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LOST CREEK ISR, LLC

January 16, 2009

Mr. Ronald Burrows
U.S. Nuclear Regulatory Commission
Two White Flint North
11545 Rockville Pike
Mail Stop T8F5
Rockville, MD 20852-2738

Re: 2nd Round Response to NRC Request for Additional Information (RAI), Dated November 6, 2008
Technical Report for the Lost Creek Project, Great Divide Basin, Wyoming
Docket No. 40-9068
TAC No. LU0142

Dear Mr. Burrows,

Please find behind this cover an original and a copy of our second round of responses to the RAI issued by NRC on November 6, 2008 for the Technical Report of the Lost Creek Application. Additional time will be required in order to complete responses for the remaining questions. Lost Creek ISR, LLC plans on submitting responses to the remaining RAI questions during the first week of February 2009.

The Technical Report discusses the installation of Class I UIC wells for the disposal of liquid 11(e)(2). However, due to recent EPA reinterpretations of UIC regulations and resulting policy changes by the State of Wyoming, Lost Creek ISR may be required to install Class V wells instead of Class I wells. If Class V wells are installed the wells will be designed, constructed, and monitored to the standards outlined in the Technical Report. Lost Creek ISR will keep the NRC apprised of this developing situation.

If you have any questions regarding this submittal please contact me at (307) 265-2373, ext. 303.

Sincerely,
Lost Creek ISR, LLC
By: Ur-Energy USA Inc., Manager

John W. Cash
Manager EHS and Regulatory Affairs

Cc: Mrs. Melissa Bautz, WDEQ Lander Field Office
Mr. Bill Boberg, Ur-Energy USA Inc.
Mr. Hal Demuth, Petrotek
Mr. Mark Newman, BLM Rawlins Field Office
Dr. Ping Wang, AATA International

LOST CREEK ISR, LLC

January 16, 2009 Responses
to the
NRC November 2008 Comments on the
Lost Creek Techncial Report

Volume 1 of 2

Responses and Supporting Materials

RESPONSES TO NRC COMMENTS
of 11/6/2008 on

SECTION 2.0
Site Characterization

in the Technical Report for the
LOST CREEK PROJECT
Wyoming

Section 2.5 Meteorology, Climatology and Air Quality

Please see Lost Creek ISR, LLC's (LC ISR, LLC's) responses of December 12, 2008 for all the comments on Section 2.5 of the Lost Creek Technical Report.

2.6 Geology and Soils

The analysis of the geology in the proposed license areas is currently insufficient to determine the relationship and isolation of the extraction layer from the overlying and underlying aquifers especially across the fault. Please provide:

1. ***The land surface elevation in mean sea level (msl) on all of the cross sections and the distance in feet between wells.***

   The requested information is being incorporated onto the cross-sections. LC ISR, LLC originally anticipated submitting the updated cross-sections in this package. However, to ensure the updates have been thoroughly reviewed, LC ISR, LLC anticipates submittal of the updated cross-sections in the near future.

2. ***Maps of the top elevation in msl for the following layers: The FG horizon, the Lost Creek Shale (LCS), the HJ horizon, the Sage Brush Shale (SBS), and the KM horizon. Include the location of the fault on all maps to enable reviewers to assess the change in elevation of these layers across the fault.***

   The requested information is being incorporated onto the cross-sections. LC ISR, LLC originally anticipated submitting the updated cross-sections in this package. However, to ensure the updates have been thoroughly reviewed, LC ISR, LLC now anticipates submittal of the updated cross-sections in the near future.

Comments 3 and 4

Please see LC ISR, LLC's responses of December 12, 2008.

5. ***Please provide an analysis of the short term stability of the storage ponds. Guidance regarding this type of analysis can be found in Regulatory Guide 3.11, "Design, Construction, and Inspection of Embankment Retention Systems for Uranium Recovery Facilities."***

   Two documents on the design and specifications for the storage ponds ("Design Report, Ponds 1 & 2" and "Technical Specification" by Western States Mining Consultants) are attached to the responses to TR Section 4.0 (see Comment 4.2 #3).

Please refer to Section 2.0 of the Design Report for the analysis of the short term stability of the storage ponds.

Section 2.7.1 Surface Water

Please see LC ISR, LLC's responses of December 12, 2008 for all the comments on Section 2.7.1 of the Lost Creek Technical Report.

Section 2.7.2 Groundwater Occurrence

The analysis of the groundwater hydrology and water quality in the proposed license area is currently insufficient to interpret the impact of operations on groundwater flow and quality in and around the license area. Please provide the following:

1. ***Potentiometric contours in msl and groundwater flow direction and gradient for the FG horizon, HJ horizon, and KM horizon across the entire license area, in addition to the fault region provided previously.***

   Additional monitor wells have been installed across the Permit Area in the DE, FG, HJ and KM horizons. Water level data have been collected from these new locations and from previously existing monitor wells in order to provide a more complete potentiometric surface representation for the DE, FG, HJ and KM horizons. The potentiometric surface maps for the DE, FG, HJ and KM horizons have been prepared and are attached as Figures 2.7.2-1a through d.

2. ***Cross-sections showing water levels in msl for the overlying (DE and FG horizon), ore zone (HJ horizon) and underlying aquifers (KM horizon) in the proposed permit area (Figures 2.6-1b-e).***

   Potentiometric surface maps have been prepared that incorporate monitor well locations for the DE, FG, HJ and KM horizons across the Permit Area. Those potentiometric surfaces are being projected onto the appropriate cross sections, which will be submitted in the near future.

3. ***A surface map showing the names and locations of the sands that act as the surficial aquifer (highest occurrence of groundwater) and contours of their water levels in feet below ground surface (bgs) across the proposed permit area.***

   The shallowest occurrence of groundwater within the Permit Area is in the DE Horizon. Data from monitor wells completed across the DE horizon indicate that the

saturated thickness of that unit ranges from approximately 5 feet in the northeastern portion of the Permit Area to over 40 feet in the southwest. A map showing the water level contours of the DE Horizon is presented as Figure 2.7.2.1a.

Section 2.7.2 - Comments 4 through 15.

Please see LC ISR, LLC's responses of December 12, 2008.

Section 2.7.3 Groundwater Quality

The analysis of the groundwater quality in the proposed license area is currently insufficient to interpret the impact of ISR recovery operations on water quality in and around the license area. Please provide an explanation of why the number, location, and completion intervals of wells selected for preoperational groundwater quality monitoring in all the horizons provide adequate coverage and are representative of the license area. Most wells are concentrated in and near the ore body and are not completely penetrating of each targeted horizon.

As noted in the December 12, 2008 response to Comment 2.7.2 #11, the testing to date is to provide general characteristics on the aquifers of concern and is not intended to provide preoperational water quality data for specific Mine Units. The baseline groundwater monitoring at in situ mines generally provides information on the major variations, if any, in the geohydrologic conditions and water quality across (and down through) the Permit Area which could influence future design and operation of the Mine Units and associated monitoring systems. For example, in the Lost Creek Permit Area, the presence of the Lost Creek Fault was anticipated to have the most influence on the subsurface conditions; therefore, a substantial number of the original monitor wells focused on understanding the influence of this feature.

Based on water quality sampling at other in situ uranium mines in Wyoming, there is usually considerable similarity in the water quality within a given permit area. This similarity in the overall water quality is evident in the data submitted in the Technical Report (see, e.g, Figures 2.7-22a and 2.7-22b and Table 2.7-13). In response to a comment from WDEQ, similar to the above comment, LC ISR, LLC has installed 10 new wells in the Permit Area. Some of the wells were installed to provide more information on potential vertical variations at existing well locations, in particular in the far southwest corner of the Permit Area and in the far northeast corner of the Permit Area. The rest of the wells were installed in T25N, R93W, Section 13 to provide information on lateral and vertical variation farther from the Lost Creek Fault. Those new wells are designated by 'MB-#', and the locations are shown on the attached figures 2.7.2.1a through d (see

above Comment 2.7.2 #1). LC ISR, LLC is in the process of sampling these wells, and the results will be submitted when they become available.

The water quality differences, if any, generally become evident only when the water quality 'inside' and 'outside' ore-bearing sands is evaluated for each Mine Unit, and the differences may only be evident in a single parameter (e.g., radium). In addition, the change in the parameter concentrations may occur over a very short distance (e.g., on the order of 100 feet or less), horizontally and vertically, in apparent concert with changes in the distribution of that parameter in the matrix (see, e.g., Harshman, 1974 and Hoy, 2006).

The preoperational water quality for each Mine Unit will be submitted separately, prior to initiation of mining in each unit, and will include data from monitor ring wells, production zone monitor wells, and wells in the overlying and underlying water-bearing zones specific to each Mine Unit. The wells will be sampled over a specified time interval for a variety of parameters per WDEQ requirements to establish the excursion detection and ground water restoration criteria. The purpose of the detailed monitoring in and around each Mine Unit is to help ensure the effects of mining remain within the Mine Unit and no other portions of the Permit Area are affected.

As noted in the December 12, 2008 response to Comment 3.2 #1, completion of monitor wells over select intervals within a horizon, such as the Lower Sand of the FG Horizon, is generally preferable to completion over the entire horizon. Therefore, LC ISR, LLC has tried to provide a balance in the baseline monitor network between completion over an entire horizon and targeting specific zones within a horizon. For example, because the HJ Horizon is the mining target of interest, the overlying and underlying baseline monitoring has focused on those sands 'closest' vertically to that Horizon. Within the HJ Horizon, however, wells were completed at several stratigraphic intervals to help determine how the aquifer characteristics and water quality varied.

LC ISR, LLC believes the existing baseline monitoring network provides sufficient information so the mine units and associated monitoring systems can be designed to detect water quality changes during mining and restoration and to improve mining efficiency.

References:

Harshman, E.N., 1974, Distribution of elements in some roll-type uranium deposits, in Formation of Uranium Ore Deposits, International Atomic Energy Agency, pp.169-183.

Hoy, R.N., 2006, "Baseline Ground Water Quality Conditions at In Situ Uranium Wellfields in Wyoming," Presentation at the NMA/NRC Uranium Recovery Workshop, June 28, 2006, NRC ADAMS ML061910420, and "Baseline Ground Water Quality

Conditions at In Situ Uranium Wellfields in Wyoming", presented at the 2006 Billings Land Reclamation Symposium (BLRS), June 4-8, 2006, Billings MT and jointly published by BLRS and American Society of Mining and Reclamation, R.I. Barnhisel (ed.) 3134 Montavesta Rd., Lexington, KY 40502.

2.9 Background Radiological Characteristics

The analysis of background radiological characteristics is currently insufficient. Background radiological characterization is necessary to determine whether LCI's future operations will affect human health and the environment. Please provide the following information:

Comments 1 and 2

Please see LC ISR, LLC's responses of December 12, 2008.

3. ***Regarding preoperational vegetation sampling for radionuclides, LCI states: "The Project will not produce particulate emissions because the end-product is yellowcake slurry. Therefore, there will be no radiological impact on vegetation; and baseline characterization of vegetation radiological characteristics was not conducted." LCI has not sufficiently demonstrated compliance with 10 CFR 40.31(h) regarding the requirements and objectives in 10 CFR 40, Appendix A. Criterion 7 of Appendix A states: "At least one full year prior to any major site construction, a preoperational monitoring program must be conducted to provide complete baseline data on a milling site and its environs." Baseline data is used not only to measure the effectiveness of effluent control systems and procedures during normal milling operations, but also to assess the impacts of unusual releases due to spills, accidents, etc. In addition, LCI recognizes in its pathway analysis (Section 7.2.1.2 and Figure 7.2-1) that radon-222 releases can lead to radionuclide foliar deposition and uptakes by vegetation. LCI has not provided sufficient regulatory or technical justification to relieve them from the requirement of 10 CFR 40, Appendix A, Criterion 7. Please submit vegetation sampling in accordance with 10 CFR 40, Appendix A, Criterion 7, for NRC review prior to any major site construction.***

   Please see the attached Technical Memorandum on Vegetation Sampling for Radionuclides which summarizes the results of the 2008 sampling program.

4. ***Preoperational radionuclide air particulate samples are not discussed. LCI has not provided sufficient regulatory or technical justification to relieve them from the requirement of 10 CFR 40 Appendix A, Criterion 7. Please submit radionuclide air***

particulate sampling in accordance with 10 CFR 40, Appendix A, Criterion 7, for NRC review prior to any major site construction.

Please see the attached Technical Memorandum on Radiological Air Particulate Sampling which summarizes the results of the 2007-2008 sampling program.

Section 2.9 - Comments 5 and 6

Please see LC ISR, LLC's responses of December 12, 2008.

7. ***Background gamma radiation survey and soils sampling:***

   a. ***Considering that LCI has stated "There is an unexpected degree of variability in gamma exposure rates in the Permit Area" and that increased exposure rates were detected over ore bodies and at Permit Area boundaries, it is not clear why only ten correlation grids were chosen and how these ten correlation grids accurately represent the Permit Area as a whole. Demonstrate and provide justification that the ten correlation grid samples are representative of the Permit Area as a whole.***

   An intensive gamma survey with hundreds of thousands of individual measurements across the entire site was conducted prior to selecting correlation plot locations and performing related measurements and soil sampling. The gamma survey data provided a highly detailed and comprehensive basis for selecting correlation plot locations that are clearly representative of the site as a whole with respect to the intent of the correlation and its connection to the gamma survey data. In this context, "representativeness" rests on several facts:

   1) The elevation across the site is relatively constant and the gamma survey was essentially completed within a few weeks. Cosmic sources of gamma radiation are likely to have been fairly constant across the site during the survey, and diurnal fluctuations in ambient radon and associated progeny in air usually produce only minor variations in gamma exposure rates (NRC, 1994). Thus, significant variations in gamma readings across the site are expected to be largely due to variations in terrestrial sources of gamma radiation residing in surface soils.

   2) Radium-226 (Ra-226) levels in surface soils are known to influence gamma survey readings, primarily due to photon emissions from lead (Pb-214) and bismuth (Bi-214) (both of which are short-lived decay products of radon-222 (Rn-222)). Because Ra-226 and its decay products normally exist in approximate secular equilibrium in soil, soil Ra-226

concentrations and ambient gamma exposure rates above the soil surface can often be well correlated, particularly under baseline conditions at undisturbed sites. This was true at the Lost Creek site.

3) Based on maps of the gamma survey data, correlation plot locations were selected to span the range of gamma readings observed across the entire site, with a reasonably even distribution of intermediate gamma levels represented. Furthermore, the spatial distribution of correlation plot locations across the site was also taken into account (locations were spread out across various areas of the site, rather than clustered in a small area). This latter consideration should help to account for potential variability in soil properties that might influence the correlation such as potential variability in the concentrations of other gamma-emitting radionuclides like potassium-40 (K-40).

The approach used to characterize gamma exposure rates and Ra-226 concentrations in surface soils at Lost Creek has advantages in terms of representativeness because the gamma survey component of the methodology captures spatially extensive portions of the entire population of possible values (well distributed across the entire site). These results, in turn, can be used to select correlation locations that are representative of the range of gamma exposure rates (and likely soil Ra-226 concentrations as well) found at the site.

Assuming other location selection criteria are also adequately addressed (e.g. gamma shine issues are avoided, plots have uniform gamma readings, etc), as few as five or six carefully-selected plots can result in a regression model that provides reasonably reliable estimates of soil Ra-226 concentration based on gamma survey data. Although five or six grids is a minimum number, ten plots is usually a minimum goal as this provides a more robust statistical analysis.

Based on the Lost Creek gamma survey data, the correlation results, and considerable experience with successful application of this technique at many other sites (e.g. Whicker et al., 2008, Johnson et al., 2006), the number of correlation plots and their locations are considered adequately representative of the entire site with respect to converting gamma survey data into estimates of approximate soil Ra-226 concentrations in surface soils.

The gamma survey and correlation methodology used at Lost Creek is not intended to replace the soil sampling recommendations provided in NRC Regulatory Guide 4.14. This methodology has been developed to help address spatial limitations of grid-based sampling approaches such as the one described in Regulatory Guide 4.14. It also helps to address other, more recent and ISR-specific guidance such as

NUREG-1569 (NRC, 2003) which indicates that 15-centimeter soil depths should also be characterized for consistency with decommissioning protocols and methods as outlined in the Multi-Agency Radiation Surveys and Site Investigation Manual (MARSSIM) (NRC, 2000). The overall approach used at Lost Creek draws on a combination of relevant regulatory guidance, state-of-the-art scanning technologies, and basic correlation techniques that have been used and accepted for decades. The goal was to produce the most detailed and comprehensive baseline characterization possible with respect to the spatial distribution of gamma exposure rates and Ra-226 concentrations in surface soils.

