	
Total Days of irrigation required (wastewater volume/(total LA rate)				261	
Irrigation Years @ 215 days/y				1.2	
Cost of Pivot Irrigation operation				**$/kWh**	**Lump Sum $**
Center pivot hydraulic pump; 15 hp for 50 ac areas (use 13 RHP)	5	350,471	kWh	0.07	24,500
Center pivot hydraulic pump; 10 hp for 25 ac areas (use 8 RHP)	0	0	kWh	0.07	0
Center pivot hydraulic pump; 7.5 hp for 15 ac areas	0	0	kWh		0
Sump pump at 25 ac land app site (return irrigation tailwater/runoff)	0	3,000	kwh	0.07	0
Sump pump at 50 ac land app site (return irrigation tailwater/runoff)	5	10,000	kwh	0.07	3,500
subtotal Land Application Power					**99,000**
Equipment Maintenance:				$	**Annual Cost**
Center pivot machines	5	1	year	500	2,500
Equip Maintenance (@ 3% of new equipment capital) - pumps only		78,000	%	3	2,300
Equipment Replacement (@ 3% of new equipment capital)		1,464,000	%	3	43,900
Subtotal Annual Maintenance					**49,000**
Prorated pivot maintenance (129/365)					**35,038**
Total Cost Land Application					**205,508**
Deep Disposal Well operating cost					
Injection pump maintenance and repair (assume 6%/y of cap cost)	2	150,000	Cap cost	0.06	**18,000**
Wastewater volume (Mgal)	43				
Days of DDW operaton (ww volume/(150 gpm total flow rate))	200				
Prorated DDW maintance					**9,863**
Electric utilities:					
Deep disposal well PD pump (4, but only one operating)					
150 gpm@1000' TDH)	1	275,300	kwh	0.070	19,300
Bldg heating (1 kw, 180 days/yr)	1	4,000	kwh	0.070	300
RO Unit Power	1	284	MWh	0.070	19,900
Subtotal annual DDW power					**20,000**
Prorated DDW power (216/365)					**10,959**
Total deep well cost (power + maint.)					**20,822**

Restoration Operating Costs
Dewey-Burdock Project

	Number	Quantity	Units	Rate	Cost ($/yr)
Restoration					
Treatment Chemicals	**Number**	**Quantity**	**Units**	**Rate**	**Cost ($/yr)**
IX Cost (from Operating Chemicals)			LS	1.000	11,000
Subtotal					**11,000**
Treatment Maintenance					
Process hardware maintenance + replmt @ 4% of Capital		994,000	cap cost	0.040	39,760
Subtotal					**40,000**
Madison Water Supply Power					
Maintenance @ 10%/y of replacement cost of ($75K/pump)	2	75,000		0.100	15,000
Madison booster pump (150 gpm; 500 TDH; 24 hr/day)	1	184,000	kwh	0.070	13,000
Subtotal					28,000
Power costs that vary with disposal option					
Madison Water supply booster pump (free flowing) @ 40' TDH	Mgal	**kWh/kgal**	**$/kWh**	**LS $**	
DDW option	23	1.040	0.07	1,700	
LA option	78	1.040	0.07	5,700	
Pump power from ponds to disposal	Mgal	**kWh/kgal**		**LS $**	
DDW option Booster Pumps (90 TDH;)	43	2.350	0.070	7,100	
LA option Booster Pumps (200 TDH;)	196	5.220	0.070	71,500	
Booster Pumps from plant to Ra-settling ponds	Mgal	**kWh/kgal**		**LS $**	
DDW option Booster Pumps (90 TDH;)	43	2.350	0.070	7,100	
LA option Booster Pumps (90 TDH;)	196	2.350	0.070	32,200	

Restoration Equipment
Dewey Burdock ISL Mine
Powertech Uranium Corporation

Restoration Equipment- Disposal Well option

Powertech Dewey Burdock ISL Project

Description	Equipment List Number	No./Size	Quantity	Units	Unit Cost	Purchase Cost	Shipping Cost	Estimated Capital Cost
Capital Equipment to be purchased								
					0	0	0	0
					0	0	0	0
Shredder (HDPE/poly/PVC/FRP)		1	1	each	50,000	50,000	2,500	53,000
BFI 30 yard roll-off containers		2	1	each	7,800	16,000	800	17,000
RO Sump Pump	300-P-011, spare	0	1	each	1,915	0	0	0
RO Skid (Incl pretrmt, filtration and feed pump) 100 gpm	100-RO-001	2	1	each	248,841	498,000	24,900	523,000
	Estimated Restoration Equipment - Subtotal:							**593,000**

Restoration Equipment- Land Application option

Powertech Dewey Burdock ISL Project

Description	Equipment List Number	No./Size	Quantity	Units	Unit Cost	Purchase Cost	Shipping Cost	Estimated Capital Cost
Restoration System								
					0	0	0	0
					0	0	0	0
Shredder (HDPE/poly/PVC/FRP)		1	1	each	50,000	50,000	2,500	53,000
BFI 30 yard roll-off containers		2	1	each	7,800	16,000	800	17,000
RO Sump Pump	300-P-011, spare	0	1	each	1,915	0	0	0
RO Skid (Incl pretrmt, filtration and feed pump) 100 gpm	100-RO-001	0	1	each	248,841	0	0	0
	Estimated Restoration Equipment - Subtotal:							**70,000**

