

DEWEY SD

Prepared by Powertech (USA) Inc. 5575 DTC Parkway, Suite #140 Greenwood Village, CO 80111 Phone: 303-790-7528 Facsimile: 303-790-3885



TR RAI-2.7-5

NRC Staff notes that the location of several of the potentiometric contour lines in Figures 2.7-14 and 2.7-15 of the TR conflicts with water level data posted at several of the well points. Please explain the cause of this error.

Response: TR RAI-2.7-5

See TR_RAI-Response and Replacement Pages; Section 2.7-5, in TR Section 2.7.2.2.8 text and Figure 2.7-14 and 2.7-15.

TR RAI-2.7-6

Please provide a complete description of the method used to determine potentiometric head for the artesian wells.

Response: TR RAI-2.7-6

See TR_RAI-Response and Replacement Pages; Section 2.7-6 in TR Section 2.7.2.2.8

TR RAI-2.7-7

Staff requests structure maps of the base of the Chilson aquifer for Burdock Wellfield I and the base of the Fall River aquifer for Dewey Wellfield I. Also, please modify Exhibits 2.1-3 and 2.1-4 to show all interbedded sandstones and shales within the Chilson and Fall River aquifers as well as the perimeter, overlying, and underlying monitoring wells and their screened intervals. Noting that Section 3.2 of the TR Supplement states, "location of any flow problems caused by clay stringers," please further discuss the effects of channel deposits and interbedded shales on the containment of production fluids and the adequacy of groundwater monitoring layout.

Response: TR RAI-2.7-7

A Structure Contour Map to the top of the Morrison for Burdock Wellfield I was developed for the ER RAI (RAI_ER Exhibit WR-6.3). This map is the equivalent to the requested structure contour map of the base of the Chilson aquifer. It shows an indication of some east-west scouring into the Morrison within the eastern portion of the proposed wellfield. A separate structure contour map to the top of the Fuson Member for Dewey Wellfield I (**TR RAI Exhibit 2.7-2**) has been developed in response to this RAI. On this Fuson structure contour map, there appears to be no indication of scouring associated with Fall River sand channels. However, the axis of this Fall River channel system is located to the east is an area of relatively sparse drilling.

Cross sections across each of the proposed Future Mine Units were prepared in response to TR RAI P&R-1. As opposed to modifying the small-scale **Supplemental Exhibits 2.1-3 and 2.1-4** to show interbedded clays, along with perimeter, overlying and underlying monitor wells on, NRC staff is referred to these larger-scale cross sections in order to see this same information.



These cross sections illustrate that interbedded clay beds isolate upper channel sand bodies from lower channel sands within the same formation. Multiple mineralized units may occur within a single channel sand and all such orebodies can be monitored by a perimeter monitoring well within that channel sand. Underlying and overlying monitor wells will be placed into underlying and overlying channel sand accumulations.

The text in Section 3.2 of the TR Supplement referred to delineation drilling being used to identify the location of any flow problems caused by clay stringers. This is a reference to potential smaller scale lenticular, interbedded clay zones within the mineralized sands. Detailed delineation drilling will be conducted to map smaller changes in the depositional environment which may have a potential to change flow on a smaller scale. Design of the pattern areas for each well field, as well as the associated monitoring system, will be done to account for any of these potential flow features to ensure such lixiviant can be contained within the production zone and adequately monitored. Well field pump tests will also be conducted in order to ensure proper communication between mining zones and perimeter monitor well rings. All of this mapping, design, and testing information will be provided for review by NRC in the well field hydrogeologic packages for each well field prior to operation.

Channel deposit systems are not unique to the Dewey-Burdock Project and have been successfully operated in other ISR projects in Wyoming, Texas, and Nebraska.

<u>TR RAI-2.7-8</u>

Staff requests potentiometric maps of the Fall River, Lakota, and Unkpapa water bearing units that include all wells that are reasonably accessible for water level measurements.

Response: TR RAI-2.7-8

See TR_RAI-Response and Replacement Pages; Section 2.7-8; Updated information and Replacement text in TR_Section 2.7.2.2.8 Below the Potentiometric Surface Figures for Fall River and Lakota.

TR RAI-2.7-9

Please provide additional information regarding the potential for whether groundwater is discharging to alluvial aquifers as referenced in this request.

Response: TR RAI-2.7-9

See TR_RAI-Response and Replacement Pages; Section 2.7-9 for information concerning groundwater/Surface water Interactions for TR Section 2.7.2.2.10.



TR RAI-2.7-10

Please provide a discussion to clarify whether wetlands, surface impoundments, and open mine pits at or downgradient of all proposed production are potentially spring fed with production zone groundwater.

Response: TR RAI-2.7-10

See TR_RAI-Response and Replacement Pages; Section 2.7-9 for information concerning groundwater/Surface water Interactions for TR Section 2.7.2.2.10.

TR RAI-2.7-11

NRC staff notes that the applicant may have intended to say "water well" instead of "water." This discrepancy should be corrected or clarified. Please also identify wells to be removed.

Response: TR RAI-2.7-11

This language is correct. If a landowner is utilizing ground water within a mining zone, the well will be removed from the owner's use. This response also addresses (in part) TR RAI 2.7-13 (a), (b), (c) and (d). Applies to Supplemental Section 5.1 and TR Section 6.1.8.

It is premature until well field packages are developed to specifically identify the well(s) that may need replacement or removal. This language (extracted from a lease agreement) is placed within the application to demonstrate to the NRC that Powertech (USA) has binding agreements in place with landowners to secure other water for landowners so that owner's water quality and availability is not diminished and that domestic water wells will not interfere with well field control. Before any well is replaced, Powertech (USA) will inform the well owner.

TR RAI-2.7-12

Please state those measures to be used to detect and inform potential human receptors of a water quality impact.

Response: TR RAI-2.7-12

SR Section 5.1 Location of Existing Wells

During well field design and development, all existing wells that could potentially be affected by well field operations or could potentially interfere with well field operations will be evaluated. Pumping test results, sampling program data, vertical and geographic locations will all be considered before final design of a well field package, which will be presented to the NRC for review prior to mining. If water wells are determined to exist within an ore zone or if the potential exists for operations to diminish quantity or quality of the well water in such a manner that the designated use is prohibitive, Powertech (USA) may utilize the well within the well field design and operation while restricting the owner's use and replace the existing well; well owner will be notified in writing. For additional information refer to Supplemental Section 5.1.1 and TR Section 6.1.8.

December 2010



TR RAI-2.7-13a

Non-verified wells in Appendix 2.2-A of the TR are described as wells that were not located at the site and mayor may not still exist. If any of these wells or other wells are discovered prior to the closure of the project site, please describe those procedures to be used to protect public health.

Response to: TR RAI-2.7-13a

TR Section 2.2.3.2.3 Study Area Groundwater Use .

Non-verified wells are described in Appendix 2.2-A. The non-verified wells are wells that were not able to be located upon field investigations. Many years have passed since the plugging of the historical wells for this reason many wells listed in the data base are no longer in existence on the property. Powertech (USA) (USA), continues building and maintaining a complete well data base, in doing so, the applicant thought it important to include both historical and existing wells. If any wells are discovered within the Proposed Action Area and are found to pose a threat to human health or the environment prior to site closure, Powertech (USA) will plug and abandon the wells based on procedures described in section 6.1.8 of this document.

Although much of the information in Section 6.1.8 of the TR is descriptive of wells owned and operated by Powertech (USA) (USA), plugging and abandonment procedures are applicable to any well determined to need replacement. Well replacement determination is based upon whether or not the well: i) poses a risk for aquifer contamination (determined via water quality analysis results and well field delineation pump test(s)), ii) poses a safety risk for humans and/or animals (determined by physical condition), iii) potentially could interfere with control of a well field (determined via well field delineation pump test(s)), and iv) if the integrity of the well is compromised and will not pass testing requirements (determined by MIT). If wells are located that require plugging and abandonment the steps described in Section 6.1.8 will be utilized to protect public health and the environment.

TR RAI-2.7-13b

Please describe the applicant's plans to address these wells if they are located in a wellfield, completed in the ore zone, and to protect public health.

Response: TR RAI-2.7-13b

See TR_RAI-Response 2.7-12 and 13a above.

TR RAI 2.7-13c

Appendix 2.2- A of the TR indicates that TVA wells 605, 609, 637, and 668 appear to be within proposed well field areas. NRC staff notes that the condition of these monitoring wells is unknown.

Response: TR RAI-2.7-13c

See TR_RAI-Response-2.7-13a above. Supplemental Section 5.1 concerning Powertech (USA)'s rights by landowner agreement to replace wells. Information known about the condition of these wells obtained post submittal is listed below.



605:

• Have not located at present. This well is PZ-3 from the Burdock TVA pump test and is likely screened throughout the Inyan Kara.

609:

- This well is currently monitored and is screened from 903-966 feet.
- Screened within the Lakota. Water levels are consistent with other Lakota wells in the area.

637:

• Have not located at present. This well is BPZ-5 from the Burdock TVA pump test.

668:

• This is the Burdock TVA test well. It is screened from 280-555 feet, and is screened throughout the entire Inyan Kara.

TR RAI-2.7-13 (d)

Figure 8 in Appendix 2.2- A of the TR appears to show that domestic well 16 is within or immediately adjacent to a proposed wellfield area. Staff is uncertain if production at this wellfield is proposed in the Lakota water bearing zone that the domestic well taps.

Response: TR RAI-2.7-13 (d)

Powertech (USA) (USA) has drilled a replacement well and will take Well 16 out of service upon well field design and delineation. See TR_RAI-Response; Section TR_RAI-2.7-12 and 13a above.

TR RAI-2.7-13 (e)

Appendix 2.2- A of the TR indicated that Lakota domestic wells 13 and 42 are within the license boundary and Inyan Kara domestic wells 2,7,8,18,20,96, 115, and 135, 4002 are outside of the license boundary in the vicinity of the site.

Response: TR RAI-2.7-13 (e)

Well 13 (section 1) and 42 (section 5) are within the PAA yet, outside the proposed aquifer exemption boundary (AEB); well 2 is located southwest of the PAA boundary and just south of the SD School property in section 16; well 7 (section 23) located south of the PAA boundary; well 8 is not within the AOR for the proposed affected area; well 18 (section 9) located west of the proposed PAA boundary just north of the SD School property. Well 20 is not within the AOR for the PAA; well 96 is not located within the AOR for the proposed affected area (SWSW section 22). Well 115 (section 18) within the AOR and outside the PAA. Well 135 (section 1) within township 8; this location is approximately 8 miles southwest of the PAA boundary. Well 4002 (section 30) located within the PAA yet, outside the proposed AEB. **See TR_RAI – Figure 2.7-13(e).**



TR RAI-2.7-13 (f)

Appendix 2.2- A of the TR indicated that stock wells 17,49,38, and 61 tap either the Fall River or Lakota water-bearing zones. These stock wells appear to be located at, or immediately adjacent to, possible production zones.

Response: TR RAI-2.7-13 (f)

See TR_RAI-Response; Section TR_RAI 2.7-12 and 13a above.

<u>TR RAI-2.7-13 (q)</u>

Appendix 2.2- A of the TR indicated that Lakota stock wells 12, 51, 510, 619, 620, and 650 are located within the license boundary.

Response: TR RAI-2.7-13 (g)

See TR_RAI-Response; Section TR_RAI-2.7-12 and 13a above.

TR RAI-2.7-14

Please determine and provide the "Type Use" of Lakota wells 51 and 14, which are located within the license boundary. Once their use is determined, provide additional discussion, as needed, of the water quality risk to the well(s) from the project and any measures that will assure environmental and humans receptors of water from a well are not subjected to any potential diminished water quality from project operations.

Response: TR RAI-2.7-14

Type Use for Lakota well 14 is unused stock; water quality risks will be assessed further via performing pump test for Burdock Well Field I, however, the designated use is stock and is unused, therefore there is no anticipated risk to humans or the environment from the water quality. If a potential environmental risk or an interference with well field operation is determined via the pump test the well would require plugging and abandonment. This well is located approximately ¾ of a mile NW of the proposed Burdock Well Field I, beyond the location of the monitoring well ring, therefore no environmental or human risks are anticipated from mining operations.

Type Use for Lakota well 51 is designated as a stock well currently in use. This well is located outside the PAA in section 9 and is approximately 1 mile east from the proposed Burdock Well Field I. Unless testing indicates a potential for environmental risk or an interference with well field operations, no measures will be taken to plug the well. If a potential for an environmental or human risk is indicated during testing the measures discussed in **Response to:**/**TR_RAI-2.7-13a** for plugging and abandonment would apply as discussed above.

TR RAI-2.7-15

Please provide a table listing the data on a parameter-by-parameter, well-by-well or surface-water location by surface-water-location basis using appropriate statistical methods. Include results of all field-measured parameters including elevations and/or depth to water. For sampling locations that were dry or ice, please note that information in the appropriate column rather than omitting the data



altogether from the table. For concentrations below the minimum detection level, please report the data as "less than" and the PQL.

Response: TR-RAI-2.7-15

See TR_RAI Response; Section RI-5 for TR_RAI Attachment RI-5 a Letter received from Energy Laboratory on 22 October 2010 concerning Powertech (USA)'s data consistency inquiry and Table 2.7-15 Parameter by Parameter for Well data.

TR-RAI-2.7-16

Please provide the rationale or justification for only one location to establish the pre-operational groundwater quality of the Sundance/Unkpapa water bearing zone.

Response: TR-RAI-2.7-16

The Morrison formation overlays the minor Sundance aquifer and is designated as the lower confining unit for the project (TR_Section 2.6.2.2). The Morrison has an average thickness of 100' below the project area and permeabilities range from 3.9×10^{-9} cm/sec to 4.2×10^{-8} cm/sec. Furthermore it is uncommon for the Sundance to serve as a water source in this area due to the depth and low flows encountered (See TR_Section 2.7.2.1.6).

During the development and into the 2007-2008 baseline sampling program there was only one Sundance well (#635) within the AOR. Well into the baseline sampling effort other Sundance wells were drilled by Powertech (USA) for pump test purposes; these additional Sundance wells were completed just 1-3 months prior to the end of baseline sampling.

The Sundance/Unkpapa is considered a minor underlying aquifer. For more information regarding the testing efforts (past, present, and future) for this aquifer refer to TR_Section 2.7.2.2.8. Powertech (USA) is cautious when determining quantity and location of holes that penetrate the proposed project's lower confining unit. Fewer intrusions through the underlying Morrison unit prove to be more protective to the minor aquifers below during mining activities.

TR-RAI-2.7-17

The heading in Table 2.7-3 implies that a parameter concentration exceeds a Maximum Contaminant level even for those parameters that do not have an MCL. Please explain whether or not the applicant was referring to standards other than MCLs.

Response: TR-RAI-2.7-17

The heading for Table 2.7-3: PKFQWin Flood Estimate Results for Beaver Creek and is located in TR Section 2.7.1.4.2. Powertech (USA) believes that Table 2.7-3 is not the intended table in question.

TR RAI-2.7-18

The applicant identified 48 Subimpoundments in the application. The applicant did not provide summary data on the eight Subimpoundments (Sub12 through Sub19).



Response: to TR RAI-2.7-18

See TR_RAI Response Replacement Pages; Section 2.7-18 for replacement text TR_Section 2.7.3.1.

TR RAI-2.7-19

The analytical data includes results for the dissolved, suspended and total analyzed fractions of a constituent at one or more sampling events at a single location. The applicant did not discuss differences/relationships between the various fractions and at times appears to include more than one fraction in a statistical analysis.

Response: to TR RAI-2.7-19

Based on guidance contained in RG 4.14 (p.4.14-3), both groundwater and surface water samples are to be analyzed for dissolved and suspended radionuclide fractions. Also see "Table 1 Preoperational Radiological Monitoring Program for Uranium Mills" (p.4.14-8) for this same guidance. RG 4.14 states "Groundwater samples from sources that could be used as drinking water for humans or livestock or crop irrigation should also be analyzed for suspended natural uranium, thorium-230, radium-226, polonium-210, and lead-210." Therefore, the applicant will determine the concentrations of both dissolved and suspended radionuclide fractions in the groundwater and surface water radionuclide samples to be collected and analyzed on a quarterly basis. The dissolved fraction will be compared against the baseline dissolved fraction. In the case of drinking water or stock water wells, the suspended fraction will also be compared against the baseline suspended fraction. The comparison of total concentrations in the application was simply for added information and was not intended to be an indication that total concentrations will be used to compare operational data to baseline data.

It is important to clarify that while the thorium-232 analytical results appear to be positive, they are all essentially non-detect (ND), or less than the PQL. The data tables generally show a value of 0.0025 mg/l, which is one-half the value of the PQL, 0.005 mg/l, which is typical protocol when calculating statistics. Consequently, with no or negligible concentrations of thorium-232, very few analyses of radium-228 were performed.

After re-examining the groundwater radionuclide data, it became apparent that there could be some confusion regarding the recordation of suspended, dissolved and total concentrations. To clarify, the results recorded for "total" are only those analyses for total concentration, and not the sum of the suspended and dissolved fractions.

<u>TR RAI-2.7-20</u>

The applicant includes surface impoundments Sub05 in the surface water monitoring program. However, sampling results for surface impoundment Sub05 are not presented in the application nor is the lack of results discussed. Please explain this lack of data.



Response: to TR RAI-2.7-20

Surface impoundment Sub05 was dry at the time of sampling.

TR RAI-2.7-21

On Page 2-195, the applicant indicates that water quality data were collected during the 2008 pumping test at additional wells listed in a table entitled "Additional Well Data"; however, the data are not presented in the application in either Appendix 2.7-G (Groundwater Quality Data), a table entitled "Additional Water Quality Data and Statistics by Well" in Appendix 2.7-I, or Appendix 2.7-B 2008 (Pumping Tests: Results and Analyses). Please address this discrepancy.

Response: to TR RAI-2.7-21

The table on page 7 of Appendix 2.7-I includes statistics for groundwater constituents at or above PQL for 14 wells, including the nine wells that were sampled once during the 2008 pumping test. See TR_RAI Response Replacement Pages; Section 2.7-21 for the new table prepared as Attachment A to Appendix 2.7-I, which includes the water quality results for each parameter and date of event for samples obtained from these nine wells during the 2008 pumping test.

TR RAI-2.7-22

- Data for Well 2 in Appendix 2.7-G differ from the data for Well 2 in Appendix 2.7-1.
- Data for Well 7 in Appendix 2.7-I list an additional sampling event from the data for Well 7 in Appendix 2.7-G.

Response: TR RAI-2.7-22

See TR_RAI Response Replacement Pages; Section 2.7-22 for the following:

Revised Table for Appendix 2.7-G be inserted for water quality data for well #2. Revised Table for Appendix 2.7-G be inserted for water quality data for well #7.

- Data submitted in Appendix 2.7-G for sampling event 2/12/2008 regarding well # 2 is well data specific to sampling event 2/12/2008 for well #4. Data submitted in Appendix 2.7-I is the correct data for all sampling events regarding the specified well #2.
- Five sampling events occurred during 2007-2008 for well #7, therefore Appendix 2.7-I represent the correct number and data for each sampling event that occurred for this well during baseline characterization.

TR RAI-2.7-23

The mean value for radon for well #18 is 5pCi/L in Appendix 2.7-I; however, this mean is not consistent with the listed range in data values (762-1210 pCi/L). Please explain this apparent discrepancy.



Response: TR RAI-2.7-23

Appendix 2.7-I column formatting issues, therefore, what seems to be 5pCi/L is actually the 5 from the number 1079.75. The columns should read 1079.75 pCi/L and the range of data vary from 762 pCi/L to 1220 pCi/L.



Response: TR RAI-2.7-5

TR_Section 2.7.2.2.8

Corrected Figures

Figure 2.7-14 and Figure 2.7-15

Response to the U.S. NRC's Request for Additional Information Dewey-Burdock Uranium Project-Source Material License Application Technical Report Submitted August 11, 2009.



The hydrologic investigation of this site included measurement of water levels in wells completed in the Inyan Kara aquifer, the overlying alluvial aquifer, and the underlying aquifer (Sundance/Unkpapa). The data were used to assess groundwater flow direction as indicated by groundwater elevations, to construct potentiometric surfaces and to calculate hydraulic gradient. Data collection and analyses were started in 2007 and are ongoing in order to document predevelopment conditions and changes in potentiometric head before, during, and after operations. Appendix 2.7-A lists water level data collected from wells completed in the Inyan Kara aquifer during this study.

Water level data were collected as follows:

- Monthly water levels were measured in wells listed in Table 2.7-14 and shown in Plate 2.5-1. This table summarizes the wells by formation as determined by well completion information or, if well completion information was not available, through analyses of water quality information. These wells were selected to provide water level data upgradient and downgradient of the proposed mine areas.
- Water levels were measured in monitoring wells listed in Table 2.7-14 as follows:
 - Static water levels were measured at most wells prior to sample collection with regard to a reference elevation, usually a mark on the well or on a permanent structure above or near to the well.
 - When possible, free-flowing wells were measured with a 15 lb/in² (psi) or 30 psi N.I.S.T.-certified pressure gauge.
 - The well was shut in and the pressure was allowed to stabilize before a reading was recorded.
 - Pressure values were recorded to within at least 0.1 psi and typically to within 0.01 psi.
 - Wells with subsurface water levels were measured using an electric water level tape with measurements reported to within at least one tenth of a foot and typically to within a hundredth of a foot.
- Exceptions to this procedure are included in Table 2.7-16 and described here:
 - Domestic wells that could not be accessed at the well head or were behind a pressure tank (well numbers 7, 8, 13, 16, 18, 42).
 - Free-flowing wells that could not be sealed due to leaks caused by corrosion and age (wells 2, 635, 4002).



- Free-flowing wells that could not be sealed due to poor valve fittings or cracked valves (well 696).
- Free-flowing wells where existed the possibility of rupturing a line when pressurized due to age (well 7002).
- Wells that contained pumps and pump tubing making it difficult to retrieve a water level tape (well 619).
- Water level measurements from pumping and monitoring wells that were taken during the aquifer tests are given in the aquifer test report (see Appendix 2.7-B).

Measurements of water levels were not collected from several wells as described in Table 2.7-16. For many of the wells it was not feasible to shut down flow for sufficient duration to fully recover to hydrostatic conditions within the formation. In most cases, these wells were in active use for a residence or stock well and the use could not be interrupted.

Table 2.7 -	14: Wel	l Data 👘
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	SD State P	lane 1983			Serooned	,	
ID	East (ft)	North (ft)	Formation	Depth, ft	interval, ft	Use	
675	1015340.3	406352.2	Alluvium	14.4	4 - 14	Piezometer	
676	999245.0	439891.6	Alluvium	22.5	12 - 22	Piezometer	
677	991947.3	434035.9	Alluvium	14.5	4 - 14	Piezometer	
678	995023.4	431834.9	Alluvium	14.5	4 - 14	Piezometer	
679	9 1000303.0 446248.3 Alluviur		Alluvium	39	29 - 39	Piezometer	
49	987330.6 444022.8 Fall River		Fall River	600	unknown	Stock	
. 607	980219.4	416377.6	Fall River	unknown	unknown	Piezometer	
610	989998.0	447969.6	Fall River	680	630-672	Piezometer	
613	990523.4	453775.8	Fall River	580	504-580	Piezometer	
622	991174.5	454033.8	Fall River	520	503 - 580	Piezometer	
631	1002575.7 449309.8 Fall River 80 30 - 80 Stor		Stock				
681	988728.3	443725.3	Fall River	600	585 - 600	Pump Test Well	
688	1003425.8	429974.4	Fall River	255	245 - 255	Piezometer	
694	997116.1	426836.1	Fall River	392	377 - 392	Piezometer	
695	990783.4	439312.5	Fall River	508	493 - 508	Piezometer	
698	1004307.8	435651.1	Fall River	205	180 - 205	Piezometer	
614	990583.8	453770.2	Fuson	620	609-620	Piezometer	
12	995376.8	434378.5	Lakota	805	unknown	Stock	
38	992726.9	442289.6	Lakota	494	unknown	Stock	
608	980228.9	416454.6	Lakota	unknown	unknown	Piezometer	
609	990133.3	447808.3	Lakota	1000	903-966	Piezometer	
615	990571.0	453708.9	Lakota	800	712 - 800	Piezometer	
619	1003106.9	437045.9	Lakota	280	unknown	Stock	
650	1012180.5	433331.4	Lakota	unknown	unknown	Stock	
680	1003476.6	429969.1	Lakota	436	426 - 436	Pump Test Well	
689	988715.0	443789.2	Lakota	730	715 - 730	Piezometer	
697	990748.4	439347.4	Lakota	682	667 - 682	Piezometer	
3026	1012037.4	432833.2	Lakota	196	166 - 196	Stock	
8002	1004651.5	418556.4	Lakota	500	unknown	Stock	
628	990894.7	449719.2	Inyan Kara	unknown	unknown	Stock	
668	999428.2	427450.3	Inyan Kara				
8003	1004520.9	418530.8	Inyan Kara	unknown	unknown	Garden	



Well	Reason for no measurements
1	Could not be sealed for pressure measurement because of leaks caused by corrosion and age
2	Could not be sealed for pressure measurement because of leaks caused by corrosion and age
7	Domestic cannot measure without pulling pump
8	Domestic cannot measure without pulling pump and shutting in for period of time
13	Domestic cannot measure without pulling pump
14	Difficult surface access
16	Difficult surface access because of fittings, domestic well would have to be shut in for period
17	Stock well would need pump pulled and to stop being used to stabilized
18	Domestic cannot measure without pulling pump and shutting in for period of time
20	Domestic cannot measure without pulling pump and shutting in for period of time
42	Domestic could not measure without pulling pump. W
51	Surface casing in poor condition, leaking
96 _	Domestic well cannot measure without pulling pump and shutting in for period of time
115	Domestic well cannot measure without pulling pump and shutting in for period of time
147	Not measured because of location north of Dewey Fault
510	Difficult access, would require shutting in for a period of time
620	Stock well would need pump pulled and to stop use to be stabilized
7002	Because of the age of this well, it is believed that pressurizing may cause a line to rupture

 Table 2.7-15: Reasons no Measurements were Obtainable During Sampling Period.

Maps of the current potentiometric surface for the Fall River (Figure 2.7-14), Lakota (Figure 2.7-15), are derived from the full data set of water level measurements collected by RESPEC for Powertech. This data set is believed to be sufficient to support estimation of the direction and velocity of groundwater flow. Additional characterization of the potentiometric surface will be gathered in greater detail for presentation in the hydro geologic packages for each well field.

A potentiometric surface (Figure 2.7-17) for the Unkpapa aquifer has been generated using water level data collected in the area from September 2007 through June 2008 (Appendix 2.7-A). The regional USGS map "*Potentiometric Surface of the Inyan Kara Aquifer in the Black Hills Area, South Dakota*" was used as a general guide in areas where water level data are unavailable (Strobel et al., 2000).



The general pattern of groundwater flow is, as expected, away from the highlands and is similar for all aquifer local units. Throughout the southwestern Black Hills including the study area, the groundwater gradient is generally southwestward. Analyses of regional information indicate that similar flow patterns should exist from ground surface to the Precambrian aquifer.

Appendix 2.7-A summarizes water levels and elevations measured in Fall River and Lakota wells. These paired wells, plus data gathered during the pumping tests, provide the capability to assess site-specific aquifer connections as follows:

- Analyses of water levels reported from wells near recharge or outcrop areas demonstrate that water levels in the Lakota Formation are somewhat higher than in the Fall River.
- With increasing distance from the recharge areas, this difference in head appears to diminish.
- Review of pumping test data from the Dewey area indicates that pumping a well located within the Fall River does not impact the Lakota heads. Where the Fuson is an ineffective confining unit, water could flow upward into the Fall River Formation. Because of this uncertain connectivity, the Fall River and Lakota Formations are considered to be one aquifer (the Inyan Kara aquifer) in this report.





Note: Potentiometric surface based on average water level values at the project site. Contours are dashed where approximate.

Figure 2.7-14: Potentiometric Surface of the Fall River Aquifer





Note: Potentiometric surface based on average water level values at the project site. Contours are dashed where approximate. Figure 2.7-15: Potentiometric Surface of the Lakota Aquifer





Figure 2.7-16: Potentiometric Surface of the Unkpapa Aquifer



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If the aquifer materials were homogeneous, groundwater would flow in the direction of the gradient. Within the PAA, it is likely that groundwater flow is partially controlled by interfingering channels and heterogeneous beds.

North of the site, the Dewey Fault is believed to affect groundwater movement. At its greatest, the Dewey Fault has more than 400 feet of offset. This offset would place the Lakota Formation, south of the fault, against the impermeable Spearfish Formation north of the fault. Based on TVA's Dewey pumping test, the fault behaved as an impermeable zone and resulted in drawdown greater than would occur in an infinite aquifer (Boggs, 1983; Appendix 2.7-K).

The potentiometric surface drawn in Figure 2.7-16 does display an area near Dewey where the hydraulic gradient is much shallower than downdip areas and locations near the Burdock side of the project. Overall, the locally flat portion of gradient is based upon approximately three measurement locations, with sparse data up and down gradient from which the contours were drawn. There is relatively small differences between the measured potentiometric elevations at these wells and reported errors of measurement are significant to the interpretation of the contours to provide the sole explanation. Because of this, it is not conclusive of a true local difference in the gradient.

However, assuming a local difference in the gradient is accurate, two explanations are possible:

- 1.) This change in gradient is the result of an area of the aquifer that simply has higher hydraulic conductivity and transmissivity values. Based on a Lakota aquifer pump test in 1982 (Boggs, 1983), the transmissivity in that area is approximately 590 ft2/day. Two Lakota aquifer pumping tests conducted in the Burdock area (Boggs and Jenkins, 1980 and Powertech's 2008 test) had average transmissivity values of 190 and 150 ft2/day respectively. Based on the pump test data alone, the transmissivity in the Dewey area is about 3 to 4 times greater than in the Burdock area. The Dewey test results also indicated that results were influenced by the Dewey Fault acting as a barrier boundary and/or a decrease in transmissivity with distance from the test site (Boggs, 1983). Given the heterogenous nature and fluvial depositional environment of the Inyan Kara aquifer, this change in transmissivity is reasonable.
- 2.) The change in the gradient may also be caused by "mounding" as the result of localized recharge up gradient. Pass Creek flows from a significant basin up stream of the Lakota outcrop. The location where Pass Creek crosses the Lakota outcrop is up gradient of central location where the locally flat gradient is observed at Dewey. It is theorized that a relatively large portion of the total local recharge into the Lakota may be from Pass Creek and thus focused into that location causing a locally elevated potentiometric surface.

In response to the possibility of upwelling from the Unkpapa or breccia pipes connecting the Unkpapa to the Lakota aquifer, this hypothesis is very unlikely. Two aquifer pump tests conducted by Powertech in May 2008 revealed that the Unkpapa showed no hydraulic response to pumping in the Inyan Kara at either Dewey or Burdock. Additionally, core data from the interlaying Morrison aquitard has a much lower permeability (TR 2.7.2.2.4). There is no data to indicate the Morrison is not an effective confining layer. The breccia pipe survey by Gott et al (1974) was conducted only on the outcrops of the Inyan Kara and those formations stratigraphically below the Inyan Kara and between the Minnelusa Formation. Extensive exploration drilling in the area has not indicated the presence of breccia pipes.

Water quality data has been taken for the Lakota and Unkpapa aquifers. If significant upwelling of water from the Unkpapa to the Lakota was occurring in the Dewey area, it would be expected that water quality at Dewey would noticeably different from water quality in the Burdock area. When comparing water quality results, it is also important to note differences in water chemistry that are primarily attributable to the well location and its proximity to an ore body, with a well either being upgradient, within, or downgradient of a uranium ore body. Based on comparison of median water quality within the Lakota and Unkpapa, the Unkpapa has a higher median total dissolved solids (TDS) and lower sulfate concentrations. Comparing wells in the ore zone at both Dewey and Burdock, there is little statistical difference between wells. However, because of the variability in water quality within the Inyan Kara across the region, there does not appear data that supports or negates the possibility for Unkpapa upwelling.

It is common practice in the area to allow artesian wells to continuously flow to prevent freezing. Undoubtedly, this practice has resulted in a decline in potentiometric head over decades.

2.7.2.2.9 Site Groundwater Recharge and Discharge

Groundwater may recharge or discharge from the site under the following mechanisms:

- Recharge via infiltration of precipitation
- Discharge via evapotranspiration
- Recharge or discharge to streams or springs
- Recharge or discharge into overlying or underlying hydrogeologic units
- Recharge or discharge along the Dewey fault zone
- Discharge to wells
- Recharging groundwater flow into the study area
- Discharging groundwater flow out of the study area.



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The first three mechanisms are limited to unconfined alluvium in stream channels with depths less than 100 feet. The remaining mechanisms apply from the highland outcrop to the PAA, as the units transition from unconfined outcrops to confined units. Recharge to confined groundwater is primarily from precipitation recharge at the outcrop. Most of this recharge occurs at the highland outcrops, as shown in Figure 2.7-17. Based on data from Carter et al. (2001), an average of 0.3 to 0.5 inches of precipitation (2 to 3 percent of 16 in/yr) that falls each year recharges the Inyan Kara aquifer.





Figure 2.7-17: Aquifer Recharge Zones



Response: TR RAI-2.7-9 and 2.7-10

Information concerning groundwater/Surface water Interactions for TR Section 2.7.2.2.10.

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2.7.2.2.10 Site-Specific Groundwater/Surface Water Interactions

Near the PAA, there are several possible modes of interaction between groundwater and surface water. Groundwater becomes surface water where free-flowing artesian wells discharge into surface water impoundments. There are no natural springs in the PAA. The only other major avenue for interchange is along the alluvium where Pass Creek crosses the Inyan Kara outcrop. Here, the alluvium may either gain or lose flow to the underlying aquifer. There is currently no stream loss data for Pass Creek to quantify this interaction.

There is no known evidence of any groundwater flowing upward from springs originating in the Inyan Kara to surface water features in the PAA, with the exceptions of the Triangle mine open pit and a location of surface water flow in the north half of the north east quarter of S 15, T 7 south, R 1 east in the Burdock area. Typically the presence of the Graneros shale prohibits this flow between the Inyan Kara and the surface.

Most of the surface impoundments are in the form of stock dams which collect surface runoff. Wetlands are only know to be centered on stream beds and recharged only by stream flow.

The Triangle mine, the Darrow mine, and other open pits previously used for mining are open to the Fall River Aquifer. In the case of the Triangle mine, the bottom of the open pit is below the potentiometric surface of the Fall River aquifer which has flooded the pit. The Darrow pits are believed to be above the potentiometric surface of the Fall River and Lakota aquifers. However, water level data on the outcrop region is not sufficient at this time to fully evaluate this.

The surface water feature near the Burdock area is believed to be Inyan Kara as it is artesian at this location. This area contains historic localized drilling into the Inyan Kara. The cause will be investigated and mitigated if necessary prior to development of initial well field at Burdock. If determined to be an improperly plugged exploration hole, licensee will locate and plug.

Development of each well field will include more detailed hydrogeologic study in the form of pump testing and mapping of the potentiometric surface in greater detail to illustrate the presence of any potential connection of each well field production zone to surface water bodies and presented for review in the hydrogeologic data packages. Surface water features will be monitored during pump testing to determine any hydraulic connection with the well field production zone. Typically, a larger number of wells consisting of the perimeter monitor ring and overlying and underlying non-production zone monitor wells will be monitored for response during a pumping test or multiple tests for each well field. If surface water features are within a

distance calculated to be of possible hydrogeologic connection, then these surface water features will also be monitored for response during the pump testing. If surface water feature can otherwise be shown to be completely isolated from the production zone hydrogeologic unit then it will not be monitored during pump testing.

2.7.2.2.11 Hydraulic Properties of the Inyan Kara at the Project Site

This section describes past and recent aquifer pumping tests and the insight on hydraulic properties that were gained.

2.7.2.2.12 Summary of Previous Pump Test Results

The TVA conducted groundwater pumping tests from 1977 through 1982 as part of a uranium mine development project near the towns of Edgemont and Dewey, South Dakota. TVA produced two summary pumping test reports, "Analysis of Aquifer Tests Conducted at the Proposed Burdock Uranium Mine Site" (Boggs and Jenkins, 1980; Appendix 2.7-K) and "Hydrogeologic Investigations at Proposed Uranium Mine near Dewey, South Dakota" (Boggs, 1983). In addition, TVA prepared a Draft Environmental Statement (DES) for the proposed Edgemont Uranium Mine in 1979.

TVA first conducted two unsuccessful tests in 1977 at the Burdock test site. The results of the 1977 tests were considered inconclusive because of various problems including questionable discharge measurements, some observation wells improperly constructed, and some pressure gauges malfunctioned. No data from the 1977 tests are currently available.

TVA conducted three successful pumping tests, two in 1979 near the current Burdock Project Area, and one in 1982 about two miles north of the current PAA. The results of these successful tests are described in separate sections, below. However, no data for these tests, in particular electronic records of drawdown, are available, other than information contained in the reports.

2.7.2.2.12.1 Dewey Proposed Action Area

The Dewey test was conducted in 1982 northeast of Dewey Road at the location shown on Figure 2.7-18. The test consisted of pumping in the Lakota formation for 11 days at an average rate of 495 gallons per minute [gpm]. The test developed the following information:

- Transmissivity of the Lakota averaged about 4,400 gallons per day per foot (gpd/ft) which is equivalent to 590 feet squared per day (ft²/day).
- Storativity of the Lakota was about 1.0×10^{-4} (dimensionless).



Response: TR RAI-2.7-18

Clarification Text for TR Section 2.7.3.1 Surface Water Quality

Subimpoundment Data

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2.7.3 Site Baseline Water Quality

2.7.3.1 Surface Water Quality

In compliance with NRC Guide 4.14 (RG 4.14), NUREG-1569, and South Dakota mining rules ARSD 74:29, the perennial and ephemeral streams and impoundments in the PAA were sampled upstream and downstream of the proposed permit boundary. Table 2.7-20 lists stream and impoundment water quality sampling sites within and adjacent to the PAA. Plate 2.5-1 shows the locations of the stream and impoundment sampling sites.

	Site ID	SD State Plane 1983		Tuno / Nomo	Groundwater
	Site ID	East (ft)	North (ft)	i ype / Name	Influence
	Sub01	998654	446816	stock pond	
	Sub02	1001071	443526	Triangle Mine Pit	x
ts	Sub03	1005005	438448	mine dam	
nen	Sub04	1002542	437518	stock pond	
upu	Sub05	1004591	437191	mine dam	
Ino	Sub06	1006665	437019	Darrow Mine pit - Northwest	
du l	Sub07	1009312	434360	stock dam	
lbi	Sub08	1004195	427057	stock pond	x
Ñ	Sub09	1004640	427089	stock pond	
	Sub10	1005961	421367	stock pond	
	Sub11	1009659	432225	stock pond	
	BVC01	989871	428716	Beaver Creek downstream	
	BVC04	965366	460922	Beaver Creek upstream	
5	CHR01	985098	423010	Cheyenne River upstream	
am	CHR05	1015626	405925	Cheyenne River downstream	
tre	PSC01	996764	436205	Pass Creek downstream	
S	PSC02	1002722	452563	Pass Creek upstream	
	BEN01	1015872	416196	Bennet Canyon	
	UNT01	1007565	422482	Unnamed Tributary	

Table 2.7-22: Surface Water Quality Sampling Sites

Surface water sampling locations were chosen based on the NRC Guide 4.14 (RG 4.14) sampling requirements and the South Dakota mining rules ARSD 74:29 which require background radiological data to be collected for surface waters "that could be affected by the proposed operations."

The following stream sampling sites were established in support of the site characterization activities:

• Two sites on Beaver Creek (BVC01 and BVC04).



- Two on Pass Creek (PSC01 and PSC02).
- Two on the Cheyenne River (CHR01 and CHR05).
- One on smaller watershed in Bennett Canyon (BEN01).
- One on an unnamed tributary within the permit boundary (UNT01).

Surface water impoundments were evaluated for additional sampling and included stock dams and mine pits. Surface water impoundments were originally identified on topographic maps and aerial photographs. Subsequently a field survey was completed in July 2007 to fully identify and gather impoundment-location data. A total of 40 impoundments were verified, photographed and described as summarized in Table 2.7-24.

The apparent data gap (Sub 12 – Sub 19), in Table 2.7-24 initially included the eight (8) stream surface water sampling sites within Pass Creek, Beaver Creek and the Cheyenne River basins. However, these sites were removed from the sequential numbering of the subimpoundments, because of their stream sample type. The eight stream sampling locations not included in Table 2.7-21 and are designated as BVC01, BVC04, CHR01, CHR05, PSC01, PSC02, BEN01, and UNT01.

ID	SD State Plane 1983		Tuno	Groundwater	
ID	East (ft)	North (ft)	Туре	Influence	
Sub01	998654	446816	stock pond	_	
Sub02	1001071	443526	Triangle Mine Pit	x	
Sub03	1005005	438448	mine dam		
Sub04	1002542	437518	stock pond		
Sub05	1004591	437191	mine dam		
Sub06	1006665	437019	Darrow Mine pit - Northwest	х	
Sub07	1009312	434360	stock pond		
Sub08	1004195	427057	stock pond	х	
Sub09	1004640	427089	stock pond		
Sub10	1005961	421367	stock pond		
Sub11	1009659	432225	stock pond		
Sub20	1002532	428038	stock pond		
Sub21	1000370	429024	stock pond		
Sub22	999992	427168	stock pond		
Sub23	999717	426319	stock pond	х	
Sub24	1000794	423427	stock pond	х	
Sub25	999224	422605	stock pond		
Sub26	1000307	420428	stock pond		
Sub27	1003423	419002	stock pond		

 Table 2.7-23:
 All Identified Impoundments

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m	SD State Plane 1983		Tuno.	Groundwater
ID	East (ft)	North (ft)	Гуре	Influence
Sub28	. 1004298	422820	stock pond	
Sub29	1002964	442601	stock pond	
Sub30	1007163	430087	stock pond	
Sub31	1004019	431822	stock pond	
Sub32	1007073	429705	stock pond	
Sub33	1005797	429469	stock pond	
Sub34	1003123	433891	stock pond	
Sub35	999672	432197	stock pond	
Sub36	987313	442298	stock pond	
Sub37	987290	441389	stock pond	
Sub38	995337	434148	stock pond	
Sub39	996815	438345	stock pond	
Sub40	1008631	433781	Darrow Mine pit - Southeast	-
Sub41	997783	439460	stock pond	
Sub42	989530	435506	stock pond	
Sub43	1010029	437824	stock pond	
Sub44	998462	429397	stock pond	
Sub45	994820	423587	stock pond	x
Sub46	1008898	438460	stock pond	
Sub47	1009398	439185	stock pond	
Sub48	980447	421586	stock pond	

Because of the number of impoundments, their relatively small drainage basin, and the tendency of many to be dry after substantial rainfall, sampling a representative subset of the water impoundments was proposed. Impoundments were selected based on the presence of water, drainage area, and location. Eleven surface water impoundments were selected to construct a representative sampling group for the PAA.