LC ISR, LLC acknowledges that baseline radiological data for surface soils at Lost Creek deviate from Regulatory Guide 4.14 recommendations in that 10 rather than 40 surface soil samples were collected and analyzed for Ra-226. However, the intensive gamma survey in conjunction with the correlation results and related sampling/analyses of surface soils as provided in the application should be sufficient to meet the basic intent and technical basis of relevant regulatory guidance with respect to surface soils at the site.

LC ISR, LLC also acknowledges that the lack of subsurface soil samples deviates from Regulatory Guide 4.14 guidance. LC ISR, LLC has collected baseline subsurface soil sampling consistent with Regulatory Guide 4.14 recommendations and will submit results to the NRC as an addendum to the Technical Report as soon as results are available.

References:

Johnson, J.A. Meyer, H.R., and Vidyasagar, M. 2006. *Characterization of Surface Soils at a Former Uranium Mill.* Operational Radiation Safety. Supplement to Health Physics, Vol. 90, February, 2006.

U.S. Nuclear Regulatory Commission (NRC). 2000. *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), Revision 1.* NUREG 1575. Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1994. *NUREG-1501, Background as a Residual Radioactivity Criterion for Decommissioning.* Division of Regulatory Applications, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2003. *NUREG-1569, Standard Review Plan for In Situ Leach Uranium Extraction License Applications.* Final Report. U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards. Washington, D.C.

Whicker, R.; Cartier, P.; Cain, J.; Milmine, K.; Griffin, M. 2008. *Radiological Site Characterizations: Gamma Surveys, Gamma/Ra-226 Correlations and Related Spatial Analysis Techniques*. Operational Radiation Safety, Health Physics, Vol. 95 (Supplement 5): S180-S189; November, 2008.

b. Estimates in the literature (e.g., Faw and Shultis, 1993) indicate that the average concentration of K-40 in soils is 12 pCi/g. Considering that the method proposed to characterize Lost Creek depends on exposure rate correlated to radium concentrations, how is the presence and variation of K-40 and other naturally occurring radionuclides taken into consideration in the proposed methodology?

The correlation is site-specific. Because correlation plot measurements and sampling was conducted in a consistent manner at various representative onsite locations, correlation results include a representative measure of all sources of variability that might influence the correlation. This includes variability associated with K-40 and other naturally occurring radionuclides. A site-specific regression provides a statistical tool for estimating soil Ra-226 concentrations that takes into account site-specific and method-specific sources of variability in paired gamma/Ra-226 data including:

- Heterogeneity in soil Ra-226 concentrations and all other terrestrial sources of ambient gamma radiation, including K-40 and other gamma-emitting radionuclides.

- Scattered radiation reaching the detectors from adjacent areas or subsurface soils (i.e. "gamma shine"). Mild gamma shine effects are believed to introduce small amounts of variability into most correlation data sets as horizontal and vertical distributions of soil radionuclide concentrations are seldom perfectly uniform. Associated variability will be reflected in data collected from representative correlation plot locations and will thus be accounted for in the regression statistics. Strong gamma shine affects, however, can produce strong outliers that badly affect the predictive reliability of the regression. Any location with an abrupt, dramatic transition between low and high soil radionuclide levels has the potential for such effects. Fortunately, areas with strong gamma shine are normally limited to very small portions of any given site and are thus not representative of the site as a whole. Such areas are avoided when selecting correlation plot locations. There was no evidence of strong gamma shine effects at the correlation plots used for Lost Creek.

- Uncertainty in field measurements due to variability in instrument response characteristics. In addition to inherent variability in the precision or reproducibility of readings within or between specific instruments, this factor includes potential differences in counting efficiencies for photons of different energies (e.g. counting efficiency for primary K-40 photons may be less than that attained for lower-energy primary photons from Ra-226 and its decay products, or from secondary scattered radiation).

- Uncertainty in laboratory results due to counting error and all other potential sources of total propagated analytical uncertainty (e.g. incomplete homogenization of composite samples, slight errors in sample weights, etc.)

- Uncertainty in results due to sampling error (e.g. slight inconsistencies in sampling depths, slight differences in volumes of each sub-sample that make up the composite sample, tendency to sample between vegetation rather than near root systems, tendency to avoid collecting larger rocks, etc.).

There are likely other sources of variability as well. Using site-specific data and a consistent methodology helps to account for various sources of sampling and measurement variability in the predictive model. There is considerable evidence to support this view. At a number of other uranium recovery sites, separate soil sampling has been conducted and direct laboratory analysis results for these samples have been compared to corresponding gamma-based estimates of Ra-226 concentrations (Whicker et al., 2008). To date, such "verification" sampling efforts have demonstrated that the scanning/correlation methodology is generally effective and reliable. This does not mean that gamma-based estimates of soil Ra-226 will agree perfectly with direct soil sampling results, but in most cases differences observed by Tetra Tech have been relatively small (e.g. within ± 1-2 pCi/g). In general, this level of agreement does not greatly exceed typical uncertainties reported by analytical laboratories for direct measurement of Ra-226 in baseline soil samples.

The coefficient of determination (R-squared) of the linear relationship between mean Ra-226 and Gamma reading at the Lost Creek site was 0.88. Therefore, the mean Sodium Iodide (NaI) gamma reading was able to explain 88% of the observed variability in mean Ra-226 concentration, despite many additional sources of potential variability and uncertainty as described above. The specific influence of variability from naturally occurring radionuclides other than Ra-226 and its decay products (such as K-40) is believed to be comparatively small.

Reference:
Whicker, R.; Cartier, P.; Cain, J.; Milmine, K.; Griffin, M. 2008. *Radiological Site Characterizations: Gamma Surveys, Gamma/Ra-226 Correlations and Related Spatial Analysis Techniques.* Operational Radiation Safety, Health Physics, Vol. 95 (Supplement 5): S180-S189; November, 2008.

c. ***Considering that the main product from Lost Creek is uranium in slurry form, and that uranium is not well correlated to radium on the Lost Creek site, demonstrate that the proposed preoperational soil sampling methodology is sufficient to allow LCI to clean up land as a result of spills and accidents, including on proposed transport routes, and meet the requirements of 10 CFR 40, Appendix A, Criterion 6(6), for decommissioning for radionuclides other than radium.***

NRC Regulatory Guide 4.14 recommends that 40 surface soil samples be collected in a radial grid surrounding the mill, and 10% (four) of these samples be analyzed for uranium (NRC, 1980). In addition, it recommends that soil samples collected at the five air particulate monitoring stations be analyzed for uranium. Therefore Regulatory Guide 4.14 recommends that fewer than ten surface soil samples be analyzed for uranium.

At the Lost Creek site, ten surface soil samples were collected in a roughly radial pattern relative to the center of the site. These samples were analyzed for Ra-226, U-nat, Th-230, and Pb-210. For characterizing baseline uranium in surface soils, this sampling design is reasonably consistent with the Regulatory Guide 4.14 recommendations, and should satisfy the basic intent and technical basis of the regulatory guidance. Furthermore, the gamma survey goes far beyond Regulatory Guide 4.14 recommendations and this information can be used to indirectly estimate approximate baseline concentrations of both Ra-226 and uranium in surface soils anywhere on the site.

The statement that uranium is not well correlated with radium at the Lost Creek site is inconsistent with the statistical analysis provided in the application. Although the data suggest that uranium and radium in surface soils at the site may commonly be in moderate disequilibrium, the R-squared value on the statistical regression between the two parameters was 0.73 and the p-value (0.001502) indicates that the correlation is statistically significant at a confidence level greater than 99.8%. This suggests that approximate baseline uranium concentrations could be estimated reasonably well anywhere on the site based on the Ra-226/U-nat regression equation, and using the kriged contour map of estimated soil Ra-226 values across the site (both of which are provided in Section 2.9 of the Technical Report).

The baseline sampling design for radionuclides in surface soils in Regulatory Guide 4.14 calls for discrete grab samples spaced 300 meters apart. Plant decommissioning standards and assessment criteria described in MARSSIM call for more detailed measurements. Radiological survey results from Lost Creek and other proposed ISR sites in Wyoming have demonstrated that baseline soil radionuclide concentrations can occasionally vary by an order of magnitude across areas significantly smaller than this amount of grid spacing. The survey described by Regulatory Guide 4.14 may not include measurements in areas where spills or accidents are most likely, and also has the potential to mischaracterize areas between designated grid sampling points. The increased density of measurements and improved spatial detail provided offers a distinct advantage over the sampling design recommended in Regulatory Guide 4.14.

The intensive gamma survey performed across the entire site helps to overcome limitations of a Regulatory Guide 4.14 design for characterizing spatial variability in baseline concentrations of Ra-226 in surface soils. The statistical correlation between Ra-226 and uranium suggests that survey data can also be used to indirectly infer approximate uranium concentrations. Had the baseline soil sampling and gamma survey designs for this site strictly adhered to Regulatory Guide 4.14, far less spatial information relevant to the question of assessing potential uranium contamination due to spills and accidents would be available.

Reference:
U.S. Nuclear Regulatory Commission (NRC). 1980. *Regulatory Guide 4.14. Radiological Effluent and Environmental Monitoring at Uranium Mills. Revision 1.* Nuclear Regulatory Commission Office of Standards Development. Washington, D.C.

d. LCI states: "Within each grid, ten soil sub-samples were collected to a depth of six inches (15 centimeters) then composited into a single sample." Demonstrate that the subsurface (greater than 15 cm below the surface) is properly characterized so as to be able to comply with 10 CFR 40 Appendix A, Criteria 6 (6).

The gamma survey and correlation methodology was not intended to characterize radiological conditions in subsurface soils. LC ISR, LLC will perform baseline subsurface soil sampling consistent with Regulatory Guide 4.14 recommendations and will submit results to the NRC as an addendum to the Technical Report as soon as results are available.

e. ***In discussing the cross-calibration of the sodium iodide (NaI) detector with a High-Pressure Ionization Chamber (HPIC), LCI states: "NaI detectors were crosscalibrated in the field at each site against an HPIC. Results were consistent with cross-calibrations at other uranium sites as well as with the literature in terms of the energy dependence of NaI detectors (Ludlum, 2006; Schiager, 1972)." Regarding the Schiager reference, please address the following: The Schiager paper describes a process where the NaI detector was calibrated with a radium point source which was then used to measure exposure from radium. The NaI detectors used in the Lost Creek evaluation were calibrated with cesium-137 (Cs-137) then used to measure exposure from radium. Explain why Cs-137 was chosen as the calibration source and the relevance of the Schiager paper to the Lost Creek survey cross-calibration.***

Cesium-137 (Cs-137) is the normal source routinely used by Ludlum for calibration of their Ludlum Model 44-10 NaI detectors. The Schiager paper provides a graph of cross-calibration measurement results showing relative response characteristics of a NaI detector versus a high-pressure ionization chamber, with two of the locations measured directly above a tailings pile (see Figure 3 in the Schiager paper).

The corresponding equation from Schiager's cross-calibration was:

Equation (a)
HPIC reading (microRem/hour, μR/hr) = 0.46 × (NaI reading in μR/hr) + 7.9

The two cross-calibration equations measured at Lost Creek (for the two different NaI detector heights) were:

Equation (b)
HPIC reading (μR/hr) = 0.57 × (3-ft NaI reading in μR/hr) + 6.97

Equation (c)
HPIC reading (μR/hr) = 0.69 × (4.5-ft NaI reading in μR/hr) + 3.99

In the Schiager paper, radium was the point source used for calibration of the NaI instrument. The photon energies from Ra-226 and its decay products (namely Pb-214 and Bi-214) are lower, and the mix of energies more complex, than that for Cs-137. We are not suggesting that there are no differences in energy response characteristics between our instruments and the instrument used by Schiager.

The intent of the reference is to demonstrate that the regression coefficients shown in Figure 3 of the Schiager paper are reasonably consistent with those observed for

the cross-calibration from Lost Creek, particularly considering the fact that Schiager took two measurements directly above a tailings pile and performed a number of measurements at other locations with gamma readings well in excess of those found anywhere at Lost Creek. Presumably, Schiager positioned the NaI detector at the same height as the HPIC, so Equation (b), above, would be the most applicable to compare with Schiager's regression, Equation (a).

As ambient gamma exposure rates increase, the difference between NaI and HPIC readings becomes more pronounced and the slope of any corresponding regression should theoretically decrease. Although differences in calibration sources between instruments probably contribute to the observed differences in regression coefficients, the mix of terrestrial sources present at each site and differences in ambient gamma exposure rates could easily be responsible for most of the difference between these regressions. Again, the point is that the differences are not large.

Schiager points out that each cross-calibration is unique to the NaI instrument; each cross-calibration is also site- and geometry specific. Further discussion of the nature of differences between NaI and HPIC readings at various sites and factors that can affect such cross-calibrations (as well as gamma/Ra-226 correlations) can be found in Whicker et al. (2008).

Finally, the correct reference for the Schiager paper is:

Schiager, K. J. 1974. *Analysis of Radiation Exposures on or Near Uranium Mill Tailings Piles*. Radiation Data and Reports, Vol. 15, No. 7. Office of Radiation Programs. US EPA. July 1974.

The correct publication date is 1974, not 1972.

References:

Schiager, K. J. 1974. *Analysis of Radiation Exposures on or Near Uranium Mill Tailings Piles*. Radiation Data and Reports, Vol. 15, No. 7. Office of Radiation Programs. US EPA. July 1974.

Whicker, R.; Cartier, P.; Cain, J.; Milmine, K.; Griffin, M. 2008. *Radiological Site Characterizations: Gamma Surveys, Gamma/Ra-226 Correlations and Related Spatial Analysis Techniques*. Operational Radiation Safety, Health Physics, Vol. 95 (Supplement 5): S180-S189; November, 2008.

f. ***The intent of the Schiager paper is to demonstrate that the exposure rate over a uranium mill tailings pile can be estimated if there is a known uniform concentration of radium in the tailings. The technique proposed in the Lost Creek analysis attempts to correlate known exposure rates with unknown radium concentrations that may or may not be uniform outside of the correlation grids. Aside from the references noted, are there other outside references that establish this type of relationship?***

The 100 m^2 correlation plot technique has been proven effective at statistically determining a valid average relationship between mean gamma readings and mean soil Ra-226 concentrations (Whicker et al. 2008, Johnson et al., 2006). Elements of the technique designed to address issues of variability include: 1) use a correlation plot large enough to significantly reduce measurement error associated with small-scale spatial variability; 2) select plots that have generally uniform gamma readings; and 3) collect a sufficient number of soil sub-samples to provide a good representation of the true mean concentration.

Relating point measurement gamma readings to Ra-226 concentrations in discrete soil samples can yield unreliable results. Data variability is much higher with unshielded (non-collimated) detectors because the gamma detector senses photons that originate across a significantly wider area. An individual soil sample is less likely to accurately represent the true mean Ra-226 concentration across the field of view of the gamma detector versus a composite soil sample.

We acknowledge that results from a 100 m^2 correlation plot model are applied to point data across the site (and areas outside of correlation plots may not be uniform). Furthermore, the converted point data are subsequently kriged in GIS to provide continuous estimates across the site. Kriging has advantages and disadvantages with respect to spatial accuracy. It tends to reduce small-scale spatial detail associated with individual point data and interpolates between vehicle scan tracks where no data exist. It can also, however, help to improve overall survey reproducibility along the scan tracks themselves as it tends to average out variability in point data associated with sources of measurement and estimation error (e.g. small inaccuracies in GPS readings, random variability in gamma count data, application of a 100 m2 correlation plot model to point data, etc.).

Aside from advantages and limitations of the overall method, larger scale distributional characteristics are most relevant to baseline characterizations at such large sites and the method appears to be reasonably reliable in this regard. On a number of occasions, we have evaluated locations corresponding to given contour lines in kriged gamma exposure rate maps and verified good agreement between

measured and predicted values (e.g. within ± 2 μR/hr from one another). In addition, soil Ra-226 sampling results to date have generally agreed well with the values predicted based on the gamma survey data, the correlation, and the kriging technique. The data indicate that the overall methodology is generally reliable.