Restoration Treatment Chemicals
Dewey-Burdock Project

Chemical usage						
Restoration Assumptions:						
Chemicals		**usage rate**				
Hydrogen peroxide - 50% solution		0.36	lb/(lb U3O8)			
Sulfuric acid - 98%		1.00	lb/(lb U3O8)			
Sodium hydroxide - 50% solution		0.92	lb/(lb U3O8)			
Sodium chloride		4.60	lb/(lb U3O8)			
Sodium carbonate		0.92	lb/(lb U3O8)			
Barium chloride -dihydrate		20	mg/(L-RC)			
Flowrate:		500	gpm			
Uranium Concentration		5	ppm			
Uranium Concentration in IX tails		1	ppm			
Volume of Restoration composite extracted		77,550,000	gal			
U3O8 Production during Restoration Activities		2588	lb U3O8			
Project year	1	2	3	4	5	6
U3O8 production from restoration activities (lb U3O8)			2588	0	0	0
Cost of Chemicals						
Hydrogen peroxide - 50% solution			300			
Sulfuric acid - 98%			300			
Sodium hydroxide - 50% solution			300			
Sodium chloride			1100			
Sodium carbonate			300			
Barium chloride - dihydrate			8,700			
Subtotal			11,000	-	-	-

Byproduct Waste During Restoraton Operations		Quantity	units	Disposal Rate	Transp. Cost	Annual Disposa	Years of Rest. + Stability	Total cost
RO and IX waste	Assume costs included in CPP	0		$/CF	$/CF			
Well Field waste	Assume 1 drum/4 weeks = 2 CF/wk	104	CF/yr	5.56	5.19	1,117	1.30	1,452
PPE	Assume 1 drum/4 weeks = 2 CF/wk	104	CF/yr	5.56	5.19	1,117	1.30	1,452
Decon waste	Assume 1 drum/4 weeks = 2 CF/wk	104	CF/yr	5.56	5.19	1,117	1.30	1,452
		Subtotal Byproduct Disposal during Restoration Ops.						**4,356**

Byproduct waste during decommissioning	Quantity	units	Disposal Rate ($/unit)	Transp. Cost			Lump Sum transport +disposal $
				unit	no. units	$/unit	
Wellfield waste -- from Table 6	8,230.00	CF	5.56	CF		5.19	88,396
Pond liners							
DDW option Facility waste-- from Table 9	21,530	CF	5.56	CF		5.19	231,248
LA option Facility waste- from Table 9	22,530	CF	5.56	CF		5.19	241,989
Equipment and resin- from Table 9	21,951	CF	5.56	Semi load	9	4,200.00	159,750
	Summary of Byproduct Disposal costs during Decommissioning						
						DDW	LA
				Byproduct Disposal		479,394	490,135

Environmental Monitoring
Dewey-Burdock Project.

	Ennironmental Monitoring	Number	Quantity	Units	Rate ($)	Cost ($/yr)		
Met Station	met station for Site	1	12	visits/yr	200	2400		
Water Qual								
	20 metals, mercury, alk, Cl, SO4, NO3, Fl, EC, pH, and TDS (Test America) @ $350 (w/shipping)							
	spec, Th, U, and gross A/B (Test America) @ $550 (w/ shipping)							
	End-of-Mining sampling Sampling from set of 6 baseline wells in production zone for all analytes of TR Table 6.1-1. Assume analytical cost of $1000/sample. Sample prior to beginning of restoration activity.	1	6	wells/ sampling event	1000	6,000	$/sampling event	
	Restoration: Monitoring during restoration for optimization, efficiency and to identify spatial discrepancies. Sample composite restoration stream at completion of of each pore volume extracted at each site, analyze for Table 6.1-1 analytes.	2	6	wells/ sampling event	1000	12,000	$ total	
	Excursion monitoring: Sampling every 60 days of all monitor wells for excursion indicator parameters + water level. Analytes tested in CPP lab @ ~ $10/sample.	1	77	wells/ sampling event	10	770	$/sampling event	
	Stability: Same as End-of-Mining sampling at beginning, middle and end of one year stability period.	3	6	wells/ sampling event	1000	18,000	$/stability period	
Radon	CPP (10 dose buttons quarterly)	4	10	buttons/qtr	50	2,000	$/year	
	Satell/Well Field (5 dose buttons/quarter)	4	5	buttons/qtr	50	1,000	$/year	
	Restor/Decom (5 buttons quarterly)	4	5	buttons/qtr	50	1,000	$/year	
	Project Year		1	2	3	4	5	6
	Restoration/Stability		Construction	production	restoration + stability mon.		Decomm.	Decomm.
	End-of-Mining				6,000			
	Met station				2,400	720		
	Restoration				12,000			
	Stability				12,000	6,000		
	Excursion monitoring				4,620	1,500		
	Radon				2,600.0	2,000		
	Annual Subtotals				40,000	10,000	-	-