2.7.3.1.1 Sample Collection and Analysis Methods

A surface water quality sample constituent list was developed based on NUREG-1569 groundwater parameters (minus radon), NRC 4.14 parameters, and added parameters from a constituent-list review with South Dakota DENR. NUREG-1569 gives no specific requirements for sampling constituents of surface water bodies. Table 2.7-21 lists constituents analyzed for in surface water samples, the number of samples of each collected, the analytical method, and the Practical Quantitation Limit (PQL) for each constituent.



Response: TR RAI-2.7-22

Revised Table for Appendix 2.7-G be inserted for water quality data for well #2.

Revised Table for Appendix 2.7-G be inserted for water quality data for well #7.

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	Well #2						
Analyte	9/26/2007 12:46	11/12/2007 9:25	2/12/2008 10:21	5/30/2008 15:21			
A/C Balance (± 5) (%)	-2.46	0.663	-2.6	3.25			
Alkalinity-Total as CaCO3 (mg/L)	214	208	88	212			
Aluminum-Dissolved (mg/L)	< 0.1	< 0.1	< 0.1	<0.1			
Ammonia (mg/L)	< 0.1	0.4	0.8	0.3			
Anions (mea/L)	16.7	16.5	53.3	16.6			
Antimony-Total (mg/L)			< 0.003	< 0.003			
Arsenic-Dissolved (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001			
Arsenic-Total (mg/L)			< 0.001	0.004			
Barium-Dissolved (mg/L)	< 0.1	<0.1	<0.1	<0.1			
Barium-Total (mg/L)			<0.1	<0.1			
Bervllium-Total (mg/L)			< 0.001	< 0.001			
Bicarbonate as HCO3 (mg/L)	261	254	107	258			
Boron-Dissolved (mg/L)	<0.1	<0.1	0.7	0.1			
Boron-Total (mg/L)			0.6	<0.1			
Cadmium-Dissolved (mg/L)	<0.01	<0.005	<0.005	<0.005			
Cadmium-Total (mg/L)			<0.005	< 0.005			
Calcium-Dissolved (mg/L)	48.5	51.7	241	57.8			
Carbonate as CO3 (mg/L)	. <5	<5	<5	<5			
Cations (meg/L)	150	16.7	50.6	17 7			
Chloride (mg/L)	10	10.7	26	9			
Chromium Dissolved (mg/L)	<0.05	<0.05	<0.05	<0.05			
Chromium Total (mg/L)		<0.05	<0.05	<0.05			
Conductivity @ 25 C (umbos/cm)	1570	1500	4400	1670			
Conner Dissolved (mg/L)	<0.01	<0.01	<0.01	<0.01			
Copper-Dissolved (http://	<0.01	~0.01	<0.01	<0.01			
Eluoride (mg/L)	0.2	0.2	~0.01	0.01			
	0.2	0.2	0.4	0.3			
Gross Alpha-Dissolved (pCi/L)	1.4	8.7	3.5	8.2			
Gross Beta-Dissolved (pCi/L)	9.3	12.4	14.4	10.3			
Gross Gamma-Dissolved (pCi/L)	<20	260	<20	0.02			
ron-Dissolved (mg/L)	< 0.03	<0.03	<0.03	<0.03			
ron-Total (mg/L)			1.32	1.54			
Lead 210-Dissolved (pCi/L)	<1	<1	<1	3.1			
Lead 210-Suspended (pCi/L)	<1	<1	<1	1.4			
Lead 210-Total (pCi/L)	<1						
Lead-Dissolved (mg/L)	< 0.05	< 0.001	< 0.001	< 0.001			
Lead-Total (mg/L)			< 0.001	<0.001			
Magnesium-Dissolved (mg/L)	15.8	16.6	87	19			
Manganese-Dissolved (mg/L)	0.08	0.08	0.07	0.08			
Manganese-Total (mg/L)			0.06	0.09			
Mercury-Dissolved (mg/L)	<0.0002	< 0.001	<0.001	< 0.001			
Mercury-Total (mg/L)	< 0.001	< 0.001	< 0.001	< 0.0001			
Molybdenum-Dissolved (mg/L)	<0.1	<0.1	<0.1	<0.1			
Molybdenum-Total (mg/L)			0.02	<0.1			
Nickel-Dissolved (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05			
Nickel-Total (mg/L)			< 0.05	< 0.05			
Nitrogen, Nitrate as N (mg/L)	<0.1	<0.1	<0.1	<0.1			
Nitrogen, Nitrite as N (mg/L)	<0.1	<0.1	<0.1	<0.1			
Oxidation-Reduction Potential (mV)		140	120	190			
рН	7.91	7.85	7.94	7.92			
Polonium 210-Dissolved (pCi/L)	<1	2	2.7	0.1			
Polonium 210-Suspended (pCi/L)	<1	<1	<1				
Polonium 210-Total (pCi/L)	<1						
Potassium-Dissolved (mg/L)	11.5	11.4	7.8	11			

e.

		•		
	Well #2	11/10/0005 0.05		
Analyte	9/26/2007 12:46	11/12/2007 9:25	2/12/2008 10:21	5/30/2008 1
Radium 226-Dissolved (pCi/L)	<0.2	1.3	1.1	2.1
Radium 226-Suspended (pCi/L)	2.2	<0.2	0.7	0.2
Radium 226-Total (pCi/L)	. 2.2			
Radon 222-Total (pCi/L)		674	908	727
Selenium-Dissolved (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001
Selenium-IV-Dissolved (mg/L)		< 0.001	0.001	< 0.001
Selenium-Total (mg/L)			. 0.002	. <0.001
Selenium-VI-Dissolved (mg/L)		< 0.001	0.001	< 0.001
Silica-Dissolved (mg/L)	8`	8.1	10.2	4.3
Silver-Dissolved (mg/L)	< 0.01	< 0.005	< 0.005	< 0.005
Silver-Total (mg/L)		-	< 0.005	< 0.005
Sodium Adsorption Ratio (SAR) (meq/L)		8.8	. 10	8.7
Sodium-Dissolved (mg/L)	273	286	716	297
Solids-Total Dissolved Calculated (mg/L)	1070	1090	3600	1110
Solids-Total Dissolved TDS @ 180 C(mg/L)	1100	1100	3700	1100
Strontium-Total (mg.L)			5.7	1.8
Sulfate (mg/L)	583	577	2440	579
TDS Balance (0.80 - 1.20) (dec.%)	1	0.97	1.02	0.96
Thallium-Total (mg/L)			· <0.001	< 0.001
Thorium 230-Dissolved (pCi/L)	< 0.2	< 0.2	<0.2	
Thorium 230-Suspended (pCi/L)	< 0.2	< 0.2	< 0.2	0.1
Thorium 230-Total (pCi/L)	<0.2			
Thorium 232-Dissolved (pCi/L)	< 0.001	< 0.005	< 0.005	< 0.005
Uranium-Dissolved (mg/L)	< 0.0003	< 0.0003	.0.0004	< 0.0003
Uranium-Suspended (mg/L)	0.0003	< 0.0003	< 0.0003	< 0.0003
Uranium-Total (mg/L)	0.0004		< 0.0005	< 0.0003
Vanadium-Dissolved (mg/L)	< 0.1	< 0.1	<0.1	< 0.1
		-0.01	<0.01	<0.01

		Well #7			
Analyte	10/3/2006 11:12	9/28/2007 17:28	11/12/2007 8:20	2/20/2008 8:45	5/29/2008 11:10
A/C Balance (± 5) (%)		-3.73	1.13	-2.5	8.11
Actinium 228-Dissolved	<20		· · · · · ·		
Alkalinity-Total as CaCO3	170	176	170	170	170
Aluminum-Dissolved (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1
Americium 241-Dissolved	<20				
Ammonia (mg/L)	0.4	0.3	0.4	0.3	0.3
Anions (meq/L)		14.1	15.6	15.9	14.4
Antimony-Total (mg/L)	`			< 0.003	< 0.003
Arsenic-Dissolved (mg/L)	< 0.01	< 0.001	< 0.001	< 0.001	< 0.001
Arsenic-Total (mg/L)				< 0.001	0.003
Barium 133-Dissolved (pCi/L)	<20			· ·	
Barium-Dissolved (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1
Barium-Total (mg/L)				<0.1	<0.1
Beryllium-Total (mg/L)			····	< 0.001	<0.001
Bicarbonate as HCO3 (mg/L)	210	215	207	207	207
Bismuth 212-Dissolved (pCi/L)	<20				
Bismuth 214-Dissolved (pCi/L)	300				
Bismuth precision (±) (pCi/L)	18				
Boron-Dissolved (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1
Boron-Total (mg/L)				<0.1	<0.1
Cadmium-Dissolved (mg/L)	< 0.001	< 0.005	< 0.005	< 0.005	< 0.005
Cadmium-Total (mg/L)	· ,	3		< 0.005	< 0.005
Calcium-Dissolved (mg/L)	37	30	36	32.9	42.1
Carbonate as CO3 (mg/L)	<5	<5	<5	<5	<5
Cations (meq/L)		13	15.9	15.1.	17
Cesium 134-Dissolved (pCi/L)	<20	· ·			
Cesium 137-Dissolved (pCi/L)	<20				
Chloride (mg/L)	13	12	12	11,	11
Chromium-Dissolved (mg/L)	< 0.01	< 0.05	< 0.05	< 0.05	< 0.05
Chromium-Total (mg/L)				< 0.05	< 0.05
Cobalt 60-Dissolved (pCi/L)	<20				
Conductivity @ 25 C	1530	1490	1440	1600	1650
Copper-Dissolved (mg/L)	< 0.01	<0.01	< 0.01	<0.01	<0.01
Copper-Total (mg/L)				< 0.01	< 0.01
Fluoride (mg/L)	0.37	0.3	0.4	0.3	0.4
Gross Alpha precision (±)	0.8				•
Gross Alpha-Dissolved (pCi/L)	17	4.4	7.2	15.5	3.3
Gross Beta precision (±)	1.6				
Gross Beta-Dissolved (pCi/L)	16	5	14.9	10.1	9.6
Gross Gamma-Dissolved	<20	1200	130	77	-
Iodine 125-Dissolved (pCi/L)	<20				
Iron-Dissolved (mg/L)	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Iron-Total (mg/L)				0.41	0.41
Lead 210-Dissolved (pCi/L)		<1	<1	24	0.5
Lead 210-Suspended (pCi/L)		<1	<1	<1	-7.4
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Well #7						
Analyte	10/3/2006 11:12	9/28/2007 17:28	11/12/2007 8:20	2/20/2008 8:45	5/29/2008 11:10	
Lead 210-Total (pCi/L)		<1				
Lead 212-Dissolved (pCi/L)	<20					
Lead 214 precision (±) (pCi/L)	30					
Lead 214-Dissolved (pCi/L)	350					
Lead-Dissolved (mg/L)	<0.01	< 0.001	<0.001	< 0.001	< 0.001	
_ead-Total (mg/L)			•	<0.001	< 0.001	
Magnesium-Dissolved (mg/L)	16	11.5	15.3	14	18.2	
Manganese 54-Dissolved	<20					
Manganese-Dissolved (mg/L)	0.03	0.03	0.03	0.03	0.03	
Manganese-Total (mg/L)				0.03	0.03	
Mercury-Dissolved (mg/L)		< 0.001	< 0.001	< 0.001	< 0.001	
Mercury-Total (mg/L)	< 0.001	< 0.0002	< 0.001	<0.001	<0.0001	
Molybdenum-Dissolved (mg/L)	< 0.005	<0.1	<0.1	<0.1	<0.1	
Molybdenum-Total (mg/L)				< 0.01	<0.1	
Nickel-Dissolved (mg/L)	< 0.01	< 0.05	< 0.05	< 0.05	< 0.05	
Nickel-Total (mg/L)				< 0.05	< 0.05	
Nitrogen, Nitrate as N (mg/L)		<0.1	0.1	<0.1	<0.1	
Nitrogen, Nitrite as N (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	
Non-polar organic materials	<5					
Dxidation-Reduction Potential			210	180	210	
θH	8.08	8.13	8.05	8.14	8.17	
Polonium 210-Dissolved		<1	2.1	<1		
Polonium 210-Suspended		<1	<1	<1	-0.1	
Polonium 210-Total (pCi/L)		<1				
Potassium 40-Dissolved (pCi/L)	<20					
Potassium-Dissolved (mg/L)	10	11	11.1	10.8	11	
Radium 223-Dissolved (pCi/L)	<20					
Radium 224-Dissolved (pCi/L)	<20					
Radium 226 precision (±)	0.6					
Radium 226-Dissolved (pCi/L)	2.6	0.6	1.1	0.7	0.9	
Radium 226-Suspended (pCi/L)		<0.2	<0.2	<0.9	-0.3	
Radium 226-Total (pCi/L)		<0.2				
Radium 228-Dissolved (pCi/L)	<1			· · · · · ·	·	
Radon 222-Total (pCi/L)			206	242	451	
Selenium-Dissolved (mg/L)	< 0.005	< 0.001	< 0.001	< 0.001	< 0.001	
Selenium-IV-Dissolved (mg/L)			< 0.001	< 0.001	< 0.001	
Selenium-Total (mg/L)		1		< 0.001	<0.001	
Selenium-VI-Dissolved (mg/L)			< 0.001	< 0.001	< 0.001	
Silica-Dissolved (mg/L)	7	7.5	7.8	7.5	4.1	
Silver-Dissolved (mg/L)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
Silver-Total (mg/L) Sodium	·····			<0.005	<0.005	

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Well #7							
Analyte	10/3/2006 11:12	9/28/2007 17:28	11/12/2007 8:20	2/20/2008 8:45	5/29/2008 11:10		
Sodium Adsorption Ratio (SAR)(meq/L)			10	10	: 9.7		
Sodium-Dissolved (mg/L)	270	237	289	276	300		
Solids-Total Dissolved		896	1040	1050	1010		
Solids-Total Dissolved TDS @ 180 C	1000	1000	1000	990	960		
Strontium-Total (mg.L)				1 .	1.1		
Sulfate (mg/L)	546	586	567	583	514		
TDS Balance (0.80 - 1.20)		1.16	0.98	0.94	0.95		
Thallium 208-Dissolved (pCi/L)	<20						
Thallium-Total (mg/L)				<0.001	< 0.001		
Thorium 228-Dissolved (pCi/L)	<20						
Thorium 230-Dissolved (pCi/L)		<0.2	<0.2	<0.2			
Thorium 230-Suspended		<0.2	<0.2	0.2	0.2		
Thorium 230-Total (pCi/L)		<0.2					
Thorium 232-Dissolved (pCi/L)		< 0.005	< 0.005	< 0.005	< 0.005		
Thorium 234-Dissolved (pCi/L)	<20				×.		
Uranium 238-Dissolved (pCi/L)	<20						
Uranium-Dissolved (mg/L)	< 0.001	< 0.0003	< 0.0003	< 0.0003	< 0.0003		
Uranium-Suspended (mg/L)		< 0.0003	< 0.0003	< 0.0003	< 0.0003		
Uranium-Total (mg/L)				< 0.0003	< 0.0003		
Vanadium-Dissolved (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1		
Water Temperature (lab, deg F)	48						
Zinc 65-Dissolved (pCi/L)	<20						
Zinc-Dissolved (mg/L)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		
Zinc-Total (mg/L)				< 0.01	< 0.01		

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Background Radiological Characteristics 2.9

TR_RAI-2.9-1

Provide the criteria used to establish air particulate sampling locations or indicate where this information can be found in the TR.

Response: TR RAI-2.9-1

See TR_RAI Response Replacement Pages; Section 2.9-1 for additional information regarding TR Section 2.9.6.1 Methods.

TR RAI-2.9-2

Please provide information (e.g., operating procedures, test results, etc.) on how the applicant determined filter saturation.

Response TR RAI-2.9-2

See TR_RAI Response Replacement Pages; Section 2.9-2 for TR Section 2.9.6.1 Methods. Additional information concerning filter saturation determination.

TR RAI-2.9-3

For all air sampling equipment, please describe the procedures used by the applicant for the calibration of air sampling and measuring equipment consistent with Regulatory Guide 4.14 or indicate where this information can be found in the TR.

Response TR RAI-2.9-3

See TR_RAI Response Replacement Pages; Section 2.9-2 for TR Section 2.9.6.1 Methods. Additional information concerning sampling equipment calibration.

TR RAI-2.9-4

Provide justification for not sampling air particulates for one full year.

Response TR RAI-2.9-4

See TR_RAI Response Replacement Pages; Section 2.9-7 for correct dates for TR Section 2.9.6.1. Appendix 2.9-A of the TR describes the monitoring period for particulate sampling as the beginning of Period 1 which is August 13, 2007 to the end of Period 5 which is August 13, 2008. The statement in Appendix 2.9-A that the air particulate sampling was performed for 351 days is an error. Air particulate sampling was conducted for 366 days (February 2008 contained 29 days), consistent with the recommendations of RG 4.14.



TR RAI-2.9-5

Please provide an analysis that the reported values are consistent with Regulatory Guide 4.14 or justification for providing alternate values.

Response TR RAI-2.9-5

See TR_RAI Response Replacement Pages; Section 2.9-5 relevant to TR Section 2.9.6.2 Air Particulate Sampling Results Tables 2.9-13 and 14.

The U-nat results for sampling Periods 1 and 2 range from 1.4 E-16 to 7.1E-15 μ Ci/ml with an average of 2.9E-15 μ Ci/ml. The maximum value (7.1E-15 μ Ci/ml) is 7.9 percent of the most restrictive effluent concentration for natural uranium (Class Y) listed in Appendix B, Table 2 of 10 CFR 20. It is clear that the maximum LLD for natural uranium is still sufficiently sensitive to demonstrate compliance with the requirement of 10 CFR §20.1302.

TR RAI-2.9-6

Please demonstrate how the U-nat concentration in microcuries per milliliter was derived from the value in milligram per filter composite.

Response TR RAI-2.9-6

The specific activity for natural uranium contained in Footnote 3 to 10 CFR Part 20 Appendix B was used to convert from mass to activity units. Footnote 3 states that the specific activity of natural uranium is 6.77E-7 curies per gram uranium. By unit conversion this is equivalent to 677 picocuries per milligram of uranium. Once the results of uranium per filter composite in milligrams were converted to picocuries per filter composite, the equation in Section 2.9.6.1 of the TR was used to convert the result to an air concentration in units of microcuries per milliliter.

TR RAI-2.9-7

Please address this discrepancy in the air particulate monitoring collection dates.

Response TR RAI-2.9-7

See TR_RAI Response Replacement Pages; Section 2.9-7. The air particulate monitoring collection time periods described in Appendix 2.9-A (p.16) are correct. The collection time periods and associated calculations in the TR should be revised as provided in replacement pages for section 2.9.6.1, 2.9.6.2, 2.9.6.3 to reflect the correct monitoring periods. The associated calculations in Appendix 2.9-A are not reported correctly and have also been revised as provided in replacement pages for Section 8.1.1 and 8.2.1, to reflect the correct monitoring periods.



<u>TR RAI-2.9-8</u>

Please address these inconsistencies in the description of the monitoring duration.

Response TR RAI-2.9-8

The air monitoring stations were operated continuously with minimal down time due to filter changes, power outages, or other unforeseen disruptions in the power supply. This short period of down time is why the term "nearly continuously" was used. In the context of the TR and Appendix 2.9-A, "continuously" and "nearly continuously" are synonymous.

TR RAI-2.9-9

On page 2-359 of the TR, the value listed for Th-230 is that of the derived airborne concentration from 10 CFR 20 Appendix B, Table 1, not the effluent concentration value as indicated. Please address this discrepancy.

Response TR RAI-2.9-9

The value listed for thorium-230 section 2.9.6.1 of the TR and Page 17 of Appendix 2.9A was inadvertently taken from 10 CFR 20 Appendix B Table 1 rather than 10 CFR 20 Appendix B, Table 2. The values for lead-210, natural uranium and radium-226 are correct. See also, TR_RAI Response Replacement Pages; Section 2.9-9.

<u>TR RAI-2.9-10</u>

Please clarify whether the "HV" designator in lab reports in Appendix 2.9-A of the TR (and Plate 2.5-1) are the same as "AMS" designators in Table 2.9-11 of the TR.

Response TR RAI-2.9-10

Yes, the "HV" designator in the lab reports in Appendix 2.9-A of the TR and Plate 2.5-1 are the same as the "AMS" (Air Monitoring Station) designators in Table 2.9-11 of the TR.

TR RAI-2.9-11

Please provide an assessment of land use for food sampling.

Response TR RAI-2.9-11

See TR_RAI Response Replacement Pages; Section 2.9-11 for additional information in TR Section 2.9.10 Food Sampling.

TR RAI-2.9-12

Please provide the results of crop sample analyses or a justification for not collecting crop samples. In this response, please describe actions taken by the applicant to determine the agricultural use of adjacent lands, including vegetable gardens.

Response TR RAI-2.9-12

See TR_RAI Response Replacement Pages; Section 2.9-12 for additional information concerning TR Section 2.9.10 Food Sampling.

TR RAI-2.9-13

Please analyze and provide results for appropriate food samples. In this response, please describe actions taken by the applicant to determine the agricultural use of adjacent lands.

Response TR RAI-2.9-13

The intent of Section 1.1.3 of RG 4.1.4 is on the forage vegetation in the permit area and the livestock that feed upon it.

RG 3.46 focuses on data that could assess the environmental impact of the proposed action. The guide states "For commercial-scale operations and for research and development operations involving drying of yellowcake, the applicant should provide data on the count and distribution of important domestic fauna, in particular, cattle, sheep, and other meat animals that may be involved in the exposure of man to radionuclides."

The guide also states "Report site-specific radiological data, including both natural background radiation levels and results of measurements of concentrations of radioactive materials occurring in [*important*] biota..."

The TR clearly shows the predominance in numbers of beef and other cattle, relative to other livestock, in the vicinity of the proposed facility. The TR states on Page 2-3 that "no data were available for poultry, pig, or sheep inventories." This might have been better phrased as "no data regarding the numbers of poultry, pigs, or sheep exist in the immediate area."

The applicant has demonstrated compliance with the intents of both guidance documents. The applicant has sampled the important livestock which forages on vegetation in the permit area.

With the absence of significant numbers of other livestock, the primary focus of the food sampling was livestock. Three samples of livestock were collected and analyzed, in accordance with RG 4.14.

<u>TR_RAI-2.9-14</u>

Consistent with Regulatory Guide 4.14, please provide results of game animal sample analyses or a justification for not collecting them.

Response TR RAI-2.9-14

See TR_RAI Response Replacement Pages; Section 2.9-14 for additional information in TR Section 2.9.10 Food Sampling. The reviewer is correct to state that game animals occur throughout the permit area. The most prevalent big game animals on the site are pronghorn antelope and mule deer.

TR RAI-2.9-15

The applicant has not addressed how the applicant will prohibit hunting on public lands. Please provide this information.

Response TR RAI-2.9-15

See TR_RAI Response Replacement Pages; Section 2.9-15 for additional information concerning hunting and mine development in Section 7.1.2 of the TR.

TR RAI-2.9-16

The applicant should provide the sample results of cows consistent with Regulatory Guide 4.14 or justification for not providing them.

Response TR RAI-2.9-16

In lieu of slaughtering three animals for the sake of collecting one sample from each, we chose to sample three types of tissue from one beef cattle.

Importantly, RG 4.14 states "At least three samples should be collected at time of harvest or slaughter or removal of animals from grazing for each type of crop (including vegetable gardens) or livestock raised within three kilometers of the mill site."

RG 4.14 does not specifically say three individual animals. We believe we met the intent of RG 4.14.

TR RAI-2.9-17

Please address the following issues regarding Table 2.9-19 (page 2-378) of the TR and Table 10-1 in Appendix 2.9-A of the TR:

a. Reporting format is not consistent with Regulatory Guide 4.14, Section 7.5.

b. Lower Levels of Detection (LLD) are significantly higher than Regulatory Guide 4.14, Section 5, and Recommendations.

c. The LLDs for meat are substantially different from each other

Response TR RAI-2.9-17a

Tables 2.9-19 and 10-1 transpose the format of RG 4.14, Section 7.5 to facilitate viewing and printing. The same information recommended by RG 4.14 is provided.



Response TR RAI-2.9-17b

We assume by Lower Levels of Detection the NRC means Lower Limits of Detection (LLDs). We agree with the reviewer and the TR states "There are several cases where reported concentrations are at or below LLDs that, in turn, exceed the LLDs recommended in RG 4.14. This is evident for all reported concentrations of natural uranium, radium-226 and polonium-210 in Sample DBAT-01, and lead-210 in all three samples."

The LLDs for food recommended in RG 4.14 are extremely low. In the context of units of picocuries per gram (pCi/g), the LLDs for U-nat and Th-230 are $2*10^{-4}$ pCi/g, Ra-226 is $5*10^{-5}$ pCi/g; and Po-210 and Pb-210 are $1*10^{-3}$ pCi/g. It would be extremely difficult for a laboratory to meet these LLDs for samples, even without matrix interferences and large requisite sample sizes.

In addition, there are no regulatory limits for food items for the purpose of comparison, to evaluate appropriate analytical sensitivities. Furthermore, there is no justification for the published suggestions in RG 4.14.

Response TR RAI-2.9-17c

We agree with the reviewer. At such low LLDs, analytical errors, low concentrations, differences in sample size, and matrix interferences are more likely to influence the LLD than at relatively higher values.

TR RAI-2.9-18

Please clarify what types of vegetation were included in the vegetation sampling and state whether this includes forage samples.

Response TR RAI-2.9-18

Consistent with RG 4.14, forage vegetation; i.e., grasses, were the only types of vegetation sampled during the pre-operational phase. The samples were collected in the vicinity of each of the air monitoring stations, which are in sectors of the highest predicted airborne concentrations due to facility operations.

TR RAI-2.9-19

Please clarify if identified grazing areas were analyzed as recommended by Regulatory Guide 4.14.

Response TR RAI-2.9-19

RG 4.14 suggests sampling grazing areas located in three different sectors having the highest predicted airborne radionuclide concentrations. Air monitoring stations were placed in sectors predicted to have the highest airborne concentrations. Forage samples were collected at all air monitoring stations. Please refer to the selection of air monitoring stations in our response to RAI 2.9-1.

Section 2.8.5.6.1.2.1 only identifies and describes generic habitats observed in the permit area.



Each of the vegetation sample locations is sited elsewhere, in areas grazed by cattle and/or horses. It is our opinion that the vegetation was sampled in accordance with the intent of RG 4.14. Forage vegetation was sampled in grazing areas in three different sectors having the highest predicted airborne radionuclide concentrations due to planned milling operations.

TR RAI-2.9-20

NRC staff could not locate these sites on Plate 2.5-1. However, these sites can be found on Figure 2.9-11 of the TR. Please correct this discrepancy in the TR.

Response TR RAI-2.9-20

See TR_RAI Response Replacement Pages; Section 2.9-20 for corrected text in TR Section 2.8.5.6.1.1.

TR RAI-2.9-21

Please confirm whether the applicant ruled out the presence of fish in all impoundments, and, if not, please provide the results of fish samples from those impoundments.

Response TR RAI-2.9-21

See TR_RAI Response Replacement Pages; Section 2.9-21 for justification of why the impoundments were not focused on during fish sampling effort; TR Section 2.8.5.6.1.1.

TR RAI-2.9-22

Please provide technical justification for the 500 m spacing used by the applicant.

Response TR RAI-2.9-22

The RG 4.14 guidance was intended for use in assessing the performance of effluent controls and releases from operating uranium mills as well as establishing baseline data for evaluating decommissioning operations. It has been well-established that airborne effluent releases, other than radon, are minimal at ISR facilities but baseline data, including gamma exposure rates, are needed to assess gamma exposure impacts proximal to processing facilities and from accidental liquid releases from well fields and processing plants. RG 4.14 recommends making direct gamma measurements at 150-meter intervals, extending from the center of the processing plant outward in the eight compass directions to 1500 meters as well as at each of the air monitoring stations. In this case, that would require only 90 measurements and cover less than 50 percent of the project site. Importantly, the number of direct gamma measurements collected by Powertech (USA) exceeds the guidance in RG 4.14.

The transect spacing in the work plan was intended to be small compared to the anticipated characteristic size of anomalous areas. Wide spacing was used for areas thought to be non-impacted; more narrow spacing was used for known or potentially impacted areas. While this work was done prior to the cited publication, we believe that the methods are similar and consistent with that publication. The authors did not recommend transect spacing. They reported typical transect spacing that they used



for certain situations (including surveys for cleanup). We do not agree that the authors intended to establish a standard method. The measure of success is determined by asking the question: did the survey adequately determine the mean and variance of the exposure rates for areas within the site, and did it identify areas with highly varying exposure rates commonly referred to as anomalous areas?

Our technical justification for the 500-meter transect spacing is based on the assumption that we did not expect mineralized ore outcrops. Therefore, non-impacted areas were expected to be made up of large areas of different soil types or large fields having a unique history of fertilizer applications, if any. The characteristic sizes of these areas were expected to be large compared to 500 meters. It was also evident that the historical surface mine area was impacted. The goal of surveying this area was to determine the boundary of the impacted area and the range of exposure rates. It was not the goal to provide adequate data for developing reclamation plans.

Data from the surveys were processed and evaluated at the end of each day to determine whether the gamma count rates were consistent with the assumptions. Data anomalies were investigated and, where appropriate, the transect spacing and areal extent of the survey were changed to bound the anomaly. These daily evaluations of the data and changes to the survey density were made to correct for small departures from the conditions that were assumed when developing the plans.

TR RAI-2.9-23

Consistent with Regulatory Guide 4.14, please describe the criteria, and basis for the criteria, used to determine the acceptability of the daily function tests performed on the sodium iodide detectors provided in Appendix 2.9-A of the TR.

Response TR RAI-2.9-23

The comments regarding function checks during September 2007 rightfully question whether the detector systems performed in a consistent manner over the 11-day survey period. The following information and analysis was done in response to those comments.

RG 4.14 allows direct measurements to be made with "properly calibrated portable survey units". While RG 4.14 doesn't provide acceptance criteria for function checks, other guidance accepts consensus standards such as ANSI N323A-1997,

Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments (ANSI, 1997). Section 4.8 of the standard states "to ensure proper operation of the instrument between calibrations, each instrument (with the exception of neutron instruments and high-dose equivalent rate photon instruments) shall be checked with a source during operation at least daily or prior to each intermittent use, whichever is less frequent. If at any time the instrument response to the source differs from the

reference reading by more than $\pm 20\%$ (for any photon instrument the reading should be at least ten times background), the instrument shall be returned to the calibration facility for calibration or for maintenance, repair, and recalibration, as required. Reference readings shall be obtained for each instrument when exposed to a source in a constant and reproducible manner, either at the time that the instrument is received in the field or before its first use." For the discussion that follows, we can assume that ± 20 percent is equivalent to a coefficient of variation (CV=standard deviation/mean value) of 0.20/3 Standard Deviations=0.067.

Acceptance ranges other than deviations of 20 percent from the mean are often specified as a function of the mean \pm a multiple of the standard deviation, recognizing that there will be failures. To reduce the probably of failing an instrument due to a statistical fluctuation, the function check is repeated and accepted if it then passes.

The response changes for a normally functioning instrument used in the gamma survey occur primarily as a result of small changes in the high voltage of the digital ratemeter. These changes may be induced by large changes in the temperature but are normally smaller than the allowable 20 percent change mentioned above. These changes are not source or count-rate dependent and thus they affect the background count rates as well as the count rate from a source. It unfortunately took four days before problems with the function check method were identified and rectified (September 13-17, 2007). The detectors were function-checked while mounted on the ATVs with the source placed on the ground. Larger deviations than normal resulted in the net count rates primarily due to changes in the detector height from tire pressure changes and possibly due to the suspension systems of the ATVs. The procedure was changed on September 18, 2007 by removing the detectors and placing them at a fixed distance from the source, resulting in a CV=0.02 for the 14 measurements taken during the last 7 days for both detector systems. No measurements were outside of the ± 20 percent limit (i.e., 0.067).

During the initial four-day period when the various procedures were applied in conducting the function checks, the data support that the morning checks differed by less than 20 percent from the checks made at the end of the day. Unfortunately, the function check for System A on September 14, 2007 at the end of the day did not have the same geometry as that at the beginning of the day, thus making a comparison impossible.

As stated above, performance changes in the detector systems will be reflected in changes in the background readings. In addition, the background count rates are less dependent on detector placement and therefore, in this case, may be used to evaluate whether the detectors were functioning properly each day. An analysis of the background count rate data taken the first four days of the survey shows that the detector systems have similar means with CVs of 0.05 and 0.04. Background data for the

last seven days of the survey were almost identical with the means differing by less than 3 percent from those during the first four days, with CVs of 0.04 for each detector system. All data were within ± 20 percent of the mean. Therefore, one can conclude that the responses of the detector systems during September 2007 were performing in a consistent manner each day throughout the survey period with CVs much less than allowed under ANSI N323A-1997.

To address the question regarding the missing function check data for July 18, 2008, a review of the field log books shows that the survey instruments were function-checked in the morning but not used on that day.

TR RAI-2.9-24

Consistent with Regulatory Guide 4.14 and NUREG-1569, Acceptance Criterion 2.9.3(1) provide the criteria used to establish TLD monitoring locations or indicate where this information can be found in the TR.

Response TR_RAI-2.9-24 Please see response TR_RAI-RC-2.9-1

TR RAI-2.9-25

NRC staff could not locate the laboratory reports for TLD results in the TR. Please provide this information or indicate where these can be found in the application.

Response TR RAI-2.9-25

The laboratory reports for the TLDs have been provided as **Attachment** A to TR Section-2.9 within this submittal **TR_RAI-Table 2.9-25** lists the Landauer Location ID Numbers shown on the reports against the sample location at which it was deployed. The table lists only those Landauer Location ID Numbers and locations for which results are available.

TR RAI-2.9-26

Please clarify and provide documentation for the monitoring period for AMS-01.

Response TR RAI-2.9-26

The reviewer is correct in that the time represented by the recovered TLDs was 164 days. This change has been incorporated in the revision to Section 2.9.5.2.1 that is addressed in the response to TR_RAI-2.9-27(a-c) as well as Section 9 of Appendix 2.9-A.

TR RAI-2.9-27

As the examples in the table below demonstrate, the ambient gamma dose rates provided in Table 2.9-10 in the TR indicate a significantly higher dose rate during the third time period (5/17/08 – 7/17/08) compared to the other measuring periods.

Station Dose Rates (mren	3 rd Measurement Period		
AMS-01	0.36	0.96	
AMS-06	0.35	0.85	
AMS-BKG	0.39	0.975	

a. Please provide justification that a TLD monitoring period for less than one full year is consistent with 10 CFR 40, Appendix A, Criterion 7. Specifically, please demonstrate that complete baseline data, including expected variations in gamma dose rates, has been provided in accordance with 10 CFR 40, Appendix A, Criterion 7, and as recommended by Regulatory Guide 4.14.

b. Referring to the above table, please update the discussion on ambient gamma dose rate monitoring, taking into account the variability of the data and the lack of data collected over an entire year.

c. In Section 2.9.2.1.1 of the TR, it is stated that the applicant collected GPS-based gamma dose rate data during two different time periods: September 2007 and July 2008. Additional data was collected for the land application area from July 17-19, 2008. These time periods appear to have potentially significantly different background gamma dose rate attributes. It appears that the applicant combined the data from these different time periods without accounting for the variations in background. Please address the following:

i) It is not clear which areas were surveyed during the July 14-16, 2008 timeframe. Please provide information on precisely which locations were surveyed and the corresponding dates.

ii) Considering the variations in expected gamma dose rates during different times of the year, please explain how the statistics for the GPS-based gamma ray surveys are affected by combining these different time periods. In your response, address the test for normality (and other types of distributions) of the data, transformations of the data, the identification of outliers, and the test for variance of the Main Permit Area, the anomalous north area and the Surface Mine Area.

iii) Considering the variations in expected gamma dose rates during the year, please explain how these variations will be taken into account when performing post reclamation and decommissioning radiological surveys to ensure appropriate action levels are established (e.g., that contamination above regulatory limits is detected).

Response TR RAI-2.9-27(a)

We agree with the observation that the average background dose equivalent rate is different for the three monitoring periods. We have re-evaluated the data and corrected some entry errors. We discovered that the dose equivalent rates had not considered the exposures that occurred during transit and while waiting to be deployed or processed. We adjusted the dose equivalent rates downward, by assuming that the dose rate for a TLD when not deployed was equal to the dose rate during deployment. This assumption is believed to be acceptable since all TLDs were deployed at locations believed to be background for the site. Since the third monitoring period was the shortest, this adjustment significantly reduced the previously reported dose equivalent rates for this period compared to the other periods.



The adjusted Table 2.9-10 presented in TR RAI Response Replacement Pages; Section 2.9-27(a) presents the individual exposure rates for periods for which data are available. The missing data occurred because the TLDs were not retrievable due to possible theft or, more probable, cattle either eating the dosimeters or dragging them away from the stations. Where data are available, there is good agreement between the relative dose equivalent rates per period for all stations. Our calculations show that the average rates are 0.30, 0.26, and 0.36 mrem/day for the first, second, and third measurement periods. While variations with time in cosmic radiation occur in an unpredictable manner, variations in the terrestrial component are known to occur and depend primarily on the amount of soil moisture, vegetation cover, and snow cover. All attenuate gamma-ray emissions and thus reduces the dose equivalent rate. The first two monitoring periods cover fall, winter and spring while the third period covers the early portion of summer. It is reasonable to assume that the higher average dose equivalent rates for summer are a result of lower average soil moisture and no snow cover. While late summer, the 29-day period for which monitoring was not done, can produce relatively high rainfall events, it is difficult to predict from one year to the next. It seems reasonable that the average daily dose rate for this unmonitored period could best be approximated by that of the third monitoring period. We have therefore calculated the projected annual dose equivalent at each monitoring station where the data are complete by assuming that the 29-day period had the same average dose equivalent rate as that of the respective third monitoring period.

Criterion 7 of 10 CFR 40 Appendix A requires that a monitoring program be established one full year prior to major site construction. Reg. Guide 4.14 is consistent with that requirement but allows periodic measurements and specifies that measurements should not be made when the soil is abnormally wet. We believe that the 11-month monitoring period provides a good measure of the expected annual dose equivalent rates. While these data are useful, they will not be used for compliance during operations since any impacts from operations will be determined by comparing the values at the monitoring locations to those obtained at the background station for each monitoring interval. The baseline direct gamma-ray survey data are considered the most useful baseline data since the gamma emission rates are mapped for the entire site.

The TLD results compare favorably with the baseline direct gamma-ray survey data for the site when expressed in exposure rate units, micoRoentgen per hour (μ R/h), where the average exposure rate was reported in the TR as 10.9 μ R/h. Since one Roentgen is approximately equal to one rem, 10.9 μ R/h can be expressed as approximately 95.5 mrem/year. This is very close to the 109 mrem/year average for the four monitoring locations reported in the table above.

During construction and operations, Powertech (USA) will establish permanent monitoring stations that are designed to limit easy access by animals and people. The impact at the locations from direct radiation will be determined by comparing the measured values to the value at the background location.

Response TR RAI-2.9-27b

Section 2.9.5.2.1 of the TR and Sections 9.2 and 11.0 of Appendix 2.9-A have been rewritten and provided within the replacement pages to reflect the response to RAI TR-2.9-27(b).

Response TR RAI-2.9-27c

i: The initial GPS-based gamma survey was done in the Main Permit and Surface Mine Areas using 500 meter and 100 meter transect spacings, respectively, from September 13-27, 2007. The boundary of the Main Permit Area was later extended to the southwest. The 500-meter survey lines were extended south to this new boundary by mobilizing to the site and conducting the survey on July 14, 2008. Work continued from July 17-19, 2008 where additional data within the land application areas were obtained to comply with the desire to have data on 100-meter transect spacings therein. Transect spacings of 100 meters were added within the previously determined 500-meter transects within the Land Application Areas only. The figure 3.1 in Appendix 2.9-A shows the survey data with 2007 and 2008 data points in different colors.

ii: The first issue to address is whether the data from 2007 and 2008 may be combined because of possible different background count rates. To provide maximum sensitivity, a search for overlapping areas was done where the overlap was in areas considered free of anomalies. Ten areas where there was overlap of the data (within 3 feet) from the two surveys were identified and corresponding count rates were recorded as shown in **TR_RAI-Table 2.9-26(2)**. The results confirm that the survey instruments produced count rates that were nearly identical, with a mean ratio of the two count rates of 1.01 with maximum difference of any two data points of 15 percent. An Anderson-Darling Test was done to see if the differences of the paired data were of a normal distribution. The results of the Anderson-Darling Test for normality yielded a p-value of 0.093 (cannot reject normal distribution hypothesis). Then a test was done to determine whether the differences were significantly different from 0. The results of the paired t-test were a p-value of 0.787 (cannot reject zero-difference hypothesis), an average difference of 84 cpm, and a 95% confidence interval on the average difference of (-603 cpm, 772 cpm). In summary, the two data sets are not statistically different from one another.

A significant effort was made to match the instrument responses to background radiation and radiation sources prior to deployment for the 2007 survey. In preparing for the 2008 survey, again the instrument performances were matched to one another and to the performances of the instruments used in 2007. Since the instrument responses in background areas were the same for the 2007 and 2008 surveys, we

therefore conclude that the background radiation was very similar for the two surveys and that merging the data was appropriate.