We are aware of the limitations of the technique, but believe that these limitations relative to those of traditional grid-based sampling or measurement approaches are fewer and less problematic. The sheer volume of information on terrestrial radiation that can now be efficiently collected overcomes many of the spatial limitations of earlier techniques. Short of collecting thousands of soil samples along a high-density grid across the entire site, we are not aware of a viable approach that is as effective or reliable as the method selected. The most pertinent and current reference for this issue is Whicker et al. (2008).

References:

Johnson, J.A. Meyer, H.R., and Vidyasagar, M. 2006. *Characterization of Surface Soils at a Former Uranium Mill.* Operational Radiation Safety. Supplement to Health Physics, Vol. 90, February, 2006.

Whicker, R.; Cartier, P.; Cain, J.; Milmine, K.; Griffin, M. 2008. *Radiological Site Characterizations: Gamma Surveys, Gamma/Ra-226 Correlations and Related Spatial Analysis Techniques.* Operational Radiation Safety, Health Physics, Vol. 95 (Supplement 5): S180-S189; November, 2008.

g. ***LCI states: "Each 1,076-square-foot (100m2) soil sampling grid was also, scanned to determine the average gamma exposure rate over the same area, following methods described in Johnson et al. (2006)." The Johnson reference indicates that the site was scanned with a "shielded sodium iodide detector." Verify if a shielded sodium iodide detector was used to survey Lost Creek and if so provide details on the shielding, including its purpose and how it alters the unshielded energy response.***

The NaI detectors used for the gamma survey or for cross-calibration and correlation measurements were not shielded.

h. For all linear regression analyses presented (Figures 2.9-7 – 2.9-9, 2.9-11 and 2.9-14), provide calculations and results of testing the null hypothesis (i.e., that no correlation exists).

The p-value for the correlation in shown Figure 2.9-7 is 0.000054:

```
StatMost for Windows        Friday, November 21, 2008     5:15:36 AM
-----------------------------------------------------------------------

                    Pearson Correlation Analysis Results
          ====================================================

Ra-226 vs. NaI_Gamma:

       Column Name     Ra-226        NaI_Gamma
       Sample Size          10           10
             Minimum Sample Size = 10
                     Correlation = 0.939677
                      Fisher's z = 1.735278
                     Probability = 0.000054

************************************ The End ******************************
```

The p-value for the correlation in shown Figure 2.9-8 is 0.001502:

```
StatMost for Windows        Friday, November 21, 2008     5:12:05 AM
-----------------------------------------------------------------------

                    Pearson Correlation Analysis Results
          ====================================================

Ra-226 vs. U-nat:

       Column Name     Ra-226        U-nat
       Sample Size          10           10
             Minimum Sample Size = 10
                     Correlation = 0.857795
                      Fisher's z = 1.284938
                     Probability = 0.001502

************************************ The End ******************************
```

The p-values for the correlations in shown Figure 2.9-9 are 0.000275 (3-foot NaI vs HPIC) and 0.000579 (4.5-foot NaI vs HPIC).

```
      StatMost for Windows        Friday, November 21, 2008     5:03:09 AM
 ---------------------------------------------------------------------------

                    Pearson Correlation Analysis Results
         ==========================================================

NaI_(3-ft) vs. HPIC:

      Column Name     NaI_(3-ft)        HPIC
      Sample Size          6             6
            Minimum Sample Size = 6
                    Correlation = 0.986434
                     Fisher's z = 2.493252
                    Probability = 0.000275


************************************* The End ******************************
```

```
      StatMost for Windows        Friday, November 21, 2008     5:04:27 AM
 ---------------------------------------------------------------------------

                    Pearson Correlation Analysis Results
         ==========================================================

NaI_(4.5-ft) vs. HPIC:

      Column Name     NaI_(4.5-ft)      HPIC
      Sample Size          6             6
            Minimum Sample Size = 6
                    Correlation = 0.980291
                     Fisher's z = 2.304961
                    Probability = 0.000579


************************************* The End ******************************
```

The p-value for the correlation in shown Figure 2.9-11 is 0.000012:

```
      StatMost for Windows        Friday, November 21, 2008     4:57:59 AM
 ---------------------------------------------------------------------------

                    Pearson Correlation Analysis Results
         ==========================================================

NaI_(3-ft) vs. NaI_(4.5-ft):

      Column Name     NaI_(3-ft)        NaI_(4.5-ft)
      Sample Size          6             6
            Minimum Sample Size = 6
                    Correlation = 0.997198
                     Fisher's z = 3.284658
                    Probability = 0.000012


************************************* The End ******************************
```

The p-values for the correlations in shown Figure 2.9-14 are 0.000055 (LC) and 0.000002 (LS):

```
StatMost for Windows        Friday, November 21, 2008      5:29:36 AM
-----------------------------------------------------------------------

                    Pearson Correlation Analysis Results
          ==========================================================

3-ft_HPIC_Eq_(LC) vs. Ra-226_(LC):

      Column Name     3-ft_HPIC_Eq_(LC)        Ra-226_(LC)
      Sample Size           10                 10
            Minimum Sample Size = 10
                    Correlation = 0.939430
                     Fisher's z = 1.733173
                    Probability = 0.000055

************************************** The End ******************************
```

```
StatMost for Windows        Friday, November 21, 2008      5:31:10 AM
-----------------------------------------------------------------------

                    Pearson Correlation Analysis Results
          ==========================================================

3-ft_HPIC_Eq._(LS) vs. Ra-226_(LS):

      Column Name     3-ft_HPIC_Eq._(LS)       Ra-226_(LS)
      Sample Size           10                 10
            Minimum Sample Size = 10
                    Correlation = 0.974875
                     Fisher's z = 2.182200
                    Probability = 0.000002

************************************** The End ******************************
```

The calculated p-values above indicate that all of these correlations are significant at a confidence level of at least 99.8%. In each case there is less than a 0.2% probability that the correlation has resulted from random chance, or that rejecting the null hypothesis would be an incorrect conclusion.

i. ***For Figures 2.9-7 – 2.9-9, 2.9-11 and 2.9-14, provide the paired X and Y coordinate data points and where these are located in the application.***

The locations of NaI/HPIC cross-calibration measurements and gamma/Ra-226 correlation plots are shown in Figure 2.9-4, with correlation plot locations shown again in Figure 2.9-6. Some of the analytical values used for the correlations provided in the cited figures are shown in Table 2.9-1 of the application. For

completeness and ease of reference, all sampling/measurement location coordinates and respective analytical data used for the correlations in the cited figures are presented in the table below.

Sampling Location ID	Latitude (DD North)	Longitude (DD West)	Mean Ra-226 (pCi/g)	Mean U-nat (pCi/g)	Mean HPIC Reading (uR/hr)	3-foot HPIC Equivalent (uR/hr)	Mean 4.5-foot NaI Reading (µR/hr)	Mean 3-foot NaI Reading (µR/hr)
LC-1	42.14155	107.88055	8.8	8.7		25.8	31.6	
LC-2	42.11874	107.88639	4.1	2.0		20.1	23.4	
LC-3	42.10628	107.87012	6.7	2.6		24.3	29.4	
LC-4	42.11892	107.86263	5.9	3.0		23.7	28.6	
LC-5	42.13146	107.87123	4.2	1.1		20.0	23.2	
LC-6	42.14215	107.85717	7.7	3.4		27.9	34.6	
LC-7	42.13118	107.85932	7.8	4.4		27.1	33.4	
LC-8	42.13024	107.85688	5.7	1.9		22.6	26.9	
LC-9	42.13038	107.84396	4.6	1.1		20.8	24.4	
LC-10	42.13951	107.82803	4.7	1.1		20.8	24.4	
PIC-LC-1	42.11733	107.86353			23.6		30.2	31.4
PIC-LC-2	42.10687	107.87045			33.0		41.4	44.0
PIC-LC-3	42.12827	107.87157			20.7		22.2	22.1
PIC-LC-4	42.13095	107.85934			25.7		34.3	35.5
PIC-LC-5	42.13122	107.85960			37.7		47.2	53.4
PIC-LC-6	42.13195	107.84903			21.7		24.9	25.3
LS-1	42.25496	107.62914	4.0			18.0		
LS-2	42.24552	107.63335	7.0			26.7		
LS-3	42.24333	107.62289	7.6			27.8		
LS-4	42.23494	107.61988	11.9			35.9		
LS-5	42.23527	107.62859	6.9			28.3		
LS-6	42.23888	107.62864	5.1			23.0		
LS-7	42.23656	107.63339	7.5			26.8		
LS-8	42.23776	107.63977	8.8			31.8		
LS-9	42.23095	107.65234	5.5			22.3		
LS-10	42.22769	107.63492	3.9			19.7		

j. For the relevant dates that data was used for correlation, provide the quality control charts titled "Lost Creek: Check Source QC chart for ATV Instruments" or indicate where these can be found in the application.

After a careful review of all relevant information and data, instrument control charts have been revised to include all QC data collected during the survey. Explanations and discussion are provided in this response, along with supporting data and analyses to provide the most complete assessment possible concerning instrument performance and data uncertainty.

QA/QC Program Overview

The purpose of the QA/QC program for this project was to ensure and demonstrate that the data and information generated would be of sufficient quality to meet the project objectives. The project objectives were to provide reliable (reproducible)

characterizations of the spatial distributions of gamma exposure rates and gamma-based estimates of Ra-226 concentrations in surface soils (0-15 cm) across a large site (about 4,400 acres). A recent peer-reviewed paper discussing the same survey methodology used for this project has been published in the journal Health Physics (Whicker et al., 2008). That paper is included as an attachment to this response because it contains information pertinent to the reliability of this survey approach.

Overall components of the applied QA/QC program for the baseline gamma survey at Lost Creek are summarized in Section 2.9.1.2 of the application. Specific elements of the program that are most relevant to this discussion are as follows:

1. All gamma detectors used during the survey were calibrated by the manufacturer within one year prior to use on this project.

   Purpose: Maintain detector accuracy relative to known gamma exposure rates from a Cs-137 calibration source under controlled measurement conditions at the manufacturer's laboratory

2. Daily QC measurements during the project included static readings of ambient background gamma exposure rates as well as readings from a Cs-137 check source.

   Purpose: Establish the degree of measurement agreement (precision) within and between detectors on each individual day of survey activities, both at low gamma field intensities (background readings) and at high gamma field intensities (check source readings). These measurements are used to evaluate each instrument against performance acceptance criteria (quality control limits), and to provide a daily indication of data uncertainty due to normal instrument variability at different gamma field intensities. Another purpose is to provide an indication of the degree of data uncertainty associated with natural temporal variability in background gamma exposure rates.

3. Scan results for each vehicle are reviewed daily for consistency along scan track paths for all onboard detectors.

   Purpose: Assess the degree of spatial agreement between onboard detectors along each vehicle's scan tracks and evaluate detector/system performance under actual scanning conditions. Obvious inconsistencies result in elimination of the questionable data from the project database and replacement of the subject detector with a factory-calibrated spare detector. Spare detectors immediately become subject to standard QC

assessment protocols to verify consistency with all other properly functioning scan detectors/systems.

Bullet number 2 above warrants additional discussion as it references "quality control limits" for evaluating instrument performance. Radioactive decay is a random process that follows a binomial probability distribution. Detector readings will thus naturally vary from one counting interval to the next. If the total number of measured counts exceeds about 20, both Poisson and normal distributions can be used to accurately describe radiation measurements (Martin & Lee, 2003). Both of these distributional approximations are valid for measurements of ambient gamma radiation with NaI scintillation detectors.

A Chi-Square dispersion test can be used to assess the performance of individual radiation measurement instruments against the Poisson distribution (Martin & Lee, 2003). This test is broadly applicable to many different types of instruments because in certain applications, the number of counts measured is less than 20 and only the Poisson distribution applies. For environmental gamma surveys using NaI detectors, properties of the normal distribution can be used as simple, effective way to assess individual detector performance.

With a correctly functioning NaI detector, a series of successive readings in a fixed location and measurement geometry should approximate a normal distribution, meaning that over 99% of the data should fall within ± 3 standard deviations from the mean of all measurements. Whether taking a single measurement, or the mean of several measurements, the normal distributional characteristics of the underlying count data are preserved (Martin & Lee, 2003). Taking the mean of several measurements, however, provides a better estimate of a true average count rate. The standard procedure for daily QC measurements from each NaI detector is to record the mean of 10-20 successive readings for assessment of instrument performance.

For this gamma survey application, we are equally concerned with the relative performance between instruments as multiple detectors are used. Even properly calibrated detectors will have slight differences in response characteristics between different instruments and this will add additional variability to survey data in the form of small relative biases between various detectors. Variability within and between detectors is additive. Analyses of various QC data sets, collected indoors under fixed counting geometries for different gamma survey projects, each indicate that combined variability from both sources will still approximate a normal distribution (Figure A). Properties of the normal distribution can thus be used to evaluate the performance of each detector relative to the total degree of measurement precision attained by the entire set of detectors used for the survey.

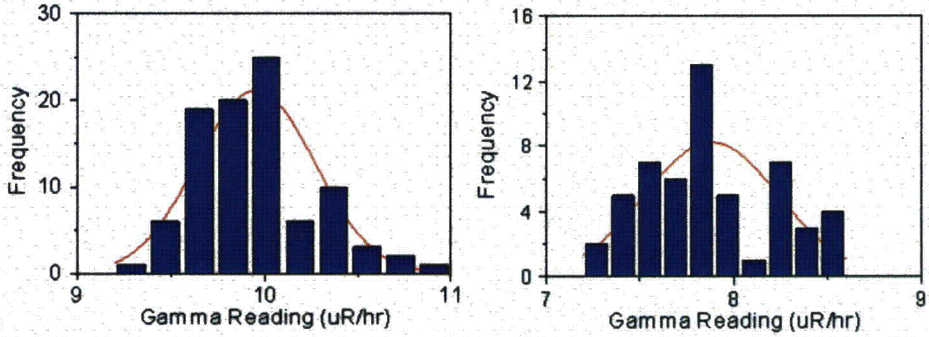


Figure A: Example frequency histograms for two series of QC measurements from different NaI detector sets used for two separate gamma survey projects. Each series was taken indoors under controlled measurement geometries. The red lines represent theoretical normal distributions.

Quality control data for each detector are plotted on QC charts that include control limit lines calculated for the particular set of detectors used on a given survey project. Field background and check source QC charts also show other lines that are useful for QC assessment, including the mean, as well as ± 1, 2, and 3 standard deviations from the mean, as separately calculated from their respective QC data sets. This enables a quick visual assessment of individual QC data relative to the overall degree of measurement precision attained by the entire set of detectors used for the survey. For each individual detector, daily QC measurements plotted on QC charts should fall within ± 3 standard deviations from the mean of all QC measurements. If QC readings are outside of these control limits, further investigation is warranted. This is true for both background readings as well as check source readings.

Background QC readings can occasionally fall outside of respective control limits due to natural temporal variations in ambient gamma exposure rates. Temporal variability can result from changes in natural shielding factors for terrestrial or cosmic sources such as changes in soil moisture or barometric pressure, and from fluctuations in radon decay product concentrations in air. To help account for temporal sources of variability not related to actual detector performance, control limits are calculated on a moving average basis. In addition, when a control limit is exceeded, data from the affected detector are not automatically excluded from the survey data set unless control limits were exceeded on both background and check source QC charts. In cases where only one control limit is exceeded, the corresponding scan track data are carefully reviewed for spatial/quantitative consistency with tracks for other on-board detectors to make a final determination regarding data validity.

Field Background QC Assessment for Lost Creek

An updated QC chart containing all field background QC data collected during the project is shown in Figure B. The indicated control limits (± 3 standard deviations) are based only on data collected from 9/6/06 through 9/11/06 because scan system staging locations and related QC protocols were consistent during these dates. These control limits are conservative with respect to QC data collected outside of this period because the consistency of location helps limit data variability to that associated with the detectors themselves, effectively minimizing control limit width relative to the mean.