Wellfield Reclamation- Table 8
Dewey-Burdock Project

Well Decommissioning			Value	Units
Unit cost per well (assume ave depth of 650 feet)				
5" diameter casing =			0.131	CF/LF
Average well depth =			525	LF
Cubic ft per well =			69.0	CF
Cement grout cost =			9.00	$/CF
Cement plug cost/well			621.29	$/well
pull tube, pump; Cut & remove casing below grade (included in contract labor).				
contractor labor w/ equipment = 4 crew-hr/well @ $125/hr = $500.			500	$/well
Total abandonment cost/well (rounded) =			1,100	$/well
Cost of plugging wells	#wells(from Table 1) =	683	751,300	$LS
	Total Well plugging & abandonment Costs		**751,000**	**$LS**

Surface Structures		No./Size	Quantity	Units	Cost	Demo Cost	Waste vol (Cu. Ft) SubtitleD	Waste vol (Cu. Ft) 11e.(2)
Overhead Power								
Power poles: one every 200' (40'H, 5' in grnd); pull + cut in half, place pole and cross arms in roll-off	47+54K' OHE	505	505	each	297	150,000	27,888	
Power cables	Assumed zero net cost (removal cost = salvage value)					0		
Wells	**ft3 per well**	**# wells**	**Quantity**					
Casing/wellhead appurtenances/cover from prod/inj/mon. wells @ 64 cu. Ft./well	64	683	683				43,712	
Well pumps from PW+MW	1	272	272					272
Down-hole tubing wells (2" X 625' x 0.36"wall)	14	683	683					9,579
Total WF Surface structures							71,600	9,851

Well Field Reclamation
Dewey-Burdock Project

Header Houses Included with building demolition/disposal in Table 9

Pipelines to be chipped and disposed as byproduct material
Trunklines from CPP or SF to wellfields

	No.	pipes	ft.	lb/ft	Chipped vol (CF))
Burdock (CPP to WF)					
1 16" HDPE per site	1	2	4000	24.2	3600
2 10" HDPE per site	1	2	4000	10.93	1600
Dewey (SF to WF)					
1 16" HDPE per site	1	2	1000	24.2	900
2 10" HDPE per site	1	2	1000	10.93	400
Per HH (valve vaults to HH)					
1 6" HDPE per HH	11	2	120	4.15	200
2 2" HDPE per HH	11	2	120	0.534	30
Per Well (HH to well)					
1 2" HDPE per PW, IMW	202	1	210	0.534	400
2 2" HDPE per PMW	70	1	720	0.534	500
3 1.5" HDPE per Inj. Well	411	1	210	0.342	600
Total to Byproduct disposal--Table 6					8,230

	# pipes	ft of trench	$/(ft-pipe)	
Pipeline chipping @ $0.15/CF				1,234.50
Pipeline removal				
CPP-SF Trunklines	4	5,000	0.533	10,660
CPP-SF trunklines	4	19,800	0.533	42,214
Valve vaults to HH	3	1320	0.267	1,057
wellfield pipelines	4	35,498	0.133	18,885
Cost of Pipeline removal				72,816
Total Well field Decommissioning Costs				975,050

Demolition Cost Estimate- Table 9								
Powertech Dewey Burdock ISL Project								
Description	**cf, gals, dimensions**	**No./Size**	**Quantity**	**Units**	**Unit Cost**	**Estimated Demo Cost**	**Vol. (CF) to**	**Notes:**
Byproduct Materials								
Pond Demo and Send to 11e(2) Disposal Site								
Accumulated solids- Radium settling pond (@ 20 mg/L)							**10,430**	cu. Ft
Load 30 cy rolloffs at site w/ FE loader			386	cy	2	770		
Deep Well Disposal Option								
CPP Pond (liner and leak detection system)								
80 mil HDPE primary liner @ 26 ft^2/cu.ft		1	166,295	sq ft	0.05	8,300	**6,396**	
Radium Settling Ponds (liner and leak detection system)								
80 mil HDPE primary liner @ 26 ft^2/cu. ft.		2	123,437	sq ft	0.05	12,300	**4,748**	
	Subtotal Materials to Demo and Send to Rad Waste Disposal Site:					20,600	**11,100**	cu ft
Load 30 cy rolloffs at site w/ FE loader			411	cy	2	800		
			Subtotal pond disposal- DDW option			**22,170**	21530	cu ft
Land Application Disposal option								
CPP Pond (liner and leak detection system)								
80 mil HDPE primary liner @ 26 ft^2/cu.ft		1	151,166	sq ft	0.05	7,600	**5,814**	
Radium Settling Ponds (liner and leak detection system)								
80 mil HDPE primary liner @ 26 ft^2/cu. ft.		2	164,529	sq ft	0.05	16,500	**6,328**	
	Subtotal Materials to Demo and Send to Rad Waste Disposal Site:					24,100	**12,100**	cu ft
Load 30 cy rolloffs at site w/ FE loader			448	cy	2	900		
			Subtotal pond disposal- LA option			**25,770**	22530	cu ft
Equipment to be transported to byproduct disposal							**CF**	**Semi-loads**
Ion Exchange columns, incl resin: assume 12' dia x 15'H	1,700	12	12	LS	1,000	12,000	**20,400**	6
Vacuum Dryers and Appurtenances								
Dryers	1071	1	2	LS	10,000	20,000	**1,071**	2
Vacuum pump/condensor skids, hot oil boiler skids, cooling t	480	1	2	LS	2,000	4,000	**480**	1
		Subtotal removal/loading of (byproduct) equipment				36,000	21951	9