Location	Rate (cpm)	Rate (cpm)	2007:2008
1	12721	14985	0.85
2	12060	11309	1.07
3	12186	11299	1.08
4	11958	11562	1.03
5	15016	15074	1.00
6	13358	13752	0.97
7	13829	13970	0.99
8	12685	12207	1.04
9	15788	14633	1.08
10	12979	12945	1.00
		Mean	1.01

TR_RAI-Table 2.9-26(2): Data pairs from 2007 and 2008 surveys. Count 2008

Count Ratio

2007

A statistical evaluation of the total data set and sets of data corresponding to defined areas was presented in the TR_Appendix 2.9-A (Radiological Baseline Report), including tests for normality and log transforms. All frequency distributions were found to be nonparametric and conventional approaches were used to describe these distributions. We do not believe that a test of variance of the three defined areas would add anything meaningful to the discussion since the two areas were evident as different from the remainder of the permit area based on historical use and geological features.

iii: It should be noted that 10 CFR 40 Appendix A decommissioning regulations limit the radionuclide concentrations in soil. Compliance with the cleanup criteria is based on laboratory analysis of soil samples. While it is true that gamma-ray action levels are used to identify anomalies, the accuracy of the action levels is known to be limited, due to changes in background count rates, vertical distribution and



aerial extent of radionuclides, soil moisture, and other factors. Experience has shown that results of gamma surveys cannot be reliably interpreted if done when there is excessive soil moisture. This limitation in itself reduces the variation in background count rates during cleanup operations. Action levels are conservatively set and periodically revaluated during cleanup, especially when known changes may influence gamma-ray emissions. The confidence lines of correlations such as is those shown in Figures 5-1 and 5-2 of the Radiological Baseline Report are useful in establishing conservative gamma-ray actions levels. Normally the application of these conservatively chosen action levels results in cleanup to near background levels, in accordance with NRC's ALARA policy.

TR RAI-2.9-28

In Section 2.9.5.2.1 of the TR, the applicant excludes AMS-02 when discussing exposure rates. Please provide justification for excluding this data point.

TR RAI-2.9-29

Provide technical justification that the projected dose for AMS-03 is a valid estimate of the actual dose at this monitoring station.

Response TR RAI-2.9-28 and 29

External dose equivalent rate data from TLDs at Monitoring Stations AMS-04, AMS-05, AMS-07, and AMS-BKG are considered complete with the annual average dose equivalent rates for the four stations reported in the rewritten Section 2.9.5.2.1 of the TR as ranging from 91 to 123 mrem. These stations are located to the north, southwest, and south of the permit area, not near the formerly mined area or other known elevated exposure rate anomalies.

TLDs at the stations located within the permit area (AMS-01, AMS-02, AMS-03, and AMS-06) were eaten or otherwise removed by cattle for one or more of the monitoring periods. In re-evaluating the data, it was decided to not attempt to compute an annual average dose equivalent rate for these stations. To show compatibility with NRC guidance, we have relied on the extensive set of exposure rate data predicted from the GPS-based gamma surveys. The gamma-ray count rates were converted to exposure rates by developing a correlation with a pressurize ionization chamber (PIC). Using the permit area-wide (excluding the Surface Mine Area) average predicted exposure rate (10.9 μ R/hr) from the correlation, an annual dose equivalent rate was calculated for the permit area (10.9*8760 hrs/yr/1000= 96 mrem). As indicated in the rewrite of Section 2.9.5.2.1 of the TR, the annual gamma dose rate for the permit area (96 mrem) agrees well with the 109 mrem annual measured dose equivalent rate from the TLD data at the four monitoring stations where the data sets are complete.



TR RAI-2.9-30

Please provide the following:

a. Documentation for all statistical analyses (histograms, data transformations, etc.) performed on the GPS-based gamma surveys, including outputs from statistical software packages, or indicate where these can be found in the application.

b. Justification for utilizing the IQR as the sole means of proving outliers.

Response TR RAI-2.9-30a

The gamma data from the Main Permit Area, Surface Mine Area, and both land application areas (Dewey and Burdock) were analyzed separately with the statistical software package Minitab, version 15.1.1.0.

Main Permit Area

The gamma data from the Main Permit Area was tested for a normal distribution. **Figure TR_RAI-RC 2.9-30(1)** displays the results of the test as well as a histogram of the data and its statistical summary.

TR_RAI-Figure 2.9-30: Summary of statistics and normality test of gamma data from the Main Permit Area (in cpm).



The normality test rejected the null hypothesis of a normal distribution. The data was then tested for lognormal and exponential distributions. **Figures** *TR_RAI-2.9-30(2)* and *TR_RAI-2.9-30(3)* show the results of the tests for lognormal and exponential distributions, along with their respective probability plots.





TR_RAI- Figure 2.9-30(2): Results of the test for lognormal distribution on the data from the Main Permit Area and its probability plot.

TR_RAI- Figure 2.9-30(3): Results of the test for exponential distribution on the data from the Main Permit Area and its probability plot.





The tests rejected the null hypotheses of lognormal or exponential distributions. Each value in the set of data was transformed by taking its natural logarithm and the transformed data set was tested for a normal distribution. **TR_RAI- Figure 2.9-30(4)** displays the results of the test as well as a histogram of the transformed data and its statistical summary.

TR_RAI- Figure 2.9-30(4): Summary of statistics and normality test of transformed gamma data from the Main Permit Area.



The normality test shows that the transformed data is not from a normal distribution.

Surface Mine Area

The gamma data from the Surface Mine Area was tested for a normal distribution. **TR_RAI- Figure 2.9-30(5)** displays the results of the test as well as a histogram of the data and its statistical summary.





TR_RAI- Figure 2.9-30(5): Summary of statistics and normality test of gamma data from the Surface Mine Area (in cpm).



The normality test rejected the null hypothesis of a normal distribution. The data was then tested for lognormal and exponential distributions. **TR_RAI- Figure 2.9-30(6)** and **TR_RAI- Figure 2.9-30(7)** show the results of the tests for lognormal and exponential distributions along with their respective probability plots.







TR_RAI-Figure 2.9-30(6): Results of the test for lognormal distribution on the data from the Surface Mine Area and its probability plot.



TR_RAI-Figure 2.9-30(7): Results of the test for exponential distribution on the data from the Surface Mine Area and its probability plot.



The tests rejected the null hypotheses of lognormal or exponential distributions. Each value in the set of data was transformed by taking its natural logarithm and the transformed data was tested for a normal distribution. Figure 8 displays the results of the test as well as a histogram of the transformed data and its statistical summary.





TR_RAI-Figure 2.9-30(8): Summary of statistics and normality test of transformed gamma data from the Surface Mine Area.



The normality test shows that the transformed data is not from a normal distribution.





Land Application Area - Dewey

The gamma data from the Land Application Area - Dewey was tested for a normal distribution. Figure TR_RAI-RC 2.9-30(9) displays the results of the test as well as a histogram of the data and its statistical summary.





The normality test rejected the null hypothesis of a normal distribution. The data was then tested for lognormal and exponential distributions. **TR_RAI-Figure 2.9-30(10)** and **TR_RAI-Figure 2.9-30(11)** show the results of the tests for lognormal and exponential distributions along with their respective probability plots.



TR_RAI-Figure 2.9-30(10) Results of the test for lognormal distribution on the data from the Land Application Area - Dewey and its probability plot.



TR_RAI-Figure 2.9-30(11) Results of the test for exponential distribution on the data from the Land Application Area - Dewey and its probability plot.



The tests rejected the null hypotheses of lognormal or exponential distributions. Each value in the set of data was transformed by taking its natural logarithm and the transformed data was tested for a normal





distribution. **TR_RAI-Figure 2.9-30(12)** displays the results of the test as well as a histogram of the transformed data and its statistical summary.



TR_RAI-Figure 2.9-30(12): Summary of statistics and normality test of transformed gamma data from the Land Application Area - Dewey.

The normality test shows that the transformed data is not from a normal distribution.





Land Application Area – Burdock

The gamma data from the Surface Mine Area was tested for a normal distribution. **TR_RAI-Figure 2.9-30(13)** displays the results of the test as well as a histogram of the data and its statistical summary.





The normality test rejected the null hypothesis of a normal distribution. The data was then tested for lognormal and exponential distributions. **TR_RAI-Figure 2.9-30(14)** and **TR_RAI-Figure 2.9-30(14)** show the results of the tests for lognormal and exponential distributions along with their respective probability plots.





TR_RAI-Figure 2.9-30(14): Results of the test for lognormal distribution on the data from the Land Application Area - Burdock and its probability plot.



TR_RAI-Figure 2.9-30(15): Results of the test for exponential distribution on the data from the Land Application Area - Burdock and its probability plot.



The tests rejected the null hypotheses of lognormal or exponential distributions. Each value in the set of data was transformed by taking its natural logarithm and the transformed data was tested for a normal



distribution. **TR_RAI-Figure 2.9-30(16)** displays the results of the test as well as a histogram of the transformed data and its statistical summary.

TR_RAI-Figure 2.9-30(16): Summary of statistics and normality test of transformed gamma data from the Land Application Area - Burdock.



The normality test shows that the transformed data is not from a normal distribution.

Response TR RAI-RC 2.9-30b

Several tools were used, prior to the decision to use IQRs to evaluate outliers, including histograms, distribution tests, and probability plots. The results of the IQR analyses were used only for informational purposes. As described in the responses to Items 85-86, the outliers defined by using the IQR were not removed nor discounted in the statistical analysis of the GPS gamma data.

TR RAI-2.9-31

In Section 2.9.2.2.1 of the TR and Section 3.2 of Appendix 2.9-A of the TR, the applicant discusses outliers in the gamma-ray count rate data. Please provide the following information: a. Discuss how these outliers were treated in the statistical analysis of gamma ray count rates.

b. If outliers were rejected from the final data set, please describe any investigations performed by the applicant to determine the cause of the outlying observations. Specifically, the applicant should demonstrate that the outlying data is either an extreme manifestation of the random variability inherent in the data or that it is the result of gross deviation from prescribed experimental procedure or error in calculating or recording the numerical value (ASTM 2002).



Response TR RAI-2.9-31a

The outliers in the GPS gamma data were treated like the other GPS gamma data in the statistical analysis. The outliers were not rejected or otherwise discounted.

Response TR RAI-2.9-31b

None of the outliers were rejected from the final data set.

TR RAI-2.9-32

Please provide the following information related to the predicted site-wide exposure rates discussed in Section 2.9.2.2.2 of the TR:

a. Input parameters to, and results obtained from, Arc View GIS.

b. A description of the Arc View GIS interpolation scheme used, including the parameters to control how the scheme is applied.

c. Error estimates of the data presented in Figure 2.9-6, Predicted Site-Wide Exposure Rates, Grid Block Averages, in the TR.

Response TR RAI-2.9-32

General: TR Figure 2.9-6 (Predicted Site-Wide Exposure Rates, Grid Block Averages) is intended for informational purposes only, to qualitatively evaluate the relative spatial distribution of exposure rates across the permit area.

Response TR RAI-2.9-32a

The input parameters to Arc View GIS are gross gamma-ray count rates, in counts per minute (cpm), measured using matched sodium iodide detectors and recorded during the GPS-based survey. The results obtained from Arc View GIS are the predicted exposure rates, in μ R/hr, calculated by using the equation given in Section 2.9.2.2.2, (*Exposure Rate = 0.0007 x Gamma Count Rate + 2.02*). Using a minimum count rate cutoff of 5500 cpm and the maximum observed gamma count rate of 460,485 cpm, the minimum and maximum exposure rates of 5.9 to 324 μ R/hr were calculated.

Response TR RAI-2.9-32b

No interpolation of the data was performed. The grid block exposure rates presented in Figure 2.9-6 reflect the average of all predicted exposure rates, as calculated from the gross gamma-ray count rates that fall spatially within each 700- by 700-foot grid block boundary. In one aspect, this figure is unintentionally misleading. With a large gamma survey spacing throughout most of the site, approximately 40 percent of the grid blocks have no gamma readings from which to calculate an exposure rate. The GIS analysis of these grid blocks interpreted no gamma-ray count rates as a zero value instead of a null value. With a zero value used in the figure a dark green colored grid block (less than 12 μ R/hr) was displayed, though this was not the intent.

Response TR RAI-2.9-32c

We are unsure how error bars would be generated on this type of data set.

TR RAI-2.9-33

Please demonstrate that the reported data is consistent with Regulatory Guide 4.14 or justification for a higher LLD for Pb-210 in soil.

Response TR RAI-2.9-33

The LLDs were 1.9E-6 to 3.8E-6 μ Ci/g, but only for the land application samples. The LLD for lead-210 in the bulk of the data set, i.e., in samples collected from the Main Permit, Northeast, Roll Front and Surface Mine Areas was 1E-7 μ Ci/g. The Land Application sample results were not used in the statistical analysis of the permit area surface soils, as reflected in our response to RAI TR-2.9-35 (Items 92-94).

There 80 sample locations for which all the recommended LLDs in RG 4.14 are met for Pb-210.

In the Land Application Area, radium-226 will be the most sensitive radionuclide by which to assess operational impacts to surface soils. Regardless, future operational surface soil data will be collected with appropriate LLDs.

TR RAI-2.9-34

Please provide data that is consistent with Regulatory Guide 4.14 and NUREG-1569 or justification for an alternate methodology.

Response TR RAI-2.9-34

Section 2.9.3.1.1 describes our general soil sampling strategy at the Dewey Burdock site. Section 2.9.3.1.1 does not clearly identify that soil samples from a 0-5 cm depth were also collected at the AMS (Air Monitoring Station) locations. These samples were analyzed for natural uranium, thorium-230, radium-226, and lead-210. These parameters and locations are consistent with the guidance contained in RG 4.14. The data from these soil samples are provided in Table 2.9-5 of the TR.

Powertech (USA) chose to collect more samples from 0-15 cm because this is the depth at which the background radium-226 soil concentration in the cleanup standards contained in 10 CFR 40, Appendix A are defined. There are no comparable soil cleanup standards for a soil depth of 0 to 5 cm. Therefore, Powertech (USA) chose to focus the soil sampling effort on a soil depth that is applicable to a standard.

We recognize that the 0 to 5 cm soil depth is more sensitive to potential particulate depositional events resulting from facility operations. Considering this, the 0 to 5 cm soil samples were co-located with the air monitoring station locations, which were placed in areas most sensitive to airborne emissions from the facility. This is consistent with RG 4.14 recommendations. In addition, these locations will be included in the operational soil monitoring program.

The total number of surface soil sample locations (87: 80 to 15 cm and 7 to 5 cm) at Dewey-Burdock is consistent with that suggested by NUREG-1569 and RG 4.14.



TR RAI-2.9-35

Regarding the Ra-226 soil sampling results, please provide the following information: a. Documentation for all statistical analyses (histograms, data transformations, calculated p-values, etc.) performed on the Ra-226 soil sampling results, including outputs from statistical software packages, or indicate where these can be found in the application.

b. Justification for utilizing the IQR as the sole means of proving outliers. See related RAI regarding Direct Radiation given above for further explanation.

c. For outliers that were rejected from the final data set; please describe any investigations performed by the applicant to determine the cause of the outlying observations. Specifically, the applicant should demonstrate that the outlying data is either an extreme manifestation of the random variability inherent in the data, or that it is the result of gross deviation from prescribed experimental procedure or error in calculating or recording the numerical value (ASTM 2002).

Response TR RAI-2.9-35a

The Ra-226 soil sampling results were analyzed with the statistical software package Minitab, version 15.1.1.0.

First Set of 80 Locations

The Ra-226 soil sampling results from the first set of 80 locations were tested for a normal distribution. **TR_RAI- Figure 2.9-35(1)** displays the results of the test as well as a histogram of the data and its statistical summary.

TR_RAI- Figure 2.9-35(1): Summary of statistics and normality test of Ra-226 soil sampling results in the first set of 80 locations (in cpm).





The normality test rejected the null hypothesis of a normal distribution. The data was then tested for a lognormal distribution. **TR_RAI- Figure 2.9-35(2)** shows the results of the test along with its respective probability plot.

TR_RAI- Figure 2.9-35(2): Results of the test for lognormal distribution Ra-226 soil sampling results in the first set of 80 locations and its probability plot.



The test rejected the null hypothesis of a lognormal distribution.

Surface Mine Area

The Ra-226 soil sampling results from the Surface Mine Area were tested for normal and lognormal distributions. **TR_RAI- Figure 2.9-35(3)** displays the results of the normality test as well as a histogram of the data and its statistical summary.





TR_RAI- Figure 2.9-35(3): Summary of statistics and normality test of the Ra-226 soil sampling results from the Surface Mine Area.

The normality test rejected the null hypothesis of a normal distribution. The data was then tested for a lognormal distribution. **TR_RAI- Figure 2.9-35(4)** shows the results of the test for a lognormal distribution along with its probability plot.

TR_RAI- Figure 2.9-35(4): Results of the test for lognormal distribution of the Ra-226 soil sampling results from the Surface Mine Area and its probability plot.





The test rejected the null hypothesis of a lognormal distribution.

The box plot in Figure 3 shows five potential outliers (defined with *). The box plot marks any data beyond the range (Q1 - 1.5*IQR, Q3 + 1.5*IQR) as potential outliers. The five potential outlier sample locations were biased, based on an evaluation of the gamma survey results, and intended to capture the upper limit of radium-226 soil concentrations.

The test for a normal distribution was repeated with the outliers removed from the data. **TR_RAI- Figure 2.9-35(5)** displays the results of the test as well as a histogram of the data and its statistical summary.





The test rejected the null hypothesis of a normal distribution. The data was then tested for a lognormal distribution. **TR_RAI- Figure 2.9-35(6)** shows the results of the test for a lognormal distribution along with its probability plot.







TR_RAI- Figure 2.9-35(6): Results of the test for lognormal distribution of the Ra-226 soil sampling results from the Surface Mine Area and its probability plot, with the five outliers removed.

The test failed to reject the null hypothesis of a lognormal distribution, indicating that the data is adequately described by a lognormal distribution.

Main Permit Area

The Ra-226 soil sampling results from the Main Permit Area were tested for normal and lognormal distributions. **TR_RAI- Figure 2.9-35(7)** displays the results of the normality test as well as a histogram of the data and its statistical summary.


Summary of Ra-226 in Surface Soil (pCi/g) Main Permit Area Anderson-Darling Normality Test A-Squared 4.77 P-Value < 0.005 Mean 1.5145 StDev 0.7723 0.5965 Variance 3,3202 Skewness 14.5309 Kurtosis N 55 Minimum 0.9000 1st Quartile 1.1000 Median 1.3000 10 20 30 40 **3rd Quartile** 1.7000 Maximum 5.6000 95% Confidence Interval for Mean **[]-**** * 1.7233 1.3058 95% Confidence Interval for Median 1.1786 1.4214 95% Confidence Intervals 95% Confidence Interval for StDev 0.6502 0.9514 Mean Madia 1.2 13 1.4 1.6 17 1.8 15

TR_RAI- Figure 2.9-35(7): Summary of statistics and normality test of the Ra-226 soil sampling results from the Main Permit Area.

The normality test rejected the null hypothesis of a normal distribution. The data was then tested for a lognormal distribution. **TR_RAI- Figure 2.9-35(8)** shows the results of the test for a lognormal distribution along with its probability plot.







TR_RAI- Figure 2.9-35(8): Results of the test for lognormal distribution of the Ra-226 soil sampling results from the Main Permit Area and its probability plot.

The test rejected the null hypothesis of a lognormal distribution.

The box plot in Figure 7 shows three potential outliers (defined with *). The box plot marks any data beyond the range (Q1 - 1.5*IQR, Q3 + 1.5*IQR) as potential outliers. No errors were found associated with these potential outliers. The three potential outliers make up about five percent of the entire data set, therefore it was determined that their relatively high values were due to random measurement variability.

The test for a normal distribution was repeated with the outliers removed from the data. **TR_RAI- Figure 2.9-35(9)** displays the results of the test as well as a histogram of the data and its statistical summary.







TR_RAI- Figure 2.9-35(9): Summary of statistics and normality test of the Ra-226 soil sampling results from the Main Permit Area, with the three outliers removed.

The test rejected the null hypothesis of a normal distribution. The data was then tested for a lognormal distribution. **TR_RAI- Figure 2.9-35(10)** shows the results of the test for a lognormal distribution along with its probability plot.

TR_RAI- Figure 2.9-35(10): Results of the test for lognormal distribution of the Ra-226 soil sampling results from the Surface Mine Area and its probability plot, with the three outliers removed.



TR_RAI-Response Document



The test failed to reject the null hypothesis of a lognormal distribution, indicating that the data is adequately described by a lognormal distribution.

North Section of Main Permit Area and Land Application Areas

The Ra-226 soil sampling results from the north section of the Main Permit Area and the land application areas were not analyzed statistically.

Response TR RAI-.9-35b

Several tools were used, prior to the decision to use IQRs to evaluate outliers, including histograms, distribution tests, and probability plots. The set of the data from the Main Permit Area was initially found to be non-parametric. The IQR was used to help identify any potential outliers non-parametrically. The potential outliers found with the IQR test were not due to analytical errors and because of their small proportion of the data set (5%); they were considered outliers due to random measurement variability.

Response TR RAI-2.9-35c

The outliers in the data from the Surface Mine Area were biased samples, as described above.

Outliers in the data obtained in the Main Permit Area were due to random measurement variability, because they constituted a small portion of the data set (5%) and no analytical errors were associated with them.

TR RAI-2.9-36

Please provide input parameters to, and results obtained from, Visual Sampling Plan.

Response TR RAI-2.9-36

Visual Sampling Plan (VSP) was used to establish random sampling points. The input parameters were the shape files of the proposed permit boundary, Surface Mine and Land Application Areas; and the proposed number of samples for each area. The output of VSP was the coordinates for the samples.

TR RAI-2.9-37

The following questions pertain to the analytical methods described in 2.9.3.1.1 of the TR:

a. Consistent with Regulatory Guide 4.14, please provide the references for procedures used to convert the soil samples to a water matrix in order for the Environmental Protection Agency (EPA) drinking water testing methods to be used.

b. NRC staff cannot verify that analytical method 909.0M is included in the EPA document Prescribed Procedures for Measurement of Radioactivity in Drinking Water (EPA-600/4-80-032), 1980. Consistent with Regulatory Guide 4.14, please indicate where this analytical method can be found in the EPA document and a justification for its use.

c. The applicant indicates that Method 6020A of EPA Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods (SW-846) was used for analyzing natural uranium in soil samples. Section 1.2 of Method 6020A of SW-846 does not specifically list uranium as an acceptable analyte for inductively coupled plasma-mass spectrometry (ICP-MS). Consistent with Regulatory Guide 4.14, please provide the demonstration of performance discussed in Section 1.3 of Method 6020A of SW-846 as it applies to uranium in the matrix evaluated.

d. 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. 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. 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.

Response TR RAI-2.9-37a

EPA Method 3050B "Acid Digestion of Sediments, Sludges, and Soils" was used "convert" the soil into an aqueous matrix (EPA, 1996). This procedure is provided in **Appendix TR_RAI-RC 2.9-37** and listed in the references at the end of this document.

Response TR RAI-2.9-37b

EPA Method 909 "Determination of Lead-210 in Drinking Water" has been provided in **Appendix TR_RAI-RC 2.9-37** (EPA, 1982). As in EPA Method 6020A, EPA Method 3050B was used to "convert" from soil to aqueous matrix.

Response TR RAI-2.9-37c

A laboratory performance evaluation for uranium in a soil matrix using EPA Method 6020A has been provided in **Appendix TR_RAI-RC 2.9-37**.

Response TR RAI-2.9-37d

Type of gamma analysis performed on the soil samples to determine the Ra-226 concentration was closed can gamma analysis per a three inch can filled with ~ 150-200 grams of soil. The soil is dried, ground, split, canned and taped (EPA Method 901.1).

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 its branching ratio (relative strength) is higher than any other pertinent energies. The radium 226 photo peak cannot be used due to its overlap with the uranium 235 photo peak. Lead 214 has two 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.

Relevant laboratory documentation is provided in Attachment TR_RAI-2.9-37.

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TR RAI-2.9-38

The following questions pertain to deriving the gamma-ray count rate-soil Ra-226 correlation: a. Considering the variations in expected gamma dose rates during different times of the year, please explain how combining gamma surveys performed at different times during the year affect the statistics for deriving the gamma ray count rate-soil Ra-226 correlation and the predicted Ra-226 concentrations over the permit area.

b. In Section 2.9.2.2.3, the applicant stated that the linear regression formula for the gamma-ray count rate-soil Ra-226 correlation, after removing five outliers, is Radium-226 = 1.9*10-4 x Gamma-Ray Count Rate – 1.04, where the radium-226 concentration is in pCi/g and the gamma-ray count rate is in gross cpm. The applicant also stated in Section 5 of Appendix 2.9-A of the TR that this model has an R2 (coefficient of determination) value of 0.43, denoting a poor fit. NRC staff agrees with this assessment. In addition, work done by the authors previously cited by the applicant (Ott and Longnecker 2001) indicate that, based on this model, the gamma count rate is not a good indicator of Ra-226 concentration in soil. Please provide justification for utilizing a regression model that exhibits such a "poor fit" to predict Ra-226 concentrations in the Permit area.

Response TR RAI-2.9-38a

It is well known that high soil moisture and snow cover are the two most influential factors that contribute to reducing the exposure rate from radionuclides in the soil.

The use of a correlation to predict the Ra-226 in soil requires that all data, including the gamma survey and correlation data, be collected under similar soil moisture conditions. All data were gathered in fair weather during the late summers of 2007 and 2008 under similar soil moisture conditions.

Response TR RAI-2.9-38b

The presentation was unfortunately misleading in that an R² should not have been presented since the data were not randomly selected over the concentration range, a basic requirement for the R² value to be meaningful. That being said, Figure 5-2 of Appendix 2.9A of the TR clearly shows that within the range of concentrations that include natural background, the data support the least-squares-fit line although there is significant scatter. In determining the *average* Ra-226 concentration, we believe that the Central Limit Theorem applies in that while each data point will have a significant error associated with it, the mean concentration in an area, as determined by averaging many values, will have a much greater accuracy.

The uranium industry decommissioning programs have relied on gamma-ray count rate/Ra-226 correlations for several decades to identify Ra-226 contaminated soils requiring removal. High density gamma surveys are used along with the correlation to define contaminated areas exceeding cleanup criteria. Again, it is the Central Limit Theorem that allows a correlation with high scatter to be used to accurately characterize the average contamination in a land parcel. We therefore do not agree with the cited author that concluded that the gamma count rate is not a good indicator of Ra-226 concentration in soil.



TR RAI-2.9-39

The following questions pertain to the gamma/Ra-226 correlation grids discussed in Section 2.9.2.1.3 of the TR:

a. Please provide input parameters and results obtained from Arc View GIS.

b. Please provide a description of the Arc View GIS interpolation scheme used, including the parameters to control how the scheme is applied.

c. Please provide error estimates of the data presented in Figure 2.9-7, Predicted Site-Wide Radium-226 Concentrations, Grid Block Averages, in the TR. In the response, include a discussion of the various sources of error (e.g., seasonal variability in gamma dose rates, using a regression model with an R2 (coefficient of determination) value of 0.43, etc.)

Response TR RAI-2.9-39a and b

Please refer to our response to TR 2.9-32 (a) and (b) above. The gamma/Ra-226 correlation grids were developed using the same methods therein.

Response TR RAI-2.9-39c

Regarding error estimates for the data presented in Figure 2.9-7, please refer to our response to TR 2.9-32 (c), and TR-2.9-38 and b.

TR RAI-2.9-40

NRC staff has the following questions to understand site-wide radiological variations in areas expected to be impacted by operations and evaluating compliance with 10 CFR 40, Appendix A, Criterion 7.

a. Please demonstrate that a sufficient number of samples have been obtained in the Dewey area. It appears that very few radium samples have been obtained in the proposed area of the satellite processing plant and wellfield that could be impacted by operations. It also appears that no uranium or Th-230 samples were obtained in areas that could be impacted by operations.

b. Please demonstrate that a sufficient number of samples have been obtained in the Burdock area. While the applicant took more total samples in this area, it is not clear how many are in the area expected to be impacted by the central processing plant and the wellfield. In addition, it appears that very few uranium and Th-230 samples were obtained in these areas.

c. There appears to be no soil sampling data for the area between Dewey and Burdock. Please demonstrate that sufficient information has been obtained on the background soil levels to characterize expected transportation routes between these areas.

Response TR RAI-2.9-40a and b

RG 4.14 recommends collecting soil samples at 0 to 5 cm on 300-meter intervals in each of eight compass directions from the center of the milling area. In the case of the Powertech (USA) permit area, the recommendation results in 40 provisional sample locations. NUREG 1569 suggests soil samples be

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collected from 0 to 15 cm, assuming the same spatial distribution recommended in RG 4.14 results in an additional 40, totaling 80 sample locations. We have collected surface soil samples at 80 locations and supplemented the effort with the GPS-based gamma survey and correlation between radium-226 concentrations and gamma count rates. In addition, 18 samples were collected to further describe radionuclide concentrations in the Land Application Areas. We have met the intent, based on numbers of soil sample locations, described in RG 4.14 and NUREG 1569.

NUREG/CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination (NRC, 1992) describes a method to determine an adequate sample size (N), where t is the t-statistic, r is the relative fractional error, and cv is the coefficient of variation.

A 95% confidence level with the degrees of freedom approaching infinity yields a t statistic of 1.645. **Figure TR_RAI-2.9-40(1)** shows the plot of this equation for a relative fraction error of 10 and 20 percent for various values of coefficients of variation.

 $N > \left(\frac{t}{r}cv\right)^2$

The mean and standard deviation of the radium-226 concentrations in the 55 samples collected in the Main Permit Area are 1.51 and 0.77 pCi/g, respectively. The coefficient of variation for the samples is 0.77/1.51=0.5. Inspection of the plot in Figure 1 indicates that about 20 and 70 samples are sufficient for collection for relative fraction errors of 10 and 20 percent, respectively. The collection of 55 samples is acceptably within this range. Therefore, we have adequately described the radium-226 concentration in the entire permit area.

The frequency at which the other radionuclides (thorium-230, lead-210, and natural uranium) were analyzed is consistent with the recommendations of RG 4.14.

Eighteen surface soil samples were collected in the Dewey and Burdock Land Application Areas, as shown in Figure 2.9-10 of the TR. All of these samples were analyzed for the radium-226, thorium-230, lead-210, and natural uranium.





TR_RAI- Figure 2.9-40(1): Plot of the equation used to determine an adequate sample size

Response TR RAI-2.9-40c

Please refer to our response to TR-2.9-40 a and b above. The area between Dewey and Burdock, including the county road, has been sufficiently characterized by way of GPS-based gamma surveys and correlation between gamma count rates and radium-226 concentrations in soil.

TR RAI-RC-2.9-41

Please address inconsistency that refers to PSC02 in TR Sec 2.9.4.3 (p2-349) as downstream and in Table 2.7-20 as upstream of Pass Creek.

Response TR RAI-2.9-41

PSC02 is considered the upstream site on Pass Creek; site PSC01 is downstream. Table 2.7-20 and Plate 2.5-1 are correct. The text in Sec 2.9.4.3 is corrected below:

"Radionuclide concentrations in sediment at downstream locations of Pass Creek (PCSO1) and Cheyenne River (CHRO5) are elevated compared to upstream locations for the same surface water bodies indicating potential impacts from mineralized areas on and adjacent to the site."

TR RAI-2.9-42

The staff could not locate laboratory reports for sediment samples. Please provide these reports or specify where these can be found in the application.

Response TR RAI-2.9-42



Laboratory reports are submitted within Replacement Pages for TR_Section 2.9.

TR RAI-2.9-43

Regarding the applicant's preoperational surface water monitoring program, please address the following issues.

a. The applicant only sampled a "representative" number of impoundments resulting in including only 11 impoundments in its preoperational surface water monitoring program as shown on Table 2.7-20 of the TR.

b. The grid 14 on Plate 2.5-1 appears to have three separate drainages exiting the Permit Area, yet they were not sampled.

Response TR RAI-2.9-43a

a. See Response: to TR_RAI-2.7-18; this addresses the quantity of impoundments verified.

Due to the number of impoundments, their relatively small drainage basin, and the tendency of many to be dry after substantial rainfall, sampling a representative subset of the water impoundments was proposed. Impoundments were selected based on the presence of water, drainage area, and location. Eleven surface water impoundments were selected to construct a representative sampling group for the Dewey-Burdock Permit Area.

Response TR RAI-2.9-43b

Referring to Plate 2.5-1 "Sampling Locations" within Sec.14, T7S, R1E there are three drainage features passing through this section. However, all three contain impoundments i.e. SUB10 located downstream of the PAA and on the easternmost drainage feature within Section 23; SUB08 and SUB09 located within the PAA on Section 14. All three Subimpoundments were sampled and the drainage features associated with these impoundments were observed as dry during each quarterly sampling event. The only drainages with reportable flow were Pass Creek, Beaver Creek and Cheyenne River, even the day preceding a flood event during 2008 there were no reportable flows for other drainage features.

<u>TR_RAI-2.9-44</u>

Provide locations to monitoring stations BVC04, CHR05, and BEN01 on Plate 2.5-1 or correct the text to incorporate the correct reference.

<u>Response TR_RAI-2.9-44</u>

Locations for surface water sampling stations BVC04, CHR05 and BEN01 are located in the TR on Figure 2.9-11.

TR RAI-2.9-45

The staff could not locate PSCOI on Plate 2.5-1 of the TR. However there is a PS-I sampling location. Please verify whether these two monitoring stations are the same or not.

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Response TR RAI-2.9-45

These sites are not the same sites. Site PSC01 is a surface water quality sampling site for the Dewey-Burdock baseline study and is located in Sec. 3, T7S, R1E. Site PS-1 is a site that was used in the Cheyenne River TMDL project and is located in Sec. 9, T7S, R1E. This site and other similar sites do not pertain to this project and should not have been included on the sampling map. Plate 2.5-1 is being resubmitted to the NRC within this response package as "Plate 2.5-1 Revised".

TR RAI-2.9-46

Regulatory Guide 4.14 recommends sampling at the site boundary or at a location immediately downstream of the area of potential influence. BVC01 (Beaver Creek downstream) and UNT01 (Unnamed Tributary) do not appear to comport with this recommendation. Please demonstrate that these sampling sites are consistent with Regulatory Guide 4.14.

Response TR RAI-2.9-46

Several considerations went into developing the water quality sampling program for baseline characterization; some factors that went into the decisions for example consisted of the following:

- Water bodies of concern
- Water sample accessibility
- Changes in water source (i.e., the convergence of two or more creeks, the effects of Subimpoundments)
- Seasonal conditions of flow

The BVC01 site location while it is not located at the site boundary as recommended in Regulatory Guide 4.14, does best characterize the water quality directly below the site where the Pass Creek/Beaver Creek confluence is located. Beaver Creek is perennial with ephemeral tributaries present and therefore just below the confluence with Pass Creek served best for obtaining a representative water quality sample that may be indicative of the highest concentrations of potential pollutants that may be present in runoff from the site at any given time.

The UNT01 location was chosen as the most suitable location due to drainage formation and accessibility for purposes of installing a passive sampler. One flow event was captured on the night of a flood event recorded on July 18th, 2008.

Surface water sampling locations were selected based on site-specific considerations in coordination with guidance from RG 4.14, therefore sampling efforts were conducted to obtain the most complete and representative baseline data as described in 10 CFR 40 and consistent with RG 4.14.

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TR RAI-2.9-47

The NRC staff did not find data for Pb-210 and Po-210 (Appendix 2.7-F) for sampling locations PSC01 and UNT01. Please provide the data or a justification of why the current data set is consistent with Regulatory Guide 4.14.

Response TR RAI-2.9-47

Samples collected at both PSC01 and PSC02 on 7/19/2007 were not analyzed for Pb-210 or Po-210. At the time, the list of constituents to be analyzed had not been finalized and did not include Pb-210 or Po-210. By September 2007 the analysis list was finalized and future samples included these constituents. Additionally, samples collected via passive samplers were also not analyzed for Pb-210, Po-210, and other constituents for the fact that the holding time had been exceeded.

TR RAI-2.9-48

Provide data for Ra-226, Th-230 and uranium for sampling location BVC01 or a justification of why the data set is consistent with RG 4.14

Response TR RAI-2.9-48

Ra-226 total and U total were measured, however, Th-230 had not been added to the list of analytes at the time of the July 2007 sampling event. The August 2007 sample analysis included U suspended and U total which U dissolve can be derived from. Ra-226 total was also measured for the August 2007 sample and reported as non detectible at a RL of 0.2At that time, the list of constituents was in the process of modification between the suggested list identified in RG 4.14 and the preoperational baseline constituents identified in NUREG 1569 and for this reason did not include Th-230 as an analyte. Shortly thereafter, the analysis list was finalized and future samples included these constituents. The sample collected on November 19, 2007 is missing a value for Ra-226 (dissolved) in the TR appendix; this sample had a non-detected value of Ra-226 (dissolved) or a value of <0.2 pCi/L.

TR RAI-2.9-49

Provide missing data of a justification of why the data set is consistent with RG 4.14 for SUB01, SUB03,SUB04-SUB06, SUB08-SUB11

Response TR RAI-2.9-49

SUB01 – missing quarterly samples for Ra-226, Th-230, and uranium; also missing semiannual samples for Pb-210 and Po-210

SUB01 was visited quarterly from June 2007 through June 2008. During this time, SUB01 was visited in September 2007, November 2007, March 2008, and June 2008. The subimpoundment, or stock pond, was dry in both September 2007 and November 2007; hence no sample was able to be collected at those times and thus explaining the missing quarterly samples. For Po-210 and Pb-210, these two constituents were only required to be sampled semiannually; during the sampling period, Po-210 and

Pb-210 were analyzed for in every quarter except the winter of 2008 (January through March 2008). One of the two samples (June 2008) that were collected at SUB01 includes data for Po-210 and Pb-210. The other sample collected in March 2008 was collected during that period in which Po-210 and Pb-210 were not analyzed.

SUB03 – missing quarterly samples for Ra-226, Th-230, and uranium.

SUB03 was visited quarterly from June 2007 through June 2008. During this time, SUB03 was visited in September 2007, November 2007, February 2008, and June 2008. The subimpoundment, or stock pond, was dry in both September 2007 and February 2008; hence no sample was able to be collected at those times and thus explaining the missing quarterly samples.

SUB04 – missing quarterly samples for Ra-226, Th-230, and uranium.

SUB04 was visited quarterly from June 2007 through June 2008. During this time, SUB04 was visited in September 2007, November 2007, February 2008, and June 2008. The subimpoundment, or stock pond, was dry in both September 2007 and February 2008; hence no sample was able to be collected at those times and thus explaining the missing quarterly samples.

SUB05 – missing all sampling data.

SUB05 is a detention pond below the Darrow Pit mines and was visited quarterly from June 2007 through June 2008 and was determined to be dry on each of the quarterly sampling dates. Dates of visits include 9/27/07, 11/27/07, 3/24/08, and 6/18/08 [Krantz and Lambert, 2008]. Note, a staff gage was installed at this site on 10/27/07. On the date the gage was installed, quarterly samples were not scheduled and the field technician did not have the necessary equipment to collect a sample from the puddle. Upon the next visit to this site, the impoundment was again dry.

SUB06 – missing quarterly samples for Ra-226 (dissolved).

Ra-226 (dissolved) for the sample collected at SUB06 on 11/27/2007 has a value of 2.0 pCi/L. Total Ra-226 was not calculated by the laboratory in September 2007 for an unknown reason.

SUB08 – missing quarterly samples for Ra-226 (dissolved).

Radium-226 (dissolved) data is not in the TR or geodatabase for 11/27/2007. Upon reviewing the lab report, the missing radium-226 data for SUB08 on 11/27/2007 has a value of 0.5 pCi/L.

SUB09 – missing quarterly samples for Ra-226, Th-230, and uranium; also missing semiannual data for Po-210 and Pb-210.

SUB09 was visited quarterly from June 2007 through June 2008. During this time, SUB09 was visited in September 2007, November 2007, March 2008, and June 2008. The subimpoundment, or stock pond, was dry in both September 2007 and November 2007; hence no sample was able to be collected at those times and thus explaining the missing quarterly samples. For Po-210 and Pb-210, these two constituents were only required to be sampled semiannually; during the sampling period, Po-210 and Pb-210 and Pb-210 were analyzed for in every quarter except the winter of 2008 (January through March 2008). One of the two samples (June 2008) that were collected at SUB09 includes data for Po-210 and Pb-210.



The other sample collected in March 2008 was collected during that period in which Po-210 and Pb-210 were not analyzed.

SUB10 – missing quarterly samples for Ra-226, Th-230, and uranium; also missing semiannual data for Po-210 and Pb-210

Like other subimpoundments, SUB10 was visited quarterly from June 2007 through June 2008. During this time, SUB10 was visited in September 2007, November 2007, March 2008, and June 2008. The subimpoundment, or stock pond, was dry in both September 2007 and November 2007; hence no sample was able to be collected at those times and thus explaining the missing quarterly samples. For Po-210 and Pb-210, these two constituents were only required to be sampled semiannually; during the sampling period, Po-210 and Pb-210 were analyzed for in every quarter except the winter of 2008 (January through March 2008). One of the two samples (June 2008) that were collected at SUB10 includes data for Po-210 and Pb-210. The other sample collected in March 2008 was collected during that period in which Po-210 and Pb-210 were not analyzed.

SUB11 – missing quarterly samples for Ra-226 (dissolved)

Radium-226 (dissolved) data is not in TR or geodatabase for 11/27/2007. Upon reviewing the lab report, the missing radium-226 data for SUB11 on 11/27/2007 is a non-detect with the reporting limit of 0.2 pCi/L.

TR RAI-2.9-50

Consistent with Regulatory Guide 4.14, provide the value of the Lower Limit of Detection (LLD) along with a description of the calculation of the LLD for surface water measurements.

Response TR RAI-2.9-50

The LLD (lower limit of detection) or PQL (practical quantitation limit) as reported by Energy Laboratories is available in the TR; Section 2.7.3.1.1 Table 0-1 "Number of Surface Water Samples Collected, Analytical Method, and PQL by Constituent".

For the description of the calculation see - **Response: TR_RAI-RI-4** "Description and Basis for Analytical Results and Reporting for LLD and Error".