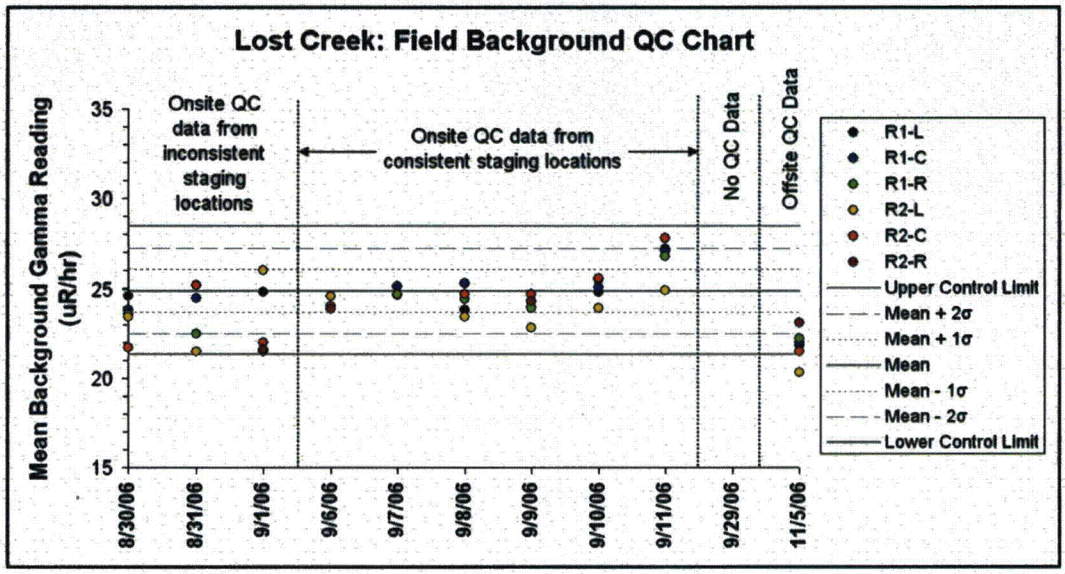


Figure B: Field background QC measurements for the dates of all activities related to the gamma survey at Lost Creek.

Although QC readings for the first three days of the survey are within conservatively calculated quality control limits, the variability of these data was higher because staging locations and related QC protocols were inconsistent during this initial period. These initial inconsistencies were related to: 1) a need to adapt the Rhino ATV systems' mounting infrastructure and suspension systems to handle unexpectedly rough micro-topography from soil mounds associated with the dense sagebrush vegetation; and 2) a determination that a 3-foot detector height was not practical for this type of survey given the frequency of deep ravine crossings, tall vegetation, and fence gate crossings.

These circumstances contributed to initial difficulties in determining a practical, consistent, and effective protocol for static QC measurements. As a result, background QC data through 9/1/06 are questionable and were not considered useful for assessment of data uncertainty, nor a valid reflection of actual instrument performance during this period, and were thus not included in the license application. We now recognize that a discussion explaining the excluded data could have facilitated complete review, had it been included in the original license application.

Background QC data from 9/6/06 through the final day of general site scanning on 9/11/06 were collected at a consistent staging location and are well within acceptable control limits. However, on 9/6/06 and 9/7/06, QC data were only collected for one of the two sets of Rhino ATV detectors. Rhino-1 measurements were missing on 9/6/06, and Rhino-2 measurements were missing on 9/7/06. It is believed that incomplete QC measurements on these two days were related to circumstances surrounding continued modifications or repairs to detector mounting systems. Background QC data from the period 9/8/06 through 9/11/06 were included in the application because these data provide a reliable measure of data uncertainty and instrument performance, and all six onboard detectors used for site scanning on these days were evaluated.

On 9/29/06, the day that gamma/soil Ra-226 correlation plot scanning and sampling was conducted, no static QC measurements were performed. These measurements were planned for the end of the day but insufficient time remained after performing all scheduled correlation activities. However, quantitative evidence of measurement precision within and between the detectors used on this date is inherent in the nature of the data collected. Mean scan data for each of the three individual detectors used at each correlation plot (Figure C) demonstrate excellent consistency of readings between detectors, at locations representing the most pertinent range of ambient gamma exposure rates with respect to the ultimate use of the data collected.

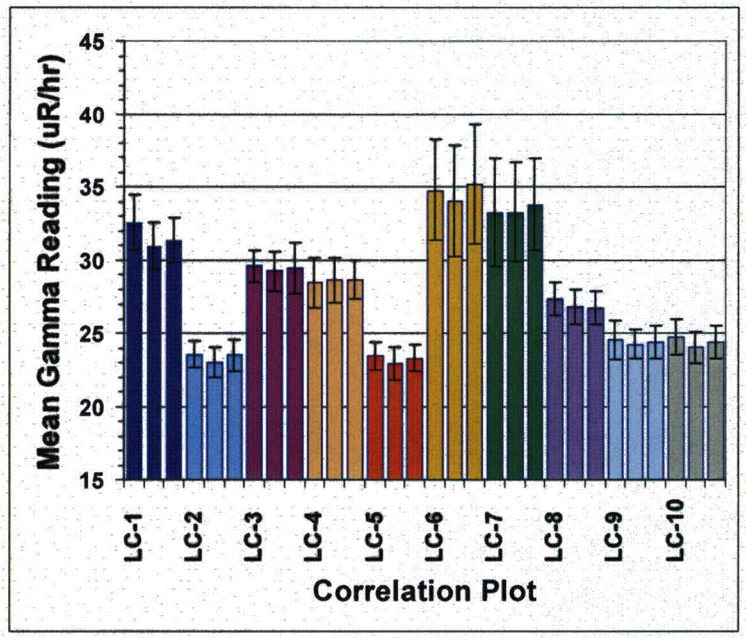


Figure C: Mean readings at each correlation plot location for each of the three individual detectors used for plot scanning. Error bars represent ± 1 standard deviation from the mean of approximately 45-50 readings for each detector across each plot.

The scale of the Y-axis shown in Figure C corresponds to the general range of virtually all gamma measurements at the Lost Creek site. As is readily apparent in Figure 2.9-3 of the license application, the vast majority of survey readings were between 20-35 μR/hr. Because this latter range of survey readings is most representative of the entire site, it demonstrates the relevance of the range of the data shown in Figure C with respect to data QC issues. This is important to note because correlation data were used to convert gamma survey data into estimates of soil Ra-226 concentrations across the site. Error bars on mean readings from each detector (± 1 standard deviation) suggest that on the day correlation measurements were performed, the detectors would have easily satisfied analogous control limit criteria across this range of values.

In addition to the above assessment of the data shown in Figure C, the coefficient of variation (CV) was calculated from the standard deviation of the three mean gamma scan results among the three detectors, divided by the average of the three

mean scan results, at each correlation plot (Table A). The average CV for all plots was 0.012, which demonstrates low variability between detectors, and a high degree of precision, across this key range of gamma levels.

Table A: Mean, standard deviation, and coefficient of variation for mean scan results among the 3 detectors at each correlation plot location.

Correlation Plot	Average of the 3 mean scan results	Standard deviation of the 3 mean scan results	CV for mean scan results among the 3 Detectors
LC-1	31.6	0.86	0.027
LC-2	23.4	0.30	0.013
LC-3	29.4	0.18	0.006
LC-4	28.6	0.10	0.004
LC-5	23.2	0.27	0.012
LC-6	34.7	0.60	0.017
LC-7	33.4	0.30	0.009
LC-8	27.0	0.33	0.012
LC-9	24.4	0.14	0.006
LC-10	24.4	0.35	0.014
		Average CV =	**0.012**

Finally, background QC data for 9/11/06 and 11/5/06 also demonstrate consistency between detectors on dates that bracket 9/26/06 (see Figure B). QC measurements performed on 11/5/06 in association with high pressure ionization chamber (HPIC)/NaI cross-calibration activities were conducted in an offsite location, several miles from the original staging area. Although these data are not truly applicable to the control limits shown in Figure B, consistency of readings between detectors on this day is clear and there is no reason to suspect the validity of instrument performance during the cross-calibration measurements.

Based on the above follow up assessments of all available information relevant to field background QC data for this project, the evidence demonstrates that the detectors were performing within acceptable limits throughout the survey. The original estimates of data uncertainty as provided in the license application have not changed. Although there were several cases in which detectors exhibited suspect performance or actual malfunctions during the day's scanning (i.e. following morning QC measurements), associated scan track data were clearly identified as being spatially inconsistent with readings from other on-board detectors and the affected data files were eliminated from the project database.

Check Source QC Assessment for Lost Creek

Regarding the collection of QC measurements using a Cs-137 check source (Figure D), additional discussion is required. On 9/9/06 it was discovered that small inconsistencies in the dimensions of protective foam padding placed around the detectors while mounted on the Rhino ATV support systems (intended to reduce vibration and potential impact damage to the detectors) may have introduced error into previous QC measurements [periods (1) and (2) as shown in Figure D] due to slight variations in distance between the check source and the detectors. As a result, none of the check source QC data collected prior to the removal of the foam padding from all detectors (on 9/9/06) were included in the license application. Other QC protocols, including documented calibration status of all instruments, background QC measurements, and daily review of the consistency of scan track data plotted with field mapping software, remained in effect during this period.

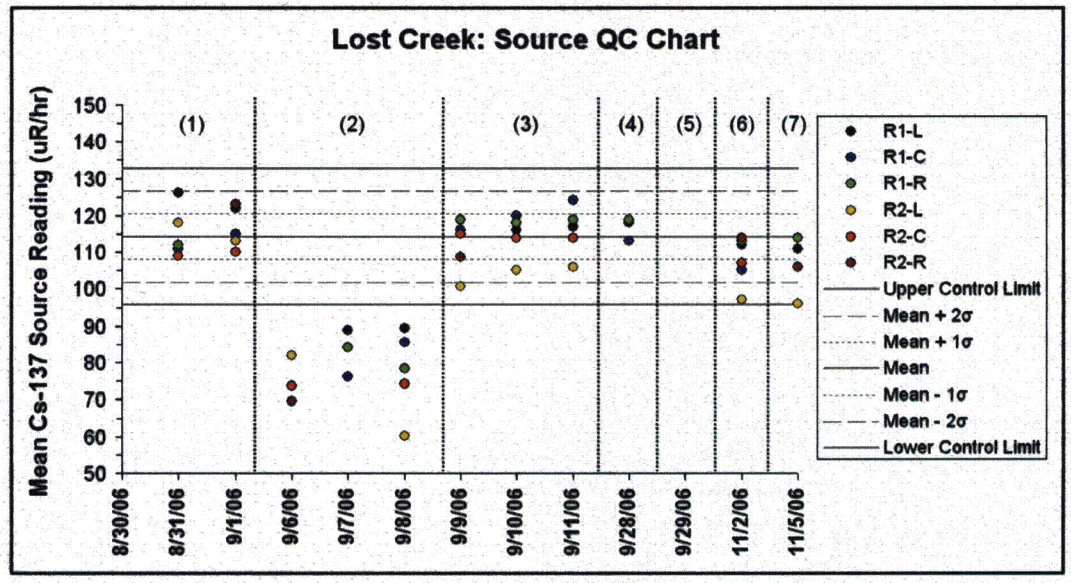


Figure D: Cesium-137 check source QC data for the dates of all activities related to the gamma survey at Lost Creek. Periods or dates of interest are numbered for ease of reference.

After the discovery of geometry problems associated with the protective foam padding, the padding was removed in favor of resilient nylon boom supports and the daily check source measurements became consistent. The control limits shown in Figure D are based only on data collected during period (3) and are thus the same as those provided in the application. Data review indicates that the reason for

the inconsistency in check source readings during time period (2) is related to the foam padding rather than to the detectors themselves. The other QC data and data reviews for this period confirm this conclusion.

After time period (1), the Rhinos were taken back to Fort Collins, CO and the detector mounting systems were modified or re-designed to better handle the rugged site conditions. However, the protective foam padding remained in place during time period (2). When the padding was removed on 9/9/06, the readings return to the normal range of check source QC values and remained this way throughout time period (3). It is likely that during mounting system redesign in Fort Collins, the foam pads were inadvertently shifted downwards, leaving more excess material extending below the detector than before. This could explain the reduction in count data as the distance from the source to the detector would have increased. When measuring a Cs-137 point source, small differences in counting geometry can make a large difference in readings and this element is critical to the applicability of such data.

The anomalous results shown for period (2) do not mean the detectors were functioning improperly during those particular days of scanning activities. The field background data for the same dates are very consistent and clearly indicate proper instrument function. More importantly, review of the scan track data for these dates showed spatial/quantitative consistency between onboard detectors, as well as consistency with other scan tracks along portions of site access roads that were repeatedly scanned throughout the survey. As described in the license application, re-scanning and daily review of consistency between on-board detectors are key components of an overall data QC program for this survey methodology. Such measures are more effective than static QC measurements in terms of evaluating instrument performance under actual scanning conditions. Static QC measurements are only part of an overall QC program to help quantify data uncertainty and assess instrument performance.

With respect to the lack of check source QC data on the date of gamma/Ra-226 correlation measurements [9/29/06, period (5) in Figure D], the correlation plot measurement data shown in Figure C clearly demonstrate the consistency of readings among detectors used on this date, across the pertinent range of gamma exposure rate values with respect to the correlation. Furthermore, check source data collected the previous day [9/28/06, period (4)] from a nearby proposed ISR site (the Lost Soldier project area) are also included in Figure D, along with check source data collected later at the Lost Soldier location [11/2/06, period (6)]. Although the Lost Soldier measurement locations were different from the staging location at Lost Creek, these data bracket the date of the missing check source QC

data for period (5) and indicate consistency in check source measurements between the detectors.

Finally, the day that HPIC/NaI cross-calibrations were performed [11/5/06, period (7) in Figure D], there had been a modification to the Rhino ATV mounting systems that allowed detectors to be easily removed from the vehicles and for QC measurements to be performed in a more controlled indoor environment at a hotel room in Rawlins, WY. Check source QC readings on this day were performed in the hotel room. Although this measurement location was different from the original survey staging area at Lost Creek, these results show consistency in check source measurements between the various detectors used on this day.

Based on the above follow up assessment of all available information relevant to check source QC data for this project, the evidence supports the conclusion that the detectors were performing properly throughout the survey, even at higher gamma radiation levels such as those found in several small areas at the site. It also reinforces the conclusion that the original estimates of data uncertainty provided in the application are based on reliable data.

Summary

The above follow up assessments of data QC for this project demonstrate that throughout this survey, the detectors in use were performing properly and within acceptable limits at both lower (background) and higher (check source) levels of incident gamma radiation. Although there were several instances of missing or inconsistent QC data during the project, numerous other QA/QC measures and protocols were in place at all times, providing both quantitative evidence and qualitative assurance of continuous data reliability with respect to the results and analyses provided in the license application.

The estimates of data uncertainty provided in the license application were based on all available reliable data from field background and check source QC measurements. No changes to those estimates are warranted based on this follow up evaluation. Assessment of both data uncertainty and instrument performance is further strengthened by the data shown in Figure C and the accompanying analyses provided in this response.

Throughout this project, terrain, plant height and other environmental conditions required that constant attention be paid by the system operators to the operational status of each gamma detector instrument system. Only factory-calibrated detector systems were utilized during the work, and a combination of formal QA/QC procedures, combined with extensive operator experience in the application of a

variety of field quality control practices, has resulted in a data set that is of sufficient quality to meet the objectives established for the project.

References

Martin, J.E.; Lee, C. 2003. Principles of Radiological Health and Safety. John Wiley & Sons, Inc., Hoboken, New Jersey.

Whicker, R.; Cartier, P.; Cain, J.; Milmine, K.; Griffin, M. 2008. Radiological Site Characterizations: Gamma Surveys, Gamma/Ra-226 Correlations and Related Spatial Analysis Techniques. Operational Radiation Safety, Health Physics, Vol. 95 (Supplement 5): S180-S189; November, 2008.