Site Demolition
Dewey-Burdock

Description	cf, gals, dimensions	No./Size	Quantity	Units	Unit Cost	Estimated Demo Cost	Vol. (CF) to	Notes:
Description	cf, gals, dimensions	No./Size	Quantity	Units	Unit Cost	Estimated Demo Cost	Vol. (CF) to	Notes:
Equipment/Materials for transport to re-use or recycling facility							**CF**	Semi-loads
Pad or pole-mounted transformers (one per Header Hse) - 10 per truckload		11	1	LS	500	600		
Haul transformers to Rapid City (100 mi one-way)		1	200	mile	3.50	800		
Wire in OHE lines - 47,000' of OHE at Dewey; 54,000' at Burdock - 4 wires			404,000	lf	0	0		
Valve vaults: cut off lid and dispose of lid	200	11	0.5	hrs	50	275		
Valve vaults: truck haul to recycler			200	mile	3.50	700		
Resin transfer truck and trailers (1 truck; 2 trailers)			1	LS	0	0		2
Chain-link fencing								
Around CPP site			2,240	lf	3.43	7,700		
Around Satellite site			1,440	lf	3.43	4,900		
Around CPP pond (380' sq)		440' per side	1,760	lf	3.43	6,000		
Around radium settling ponds; CPP			9,700	lf	3.43	33,300		
Around radium settling ponds; Satellite			8,200	lf	3.43	28,100		
Barbed wire fencing in wellfields - 3 strand			87,000	lf	1.75	152,300		
Support steel in Drying area	4,500	1	1	LS	5,000	5,000	**4,500**	2
Standby generator	512	1	1	each	500	500	**512**	0.5
Diesel fuel tank - above ground, assume 15,000 gal	2005	1	1	each	500	500	**2,005**	1
Gasoline fuel tank - above ground, assume 15,000 gal	2005	1	1	each	500	500	**2,005**	1
Fire suppression pump system	512	1	1	LS	500	500	**512**	0.5
Subtotal Demolition and Transportation/Disposal Equip/Mat'ls to be Sold or Recycled						**242,000**	**9,500**	**7**
					Equipment re-used/recycled	**242,000**		

Description	cf, gals, dimensions	No./Size	Quantity	Units	Unit Cost	Estimated Demo Cost	Vol. (CF) to	Notes:
Equipment disposal specific to Wastewater Disposal method.								
DDW option							CF	semi loads
Equipment at DDW		1	4	LS	1,000	4,000		1
Pond outlet structures, pumps (DDW option)		1	4	LS	**500**	2,000		1
CPP Pond (liner and leak detection system)								
60 mil HDPE secondary liner		1	122,660	sq ft	0.05	6,100	**3,505**	
Geonet		1	122,660	sq ft	0.05	6,100	**3,505**	
Radium Settling Ponds (liner and leak detection system)								
60 mil HDPE secondary liner		2	123,437	sq ft	0.05	12,300	**3,527**	
Geonet		2	123,437	sq ft	0.05	12,300	**3,527**	
							14062.686	2
Load 30 cy rolloffs at site w/ FE loader			521	cy	2	1,000		
Subtotal DDW option						43,800		

Site Demolition
Dewey-Burdock

Description	cf, gals, dimensions	No./Size	Quantity	Units	Unit Cost	Estimated Demo Cost	Vol. (CF) to	Notes:
LA option								
Land application center pivot machines	4,000	5	5	LS	1,000	5,000		5
Pond outlet structures, pumps (LA option)		1	5	LS	**500**	2,500		2
Storage ponds (liner and leak detection system)								
40 mil single liner 8 ponds @ 35 ft^2/CF		8	301,385	sq. ft	0.05	120,600	**8,611**	
CPP Pond (liner and leak detection system)								
60 mil HDPE secondary liner		1	151,166	sq ft	0.05	7,600	**4,319**	
Geonet		1	151,166	sq ft	0.05	7,600	**4,319**	
Radium Settling Ponds (liner and leak detection system)								
60 mil HDPE secondary liner		2	164,529	sq ft	0.05	16,500	**4,701**	
Geonet		2	164,529	sq ft	0.05	16,500	**4,701**	
							26,651	7
Load 30 cy rolloffs at site w/ FE loader			987	cy	2	2,000		
Subtotal LA option						178,300		