TR_RAI Section 2.9.6.1

Methods

Air Particulate Sampling Locations Criteria

1



TR_RAI Section 2.9.6.1

Methods

Determination of Filter Saturation



TR_RAI Section 2.9.6.1

Methods

Additional Information: Sampling Equipment Calibration



TR Section 2.9.6.2

Air Particulate Sampling Results

Tables 2.9-13 and 14



Applicable to Monitoring Collection Dates

TR Section 2.9.6.1 through 2.9.6.3

And Associated calculation in Appendix 2.9-A; Section 8.1.1 and 8.2.1



2.9.5.3 Conclusions

In terms of effluent limits, the measured values exceed the 10 CFR 20 limit of 0.1 pCi/L for radon-222 with daughters present. However, on average the measured values are within the range of reported worldwide ambient background radon concentrations, 0.027 to 2.7 pCi/L (United Nations Scientific Committee on the Effects of Atomic Radiation [UNSCEAR], 2000).

2.9.6 Air Particulate Monitoring

Air particulate monitoring was conducted at the project for one year. Particulates were collected using high volume air samplers.

2.9.6.1 Methods

NUREG 1569 (NRC, 2003), Section 2.9.3 states that the characterization of the site background radiological characteristics is acceptable if the monitoring programs, including sampling frequency, methods, locations and density are established in accordance with pre-operational monitoring guidance provided in Regulatory Guide (RG) 4.14, Revision 1, Section 1.1 (NRC, 1980). In addition, air monitoring stations are to be located in a manner consistent with the principal wind directions as discussed in Section 2.5 of NUREG 1569. The predominant wind directions at the site, as shown in the annual wind rose in Appendix 2.5-C of the Technical Report (TR), are from the northwest and the southeast. Demonstration of how the pre-operational air particulate monitoring locations meet or exceed the recommendations in RG 4.14 is shown below.

Table 12 compares the air monitoring station locations suggested by RG 4.14 to those established for the site. The locations of the air monitoring stations are shown on Figure 2.9-8 (p. 2-325) of the TR.

The air monitoring locations suggested by RG 4.14 were developed for a conventional uranium mill. The "site boundary" for a conventional uranium mill is typically the restricted area and members of the public are precluded from entering the restricted area. Uranium in-situ recovery operations typically have a restricted area around the central processing plant much like a conventional mill, but the site boundary includes the well fields and represents a much larger area. In addition, it is not uncommon for residences to be located within the "site boundary" at a uranium in-situ recovery facility. This scenario changes the monitoring focus from the site



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boundary in the case of conventional mills, to actual receptors in the case of in-situ recovery operations.

The number of air monitoring locations at the site is consistent with the guidance in RG 4.14 and exceeds the minimal recommendation of four locations. The number and locations reflect the change of emphasis from permit boundary to receptor monitoring as discussed in Table 1.

Regulatory Guide 4.14	Actual Dewey Burdock Pre-Operational Monitoring Locations
Suggested Location	
Three locations at or near	AMS-01 is near the eastern permit boundary of the southern portion of the
the site boundary	site; approximately 2 kilometers (km) east of the proposed central processing plant (CPP). AMS-01 was positioned here to evaluate particulate emissions potentially resulting from disturbed areas associated with existing
	open pit uranium mines to the west and northwest of this location.
	AMS-02 is near the site boundary in the center of the site. It is approximately 3.5 km east southeast of the proposed satellite facility in the northern portion of the site and 2.5 km northwest of the proposed CPP in the southern portion of the site. This location includes a residence. AMS-02 was positioned here to evaluate particulate emissions potentially resulting from both the proposed satellite facility and the CPP at a residence and permit boundary receptor in predominant wind directions from both proposed facilities.
	AMS-03 is near the northwest site boundary of the northern portion of the site. It is approximately 2 km northwest of the proposed satellite facility. This location includes a residence. AMS-03 was positioned here to evaluate particulate emissions potentially resulting from the proposed satellite facility at a residence and permit boundary receptor in a predominant wind direction.
	AMS-06 is near the southwest permit boundary of the southern portion of the site. It is approximately 3 km southwest of the proposed CCP. Currently no residents are at this location. AMS-06 was positioned here to evaluate potential particulate emissions from the proposed CCP at a boundary receptor southwest of the CCP.

Table 2.0.11.	Dogulator	Guida A 1A	recommended	vorcus actual	air monitoring	locations
1 able 2.9-11:	Regulatory	y Gulae 4.14	recommended	versus actual	air monitoring	locations.

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Table 2.9-12:	Regulatory	Guide 4.14	recommended	versus a	actual air	monitoring	locatio	ns
(concluded)								

Regulatory Guide 4.14	Actual Dewey Burdock Pre-Operational Monitoring Locations
Suggested Location	
If within 10 kilometer of the site, an air sampler should be at or near the structure with the highest predicted airborne radionuclide concentration due to milling operations and at or near at least one structure in any area where predicted doses	AMS-04 is approximately 4 km north of the proposed satellite facility in the northern portion of the site. This location includes a residence within the town of Dewey. AMS-04 was positioned here to evaluate potential emissions from the proposed satellite facility in the town of Dewey. AMS-05 is approximately 5 km south of the proposed CPP in the southern portion of the site. This location includes a residence and is near Dewey Road and the Burlington Northern Railroad. AMS-05 was positioned here to evaluate potential emissions from the proposed CPP as well as from trains hauling coal from the Powder River Basin of Wyoming.
exceed five percent of the standards in 40 CFR Part 190.	AMS-07 is approximately 7 km south of the proposed CPP in the southern portion of the site. This location includes a residence and is near Dewey Road and the Burlington Northern Railroad. It was positioned here to evaluate potential emissions from trains hauling coal from the Powder River Basin of Wyoming.
A remote location that represents background conditions at the mill site.	AMS-BKG is approximately 7 km south of the proposed satellite processing plant and 6 km east southeast of the proposed CPP. AMS-BKG is in one of the least prevalent wind directions from both the proposed satellite plant and the CPP. It is also located away from the Burlington Northern Railroad. It is expected that this location would be unaffected by mining or other related uranium recovery operations.

Eight Hi-Q Model HVP-4200AFC high volume air samplers were established within and surrounding the proposed permit area. The samplers operated nearly continuously from August 2007 to August 2008.

The model number of the high volume air sampler used at the Dewey-Burdock site was an HVP-4200AFC. The unit is manufactured by Hi-Q Environmental Products Company, San Diego, CA. The procedure to operate and maintain this equipment is described in the manufacturer's operations and maintenance manual (Hi-Q, 2006). The samplers were purchased new from the manufacturer and deployed on or near August 13, 2007. The operations and maintenance manual states that the unit is calibrated before leaving the factory and there is no need to calibrate it upon use.



The operations and maintenance manual also states that all air flow devices should be recalibrated at least once a year against a traceable standard. Air monitoring was discontinued on August 13, 2008, one year after installation.

The locations of the air samplers are shown on Figures 2.9-8 and 2.9-13.

Each high volume air sampler was equipped with an 8-in. by 10-in. 0.8 micron glass fiber filter paper. The air filters were collected approximately bi-weekly, prior to saturation, from each of the eight air samplers. Flow rate and total flow data were recorded at the same time. The samples were collected as follows:

- Period 1: August 28 to October 2, 2007
- Period 2: October 2, 2007 to January 1, 2008
- Period 3: January 4 to April 1, 2008
- Period 4: April 1 to July 9, 2008
- Period 5: July 9 to August 13, 2008

No attempt was made to determine the level of filter saturation or dust loading. An approximately bi-weekly filter collection was chosen for the following reasons:

- 1. The high volume air sampler model number was an HVP-4200AFC manufactured by Hi-Q Environmental Products Company, San Diego, CA. This air sampler contains a three stage centrifugal blower powered by a brushless, variable speed motor. The motor speed is controlled by a programmable logic controller that accepts input from a mass air flow sensor placed in the air flow path downstream of the filter paper. Any changes in the pre-set flow rate due to changes in dust loading, barometric pressure and temperature are detected by the air flow sensor. The programmable logic controller compensates for these changes by adjusting the motor speed to maintain the pre-set flow rate.
- 2. If dust loading is large enough that the motor cannot adjust air flow to compensate, the air flow rate will decrease. The HVP-4200AFC contains an air flow totalizer which can be reset at the time of the filter change out. If an unforeseen dust loading event occurs that overcomes the motor's ability to compensate and the air flow is reduced, the total volume of air sampled is still known.



3. The Dewey Burdock area is in rural South Dakota. Given the site location, coupled with the features of the sampling unit described above, it was not expected that total suspended particulate concentrations in air would interfere with air flow rates over a two week period.

Filters were composited quarterly and sent to the laboratory. At the laboratory, all the filters within the composite were digested together, using acid. The digestate was then analyzed for the appropriate radionuclides. The glass fiber filters contain materials which can interfere with radiochemical procedures at the vendor laboratory. Limiting the number of filters by collecting quarterly composites reduced the potential of sample matrix interference.

The samples were composited and digested by the external independent analytical laboratory. The samples were analyzed for radium-226, thorium-230, natural uranium, and lead-210, using the same methods as listed for the soil samples.

The laboratory data were reported in units of picocuries per filter composite (pCi/f). The data were converted to units of micocuries per milliliter (μ Ci/ml), as follows:

Concentration,
$$\mu Ci / ml = \frac{Filter \ Concentration}{Total \ Flow} (1*10^{-12})$$

The units of total flow and filter concentration in the equation are cubic meters and pCi/f, respectively. The resulting concentrations for each radionuclide and high volume sampler were compared to effluent concentration limits listed in Table 2 of 10 CFR 20 Appendix B and reported in Table 2.9-12 as percentages of the respective effluent limits. The most conservative effluent limits were applied to thorium-230 ($3*10^{-12} \mu$ Ci/ml) and lead-210 ($6*10^{-13} \mu$ Ci/ml). The Class D and W limits were applied to natural uranium ($3*10^{-12} \mu$ Ci/ml) and radium-226 ($9*10^{-13} \mu$ Ci/ml), respectively.

2.9.6.2 Air Particulate Sampling Results

In general and relative to one another (e.g., natural uranium to radium-226), the average concentrations of radionuclides were consistent at each location from period to period. The lowest average concentration was radium-226, followed by thorium-230, natural uranium, and lead-210. Average radium-226 concentrations were five orders of magnitude lower than lead-210

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Site-wide, the data can be summarized as follows:

- Natural uranium concentrations ranged from $-3.0*10^{-17}$ to $1.5*10^{-14}$ µCi/ml and averaged $1.4*10^{-15}$ µCi/ml.
- Thorium-230 concentrations ranged from $-1.5*10^{-18}$ to $5.6*10^{-17}$ µCi/ml and averaged $1.2*10^{-17}$ µCi/ml.
- Radium-226 concentrations ranged from $-4.9*10^{-17}$ to $5.3*10^{-17}$ µCi/ml and averaged $1.6*10^{-18}$ µCi/ml.
- Lead-210 concentrations ranged from $6.0*10^{-15}$ to $4.1*10^{-14} \,\mu\text{Ci/ml}$ and averaged $1.5*10^{-14} \,\mu\text{Ci/ml}$.

There are no clear patterns in the radionuclide concentrations, when evaluating them spatially or temporally. Natural uranium concentrations at each location fluctuated between the orders of 10⁻¹⁷ and 10⁻¹⁴ μ Ci/ml over the course of monitoring. The high end of this range occurred in the first monitoring period and is likely due to the low sensitivity of the uranium analytical results and not actual uranium concentrations in air. The uranium concentrations in air for the first monitoring period were reported at their detection limits. Thorium-230 concentrations fluctuated between the orders of 10⁻¹⁷ and 10⁻¹⁸ μ Ci/ml. Radium-226 concentrations fluctuated between the orders of 10⁻¹⁷ and 10⁻¹⁸ μ Ci/ml. Finally, lead-210 concentrations at each location were all on the order of 10⁻¹⁴ μ Ci/ml over the course of monitoring.



Table 2.9-12:	Radionuclide	Concentrations	in Air
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		Concentration (µCi/ml)							% of Effluent Concentration			ation	Lower Limit of Detection (µCi/ml)			
Location	Period	U-nat	Th-230	Th-230 2σ Error	Ra-226	Ra-226 2σ Error	Pb-210	Pb-210 2σ Error	U-nat	Th- 230	Ra- 226	Pb- 210	U-nat	Th-230	Ra-226	Pb-210
	1	7.1E-15	1.7E-17	2.8E-17	5.3E-17	4.3E-17	2.4E-14	6.2E-16	0.24%	0.00%	0.01%	4.00%	7.1E-15	4.2E-18	4.8E-17	2.1E-17
	2	0.0E+00	1.6E-18	1.1E-17	7.2E-18	9.1E-18	4.1E-14	6.9E-16	0.00%	0.00%	0.00%	6.78%	1.6E-16	1.6E-18	1.6E-18	7.9E-18
AMS-01	3	-1.3E-17	3.4E-18	1.0E-17	1.8E-17	1.7E-17	2.1E-14	3.5E-16	0.00%	0.00%	0.00%	3.54%	1.7E-18	1.7E-18	1.2E-17	2.1E-16
	4	2.4E-17	1.3E-17	9.8E-18	1.4E-17	9.7E-18	2.1E-14	4.9E-16	0.00%	0.00%	0.00%	3.51%	1.5E-18	1.5E-18	8.3E-18	4.2E-16
	5	-1.7E-17	6.5E-18	2.5E-17	-3.1E-17	2.7E-17	1.0E-14	6.5E-16	0.00%	0.00%	0.00%	1.74%	4.3E-18	4.3E-18	5.6E-17	6.7E-16
	1	7.0E-15	4.1E-18	2.8E-17	-8.3E-18	2.9E-17	1.1E-14	4.5E-16	0.23%	0.00%	0.00%	1.85%	7.0E-15	4.1E-18	3.7E-17	2.1E-17
	2	0.0E+00	1.6E-17	1.1E-17	-2.3E-18	7.0E-18	2.0E-14	4.7E-16	0.00%	0.00%	0.00%	3.26%	1.5E-16	1.5E-18	1.5E-18	7.6E-18
AMS-02	3	-2.0E-17	4.7E-18	1.1E-17	-8.6E-18	1.3E-17	8.9E-15	2.5E-16	0.00%	0.00%	0.00%	1.49%	1.6E-18	1.6E-18	1.1E-17	1.9E-16
	4	4.2E-18	0.0E+00	7.4E-18	-4.2E-18	7.4E-18	8.2E-15	4.2E-16	0.00%	0.00%	0.00%	1.37%	1.4E-18	1.4E-18	7.6E-18	3.9E-16
	5	-1.3E-17	0.0E+00	8.0E-18	-4.9E-17	2.3E-17	1.5E-14	6.5E-16	0.00%	0.00%	0.00%	2.44%	4.0E-18	4.0E-18	5.3E-17	6.2E-16
	1	5.0E-15	-1.5E-18	2.0E-17	-5.9E-18	2.1E-17	1.2E-14	3.7E-16	0.17%	0.00%	0.00%	1.97%	5.0E-15	3.0E-18	2.7E-17	1.5E-17
	2	0.0E+00	9.3E-18	1.0E-17	5.4E-18	8.9E-18	1.3E-14	3.9E-16	0.00%	0.00%	0.00%	2.16%	1.6E- 1 6	1.6E-18	1.6E-18	7.8E-18
AMS-03	3	-3.0E-17	9.3E-18	1.2E-17	-1.4E-17	1.3E-17	9.2E-15	2.5E-16	0.00%	0.00%	0.00%	1.53%	1.5E-18	1.5 E- 18	1.2E-17	1.9E-16
	4	1.8E-17	8.9E-18	9.0E-18	9.6E-18	9.5E-18	8.0E-15	4.4E-16	0.00%	0.00%	0.00%	1.34%	1.5E-18	1.5E-18	8.9E-18	4.1E-16
	5	-1.6E-17	1.9E-17	9.7E-18	-3.2E-18	3.1E-17	1.2E-14	6.5E-16	0.00%	0.00%	0.00%	1.99%	4.2E-18	4.2E-18	5.0E-17	6.6E-16
	1	5.0E-15	5.9E-18	2.5E-17	4.6E-17	2.9E-17	1.1E-14	3.7E-16	0.17%	0.00%	0.01%	1.89%	5.0E-15	3.0E-18	3.0E-17	1.5E-17
	2	0.0E+00	9.4E-18	1.1E-17	_2.3E-18	8.3E-18	2.2E-14	5.1E-16	0.00%	0.00%	0.00%	3.66%	1.6E-16	1.6E-18	1.6E-18	7.8E-18
AMS-04	3	-2.6E-17	2.5E-18	1.1E-17	-2.8E-17	1.2E-17	8.5E-15	2.6E-16	0.00%	0.00%	0.00%	1:42%	1.7E-18	1.7E-18	9.9E-18	2.0E-16
	4	1.9E-17	6.6E-18	9.0E-18	1.2E-17	9.5E-18	1.0E-14	4.6E-16	0.00%	0.00%	0.00%	1.74%	1.5E-18	1.5E-18	8.1E-18	4.1E-16
	5	-1.0E-18	2.7E-17	9.7E-18	-5.2E-18	3.3E-17	1.3E-14	6.7E-16	0.00%	0.00%	0.00%	2.23%	4.2E-18	4.2E-18	5.5E-17	6.6E-16
	1	5.9E-15	2.6E-17	2.5E-17	-4.5E-17	2.4E-17	1.1E-14	5.3E-16	0.20%	0.00%	0.00%	1.82%	5.9E-15	3.5E-18	4.5E-17	1.7E-17
	2	0.0E+00	2.0E-17	1.4E-17	4.7E-17	1.3E-17	2.5E-14	2.6E-16	0.00%	0.00%	0.01%	4.09%	1.6E-16	1.5E-18	1.5E-18	7.7E-18
AMS-05	3	1.0E-18	4.7E-18	1.1E-17	1.1E-17	1.5E-17	1.0E-14	4.4E-16	0.00%	0.00%	0.00%	1.66%	1.6E-18	1.6E-18	1.1E-17	1.9E-16
	4	2.5E-17	1.3E-17	9.2E-18	1.3E-17	9.0E-18	1.0E-14	6.3E-16	0.00%	0.00%	0.00%	1.74%	1.4E-18	1.4E-18	7.7E-18	3.9E-16
	5	2.4E-17	5.6E-17	9.5E-18	2.2E-17	3.4E-17	1.1E-14	0.0E+00	0.00%	0.00%	0.00%	1.85%	4.1E-18	4.1E-18	4.9E-17	6.4E-16

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February 2009



 Table 2.9-13:
 Radionuclide Concentrations in Air (concl.)

Location Pari		Concentration (µCi/ml)							% of Effluent Concentration				Lower Limit of Detection (µCi/ml)			
Location	Period	U-nat	Th-230	Th-230 2σ Error	Ra-226	Ra-226 2ơ Error	Pb-210	Pb-210 2σ Error	U-nat	Th-230	Ra-226	РЬ- 210	U-nat	Th-230	Ra-226	Pb-210
	1	5.0E-15	1.5E-18	2.0E-17	-3.9E-17	1.8E-17	1.4E-14	4.0E-16	0.17%	0.00%	0.00%	2.28%	5.0E-15	3.0E-18	3.1E-17	1.5E-17
AMS-06	2	0.0E+00	1.4E-17	1.2E-17	2.3E-17	1.0E-17	2.1E-14	4.8E-16	0.00%	0.00%	0.00%	3.56%	1.5E-16	3.0E-18	1.5E-18	7.3E-18
	3	-1.4E-17	9.4E-18	1.2E-17	0.0E+00	1.4E-17	6.0E-15	2.2E-16	0.00%	0.00%	0.00%	0.99%	1.6E-18	3.0E-18	1.1E-17	1.9E-16
	4	1.5E-17	4.9E-18	9.1E-18	-4.9E-18	7.4E-18	9.5E-15	4.3E-16	0.00%	0.00%	0.00%	1:58%	1.4E-18	3.0E-18	8.3E-18	3.9E-16
	5.	-2.6E-18	2.0E-17	9.1E-18	6.9E-18	3.3E-17	1.9E-14	6.9E-16	0.00%	0.00%	0.00%	3.25%	4.0E-18	3.0E-18	4.9E-17	6.2E-16
	1.	1.5E-14	2.0E-17	2.1E-17	-4.3E-18	2.5E-17	1.8E-14	4.4E-16	0.51%	0.00%	0.00%	3.03%	4.8E-15	2.8E-18	3.4E-17	1.4E-17
	2	0.0E+00	1.3E-17	1.2E-17	2.9E-17	1.0E-17	2.8E-14	5.3E-16	0.00%	0.00%	0.00%	4.62%	1.4E-16	1.4E-18	1.4E-18	6.9E-18
AMS-07	3	-1.1E-17	6.3E-18	9.0E-18	-1.3E-17	1.1E-17	7.2E-15	2.2E-16	0.00%	0.00%	0.00%	1.19%	1.4E-18	1.4E-18	9.1E-18	1.7E-16
	4	2.0E-17	7.9E-18	8.1E-18	-6.6E-19	7.5E-18	1.3E-14	4.4E-16	0.00%	0.00%	0.00%	2.13%	1.3E-18	1.3E-18	7.3E-18	3.7E-16
	5	-9.2E-19	1.7E-17	8.5E-18	1.4E-17	3.0E-17	1.3E-14	5.9E-16	0.00%	0.00%	0.00%	2.10%	3.7E-18	3.7E-18	4.6E-17	5.8E-16
	1	5.7E-15	3.0E-17	2.6E-17	5.0E-18	3.1E-17	1.4E-14	4.2E-16	0.19%	0.00%	0.00%	2.26%	5.7E-15	3.3E-18	4.0E-17	1.7E-17
	2	0.0E+00	-7.8E-19	9.4E-18	1.2E-17	9.5E-18	2.0E-14	4.8E-16	0.00%	0.00%	0.00%	3.29%	1.6E-16	1.6E-18	1.6E-18	7.8E-18
AMS-BKG	3	1.6E-18	2.0E-17	1.3E-17	-5.6E-18	1.4E-17	8.3E-15	2.5E-16	0.00%	0.00%	0.00%	1.38%	1.6E-18	1.6E-18	1.2E-17	2.0E-16
	4 ·	1.5E-17	1.4E-18	8.6E-18	2.1E-18	8.0E-18	1.3E-14	4.6E-16	0.00%	0.00%	0.00%	2.13%	1.4E-18	1.4E-18	8.5E-18	4.0E-16
	5	-8.1E-18	2.4E-17	9.3E-18	-1.7E-17	2.4E-17	1.2E-14	6.3E-16	0.00%	0.00%	0.00%	2.00%	4.0E-18	4.0E-18	4.0E-17	6.3E-16

Notes:

The laboratory reported no blank assay data for Period 5. Blank assays in the sample concentration calculation were assumed to be 50 percent of the values for blanks reported for the previous period. The assumption is based on the relative, approximate run-time of the air samplers in both periods. No blank corrections were performed on uranium results for the first monitoring period since sample results were reported as non-detects.





Table 2.9-13: Summary of Radionuclide Concentrations in Air

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In terms of comparison to 10 CFR 20 Appendix B effluent concentrations, the data can be summarized as follows:

- Natural uranium concentrations were 0.0 to 0.5 percent of its effluent concentration.
- Thorium-230 concentrations were 0.0 percent of its effluent concentration.
- Radium-226 concentrations were 0.0 percent of its effluent concentration.
- Lead-210 concentrations were 1.0 to 6.78 percent of its effluent concentration.

The LLDs, in pCi/f, reported by the laboratory for each radionuclide were converted to μ Ci/ml by dividing pCi/f by the total flow in cubic meters and multiplying by $1*10^{-12}$ to reflect appropriate units. In no cases were the LLDs higher that their respective 10 CFR 20 effluent concentration limits. The LLDs reported in Periods 1 and 2 by the laboratory for uranium exceeded the recommendation in NRC Regulatory Guide 4.14.

The LLDs for each of the radionuclides are listed in Table 2.9-12.

2.9.6.3 Conclusions

With the exception of natural uranium, the values determined above are similar to U.S. background concentrations reported in the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) Report to the General Assembly, Sources and Effects of Ionizing Radiation, Annex B. The regional concentrations reported in this reference document are: uranium-238 ($2.4*10^{-17}$ to $1.4*10^{-16}$ µCi/ml), thorium-230 ($1.6*10^{-17}$ µCi/ml), radium-226 ($1.6*10^{-17}$ µCi/ml), and lead-210 ($2.7*10^{-15}$ to $2.7*10^{-14}$ µCi/ml).

2.9.7 Radon Flux Measurements

Radon flux rates were measured at nine locations on three occasions in the Dewey and Burdock roll front areas. The locations are shown on Figure 2.9-8. The locations coincide with the nine soil samples collected from 0 to 100 cm below ground surface (not in land application areas).



Response: TR RAI-2.9-11and 12

TR Section 2.9.10

Food Sampling



POWERTECH (USA) INC.

2.9.9.3 Conclusions

Other than the observation that radionuclide concentrations in the vegetation samples are one to two orders of magnitude lower than those in the corresponding shallow (0 to 5 cm) soil samples, there are no apparent relationships between the media. Radium-226, natural uranium, and thorium-230 concentrations were highest in offsite soil sample AMS-BKG, located 1.9 miles west of the site near the offsite topsoil pile. Only the concentration of natural uranium was highest at this location in vegetation and soil. The concentration of radium-226 in soil at this location was in the middle of its range.

2.9.10 Food Sampling

To determine baseline radionuclide concentrations in local food, Powertech (USA) collected three tissue samples, one liver (DBAT 03) and two meat samples (DBAT 01 DBAT 02), from a locally grazing cow on June 25, 2008. The results are listed in Table 2.9-19. Errors are reported as $\pm 2\sigma$.

Powertech (USA)'s assessment of land use regarding food sampling (crop production) at the 3 km limit from the millsite and 3.3 km from the site boundary was limited to the sampling of cattle, since no crops are grown and available for sample analysis within these distances from the site. This assessment was confirmed through on-site surveys and direct communication with landowners and ranchers. The closest land with crop related land uses is located in eastern Fall River County, approximately 48 km (30 miles) east of the site boundary.

Powertech obtained general land use information for Fall River and Custer Counties from the United States Department of Agriculture 2002 census as referenced in Section 2.2.2 of the TR. However, site specific data provided by county governments regarding crop production are not available since land use plans are not required. Powertech has verified that there is no crop production within 3 km of the millsite and 3.3 km of the site boundary through on-site surveys and direct communication with the local landowners and ranchers. Since no crops are grown in the area, crop samples were not collected and analyzed.

Regulatory Guide 4.14 does not specifically require the collection and analysis of garden vegetables, although none were available for baseline sampling. It is important to note that the MILDOS Model results provided in Section 7.3 of the TR and Appendix 7.3-A show that the food ingestion pathway (food consumed from crops grown within the area) is an insignificant source of exposure to human receptors.



Response: TR RAI-2.9-20 and 21

TR Section 2.8.5.6.1.1

Aquatic Species and Habitats-Survey Methods



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TR Section 2.9

Attachment A

TR_RAI-Table 2.9-25

TR Section 2.9: Attachment A

TR_RAI- Table 2.9-25: TLD Location ID Numbers and Sample Locations

Period	Date Deployed	Date Collected	Landauer Location ID Number	Sample Location
	08/15/2007	02/04/2008	00001	AMS-06
	08/15/2007	02/04/2008	00002	AMS-02
	08/15/2007	02/04/2008	00003	AMS-07
	08/15/2007	02/04/2008	00004	AMS-03
1	08/16/2007	02/04/2008	00005	AMS-BKG
	08/15/2007	02/04/2008	00006	AMS-05
	08/15/2007	02/04/2008	00007	AMS-BKG
	08/15/2007	02/04/2008	00008	AMS-01
	08/15/2007	02/04/2008	00009	AMS-04
	02/04/2008	05/17/2008	00010	AMS-01
	02/04/2008	05/17/2008	00011	AMS-01
	02/04/2008	05/17/2008	00012	AMS-02
2	02/04/2008	05/17/2008	00013	AMS-05
	02/04/2008	05/17/2008	00014	AMS-03
2	02/04/2008	05/17/2008	00015	AMS-06
	02/04/2008	05/17/2008	00016	AMS-07
	02/04/2008	05/17/2008	00017	AMS-04
	02/04/2008	05/17/2008	00018	AMS-BKG
	02/04/2008	05/17/2008	00019	AMS-BKG
	05/17/2008	07/17/2008	00001	AMS-04
	05/17/2008	07/17/2008	00002	AMS-02
	05/17/2008	07/17/2008	00003	AMS-BKG
	05/17/2008	07/17/2008	00005	AMS-BKG
2	05/17/2008	07/17/2008	00006	AMS-06
5	05/17/2008	07/17/2008	00007	AMS-01
	05/17/2008	07/17/2008	00008	AMS-01
	05/17/2008	07/17/2008	00009	AMS-03
	05/17/2008	07/17/2008	00026	AMS-05
	05/17/2008	07/17/2008	00027	AMS-07



TR Section 2.9.5.2.1

Monitoring Period

Appendix 2.9-A

Revisions

		LANDAU	JER	
Landaver, Inc.	2 Science Road	Glenwood, Illinois 60425-1586	Telephone: (708) 755-7000	Facsimile: (708) 755-7016

ENVIRONMENTAL / LOW LEVEL DOSIMETRY REPORT

ADDRESS	ACCOUNT NO.	SERIES CODE
POWER TECH URANIUM ATTN : 310 SECOND AVE EDGEMOUNT, SD 57735	291406	
FOR EXPOSURE PERIOD		

NET CUMULATIVE TOTALS (MILLIREMS)

LOCATION ID NUMBER	IDENTIFIER (CLIENT SUPPLIED)	NOTE CODE	EXPOSURE DOSIMETE AMBIENT	OF R (MILLIREM DOSE EQUIVA	IS (LENT)	CALENDAR QUARTER	YEAR TO DATE	PERMANENT	ADJUST- MENTS	NUMBER OF DOSIMETERS REPORTED	INCEP DATE (PERM.	FION OF TOTAL
		`	GROSS	NET	,		**	-				
00000 00003 00005 00006 00007 00009	TRANSIT CONTROL	NC NC NC NC NC	56.2 73.7 57.0 50.6 80.6 62.4						,			

NOTES (COLUMN 3) : NC Returned Separately From The Deployment Control

Q.C. Release	Process No.	Reported Date	Date Processed	Date Received	Minimum Detectable Dose In This Process, Millirems Ambient Dose Equivalent	ONLY PAGE
LD	GK100A	02/28/2008	02/27/2008	02/15/2008	0.02	1
8.1.1 High Volume Air Sampling

Airborne particulates were collected using the Hi-Q high volume air samplers. The samplers operated continuously from August 2007 to August 2008. The locations of the air samplers are shown on Figure 4-1.

Each high volume air sampler was equipped with an 8-in. by 10-in. 0.8 micron glass fiber filter paper. The air filters were collected approximately bi-weekly, prior to saturation, from each of the eight air samplers. Flow rate and total flow data were recorded at the same time. Over the course of 366 days, the filters were collected as follows:

- Period 1: August 13 to October 2, 2007
- Period 2: October 2, 2007 to January 4, 2008
- Period 3: January 4 to April 1, 2008.
- Period 4: April 1 to July 9, 2008
- Period 5: July 9 to August 13, 2008

The filters were composited and digested by the external analytical laboratory. The samples were analyzed for radium-226, thorium-230, natural uranium, and lead-210, using the same methods as listed for the soil samples. A blank set of filter composites was also submitted to the laboratory for analysis with the composite samples to evaluate the radionuclide content of the filter material.

The laboratory data were reported in units of picocuries per filter composite (pCi/f). The data were converted to units of micocuries per milliliter (μ Ci/ml), as follows:

Concentration,
$$\mu Ci / ml = \frac{Filter Concentration - Blank}{TotalFlow} (1 * 10^{-12})$$

The units of total flow and filter concentration in the equation are cubic meters and pCi/f, respectively. The resulting concentrations for each radionuclide and high volume sampler were compared to effluent concentration limits listed in Table 2 of 10 CFR 20 Appendix B and reported in Table 8-1 as percentages of the respective effluent limits. The most conservative effluent limits were applied to thorium-230 (2*10⁻¹⁴ μ Ci/ml) and lead-210 (6*10⁻¹³ μ Ci/ml). The Class D and W limits were applied to natural uranium (3*10⁻¹² μ Ci/ml) and radium-226 (9*10⁻¹³ μ Ci/ml), respectively.

8.2.1 High Volume Air Sampling

In general and relative to one another (e.g., natural uranium to radium-226), the average concentrations of radionuclides were consistent at each location from period to period. The radionuclide with the lowest average concentration was radium-226, followed by thorium-230, natural uranium, and lead-210. Average radium-226 concentrations were five orders of magnitude lower than lead-210 concentrations. The data are listed in Table 8-1.

Site-wide, the data can be summarized as follows:

- Natural uranium concentrations ranged from $-3.0*10^{-17}$ to $1.5*10^{-14}$ μ Ci/ml and averaged $1.4*10^{-15}$ μ Ci/ml.
- Thorium-230 concentrations ranged from $-1.5*10^{-18}$ to $5.6*10^{-17}$ μ Ci/ml and averaged $1.2*10^{-17}$ μ Ci/ml.
- Radium-226 concentrations ranged from $-4.9*10^{-17}$ to $5.3*10^{-17} \,\mu\text{Ci/ml}$ and averaged $1.6*10^{-18} \,\mu\text{Ci/ml}$.
- Lead-210 concentrations ranged from $6.0*10^{-15}$ to $4.1*10^{-14} \mu \text{Ci/ml}$ and averaged $1.5*10^{-14} \mu \text{Ci/ml}$.

There are no clear patterns in the radionuclide concentrations, when evaluating them spatially or temporally. Natural uranium concentrations at each location fluctuated between the orders of 10^{-17} and 10^{-14} µCi/ml over the course of monitoring. The high end of this range occurred in the first monitoring period and is likely due to the low sensitivity of the uranium analytical results and not actual uranium concentrations in air. The uranium concentrations in air for the first monitoring period were reported at their detection limits. Thorium-230 concentrations fluctuated between the orders of 10^{-17} and 10^{-18} µCi/ml. Radium-226 concentrations fluctuated between the orders of 10^{-17} and 10^{-18} µCi/ml. Finally, lead-210 concentrations at each location were all on the order of 10^{-14} µCi/ml over the course of monitoring.

With the exception of natural uranium, the values determined above are similar to U.S. background concentrations reported in the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) Report to the General Assembly, Sources and Effects of Ionizing Radiation, Annex B. The regional concentrations reported in this reference document are: uranium-238 $(2.4*10^{-17} \text{ to } 1.4*10^{-16} \ \mu\text{Ci/ml})$, thorium-230 $(1.6*10^{-17} \ \mu\text{Ci/ml})$, radium-226 $(1.6*10^{-17} \ \mu\text{Ci/ml})$, and lead-210 $(2.7*10^{-15} \text{ to } 2.7*10^{-14} \ \mu\text{Ci/ml})$.

In terms of comparison to 10 CFR 20 Appendix B effluent concentrations, the data can be summarized as follows:

- Natural uranium concentrations were 0.0 to 0.5 percent of its effluent concentration.
- Thorium-230 concentrations were 0.0 percent of its effluent concentration.
- Radium-226 concentrations were 0.0 percent of its effluent concentration.
- Lead-210 concentrations were 1.0 to 6.78 percent of its effluent concentration.

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The LLDs, in pCi/f, reported by the laboratory for each radionuclide were converted to μ Ci/ml by dividing pCi/f by the total flow in cubic meters and multiplying by 1*10⁻¹² to reflect appropriate units. In no cases were the LLDs higher that their respective 10 CFR 20 effluent concentration limits. The LLDs reported in Periods 1 and 2 by the laboratory for uranium exceeded the recommendation in NRC Regulatory Guide 4.14.

The LLDs for each of the radionuclides are listed in Table 8-1.

Note: To facilitate review, revised Table 8-1 is not provided in this submittal. It is the same as revised Table 2.9-13, provided above.

9.2 Ambient Exposure Rates Determined using Thermoluminescent Detectors

Ambient exposure rates were determined for three periods, using TLDs supplied and analyzed by Landauer, Inc. The monitoring periods were: August 18, 2007 to February 4, 2008, February 4 to May 17, 2008, and May 17 to July 17, 2008. The 29-day period between July 17 and August 15 that would make up the year was not monitored.

The TLDs were deployed at each of the eight AMS locations. Duplicates were deployed at AMS-01 and the background location (AMS-BKG). Five of the nine TLDs deployed in the August 2007 to February 2008 period were lost, presumably by way of cattle consumption and/or disturbance. Two additional TLDs were lost from subsequent deployments, presumably as a result of cattle in the area.

The ambient gamma dose rate monitoring results are listed in Table 9-1. All reported dose equivalents were converted to an adjusted dose rate by dividing by the time between the shipment of the dosimeters to the site to the time that the dosimeters were processed by the vendor. In order to obtain an estimate of the annual dose equivalent rate, the average daily dose rate for the 29-day period (July 17, 2008-August 15, 2008) which was not monitored was assumed equal to the May 17, 2008 too July 17, 2008 period. This is reasonable since terrestrial dose rates for a location primarily depend on soil moisture and snow and vegetation cover. For locations where TLDs were missing, no attempt was made to obtain an annual projected dose equivalent. The results for the TLDs reported in millirem per year (mrem/yr) ambient dose equivalents are as follows:

- AMS-04: 112 mrem/yr
- AMS-05: 91 mrem/yr
- AMS-07: 109 mrem/yr
- AMS-BKG: 123 mrem/yr

The range of exposure rates (91 to 123 mrem/yr) and average (109 mrem/yr) is similar to average worldwide exposures to natural radiation sources comprised of comic radiation, cosmogenic radionuclides, and external terrestrial radiation reported in the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) Report to the General Assembly, Sources and Effects of Ionizing Radiation, Annex. The typical ranges of average worldwide exposures reported in this reference document are to 60 to 160 mrem/yr.

The TLD results compare favorably with the baseline direct gamma-ray survey data reported in Section 3 when expressed in exposure rate units (μ R/h) as reported in Section 9.1, where the average exposure rate was reported as 10.9 microRoentgen/h (μ R/h). Since a Roentgen is approximately equal to a rem, 10.9 μ R/h can be expressed as 95.5 mrem/year. This is very close to the 109 mrem/yr average for the four monitoring locations reported above.

Location	Starting Date	End Date	Dose (mrem)	Adjusted Dose Rate (mrem/day) [♭]	Projected Annual Dose (mrem)
	8/15/07	2/4/08	-		
AMS-01	2/4/08	5/17/08	37.2ª	0.260	
	5/17/08	7/17/08	57.7 ^a	0.412	
	9/18/07	2/4/08	-		
AMS-02	2/4/08	5/17/08	-		
	5/17/08	7/17/08	54.0	0.386	
	8/15/07	2/4/08	-		
AMS-03	2/4/08	5/17/08	38.6	0.270	
	5/17/08	7/17/08	-		
	8/15/07	2/4/08	62.4	0.297	
AMS-04	2/4/08	5/17/08	36.1	0.252	112
	5/17/08	7/17/08	54.3	0.388	
	8/15/07	2/4/08	50.6	0.241	
AMS-05	2/4/08	5/17/08	36.7	0.257	91
	5/17/08	7/17/08	36.4	0.260	
	8/15/07	2/4/08	-		
AMS-06	2/4/08	5/17/08	36.9	0.258	
	5/17/08	7/17/08	51.1	0.365	
	8/15/07	2/4/08	73.7	0.351	
AMS-07	2/4/08	5/17/08	35.5	0.248	109
1	5/17/08	7/17/08	36.1	0.258	
	8/15/07	2/4/08	68.8ª	0.328	
AMS-BKG	2/4/08	. 5/17/08	40.5 ^a	0.283	123
	5/17/08	7/17/08	58.5 ^a	0.418	

Table 9-1. Ambient Gamma Dose Rates using TLDs

Notes:

Result is average of measurement plus duplicate.

b. Dose rate adjusted by dividing by the reported dose by the time from vendor shipment of dosimeters to site and the time dosimeters were processed.

Revisions to Section 11.0 of Appendix 2.9-A

The last bullet in Section 11.0 of Appendix 2.9-A should be revised as follows:

Baseline ambient exposure rates, as determined using TLDs, range from 91 to 123 mrem/yr.

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Response: TR RAI-2.9-37 (a-c)

Applicable to TR Section 2.9.3.1.2

EPA Test Methods

Response to the U.S. NRC's Request for Additional Information Dewey-Burdock Uranium Project-Source Material License Application Technical Report Submitted August 11, 2009.

PERFORMANCE EVALUATION

First Choice for Quality |



6-Feb-2008 through 21-Mar-2008



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







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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.