List of Information Included with the Responses
to
NRC Comments on Lost Creek TR Section 2.0
January 16, 2009

For Comment 2.7.2 #1:

New Figure - Potentiometric Surface Map - DE Horizon
New Figure - Potentiometric Surface Map - FG Horizon
New Figure - Potentiometric Surface Map - HJ Horizon
New Figure - Potentiometric Surface Map - MK Horizon

For Comment 2.9 #3:

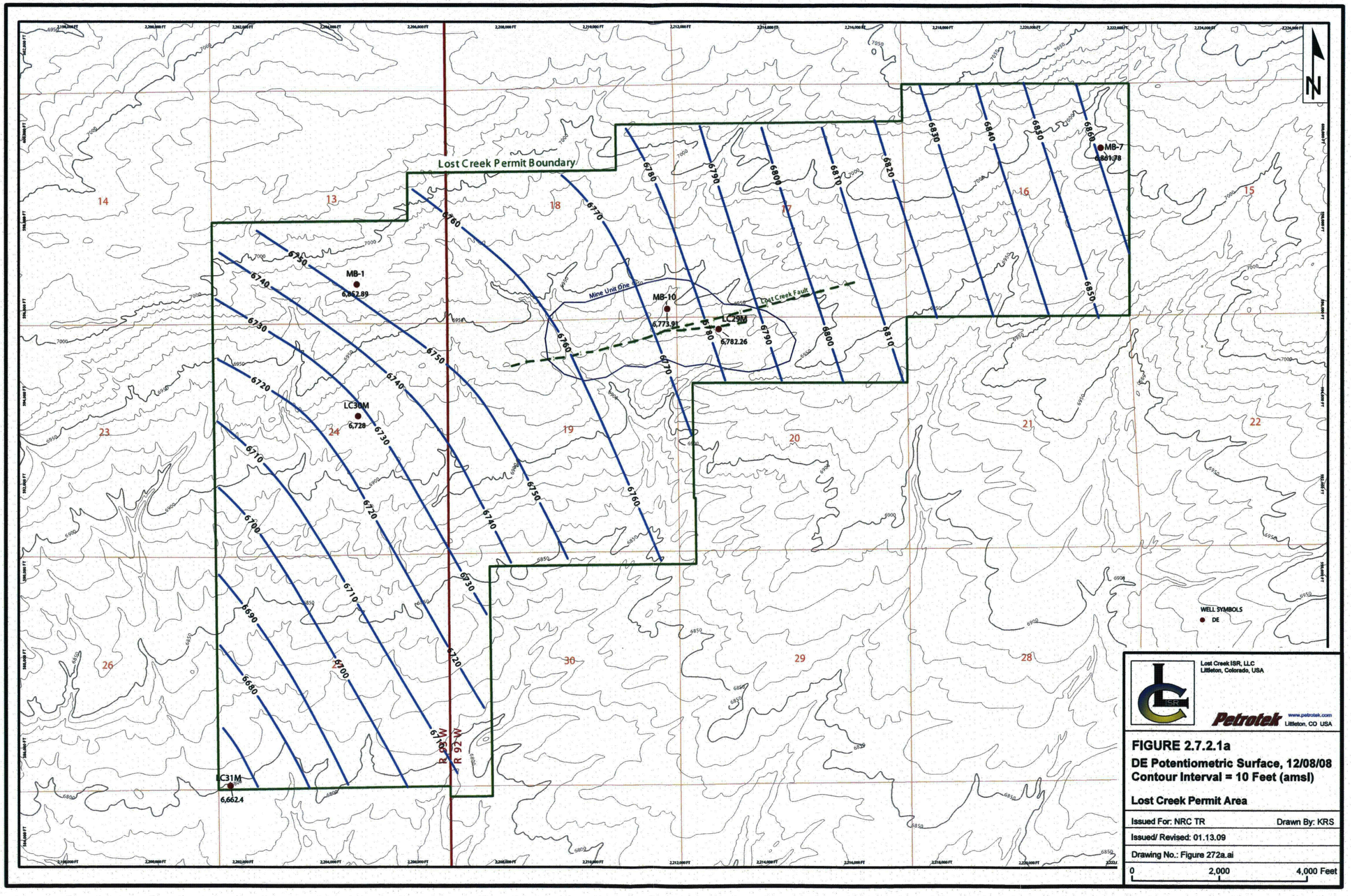
Technical Memorandum - Results of Vegetation Analyses for Radiological Parameters

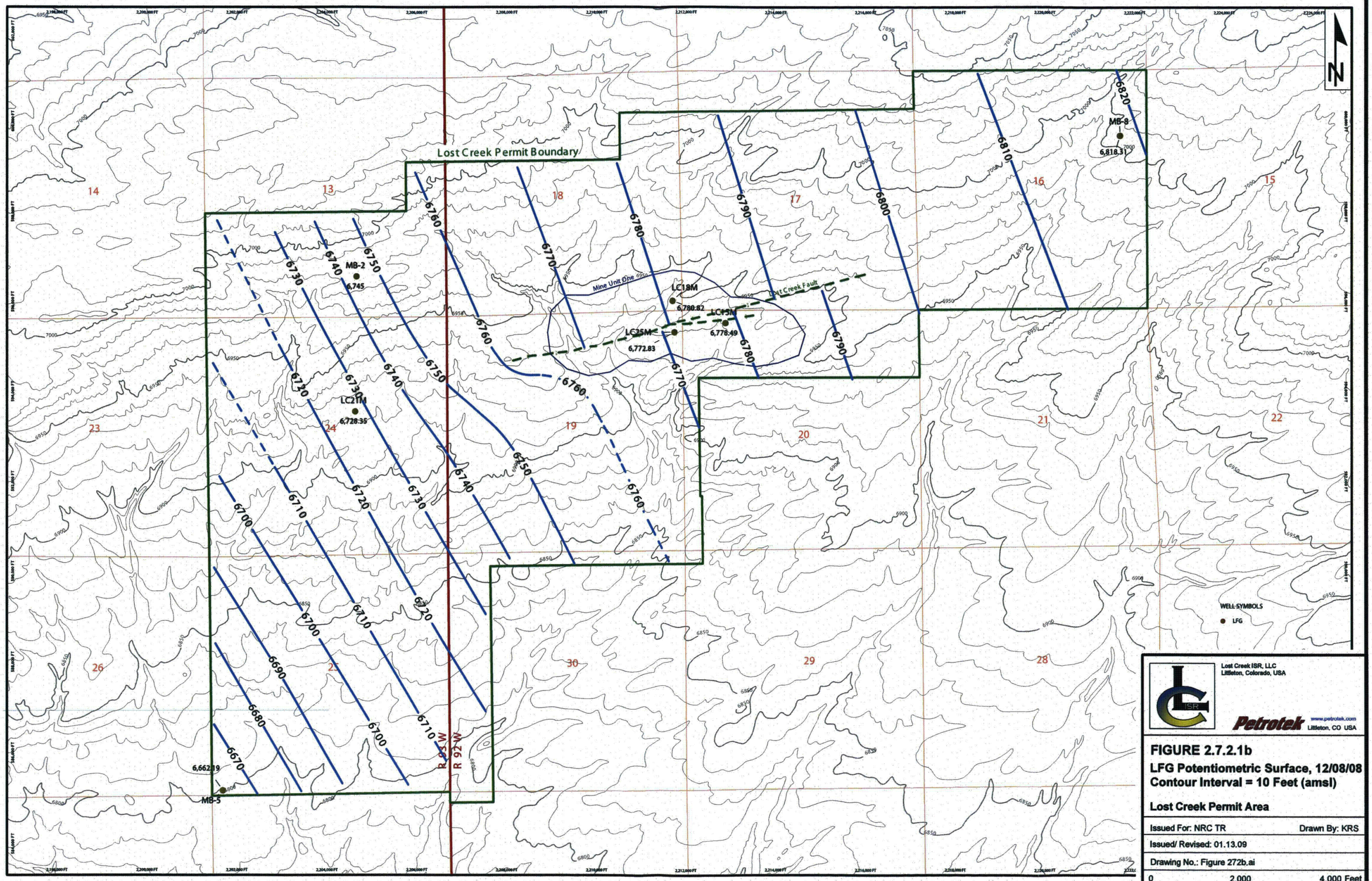
For Comment 2.9 #4:

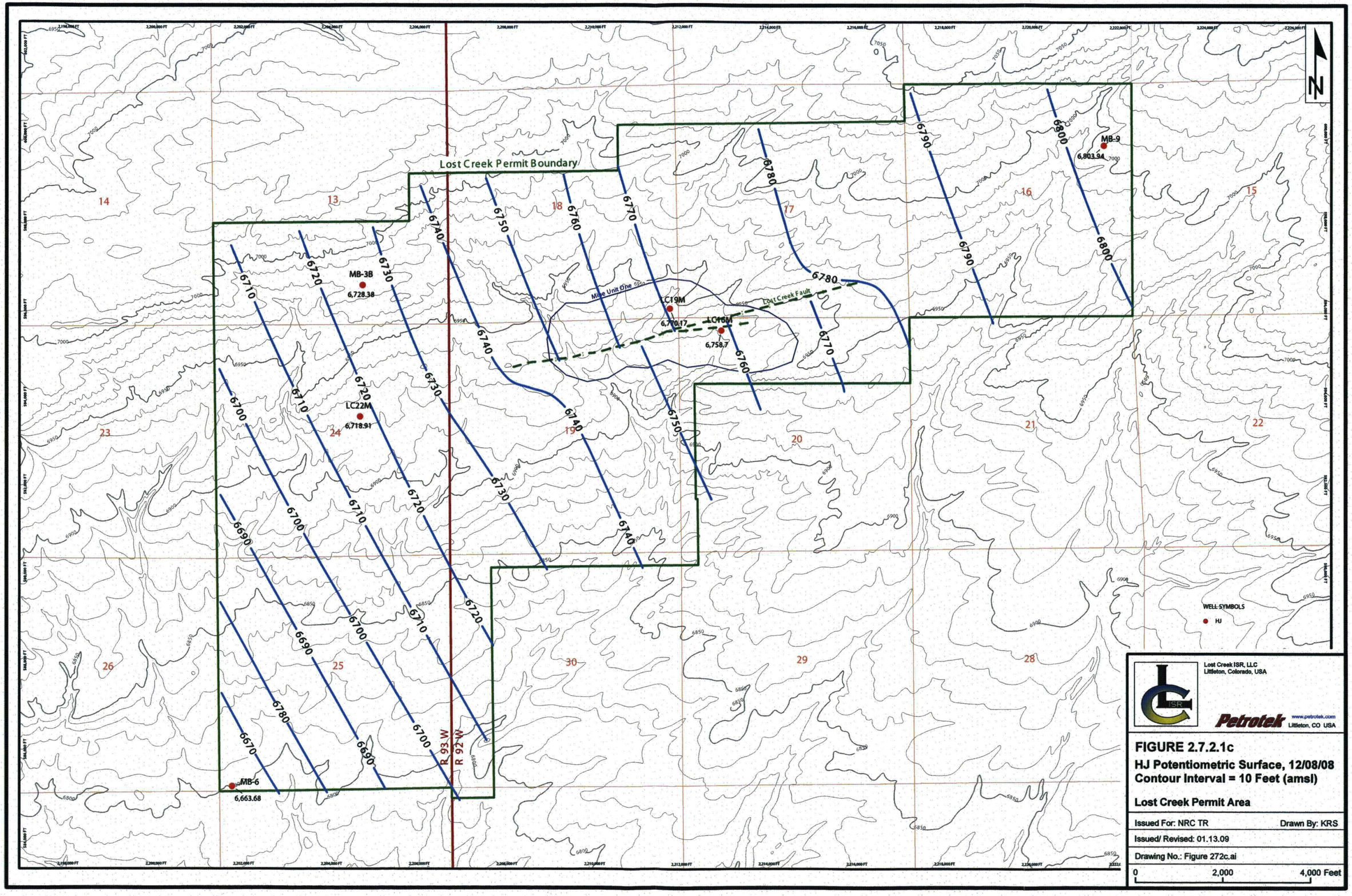
Technical Memorandum - Results of Air Partiulate Analyses for Radiological Parameters

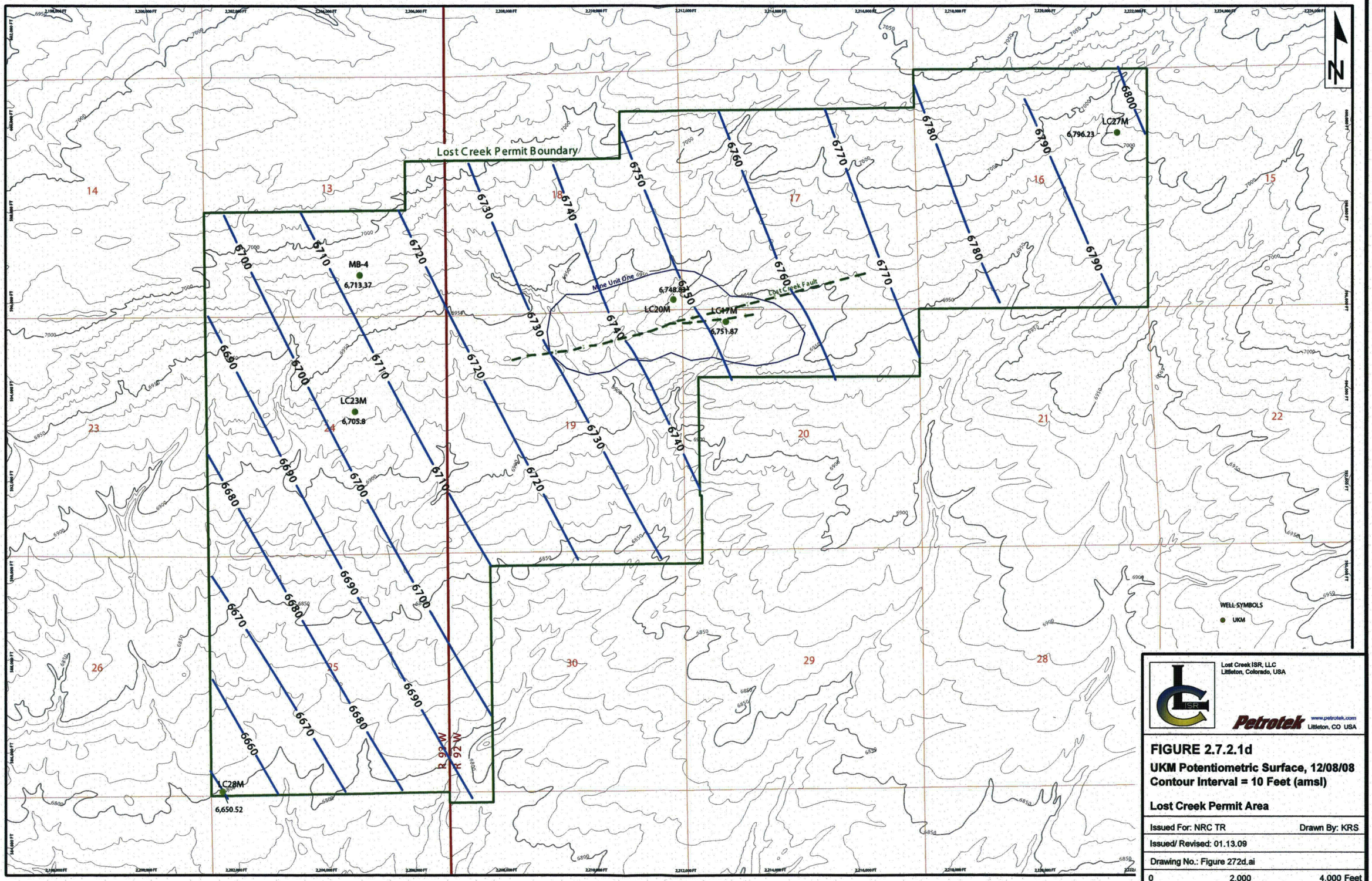
For Comment 2.9 #7j:

Referencre - Whicker, R.; Cartier, P.; Cain, J.; Milmine, K.; Griffin, M. 2008. Radiological Site Characterizations: Gamma Surveys, Gamma/Ra-226 Correlations and Related Spatial Analysis Techniques. Operational Radiation Safety, Health Physics, Vol. 95 (Supplement 5): S180-S189; November, 2008.