Description	cf, gals, dimensions	No./Size	Quantity	Units	Unit Cost	Estimated Demo Cost	Vol. (CF) to	Notes:
Equipment/Materials to Demo and Dispose at Construction and Demolition Landfill								
Process Pumps in buildings	16	60	60	LS	200	12,000	**960**	1
Shaker screens: 10'x7'x5'H	400	2	2	LS	2,000	4,000	**800**	1
Elution columns: 7' dia x 15'H	600	4	4	LS	1,000	4,000	**2,400**	2
13 ft diameter tanks x 16'H	2,100	22	22	LS	500	11,000	**46,200**	11
11 ft diameter tanks x 16'H	1,500	2	2	LS	1,000	2,000	**3,000**	1
10 ft diameter tanks x 16'H	1,300	1	1	LS	1,000	1,000	**1,300**	1
RO units	400	4	4	LS	1,000	4,000	**1,600**	1
Thickeners	10,600	2	2	LS	10,000	20,000	**21,200**	5
Screw conveyors	100	2	2	LS	1,000	2,000	**200**	6
Filter Presses	2000	2	2	LS	5,000	10,000	**4,000**	1
Chemical storage tanks outside CPP - assume 20,000 gal	2674	3	3	LS	500	1,500	**8,021**	3
Drum conveying system	2,900	1	1	LS	1,000	1,000	**2,900**	0.5
Drum washer and drying system	1,200	1	1	LS	1,000	1,000	**1,200**	0.5
Paint booth	400	1	1	LS	500	500	**400**	0
Building Structures								
Office bldg	60x90x20+roof		148,500	cu ft	0.15	22,300	**18,600**	
Maintenance/Warehouse	140x120x20		462,000	cu ft	0.15	69,300	**33,800**	
Fire suppression tank	240,000 gal		30,968	cu ft	0.15	4,600		
Building Structure								
CPP, includes loading dock area	392'x130'x20'+roof		1,486,840	cu ft	0.15	223,000	**77,560**	
Lab/control rm/break rm/showers/restrooms w/in CPP	30x90x20'		54,000	cu ft	0.15	8,100	**10,200**	
Rad container bldg	30x24x15		10,800	cu ft	0.15	1,600	**2,340**	
Header houses - assume equip/piping inside demo'd w/ bldg	10x40x8	11	3,200	cu ft	0.15	5,280	**8,800**	
Satellite bldg, incl interior wall	124x156x20		396,552	cu ft	0.15	59,500	**39,448**	
Lab/control rm/break rm/showers/restrooms w/in Satellite	45x45x20		40,500	cu ft	0.15	6,100	**4,950**	

Site Demolition
Dewey-Burdock

Description	cf, gals, dimensions	No./Size	Quantity	Units	Unit Cost	Estimated Demo Cost	Vol. (CF) to	Notes:
				Subtotal Bldgs Demo:		399,780	342,600	34
Transportation/Disposal								
Loading 30 cy rolloffs at site w/ FE loader			12,689	cy	2	25,400		
Loading process equipment			34	semi load	1,000	34,000		
Transportation to Regional landfill at Edgemont, SD @ 16 miles	$3.50/mi x 16 mi + $1.98/mi x 1		423	semi-load	88	37,100		
Transportation to RE-use/Recycling sit @ Rapid City, SD @ 87 m	$3.50/mi x 87 mi + $1.98/mi x 8		7	semi load	477	3,300		
Disposal fee at Custer -Fall River landfill, Edgemont, SD			12,689	cy	10	126,900		
	Subtotal Transportation/Disposal - Subtitle D Material:					**226,700**		
			Transportation/Disposal in Landfill			**626,000**		
Description	**cf, gals, dimensions**	**No./Size**	**Quantity**	**Units**	**Unit Cost**	**Estimated Demo Cost**		
Other Misc Demo Activities								
Rinse piping and treat rinsewater - assume 3 piping volumes	2,263,486 gal/pipe vol		6,790	1,000 gal	3	20,400		
Valve vaults at mining units - leave in place fill with soil		11	11	cu yd	20	2,500		
Septic tank - CPP: 15,000 gal (fill with soil and leave in place)	15,000 gal	1	2,005	cu yd	10	20,100		
Septic tank - Satellite: 10,000 gal (fill with soil and leave in place)	10,000 gal	1	1,337	cu yd	10	13,400		
Backfill excavation and compact Surge Pond (Dewey)			59,259	cu yd	1	59,300		
Backfill excavation and compact Radium settling ponds volume (Dewey)			185,185	cu yd	1	185,200		
Abandon Deep Injection Wells			0	wells	100,000	0		
Reseed wellfield areas (fertilize, seeding, mulching)			67	acre	1,500	100,700		
Reseed CPP site			11	acre	1,500	16,600		
Reseed CPP radium settling ponds			48	acre	1,500	71,300		
Reseed Satellite Plant area			35	acre	1,500	52,300		
Reseed access road to CPP			11	acre	1,500	16,500		
Reseed access road to Satellite			8	acre	1,500	12,000		
			Subtotal Other Misc Demo Activities:			**570,300**		
LA Option only								
Backfill excavation and compact storage ponds 1020' sq.	8 x 63.8 ac ft		103000	cu yd	1	103,000		
Reseed storage pond area			24	acre	1,500	35,800		
			Subtotal addl other Misc for LA option			**138,800**		
Summary of Facility Decommissioning Costs			DDW		LA			
A Reclyclable/salvageable equipment			242,000		242,000			
B Non-salvageable bldg, & equipment disposal			670,280		1,046,780			
C Byproduct materials processing/loading			58,170		61,770			
D Restore contaminated areas			570,300		709,100			