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





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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 ⁰F	172 to 206 178 to 200	-0.18	Acceptable
Analysis FPA 9045C 3 (1995)				Method Number 10198400
Ion Selective Electrode				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 FPA 6010 (1986)				Method Number 10155201
Atomic Emission - Inductively Coupled Plasma Spectrometry				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 - Loi 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

LPTP08-S ²	
Concluded 03/21/2008	3

Silicon, Si 4	2300 mg/Kg	0.00 to 2460	2.73	Acceptable
	Result Units	Accept / Warn	Z	Evaluation
Analysis EPA 6010 (1986) Atomic Emission - Inductvely Coupled Plasma Spectrometry			Tec	Method Number 10155201 hnology Code: ICP-AES

Silicon, Si 4 1145 / 001 - Lot 013023

Analysis EPA 6010B (1996) Atomic Emission - Inductvely Coupled Plasma Spectrometry			т	Method Number 10155609 echnology Code: ICP-AES
	Pecult Linite	Accent / Marn	7	Evaluation

	result offits	Accept / Warn		Litalation
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

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	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

Method Number 10156000

Technology Code: ICP-MS





Method Number 10156000

Technology Code: ICP-MS

(continued)

Trace Metals (continued)

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EPA 6020 (1994) Mass Spectrometry - Inductively Coupled Plasma

	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, TI 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
 31 mg/Kg
 12.4 to 35.7
 1.79
 Acceptable

 1095 / 001 - Lot 013023
 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			Тес	(continued) Method Number 10184802 hnology Code: GC-MS
	Result Units	Accept / Warn	Z	Evaluation
T-amyImethylether (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/Кg	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	180 µg/Kg	100 to 229 122 to 208	0.70	Acceptable





Volatiles - Low Level (Solids) (continued)

Analysis EPA 8260B 2 (1996) Can Chromatography Mana Sportromotor				(continued) Method Number 10184802 Technology Code: GC-MS
Gas Chronialography - Mass Spectrometry	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 - Loi 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





Method Number 10184802

(continued)

Volatiles - Low Level (Solids) (continued)

Analysis

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

Gas Chromatography - Mass Spectrometry			Te	echnology 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/Кg	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, totał ^{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



.PTP08-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





Method Number 10155609 Technology Code: ICP-AES

Trace Metals

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

· · · · · · · · · · · · · · · · · · ·	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 tô 157	-0.27	Acceptable
Manganese, Mn ^{1, 4} 1090 / 001 - Lót 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, TI ^{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



Study Lot 013023

Sample Information

Metals in Soil

SF	E-001							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	mg/Kg	39.73	3.75	39.39	4.07	39.73	4.04	42.3
	Boron, B	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	mg/Kg	14,300.00	1,260.00	15,068.7	5,462.36	14,321.7	1,160.40	14300
	Chromium, Cr (total)	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 Matals	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, TI 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					



Study Lot 013067

Concluded 03/21/2008

Volatiles on Soil - Low Level SPE-002-L



SF	2E-002-L							Mfg	J 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-amyImethylether (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/Кg	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	µg/Kg	0.00	0.00			-		0.00
	1,1-Dichloroethylene	µg/Kg	93.73	16.77	91.15	19.98	93.73	16.77	101
	cis-1,2-Dichloroethylene	µg/Kg	0.00	0.00					0.00
	1,2-Dichloropropane	µg/Kg	164.94	21.49	164.14	19.11	162.70	16.98	172
	cis-1,3-Dichloropropene	µg/Kg	88.33	12.08	87.64	11.18	88.33	12.08	102
	trans-1,3-Dichloropropene	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





Study Lot 013067

Concluded 03/21/2008

es on Soil - Low Level

V	ola	tile
SF	PE-(002-

PE-002-L							Mfg	Lot 013067
(continued)	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Methyl chloride (Chloromethane)	µg/Kg	58.38	11.69	55.80	13.63	58.38	11.69	142
Methylene chloride (Dichloromethane) 4975 Volatiles - Low Level (Solida)	µg/Kg	170.64	28.95	151.67	29.91	152.58	30.01	179
4-Methyl-2-pentanone (MIBK)	µg/Kg	166.92	30.21	189.10	45.76	179.50	38.06	176
Methyl tert-butyl ether (MTBE)	µg/Kg	82.71	15.69	79.56	16.93	85.70	9.68	85.2
Naphthalene 5005 Videlies - 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-Tetrachoroethane	μg/Kg	166.27	19.23	168.71	24.61	165.67	11.23	166
1,1,2,2-Tetrachloroethane	µg/Kg	0.00	0.00					0.00
Tetrachloroethylene (Perchloroethylene) 5115 Volatiles - Low Level (Solida)	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
CLP Metals in Soil							Study	y Lot 000718
PE-005		Proficiency	Proficiencv		Standard	Robust	Mfg Robust	g Lot 000718
Accorio Ac	Units	Value	Std. Dev.	Mean	Deviation	Mean	Std. Dev.	Gravimetric
ATSERIIC, AS 1010 TCLP Metals	mg/L	3.14	0.41	3.16	0.41	3.14	0.41	3.20
Barlum, Ba 1015 TCLP Metals	mg/L	2.13	0.27	2.12	0.27	2.13	0.18	2.30
	mg/L	13.10	0.86	13.07	1.18	13.06	0.56	13.0

mg/L

mg/L

mg/L

mg/L

0.28

4.87

1.40

7.31

0.10

1.32

0.50

0.73

0.39

4.93

1.41

7.73

0.24

1.26

0.45

0.91

0.28

4.87

1.40

7.31

0.10

1.32

0.50

0.51



1030 TCLP Metals Chromium, Cr (total)

1040 TCLP Metals Lead, Pb

1075 TCLP Metals

0.888

5.20

1.60

7.80





Concluded 03/21/2008

TCLP Metals in Soil SPE-005							Study Mfg	y Lot 000718 g 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		1.00	0.00					1.00
Corrosivity - Soil SPE-023							Stud Mfg	y Lot 013026 g 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	y Lot 013068 g Lot 013068
	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Ignitability (Flashpoint) 1780 Miscellaneous Analytes	۰F	189.00	5.67	188.99	5.56	189.08	7.90	189
Uranium in Soil							Study Mfg	y Lot 013025 g 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 ³ Other

- ⁵ NELAC Experimental

² EPA ⁴ A2LA

PERFORMANCE EVALUATION

First Choice for Quality |





30-Jul-2008 through 12-Sep-2008



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.col If you have any questions or comments about this study please contact me.

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Sincerely,

Christopher Rucinski Quality Director

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







10/3/08 RT1014 LPTP08-S3

LPTP08-S3 Set 1

Page 2 of 16



Dataset



PTP08-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

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

Miscellaneous Analytes

Analysis EPA 1010 (1986) Auto Analyzer		·		Method Number 10116606 Technology Code: AUTO
	ResultUnits	Accept / Warn	z	Evaluation
		130 to 164		

138°F

136 to 158

-1.59

Ignitability (Flashpoint, °F) ^{1, 4} 1780 / 029 - Lot 013616

Acceptable





Miscellaneous Analytes (continued)

20mg/L 26mg/L 1.0mg/L <0.5mg/L 1.2mg/L <0.5mg/L ResultUnits 2.2mg/L	14.1 to 84.2 0.00 to 4.30 0.00 to 4.64 1.32 to 2.33 0.00 to 0.5 <u>Accept / Warn</u> 0.128 to 2.79	-1.97 -0.74 -3.69 <u>Z</u> 1.67	Acceptable Acceptable Acceptable Not Acceptable Acceptable Method Number 10165807 Technology Code: CVAAS Evaluation Acceptable
20mg/L 26mg/L 1.0mg/L <0.5mg/L 1.2mg/L <0.5mg/L ResultUnits	14.1 to 84.2 0.00 to 4.30 0.00 to 4.64 1.32 to 2.33 0.00 to 0.5	-1.97 -0.74 -3.69	Acceptable Acceptable Acceptable Not Acceptable Acceptable Method Number 10165807 Technology Code: CVAAS Evaluation
20mg/L 26mg/L 1.0mg/L <0.5mg/L <0.5mg/L	14.1 to 84.2 0.00 to 4.30 0.00 to 4.64 1.32 to 2.33 0.00 to 0.5	-1.97 -0.74 -3.69	Acceptable Acceptable Acceptable Not Acceptable Acceptable Method Number 1016580 Technology Code: CVAA
20mg/L 26mg/L 1.0mg/L <0.5mg/L 1.2mg/L <0.5mg/L	14.1 to 84.2 0.00 to 4.30 0.00 to 4.64 1.32 to 2.33 0.00 to 0.5	-1.97 -0.74 -3.69	Acceptable Acceptable Acceptable Not Acceptable Acceptable
20mg/L 26mg/L 1.0mg/L <0.5mg/L 1.2mg/L	14.1 to 84.2 0.00 to 4.30 0.00 to 4.64 1.32 to 2.33	-1.97 -0.74 -3.69	Acceptable Acceptable Acceptable Not Acceptable
20mg/L 26mg/L 1.0mg/L <0.5mg/L	14.1 to 84.2 0.00 to 4.30 0.00 to 4.64	-1.97 -0.74	Acceptable Acceptable Acceptable
20mg/L 26mg/L 1.0mg/L	14.1 to 84.2	-1.97 -0.74	Acceptable Acceptable
26mg/L	14.1 to 84.2	-1.97	Acceptable
20mg/L			
	12.3 to 26.1	0.35	Acceptable
3.1mg/L	1.28 to 9.46	-1.67	Acceptable
ResultUnits	Accept / Warn	Z	Evaluation
			Method Number 1015560 Technology Code: ICP-4E
Fluid #1	2.00 to 2.00		Not Acceptable
ResultUnits	Accept / Warn	Z	Evaluation
			Method Number 1015520 Technology Code: ICP-AE
6.38Units	5.90 to 7.10 6.10 to 6.90	-0.60	Acceptable
ResultUnits	Accept / Warn	Z	Evaluation
			Method Number 1019840 Technology Code: IS
	ResultUnits 6.38Units ResultUnits Fluid #1 ResultUnits 3.1mg/L	ResultUnits Accept / Warn 6.38Units 5.90 to 7.10 6.38Units 6.10 to 6.90 ResultUnits Accept / Warn 2.00 to 2.00 Fluid #1 2.00 to 2.00 ResultUnits Accept / Warn 2.00 to 2.00 Fluid #1	ResultUnits Accept / Warn Z 6.38Units 5.90 to 7.10 -0.60 6.38Units 6.10 to 6.90 -0.60 ResultUnits Accept / Warn Z 2.00 to 2.00 2.00 to 2.00 Fluid #1 1.28 to 9.46 1.28 to 9.46 3.1mg/L -1.67

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

		ResultUnits	Accept / Warn	Ζ	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	1	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, TI 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	

(continued)

Method Number 10156000 Technology Code: ICP-MS







ResultUnits 257mg/Kg	Accept / Warn	z	
257mg/Kg	179 to 326	_	Evaluation
	203 to 301	0.20	Acceptable
204mg/Kg	138 to 256 158 to 236	0.36	Acceptable
			Method Number 10166208 Technology Code: CVAAS
ResultUnits	Accept / Warn	z	Evaluation
20mg/Kg	12.8 to 37.1 16.9 to 33.0	-1.24	Acceptable
			Method Number 10184802
			Technology Code: GC-MS
	ResultUnits 20mg/Kg	ResultUnits Accept / Warn 12.8 to 37.1 20mg/Kg 16.9 to 33.0	ResultUnits Accept / Warn Z 12.8 to 37.1 12 20mg/Kg 16.9 to 33.0 -1.24

1600µg/Kg	0.00 to 1060	5.39	Not Acceptable
<20µg/Kg	0.00 to 40		Acceptable
<20µg/Kg	0.0 to 0.0		Acceptable
<2.0µg/Kg	0.0 to 0.0		Acceptable
62µg/Kg	42.1 to 99.0 51.6 to 89.5	-0.90	Acceptable
57µg/Kg	25.1 to 72.5	1.04	Acceptable
77µg/Kg	54.3 to 118 64.8 to 107	-0.85	Acceptable
<2.0µg/Kg	0.0 to 0.0 0.0 to 0.0		Acceptable
250µg/Kg	18.6 to 579	0.03	Acceptable
<2.0µg/Kg	0.0 to 0.0		Acceptable
140µg/Kg	77.5 to 234 104 to 208	-0.61	Acceptable
180µg/Kg	73.4 to 180 91.1 to 162	2.99	Acceptable
	1600µg/Kg <20µg/Kg <20µg/Kg <2.0µg/Kg 62µg/Kg 57µg/Kg 77µg/Kg <2.0µg/Kg <2.0µg/Kg 140µg/Kg 180µg/Kg	1600µg/Kg 0.00 to 1060 <20µg/Kg	1600µg/Kg 0.00 to 1060 5.39 <20µg/Kg





(continued)

Method Number 10184802

Volatiles - Low Level (Solids) (continued)

Analysis

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

ZPA 02000 2 (1990) Gas Chromatography - Mass Spectrometry				Technology Code: GC-MS
	ResultUnits	Accept / Warn		Evaluation
Chloroethane 4, 5 4485 / 002-L - Lot 013612	<2.0µg/Kg	0.0 to 0.0		Acceptable
Chloroform ^{1, 4} 4505 / 002-L - Lot 013612	54µg/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	56µg/Kg	30.9 to 121	-1.32	Acceptable
Dibromochloromethane ^{1, 4} 4575 / 002-L - Lot 013612	42µg/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	110µg/Kg	52.6 to 157	0.29	Acceptable
Dibromomethane 4 4595 / 002-L - Lot 013612	150µg/Kg	68.3 to 245	-0.24	Acceptable
1,2-Dichlorobenzene 1,4 4610 / 002-L - Lot 013612	240µg/Kg	90.7 to 264 120 to 235	2.19	Acceptable
1,3-Dichlorobenzene 1,4 4615 / 002-L - Lot 013812	230µg/Kg	68.4 to 257 99.8 to 226	2.13	Acceptable
1,4-Dichlorobenzene ^{1,4} 4620 / 002-L - Lot 013612	91µg/Kg	22.4 to 91.9 34.0 to 80.3	2.92	Acceptable
Dichlorodifluoromethane ^{4, 5} 4625 / 002-L - Lot 013612	<2.0µg/Kg	0.0 to 0.0		Acceptable
1,1-Dichloroethane ^{1,4} 4630 / 002-L - Lot 013612	51µg/Kg	25.8 to 67.6 32.7 to 60.6	0.62	Acceptable
1,2-Dichloroethane ^{1,4} 4635 / 002-L - Lot 013512	190µg/Kg	96.5 to 231 119 to 208	1.16	Acceptable
1, 1-Dichloroethylene ^{4, 5} 4640 / 002-L - Lot 013612	<2.0µg/Kg	0.0 to 0.0		Acceptable
cis-1,2-Dichloroethylene ^{4, 5} 4645 / 002-L - Lot 013612	170µg/Kg	73.9 to 232	0.64	Acceptable
1,2-Dichloropropane ^{1,4} 4655 / 002-L - Lot 013612	190µg/Kg	99.9 to 228 121 to 207	1.21	Acceptable
cis-1,3-Dichloropropene ^{4, 5} 4680 / 002-L - Lot 013612	<2.0µg/Kg	0.0 to 0.0		Acceptable
trans-1,3-Dichloropropene ^{4, 5} 4685 / 002-L - Lot 013612	170µg/Kg	101 to 231	0.18	Acceptable
trans-1,2-Dichloroethylene ^{4, 5} 4700 / 002-L - Lot 013612	76µg/Kg	37.3 to 117	-0.07	Acceptable
Ethylbenzene ^{1, 4} 4765 / 002-L - Lot 013612	78µg/Kg	37.0 to 99.0 47.4 to 88.7	0.97	Acceptable
Hexachlorobutadiene ^{1, 4} 4835 / 002-L - Lot 013612	<2.0µg/Kg	0.0 to 0.0 0.0 to 0.0		Acceptable
2-Hexanone ^{4, 5} 4860 / 002-L - Lot 013612	290µg/Kg	17.8 to 614	-0.26	Acceptable





(continued)

Method Number 10184802

Technology Code: GC-MS

Volatiles - Low Level (Solids) (continued)

Analysis
FDΔ

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

ere entered they were electronically				
	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 - Lol 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 - Loi 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 - Loi 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/Кg	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	<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
	ResultUnits	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

86µg/Kg

226µg/Kg

<2.0µg/Kg

30.0 to 98.3

41.4 to 86.9

93.2 to 280 124 to 249

0.0 to 0.0

1.91

1.25

Acceptable

Acceptable

Acceptable

0-Xylene 4 5250 / 002-L - Lot 013612

Xylene, total ^{1,4} 5260 / 002-L - Lot 013612

Di-isopropylether (DIPE) 4 9375 / 002-L - Lot 013612

Group Analysis Summary Acceptable 57 / 59 Score 96.6% - (Acceptable)

End of LPTP08-S3 Set 1



Dataset



PTP08-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)

Method Number 10155609 Technology Code: ICP-AES

Atomic Emission - Inductvely Coupled Plasma Spectrometry				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

10/3/08 RT1014 LPTP08-S3





(continued)

Method Number 10155609 Technology Code: ICP-AES



Trace Metals (continued)

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

	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	





(continued)

Method Number 10155609 Technology Code: ICP-AES



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

	ResultUnits	Accept / Warn	Z	Evaluation	
Strontium, Sr 4 1160/001 - Lot 013545	132mg/Kg	14.1 to 234	0.22	Acceptable	
Thallium, TI 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

Metals in Soil SPE-001			•					Study Mfg	Lot 013545 Lot 013545
		 Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Aluminum, Al		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	· .	mg/Kg	62.70	35.70	117.00	354.00	62.70	28.90	141 ± 0.721
Arsenic, As		mg/Kg	132.00	13.10	127.00	22.30	132.00	13.70	154 ± 0.784
Barium, Ba		mg/Kg	492.00	41.80	502.00	140.00	492.00	46.20	502 ± 2.56
Beryllium, Be		mg/Kg	215.00	17.40	211.00	42.40	215.00	20.90	239 ± 1.22
Boron, B		mg/Kg	139.00	16.30	148.00	37.70	139.00	16.30	167 ± 0.852
Cadmium, Cd		mg/Kg	56.60	5.07	78.10	112.00	56.60	5.60	69.8 ± 0.356
Calcium, Ca		mg/Kg	7,750.00	653.00	8,810.00	6,810.00	7,750.00	698.00	7670 ± 39.1
Chromium, Cr (total)		mg/Kg	301.00	29.00	300.00	26.30	301.00	26.80	328 ± 1.67
Cobalt, Co		mg/Kg	108.00	9.23	104.00	18.20	108.00	9.34	121 ± 0.619
Copper, Cu		mg/Kg	61.10	5.54	81.70	146.00	61.10	5.52	59.0 ± 0.25
Iron, Fe	•	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		mg/Kg	314.00	25.20	313.00	34.10	314.00	35.80	334 ± 1.7
Lithium, Li		mg/Kg	121.00	44.10	127.00	47.30	121.00	44.10	127
Magnesium, Mg		mg/Kg	9,910.00	813.00	9,840.00	1,470.00	9,910.00	1,180.00	11000 ± 56.1
Manganese, Mn		mg/Kg	654.00	110.00	631.00	133.00	654.00	110.00	735 ± 3.75
Mercury, Hg		mg/Kg	25.00	4.04	24.20	5.01	25.00	3.68	29.1 ± 0.148
Molybdenum, Mo		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	· · · ·	mg/Kg	18,800.00	1,860.00	18,300.0	3,680.00	18,800.0	2,510.00	20400 ± 104
Selenium, Se		mg/Kg	304.00	30.80	302.00	74.50	304.00	34.60	358 ± 1.82
Silicon, Si		mg/Kg	577.00	451.00	937.00	881.00	577.00	451.00	4260 ± 21.7
Silver, Ag		mg/Kg	81.20	8.84	75.80	17.00	81.20	7.66	89.4 ± 0.456
Sodium, Na		mg/Kg	1,540.00	189.00	1,570.00	226.00	1,540.00	214.00	1590 ± 8.09
Strontium, Sr		mg/Kg	124.00	36.60	141.00	95.20	124.00	36.60	141 ± 0.401
Thallium, TI 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	. • •	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 - Lov SPE-002-L	v Level							Study Mfg	Lot 013612 Lot 013612







Concluded 09/12/2008 Study Lot 013612

Volatiles on Soil - Low Level



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ŞF	PE-002-L							Mfg I	Lot 013612
)		Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
	Acetone (315. Volotiles - Low Level (Solide)	µg/Kg	381.00	226.00	459.00	330.00	381.00	226.00	381 ± 3.69
	Action trailer	µg/Kg	. 0.00	0.00					0.00
	Accolein (Propenal)	µg/Kg	0.00	0.00					. 0.00
	4325 Volatiles - Low Level (Solids) T-amyImethylether (TAME)	ua/Ka	0.00	0.00					0.00
	4370 Volatiles - Low Level (Solids) Benzene	ug/Kg	70 50	0.00	71 50	0.01	71 50	11 20	71 7 + 0 695
	4375 Volatiles - Low Level (Solids) Bromobenzene	pg/ng	10.00	5.45	11.50	3.31	10.00	7.00	17.7 ± 0.095
	4385 Volatiles - Low Level (Solids) Bromodichloromethane	µg/Kg	48.80	7.90	49.10	7.02	48.80	7.90	47.5 ± 0.461
	4395 Volatiles - Low Level (Solids) Bromoform	µg/Kg	86.00	10,60	82.80	9.24	82.80	10.90	84.9 ± 0.823
	4400 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
•	4410 Volatiles - Low Level (Solids)	µg/Kg	247.00	111.00	298.00	154.00	247.00	111.00	186 ± 1.8
	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)	µg/Kg	75.80	15.00	86.70	33.10	75.80	15.00	78.3 ± 0.759
	Dibromochloromethane	µg/Kg	53.20	7.35	54.70	8.48	54.10	8.86	53.6 ± 0.52
)	1,2-Dibromoethane (EDB, Ethylene dibromide)	µg/Kg	105.00	17.40	106.00	16.30	105.00	17.40	103 ± 1
	Dibromethane	µg/Kg	157.00	29.50	158.00	26.60	157.00	29.50	151 ± 1.46
	1,2-Dichlorobenzene	µg/Kg	177.00	28.80	192.00	22.40	193.00	22.20	187 ± 1.81
	1,3-Dichlorobenzene	ua/Ka	163.00	31.40	176.00	21.00	176.00	19.60	174 ± 1.69
	4615 Volatiles - Low Level (Solids) 1,4-Dichlorobenzene	ua/Ka	57 10	11.60	71 10	10.10	70 10	10 40	64 6 + 0 627
	4620 Volatiles - Low Level (Solids) Dichlorodifluoromethane	Harra	0.00	0.00		10.10		10.40	0.00
	4625 Volatiles - Low Level (Solids) 1,1-Dichloroethane	µg/itg	46.70	0.00	40.00	7 07	40.00	7 00	0.00
	4630 Volatiles - Low Level (Solids) 1 2-Dichloroethane	µg/Kg	46.70	6.97	46.80	7.87	46.60	7.89	46.4 ± 0.45
	4635 Volatiles - Low Level (Solids) 1 1-Dichloroethylene	µg/Kg	164.00	22.40	170.00	19.70	170.00	22.30	167 ± 1.62
	4640 Volatiles - Low Level (Solids)	µg/Kg	0.00	0.00					0.00
	4645 Volatiles - Low Level (Solids)	µg/Kg	153.00	26.40	152.00	22.40	153.00	26.40	159 ± 1.54
	1,2-DICRIOFOPDOPANE 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-Dichłoropropene 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 (Salids)	µg/Kg	76.90	13.20	73.80	18.50	76.90	13.20	71.1 ± 0.689
	Ethylbenzene 4765 Valatiles - Low Level (Salids)	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 4960 Violatine - Love Level (Solido)	µg/Kg	316.00	99.40	323.00	90.80	316.00	99.40	316 ± 3.07
,		µg/Kg	124.00	16.60	123.00	14.80	124.00	16.60	113 ± 1.09
	4900 Volatiles - Low Level (Solids)								
ACCREDITED									
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LPTP08-S3

Concluded 09/12/2008

Volatiles on Soil - Low Level

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Volatiles on Soil - SPE-002-L	Low Level								Study I Mfg I	Lot 013612 Lot 013612
(continued)			Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Methyl bromide (B 4950 Volatiles - Low Level	(Solids)	·	µg/Kg	84.70	27.00	85.40	27.80	84.70	27.00	122 ± 1.19
Methyl chloride (C 4960 Volatiles - Low Level	hloromethane) (Solids)		µg/Kg	125.00	28.10	118.00	39.20	125.00	28.10	165 ± 1.6
4975 Volatiles - Low Level	e (Dichloromethane) (Solids)		µg/Kg	0.00	0.00					0.00
4-Methyl-2-pentan 4995 Volatiles - Low Level	IONE (MIBK) (Solids)		µg/Kg	135.00	24.80	156.00	31.20	157.00	36.40	142 ± 1.38
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-Tetrachlor 5105 Volatiles - Low Level	Oethane . (Solids)		µg/Kg	50.90	6.36	51.50	4.92	51.80	5.26	49.7 ± 0.482
1,1,2,2-Tetrachlore 5110 Volatiles - Low Level	O ethane (Solids)		µg/Kg	98.80	15.80	106.00	21.60	101.00	11.20	100 ± 0.973
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-Trichloroben 5155 Volatiles - Low Level	IZENE (Solids)		µg/Kg	76.40	16.90	77.10	16.10	76.40	16.90	73.1 ± 0.709
1,1,1-Trichloroetha 5160 Volatiles - Low Level	ane (Solids)		µg/Kg	91.90	13.30	92.90	11.70	93.60	11.40	92.5 ± 0.897
1,1,2-Trichloroetha 5165 Volatiles - Low Level	Ane (Solids)		µg/Kg	128.00	17.20	138.00	19.90	138.00	22.40	131 ± 1.27
Trichloroethene (T 5170 Volatiles - Low Level	richloroethylene) (Solids)		µg/Kg	118.00	18.50	123.00	15.40	122.00	17.90	122 ± 1.18
Trichlorofluoromet 5175 Volatiles - Low Level	hane (Solids)		µg/Kg	121.00	20.20	121.00	20.10	121.00	20.20	150 ± 1.45
1,2,3-Trichloroproj 5180 Volatiles - Low Level	pane (Solids)		µg/Kg	0.00	0.00					0.00
1,2,4-Trimethylber 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-Trimethylber 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 (9375 Volatiles - Low Level	(DIPE) (Solids)	and a second	µg/Kg	0.00	0.00					0.00
TCLP Metals in Sc	bil								Study I Mfa I	Lot 000962
SF E-000			Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Arsenic, As			mg/L	5.37	1.36	5.31	1.22	5.37	1.36	5.37
Barium, Ba			mg/L	19.20	2.29	19.10	2.09	19.20	2.29	19.2
Cadmium, Cd			mg/L	49.10	11.70	48.40	10.50	49.10	11.70	49.1
Chromium, Cr (tota 1040 TCLP Metals	al)		, mg/L	1.65	0.88	1.73	0.86	1.65	0.88	1.65
Lead, Pb			mg/L	1.51	1.04	1.57	0.95	1.51	1.04	1.51
Mercury, Hg			mg/L	1.46	0.44	1.50	0.49	1.46	0.44	1.46
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LPTP08-S3

Concluded 09/12/2008

TCLP Metals in Soil SPE-005						· .	Study Mfg	Lot 000962 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		2.00	0.00					2.00
Corrosivity - Soil SPE-023							Study Mfg	Lot 013535 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					ć		Study Mfg	Lot 013616 Lot 013616
	Units	Proficiency Value	Proficiency Std. Dev.	Mean	Standard Deviation	Robust Mean	Robust Std. Dev.	Gravimetric
Ignitability (Flashpoint, °F) 1780 Miscellaneous Analytes	۰F	147.00	5.67	145.00	8.40	147.00	4.62	147 ± 1.41
Uranium in Soil SPE-071							Study Mfg	Lot 013547 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

Program analyte accrediting footnotes ¹ NELAC ³ Other ⁵ NELAC Experimental

10/3/08 RT1014 LPTP08-S3

LPTP08-S3 Set 2

² EPA ⁴ A2LA

PERFORMANCE EVALUATION

First Choice for Quality |





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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Sincerely,

Christopher Rucinski Quality Director

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







11/21/08 RT1014 LPTP08-4-17

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Dataset



_PTP08-4-17 MU 1

Accreditors

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

TCLP Metals

Analysis
EPA 6010B (1996)
Atomic Emission - Inductively Coupled Plasma Spectrometry
Result Units
Assigned
Accept.
Z
Evaluation
Value





Analysis EPA 6010B (1996) Atomic Emission - Inductvely Coupled Plasma Spectrometry			1	÷	(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: jir/ 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: jir/ Analysis Date: 11/13/08	98 μg/Kg	105.00	46.3 to 165	-0.36	Acceptable

End of LF	PTP08-4-17	MU	1
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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. Accrediting Labcode WY00002

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

TCLP Metals

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

Mass Spectrometry - Inductively Coupled Plasma					Technology Code: ICP-MS
	Result Units	Assigned Value	Accept.	Z	Evaluation

Method Number 10156000



TCLP Metals (continued)

Analysis

EPA 6020 (1994) Mass Spectrometry - Inductively Coupled Plasma

Mass Spectrometry - Inductively Coupled Plasma	Popult Lipite	Assigned	Accent	7	Technology Code: ICP-MS
· · · · · · · · · · · · · · · · · · ·	Result Onlits	Value	Ассера.	2	
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)	hâ\Kâ	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





11-Feb-2009 through 27-Mar-2009



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

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

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





















Dataset



LPTP09-S1_Set_1

Accreditors

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> 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





Method Number 10116606

Miscellaneous Analytes

-	

Analysis	
EPA 1010	(1986)

	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)	· · · ·		. <u></u>		Method Number 10155609
	Result Units	Assigned Value	Accept.	Z	Evaluation
Silica as SiO2 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 5
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)

	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
Selenìum, 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

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

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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	0.7 9	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

(continued) Method Number 10155609



Trace Metals (continued)

Analysis EPA 6010B (1996)

	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

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Analysis EPA 6020 (1994)

	' 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 /Analysis 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	

(continued) Method Number 10155609

Method Number 10156000



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, TI 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/Кg	0.00	0.0 to 0.0		Acceptable





Volatiles - Low Level (Solids) (continued)

Analysis EPA 8260B 2 (1996)

	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/Кg	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/Кg	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)

	Result Units	Assigned Value	Accept.	Z	Evaluation
1,3-Dichlorobenzene 1, 4 4615 / 002-L - Lot 014499 /Analyst: wer/ 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)

	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/Кg	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)

	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

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Dataset

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 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





Method Number 10155609

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Trace Metals



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Analysis EPA 6010B (1996)

	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 60)10B	(1996)

	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)

	Result Units	Assigned Value	Accept.	Z	Evaluation
Benzene 1, 4 4375 / 002-L - Lot 014499 /Analyst: jir/ 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: jir/ 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: jir/ 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: jir/ 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

(continued) Method Number 10155609

Method Number 10174808





Sample Information

Metals in Soil

SPE-001 / Lot {EncryptedLotCode}

		Units	Assigned Value	Mean	Study Std. Dev.	Value
	Aluminum, Al	mg/Kg	10000.00	10,000.0	4,540.00	3140 ± 16
	Antimony, Sb	mg/Kg	84.80	84.80	53.10	185 ± 0.94
	Arsenic, As	ma/Ka	70.60	70.60	7.84	79.6 ± 0.41
	1010 Trace Metals Barium, Ba	ma/Ka	168.00	168.00	20.60	123 + 0 63
	1015 Trace Metals Beryllium, Be	mg/Kg	69.00	69.00	4 69	71.8 + 0.37
	1020 Trace Metals Boron, B	ing/kg	09.00	09.00	4.05	11.8 ± 0.37
	1025 Trace Metals	mg/Kg	135.00	135.00	12.90	157 ± 0.8
	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	mg/Kg	84.90	84.90	7.60	84.0 ± 0.43
	Lithium, Li 1980 Trace Metals	mg/Kg	97.10	97.10	10.00	99.2 ± 0.51
)	Magnesium, Mg	mg/Kg	1940.00	1,940.00	240.00	1820 ± 9.3
	Manganese, Mn	mg/Kg	546.00	546.00	59.30	576 ± 2.94
	Mercury Mala	mg/Kg	13.40	13.40	1.37	15.1 ± 0.08
	Molybdenum, Mo	mg/Kg	63.00	63.00	6.86	73.1 ± 0.37
	Nickel, Ni	mg/Kg	232.00	232.00	19.90	236 ± 1.2
	Potassium, K	ma/Ka	3590.00	3,590.00	472.00	3260 ± 16.6
	1125 Trace Metals Selenium, Se	ma/Ka	70 80	70.80	6.48	83.0 ± 0.42
	1140 Trace Metals Silicon, Si	malKa	443.00	443.00	480.00	790 + 4 03
	1145 Trace Metals Silver, Ag	mg/itg	70.50	70.50	7.00	76014.000
	1150 Trace Metals Sodium Na	mg/Kg	72.50	72.50	7.00	76.3 ± 0.39
	1155 Trace Metals	mg/Kg	1050.00	1,050.00	144.00	990 ± 5.05
	1160 Trace Metals	mg/Kg	195.00	195.00	36.20	133 ± 0.68
	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 Silo2	mg/Kg	1050.00	1,050.00	889.00	1050
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VOAs in Soil - Low Level

SPE-002-L / Lot {EncryptedLotCode}

· _ · · · · · · · · · · · · · · · · · ·	Units	Assigned Value	Study Mean	Study Std. Dev.	Gravimetric Value	
Acetone	µg/Kg	293.00	293.00	148.00	185 ± 1.8	
ASTS 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	
Carpon tetrachloride 4455 Volatiles - Low Level (Solids)	µg/Kg	164.00	161.00	24.30	167 ± 1.62	
4475 Volatiles - Low Level (Solids)	µg/Kg	168.00	175.00	14.20	172 ± 1.67	
4485 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00	
4500 Volatiles - Low Level (Solids) Chloroform	µg/Kg	0.00			0.00	
4505 Volatiles - Low Level (Solids) 1.2. Dibromo-3-chloronzonane (DBCP)	µg/Kg	67.70	65.80	7.99	67.6 ± 0.66	
4570 Volatiles - Low Level (Solids) Dipromochloromethane	µg/Kg	95.40	95.40	12.60	94.7 ± 0.92	
4575 Volatiles - Low Level (Solids) 1.2. Dipromoethane (EDB, Ethylene dipromide)	µg/Kg	143.00	142.00	17.30	144 ± 1.4	
4585 Volatiles - Low Level (Solids) Dibromomethane	µg/Kg	179.00	179.00	18.00	173 ± 1.68	
4595 Volatiles - Low Level (Solids)	µg/Kg	0.00			0.00	
4610 Volatiles - Low Level (Solids) 1.3. Dichlorobenzene	µg/Kg	169.00	180.00	22.70	178 ± 1.73	,
4615 Volatiles - Low Level (Solids) 1.4 Dichlorobenzene	µg/Kg	55.40	61.50	9.97	60.3 ± 0.58	
4620 Volatiles - Low Level (Solids) Dichlorodifluoromethane	µg/Kg	77.50	90.40	8.91	87.8 ± 0.85	
4625 Volatiles - Low Level (Solids) 1 1 - Dichloroethane	µg/Kg	0.00			0.00	
4630 Volatiles - Low Level (Solids) 1. 2. Dichloroethane	µg/Kg	153.00	150.00	14.20	152 ± 1.47	
4635 Volatiles - Low Level (Solids)	µg/Kg	125.00	124.00	16.30	127 ± 1.23	
4640 Volatiles - Low Level (Solids) cis-1 2-Dichloroothylano	µg/Kg	86.00	86.00	15.00	89.6 ± 0.87	
4645 Volatiles - Low Level (Solids) 1 2-Dichloronononane	µg/Kg	125.00	125.00	19.00	128 ± 1.24	
4655 Volatiles - Low Level (Solids)	µg/Kg	105.00	112.00	7.25	109 ± 1.05	
4680 Volatiles - Low Level (Solids) trans_1_3_Dichloropronene	µg/Kg	56.40	56.40	7.76	55.5 ± 0.54	
4685 Volatiles - Low Level (Solids) trans-1 2-Dichloroethylene	µg/Kg	166.00	166.00	30.40	164 ± 1.59	
4700 Volatiles - Low Level (Solids) Ethylbenzene	µg/Kg	78.00	78.00	12.30	77.8 ± 0.75	
4765 Volatiles - Low Level (Solids) Heyachlorobutadiane	µg/Kg	114.00	117.00	13.30	115 ± 1.11	
4835 Volatiles - Low Level (Solids) 2-Hevanone	µg/Kg	0.00		,	0.00	
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 Voletiles - 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)	<i>∣</i> 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/Кg	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 Volaties - 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/Кg	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	mg/L	0.00			0.00	
Cadmium, Cd 1030 TCLP Metels	mg/L	5.55	5.55	0.47	5.66	
Chromium, Cr (total)	mg/L	0.43	0.43	0.08	0.465	

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TCLP Metals in Soil

SPE-005 / Lot	t {EncryptedLotCode	3)
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(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}		Assigned	Study	Study	Gravimetric	
	 Units	Value	Mean	Std. Dev.	Value	
pH 1900 Miscellaneous Analytes	Units	7.35	7.34	0.08	7.35 ± 0.039	
Flash Point						
SPE-029 / Lot {EncryptedLotCode}		Assigned	Study	Study	Gravimetric	
	 Units	Value	Mean	Std. Dev.	Value	
Ignitability (Flashpoint, °F) 1780 Miscellaneous Analytes	۴	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.

² EPA
⁴ A2LA

PERFORMANCE EVALUATION

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4-May-2009 through 3-Jun-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 LPTP09-2-186. 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

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







Page 2 of 9







Dataset

_PTP09-2-186_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.

Accrediting Labcode WY00002

Colorado Dept. of Public Health & Environment

451 Ben Chouaf Certification 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



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

Trace Metals

Analysis EPA 7471A 1 (1994)

Method Number 10166208



Concluded 06/03/2009

Trace Metals (continued)

Analysis		
EPA 7471A	1	(1994)
		· · /

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)

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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

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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

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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)

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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	Study	Study	Gravimetric	
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	18	analyte accrediting footnotes		
, °	1	NELAC	2	EPA
:	3	Other	4	A2LA
	5	NELAC Experimental		

PERFORMANCE EVALUATION



20-May-2009 through 28-May-2009



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







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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 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 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

Miscellaneous Analytes

Analysis

End of LPTP09-2-217_Set_1

5/28/09 RT1014 LPTP09-2-217





Sample Information

Free Liquids in Paint

SDE 075 / Lot (Enonyptod) atCade)

		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.

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



Response: TR RAI-2.9-42

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Sediment Analysis Reports

Response to the U.S. NRC's Request for Additional Information Dewey-Burdock Uranium Project-Source Material License Application Technical Report Submitted August 11, 2009.



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 R	RL	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 Page 1 of 7



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

 Report Date:
 08/28/08

 Collection Date:
 06/17/08 11:00

 Date Received:
 06/18/08

 Matrix:
 SEDIMENT

	MCL									
Analyses	Result	Units	Qual	RL	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/el⊦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/ei⊦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		

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.

Page 2 of 7

U - Not detected at minimum detectable concentration



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

	MCL								
Analyses	Result	Units	Qual	RL	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/el⊦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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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

	MCL/									
Analyses	Result	Units	Qual	RL	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/el⊦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

Page 4 of 7



Client: RESPEC Inc Project: Edgemont (Soils/Air filters) Lab ID: R08060341-005 Client Sample ID: DewBurd PSC015
 Report Date:
 08/28/08

 Collection Date:
 06/17/08 12:50

 Date Received:
 06/18/08

 Matrix:
 SEDIMENT

	MCL								
Analyses	Result	Units	Qual	RL	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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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, Page 5 of 7



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

	MCL/								
Analyses	Result	Units	Qual	RL	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/el⊦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	
Uranlum, Activity	4.4	pCi/g-dry		0.34		10	SW6020	07/07/08 23:03/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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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

	MCL/									
Analyses	Result	Units	Qual	RL	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. Page 7 of 7

U - Not detected at minimum detectable concentration



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: 0	C_18954
Sample ID: C08061146-004AMS	Sample Matri	x Spike			Run: SUB-	C104563		07/16/	08 15:36
Radium 226	7.7	pCi/g-dry		100	70	130			
Sample ID: C08061146-004AMSD	Sample Matri	x 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: 1 CS-18954	Laboratory C	ontrol Sample			Run: SUB-	C104563		07/16/	N8 15-36
Radium 226	0.017	pCl/g-dry		117	70	130		0//10/	00 10.00
Completion NR 48054	Math ad Diau					0404502		07//01	00 45-20
Radium 226	-0.002	pCi/a-drv			Kun. 30B-	0104003		0//16/	U0 15.30 U
Method: E907.0								Batch: C_I	R104773
Sample ID: C08061133-004AMS	Sample Matri	x Spike			Run: SUB-	C104773		07/14/	08 21:06
Thorium 230	7.06	pCl/g-dry	0.10	101	70	130			
Sample ID: C08061133-004AMSD	Sample Matri	x 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 C	ontrol Sample			Run: SUB-	C104773	·	07/15/	08 12:58
Thorium 230	0.0531	pCl/g-dry	0.10	119	70	130			
Sample ID: MB-18954	Method Blank	ć			Run: SUB-	C104773		07/15/	08 12 58
Thorium 230	0.0003	pCi/g-dry							U
Method: E909.0M					······		<u> </u>	Batch: (C 18954
Sample ID:0000341.0064	Somolo Motri	y Snka			Bus: SHD	C105400		07/15/	
Lead 210	47.2	pCi/a-drv		81	70	130		077137	00 00.30
Sample ID: R08060341-006A	Sample Matri	x Spike Duplicate		70	Run: SUB-	C105490	15	07/15/	08 08:30
Lead 210	40.6	povg-dry		70	70	130	15	30	
Sample ID: MB-R105490	Method Blani	ĸ			Run: SUB-	C105490		07/15/	08 08:30
Lead 210	0.002	pCi/g-dry							U
Sample ID: LCS-R105490	Laboratory C	ontrol 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



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

Qualifiers: RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

ENERGY Chain of Cus	tody ar	nd Analytic	cal Reques	t Rec	ord	Page of
Company Name:	Project Na	me, PWS, Permit, E	ic.		Sample Origin	EPA/State Compliance:
KESTEC	Zower	Tech Denrey	burdock		State:	
Report Mail Address:	Contact Na	ime: /Ph	ione/Fax:		Email:	Sampler: (Please Print)
	cory.	former er	espec, con			Eric Kantz
Invoice Address:	Invoice Con	ntact & Phone:		·····	Purchase Order:	Quote/Bottle Order:
Special Report/Formats – ELI must be notified prior to sample submittal for the following:	Office Office	ANALYSIS	REQUESTED	F	R Contact ELI prior RUSH sample su for charges and	r to Shipped by: ubmittal Cooler ID(s):
	Contain A W S polis/Sol passay		Le II	CHED nd (TA	U Instruction Page	Becality Terrer
GSA EDD/EDT(Electronic Data) POTW/WWTP Format:	Number of Sample Type: Air Water S Vegetation Bi	pre Per Q		EE ATTA(mal Turnarou	S all sediment	Ves No
SAMPLE IDENTIFICATION Collection Collection (Name, Location, Interval, etc.) Date Time	MATRIX			υ Ž	H	Custody Seal Y N Intact Y N Signature Y N
Dew Burd CHROJS 6/17/08 10:40	5				Chey R. C. Mer	etter and nell a
Denburd BUCO15 6/17/08 11:00	S				Bear or Gr & And	The popposition
Den Bund CHROIS 6/17/0F 11:35	S				chay & Ander	sey O
Denby BVC045 6/17/08/12:17	5				Bearsterev	1543 B CL
Deuburd PSCO15 1/17/08 12:50	5				Passe . sparce	0
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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. Alt sub-contract data will be clearly notated on your analytical report. Visit our web site at <u>www.energylab.com</u> for additional information, downloadable fee schedule, forms, and links.