Lost Creek Permit Boundary
Mine Unit One
Lost Creek Fault
MB-1
6,852.89
MB-10
6,773.91
LC29M
6,782.26
MB-7
6,861.78
LC30M
6,728
LC31M
6,662.4
R 93 W
R 92 W
WELL SYMBOLS
DE
N
Lost Creek ISR, LLC
Littleton, Colorado, USA
Petrotek
www.petrotek.com
Littleton, CO USA
FIGURE 2.7.2.1a
DE Potentiometric Surface, 12/08/08
Contour Interval = 10 Feet (amsl)
Lost Creek Permit Area
Issued For: NRC TR
Drawn By: KRS
Issued/ Revised: 01.13.09
Drawing No.: Figure 272a.ai
0
2,000
4,000 Feet


Lost Creek Permit Boundary
Mine Unit One
Lost Creek Fault
MB-2
6,745
MB-8
6,818.31
LC18M
6,780.82
LC15M
6,778.49
LC25M
6,772.83
LC21M
6,728.35
MB-5
6,662.19
R 93 W
R 92 W
WELL SYMBOLS
LFG
Lost Creek ISR, LLC
Littleton, Colorado, USA
Petrotek
www.petrotek.com
Littleton, CO USA
FIGURE 2.7.2.1b
LFG Potentiometric Surface, 12/08/08
Contour Interval = 10 Feet (amsl)
Lost Creek Permit Area
Issued For: NRC TR
Drawn By: KRS
Issued/ Revised: 01.13.09
Drawing No.: Figure 272b.ai
0
2,000
4,000 Feet


Lost Creek Permit Boundary
Mine Unit One
Lost Creek Fault
MB-3B
6,728.38
LC19M
6,770.17
LC16M
6,758.7
LC22M
6,718.91
MB-9
6,803.94
MB-6
6,663.68
R 93 W
R 92 W
WELL SYMBOLS
HJ
Lost Creek ISR, LLC
Littleton, Colorado, USA
Petrotek
www.petrotek.com
Littleton, CO USA
FIGURE 2.7.2.1c
HJ Potentiometric Surface, 12/08/08
Contour Interval = 10 Feet (amsl)
Lost Creek Permit Area
Issued For: NRC TR
Drawn By: KRS
Issued/ Revised: 01.13.09
Drawing No.: Figure 272c.ai
0
2,000
4,000 Feet


Lost Creek Permit Boundary
Mine Unit One
Lost Creek Fault
MB-4
6,713.37
LC23M
6,705.8
LC28M
6,650.52
LC20M
6,748.61
LC17M
6,751.87
LC27M
6,796.23
R 93 W
R 92 W
WELL SYMBOLS
UKM
Lost Creek ISR, LLC
Littleton, Colorado, USA
Petrotek
www.petrotek.com
Littleton, CO USA
FIGURE 2.7.2.1d
UKM Potentiometric Surface, 12/08/08
Contour Interval = 10 Feet (amsl)
Lost Creek Permit Area
Issued For: NRC TR
Drawn By: KRS
Issued/ Revised: 01.13.09
Drawing No.: Figure 272d.ai
0
2,000
4,000 Feet

TECHNICAL MEMORANDUM

TO: **Ur-Energy Inc.**

FROM: **AATA International, Inc.**

DATE: **January 16, 2009**

SUBJECT: **Vegetation Sampling for Radionuclides**

Vegetation samples for radionuclide analyses were collected from three areas downwind of the Plant in the Lost Creek License Area in the summer of 2008. The samples were analyzed for natural uranium, lead-210 (Pb-210), polonium 210 (Po-210), radium-226 (Ra-226), and thorium-230 (Th-230).

Figure Veg-1 shows the three areas from which the vegetation samples were collected. The sampling areas radiate from the Plant in the direction of the prevailing wind. A transect was established along the northern (or northeastern) boundary of each area during the first sampling event, and grazing fodder within 5 meters of those transects was sampled. During subsequent sampling events, the transects in each area were relocated 10 meters to the south or southwest of the previous transect in that area, and parallel to the first transect (**Figure Veg-2**).

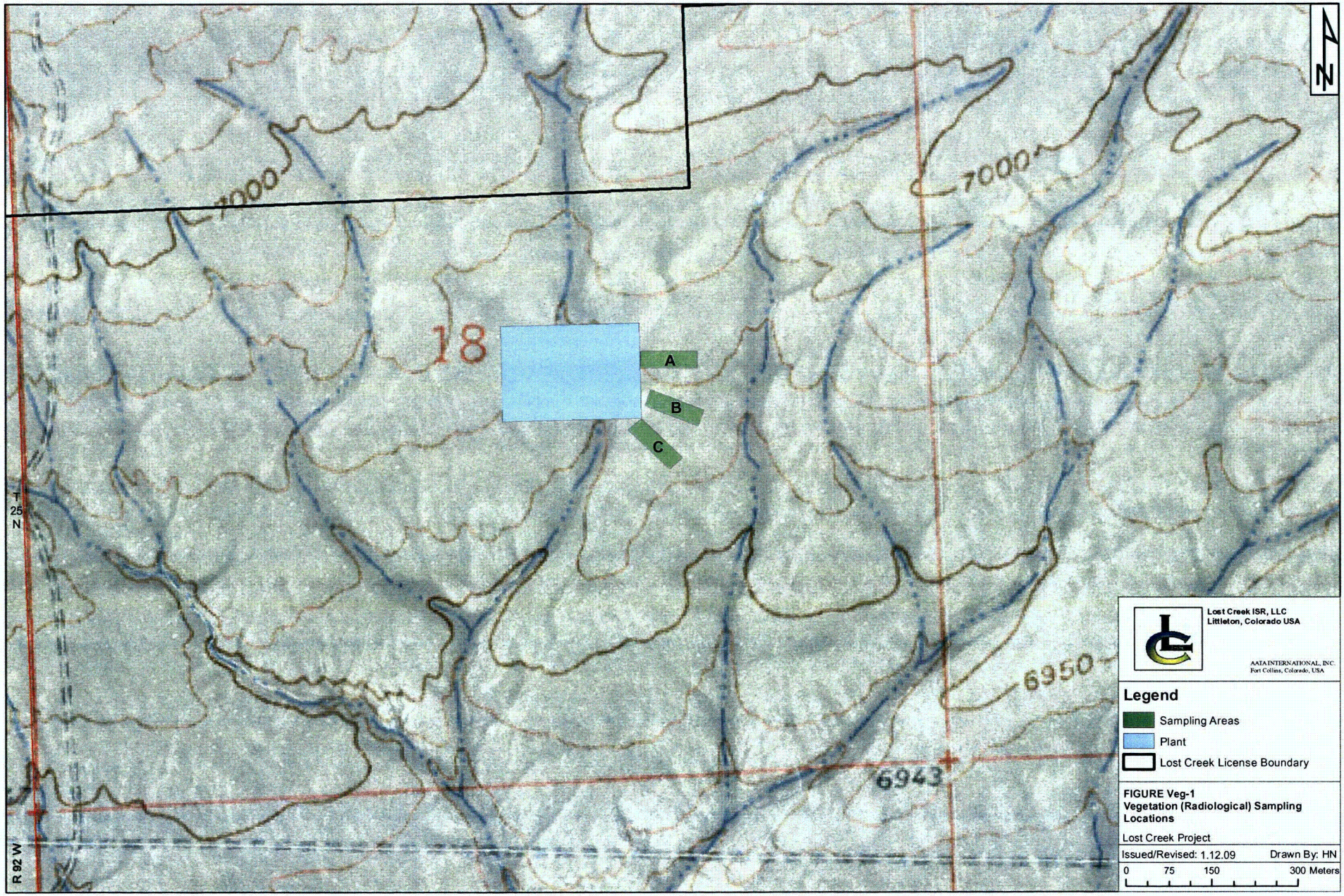
Sagebrush, rabbitbrush, succulents, and other non-grazing vegetation were avoided, since they are generally not consumed by cattle, and therefore any radionuclides that might be present in shrubs or succulents are less likely to enter the human food chain. In addition, sampling of shrubs (especially sagebrush) can be detrimental to the plant survival. Given the quantity of vegetative material needed for analysis, it was not considered prudent to collect significant quantities of sagebrush. Historical data at a different uranium project in Wyoming shows that levels of natural uranium, Pb-210, Po-210, Ra-226, and Th-230 are very similar between grasses and sagebrush (Conoco, 1980 in EMC, 2007).

Table Veg-1 shows the analytical results for the vegetation sampling, and the laboratory data sheets are included in **Appendix Veg-1**. The overall average uranium concentration was 0.18 mg/kg. However, if the outlier value (0.76 mg/kg) is excluded, the average was 0.11 mg/kg. Uranium concentrations were greatest in the first sample, then fairly consistent between the second and third sample. Not surprisingly, uranium activity showed a similar trend, as did Pb-210, which averaged 0.0014 uCi/kg in the first sample, and 0.00051 and 0.00083 uCi/kg in the subsequent samples. Po-210 concentrations averaged 0.000062 uCi/kg, and generally increased over time, with the highest concentrations in the final samples. Noticeable changes in radiological activity after the first sample may be due to vegetation drying out and becoming dormant as summer progresses. No trends in time or space were apparent in Ra-226 or Th-230, which averaged 0.00012, and 0.000025 uCi/kg, respectively.

References:

Conoco, Inc. 1980. Environmental Report for the Sand Rock Mill Project, Campbell County, Wyoming. Docket No. 40-8743. July, 1980.

EMC (Energy Metals Corporation US). 2007. Application for US NRC Source Material License, Moore Ranch Uranium Project. Technical Report, Volume II. NRC website, ADAMS accession number ML072851268


7000
7000
18
A
B
C
T 25 N
R 92 W
6950
6943
N
Lost Creek ISR, LLC
Littleton, Colorado USA
AATA INTERNATIONAL, INC.
Fort Collins, Colorado, USA
Legend
Sampling Areas
Plant
Lost Creek License Boundary
FIGURE Veg-1
Vegetation (Radiological) Sampling Locations
Lost Creek Project
Issued/Revised: 1.12.09
Drawn By: HN
0
75
150
300 Meters

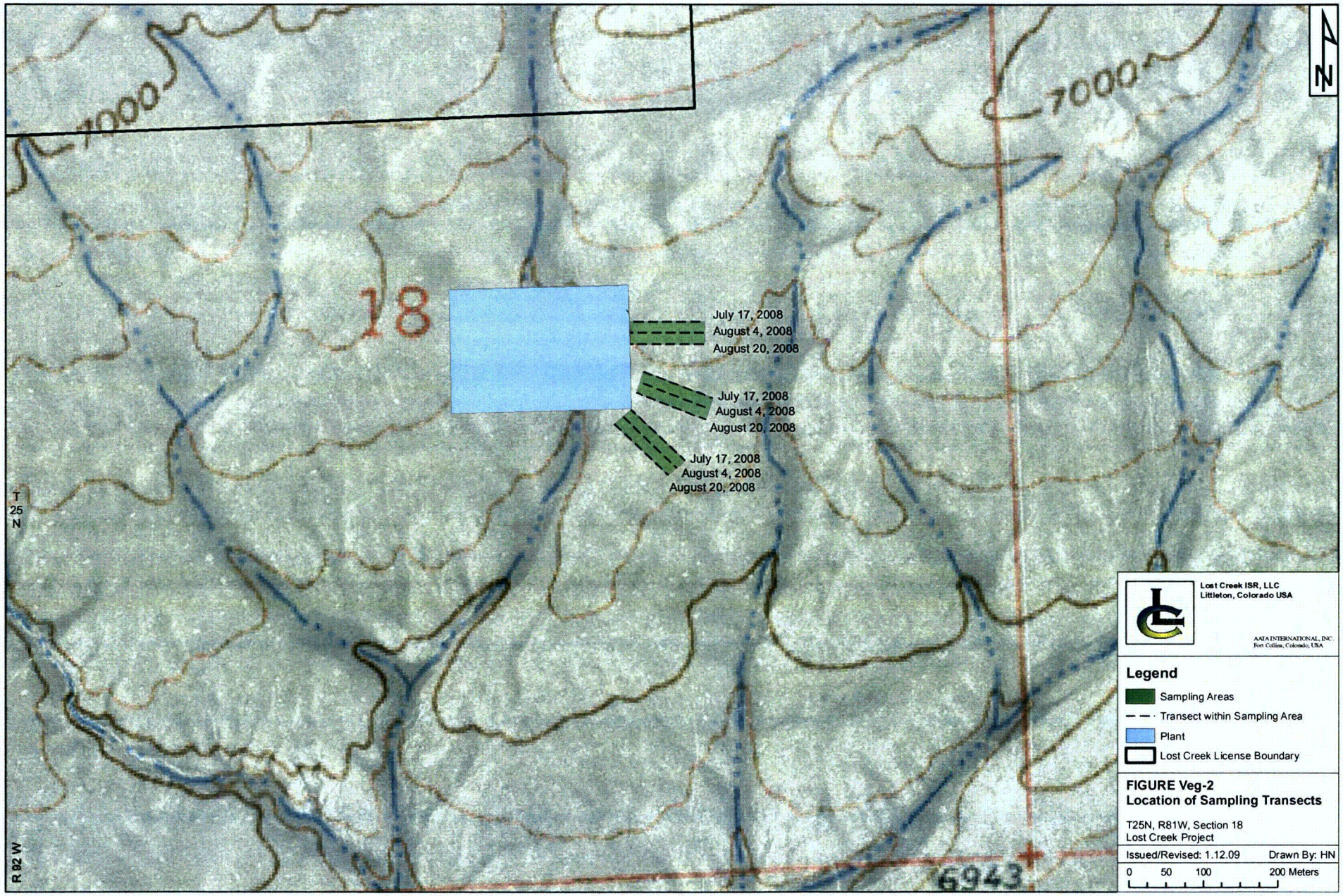

7000
7000
18
July 17, 2008
August 4, 2008
August 20, 2008
July 17, 2008
August 4, 2008
August 20, 2008
July 17, 2008
August 4, 2008
August 20, 2008
T 25 N
R 92 W
6943
N
Lost Creek ISR, LLC
Littleton, Colorado USA
AATA INTERNATIONAL, INC.
Fort Collins, Colorado, USA
Legend
Sampling Areas
Transect within Sampling Area
Plant
Lost Creek License Boundary
FIGURE Veg-2
Location of Sampling Transects
T25N, R81W, Section 18
Lost Creek Project
Issued/Revised: 1.12.09
Drawn By: HN
0 50 100 200 Meters

Table Veg-1 Summary of Analytical Results - Vegetation Sampling for Radionuclides

Sample Location	Analyte	Units	Sampling Date		
			7/17/2008	8/4/2008	8/20/2008
LC-A	Uranium	mg/kg-dry	0.76	0.08	0.11
	Uranium, Activity	uCi/kg	0.00052	0.00006	0.000076
	Lead 210	uCi/kg	0.0015	<0.00065	0.00069
	Polonium 210	uCi/kg	0.000072	0.000035	0.000100
	Radium 226	uCi/kg	0.000083	0.000075	0.00015
	Thorium 230	uCi/kg	0.000016	0.000014	0.000028
LC-B	Uranium	mg/kg-dry	0.17	0.06	0.06
	Uranium, Activity	uCi/kg	0.00012	0.00004	0.000042
	Lead 210	uCi/kg	0.0019	0.0009	0.001
	Polonium 210	uCi/kg	0.000035	0.000068	0.00008
	Radium 226	uCi/kg	0.000071	0.00015	0.00016
	Thorium 230	uCi/kg	0.000022	0.000024	0.000034
LC-C	Uranium	mg/kg-dry	0.2	0.09	0.08
	Uranium, Activity	uCi/kg	0.00013	0.00006	0.000052
	Lead 210	uCi/kg	0.00089	<0.00062	0.00079
	Polonium 210	uCi/kg	0.000032	0.000035	0.000097
	Radium 226	uCi/kg	0.00015	0.00015	0.00013
	Thorium 230	uCi/kg	0.000032	0.000039	0.000019
Overall Average	Uranium	mg/kg-dry	0.18		
	Uranium, Activity	uCi/kg	0.00012		
	Lead 210	uCi/kg	0.00092		
	Polonium 210	uCi/kg	0.000062		
	Radium 226	uCi/kg	0.00012		
	Thorium 230	uCi/kg	0.000025		

Appendix Veg-1

Laboratory Data Sheets
Baseline Vegetation Sampling for Radionuclides
Lost Creek In Situ Uranium Project

ENERGY LABORATORIES, INC. • 2393 Salt Creek Highway (82601) • P.O. Box 3258 • Casper, WY 82602
Toll Free 888.235.0515 • 307.235.0515 • Fax 307.234.1639 • casper@energylab.com • www.energylab.com

ANALYTICAL SUMMARY REPORT

October 09, 2008

AATA International Inc
300 E Boardwalk Dr STE 4A
Fort Collins, CO 80525

Workorder No.: C08080492 Quote ID: C2889 - 301 UR Energy

Project Name: Lost Creek 301

Energy Laboratories, Inc. received the following 6 samples from AATA International Inc on 8/12/2008 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
C08080492-001	LC-A	07/17/08 12:00	08/12/08	Vegetation	Metals by ICP/ICPMS, Total Digestion, Radiochemistry Digestion, Total Metals for Core Samples Lead 210 Polonium 210 Radium 226 Thorium, Isotopic
C08080492-002	LC-B	07/17/08 14:00	08/12/08	Vegetation	Same As Above
C08080492-003	LC-C	07/17/08 16:00	08/12/08	Vegetation	Same As Above
C08080492-004	LC-A	08/04/08 11:00	08/12/08	Vegetation	Same As Above
C08080492-005	LC-B	08/04/08 13:00	08/12/08	Vegetation	Same As Above
C08080492-006	LC-C	08/04/08 15:00	08/12/08	Vegetation	Same As Above

As appropriate, any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

If you have any questions regarding these tests results, please call.