Dewey-Burdock Project
Decontamination Survey and Long term Surveillance

			Disposal Option	
Gamma Survey Area (acre)			DDW	LA
Disturbe(Area (acre)				
Wellfields				
Burdock WF1			17.6	17.6
Dewey WF1			39.3	39.3
Site areas: CPP, SF, pipelines between CPP-SF, site access roads			23.8	23.8
Major pipelines (est. 30% of 24.79 ac total)			7.4	7.4
WF access roads (est. 30% of 140 acres total)			6.2	6.2
Deep wells				0
Irrigation area				1052
Impoundments, topsoils			33	136
Total survey area (acre)			**127**	**1282**
Gamma Survey Costs				
Mob/Demob			4000	4000
100 M transects ($/acre)			10	12
Survey cost			1270	15384
Survey Report			5000	5000
Survey Total $			10300	24400
Long Term Monitoring				
Long Term Surveillance- pd to NRC				
($250,000-1978 dollars, adj to 2009 $)	CF=	0.304	822,639	822,639
Total Survey and Environmental monitoring			832,939	847,039

Labor- Table 11				Project Year					
				1	2	3	4	5	6
			Activity	Constrctn	Prodctn	Restoration+ stability		Recl. + Decomm.	
	Administration								
		Radiation Safety Officer				1	1	1	1
	Restoration								
		Superintendent				1	1	1	
		Restoration Engineer				1	1	0	0
		Restoration Operator				2	0	0	0
		Lab Technicians				1	1	0	0
Unit Labor Costs including 35% overhead									
	Administration								
		Radiation Safety Officer	135,000			135000	135000	135000	135000
	Restoration								
		Superintendent	135,000			135000	135000	135000	0
		Restoration Engineer	81,000			81000	81000	0	0
		Restoration Operator	68,000			136000	0	0	0
		Lab Technicians	47,000			47000	47000	0	0
		Project Year		1	2	3	4	5	6
		Restoration and Reclamation Labor Cost				534000	398000	270000	135000

Management and Miscellaneous Costs- Table 12 Dewey-Burdock Project						
		Project year				
		3	4	5	6	Total
Mob/Demob		12,500			12,500	25,000
Total Management						
Site Manager @ $150000 + 35%		202,500	202,500	202,500	202,500	810,000
Contractor Profit						
Percent of labor	10%	53,400	39,800	27,000	13,500	133,700
Subtotals Mgmt & Misc. - $		268,400	242,300	229,500	228,500	968,700
						968,700

Pond Liner details
Dewey-Burdock Project

DB Pond Parameters-- Table 13											
			# ponds	DDW				LA			
		PONDS		capacity	liner/pnd	Primary	Secondary	capacity	Liner	Primary	Secondary
				ac-ft	ft2*	mil	mil	ac-ft	ft2*	mil	mil
		CPP	1	15.8	122,660	80	60	36.2	151,166	80	60
		Radium Settling	2	15.9	123,437	80	60	39.4	164,529	80	60
		Outlet	2	5.1	53,068	40		4.9	23,147	40	
		Surge	2	8.4	87,405	40					
		Storage Pond	8					63.8	301,385	40	
		Spare	2	15.9	123,437	80	60	63.8	266,420	80	60
Totals		Liner ft2 (KP)-Dewey			264,718	80			433,190	80	
		Liner ft2 (KP)-Dewey			264,718	60			433,190	60	
		Liner ft2 (KP)-Dewey			140,473	40			1,228,687	40	
		Liner ft2 (KP)-Burdock			351,689	80			579,875	80	
		Liner ft2 (KP)-Burdock			351,689	60			579,875	60	
		Liner ft2 (KP)-Burdock			140,473	40			1,228,687	40	
		Total 80 mil (KP)			616,407	80			1,013,065	80	
		Total 60 mil (KP)			616,407	60			1,013,065	60	
		Total 40 mil (KP)			280,946	40			2,457,374	40	
Check totals					616,408	80			1,013,064	80	
					616,408	60			1,013,064	60	
					280,946	40			2,457,374	40	

* Liner area of individual ponds estimated as proportional to pond capacity

Removal of Wellfield Pipe- Table 14
Dewey-Burdock Project

Assumptions\

1 Backhoe trench to uncover pipe @ 1500 ft/day
2 Extract pipeline and backfill @ 1500 ft/day
3 Backhoe rental $2688/mo., plus fuel, maint., mob. @ $1200/wk) = 1840/wk
4 Backhoe operator @ $20/hr
5 Pipeline extraction with 2 workers @ $17/h in addition to backhoe operator
6 Operating schedule: 8 hr/day, 5 days/week

Main Pipeline removal

Equipment

$ / week	1840	x	1 week / 5 days	x	1 day / 1500 ft	=$	0.245333

Labor

Backhoe Operator

$ / man-hr	20	x	8 man-hr / 1 day	x	1 d / 1500 ft	=$	0.11

Pipeline extraction

$ / man-hr	17	x	16 man-hr / 1 day	x	1 d / 1500 ft	=$	0.18

Pipelines extraction cost per foot	**=$**	**0.533**

Environmental Effects 7.0

The applicant has not provided sufficient information regarding the manner in which it will monitor for, remediate, and prevent accidents. Please provide the following information:

TR RAI-7-1
Consistent with Regulatory Guide 3.46 and NUREG-1569, Acceptance Criteria 7.5.3(1) and 7.5.3(2), please address preventive measures, consequences from, and actions and equipment used to stop, a major pipe or tank rupture in the facility. In the discussion, please provide the manner in which major piping/tank ruptures will be stopped and also the capacity of the sumps/bermed areas.