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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

					MCL/			
Analyses	Result	Units	Qual	RL	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/el⊦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

Page 1 of 4



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

	MCL/									
Analyses	Result	Units	Qual	RL	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/el⊦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/el⊦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.

Page 2 of 4

U - Not detected at minimum detectable concentration



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

					MCL/			
Analyses	Result	Units	Qual	RL	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/el⊢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. Page 3 of 4



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

					MCL/			
Analyses	Result	Units	Qual	RL	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



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RL - Analyte reporting limit. QCL - Quality control limit. MDC - Minimum detectable concentration MCL - Maximum contaminant level. ND + Not detected at the reporting limit. Page 4 of 4



QA/QC Summary Report

Cilent: 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:	E903.0					,			Batch:	C_18954
Sample ID:	C08061146-004AMS	Sample Matri	x Spike		. '	Run: SUB-	C104563		07/16	6/08 15:36
Radium 226		77	pCi/g-dry		100	70	130			
Sample ID:	C08061146-004AMSD	Sample Matri	x Spike Duplicate	•		Run: SUB-	C104563		07/16	6/08 15:36
Radium 226		8.7	pCi/g-dry	. •	125	70	130	12	20.9	
Sample ID:	LCS-18954	Laboratory Co	ontrol 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	1			Run: SUB-	C104563		07/1 6	6/08 15:36
Radium 226		-0.002	pCi/g-dry							U
Method:	E907.0								Batch: C	_R104773
Sample ID:	C08061133-004AMS	Sample Matri	x Spike			Run: SUB-	C104773		07/14	1/08 21:06
Thorium 230)	7.06	pCi/g-dry	0.10	101	70	130			
Sample ID:	C08061133-004AMSD	Sample Matri	x 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 Co	ontroi Sample	•		Run: SUB-	C104773		07/15	5/08 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	5/08 12:58
Thorium 230)	0.0003	pCi/g-dry							U
Method:	E909.0M								Batch:	C_18954
Sample ID:	R08060341-006A	Sample Matri	x Spike			Run: SUB-	C105490		07/15	5/08 08:30
Lead 210		47.2	pCi/g-dry		81	70	130			
Sample ID:	R08060341-006A	Sample Matri	x Spike Duplicate			Run: SUB-	C105490		07/15	5/08 08:30
Lead 210		40.6	pCi/g-dry		70	70	130	15	30	
Sample ID:	MB-R105490	Method Blank	l			Run: SUB-	C105490		07/15	5/08 08:30
Lead 210		0.002	pCi/g-dry							U
Sample ID:	LCS-R105490	Laboratory Co	ontrol Sample			Run: SUB-	C105490		07/15	5/08 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



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 Uranium	Method Blank 5E-06 mg/kg-dry	1E-06		Run: SUB-	C103886		07/08	8/08 15:05
Sample ID: LCS3-18974 Uranium	Laboratory Control Sample 1.7 mg/kg-dry	0.50	99	Run: SUB- 87.9	C103886 127		07/08	3/08 15:11
Sample ID: C08061115-022A (Uranium	MS3 Sample Matrix Spike 31 mg/kg-dry	0.50	119	Run: SUB- 75	C104503 125		07/19	9/08 09:58
Sample ID: C08061115-022A I Uranium	MSD3 Sample Matrix Spike Duplicate 26 mg/kg-dry	0.50	118	Run: SUB- 75	C104503 125	17	07/19 20	9/08 10:04

Qualifiers: RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

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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 <u>www.energylab.com</u> for additional information, downloadable fee schedule, forms, and links.



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Chain of Custody and Analytical Request Record PLEASE PRINT, provide as much information as possible. Refer to corresponding notes on reverse side.

Page__ of

Company Name:	Project Name, PWS #, Permit #, Etc.:
LOWES BRULE SIOUX TIZIRE	Contact Name, Phone, Fax, E-mail: Sampler Name if other than Contact:
187 OVATE CLIELLE	605-473-0163
Lower BRULE S.D. 51545	GEORGE HONEY WELL GALEN GROUPS LORE
Invoice Address:	Invoice Contact & Phone #: Purchase Order #: ELI Quote #:
544	SAA
Report Required For: POTW/WWTP DW	ANALYSIS REQUESTED Notify ELI prior to RUSH Shipped by:
Other	Sample submittal for additional
Special Report Formats - ELI must be notified prior to sample submittel for the following:	ित के में दिनावायुख्य and scheduling Codier iD(s)
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(Name, Location, Interval, etc.) Date Time	
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Signed Sample Disposal: Return to client:	LABORATORY USE ONLY Lab Disposal: Sample Type: # of fractions



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

					MCL/			
Analyses	Result	Units	Qual	RL	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/el⊦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

Page 1 of 8



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

					MCL/			
Analyses	Result	Units	Qual	RL	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/el⊦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, Page 2 of 8

U - Not detected at minimum detectable concentration



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

					MCL/			
Analyses	Result	Units	Qual	RL	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/el⊦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, Page 3 of 8



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

					MCL/			
Analyses	Result	Units	Qual	RL	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

Page 4 of 8



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

					MCL/			
Analyses	Result	Units	Qual	RL	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.

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ND \div Not detected at the reporting limit. U - Not detected at minimum detectable concentration



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

					MCL/			
Analyses	Result	Units	Qual	RL	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/el⊦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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F 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: R08060402-007 Client Sample ID: DewBurd SUB10S

 Report Date:
 08/28/08

 Collection Date:
 06/23/08 16:30

 Date Received:
 06/24/08

 Matrix:
 SEDIMENT

		MCL/								
Analyses	Result	Units	Qual	RL	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/el⊨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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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

					MCL/			
Analyses	Result	Units	Qual	RL	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/el∔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/el∔c

Report Definitions: RL - Analyte reporting limit. QCL - Quality control limit. MDC - Minimum detectable concentration MCL - Maximum contaminant level.

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ND + Not detected at the reporting limit.

U - Not detected at minimum detectable concentration



QA/QC Summary Report

Client: RESPEC Inc

Project: Edgemont (Soils/Air filters)

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

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



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_R1054	93
Sample ID:	C08061062-003AMS	Sample Matri	ix Spike			Run: SUB-	C105493		07/16/08 09:	30
Lead 210		0.0010	uCi/kg		82	70	130			
Sample ID:	C08061062-003AMSD	Sample Matr	ix 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 Blani	ĸ			Run: SUB-	C105493		07/16/08 09:	30
Lead 210		0.002	pCi/g-dry						U	
Sample ID:	LCS-R105493	Laboratory C	ontrol Sample			Run: SUB-	C105493		07/16/08 09:	30
Lead 210		0.113	pCi/g-dry		94	70	130			
Method:	SW6020								Batch: C_189	86
Sample ID:	MB-18986	Method Blan	k			Run: SUB-	C104200		07/14/08 09:	22
Uranium		2E-05	mg/kg-dry	1E-06						
Sample ID:	LCS3-18986	Laboratory C	ontrol 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 Matr	ix Spike			Run: SUB-	C104200		07/14/08 11:	37
Uranium		30	mg/kg-dry	0.50	101	75	125			
Sample ID:	C08061293-016BM SD3	Sample Matr	ix 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.

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RESPEC	Power	fee	Τ.	De	vez	Bur	1. J	۲			State	SD.	Yes 🗋 No 🗖	
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	Cory.	for	er	\a ~	ere	spec	. (9^	~					Eri	~ Krantz
nvoice Address:	Invoice Con	ntact	& Ph	ione:					<u></u>		Purcl	nase Order:	Quote	Bottle Order:
Special Report/Formats – ELI must be notified prior to sample submittal for the following:		A	RIA	L.YX	30S	req	UES) Te	D		R	Contact ELI price RUSH sample s	or to submittal	Shipped by:
	ontainers W S V B Is/Solids Is/solids Issay <u>O</u> the				X					HED		for charges and scheduling - Se Instruction Page	e }	
DW A2LA GSA EDD/EDT(Electronic Data)	Type: A Type: A (ater Sol		0	s C	F						G	Comments:		C Dr Jees
State: LEVEL IV Other: NELAC	Numt Sampte Air M Egetai	-	K							SEE A	H	Sedim	}-	(Yes) No Custody Seel (Y) N
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Den Bud 5. 5073 6/23/08 14:35	5										T	David Ray	L NI.	NSI.
Dew Bud Site 115 6/22/08 15:15	S										1	Daniel Rom	<u>ل</u> کر	A
Den Bud UNTOIS 6/25/08 16:00	3											Unknow Tri	b.	NO
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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 <u>www.energylab.com</u> for additional information, downloadable fee schedule, forms, and links.


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

	*				MCL/			
Analyses	Result	Units	Qual	RL	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	pĊ i/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. Page 1 of 19



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

					MCL/			
Analyses	Result	Units	Qual	RL	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/el⊦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. Page 2 of 19



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

·	•				MCL/			
Analyses	Result	Units	Qual	RL	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/el⊦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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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

					MCL/			
Analyses	Result	Units	Qual	RL	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	É909.0M	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/el⊦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. Page 4 of 19



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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

					MCL/			
Analyses	Result	Units	Qual	RL	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



RL - Analyte reporting limit. QCL - Quality control limit. MDC - Minimum detectable concentration MCL - Maximum contaminant level. ND + Not detected at the reporting limit. Page 5 of 19



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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

					MCL/			
Analyses	Result	Units	Qual	RL	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/el⊦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. Page 6 of 19



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

					MCL/			
Analyses	Result	Units	Qual	RL	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
 RL - Analyte reporting limit.

 Definitions:
 QCL - Quality control limit.

 MDC - Minimum detectable concentration

MCL - Maximum contaminant level. ND - Not detected at the reporting limit, Page 7 of 19



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LABORATORY ANALYTICAL REPORT

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

 Report Date:
 10/23/08

 Collection Date:
 08/21/08 10:56

 Date Received:
 08/21/08

 Matrix:
 SEDIMENT

					MCL/			
Analyses	Result	Units	Qual	RL	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	<i>.</i>			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. Page 8 of 19



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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

					MCL/			
Analyses	Result	Units	Qual	RL	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. Page 9 of 19



Client: RESPEC Inc Project: Edgemont (Soils/Air filters) Lab ID: R08080356-010 Client Sample ID: DewBurd PSC015
 Report Date:
 10/23/08

 Collection Date:
 08/21/08 11:24

 Date Received:
 08/21/08

 Matrix:
 SEDIMENT

					MCL/			
Analyses	Result	Units	Qual	RL	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
Uranlum, 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. Page 10 of 19



RESPEC Inc Client: 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

DF	Method	Analysis Date / By
		(
1	E909.0M	10/10/08 09:17/eli-c
1	E909.0M	10/10/08 09:17/eli-c
1	E909.0M	10/10/08 09:17/eli⊦c
1	E903.0	09/22/08 17:42/eli-c
· 1	E903.0	09/22/08 17:42/eli-c
1	E903.0	09/22/08 17:42/eli-c
1	E907.0	09/26/08 14:00/eli-c
1	E907.0	09/26/08 14:00/eli-c
10	SW6020	09/07/08 03:36/eli-c
. 10	SW6020	09/07/08 03:36/el⊦c
	1 1 1 1 1 1 1 1 10	1 E909.0M 1 E909.0M 1 E903.0 1 E903.0 1 E903.0 1 E903.0 1 E907.0 1 E907.0 1 E907.0 1 SW6020 10 SW6020

RL - Analyte reporting limit. Definitions: QCL - Quality control limit. MDC - Minimum detectable concentration

Report

MCL - Maximum contaminant level. ND + Not detected at the reporting limit, Page 11 of 19



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

					MCL/			
Analyses	Result	Units	Qual	RL	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/el⊦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. Page 12 of 19



Client: RESPEC Inc Project: Edgemont (Soils/Aîr 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

					MCL/			
Analyses	Result	Units	Qual	RL	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/el-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. Page 13 of 19



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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

					MCL/			
Analyses	Result	Units	Qual	RL	QCL	DF	Method	Analysis Date / By
RADIONUCLIDES - TOTAL								
Lead 210	1.8	pĊi/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/el-c
Lead 210 MDC	1.1	pCi/g-dry	•			1	E909.0M	10/10/08 09:17/el⊦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		7						
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. Page 14 of 19



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

					MCL/			
Analyses	Result	Units	Qual	RL	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. Page 15 of 19



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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

 Date Received:
 08/21/08

 Matrix:
 SEDIMENT

					MCL/			
Analyses	Result	Units	Qual	RL	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 Page 16 of 19



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

					MCL/		2	
Analyses	Result	Units	Qual	RL	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/el⊦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. Page 17 of 19



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

					MCL/	•		
Analyses	Result	Units	Qual	RL	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/el⊦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/el⊦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. Page 18 of 19

U - Not detected at minimum detectable concentration



Client: RESPEC Inc Project: Edgemont (Soils/Aîr 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

					MCL/			
Analyses	Result	Units	Qual	RL	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
 RL - Analyte reporting limit.

 Definitions:
 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

Page 19 of 19



QA/QC Summary Report

Client: RESPEC Inc

Project: Edgemont (Soils/Air filters)

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

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 pC/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 pC/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 pC/g-dry 112 70 130 Sample ID: MB-19745 Method Blank Run: SUB-C108008 09/22/08 19:17 Radium 226 -0.001 pC/g-dry 112 70 130 Sample ID: MB-19745 Method Blank Run: SUB-C108008 09/22/08 19:17 Radium 226 -0.001 pC/g-dry 0.10 153 70 130 Sample ID: MB-19745 Sample Matrix Spike Run: SUB-C109045 09/26/08 14:00 <td< th=""></td<>
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Sample ID: LCS-19745 Laboratory Control Sample Run: SUB-C109410 10/10/08 09:17
Lead 210 0.116 pCl/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

Page 1 of 2



QA/QC Summary Report

Client: RESPEC Inc

Project: Edgemont (Soils/Air filters)

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

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Analyte		Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW	6020								Batch:	C_19668
Sample ID: MB Uranium	3-19668	Method Blani 0.004	k mg/kg-dry	4E-05		Run: SUB-	C107115		09/07	7/08 02:06
Sample ID: LC:	S1-19668	Laboratory C	ontrol Sample		•	Run: SUB-	C107115		09/07	7/08 02:11
Uranium		110	mg/kg-dry	0.50	111	91	133			
Sample ID: R01	8080356-019A	Sample Matr	x Spike			Run: SUB-	C107115		09/07	7/08 04:44
Uranium		20	mg/kg-dry	0.50	124	75	125			
Sample ID: R0	8080356-019A	Sample Matr	x Spike Duplicate			Run: SUB-	C107115		09/07	7/08 04:50
Uranium		18	mg/kg-dry	0.50	129	75	125	11	20	S

Qualifiers:

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

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Invoice Address:			Invoice Cor	Invoice Contact & Phone: F				Purch	ase Order:	Quote	Quote/Bottle Order:				
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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 <u>www.energylab.com</u> for additional information, downloadable fee schedule, forms, and links.





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In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified (aboratories 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 <u>www.energv(ab.com</u> for additional information, downloadable fee schedule, forms, and links.



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Process and Equipment 3.1

<u>TR RAI-3.1-1</u>

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

See TR_RAI-Response and Replacement Pages; Section 3.1 for additional information concerning detection and inspection of spill prevention instrumentaion and procedures for TR Sections 3.1.4, 3.2.12, 4.1.2 and 5.7.1.3

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

See ER_RAI Response WR-3.1 and WR-3.2 on pages 23 through 26 submitted to the NRC August 11, 2010.

TR RAI-3.1-3

The applicant's general schedule did not provide a timetable for restoration of individual wellfields. 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.

Response TR RAI-3.1-3

See TR_RAI -Response and Replacement Pages, Section 6.1-11 for Schedule of Proposed Activities described in TR Section 6.1.4 as Figure 6.1-1.

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 wellfield must be maintained. Therefore, please include information regarding the manner in which hydraulic control will be maintained throughout the life of a wellfield, from the first injection of lixiviant to the end of restoration.

Response TR RAI-3.1-4

See TR_RAI -Response and Replacement Pages; Section 3.1-4 for additional information in TR Section

3.1.3.1.

Response to the U.S. NRC's Request for Additional Information Dewey-Burdock Uranium Project-Source Material License Application Technical Report Submitted August 11, 2009.

December 2010

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

The use of the term "leachate" in TR Section 3.1.3, on page 3-14, has been replaced with the word "lixiviant". The corrected form is in TR_RAI-Response and Replacement Pages; Section 3.1-5 for TR Section 3.1.3 "Monitoring Well Layout and Design".

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

The labeled black lines depicting the Dewey Fault Zone was modified by the addition of one label to the northernmost fault line and adjusting the original label near the northernmost fault line, also a label was added to the fault label 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 875 acres discussed in the narrative. Please clarify this apparent discrepancy.

Response TR RAI-3.1-7

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. Revisions to the text are in the TR_RAI-Response and Replacement Pages; Section3.1-7 for insertion into TR Sections 3.1.6.1.1 and 4.2.2.1 and 4.2.2.1.3.

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 wellfields, please provide further information regarding the manner in which both the wellfield and land application areas will be operated.



See TR_RAI-Response and Replacement Pages; Section 3.1-8 for text and figures relating to TR 4.2.2.1 Land Application.

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

See TR_RAI-Response and Replacement Pages; Section 3.1-9 for the water balance diagram in Figure 3.1-7 of the TR Section 3.1-5.



Detection and Inspection of Spill Prevention Instrumentaion and Procedures

Applicable To TR Sections:

3.1.4, 3.2.12, 4.1.2 and 5.7.1.3



Schedule of Proposed Activities

TR Section

6.1.4 and Figure 6.1-1



Additional Information Concerning Hydraulic Control

During the Life of the Project

TR Section 3.1.3.1.



Leachate Term Removed

TR Section 3.1.3.



Pond and Land Application Area

TR Sections 3.1.6.1.1 and 4.2.2.1 and 4.2.2.1.3.



Land Application

TR Sections 4.2.2.1



TR Section 3.1-5

Water Balance Diagram Figure 3.1-7



3.0 Description of Proposed Facility

3.1 In Situ Leach Process and Equipment

The ISL process involves the oxidation and solubilization of uranium from its reduced state using a leaching solution (lixiviant). The leach solution consists of groundwater with an oxidant, such as gaseous oxygen, added to oxidize the uranium to a soluble valence and gaseous carbon dioxide to complex and solubilize the uranium. At the PAA, Powertech (USA) will add gaseous oxygen and gaseous carbon dioxide to the recirculated groundwater from the ore zone aquifer. Once solubilized, the uranium bearing groundwater will be pumped by submersible pumps in the production wells in the well field to the surface where it is ionically bonded onto ion exchange, (IX) resins. After the uranium is removed, the groundwater will be re-circulated and reinjected via the injection wells in the well field. When the IX resin is loaded with uranium, the loaded resin is moved to an IX elution (stripping) column where the uranium is eluted (stripped) off the resin by a salt water solution. The resulting barren resin is then recycled to recover more uranium. The salt water eluate solution is pumped to a precipitated uranium oxide is then filtered, washed, dried and packaged in sealed containers for shipment for further processing.

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Typically, an ISL well field consists of a set of contiguous geometric shaped patterns of injection and production wells. Powertech (USA) will mostly utilize square or rectangular patterns, sometimes hexagons or triangles to cover the economically recoverable portions of the uranium deposit. This provides for uniform distribution of leach fluid (lixiviant) to efficiently contact the economically recoverable portions of the uranium orebody. The injection wells will be located at the corners of the geometric patterns and the production wells will be in the center of the geometric patterns. Powertech (USA) will withdraw 0.5 to 3 percent more groundwater than is reinjected to maintain a flow of native groundwater into the production well field and to prevent the flow of leach fluid from the mining zone into the surrounding aquifer. The excess produced water (bleed) creates and maintains a cone of depression in the potentiometric surface of the aquifer so that the native groundwater is continually flowing into the production zone. This bleed also helps Powertech (USA) control and limit the increase in the sulfate and chloride concentration in the leach solution.

At the surface, the pregnant lixiviant flows through IX columns, where the uranium is transferred to resin. The resin will be trucked or piped to a CPP for further refinement into yellowcake - the final product for the first stage of the uranium fuel cycle.

The barren lixiviant is re-fortified with oxygen and carbon dioxide and re-circulated through the orebody to leach uranium.



Powertech (USA) proposes to use a lixiviant consisting of varying concentrations of oxygen (O2) and carbon dioxide (CO2) added to the native groundwater to promote the dissolution of uranium as uranyl carbonate anionic species. The expected or typical lixiviant concentrations and compositions are shown in Table 3.1-1. This lixiviant formulation will minimize potential impacts to groundwater quality during uranium recovery and enable restoration goals to be achieved in a timely manner (NUREG-1569, 2003).

Constituent	Units	Concentration Range	
		Minimum	Maximum
Calcium	mg/L	≤20	500
Sodium	mg/L	≤400	6000
Magnesium	mg/L	≤3	100
Potassium	mg/L	≤15	300
Chloride	mg/L	≤200	5000
Carbonate	mg/L	≤0.5	5000
Bicarbonate	mg/L	≤400	5000
Sulfate	mg/L	≤400	5000
Uranium	mg/L	≤0.01	500
Vanadium	mg/L	≤0.01	100
pH	Std units	≤6.5	10.5
Total Dissolved Solids, TDS	mg/L	≤1650	12000

tuble 511 11 1 ypical Elantant Concentrations and Compositions	Table 3.1-1:	Typical Lixiviant	Concentrations	and Compositions
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Notes:

Table adapted from USNRC (2008) Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities-Draft Report for Comment. NUREG-1910. July 2008.

For purposes of the proposed action, it is anticipated that lixiviant concentrations will be within the parameters outlined in Table 3.1-1. The ISL process involves an oxidation step that converts uranium in the solid state to a form that is easily dissolved by the leaching fluid. The reactions representing these steps are as follows:

Oxidation: UO_2 (solid) + $\frac{1}{2}O_2$ (in solution) $\rightarrow UO_3$ (at solid surface)

Dissolution: $UO_3 + 2 HCO_3^{1-} \rightarrow UO_2(CO_3)_2^{2-} + H_2O$

 $UO_3 + CO_3^{2-} + 2HCO_3^{1-} \rightarrow UO_2(CO_3)_3^{4-} + H_2O$

The principal uranyl carbonate ions formed as shown above are uranyl dicarbonate, $UO_2 (CO_3)_2^{-2}$ [i.e., UDC] and uranyl tricarbonate $UO_2(CO_3)_3^{-4}$ [i.e., UTC]. The relative abundance of each is a function of pH and total carbonate strength.



The uranium-rich lixiviant is then extracted via production wells and pumped to an ion-exchange facility near the well field. At an IX facility, the uranium is removed from the pregnant lixiviant by complexation of UDC and UTC onto IX resins.

Logistically, if the IX process occurs at a SF, the uranium-rich resin is physically removed from the IX columns at the SF and transported via tanker truck to the CPP where uranium is eluted from the resin. Regenerated resin is then returned to the IX columns within the SF. If IX occurs at the CPP, trucking is not necessary.

The following paragraphs describe the upfront uranium processing facilities, including: well field layout; design and construction of injection, production, and monitoring wells; layout of header houses and associated infrastructure; leak detection and cleanup procedures; water balance and general well field operations; evaporation ponds and land application areas; waste disposal well sites; surface water management; quality control; 11e.(2) waste disposal agreements, and ISL references. The NRC will have the opportunity to review and inspect control equipment prior to facility operation to ensure compliance with 10 CFR 40.32(c).

3.1.1 Orebody

For a description of the orebody and mineralized zones see the geology Section 2.6. The aquifer characterization is summarized in Section 2.7

3.1.1.1 Approach to Well Field Development

An ISL well field consists of a series of injection and production wells that are completed across the target mineralization zone. Prior to design of the wells, the ore bodies will be delineated with exploration holes drilled on 100-feet centers. As discussed earlier, these holes will be geologically and geophysically logged Using this information, each new injection and production well will be assigned lateral coordinates, a ground surface elevation, depth to base of casing, i.e., top of completion interval, and length of completion interval, before it is drilled.

For all injection and production wells, the base of casing will be established at or below the confining unit overlying the mineralized zone. The screened interval will be completed only across the targeted ore zone.

A typical (100 x 100 ft grid) well field layout is illustrated on Plate 3.1-1. This typical layout is based on the lateral distribution and grade of one of the uranium deposits within the PAA.

The well field patterns may differ from well field to well field, but a typical pattern will consist of five wells, with one well in the center and four wells surrounding it oriented in four corners of a square between 50 and 150 feet on a side. Typically, a production well is located in the center of the pattern, and the four corner wells are injection wells. Such a pattern will be modified as

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needed to fit the characteristics of each orebody. A typical well pattern for an orebody is illustrated in Plate 3.1-1.

The pattern dimensions will vary depending on the geometry of the orebody. All wells will be completed so they can be used as either injection or production wells, so that well field flow patterns can be changed as needed to improve uranium production and restore groundwater quality in the most efficient manner. Other well field designs that may be considered include alternating single lines of production and injection wells.

Production and injection wells will be connected to a common header house, as shown on Plate 3.1-2. Construction of well heads are detailed in section 3.1.3. Well head connection details for injection and production wells are illustrated on Figures 3.1-1 and 3.1-2, respectively.

It should also be noted that monitor wells will be constructed in the same fashion as production wells shown in Figure 3.1-2. All wells are constructed such that the interior of the well casing is sealed to the external environment. Additionally, cement secures the well casing from total depth to surface level preventing any erosion of the well head. Because of these design considerations, all wells are expected to be sufficient to withstand submergence without contamination to external or internal environment of the well casing.











Figure 3.1-2: Typical Production Wellhead Diagram

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Typically, one header house will service up to 20 production wells and 80 injection wells. Piping between the wells and header house will consist of high density polyethylene (HDPE) pipe with heat-welded joints, buried approximately 5 feet below grade. The piping will typically be designed for operating pressure of 150-300 psig, but actual pressures will typically be less than 100 psig. The piping will terminate at the header house where it will be connected to manifolds equipped with control valves, flow meters, check valves, pressure sensors, oxygen and carbon dioxide feed systems (injection only), and programmable logic controllers. Electrical power to the header houses will be delivered via overhead power lines and via buried cable (see Figure 2.2-1). Electrical power to individual wells will be delivered via buried cable from the header house.

Production activities within a well field will typically begin in a subset of the total number of patterns to be constructed for that well field. As production activities are completed in these patterns, additional wells, pipelines and header houses will be constructed. They will be connected to one another via buried header piping that is sized to accommodate the necessary injection and production flow rates and pressures. In turn, header pipes from entire well fields will be connected to either a SF or CPP, as discussed earlier. A piping detail that shows the connection between the main header piping and laterals to header houses is shown in Plate 3.1-2.

Monitoring wells will be positioned around the perimeter of each well field ring, as illustrated on Plate 3.1-1. Internal to the well field additional monitoring wells will be installed. Perimeter wells will be screened across the entire mineralized zone to monitor for potential lateral excursion within the zone outside the well field, and to demonstrate compliance with groundwater quality standards within this zone. Internal monitoring wells will be screened across the overlying and underlying aquifers, respectively, where the greatest potential for vertical excursion may occur. An in-depth discussion of the positioning and spacing of monitoring wells is provided in Section 3.1.3 of this application.

3.1.2 Well Construction and Integrity Testing

Well construction materials, methods, development, and integrity testing are described in the following subsections.

3.1.2.1 Well Materials of Construction

Well casing material will typically be thermoplastic such as polyvinyl chloride (PVC). Wells typically will be 4, 5 and 6-inch nominal diameter, with wall thickness appropriate for design conditions. In order to provide an adequate annular seal, the drill hole diameter will be at least two inches greater in nominal diameter than the outside diameter of the well casing. The annular seal will be pressure-grouted and sealed with either cement grout or bentonite grout.



Casing will be joined by fittings or using methods recommended by the casing manufacture.

3.1.2.2 Well Construction Methods

Typical well installation will begin with drilling a pilot bore hole through the ore zone to obtain a measurement of the uranium grade and the depth. The pilot bore hole will be geologically and geophysically logged. After logging, the pilot bore hole will be reamed to the appropriate diameter to the top of the ore zone. A continuous string of PVC casing will be placed into the reamed borehole. Casing centralizers will be installed as appropriate. With the casing in place a cement/bentonite grout will be pumped into the casing. The grout will circulate out the bottom of the casing and back up the casing annulus to the ground surface. The volume of grout necessary to cement the annulus will be calculated from the bore hole diameter of the casing with sufficient additional allowance to achieve grout returning to surface. Grout remaining inside the well casing and be by water or heavy drill mud to minimize the column of the grout plug remaining inside the casing. The casing and grout will then be allowed to set undisturbed for a minimum of 24 hours. When the ground surface, additional grout will be placed into the annular space to bring the grout seal to the ground surface.

After the 24-hour (minimum) setup period, a drill rig will be mobilized to finish well construction by drilling through the grout plug and through the mineralized zone to the specified total well depth. As illustrated in Figure 3.1-3, the open borehole will then be underreamed to a larger diameter.

A well screen assembly will then be lowered through the casing into the open hole. The top of the well screen assembly will be positioned inside the well casing and centralized and sealed inside the casing using "K" packers. With the drill pipe attached to the well screen, a one-inch diameter tremie pipe will be inserted through drill pipe and screen, and through the sand trap check valves at the bottom of well screen assembly. Filter sand, comprised of well rounded silica sand sized to optimize hydraulic communication between the target zone and well screen, will then be placed between the well screen and the formation. The volume of sand introduced will be calculated such that it fills the annular space. The sand will not extend upward beyond the K packers due to packer design. A well completion report will then be prepared for each well. The reports will be kept available on-site for review. Copies will be submitted to regulatory agencies upon request.



Figure 3.1-3 Typical Well Construction



3.1.2.3 Well Development

The primary goals of well development are to allow formation water to enter the well screen and flush out drilling mud, or cement filtrate water and to develop the well bore to remove the finer clays and silts to reduce the pressure drop between the formation and the well screen. This process is necessary to allow representative samples of groundwater to be collected, if applicable, and to ensure efficient injection and production operations. Wells will be developed immediately after construction using air lifting, swabbing, pumping or other accepted development techniques which will remove water and drilling fluids from the casing and borehole walls along the screened interval. Prior to obtaining baseline samples from monitor or restoration wells, additional well development will be pumped sufficiently to show stabilization of pH and conductivity values prior to sampling and used to indicate that development activities have been effective.

3.1.2.4 Well Integrity Testing

Field-testing of all injection, recovery, and monitor wells will be performed to demonstrate the mechanical-integrity of the well casing. The mechanical integrity test (MIT) will be performed using pressure-packer tests. The bottom of the casing will be sealed with a plug, downhole packer, or other suitable device. The casing will be filled with water and the top of the casing will be sealed with a threaded cap or mechanical seal. The well casing will then be pressurized with water or air and monitored with a calibrated pressure gauge. Internal casing pressure will be increased to 125 percent of the maximum operating pressure of the well field, 125 percent of the maximum operating pressure rating of the pipe), or 90 percent of the formation fracture pressure (which equates to approximately 1 psi per foot of overburden above the bottom of casing), whichever is less. A well must maintain 90 percent of this pressure for a minimum of 10 minutes to pass the test.

If there are obvious leaks, or the pressure drops by more than 10 percent during the 10 minute period, the seals and fittings on the packer system will be checked and/or reset and another test will be conducted. If the pressure drops less than 10 percent the well casing will have demonstrated acceptable mechanical integrity.

If a well casing does not meet the MIT criteria, the well will be removed from service. The casing may be repaired and the well re-tested, or the well may be plugged and abandoned. Plugging of wells will be in accordance with the EPA regulations located in Title 40 Part 146.10 which comply with the South Dakota Administrative Rules contained in Chapter 74:55:01:59. DENR will be notified of any well that fails the MIT. If a repaired well passes the MIT, it will

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be employed in its intended service following approval from EPA and/or DENR that the well has demonstrated mechanical integrity. If an acceptable test cannot be demonstrated following repairs, the well will be plugged and abandoned.

In addition to the integrity testing of new wells, a MIT will be conducted on any well following any repair where a downhole drill bit or under-reaming tool is used. Any injection well with evidence of suspected subsurface damage will require a new MIT prior to the well being returned to service. Mechanical integrity tests will also be repeated once every five years for all active wells.

The MIT of a well will be documented to include the well designation, date of test, test duration, beginning and ending pressures, and the signature of the individual responsible for conducting the test. Results of the MITs will be maintained on-site and will be available for inspection by EPA and DENR. Results of MIT shall be reported within quarterly reports in accordance with the EPA UIC regulations in Title 40 Part 146.33 which also meet the DENR requirements in § 74:55:01:49.

3.1.3 Monitoring Well Layout and Design

As discussed in Sections 5 and 6 of Powetech (USA)'s application, an extensive groundwater sampling program specific to each well field will be conducted prior to ISL operations to establish baseline conditions, to monitor operations during recovery and restoration, and following aquifer restoration, to identify and monitor any potential impacts to water resources of the area. The groundwater monitoring program for individual well fields is designed to (1) establish baseline water quality prior to production, (2) detect excursions of lixiviant either horizontally or vertically outside the of the target mineralization zone, (3) demonstrate compliance with groundwater quality standards, and (4) determine when the mined mineralized zone has been adequately restored following ISL operations. Objectives 1 (partially) and 4 will accomplished using injection and recovery wells. Objectives 1 (partially), 2, and 3 will be accomplished using perimeter and internal non-production zone monitoring wells.

The production wells are laid out in a regular grid to efficiently contact the mineralized deposit (Figure 3.1-4). Generally, the wells are laid out in regular geometric shapes, usually squares, rectangles, triangles, or hexagons. The important features are that the patterns cover the economically mineable portions of the orebody, the production (pumping) well is in the center of each geometric shape, the injection wells are equally spaced from each other and from the production wells in each pattern (geometric shape). This is to ensure efficient contacting of the ore by uniform flow distribution and to facilitate control of the flow to prevent excursion of lixiviant to the monitor well ring. The injection wells are on the outside to ensure the ore is



contacted with lixiviant and a bleed withdrawing of some 0.5 to 3 per cent of the lixiviant circulating to maintain a cone of depression ensuring outside groundwater in the ore zone flows in toward the production well field to prevent flow of lixiviant outwards (NMA, 2007).

Within each well field a subset of wells 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 baseline sampling 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.

The perimeter monitor wells are completed in the same geologic formation as the mineralized ore zone around the perimeter of the production well fields spaced at a distance of 400 feet outside the production well field and evenly spaced around the perimeter of the well field with a minimum spacing either 400 feet or the spacing that will ensure a 70 degree angle between adjacent production zone monitor wells and the nearest injection well (NUREG/CR-6733; NUREG-1910, 2008; NUREG-1569).

Internal, non-production zone monitoring wells will be installed at spacing densities to be determined as described in section 3.1.3.1.1.





Figure 3.1-4 Typical 5 Spot Well Field Pattern



3.1.3.1 Well Field Operational Monitoring

The primary purpose of a monitoring well is to serve as an early warning system for detection of excursions and to meet the operation point of compliance (POC) in accordance with NRC's interpretations of 10 CFR Part 40, Appendix A. The proposed monitoring system is described below.

The plant facilities and equipment at the PA will consist of standard design, construction, and materials for uranium in-situ recovery extraction. Powertech 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.

Water levels will be monitored and samples will be collected on the frequency of semi-monthly 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 monitoring well ring, overlying and underlying monitor wells. If there is any period of inactivity between production and restoration phases, monitoring will continue during this time as well. For each well field, this monitoring activity will continue until the 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.

3.1.3.1.1 Non-Production Monitoring Wells

Depending on-site specific conditions, non-production monitoring wells may consist of two types of monitor wells termed "overlying" and "underlying". The screened intervals of overlying wells are located in the sand unit or aquifer immediately above the ore-bearing stratum.

Depending on-site specific conditions, non-production monitoring wells may consist of two types of monitor wells termed "overlying" and "underlying".

Overlying Non-Production Monitoring Wells

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.

Exhibit 2.7-1d in TR Section 2.7 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.

Exhibit 2.7-1b 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 nonproduction 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.

Exhibit 2.7-1b 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.

Exhibit 2.7-1d 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 #4. However, outside of the Dewey Well field #4. However, outside of the monitor ring for the well field #4. However, outside of the monitor ring for the 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.

The underlying monitor wells are used to obtain baseline water quality data and are used in the development of UCLs for the underlying aquifer that will be used to determine if vertical migration of leach fluids is occurring. The screened zone for the underlying monitor wells is determined from electric logs by qualified geologists or hydrogeologists. Underlying wells will not be installed below the Lakota formation, primarily due to the presence of the approximately 100' thick and relatively impermeable Morrison formation immediately below the Lakota formation.

Non-production zone monitoring wells will be designed and installed for detection of potential excursions of lixiviant.

"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 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.

Design of the monitor ring and overlying and underlying monitor wells will be performed for each well field according to site specific lithology and processes of the production zone(s) of each well field. Powertech (USA) will present each monitoring well program to NRC and the South Dakota Department of Environmental Natural Resources (DENR) before installation of proposed well placement to ensure administrative approval is obtained. After completion of the required hydrologic test, it may be necessary to revise the location and/or number of wells proposed. Each well field will be handled on a case-by-case basis in consultation with the NRC and DENR. Powertech's (USA) Safety and Environmental Review Panel (SERP) to be established under NRC requirements will review hydrologic test results and documentation to demonstrate that the monitoring wells are not hydrologically connected to the injection or production wells. Based on current knowledge of site lithology and processes of the production area, and industry proven practices, the number and spacing of overlying and underlying monitoring wells meets criteria to protect human health and the environment. Wells completed



in overlying and underlying aquifers will be subject to sampling, remedial action, and reporting requirements pertinent to EPA and DENR rules.

Additional information about sampling parameters, frequencies, and procedures is provided in Section 5 of this application.





Figure 3.1-5 Cross Section of Typical Well Placement



3.1.3.1.2 Production Zone Monitoring Wells

Production zone monitoring wells are installed around the periphery of each production area to monitor for any fluids that might escape the hydraulic controls (Hunkin, G. G., 1977 and Dickinson, K. A., and J. S. Duval, 1977), with a screened interval open to the sand unit containing the production zone. This monitoring "ring" design serves two purposes: (1) to monitor any horizontal migration of fluid within the sand unit or aquifer where production is occurring and, (2) to determine baseline water quality data and characterize the area outside the production pattern area. Upper Control Limits (UCLs) are determined from indicator constituents that are selected due to their nature of mobility to provide early warning with regards to a potential excursion; these constituents are determined from the well field specific groundwater quality baseline data. By establishing UCLs, the operator is allowed the capability of early detection of an excursion at a monitor well and then has the time to apply corrective action before water quality outside the aquifer exemption boundary is adversely affected (NUREG/CR-6733, 2001).

The screen interval for perimeter production zone monitor wells will be the entire hydrologeologic unit. Similarly, overlying and underlying wells will be screen across the entire hydrogeologic unit which either overlies or underlies the production zone hydrogeologic unit. These screened intervals are determined by mapping of the 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 hydrologeologic package for each well field for review 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 Figure 2.7-13 and Figure 2.7-14 for the first well fields at Dewey and Burdock respectively.

3.1.3.1.2.1 Excursion Detection

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.

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 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 wellfield 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.



3.1.3.1.3 Selection of Upper Control Limit (UCL) Parameters

Powertech proposes to use the following UCL parameters for early warning of potential excursions:

Chloride, Conductivity and Total Alkalinity

Final UCL parameters will be chosen upon evaluation of each individual well field's baseline water quality. The constituents chosen will be those that would best serve as an early warning of a potential migration of lixiviant from the particular well field.

Total alkalinity concentrations should be affected during an excursion as bicarbonate is the major constituent added to the lixiviant during mining (in the form of carbon dioxide).

Sulfate will not be proposed as a UCL parameter as this constituent is known to increase across the Dewey-Burdock PAA.

Lixiviant mixtures typically contain higher TDS than native groundwater and therefore have a higher specific conductivity. For this reason conductivity is is useful for the early detection of movement of lixiviant outside the production zones.

The applicant does not propose to use uranium as a UCL parameter for detection of potential excursions, as uranium is easily precipitated from solution and hence the absence of uranium in a monitor well does not clearly indicate the absence of an excursion.

This approach is based on standard monitoring practices with proven operational history in uranium ISL recovery. Further justification for this approach is found in Appendix 6.6-B "Numerical Modeling of Groundwater Conditions Related to In Situ Recovery at the Dewey–Burdock Uranium Project, South Dakota". This justification demonstrates that the spacing is adequate to detect an excursion and that an excursion can be controlled at the monitor ring.

The width of the buffer zone (area between production field and monitor wells) is such that monitor wells are within the zone of control of pumping wells which would be used to control an excursion. The operator is responsible for restoring groundwater affected via the mining process (including the buffer zone if affected); therefore, it is in the best interest of the operator to establish a buffer zone that is operationally feasible. This spacing was originally determined through practical experience to locate monitor wells near enough to the operational areas to prevent broad areas of potential solution contamination, yet beyond the normal extent of the



radially transported lixiviant. Final determination of distance between the horizontal monitoring wells and the well field will be based upon well field specific considerations such as drawdown of potentiometric surface, gradient, transmissivities, aquifer storage, hydrologic boundary conditions, etc.

Production zone monitoring wells are installed before the start of production activities in order that required baseline sampling and hydrologic tests can be conducted. Well design, construction, and development will be identical to those of injection and recovery wells, except well screens will be completed across the entire mineralized sandstone (Figure 3.1-6). Additional information about sampling parameters, frequencies, and procedures is provided in Section 5 of this application.

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Figure 3.1-6: Typical Monitor Well Construction Diagram

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3.1.4 Detection and Cleanup of Piping Leaks

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 shutdown will consist of a shutdown switch and an internal shutdown control will be located within the header house sump. The external and internal shutdown controls are designed for automatic and remote shut down of the header house power. Some header houses may have a disconnect 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 mitigate potential electrical hazards while de-energizing the operating equipment including the production pumps. The header house sumps will also be equipped with level transmitters 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. 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.

Cleanup will involve characterizing the extent of release via visual observation coupled with sampling of soils for constituents of concern in accordance with a standard operating procedure. To the greatest extent practicable, impacted material will be consolidated into a centralized area to mitigate the potential for proliferation of small waste disposal sites within the license area. More information regarding spill management is presented in Subsection 5.7.1.3 (Spill Provision Plans) of this application.