Report Approved By: STEVE CARLSTON

ENERGY LABORATORIES, INC. • 2393 Salt Creek Highway (82601) • P.O. Box 3258 • Casper, WY 82602
Toll Free 888.235.0515 • 307.235.0515 • Fax 307.234.1639 • casper@energylab.com • www.energylab.com

LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: Lost Creek 301
Lab ID: C08080492-001
Client Sample ID: LC-A

Report Date: 10/09/08
Collection Date: 07/17/08 12:00
DateReceived: 08/12/08
Matrix: Vegetation

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS - TOTAL							
Uranium	0.76	mg/kg-dry		0.02		SW6020	08/27/08 20:53 / sml
Uranium, Activity	5.2E-04	uCi/kg		1.0E-05		SW6020	08/27/08 20:53 / sml
RADIONUCLIDES - TOTAL							
Lead 210	1.5E-03	uCi/kg				E909.0M	09/04/08 09:45 / dm
Lead 210 precision (±)	5.3E-04	uCi/kg				E909.0M	09/04/08 09:45 / dm
Lead 210 MDC	8.5E-04	uCi/kg				E909.0M	09/04/08 09:45 / dm
Polonium 210	7.2E-05	uCi/kg		5.4E-06		RMO-3008	09/04/08 19:15 / plj
Polonium 210 precision (±)	2.4E-05	uCi/kg				RMO-3008	09/04/08 19:15 / plj
Radium 226	8.3E-05	uCi/kg				E903.0	09/08/08 22:46 / trs
Radium 226 precision (±)	1.2E-05	uCi/kg				E903.0	09/08/08 22:46 / trs
Radium 226 MDC	6.6E-06	uCi/kg				E903.0	09/08/08 22:46 / trs
Thorium 230	1.6E-05	uCi/kg		1.1E-06		E907.0	09/05/08 16:15 / dmf
Thorium 230 precision (±)	7.0E-06	uCi/kg				E907.0	09/05/08 16:15 / dmf

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

ENERGY LABORATORIES, INC. • 2393 Salt Creek Highway (82601) • P.O. Box 3258 • Casper, WY 82602
Toll Free 888.235.0515 • 307.235.0515 • Fax 307.234.1639 • casper@energylab.com • www.energylab.com

LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: Lost Creek 301
Lab ID: C08080492-002
Client Sample ID: LC-B

Report Date: 10/09/08
Collection Date: 07/17/08 14:00
DateReceived: 08/12/08
Matrix: Vegetation

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS - TOTAL							
Uranium	0.17	mg/kg-dry		0.02		SW6020	08/27/08 21:07 / sml
Uranium, Activity	1.2E-04	uCi/kg		1.0E-05		SW6020	08/27/08 21:07 / sml
RADIONUCLIDES - TOTAL							
Lead 210	1.9E-03	uCi/kg				E909.0M	09/04/08 09:45 / dm
Lead 210 precision (±)	5.2E-04	uCi/kg				E909.0M	09/04/08 09:45 / dm
Lead 210 MDC	8.3E-04	uCi/kg				E909.0M	09/04/08 09:45 / dm
Polonium 210	3.5E-05	uCi/kg		5.2E-06		RMO-3008	09/04/08 19:15 / plj
Polonium 210 precision (±)	1.6E-05	uCi/kg				RMO-3008	09/04/08 19:15 / plj
Radium 226	7.1E-05	uCi/kg				E903.0	09/08/08 22:46 / trs
Radium 226 precision (±)	1.1E-05	uCi/kg				E903.0	09/08/08 22:46 / trs
Radium 226 MDC	6.7E-06	uCi/kg				E903.0	09/08/08 22:46 / trs
Thorium 230	2.2E-05	uCi/kg		1.1E-06		E907.0	09/05/08 16:15 / dmf
Thorium 230 precision (±)	8.4E-06	uCi/kg				E907.0	09/05/08 16:15 / dmf

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

ENERGY LABORATORIES, INC. • 2393 Salt Creek Highway (82601) • P.O. Box 3258 • Casper, WY 82602
Toll Free 888.235.0515 • 307.235.0515 • Fax 307.234.1639 • casper@energylab.com • www.energylab.com

LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: Lost Creek 301
Lab ID: C08080492-003
Client Sample ID: LC-C

Report Date: 10/09/08
Collection Date: 07/17/08 16:00
DateReceived: 08/12/08
Matrix: Vegetation

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS - TOTAL							
Uranium	0.20	mg/kg-dry		0.02		SW6020	08/27/08 21:13 / sml
Uranium, Activity	1.3E-04	uCi/kg		1.0E-05		SW6020	08/27/08 21:13 / sml
RADIONUCLIDES - TOTAL							
Lead 210	8.9E-04	uCi/kg				E909.0M	09/04/08 09:45 / dm
Lead 210 precision (±)	5.4E-04	uCi/kg				E909.0M	09/04/08 09:45 / dm
Lead 210 MDC	8.7E-04	uCi/kg				E909.0M	09/04/08 09:45 / dm
Polonium 210	3.2E-05	uCi/kg		5.6E-06		RMO-3008	09/04/08 19:15 / plj
Polonium 210 precision (±)	2.1E-05	uCi/kg				RMO-3008	09/04/08 19:15 / plj
Radium 226	1.5E-04	uCi/kg				E903.0	09/08/08 22:46 / trs
Radium 226 precision (±)	1.7E-05	uCi/kg				E903.0	09/08/08 22:46 / trs
Radium 226 MDC	7.1E-06	uCi/kg				E903.0	09/08/08 22:46 / trs
Thorium 230	3.2E-05	uCi/kg		1.1E-06		E907.0	09/05/08 16:15 / dmf
Thorium 230 precision (±)	1.2E-05	uCi/kg				E907.0	09/05/08 16:15 / dmf

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

ENERGY LABORATORIES, INC. • 2393 Salt Creek Highway (82601) • P.O. Box 3258 • Casper, WY 82602
Toll Free 888.235.0515 • 307.235.0515 • Fax 307.234.1639 • casper@energylab.com • www.energylab.com

LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: Lost Creek 301
Lab ID: C08080492-004
Client Sample ID: LC-A

Report Date: 10/09/08
Collection Date: 08/04/08 11:00
DateReceived: 08/12/08
Matrix: Vegetation

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS - TOTAL							
Uranium	0.08	mg/kg-dry		0.02		SW6020	08/27/08 21:20 / sml
Uranium, Activity	6.0E-05	uCi/kg		1.0E-05		SW6020	08/27/08 21:20 / sml
RADIONUCLIDES - TOTAL							
Lead 210	5.3E-04	uCi/kg	U			E909.0M	09/04/08 09:45 / dm
Lead 210 precision (±)	3.9E-04	uCi/kg				E909.0M	09/04/08 09:45 / dm
Lead 210 MDC	6.5E-04	uCi/kg				E909.0M	09/04/08 09:45 / dm
Polonium 210	3.5E-05	uCi/kg		4.1E-06		RMO-3008	09/04/08 19:15 / plj
Polonium 210 precision (±)	1.7E-05	uCi/kg				RMO-3008	09/04/08 19:15 / plj
Radium 226	7.5E-05	uCi/kg				E903.0	09/08/08 22:46 / trs
Radium 226 precision (±)	1.0E-05	uCi/kg				E903.0	09/08/08 22:46 / trs
Radium 226 MDC	5.2E-06	uCi/kg				E903.0	09/08/08 22:46 / trs
Thorium 230	1.4E-05	uCi/kg		8.2E-07		E907.0	09/05/08 16:15 / dmf
Thorium 230 precision (±)	5.3E-06	uCi/kg				E907.0	09/05/08 16:15 / dmf

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

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: Lost Creek 301
Lab ID: C08080492-005
Client Sample ID: LC-B

Report Date: 10/09/08
Collection Date: 08/04/08 13:00
DateReceived: 08/12/08
Matrix: Vegetation

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS - TOTAL							
Uranium	0.06	mg/kg-dry		0.02		SW6020	08/27/08 21:54 / sml
Uranium, Activity	4.0E-05	uCi/kg		1.0E-05		SW6020	08/27/08 21:54 / sml
RADIONUCLIDES - TOTAL							
Lead 210	9.0E-04	uCi/kg				E909.0M	09/04/08 09:45 / dm
Lead 210 precision (±)	4.2E-04	uCi/kg				E909.0M	09/04/08 09:45 / dm
Lead 210 MDC	6.8E-04	uCi/kg				E909.0M	09/04/08 09:45 / dm
Polonium 210	6.8E-05	uCi/kg		4.3E-06		RMO-3008	09/04/08 19:15 / plj
Polonium 210 precision (±)	2.2E-05	uCi/kg				RMO-3008	09/04/08 19:15 / plj
Radium 226	1.5E-04	uCi/kg				E903.0	09/08/08 22:46 / trs
Radium 226 precision (±)	1.5E-05	uCi/kg				E903.0	09/08/08 22:46 / trs
Radium 226 MDC	5.7E-06	uCi/kg				E903.0	09/08/08 22:46 / trs
Thorium 230	2.4E-05	uCi/kg		8.6E-07		E907.0	09/05/08 16:15 / dmf
Thorium 230 precision (±)	1.2E-05	uCi/kg				E907.0	09/05/08 16:15 / dmf

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

ENERGY LABORATORIES, INC. • 2393 Salt Creek Highway (82601) • P.O. Box 3258 • Casper, WY 82602
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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: Lost Creek 301
Lab ID: C08080492-006
Client Sample ID: LC-C

Report Date: 10/09/08
Collection Date: 08/04/08 15:00
DateReceived: 08/12/08
Matrix: Vegetation

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS - TOTAL							
Uranium	0.09	mg/kg-dry		0.02		SW6020	08/27/08 22:01 / sml
Uranium, Activity	6.0E-05	uCi/kg		1.0E-05		SW6020	08/27/08 22:01 / sml
RADIONUCLIDES - TOTAL							
Lead 210	6.1E-04	uCi/kg	U			E909.0M	09/04/08 09:45 / dm
Lead 210 precision (±)	3.8E-04	uCi/kg				E909.0M	09/04/08 09:45 / dm
Lead 210 MDC	6.2E-04	uCi/kg				E909.0M	09/04/08 09:45 / dm
Polonium 210	3.5E-05	uCi/kg		3.9E-06		RMO-3008	09/04/08 19:15 / plj
Polonium 210 precision (±)	1.3E-05	uCi/kg				RMO-3008	09/04/08 19:15 / plj
Radium 226	1.5E-04	uCi/kg				E903.0	09/08/08 22:46 / trs
Radium 226 precision (±)	1.3E-05	uCi/kg				E903.0	09/08/08 22:46 / trs
Radium 226 MDC	4.8E-06	uCi/kg				E903.0	09/08/08 22:46 / trs
Thorium 230	3.9E-05	uCi/kg		7.9E-07		E907.0	09/05/08 16:15 / dmf
Thorium 230 precision (±)	1.7E-05	uCi/kg				E907.0	09/05/08 16:15 / dmf

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

ENERGY LABORATORIES, INC. • 2393 Salt Creek Highway (82601) • P.O. Box 3258 • Casper, WY 82602
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QA/QC Summary Report

Client: AATA International Inc
Project: Lost Creek 301

Report Date: 10/09/08
Work Order: C08080492

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E903.0									Batch: 19597
Sample ID: LCS-19597	Laboratory Control Sample				Run: BERTHOLD 770_080902A				09/08/08 22:46
Radium 226	4.2E-05	pCi/L		107	70	130			
Sample ID: MB-19597	Method Blank				Run: BERTHOLD 770_080902A				09/08/08 22:46
Radium 226	3E-07	pCi/L							U
Sample ID: C08080492-005AMS	Sample Matrix Spike				Run: BERTHOLD 770_080902A				09/08/08 22:46
Radium 226	0.00034	uCi/kg		114	70	130			
Sample ID: C08080624-002ADUP	Sample Duplicate				Run: BERTHOLD 770_080902A				09/09/08 00:27
Radium 226	1.0E-05	uCi/kg					7.3	97.6	
Method: E907.0									Batch: 19597
Sample ID: C08080492-006AMS	Sample Matrix Spike				Run: EGG-ORTEC_080905D				09/05/08 16:15
Thorium 230	0.00022	uCi/kg	7.9E-07	96	70	130			
Sample ID: C08080492-006AMSD	Sample Matrix Spike Duplicate				Run: EGG-ORTEC_080905D				09/05/08 16:15
Thorium 230	0.00020	uCi/kg	7.9E-07	97	70	130	9.3	30	
Sample ID: LCS-19597	Laboratory Control Sample				Run: EGG-ORTEC_080905D				09/05/08 16:15
Thorium 230	9.5E-05	uCi/kg	4.0E-07	102	70	130			
Sample ID: MB-19597	Method Blank				Run: EGG-ORTEC_080905D				09/05/08 16:15
Thorium 230	1E-06	uCi/kg							
Method: E909.0M									Batch: 19597
Sample ID: C08080492-002AMS	Sample Matrix Spike				Run: PACKARD 3100TR_080904C				09/04/08 09:45
Lead 210	0.0090	uCi/kg		115	70	130			
Sample ID: C08080492-002AMSD	Sample Matrix Spike Duplicate				Run: PACKARD 3100TR_080904C				09/04/08 09:45
Lead 210	0.0078	uCi/kg		96	70	130	14	30	
Sample ID: MB-R107765	Method Blank				Run: PACKARD 3100TR_080904C				09/04/08 09:45
Lead 210	4E-06	uCi/kg							U
Sample ID: LCS-R107765	Laboratory Control Sample				Run: PACKARD 3100TR_080904C				09/04/08 09:45
Lead 210	0.00010	uCi/kg		90	70	130			
Method: RMO-3008									Batch: 19597
Sample ID: LCS-19597	Laboratory Control Sample				Run: EGG-ORTEC_080904B				09/04/08 19:15
Polonium 210	6.7E-05	uCi/kg	1.0E-06	78	70	130			
Sample ID: MB-19597	Method Blank				Run: EGG-ORTEC_080904B				09/04/08 19:15
Polonium 210	1E-07	uCi/kg	1E-06						U

Qualifiers:

RL - Analyte reporting limit.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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QA/QC Summary Report

Client: AATA International Inc
Project: Lost Creek 301

Report Date: 10/09/08
Work Order: C08080492

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: RMO-3008									Batch: R107637
Sample ID: C08080827-001FMS	Sample Matrix Spike				Run: EGG-ORTEC_080904B				09/04/08 19:15
Polonium 210	55	pCi/L	1.0	127	70	130			
Sample ID: C08080827-001FMSD	Sample Matrix Spike Duplicate				Run: EGG-ORTEC_080904B				09/04/08 19:15
Polonium 210	54	pCi/L	1.0	125	70	130	1.8	30	
Sample ID: LCS-19540	Laboratory Control Sample				Run: EGG-ORTEC_080904B				09/04/08 19:15
Polonium 210	100	pCi/L	1.0	121	70	130			
Sample ID: MB-19540	Method Blank				Run: EGG-ORTEC_080904B				09/04/08 19:15
Polonium 210	3	pCi/L							
Method: SW6020									Batch: 19576
Sample ID: MB-19576	Method Blank				Run: ICPMS4-C_080827A				08/27/08 20:33
Uranium	ND	mg/kg-dry	0.003						
Sample ID: LCS1-19576	Laboratory Control Sample				Run: ICPMS4-C_080827A				08/27/08 20:40
Uranium	135	mg/kg-dry	0.50	131	91	133			
Sample ID: C08080981-002AMS3	Sample Matrix Spike				Run: ICPMS4-C_080827A				08/28/08 00:09
Uranium	19.4	mg/kg-dry	0.50	116	75	125			
Sample ID: C08080981-002AMSD3	Sample Matrix Spike Duplicate				Run: ICPMS4-C_080827A				08/28/08 00:16
Uranium	20.7	mg/kg-dry	0.50	126	75	125	6.3	20	S

Qualifiers:

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

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

Page 1 of 1

PLEASE PRINT- Provide as much information as possible.