Response: TR RAI-7-1

Major pipe or tank ruptures in the CPP or Satellite facility

a. Preventative measures: Facilities will be designed and operated according to 40 CFR part 68. In addition, the applicant will comply with 40 CFR Part 355 in disclosing the reportable quantities of sulfuric acid and sodium hydroxide, the only chemicals used in the PAA that are expected to be present in quantities greater than the minimum reportable amounts.

b. Consequences: The rupture of a major pipe or tank within either the CPP or Satellite facility would result in the release of process liquids onto the floor of the facility. The spilled material would flow to the trench drains and sumps, from which it could be pumped to the wastewater tanks and ultimately to disposal. Alternatively, the spilled materials could be transferred to the central plant pond for possible reprocessing prior to eventual disposal.

c. Actions used to Stop: Personnel will be trained in the hazards associated with process chemicals and solutions present at each facility, and the proper procedure to follow in the clean-up of a spill of the materials within the plant facilities. In particular, for tank ruptures, operators will be trained to close valves on any pipelines connected to the ruptured tank. In the case of a pipe rupture, personnel will be trained to shut down pumps and close valves in order to isolate the section of pipe containing the rupture from other parts of the process.

Capacities of sumps and bermed areas

The central plant and satellite facilities are designed with trench drains, sumps and a concrete curb at the perimeter of the floor designed to contain the contents of the largest vessel in the facility. For the central plant, the largest vessel is the yellowcake thickener, which has an operating volume of 5,050 ft^3. For the satellite facility, the largest vessel is the Utility water tank with a volume of 16,000 gallons. For both facilities, a containment curb along the perimeter wall of each building slab with internal trench drains and sumps are planned sufficient to contain a spill of 150% of the largest tank volume in each facility. Sumps and sump pumps will be operable for the removal of spilled materials to waste holding tanks or the central plant pond and ultimately to the wastewater disposal system.

TR RAI-7-2

Consistent with Regulatory Guide 3.46 and NUREG-1569, Acceptance Criterion 7.5.3(2), please address any site specific preventive and mitigating measures for potential chemical accidents.

Response: TR RAI-7-2

Freezing temperatures

Preventative and mitigating measures: Because outdoor winter temperatures at the PAA will be below freezing, all tanks and pipelines that will contain fluids that are subject to freezing and are located outside the facilities will be heat traced to maintain the contents above the freezing point of the material. In particular, the sulfuric acid and sodium hydroxide (caustic) pipelines and tanks will fall into this category. Freezing of the sulfuric acid or caustic pipelines would prevent flow in those lines, but would not likely lead to a pipe or tank rupture. Freezing of injection or production composite pipelines could lead to ruptures due to the expansion of dilute water solutions upon freezing. Pipelines between the facilities and the well fields, as well as pipelines within well fields, will be buried to a depth below the frost line in order to prevent freezing of the aqueous solutions within those lines. Header houses, valve vaults, and wellhead covers will contain electric heaters in order to prevent freezing temperatures from occurring in these structures.

Windstorm, winter storm

All facilities, including buildings, storage tanks, and well head covers will be designed and constructed to withstand the highest wind velocities that are reasonably expected to occur in the within the PAA. During winter months, winter storms with high winds and snowfall may cause blizzard conditions, but these events do not present a higher potential for chemical accidents.

Personnel will be trained in the hazards associated with process chemicals and solutions present at each facility, and the proper procedure to follow in the clean-up of a spill of the materials within the plant facilities. In particular, for tank ruptures, operators will be trained to close valves on any pipelines connected to the ruptured tank. In the case of a pipe rupture, personnel will be trained to shut down pumps and close valves in order to isolate the section of pipe containing the rupture from other parts of the process.

TR RAI-7-3

Consistent with Regulatory Guide 3.46 and NUREG-1569, Acceptance Criteria 7.5.3(1), 7.5.3(2) and 7.5.3(3), please provide a discussion on accident consequences, including preventive and mitigating measures for fires and explosions at the Dewey-Burdock facility. In the discussion, include the potential for wildfires.

Response: TR RAI-7-3

Accident Consequences - Explosions

An explosion, although unlikely, could result from: a prematurely sealed drum of yellowcake, in a dryer, from the use of propane in the thermal fluid heater or space heaters, or from the mixing of oxygen gas with combustible materials. Of these, an explosion from the drum of yellowcake has the greater potential to impact radiological safety of the workers. An explosion in a sealed drum would be contained within the dryer room. According to the NRC, multiple hearth dryers posed a greater hazard than vacuum dryers. Multiple hearth dryers operate at higher temperatures and may be directly fed with gas. The vacuum dryers proposed in this application operate at lower temperatures and are not directly fed by gas therefore posing less of a hazard for explosion. In the unlikely event of an unmitigated explosion accident of a yellowcake dryer, doses to the workers could have a MODERATE impact depending on the type of accident, but exposure to the general public would result in a dose below the 10 CFR Part 20 public dose limit (NRC, 2009, § 4.2-56).