3.1.5 Water Balance for the Proposed Project

Powertech (USA) proposes two methods of wastewater disposal, Class V disposal wells and land application, that are described in detail in TR Section 6.1.9. The disposal method selected will determine the method of aquifer restoration, groundwater treatment or groundwater sweep, as described in detail in TR Section 6.1.3. In addition to these options, the PA proposes two aquifer bleed options during aquifer restoration, a 1.0 percent aquifer bleed or a one pore volume bleed,



as described in detail in TR Section 6.1.3. The water balanced for both the production and the restoration phases, at both the Burdock site and the Dewey site, for these options is presented in Figure 3.1-7. 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.





				Wa	ter bal	ance fl	ow rat	es (gal	/min)							
Operation	Aquifer	Disposal	Stream ID													
phase	bleed	Option	А	в	с	D	E	F	G	н	1	J	к	L	м	N
Deservers	0.075.00/	DDW	20	2280	2260	20	0	12	12	12	32	15	1720	1705	0	15
Recovery	0.8750%	LA	20	2280	2260	20	0	12	12	12	32	15	1720	1705	0	15
	1.00/	DDW	2.7	267	187	80	77	0	77	0	80	2.7	274	192	79	82
D	1.0%	LA	2.7	267	0	267	264	0	264	0	267	2.7	274	0	271	274
Restoration	1.0.01/	DDW	28	167	117	50	22	0	22	0	50	25	149	104	20	45
	1.0 PV	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

3.1.6 Pond Design and Land Application

Ponds will be required for both of the wastewater disposal options proposed. Regardless of the option selected for wastewater disposal, wastewater will be treated with barium chloride and directed to radium settling ponds for the removal of the insoluble radium precipitate.

The design criterion for both systems is such that it could allow continuous disposal of a 3 percent bleed from recovery operations as well as simultaneous operation of restoration activities.



In the case of the deep disposal well method of wastewater disposal, ponds will be both smaller and fewer in number than needed with the land application method. Other than radium removal ponds, an outlet pond, and a CPP pond, the waste disposal well option requires ponds only for surge and temporary storage of wastewater destined for injection into the disposal well.

In the case of the land application method of wastewater disposal, several ponds will be required for seasonal storage of water during non-application periods. (Figure 2.1-1).

3.1.6.1 Pond Leak Detection

All ponds will be lined with at least a single polymeric liner. Ponds potentially containing radiological constituents have been designed with a dual liner system and a leak detection system, as detailed in Figure 3.1-8. The primary liner and secondary liner are separated by a geonet which provides a physical separation and allows fluid flow between the two liners. The contour of each secondary liner in ponds so equipped is graded at approximately 2 percent towards a leak detection sump. Any leakage from the primary liner will be contained by the secondary liner and collected in the leak detection sump. The sump is routinely monitored for the presence of fluid on a frequency of at least once per week, if appropriate. This leak detection sump is monitored through a pipe installed within the impoundment wall. This pipe allows a submersible pump to be installed within the sump for the purpose of monitoring and/or removal of fluid should a leak occur.

Detection of fluid within the leak detection sump will initiate measures to take the pond out of use, remove its contents to another pond, and initiate an investigation into the cause of, and ultimately the repair of the condition creating the leak. The ponds are designed to be completely emptied with the use of a submersible pump.

3.1.6.1.1 Inspection of Impoundment System.

A continuous program of inspection for the retention system(s) will be implemented during the construction, retention and reclamation phases of pond life. The inspection program will be designed around consideration for the site and specific structure type characteristics. Some considerations will include size of the retention system, geology and any other structure or site characteristics that may influence the performance of the overall retention system. Baseline data gathered will be utilized for the inspection program design as well as the guidance provided by the NRC in RG 3.11.A detailed inspection program will be designed and systematically implemented during the construction phase of the ponds to ensure sound construction and

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proper installation of instrumentation within the retention system. The inspection program during construction, retention and reclamation will include inspections by trained and experienced personnel of:

- Water levels; to ensure proper freeboard area is maintained
- Pipes and couplings, pumps and testing of any sensors that may be in place; to protect against potential clogs and/or ice accumulation
- Retention embankment inspections; to prevent erosion, movement and seepage
- Instrumentation, including any that deal with safety features of the system, will be inspected and tested; to ensure readings are correct after construction and installation and before retention system is put online. Periodic inspection and testing of instrumentation will continue until the retention system is reclaimed.
- Liners will be inspected regularly to prevent degradation
- Unscheduled inspections to ensure against damage from significant storm events or other unusual events. These inspections may be performed before and after such an event to ensure that proper conditions exist that are protective of human health and the environment.
- Technical evaluation will be performed as needed as per RG 3.11 section 4.3.
- Inspection Reports will be housed at the facility where the retention system is in use and available for regulator review. Communication with the NRC will be initiated if any abnormal hazards are observed during inspection.

Ponds have been designed to meet NRC's 10 CFR Part 40 Appendix A Criterion 5 and South Dakota Administrative Rule 74:29:11:23, pond and surface impoundment design and construction requirements (Figure 3.1-8). The ponds were sized using the industry accepted Soil-Plant–Atmosphere- Water (SPAW) estimation method (Saxton, 2006), which estimates the daily water budgets of inundated ponds and wetlands, assuming the following inflow to the ponds at each site:

- 1. An inflow rate, consisting of production bleed and restoration flows, of 320 gpm for 24 hours per day, 365 days per year
- 2. All irrigation tail water and rainfall runoff from the irrigated (land application) areas is returned to the ponds

With these design conditions, the ponds will occupy 71 acres for the land application option. The land application areas (pivot irrigation systems) will occupy 760 acres.



Figure 3.1-8 Typical Pond Sections Including Leak Detection

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Only 630 acres are expected to be irrigated at any one time during operation of the project.

The assumed outflow from the ponds at each site is during irrigation of the land application areas. Irrigated at each site, 24 hours every day from March 29 to May 10 at a rate of 297 gallons per minute (gpm); from May 11 to September 24 at a rate of 653 gpm; and from September 25 to October 31 at a rate of 297 gpm.

Using these assumptions, the ponds are sized to contain a volume with a one percent exceedance probability for the 15-year operating life of the facility.

Should the proposed action operate with only waste disposal well(s) as the wastewater method, a much smaller pond design is required. 71 acres for the land application ponds and only 18 acres for the deep well disposal option ponds. The ponds are 53 acres less with the deep disposal option. Should both land application and deep disposal options be utilized, the total number and size of ponds are expected to fall somewhere between the two options. Installation of waste disposal well(s) is deemed initially feasible due to characterization of the water quality and geologic structure at and surrounding the PAA. Further analysis is in progress to determine the location of this well(s) with possibilities within the permit boundary as well as near the project boundary within Wyoming. Powertech (USA) expects that the well will be classified under a Class V permit.

The designs of both systems for wastewater disposal have the capacity of 3 percent bleed on a continuous basis for the life of the project. This bleed is believed to be at a minimum 2-3 times anticipated normal requirements of well field bleed in order to maintain sufficient cone of depression for operational well field control. This design criterion is believed to be highly conservative since it is not expected that the project will reach the full capacity of wastewater disposal systems (Figure 3.1-7).

3.1.6.2 Deep Disposal Well

The waste disposal Area Permit would consist of four to eight DDWs installed within the PAA.

The offsite disposal of CPP brines is no longer being considered.

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Figure 3.1-9 provides the facilities map depicting the deep disposal well option.





Figure 3.1-9: Facilities Map_Deep Disposal Option

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3.1.7 Surface Water Management

All of the Dewey-Burdock facilities are located outside of the FEMA 100-year flood plain as discussed in Section 2.7.1.4.4.

For well fields and non-CPP/SF areas, stormwater management will include general grading of roads and building pads to promote positive drainage toward existing water courses. Best management practices (BMPs) for sediment control during construction and operations will be provided until vegetative cover on disturbed ground has been restored. Such practices will include, but not be limited to, use of silt fences and hay bales downstream of disturbed areas, and as necessary, long-term erosion protection using stream channel armoring such as rip rap, gabions, and/or geotextiles.

For the CPP site area, SF site, and contiguous impervious services, excess runoff above preexisting conditions will be temporarily detained to assure that peak runoff flow following construction does not exceed peak runoff flow prior to construction. BMPs will include construction of bermed parking lots with controlled outlet structures, routing flow into stormwater detention ponds with controlled outlet structures, or some combination thereof. In addition, sediment control during construction will be accomplished using similar BMPs.

Surface water/groundwater interactions and potential impacts to these media from site activities are discussed in Section 7 of this application.

3.1.8 Quality Control

Quality Control during construction, operations, and reclamation will be assured through strict compliance with construction plans and specifications, operations manuals, and standard operating procedures. During construction, quality will be assured through material testing programs prescribed in the specifications, review of testing results by the design engineer, and inspection and acceptance of work products by the owner's representative.

During operations, standard operating procedures developed during project design will be followed. Operations supervisors will instruct field personnel as to the documented procedures and routinely inspect and document their performance.

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3.1.9 Approved Waste Disposal Agreement for 11e.(2) Material

Prior to engaging in licensed ISL operations, Powertech (USA) will supply a waste disposal agreement with an NRC approved facility for the disposition of solid 11e.(2) materials.

3.2 Central Processing (CPP) and Chemical Storage Facilities; Equipment Used and Material Processed

One SF will be located at the Dewey site and one will be located at CPP at the Burdock site (Figure 3.2-1). The downstream uranium recovery processes described in the preceding section will be accomplished in several steps. Uranium recovery from the solution by IX, subsequent processing of the loaded IX resin to remove the uranium (elution), the precipitation of uranium, thickening of the uranium slurry, and the dewatering, drying, and packaging of solid uranium oxide (yellowcake) will be performed at the CPP.

The sites for both the CPP and the SF have been designed to provide security and ease of access for operating purposes. The sites are designed with ample areas for access by resin transfer trucks as well as truck transports for chemical delivery and shipment of product and byproduct materials. Figure 3.2-2 shows the site layout of the CPP site, including the placement of an office building, a maintenance shop and the CPP proper. Traffic routes and truck turning radii are indicated on this figure. The site layout for the SF is shown in Figure 3.2-3.





3.2-1: Proposed Locations for the Satellite Facility and Central Processing Plant





Figure

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Figure 3.2-2: General Site Plan Central Processing Plant

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Figure 3.2-3: General Site Plan - Satellite Facility

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Р	owertech (USA) IN	С.
Satel	lite Processing	Plant
Satel	lite Processing Dewey-Burdock	Plant
Satel	lite Processing Dewey-Burdock	
Satel	16-Feb-2009 REF	Plant



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3.2.1 CPP Equipment

The processing facilities will be housed in pre-engineered metal buildings. The equipment layout within these buildings is shown in Figures 3.2-4 and 3.2-5 for the CPP and SF, respectively. The CPP includes the following:

- IX
- Chemical addition
- Filtration
- Elution circuit
- Precipitation and thickening circuit
- Product dewatering, drying and packaging
- Liquid waste stream circuit
- Drum storage and decontamination area
- Waste Storage buildings are located at the SF in Dewey and the CPP area at Burdock.

Based on preliminary design and site geotechnical evaluations, the project CPP will be located within Section 2, T7S, R1E. Chemical storage and a septic tank and leachfield will also be located within this area. The Dewey SF will be located in Section 29, T6S, R1E. These plant locations are shown in Figure 3.2-1.

The CPP will serve production from Dewey-Burdock ISL operations, and possibly resin from other potential Powertech (USA) satellite projects in the area. In addition, depending on market conditions and regional demand for yellowcake processing, the CPP may be used for tolling arrangements with other ISL operations licensed under a different operator.

The following subsections present a description of each recovery and processing system and the equipment components comprising each system. An overall process flow diagram is presented in Figure 3.2-6.





Figure 3.2-4: Central Processing Plant Detail

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Figure 3.2-5: Satellite Facility Plant Detail

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Recovery of the uranium from the uranium bearing or pregnant lixiviant solution will be accomplished via an ion exchange process. The pregnant lixiviant from the well field will be pumped through IX vessels containing uranium-specific IX resin beads (Dowex 21K XLT or equivalent). As the lixiviant flows through the resin beds, the complexed uranium molecules attach themselves to the beads of resin, displacing a chloride ion or bicarbonate ion as shown below:

$$2 \text{ RCl} + \text{UO}_2(\text{CO}_3)_2^{-2} \rightarrow \text{R}_2 \text{UO}_2(\text{CO}_3)_2 + 2\text{Cl}^{-1}$$
$$2 \text{ RHCO}_3 + \text{UO}_2(\text{CO}_3)_2^{-2} \rightarrow \text{R}_2 \text{UO}_2(\text{CO}_3)_2 + 2\text{HCO}_3^{-1}$$

Each resin bead has a finite number of sites where the uranium complex can attach. When most of the available sites in the resin bed are occupied by uranyl dicarbonate (UDC) or uranyl tricarbonate (UTC) ions, the resin will be considered to be "loaded" and will be ready for processing.

The IX vessels will be designed to operate in downflow mode, and each will contain approximately 500 ft³ of IX resin. The IX vessels will be arranged in multiples of two vessels in series. The lixiviant will be passed through the primary or lead vessel which will be where most of the resin loading takes place. The lixiviant will then pass through the secondary or lag vessel where the solution will be "polished" by removal of any remaining dissolved uranium. When the lead vessel becomes loaded, it will be taken off line and flow of lixiviant will be routed to the secondary vessel which will become the lead vessel. The resin in the off-line vessel will be removed and regenerated resin will be returned to the vessel. The vessel containing the regenerated resin will be then brought back on line in the lag position. The resin that was removed will be transferred to the elution and regeneration process in the CPP.

After passing through the IX vessels, the barren lixiviant will be returned to the well field where oxygen and carbon dioxide will be added prior to reinjection. A booster pump station may be required to achieve the required injection pressure. A sidestream referred to as the production bleed will be removed from the barren lixiviant and routed to either the wastewater system or the production bleed reverse osmosis (RO) system, depending on which operating option, A or B as discussed in section 3.1.5 (nowhere we said Option A or B in 3.1.5., we said disposal wells and land application options), is utilized. The flowrate of this sidestream will be approximately 0.5 percent to 3 percent (we talk about 1% in 3.1.5) of the pregnant lixiviant flowrate. The purpose

of the production bleed stream is to maintain a hydraulic gradient towards the production zone (as said in 3.1), as discussed in Section 3.1.

3.2.2.1 Recovery Equipment

The recovery equipment includes the recovery IX vessels, the production bleed reverse osmosis system (land application option only), and the recovery and injection composite booster pumps.

Ion Exchange Vessels

The IX columns will be vertical cylindrical pressure vessels with dished heads. The vessels will be constructed of fiberglas-reinforced plastic (FRP), and will be approximately 13 feet in diameter with a seam to seam height of 8 feet. The vessels will be constructed according to American Society of Mechanical Engineers (ASME) Section VIII specifications. Each vessel will be equipped with an upper flow distribution plate and a lower flow distribution manifold constructed of stainless steel pipe and slotted well screen. The IX vessels will be designed to provide optimum contact time between pregnant lixiviant and IX resin. These vessels can be operated at a wide range of flowrates without loss of performance.

At both the SFs and the CPP, the air/vacuum relief valves on the IX columns will be piped together in a manifold which will be vented above the roofline of the building. In addition, a flexible duct designed to attach to tanker trucks during loading and unloading of resin will be connected to this vent manifold. This vent system will not have a fan because vacuum relief requires an inflow of air.

Each vessel will be equipped with a pressure relief valve and an air/vacuum release valve. Pressure transmitters and pressure gauges on the inlet and outlet piping connected to each vessel will measure and indicate pressure both locally and in the control room. Control interlocks with the well pumps and booster pumps will be used to prevent system pressure from exceeding the pressure rating of the lowest rated system component.

Production Bleed RO System (DDW Option)

The production bleed RO system will be designed to accommodate the production bleed flow, rejecting approximately 30 percent of the flow as brine and returning 70 percent of the flow as permeate. The production bleed RO system will be a packaged system including feed conditioning, filtration, membranes, and control system.



Booster pumps may be used to convey pregnant lixiviant to the SF or CPP, and to convey barren lixiviant from the SF or CPP to the well field. These pumps will be in-line centrifugal pumps, and will each have the capacity to pump 50 percent of the design flow. The pumps will be equipped with pressure indicators on the discharge lines, and a flow meter and flow indicator transmitter in the discharge line. Flow will be indicated both locally and in the control room located in the SF or CPP, respectively. The measured flow will be used to control pump motor speed via a variable frequency drive.

3.2.3 Resin Transfer

Resin will be transferred out of IX vessels at the CPP and SF to the elution circuit where it will be regenerated by contacting it with concentrated salt solutions. The concentrated salt solution displaces the UDC and UTC and replaces them with chloride or carbonate ions. The regenerated resin will be then transferred back to IX vessels.

At the CPP, resin transfer will be accomplished by pumping water into the top of the IX vessel with the bottom discharge valve open. This will force the resin to flow out of the vessel into the transfer pipe. The resin and water will be pumped via the transfer piping to one of two elevated shaker screens. The shaker screens will be inclined, vibrating screens which will separate transfer water, loaded resin, and waste into separate streams. The transfer water will pass through the screens and flow by gravity into a collection tank which feeds the resin transfer pumps. The loaded resin will drop into one of four elution columns to be regenerated. The oversized or undersized solid waste from the shaker screens will consist of broken resin beads, silt and sand from the wells, and scale removed from the resin, and will collect in a hopper to be periodically removed and drummed for disposal.

Following elution of the resin, the transfer process will be reversed. Water will be pumped into the top of the elution column with the bottom discharge valve open. This will force the resin out of the column and into the resin transfer piping. The resin and water will be pumped back to the IX vessel where they will enter through a nozzle on the side of the vessel. The resin transfer water will exit the vessel through the bottom liquid distributor and flow back to the resin transfer water tank. The resin will remain in the IX vessel because it will not be able to pass through the screen openings in the bottom liquid distributor.

At the SFs, loaded resin will be transferred from the IX vessels to a tanker truck that enters the building (Figure 3.2-5). Resin transfer will be accomplished through resin transfer piping and hoses that connect the exchange vessels to the transfer truck. With the connections made and



transfer valves opened, resin transfer water will be pumped into the top of the IX vessel with the bottom discharge valve of the vessel open. This will force the resin to flow out of the vessel and into the tanker truck. Water and resin will enter the tanker, and water will exit the tanker through a screened outlet port and be returned to the resin transfer water tank. The resin, which cannot pass the screen, will remain in the tanker. When the resin has been flushed from the vessel and piping, the excess transfer water is drained from the truck, the valves controlling the transfer will be closed and the hoses disconnected from the truck.

The truck will then transport the resin to the CPP where the truck will be connected via hoses to the resin transfer water headers. To transfer resin out of the tanker, water will be introduced to the tanker from the resin transfer water tank, and water and resin will flow out of the tanker to the vibrating screens described above. To transfer resin back into the tanker following elution, water and resin will be pumped out of the columns as described above, and routed into the tanker via the hose connections between the tanker and the resin transfer header. As with the transfer at the SF, the resin will remain in the tanker and the transfer water will return to the resin transfer water tank. When the tanker returns to the SF, the regenerated resin will be transferred back into the IX vessel using the same methods.

3.2.3.1 Resin Transfer Equipment

Equipment associated with the resin transfer system includes a resin transfer tanker truck, two shaker screens, a shaker screen water tank, a resin transfer water tank, and a resin transfer pump.

Resin Transfer Tanker Truck

Resin transfer tanker trucks will have one or more compartments with sloped bottoms and screened bottom outlet nozzles. Resin transfer tanker trucks will have a minimum capacity of 500 ft3 per compartment.

Shaker Screens

The shaker screens will be packaged units that allow adjustment of angle and motion to optimize separation. The screens will be installed on an elevated platform to allow resin to drop into the elution columns. Hoods will be constructed above each shaker screen. Each hood will be connected to a vent header that will exhaust through a vent stack in the building roof to prevent radon accumulation inside the CPP.

Shaker Screen Water Tank

The shaker screen water tank will be a vertical cylindrical atmospheric tank with a cone bottom and flat cover. The tank will be constructed of fiberglass reinforced plastic (FRP) and will be



elevated to allow gravity flow of water into the resin transfer water tank from the shaker screen. Waste solids from the resin transfer process will collect in the conical bottom of the tank and will be removed periodically and disposed. The tank will be equipped with a level indicator/transmitter which will measure and indicate tank level both locally and in the control room. The tank will be connected to a vent header which will exhaust through a vent stack on the building roof.

Resin Transfer Water Tank

The resin transfer water tank will have a capacity of approximately 12,000 gallons. This tank will be a vertical cylindrical atmospheric tank with a flat bottom and flat cover. The tank will be constructed of FRP, and will be approximately 13 ft in diameter with a height of 13 ft. The tank will be equipped with a level indicator/transmitter which will measure and indicate tank level both locally and in the control room. The tank will be connected to a vent header which exhausts through a vent stack on the building roof.

Resin Transfer Water Pump

The resin transfer water pump will have a capacity of approximately 300 gpm. This pump will be a horizontal, end-suction centrifugal pump and will be constructed of ductile iron. The pump will be equipped with a pressure indicator on the pump discharge line, and a flow meter and flow indicator transmitter in the discharge line. Flow will be indicated both locally and in the control room. The measured flow will be used to control pump motor speed via a variable frequency drive.

3.2.4 Elution

The elution process will remove the UDC and UTC from the resin and restore the resin to its chloride form to allow it to be put back into service to remove uranium from pregnant lixiviant. This process is represented by the following equations:

$$R_2 UO_2(CO_3)_2 + 2C1^- \rightarrow 2 RCl + UO_2(CO_3)_2^{-2}$$

$$R_4 UO_2(CO_3)_3 + 4C1^- \rightarrow 4RCl + UO2(CO_3)_3^{-4}$$

Elution will be a four-stage process that takes place in an elution column and will involve contacting the loaded resin with batches of eluant solution containing approximately 10 percent by weight sodium chloride and 2 percent by weight sodium carbonate. Each elution stage will strip the resin of additional uranium complex and further restore the exchange capacity of the resin. Following the final elution stage, more than 95 percent of the uranyl carbonate complex will have been removed from the resin.



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In the first elution stage, intermediate eluant will be pumped from the intermediate eluant tank through the elution column, stripping approximately 80 percent of the uranyl carbonate ions from the resin. After exiting the column, this solution will be pumped into the rich eluate tank.

In the second elution stage, lean eluant will be pumped from the lean eluant tank through the elution column, stripping approximately 60 to 70 percent of the remaining uranyl carbonates from the resin. After exiting the column, this solution will be pumped into the empty intermediate eluant tank to be used as intermediate eluant in the processing of the next batch of loaded resin.

In the third elution stage, fresh eluant will be pumped from the fresh eluant tank through the elution column, stripping approximately 30 to 40 percent of the remaining uranyl carbonate ions from the resin. After exiting the column, this solution will be pumped into the lean eluant tank to be used as lean eluant in the processing of the next batch of loaded resin.

In the fourth and final elution stage, utility water will be pumped from the utility water tank through the elution column, displacing the eluant entrained in the resin. After exiting the column, the rinse water will be pumped into the fresh eluant tank. Saturated sodium chloride and sodium carbonate solutions will be pumped into the fresh eluant tank to make up the next batch of fresh eluant.

3.2.4.1 Elution System Equipment

Elution system equipment includes four elution columns, eight eluant/eluate tanks, and elution pumps.

Elution Columns

The four elution columns will be vertical cylindrical pressure vessels with dished heads. The vessels will be constructed of FRP. The vessels will be constructed according to ASME Section VIII specifications. Each vessel will be equipped with upper and lower flow distribution manifolds constructed of stainless steel pipe and slotted well screen. The elution columns will be designed to provide optimum contact time between eluant solutions and IX resin. These columns will be capable of being operated over a range of flowrates without loss of performance.

Each column will be equipped with a pressure relief valve and an air/vacuum release valve. Each column will also be equipped with a level indicator/transmitter which will measure and indicate level in the column both locally and in the control room. Pressure transmitters and pressure gauges on the inlet and outlet piping connected to each vessel will measure and indicate



pressure both locally and in the control room. Each tank will be connected to a vent header which exhausts through a vent stack on the building roof to minimize radon emissions within the CPP building.

Elution Tanks

There will be a total of 8 elution tanks in the CPP. These include two Fresh Eluant Tanks, two Lean Eluant Tanks, two Intermediate Eluant Tanks, and two Rich Eluate Tanks. Each elution tank will have a capacity of approximately 16,500 gallons. Each tank will be equipped with a level indicator/transmitter which will measure and indicate tank level both locally and in the control room. Each tank will be connected to a vent header which will exhaust through a roof vent on the building roof to prevent radon accumulation inside the CPP building.

Elution Pumps

There will be a total of 10 elution pumps, each with a capacity of approximately 150 gpm. These pumps will be horizontal, end-suction centrifugal pumps and have wetted parts constructed of FRP. Each pump will be equipped with a pressure indicator on the pump discharge line, and a flow meter and flow indicator transmitter in the discharge line. Flow will be indicated both locally and in the control room. The measured flow will be used to control pump motor speed via a variable frequency drive.

3.2.5 Precipitation

The precipitation process will be designed to break the uranyl carbonate complex, precipitate the uranium as uranium peroxide, and settle the precipitated solids from the eluant solution. The precipitation process will be comprised of a series of chemical addition steps, each causing a specific change in the rich eluate solution.

Prior to beginning the precipitation process, the rich eluate transfer pump will be used to transfer the rich eluate from the rich eluate tank to the precipitation tank. The precipitation tank contents will be mixed via an agitator. The first stage of chemical addition will be to add sulfuric or hydrochloric acid to bring the pH down to a range of approximately 2-3 pH units. This change in pH will cause the uranyl carbonate complex to break, liberating carbon dioxide, which will be vented from the tank, as illustrated in the following chemical reaction.

 $UO_2(CO_3)_3^{-4} + 6H^+ \rightarrow UO_2^{++} + 3 CO_2 \uparrow + 3H_2O$

Following completion of CO2 evolution, sodium hydroxide will be added to raise the pH of the solution to between 4 and 5 pH units. When the pH has stabilized, hydrogen peroxide (H2O2)

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will be added to the solution to form insoluble uranium peroxide (UO4). Following addition of H2O2, the agitator speed will be slowed down to promote crystal growth.

 $UO_2^{++} + H_2O_2 + 2H_2O \rightarrow UO_4 \cdot 2H_2O + 2H^+$

After a precipitation period of up to 8 hours, sodium hydroxide will be added to raise the pH to approximately 7, and the contents of the precipitation tank will be pumped into the thickener using the precipitation transfer pumps.

3.2.5.1 Precipitation System Equipment

Precipitation system equipment will include precipitation tanks, transfer pumps, and thickeners.

Precipitation Tanks

There will be two precipitation tanks in the CPP. Each precipitation tank will have a capacity of approximately 20,000 gallons. Each tank will be a vertical cylindrical atmospheric tank with sloped bottom and flat cover. Each tank will be constructed of FRP. Each tank will be equipped with a level indicator/transmitter which will measure and indicate tank level both locally and in the control room. Each tank will be equipped with a pH sensor connected to a pH indicator/controller in the control room. Each tank will be connected to a vent header which will exhaust through a vent stack on the building roof to prevent radon accumulation inside the CPP building.

Thickeners

There will be two gravity thickeners in the CPP. Each thickener will be a rubber lined 30-ft. diameter steel tank with conical bottom. The thickeners have a rake mechanism which has angled arms that match the angle of the conical bottom of the tank. As the rake rotates, the motion of the paddles through the sludge blanket at the bottom of the thickener will express liquid out of the sludge and increases the solids content of the sludge. The liquid and suspended solids from the precipitation tank will be introduced into the thickener via-a center feed tube. The suspended solids will settle out of the liquid as it flows from the center of the thickener to the side overflow launders. Clarified effluent will spill over a weir into the launders, and from there it will be collected and directed to the solids removal tank in the wastewater system.

Precipitation Transfer Pumps

There will be 2 precipitation transfer pumps, each with a capacity of approximately 200 gpm. Each pump will be a horizontal, end-suction centrifugal pump and has wetted parts constructed of FRP. Each pump will be equipped with a pressure indicator on the pump discharge line, and a

flow meter and flow indicator transmitter in the discharge line. Flow will be indicated both locally and in the control room.

Pressure Filtration

The pressure filtration system will be designed to dewater, rinse, and air dry the precipitated uranium peroxide present in the thickener underflow. The thickener underflow will be pumped by progressive cavity pumps into the two horizontal plate and frame filter presses where the solids content of the thickener underflow will be increased to approximately 60 percent by weight by first pressing the slurry between filtration diaphragm plates. Then the press pressure will be released and utility water will be pumped through the filter cake to remove impurities, particularly chloride. The plates will then be pressed again, followed by introducing compressed air to the pressed cake to further dry it. Upon completion of the drying cycle, the filter cake will, be conveyed out of each filter chamber on the moving filter cloth and directed into the two filter press cake chutes. An enclosed inclined screw conveyor will convey the filter cake from the shoot to the feed inlet on one of the two vacuum dryers.

Wastewater exiting the filter press will flow into a sump and be pumped into the solids removal tank in the wastewater system.

In order to minimize the potential for fugitive dust particles, the filter presses will located in a separate room and each will be enclosed in an interlocked cover. The connections between the cake chutes and enclosed screw conveyors will be gasketed and flanged, the screw conveyors will be enclosed, and the connection between each screw conveyor and knife gate valve on the dryer feed inlet will be gasketed and flanged. HVAC considerations for this system are discussed in Section 3.2.11 below.

The filter presses will be equipped with pressure gauges that indicate the pressure in the hydraulic system, as well as an inlet pressure indicator transmitter. Inlet pressure will be interlocked with the feed pumps to prevent over-pressurization of the filter presses.

3.2.6 Drying and Packaging

The uranium peroxide filter cake will be dried in a rotary vacuum dryer at approximately 450°F. Angled paddles attached to a central shaft in the dryer will agitate the filter cake to promote even drying. The dryers will be heated with a thermal fluid (e.g., MultiTherm IG-4) that will be circulated through the dryer shell and the rotating central shaft. The thermal fluid (TF) will be heated by an electric heater with a pump for circulating the TF through the shell and central shaft of the dryer.



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The vapor pulled from the dryer by the vacuum pump will be filtered through a baghouse filter located on the top of the dryer to remove particles down to approximately 1 micron in size. The vapor exiting the baghouse will be cooled using a condenser to remove water vapor and remaining small particles. Liquid ring vacuum pumps will provide the vacuum source. The water that will be collected from the condenser will be pumped to the solids removal tank in the wastewater system.

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Two rotary vacuum dryers, baghouses, and packaging equipment will be housed in a separate room in the CPP. The vacuum pump and condenser system for each dryer, and the TF heaters and pumps will be located in the main CPP area to provide access for operation and maintenance. The vacuum pumps will discharge to the dryer room. Air in the dryer and packaging room will be monitored routinely for airborne dust. A dedicated air handler equipped with HEPA filters will ventilate the dryer and packaging room and will provide an additional level of controlling particulate emissions.

3.2.6.1 Drying and Packaging Equipment

The major components of the system include the vacuum dryers, baghouses, vacuum pump and condenser systems, thermal fluid heaters, and the packaging system.

Vacuum Dryer

There will be two vacuum dryers in the CPP. The dryer chambers will be designed for 450° F and full vacuum, and a production rate of 2200 dry pounds per day. The dryer chambers will be heated externally and fitted with rotating paddles attached to a central shaft to agitate the yellowcake. The chamber will have a top port for loading the dewatered filter cake and a bottom port for unloading the dry powder. A port will be provided for pulling vapors through the baghouse using the vacuum pump.

Baghouse Filter

Each dryer will be connected to a baghouse filter enclosure. Each baghouse filter will have an integrated compressed air blow down system. The baghouse filters will be mounted directly above the drying chamber so that any dry solids collected on the bag filter surfaces can be discharged back to the drying chamber. The bag house filters will be heated to prevent condensation of water vapor during the drying cycle. It will be kept under negative pressure by the vacuum system.



Vacuum Pump and Condenser System

The vacuum pump and condenser systems will include water sealed liquid ring vacuum pumps with seal water reservoirs, seal water cooling heat exchangers, condensers, condensate receivers, and condensate pumps. Three of these systems will be provided, with two being on line and the third acting as a backup unit. The suction side of the vacuum pump will pull vapors from the vacuum dryer through the baghouse and then through the condenser. Seal water will be cooled in a heat exchanger as it flows to the vacuum pump head. Cooling water from the cooling tower will be circulated through the condenser and the seal water heat exchanger. Condensate from the condenser will flow into a receiver tank constructed of 304 SS. When the receiver tank is full as sensed by a level switch, a condensate transfer pump will pump the condensate to the solids removal tank in the wastewater system.



Thermal Fluid Heaters

Packaged electrical thermal fluid heaters will be used to circulate hot thermal fluid through the shell and central shaft of the rotary dryers. Each thermal fluid heater will be equipped with a circulating pump to circulate the thermal fluid through the dryer and back to the heater.

Packaging System

The packaging system will be operated on a batch basis and will include conveyors, scales, and a spray booth. When the yellowcake is dried sufficiently, it will be discharged from the drying chamber through a knife, gate valve on the bottom port of the dryer into 55-gallon steel drums. Particulate emissions will be minimized by use a sealed hood that fits on the top of the drum. A weigh scale will be used to determine when a drum is full. A conveyor system will allow drums from both dryers to be moved from beneath the dryer to an enclosed spray booth where each drum will be rinsed with a spray of water. The conveyor system will then move the drum to a scanning station where the drum will be hand scanned for radioactivity and then placed in the storage area or rinsed further.

3.2.7 Restoration

The restoration system is designed to extract, store, and distribute makeup water for restoration of well fields. The restoration system may also incorporate a reverse osmosis (RO) system to remove TDS from extracted water and return low TDS permeate to the restoration system. Reject from the reverse osmosis system, if utilized will be routed to a high TDS wastewater system.

3.2.7.1 Restoration System Equipment

Restoration system equipment includes a restoration water tank, a restoration makeup water pump, and a restoration RO system. Each SF will be equipped for restoration of post-production well fields.

Restoration Water Tank

The restoration water tank will be constructed of FRP. The tank will be equipped with a level indicator/transmitter which will measure and indicate tank level both locally and in the control room.

Restoration Makeup Water Pump

The restoration makeup water pump will have wetted parts constructed of ductile iron. The pump will be equipped with a pressure indicator on the pump discharge line, and a flow meter and flow indicator transmitter in the discharge line. Flow will be indicated both locally and in



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the control room. The measured flow will be used to control pump motor speed via a variable frequency drive.

Restoration Reverse Osmosis System

The restoration RO system at each site will be a packaged system capable of treating approximately 500 gpm and producing a permeate stream and a reject brine. This system will include necessary pretreatment, including multi-media or sand filters and feed conditioning.

3.2.8 Chemical Storage and Feeding Systems

The ISL process requires chemical storage and feeding systems to store and dose chemicals at various stages in the extraction, processing, and waste treatment processes. Chemical storage and feeding systems will include chemicals listed in Table 3.2-1 and propane. Each chemical storage and feeding system will be designed to safely store and accurately deliver process chemicals to their intended delivery point in the process. Design criteria for chemical storage and feeding systems include applicable sections of the international building code, international fire code, OSHA regulations, RCRA regulations, and Homeland Security.

3.2.8.1 Chemical Incidents and Radiological Safety

Risk assessments completed by the NRC in NUREG-6733 Section 4 for ISL facilities focused on indirect interactions between the chemicals used in ISL mining and other substances and the potential of operational hazards to workers. Powertech will, via engineering design and implementation of safety standards utilized in the chemical process industry, ensure that risk from chemical events are lower or at the acceptable industry standard. The radiological risks are minimal when considering specific chemicals that would directly interact with radionuclides to cause a hazardous event (NUREG/CR-6733, 2001). With that stated, Powertech will implement applicable regulations such as:

- 40 CFR Part 68, Chemical Accident Prevention Provisions
- 29 CFR 1910.119, Occupational Safety and Health Administration Standards
- 40 CFR Part 355, Emergency Planning and Notification
- 40 CFR 302.4, Designation, Reportable Quantities, and Notification

Also, see Table 4-1 in NUREG-6733 for a list of pertinent regulations for the chemicals used at ISL facilities.



Appropriate engineering controls and implementation of the appropriate design, compliance with applicable regulatory standards will ensure safe handling procedures, operating practices, and will serve to prevent a chemical event from impacting radiological safety. Acceptable safeguards will be implemented to ensure that if such an event were to occur, the impact would be small and quickly addressed by trained spill response staff.

See section 7.5 for information regarding potential radiological safety impacts of chemicals utilized at ISL facilities.

The CPP will be designed in such a manner as to comply with industry building codes and concrete containment designed to hold the contents of the largest tank inside the facility. Any spill would be directed into a floor sump and back into the process circuit or into a waste disposal system. Tanks located outside the CPP will utilize a similar containment system. Some tanks may be reinforced via a double wall.

BURDOCK								
Chemical Name	Unit No. Storage Tanks Capacity		Units	Consumption Rate ton/yr				
Sodium Chloride (NaCl)	2	20000	gal	2250				
Sodium Carbonate (Na ₂ CO ₃) i.e. Soda Ash	1	20000	gal	450				
Hydrochloric Acid (HCl, 32%, or Sulfuric Acid (H ₂ SO ₄ 98%)	1	7000	gal	487				
Sodium Hydroxide (NaOH 50%)	1	7000	gal	446				
Hydrogen Peroxide (H ₂ O ₂ 40%)	1	7000	gal	177				
Oxygen (O ₂ , liquid)	1	11000	gal	979				
Carbon Dioxide (CO ₂)	1	6000	gal	245				
Barium Chloride (BaCl ₂)	1	275	50kg sacks	7				
Oxygen (O2, liquid)	1	11000	gal	653				
Carbon Dioxide	1	6000	gal	163				
Barium Chloride	1	138	50-kg sacks	7				

Table 3.2-1: Process-related chemicals and quantities stored on-site

Powertech (USA) Inc. 3.2.8.2 Sodium Chloride Storage

Sodium chloride will be used to make up fresh eluant and will be stored in tanks as a saturated solution (approximately 26 percent by weight) in equilibrium with a bed of crystals in each storage tank. Dry sodium chloride will be delivered by truck and will be blown into the storage tanks using air pressure. Sodium chloride is classified as a non-flammable. Sodium chloride react vigorously with H_2SO_4 , therefore the storage areas are located in separate areas of the CPP where unintentional contact is unlikely to occur (Figures 3.2-4 and 3.2-5). Sodium chloride can be moderately toxic if inhaled, therefore precautions are taken to ensure that inhalation of the dust is avoided via good housekeeping, and appropriate ventilation.

Sodium Chloride Tanks

Sodium chloride will be stored as a saturated solution in equilibrium with a bed of solid crystals within the storage tank. The sodium chloride tanks will each be a vertical cylindrical atmospheric tank with a sloped bottom and flat cover. Each tank will be constructed of Fiberglass reinforced plastic (FRP), and will be approximately 13 ft in diameter with a height of 20 ft. Each tank will be equipped with a level indicator/transmitter which will measure and indicate tank level both locally and in the control room. Each tank will be connected to a vent header which exhausts through a vent stack on the building roof, and will be equipped with a scrubber to prevent emission of particulates during truck unloading.

Sodium Chloride Pumps

There will be two sodium chloride pumps that will have wetted parts constructed of FRP. Each pump will be equipped with a pressure indicator on the pump discharge line, and a flow meter and flow indicator transmitter in the discharge line. Flow will be indicated both locally and in the control room. The measured flow will be used to control pump motor speed via a variable frequency drive.

3.2.8.3 Sodium Carbonate Storage

Sodium carbonate will be used to make up fresh eluant and will be stored in tanks as a saturated solution in equilibrium with a bed of crystals in the storage tank. Sodium carbonate react vigorously with HCL therefore the storage areas are located in separate areas of the CPP where unintentional contact is unlikely to occur (Figures 3.2-4 and 3.2-5). Sodium carbonate can be moderately toxic if inhaled, therefore precautions are taken to ensure that inhalation of the dust is avoided via good housekeeping, and appropriate ventilation. Sodium carbonate solution will be maintained at a temperature of 105 F to prevent precipitation in the tank and piping. This will be accomplished by circulating liquid from the tank through a heat exchanger. Dry sodium



carbonate will be delivered by truck and will be blown into the storage tanks using air pressure. Sodium carbonate is also known as soda ash and is classified as a non-flammable material.

Sodium Carbonate Tank

The sodium carbonate tank will be constructed of FRP, and will be equipped with a level indicator/transmitter which will measure and indicate tank level both locally and in the control room. The tank will be connected to a vent header which exhausts through a vent stack on the building roof, and will be equipped with a scrubber to prevent emission of particulates during truck unloading.

Sodium Carbonate Pumps

The sodium carbonate pumps will have wetted parts constructed of FRP. Each pump will be equipped with a pressure indicator on the pump discharge line, and a flow meter and flow indicator transmitter in the discharge line. Flow will be indicated both locally and in the control room. The measured flow will be used to control pump motor speed via a variable frequency drive.

3.2.8.4 Acid Storage and Feeding System

The acid storage and feeding system will include a storage tank and delivery pump. The storage tank will be located outside of the CPP building in a lined concrete secondary containment basin designed to contain 110 percent of tank volume plus a 25 year, 24 hour storm event. This secondary containment basin will be separate from the containment basins for other chemical systems. The acid feed pump will be located inside the building, directly adjacent to the outside storage tank. Proper ventilation will prevent a significant inhalation hazard should a leak or spill occur inside the CPP. If the ventilation system is inoperable and a spill occurs, personnel would be directed to exit the building immediately. Spill response according to standard operating procedures will be implemented upon discovery of a potential leak or spill.

Acid Storage Tank

The acid storage tank will be designed to store sulfuric or hydrochloric acid. The tank will be constructed of HDPE, and will be equipped with a level indicator/transmitter which will measure and indicate tank level both locally and in the control room. The tank will be located outside and vented to the atmosphere. Sulfuric and hydrochloric acids are classified as non-flammable materials. Sulfuric and hydrochloric acids are corrosive materials. Pertinent requirements for Sulfuric acid and Hydrochloric acid for Threshold Planning Quantities (TPQs) and Threshold

Quantities from Clean Air Act (CAA) 40 CFR will be implemented. There is no direct impact to radiological safety from the storage and use of these chemicals.

Acid Transfer Pump

The acid feed pump will have wetted parts constructed of FRP. The pump will be equipped with a pressure indicator on the pump discharge line, and a flow meter and flow indicator transmitter in the discharge line. Flow will be indicated both locally and in the control room. The measured flow will be used to control pump motor speed via a variable frequency drive.

3.2.8.5 Sodium Hydroxide Storage and Feeding System

The sodium hydroxide system will include a storage tank and delivery pump. The storage tank will be located outside of the CPP building in a concrete secondary containment basin designed to contain 110 percent of tank volume plus a 25-year, 24-hour storm event. This secondary containment basin will be separate from the containment basins for other chemical systems. The sodium hydroxide feed pump will be located inside the building, directly adjacent to the storage tank. Sodium hydroxide will be purchased as aqueous caustic soda, and will be pumped directly into the storage tank from the supplier's tanker trucks. Sodium hydroxide reacts vigorously with acid, therefore pertinent regulations for use and storage under 40 CFR will be implemented. Personnel will follow design and operating practices published in the accepted codes and standards that govern sodium hydroxide is classified as a non-flammable material. Sodium hydroxide is considered a strong base.

Sodium Hydroxide Storage Tank

The sodium hydroxide storage tank will be constructed of carbon steel. The tank will be equipped with a level indicator/transmitter which will measure and indicate tank level both locally and in the control room.

Sodium Hydroxide Pump

The sodium hydroxide feed pump will have wetted parts constructed of alloy 20 stainless steel. The pump will be equipped with a pressure indicator on the pump discharge line, and a flow meter and flow indicator transmitter in the discharge line. Flow will be indicated both locally and in the control room. The measured flow will be used to control pump motor speed via a variable frequency drive.



3.2.8.6 Hydrogen Peroxide Storage and Feeding System

The hydrogen peroxide system will include a storage tank and delivery pump. The storage tank will be located outside of the CPP building in a concrete secondary containment basin designed to contain 110 percent of tank volume plus a 25 year, 24 hour storm event. This secondary containment basin will be separate from the containment basins for other chemical systems. The hydrogen peroxide feed pump will be located inside the building, directly adjacent to the storage tank. Hydrogen peroxide is classified as a non-flammable material. Personnel will implement design and operating practices published in accepted codes and standards that govern hydrogen peroxide systems. TPQs for 40 CFR will be implemented.

Hydrogen Peroxide Storage Tank

The hydrogen peroxide storage tank will be constructed of 304L stainless steel, 5254 Aluminum or HDPE, and will be equipped with a level indicator/transmitter which will measure and indicate tank level both locally and in the control room.

Hydrogen Peroxide Pump

The hydrogen peroxide feed pump will have wetted parts constructed of 304L stainless steel. The pump will be equipped with a pressure indicator on the pump discharge line, and a flow meter and flow indicator transmitter in the discharge line. Flow will be indicated both locally and in the control room. The measured flow will be used to control pump motor speed via a variable frequency drive.

3.2.8.7 Oxygen Storage and Feeding System

Oxygen is typically stored near or within well field areas, where it is centrally located for addition to the injection stream in each header house. Since oxygen readily supports combustion, fire and explosion are the principal hazards that must be controlled. The oxygen storage facility will be located a safe distance from the CPP and other chemical storage areas for isolation. The storage facility will be designed to meet industry standards in NFPA-50. Automatic shutoffs will be utilized in case of a power failure. Ventilation in each header house will prevent build up of oxygen inside. Industrial practices for compressed gases will be followed along with appropriate isolation and barrier of the system will be implemented.Carbon Dioxide Storage and Feeding System.

The carbon dioxide storage and feeding system will be used to dissolve carbon dioxide into the pregnant lixiviant to improve recovery of uranium in the IX vessel. This system will be a vendor supplied packaged system including tank, vaporizer, pressure gauges, and pressure relief devices. Carbon dioxide is nonflammable. Carbon dioxide will be stored in tanks located outside of the

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CPP and satellite facilities Personnel will follow appropriate design and operating practices published in accepted codes and standards that govern carbon dioxide systems.

3.2.8.8 Barium Chloride Storage and Feeding System

The barium chloride storage and feeding system includes a storage tank, agitator, and chemical metering pump. This system will be designed to dissolve solid barium chloride in water to make up the saturated solution for feeding into the wastewater stream just upstream of the radium precipitation tank at each site. This system will be located in a metal building located adjacent to the wastewater pond. Barium chloride is classified as a noncombustible, nonflammable material. This substance can be incompatible with acids and oxidizers. Safeguards will be designed to prevent the formation of mists and sprays from a leak in piping system and the formation of dust in order to avoid airborne contamination.

3.2.8.9 Byproduct Storage

Prior to transportation to a licensed disposal facility, byproduct material will be stored in designated storage buildings (also referred to as "byproduct storage buildings"), one located at the CPP site and one located at the SF site. These buildings will consist of a concrete slab with a containment curb surrounding the perimeter. Storage of byproduct material will be within "roll-off" containers (bins) which are both liquid tight and fully enclosed. As each storage building can accommodate two 20 cubic yard bins, the volume of byproduct material could accumulate to 30 to 40 cubic yards at each of the two storage locations prior to transport. There are two bays in each storage building, each accessed by an overhead roll-up door and allowing exchange of containers necessary for transport to a licensed 11e.(2) disposal site. The concrete slabs will be designed to allow external decontamination of the roll-off bins prior to transport.

The byproduct storage buildings will allow for control of byproduct materials and specific segregation of these wastes from other non-11e.(2) wastes. Typically these wastes are expected to consist of contaminated used equipment parts, personal protective equipment, and wastes from cleanup of spills or other housekeeping activities. Other waste not in contact with the uranium production process will be disposed of in regular dumpsters situated at a separate location.

Containment of these byproduct wastes within a designated, fully enclosed building will allow for proper control of the materials, monitoring, and necessary restricted access. These measures will ensure best possible control of 11e.(2)solid and liquid wastes to minimize any potential exposures or contamination.



3.2.9 Utility Water

The utility water system will be used to extract, store, and distribute water for consumptive process uses and potable uses. Water will be extracted from wells drilled in a suitable formation in the vicinity of the SF and CPP. Water for potable uses will be chlorinated and stored in a pressurized tank.

3.2.9.1 Utility Water System Equipment

The utility water system equipment will include the utility water tank and utility water pumps.

Utility Water Tank

The utility water tank will be constructed of FRP, and will be equipped with a level indicator/transmitter which will measure and indicate tank level both locally and in the control room.

Utility Water Pump

The utility water pump will have wetted parts constructed of FRP. Each pump will be equipped with a pressure indicator on the pump discharge line, and a flow meter and flow indicator transmitter in the discharge line. Flow will be indicated both locally and in the control room. The measured flow will be used to control pump motor speed via a variable frequency drive.

3.2.10 Wastewater

The wastewater system will be designed to receive, treat, and discharge wastewater generated at various stages of the process. The wastewater system will be divided into two main categories of wastewater, high TDS wastewater, and low TDS wastewater. High TDS wastewater consists of waste eluant brine from the CPP and the reject streams from process bleed or restoration reverse osmosis systems if these systems are in use. Low TDS water sources include process bleed and extracted restoration water that have not been concentrated by a reverse osmosis process.

High TDS wastewater will flow by gravity from the solids removal tank to the high TDS wastewater tank. This wastewater will then be pumped to an onsite deep disposal well. or to the high TDS wastewater holding pond.

Low TDS wastewater will be collected in the low TDS wastewater tank and then pumped to a radium precipitation tank where barium chloride will be added to co-precipitate barium and radium sulfates. Treated wastewater will flow from the radium precipitation tank to the low TDS wastewater pond for removal of the precipitate by settling.

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3.2.10.1 Wastewater System Equipment

Wastewater system equipment includes the solids removal tank, the high TDS wastewater tank, the low TDS wastewater tank, the wastewater pumps, the radium precipitation tank and agitator.

Solids Removal Tank

The Solids Removal Tank will be constructed of FRP, and will be equipped with a level indicator/transmitter which will measure and indicate tank level both locally and in the control room. Each tank will be connected to a vent header which exhausts through a vent stack on the building roof.

High TDS Wastewater Tank

The High TDS Wastewater Tank will be constructed of FRP, and will be equipped with a level indicator/transmitter which will measure and indicate tank level both locally and in the control room. Each tank will be connected to a vent header which exhausts through a vent stack on the building roof.

Low TDS Wastewater Tank

The Low TDS Wastewater Tank will be constructed of FRP, and will equipped with a level indicator/transmitter which will measure and indicate tank level both locally and in the control room.

Wastewater Pumps

Wastewater pumps will be provided for both high TDS wastewater and for low TDS wastewater, as needed, depending on the processing option selected in the final design. Each pump will have wetted parts constructed of FRP. Each pump will be equipped with a pressure indicator on the pump discharge line, and a flow meter and flow indicator transmitter in the discharge line. Flow will be indicated both locally and in the control room. The measured flow will be used to control pump motor speed via a variable frequency drive.

Radium Precipitation Tank

The radium precipitation tank will be used to add barium chloride to the wastewater and provide thorough mixing prior to discharge to a radium settling pond.

3.2.11 HVAC System

The heating, ventilating and air conditioning (HVAC) systems in the SF and CPP will be designed to provide routine heating, cooling and required air changes in occupied areas, as well



as mitigate the potential for human exposure to radionuclides. The primary exposure concerns will be radon gas and uranium oxide dust or particulates.

The HVAC system for the main plant area will be designed both for controlling the temperature in the main plant area, and for preventing the buildup of fugitive radon emissions by ensuring a minimum number of air changes.

Radon gas is a daughter product of radium, which is present in the orebody, and thus is mobilized and dissolved into the pregnant lixiviant during production. The potential for radon emissions from the process arises when the pressurized flow from the extraction wells and booster pumps is exposed to atmospheric pressure. The two process systems with the potential for radon emissions are the IX vessels via the air/vacuum relief valves, and the shaker screens where the loaded resin and resin transfer water will be pumped onto an open screen at atmospheric pressure.

The shaker screens will each have a dedicated vent hood directly overhead. The vent hoods will be connected to an exhaust fan designed to create sufficient air flow and velocity to minimize the emission of radon in the vicinity of the shaker screens. The exhaust fans will discharge the air through a vent stack in the roof of the building. The vent stack will be located away from air intakes for the building.

Systems that have the potential to emit dust particles containing uranium include the filter presses, the dryers, and the drum filling stations.

The filter presses will be installed in a dedicated filtration room, and the vacuum dryers will be installed in a dedicated dryer room. These two rooms will be serviced with dedicated HVAC equipment that includes particulate filtration to minimize the potential for personnel exposure within the rooms and to prevent the emission of particles.

3.2.12 Instrumentation and Control

The plant facilities and equipment at the PA will consist of standard design, construction, and materials for uranium in-situ recovery extraction. Powertech 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.



The control systems will continuously monitor the process variables, and will provide alarms to notify operators when operating parameters are outside of the specified operating ranges. Operators will refer to SOPs to determine the corrective actions to take in order to return the parameter back to its specified operating range.

The control system for both the SF and CPP will include a programmable logic controller (PLC), personal computer (PC) based operator interface stations, and remote digital and analog input/output (I/O) racks. Instruments and devices that send or receive digital or analog signals to/from the control system will be wired to the remote I/O racks. The remote I/O racks will be connected to the PLC via Ethernet cables. The control systems at the SFs and the CPP will receive critical process variable signals such as header pressure and flowrate from header houses via radio frequency signal.

The control system will enable operators to use the operator interface in the control room to configure flowpaths for process streams by opening and closing valves. Operators will also be able to use the operator interface to start and stop pumps and other equipment, monitor and control liquid levels, flowrates, pressures, and temperatures in process equipment. The control system will also allow operators to monitor process variables and trouble alarms from packaged equipment systems in the control room. Control interlocks will be provided to prevent overfilling of tanks during liquid transfers within the CPP and from tanker trucks filling storage tanks. Control interlocks will also be configured to prevent overpressure conditions in equipment and piping both inside the SF or CPP, as well as in the header houses and pipelines.

The header houses, pipelines, and deep disposal wells may pose the greatest risk for fluid spills of radioactive material; consequently, these systems will have high and low pressure, and flow alarms for automatic shutdown of related equipment. For more information concerning timely detection of releases or spills see section 5.7.1.3.

3.2.12.1 Backup Protection for Operating System

Loss of power to the project site may result in the following: production wells stop operating, resulting in shutdown of all production and injection flows. This condition avoids any flow imbalance within the well fields though a well field bleed is not maintained during the power failure. The time span for the aquifer to recover from operational drawdown back to its natural groundwater gradient is typically much longer than the duration of typical power outage. Since the maximum rate at which lixiviant could travel to the monitoring ring would equal the rate which the groundwater returns to its natural gradient, excursions are not likely to occur within the short time period of a power outage.



Backup generators will be installed such that in event of power failure instrumentation maybe be monitored to confirm conditions in the CPP, SF, and well fields.

Shutdown due to power failure during winter months is not expected to be problematic as well field pipelines are buried sufficiently below the frost line. In addition, heating of the SF and CPP is will be maintained by propane or natural gas and will be unaffected by power loss.

3.3 OSHA Design Criteria

In addition to the design criteria discussed in the preceding subsections worker health and safety measures identified in 29 CFR Part 1910 will be incorporated into design of the ISL production and processing facilities, as discussed below.

- Walking and working surfaces (Subpart D) Aisles, passageways, and storage areas will be designed to be free of obstruction such that emergency egress will not be hindered. Wet areas in the plant will be provided with drainage, platforms, mats, or other dry walking surfaces, as necessary. All open-sided platforms or other working areas greater than 4 feet high will be equipped with standard railings. Flights of stairs more than 4 risers high will be equipped with standard hand railings in accordance with OSHA requirements.
- Means of egress (Subpart E) Building will be designed and maintained to facilitate emergency egress. Exits will be clearly marked with illuminated exit signs.
- Occupational Health and Environmental Control (Subpart G) Facilities will be designed with adequate ventilation systems to control worker exposure to vapors and temperature extremes. Noise will be minimized using engineering and administrative controls to ensure worker noise exposures are maintained below the permissible limits. As necessary, air compressors will be isolated to minimize noise levels within the processing facilities.
- Hazardous Materials (Subpart H) –Acid, caustic, and hydrogen peroxide storage areas will be individually curbed to provide secondary containment for each chemical. Sodium chloride, sodium carbonate, and barium chloride storage tanks will also have secondary containment, but do not need to be individually segregated. Operators will be provided hazard communication training, will have an MSDS onsite for these chemicals, and will have appropriate personal protective equipment (PPE) available for tank system maintenance and spill cleanup. An emergency eyewash/shower will be located adjacent to the storage areas. Spill response procedures will be included in the plant operating procedures. If used, flammable materials will be stored in the flammable storage locker.
- Personal Protective Equipment (PPE) (Subpart I) The standards associated with respiratory, electrical, head, foot, and eye protection will apply. A workplace hazard assessment will be performed and documented. PPE is not expected to be required

because of the engineering and administrative controls that will be used to mitigate identified hazards. PPE will be used only to supplement these controls when required to ensure protection of employees.

- General Environmental Controls (Subpart J) The general sanitation requirements for fixed facilities are applicable to the treatment facility. A restroom with a toilet and sink serviced by potable water will be provided. Fire systems and physical hazards will be color coded in accordance with subpart requirements. In addition to OSHA requirements, piping and facilities systems will be labeled.
- Medical and First Aid (Subpart K) Plant operators will be trained in first aid and cardiopulmonary resuscitation. A first aid kit, eyewash, and emergency shower will be available.
- Fire Protection (Subpart L) Portable fire extinguishers will be placed within the plant such that the maximum travel distance to an extinguisher will be less than 50 feet. Portable extinguishers will be inspected monthly and subjected to an annual maintenance check. In addition, the CPP, office building, maintenance area, and warehouse will be equipped with automatic fire sprinklers.
- Compressed Gas Equipment (Subpart M) Compressed air piping, safety valves, and pressure gages will be constructed to American Society of Mechanical Engineers (ASME) standards. Safety valves will be inspected frequently and at regular intervals to determine operational condition.
- Materials Handling and Storage (Subpart N) Safe clearances, secure storage, good housekeeping, and guarding of fall hazards will be used to protect workers. Forklift operators will be trained in accordance with 29 CFR 1910.178.
- Machinery and Machine Guarding (Subpart O) Workers will be protected from physical hazards associated with grinding, fans, rotating shafts, and pinch points through guarding in conformance with subpart requirements.
- Electrical Installations (Subpart S) All electrical installations will be made in conformance with the National Electric Code and will be designed and installed by competent persons. Ground-fault circuit interrupters will be used for power tools or for other circuits that are not part of the plant's permanent wiring. Operators will be trained in electrical safety.
- Toxic and Hazardous Substances (Subpart Z) Potential chemical hazards at the plant include acids, caustics, oxidants, brine solutions, barium chloride, ammonium sulfate, uranium, radium, and radon gas. Fire notification to employees will be through voice communication. Fire Department response will be initiated through the 911 emergency telephone system. Workers will be provided hazard communication training and exposure monitoring will be conducted as necessary to ensure compliance with subpart requirements.

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3.4 References for Uranium Processing

The uranium processing techniques proposed for this project are well documented in the literature and have been successfully implemented in the United States for the past 20 years.

3.5 Master Schedule

The proposed Dewey-Burdock ISL mine schedule is shown on Figure 1.9-1. The mine schedule is preliminary based on Powertech's (USA) current knowledge of the recoverable reserves, land ownership, available water rights, and uranium market conditions. As the project is developed, the mine schedule will be updated accordingly.

3.6 References

Center for Nuclear Waste Regulatory Analyses, NUREG/CR-6733, "A Baseline Risk-Informed, Performance-Based Approach for In Situ Leach Uranium Extraction Licenses", 2001.

Compressed Gas Association, CGA G-4.1, "Cleaning Equipment for Oxygen Service", (CGA, 2000).

Compressed Gas Association, CGA G-4.4, "Industrial Practices for Gaseous Oxygen Transmission and Distribution Piping Systems", (CGA, 1993).

Hunkin, G. G., 1977, "Uranium In-Situ Leaching in the Tertiary Deposits of South Texas, Chapter 3: Resource Development / Utilization in Geology of Alternate Energy Resources in the South-Central United States" (M. D. Campbell (ed), Houston Geological Society, pp. 67-82. See: http://www.ela-iet.com/ie08000B.htm

National Fire Protection Association, NFPA-50, "Standard for Bulk Oxygen Systems at Consumer Sites", (NFPA, 1996).

Sterrett, R. J., "Groundwater and Wells", Third Edition, (Johnson Division, 2008).

U.S. Nuclear Regulatory Commission, June 2003, "NUREG-1569 – Standard Review Plan for In Situ Leach Uranium Extraction License Applications – Final Report", USNRC, Office of Nuclear Material Safety and Safeguards, Washington, D.C.

US Nuclear Regulatory Commission, NUREG-1910, "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities", US Nuclear Regulatory Commission, July, 2008.



4.2.2.1.3 Modeling Approach

The general assumptions for the SPAW model include the following:

- 1. The model is a one-dimensional vertical model.
- 2. The model assumes that the modeled area is spatially uniform in soil, crop and climate characteristics.
- 3. Model inputs and outputs are based on daily values.
- 4. The model does not does not include flow routing or channel descriptors.
- 5. Daily runoff is estimated as an equivalent depth over the simulation field by the USDA/SCS Curve Number method.
- 6. The field budget utilizes a one-dimensional vertical system beginning above the plant canopy and proceeding downward through the soil profile to a depth sufficient to represent the complete root penetration and subsurface hydrologic processes (lateral soil water flow is not simulated).

Specific assumptions related to this project are as follows:

- 7. Daily precipitation and temperature data used in the model are based on 28 years of record from the Edgemont, South Dakota station.
- 8. SPAW modeling was done for two land application and pond areas, the Dewey site and the Burdock site.
- 9. Soils data used in the modeling of the Dewey site was based on a composite of soils data from Test Pits 1, 2 and 5.
- 10. Soils data used in the modeling of the Burdock site was based on a composite of soils data from Test Pits 8, 9 and 10.
- 11. The 24/7 year-round inflow rate from process water and bleed water at each site is 310 gpm.
- 12. The growing and irrigation season is from March 29 to October 31 each year.
- 13. Two cuttings of alfalfa are assumed during the irrigation season.
- 14. The irrigation water will be applied during the irrigation season at a rate that balances the total annual amount of process inflow water (at approximately 297 gpm from March 29 to May 10, from May 11 to September 24 at a rate of 653 gpm, and from September 25 to October 31 at a rate of 297 gpm)



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- 15. All irrigation tailwater and rainfall runoff from the land application areas will be collected and returned to the storage impoundments.
- 16. The impoundments are designed to contain the one percent exceedance probability event (100-year event) plus 3 feet of freeboard.
- 17. All storage impoundments have side slopes of 3 to 1 and are 30 feet deep.

The objective of the SPAW modeling was to help design a land application system that: (1) maximizes evapotranspiration; (2) minimizes surface runoff; (3) minimizes percolation below the rooting zone; (4) minimizes the irrigated acreage required; and (5) minimizes the required volume of the storage ponds while maintaining a one percent probability that the design pond volume will be exceeded during the operating life of the facility.

SPAW modeling was performed at both the Dewey and Burdock sites. A composite of the soil properties at each site was created for use in the model using analytical data from three test pits from each site. Test pits 1, 2 and 5 were used for the Dewey site and test pits 8, 9 and 10 were used for the Burdock site. The composites were created by taking the averages of the gravel, sand and clay fractions and the dry bulk densities for each depth interval for the three test pits at each site.

The SPAW modeling assumed that the facility will operate on a year-round basis for 15 years. Twenty-eight years of daily precipitation, temperature and evaporation data from January 1, 1980 to December 31, 2007 were used to create 28 unique and equally likely simulations of the process water balance. Each simulation used 15 years of sequential climatic data corresponding to the 15 years of operation of the facility. The climatic data intervals used for each of the 28 simulations are shown in Table 4.2-8.

Field simulations using the SPAW model were run using each of the 28 climatic data intervals shown in Table 4.2-8. The results of these field simulations were used as the input to pond simulations for the same 28 climatic intervals. The result was a daily pond volume for each day of the year for each of the 28 15-year simulations.

Two methods were then used to estimate the pond volume with a 1 percent exceedance probability during a 15-year operating period. In the first method, the average pond volume for each day of the year for the 28 simulations was calculated. Then, the pond volume for each day of the year with a 1 percent exceedance probability was calculated using the Gumball Extreme Value distribution, which resulted in 365 possible values. The greatest of these 365 values was then selected as the volume with a 1 percent exceedance probability during a 15-year period.

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Simulation No.	15-Year Climatic Data Interval
1	01/01/1980 to 12/31/1994
2	01/01/1981 to 12/31/1995
3	01/01/1982 to 12/31/1996
4	01/01/1983 to 12/31/1997
5	01/01/1984 to 12/31/1998
6	01/01/1985 to 12/31/1999
7	01/01/1986 to 12/31/2000
8	01/01/1987 to 12/31/2001
9	01/01/1988 to 12/31/2002
10	01/01/1989 to 12/31/2003
11	01/01/1990 to 12/31/2004
12	01/01/1991 to 12/31/2005
13	01/01/1992 to 12/31/2006
14	01/01/1993 to 12/31/2007
15	01/01/1994 to 12/31/1980
16	01/01/1995 to 12/31/1981
17	01/01/1996 to 12/31/1982
18	01/01/1997 to 12/31/1983
19	01/01/1998 to 12/31/1984
20	01/01/1999 to 12/31/1985
21	01/01/2000 to 12/31/1986
22	01/01/2001 to 12/31/1987
23	01/01/2002 to 12/31/1988
24	01/01/2003 to 12/31/1989
25	01/01/2004 to 12/31/1990
26	01/01/2005 to 12/31/1991
27	01/01/2006 to 12/31/1992
28	01/01/2007 to 12/31/1993

 Table 4.2-8: Sequential Water Balance Simulations

In the second method, the 24-hour 100-year rainfall amounts for each month were calculated from the 28 values of daily data for each month using the Gumball Extreme Value Distribution. These values are shown in Table 4.2-9.

Table 4.2-9:	24-Hour 100-Year Monthly Precipitation at						
Edgemont, SD Station							

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.57	0.88	1.97	3.41	2.31	3.83	3.83	2.86	3.11	2.48	1.32	0.96

The 24-hour 100-year runoff volume for each month was then calculated for the irrigated area contributing to the pond using the USACE HEC-1 model. These runoff volumes were then

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added to the average daily values of pond volume for each month for the 28 simulations. The maximum of the 365 values obtained in this way was compared to the maximum value obtained using the first method. The greater of these two values was selected as the pond volume with a one percent exceedance probability during a 15-year period.

4.2.2.1.4 Model Results

Field Model Results

Based on the SPAW modeling, the total irrigated area at any given time at the Dewey site would be 315 acres, consisting of four 50-acre pivots, four 25-acre pivots, plus one 15-acre pivot. In addition, there would be one 50-acre pivot and one 15-acre pivot on standby (total pivots at Dewey is five 50-acre pivots, four 25-acre pivots, and two 15-acre pivots). Pumping at Dewey would occur for 24 hours every day from March 29 to May 10 at a rate of 297 gallons per minute (gpm); from May 11 to September 24 at a rate of 653 gpm; and from September 25 to October 31 at a rate of 297 gpm.

The total irrigated area at any given time at the Burdock site would also be 315 acres (six 50-acre pivots plus one 15-acre pivot). In addition, there would be two 25-acre pivots and one 15-acre pivot on standby. The total pivots at Burdock would be six 50-acre pivots, two 25-acre pivots, and two 15-acre pivots. Pumping at Burdock would also occur for 24 hours on every day from March 29 to May 10 at 297 gpm, from May 11 to September 24 at a rate of 653 gpm, and from September 25 to October 31 at a rate of 297 gpm.

The annual summaries of the SPAW field modeling results for the twenty-eight 15-year simulations at both the Dewey and Burdock sites are shown in Appendix 4.2-A. The center pivot areas at both the Dewey and Burdock sites are shown on Figure 2.1-1.

Pond Model Results

Based on the assumptions listed above (Section 4.2.2.1.3), the model results showed that the total pond volume is 393 acre-feet for the Dewey site. Four single-lined impoundments (ponds) would be constructed at the Dewey site for the temporary storage of the irrigation water. Each pond will be 465 ft wide x 465 ft long x 30 ft deep including 3 ft of freeboard, with an operating capacity of 61.8-acre-ft. In addition to the storage ponds, double-lined radium settling and spare ponds with leak detection, and single-lined spare storage and outlet ponds will also be constructed at Dewey. The radium settling pond and spare ponds will be 880 ft long x 200 ft wide x 25.5 ft deep, including 3 ft of freeboard, and will have an operational storage of 39.4-

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).

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

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(a)

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. Also, see TR_RAI-Response and Replacement Pages; Section 4.1(a) for additional information for TR Section 4.1.

Response TR RAI-4.1(b)

See TR_RAI-Response and Replacement Pages; Section 4.1(b) for additional information for TR Section 4.1.1

TR RAI- 4.1-2

Please specify the discharge location(s) for the yellowcake drying and packaging system.

Response TR RAI-4.1-2

See TR_RAI-Response and Replacement Pages, Section 4.1-2 TR Section 4.1.2 "Radionuclide Particulates".

See TR_RAI-Response and Replacement Pages; Section 4.1.2.2 "Atmospheric Discharges from the Yellowcake Drying and Packaging System".

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

See TR_RAI-Response and Replacement Pages; Section 4.1-3 for additional information in TR Section 4.1.2.

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

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.

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

See TR_RAI-Response and Replacement Pages; Section 4.1-5 for additional information concerning TR 4.1.3 Other Airborne Emissions.



Response: TR RAI-4.1(a) and (b)

TR Section 4.1.1

Exposures Outside Plant
concludes that doses from normal radon releases would be expected to have a small impact on workers.

4.1.1 Radon

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 0.03 WL as described in RG 8.30. The time, date, and state of operation of the equipment in the vicinity of the measurement will be recorded. Refer to section 5.0 Operations for a detailed description of the radon and radon decay products monitoring program and the proposed locations of monitoring stations.

The primary radioactive airborne effluent at the Dewey-Burdock ISL Facility will be radon-222 gas. Radon-222 is dissolved in the pregnant lixiviant that comes from the well field into the facility for separation of uranium. At the locations where the lixiviant solution is initially exposed to atmospheric pressure and ambient temperatures, radon gas will be evolved. These locations constitute primary release points and are expected to include the IX vessels into which the lixiviant is directed for loading of the uranium onto resin and the elevated shaker screens, which will receive the loaded resin prior to elution (NMA 2007, Brown 1982, 2007, 2008). The IX vessels will normally operate as sealed, pressurized vessels, so that radon releases from the IX vessels will only occur during resin transfer operations. Dedicated local exhaust at the IX vessels and shaker screens will be directed to a manifold that is exhausted to the atmosphere outside the building via an induced draft fan. Exhausting radon-222 gas to the atmosphere outside the plant minimizes opportunity for in-growth of radon particulate daughter products (progeny) in occupied work areas and therefore minimizes employee airborne exposure. Small amounts of radon-222 may also be released from the well field, solution spills, filter changes, 11e (2) by-product impoundment areas, reverse osmosis (RO) system operation during groundwater restoration, and maintenance activities. These secondary and/or infrequent additional releases would be quite small relative to radon dissolved in the pregnant lixiviant returning from underground. Radon releases associated with these secondary release points have been shown to be minor components of the overall facility radon-222 source term. (NMA 2007, Marple and Dziuk 1982, Brown 1980, 2007, 2008). An operational monitoring program will be utilized that is similar to the preoperational monitoring program set up to measure radionuclide particulates and radon -222 that may result in the atmosphere outside the building and other specified locations within the PAA.

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The filters from air samplers operating continuously will be analyzed quarterly for natural uranium, thorium-230, radium-226, and lead-210. Samplers will have sensors to measure total air flow within a sampling period. 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. Additionally, effluents from the yellowcake dryer and packaging roof vents will be sampled quarterly. The grab samples will be isokinetic in nature and will be analyzed for natural uranium, thorium-230, radium-226, and lead-210. The maximum LLDs for the analyses will be consistent with recommendations of RG 4.14. Refer to section 5.0 Operations for a detailed description of the particulate air monitoring program and the proposed locations of monitoring stations.

The general HVAC system in the plant will further reduce employee exposure by removing radon from plant air and will be exhausted through a separate stack. This system will be connected via ductwork and manifolds to the eluant and precipitation tanks. Potential release points as well as general air in the plant will be routinely sampled for radon daughters to assure that concentration levels of radon and progeny are maintained as low as reasonably achievable (ALARA). Sampling and monitoring methods specific for radon progeny will be used (USNRC 2002a). Results of monitoring obtained during initial plant operation will be used to adjust monitoring programs (location, frequency, etc), upgrade ventilation and/or other effluent control equipment as may be necessary.

Redundant exhaust fans will direct collected gases to discharge piping that will exhaust fumes to the outside atmosphere. Redundancy of fans will minimize employee exposures should any single fan fail. Discharge points will be located away from building ventilation intakes to prevent introducing exhausted radon back into the facility (NRC 2002b). Airflow through any openings in the vessels will be from the process area into the vessel and then into the ventilation systems, maintaining negative flow into the vessel and controlling any releases. (note that the lixiviant circuit through IX will be a closed system; atmospheric conditions will initially be encountered during resin transfer at the shaker screens.) Tank ventilation of this type has been successfully utilized at other ISL facilities and proven to be an effective method for minimizing employee exposure. (Brown 1982, 2007, 2008)

The general building ventilation system will be designed to maintain air flow from the least likely to most likely process areas with potential for airborne releases and then exhaust to outside areas. Ventilation systems will exhaust outside the building and draw in fresh air. During



favorable weather conditions, open doorways and convection vents in the roof will provide supplemental work area ventilation.

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 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.

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.

4.1.2 Radionuclide Particulates

Since there will be no ore grinding at the facility, no monitoring of airborne uranium ore dust will be necessary. However, airborne yellowcake will be monitored at the facility. The facility will be drying yellowcake under low temperature (less than 400 °C). According to the footnotes of 10 CFR 20 Appendix B, yellowcake dried under low temperature should be considered soluble. Weekly 30 minute grab samples (low volume breathing zone samples) will be taken 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 x 10⁻¹¹ μ Ci / mL. Breathing zone samples will be taken during non-routine operations with potential for a worker to receive exposure to airborne yellowcake above 1 x 10⁻¹⁰ μ Ci / mL. Manufacturer's recommendations for the operation and maintenance of the dryer will be followed and recorded according to 10 CFR Part 40, Appendix A, Criterion 8. The critical control functions will be equipped with backup systems are automatically activated in a power failure or operating failure.

Refer to section 5.0 Operations for a detailed description of the radon and radon decay products monitoring program and the proposed locations of monitoring stations.

Potential radiological air particulate effluents are generated primarily from dried uranium concentrate in the yellowcake drying and packaging areas. Following precipitation, the uranium



Response: TR RAI-4.1-2

TR Section 4.1.2.2

Atmospheric Discharges

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be mounted directly above the drying chamber so that any dry solids collected on the bag filter surfaces can be batch discharged back to the drying chamber. The baghouse will be heated to prevent condensation of water vapor during the drying cycle. It will be kept under negative pressure by the vacuum system.

The condenser will be located downstream of the baghouse and will be water cooled. It will be used to remove the water vapor from the non-condensable gases emanating from the drying chamber. The gases are moved through the condenser by the vacuum system. Dust passing through the bag filters is wetted and entrained in the condensing moisture within this unit. The vacuum pump will be rotary water sealed providing negative pressure on the entire system during the drying cycle. It will also be used to provide negative pressure during transfer of the dry powder from the drying chamber to 55-gallon steel drums. The water seal of the rotary vacuum pump captures entrained particulate matter remaining in the gas streams.

The packaging system will be operated on a batch basis. When the yellowcake is dried sufficiently, it will be discharged from the drying chamber through a bottom port into 55-gallon steel drums. A level gauge, a weigh scale, or other suitable device will be used to determine when a drum is full. Particulate capture will be provided by a sealed hood that fits on the top of the drum, which will be vented through a sock filter to the condenser and the vacuum pump system when the powder is being transferred.

4.1.2.2 Atmospheric Discharges from the Yellowcake Drying and Packaging System

The system of treating gases emanating from the dryer chamber with baghouse filters and water condenser is designed to capture virtually all escaping particles thereby eliminating airborne particulate uranium releases from drying operations. (NRC-2009, NRC-2003). The vacuum pump exhausts only inconsequential quantities of air. The vacuum pump is a rotary water sealed unit that provides a negative pressure on the entire system during the drying cycle. It is also used to provide ventilation during transfer of the dry powder from the drying chamber to 55-gallon drums. The water seal of the rotary vacuum pump captures entrained particulate matter remaining in the gas streams and is recycled back to the process. This water seal water will be routinely monitored via filter collection and radiochemical analysis for Natural U, Th 230, Ra 226 and Pb 210 to ensure radionuclide effluent releases are maintained ALARA. The water that is collected from the condenser will be recycled to the precipitation circuit, eluant makeup, or disposed with other process water. General plant air will be monitored routinely for airborne radionuclides.

The system will be instrumented sufficiently to operate automatically and to shut itself down for malfunctions such as heating or vacuum system failures. The system will alarm if there is an indication that the emission control system is not performing within operating specifications. If the system is alarmed due to the emission control system, the operator will follow standard operating procedures to recover from the alarm condition, and the dryer will not be unloaded or reloaded until the emission control system is returned to normal service.

To ensure that the emission control system is performing within specified operating conditions, instrumentation will be installed that monitor continuously (this exceeds the requirement of hourly checks and documentation specified in 10 CFR Part 40 Appendix A Criterion 8) and will signal an audible alarm if the air pressure (i.e. vacuum level) falls below specified levels. The operation of this system is routinely monitored during dryer operations. The operator will perform visual inspections and document inspections of the differential pressure or vacuum every four (4) hours. Additionally, the air pressure differential gauges for other emission control equipment is observed and documented at least once per shift during dryer operations.

4.1.3 Other Airborne Emissions

As discussed 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
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- 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.



Response: TR RAI-4.1-3

TR Section 4.1.2

Atmospheric Discharges

Response to the U.S. NRC's Request for Additional Information Dewey-Burdock Uranium Project-Source Material License Application Technical Report Submitted August 11, 2009.

POWERTECH (USA) INC.

favorable weather conditions, open doorways and convection vents in the roof will provide supplemental work area ventilation.

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 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.

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.

4.1.2 Radionuclide Particulates

Since there will be no ore grinding at the facility, no monitoring of airborne uranium ore dust will be necessary. However, airborne yellowcake will be monitored at the facility. The facility will be drying yellowcake under low temperature (less than 400 °C). According to the footnotes of 10 CFR 20 Appendix B, yellowcake dried under low temperature should be considered soluble. Weekly 30 minute grab samples (low volume breathing zone samples) will be taken 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 x 10⁻¹¹ μ Ci / mL. Breathing zone samples will be taken during non-routine operations with potential for a worker to receive exposure to airborne yellowcake above 1 x 10⁻¹⁰ μ Ci / mL. Manufacturer's recommendations for the operation and maintenance of the dryer will be followed and recorded according to 10 CFR Part 40, Appendix A, Criterion 8. The critical control functions will be equipped with backup systems are automatically activated in a power failure or operating failure.

Refer to section 5.0 Operations for a detailed description of the radon and radon decay products monitoring program and the proposed locations of monitoring stations.

Potential radiological air particulate effluents are generated primarily from dried uranium concentrate in the yellowcake drying and packaging areas. Following precipitation, the uranium



concentrate is fed to a gravity thickener. The gravity-thickened yellowcake solids solution will be pumped into a plate and frame filter press for dewatering from which the product is only at an approximately 60 percent solids content. Dewatered yellowcake drops from the filter press into a live bottom hopper with a screw auger to move the pressed yellowcake slurry to a sump where a progressing-cavity positive displacement pump transfers the yellowcake to the dryers. Although minor spills can occur during the thickening and dewatering process, they would be cleaned up quickly and subsequently surveyed to minimize any potential airborne source.

4.1.2.1 Yellowcake Drying and Packaging

The yellowcake drying and packaging area at the Dewey-Burdock ISL facility will be serviced by a dedicated ventilation system. By design, vacuum dryers do not discharge uranium for the following reasons. The vacuum drying system is proven technology, which is being used successfully at several facilities where uranium oxide is being produced, including ISL facilities (NMA 2007). The off gas treatment system of the vacuum dryers includes a baghouse, condenser, vacuum pump, and packaging hood. The potential radionuclide particulate releases from the drying process and associated off gas treatment system are discussed below.

The yellowcake will be dried at approximately 250 degrees Fahrenheit (°F) in the rotary vacuum drying process. The off gases generated during the drying cycle are filtered through a baghouse, which is located on the top of the dryer, to remove particles down to approximately 1 micron in size. The gases are then cooled and scrubbed in a surface condenser to further remove the smaller size fraction particulates and the water vapor during the drying process. Two rotary vacuum dryers will be located in a separate building attached to the CPP. This attached building will contain the dryers, the baghouses on the dryers, and a condenser scrubber and vacuum pump system for each dryer. The dryers will be heated with a heat transfer fluid (HTF) that circulates through the shell and the rotating central shaft. The heat transfer fluid will be heated by two natural gas or propane-fired HTF heaters, each provided with HTF pumps for circulating the HTF through the shell and central shaft of the dryer. The HTF heaters and pumps will be in a separate structure attached to the back of the dryer building. The water-sealed vacuum pumps will provide the vacuum source while the dryer is being loaded and while the yellowcake is unloaded into drums.

The vacuum dryers are steel vessels heated externally as described above and fitted with rotating plows to stir the yellowcake. The chamber will have a top port for loading the wet yellowcake and a bottom port for unloading the dry powder. A third port will be provided for venting through the baghouse during the drying procedure. The baghouse and vapor filtration unit will



be mounted directly above the drying chamber so that any dry solids collected on the bag filter surfaces can be batch discharged back to the drying chamber. The baghouse will be heated to prevent condensation of water vapor during the drying cycle. It will be kept under negative pressure by the vacuum system.

The condenser will be located downstream of the baghouse and will be water cooled. It will be used to remove the water vapor from the non-condensable gases emanating from the drying chamber. The gases are moved through the condenser by the vacuum system. Dust passing through the bag filters is wetted and entrained in the condensing moisture within this unit. The vacuum pump will be rotary water sealed providing negative pressure on the entire system during the drying cycle. It will also be used to provide negative pressure during transfer of the dry powder from the drying chamber to 55-gallon steel drums. The water seal of the rotary vacuum pump captures entrained particulate matter remaining in the gas streams.

The packaging system will be operated on a batch basis. When the yellowcake is dried sufficiently, it will be discharged from the drying chamber through a bottom port into 55-gallon steel drums. A level gauge, a weigh scale, or other suitable device will be used to determine when a drum is full. Particulate capture will be provided by a sealed hood that fits on the top of the drum, which will be vented through a sock filter to the condenser and the vacuum pump system when the powder is being transferred.

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Response: TR RAI-4.1-5

TR Section 4.1.3

Other Airborne Emissions

Response to the U.S. NRC's Request for Additional Information Dewey-Burdock Uranium Project-Source Material License Application Technical Report Submitted August 11, 2009.

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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.

Other emissions to the air are possible from limited vehicular traffic (exhaust and dust). Potential impacts from potential emissions from process chemicals that will be used at the plant are described in Section 7.5. There will not be any significant combustion related emissions from the process facility as commercial electrical power is available to the site.

4.2 Liquid Waste

The PA is proposing two options for the disposal of wastewater from well field operations: Injection into Class V deep disposal wells and land application. The deep disposal well option, described in TR Section 4.2.2.2 and in TRS Section 4.2, is Powertech's preferred option, and will be selected following approval by the US Environmental Protection Agency (EPA). The alternate disposal method of land application of waste water is described in TR Section 4.2.2.1 and in SR Section 4.3. The land application option will be selected if either the class V injection well permit(s) cannot be obtained, or the injection wells lack sufficient disposal capacity; in the latter case, both deep well disposal and land application will be utilized for disposal of waste water.

4.2.1 Sources of Liquid Waste

Several sources of liquid waste are collected as a result of ISL production:

- Storm water runoff
- Waste petroleum products and chemicals
- Domestic sewage and
- Three types of byproduct materials

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