Preventative and Mitigation Measures

As noted in TR Section 3.2.8, design criteria for chemical storage and feeding systems, includes applicable sections of the international building code, international fire code, OSHA regulations, RCRA regulations, and Homeland Security. Propane fired heating devices will be installed to meet applicable NFPA/FM safety standards. Additional measures for preventing fires and explosions within process facilities include:

- As noted in TR 3.2.8.6, the oxygen tanks will be located a safe distance from the CPP and other storage tanks, and will be designed to meet industry standards of NFPA-50.
- Header houses will be ventilated continuously in order to prevent any buildup of oxygen.
- The oxygen lines to each header house will be equipped with low pressure shut-off valves to minimize the delivery of oxygen to a fire.
- Procedures will be in place for confined space work or hot work for monitoring of oxygen build-up prior to start of work.
- Fire extinguishers will be placed at accessible locations in all buildings and vehicles for quick response and training will be provided for appropriate personnel in use of fire extinguishers.

- Personnel will receive training for responding to a fire or explosion.

- The CPP facilities are designed to contain and reduce the exposures to individuals in the event of an accident. Emergency response procedures would be implemented and employees would be directed as to what actions to perform in the event of an accident. For instance, respiratory protection program in place and executed as necessary as part of worker protection during assessment and cleanup phases. In addition to the above mentioned protections other safeguards and mitigatory protocols are always in place during operation of a CPP facility. For example, bioassay program for worker safety and contamination control programs involving personnel survey, clothing survey and equipment survey before release to unrestricted areas are common practices workers are subject to on a regular basis. These types of protocols are also utilized to assess if an accidental exposure took place during the course of an unintentional incident.

Preventative and mitigating measures-Wildfire

In order to protect facilities from wildfires, all facility buildings will be located within an area that is maintained in a vegetation-free state by the use of a crushed aggregate or asphalt surface and by appropriate weed-control measures if necessary. The creation of this buffer zone is expected to prevent any significant damage to equipment that could cause a chemical accident by acting as a firebreak if needed.

Within the well fields, vegetation will be removed, mowed or sprayed around each header house and around each well head cover to reduce the amount of combustible material adjacent to these structures. In the event of an approaching wildfire, operators will be trained to shut down well field operations and, if necessary, to evacuate facilities until the danger to personnel has passed. Damage, if any, will be assessed and remediated prior to re-starting operations.

The emergency response plan will include descriptions of the following provisions of 29 CFR Part 1910:

- Notification and evacuation procedures
- Personal protective equipment
- General fire fighting safety rules
- Reporting procedures
- Electrical and gas emergencies

TR RAI-7-4

Based on NUREG/CR-6733, the applicant concluded that the most significant risk from natural events at the proposed Dewey-Burdock facility is a tornado that dispersed yellowcake. However, the applicant did not address emergency procedures including notification of personnel of potential severe weather, evacuation procedures, damage inspection and reporting, and cleanup and mitigation of spills. Please address these issues.

Response: TR RAI-7-4

The NRC determined that in the event of a tornado strike, chemical storage tanks could fail resulting in the release of chemicals. NUREG-0706 analyzed the risk from a tornado strike, which determined that ISL facilities were not designed to withstand tornado strength winds and assumed that an inventory of 45,000 kg of yellowcake was present on-site and that 15 percent (11,400 kg) or 26, 55-gallon drums of the yellowcake was dispersed by the tornado. The model assumes that all the yellowcake was in a respirable form and was carried by the tornado to the project's site boundary. According to the model, the maximum 50-yr. dose to an individual's lung would be 8.3×10^{-7} rem and located approximately 2.5 miles from the mill. NUREG-6733/CR concluded that the risk of a tornado strike on an ISL facility was very low and that no design or operational changes were necessary to mitigate the potential risks, but that it was important to locate chemical storage tanks far enough from each other to prevent contact of reactive chemicals in the event of an accident. Considering the relative remoteness of the proposed Dewey-Burdock Project, the potential risks from a tornado strike would be considerably less than if the facilities were in a more populated area.

Nevertheless, there are risks to workers that must be addressed. The applicant will prepare and have available onsite for NRC inspectors an Emergency Response Plan that will contain emergency procedures to be followed in the event of severe weather or other emergencies. Included in the plan will be procedures for notification of personnel, evacuation procedures, damage inspection and reporting. It will also address cleanup and mitigation of spills that may result from severe weather. In advance of preparing the Emergency Response Plan, the applicant offers the following discussion on these issues.

Initially, the applicant will provide adequate training to its employees and visitors regarding communication systems used at the facilities. In the event of a report of a tornado sighting in the vicinity of the facility, the RSO, RST and/or Safety Engineer will ensure that the proper alarm (preset signal) has been sounded at both the Burdock and Dewey facilities. Additionally, all supervisors will be personally contacted via phone or radio and advised of the emergency. The supervisors and radiation safety staff will direct the employees' evacuation to either the Edgemont or Hot Springs office, whichever is appropriate. If there is not enough time to evacuate, employees and others onsite would be directed to the conference room of the office building. Once it is safe to access the facilities, supervisory staff and radiation safety staff will begin the process of assessing damage to the facilities, including header houses and wellheads. This process would include radiological surveys and assessment of non-radiological hazards as well. NRC, DENR, BLM and other regulatory agencies as appropriate would be notified and advised of the damage, if any was observed. After consultation with the regulatory agencies the cleanup and mitigation efforts would commence.