Company Name:	Project Name, PWS, Permit, Etc.	Sample Origin	EPA/State Compliance:
ATA Int'l	Lost Creek 301	State: WY	Yes ☑ No ☐
Report Mail Address:	**Contact Name:** / **Phone/Fax:**	**Email:**	**Sampler: (Please Print)**
300 E. Boardwalk Ste 4A Ft. Collins Co 80525	Duncan Eccleston 970-223-1333	duncan.eccleston@aate.com	DTE
Invoice Address:	**Invoice Contact & Phone:**	**Purchase Order:**	**Quote/Bottle Order:**
2240 Blake St. Ste 210 Denver Co 80205	Carol Collins 720-974-2550	301-805	C2889

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

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

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

Comments: C08080492

Shipped by: DTE ups APS Grnd

Cooler ID(s): N/A BOX

Receipt Temp: 26 °C

On Ice: Yes (No)

Custody Seal (Y) N Intact (Y) N Signature Match (Y) N

ANALYSIS REQUESTED: NRC 4.14 primary

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX (Number of Containers; Sample Type: A W S V B O; Air Water Soils/Solids Vegetation Bioassay Other)	NRC 4.14 primary	SEE ATTACHED	Normal Turnaround (TAT)	RUSH
1	LC-A	7/17/08	12:00	Veg	↓		✓	
2	LC-B	↓	14:00	↓	↓		✓	
3	LC-C	↓	16:00	↓	↓		✓	
4								
5								
6								
7								
8								
9								
10								

LABORATORY USE ONLY

Custody Record MUST be Signed

Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
Duncan Eccleston	8/11/08	[signature]		8-12-08 9:20	[signature]
Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
			Received by Laboratory:	Date/Time:	Signature:

Sample Disposal: Return to Client: _____ Lab Disposal: ✓

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

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

Page 1 of 1

PLEASE PRINT- Provide as much information as possible.

Company Name: ARTA Int'l	Project Name, PWS, Permit, Etc.: Lost Creek 301	Sample Origin State: WY	EPA/State Compliance: Yes ☑ No ☐
Report Mail Address: 300 E Boardwalk Ste 4A Ft. Collins Co 80525	Contact Name: Duncan Eccleston Phone/Fax: 970-223-1333 Email: duncan.eccleston@arta.com		Sampler: (Please Print) DTE
Invoice Address: 2240 Blake St. Ste 210 Denver Co 80205	Invoice Contact & Phone: Carol Collins 720-974-2550	Purchase Order: 301-805	Quote/Bottle Order: C2889

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

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

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

RUSH

Comments: C08080492

Shipped by: DTE ups ARS Grnd
Cooler ID(s): N/A BOX
Receipt Temp: 26 °C
On Ice: Yes (No)
Custody Seal (Y) N
Intact (Y) N
Signature Match (Y) N

ANALYSIS REQUESTED

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX (Number of Containers; Sample Type: A W S V B O; Air Water Soils/Solids Vegetation Bioassay Other)	NRC 4-4 pinnipeds								SEE ATTACHED	Normal Turnaround (TAT)
1 LC-A	8/4	11:00	Veg	✓									✓
2 LC-B	↓	13:00	↓	✓									✓
3 LC-C	↓	15:00	↓	✓									✓
4													
5													
6													
7													
8													
9													
10													

LABORATORY USE ONLY

Custody Record MUST be Signed

Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
Duncan Eccleston	8/1/08	[signature]		8-12-08 9:20	[signature]
Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
			Received by Laboratory:	Date/Time:	Signature:

Sample Disposal: Return to Client: _____ Lab Disposal: _____

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

Energy Laboratories Inc
Workorder Receipt Checklist

AATA International Inc

C08080492

Login completed by: Kimberly Humiston

Date and Time Received: 8/12/2008 9:20 AM

Reviewed by:

Received by: kh

Reviewed Date:

Carrier name: Ground

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature:	26°C		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Contact and Corrective Action Comments:

None

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CLIENT: AATA International Inc
Project: Lost Creek 301
Sample Delivery Group: C08080492

Date: 09-Oct-08

CASE NARRATIVE

The following Case Narrative contains exceptions or comments pertaining to the analysis of samples submitted by AATA International Inc on 8/12/2008 09:20:00. These samples were assigned ELI Workorder Number C08080492.

ORIGINAL SAMPLE SUBMITTAL(S)
All original sample submittals have been returned with the data package.

SAMPLE TEMPERATURE COMPLIANCE: 4°C (±2°C)
Temperature of samples received may not be considered properly preserved by accepted standards. Samples that are hand delivered immediately after collection shall be considered acceptable if there is evidence that the chilling process has begun.

GROSS ALPHA ANALYSIS
Method 900.0 for gross alpha and gross beta is intended as a drinking water method for low TDS waters. Data provided by this method for non potable waters should be viewed as inconsistent.

RADON IN AIR ANALYSIS
The desired exposure time is 48 hours (2 days). The time delay in returning the canister to the laboratory for processing should be as short as possible to avoid excessive decay. Maximum recommended delay between end of exposure to beginning of counting should not exceed 8 days.

SOIL/SOLID SAMPLES
All samples reported on an as received basis unless otherwise indicated.

ATRAZINE, SIMAZINE AND PCB ANALYSIS USING EPA 505
Data for Atrazine and Simazine are reported from EPA 525.2, not from EPA 505. Data reported by ELI using EPA method 505 reflects the results for seven individual Aroclors. When the results for all seven are ND (not detected), the sample meets EPA compliance criteria for PCB monitoring.

SUBCONTRACTING ANALYSIS
Subcontracting of sample analyses to an outside laboratory may be required. If so, ENERGY LABORATORIES will utilize its branch laboratories or qualified contract laboratories for this service. Any such laboratories will be indicated within the Laboratory Analytical Report.

BRANCH LABORATORY LOCATIONS
eli-b - Energy Laboratories, Inc. - Billings, MT
eli-g - Energy Laboratories, Inc. - Gillette, WY
eli-h - Energy Laboratories, Inc. - Helena, MT
eli-r - Energy Laboratories, Inc. - Rapid City, SD
eli-t - Energy Laboratories, Inc. - College Station, TX

CERTFICATIONS:
USEPA: WY00002; FL-DOH NELAC: E87641; Arizona: AZ0699; California: 02118CA
Oregon: WY200001; Utah: 3072350515; Virginia: 00057; Washington: C1903

ISO 17025 DISCLAIMER:
The results of this Analytical Report relate only to the items submitted for analysis.

ENERGY LABORATORIES, INC. - CASPER,WY certifies that certain method selections contained in this report meet requirements as set forth by the above accrediting authorities. Some results requested by the client may not be covered under these certifications. All analysis data to be submitted for regulatory enforcement should be certified in the sample state of origin. Please verify ELI's certification coverage by visiting www.energylab.com

ELI appreciates the opportunity to provide you with this analytical service. For additional information and services visit our web page www.energylab.com.

THIS IS THE FINAL PAGE OF THE LABORATORY ANALYTICAL REPORT

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ANALYTICAL SUMMARY REPORT

October 20, 2008

AATA International Inc
300 E Boardwalk Dr STE 4A
Fort Collins, CO 80525

Workorder No.: C08090017 Quote ID: C2889 - 301 UR Energy

Project Name: URE-LC

Energy Laboratories, Inc. received the following 3 samples from AATA International Inc on 9/2/2008 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
C08090017-001	LC-A	08/20/08 13:00	09/02/08	Vegetation	Metals by ICP/ICPMS, Total Digestion, Radiochemistry Digestion, Total Metals for Core Samples Lead 210 Polonium 210 Radium 226 Thorium, Isotopic
C08090017-002	LC-B	08/20/08 15:00	09/02/08	Vegetation	Same As Above
C08090017-003	LC-C	08/20/08 17:00	09/02/08	Vegetation	Same As Above

As appropriate, any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

If you have any questions regarding these tests results, please call.

Report Approved By: STEVE CARLSTON

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: URE-LC
Lab ID: C08090017-001
Client Sample ID: LC-A

Report Date: 10/20/08
Collection Date: 08/20/08 13:00
DateReceived: 09/02/08
Matrix: Vegetation

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS - TOTAL							
Uranium	0.11	mg/kg-dry		0.01		SW6020	09/10/08 05:54 / sml
Uranium, Activity	8.0E-05	uCi/kg-dry		7.0E-06		SW6020	09/10/08 05:54 / sml
RADIONUCLIDES - TOTAL							
Lead 210	6.9E-04	uCi/kg				E909.0M	09/24/08 09:01 / dm
Lead 210 precision (±)	6.4E-05	uCi/kg				E909.0M	09/24/08 09:01 / dm
Lead 210 MDC	9.1E-05	uCi/kg				E909.0M	09/24/08 09:01 / dm
Polonium 210	1.0E-04	uCi/kg		2.6E-06		RMO-3008	10/01/08 08:45 / plj
Polonium 210 precision (±)	2.7E-05	uCi/kg				RMO-3008	10/01/08 08:45 / plj
Radium 226	1.5E-04	uCi/kg				E903.0	10/09/08 14:32 / trs
Radium 226 precision (±)	1.3E-05	uCi/kg				E903.0	10/09/08 14:32 / trs
Radium 226 MDC	4.6E-06	uCi/kg				E903.0	10/09/08 14:32 / trs
Thorium 230	2.8E-05	uCi/kg		5.1E-07		E907.0	10/06/08 13:38 / dmf
Thorium 230 precision (±)	5.6E-06	uCi/kg				E907.0	10/06/08 13:38 / dmf

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

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: URE-LC
Lab ID: C08090017-002
Client Sample ID: LC-B

Report Date: 10/20/08
Collection Date: 08/20/08 15:00
DateReceived: 09/02/08
Matrix: Vegetation

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS - TOTAL							
Uranium	0.06	mg/kg-dry		0.01		SW6020	09/10/08 06:01 / sml
Uranium, Activity	4.0E-05	uCi/kg-dry		7.0E-06		SW6020	09/10/08 06:01 / sml
RADIONUCLIDES - TOTAL							
Lead 210	1.0E-03	uCi/kg				E909.0M	09/24/08 09:01 / dm
Lead 210 precision (±)	8.9E-05	uCi/kg				E909.0M	09/24/08 09:01 / dm
Lead 210 MDC	1.2E-04	uCi/kg				E909.0M	09/24/08 09:01 / dm
Polonium 210	8.0E-05	uCi/kg		3.5E-06		RMO-3008	10/01/08 08:45 / plj
Polonium 210 precision (±)	2.6E-05	uCi/kg				RMO-3008	10/01/08 08:45 / plj
Radium 226	1.6E-04	uCi/kg				E903.0	10/09/08 14:32 / trs
Radium 226 precision (±)	1.6E-05	uCi/kg				E903.0	10/09/08 14:32 / trs
Radium 226 MDC	6.3E-06	uCi/kg				E903.0	10/09/08 14:32 / trs
Thorium 230	3.4E-05	uCi/kg		7.0E-07		E907.0	10/06/08 13:38 / dmf
Thorium 230 precision (±)	8.3E-06	uCi/kg				E907.0	10/06/08 13:38 / dmf

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

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: URE-LC
Lab ID: C08090017-003
Client Sample ID: LC-C

Report Date: 10/20/08
Collection Date: 08/20/08 17:00
DateReceived: 09/02/08
Matrix: Vegetation

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS - TOTAL							
Uranium	0.08	mg/kg-dry		0.01		SW6020	09/10/08 06:07 / sml
Uranium, Activity	5.0E-05	uCi/kg-dry		7.0E-06		SW6020	09/10/08 06:07 / sml
RADIONUCLIDES - TOTAL							
Lead 210	7.9E-04	uCi/kg				E909.0M	09/24/08 09:01 / dm
Lead 210 precision (±)	9.2E-05	uCi/kg				E909.0M	09/24/08 09:01 / dm
Lead 210 MDC	1.3E-04	uCi/kg				E909.0M	09/24/08 09:01 / dm
Polonium 210	9.7E-05	uCi/kg		3.8E-06		RMO-3008	10/01/08 08:45 / plj
Polonium 210 precision (±)	3.0E-05	uCi/kg				RMO-3008	10/01/08 08:45 / plj
Radium 226	1.3E-04	uCi/kg				E903.0	10/09/08 14:32 / trs
Radium 226 precision (±)	1.6E-05	uCi/kg				E903.0	10/09/08 14:32 / trs
Radium 226 MDC	7.5E-06	uCi/kg				E903.0	10/09/08 14:32 / trs
Thorium 230	1.9E-05	uCi/kg		7.6E-07		E907.0	10/06/08 13:38 / dmf
Thorium 230 precision (±)	5.6E-06	uCi/kg				E907.0	10/06/08 13:38 / dmf

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

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QA/QC Summary Report

Client: AATA International Inc
Project: URE-LC

Report Date: 10/20/08
Work Order: C08090017

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E903.0									Batch: R109081
Sample ID: C08090263-001FMS	Sample Matrix Spike				Run: BERTHOLD 770_081003D				10/09/08 14:32
Radium 226	180	pCi/L		114	70	130			
Sample ID: C08090263-001FMSD	Sample Matrix Spike Duplicate				Run: BERTHOLD 770_081003D				10/09/08 14:32
Radium 226	180	pCi/L		118	70	130	3.6	24.2	
Sample ID: LCS-19814	Laboratory Control Sample				Run: BERTHOLD 770_081003D				10/09/08 18:31
Radium 226	18	pCi/L		114	70	130			
Sample ID: MB-19814	Method Blank				Run: BERTHOLD 770_081003D				10/09/08 18:31
Radium 226	0.1	pCi/L							U
Method: E907.0									Batch: R109319
Sample ID: C08090263-002FMS	Sample Matrix Spike				Run: EGG-ORTEC_080929D				10/07/08 17:03
Thorium 230	84	pCi/L	0.20	85	70	130			
Sample ID: C08090263-002FMSD	Sample Matrix Spike Duplicate				Run: EGG-ORTEC_080929D				10/07/08 17:03
Thorium 230	90	pCi/L	0.20	98	70	130	7.6	40.3	
Sample ID: LCS-19814	Laboratory Control Sample				Run: EGG-ORTEC_080929D				10/08/08 08:37
Thorium 230	43	pCi/L	0.20	89	70	130			
Sample ID: MB-19814	Method Blank				Run: EGG-ORTEC_080929D				10/08/08 08:37
Thorium 230	0.06	pCi/L							U
Method: E909.0M									Batch: 19797
Sample ID: C08090017-003AMS	Sample Matrix Spike				Run: PACKARD 3100TR_080924B				09/24/08 09:01
Lead 210	0.0046	uCi/kg		87	70	130			
Sample ID: C08090017-003AMSD	Sample Matrix Spike Duplicate				Run: PACKARD 3100TR_080924B				09/24/08 09:01
Lead 210	0.0060	uCi/kg		118	70	130	26	30	
Sample ID: MB-R108856	Method Blank				Run: PACKARD 3100TR_080924B				09/24/08 09:01
Lead 210	2E-06	uCi/kg							U
Sample ID: LCS-R108856	Laboratory Control Sample				Run: PACKARD 3100TR_080924B				09/24/08 09:01
Lead 210	0.00011	uCi/kg		93	70	130			

Qualifiers:

RL - Analyte reporting limit.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

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Toll Free 888.235.0515 • 307.235.0515 • Fax 307.234.1639 • casper@energylab.com • www.energylab.com

QA/QC Summary Report

Client: AATA International Inc
Project: URE-LC

Report Date: 10/20/08
Work Order: C08090017

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: RMO-3008									Batch: R108821
Sample ID: C08090354-002FMS	Sample Matrix Spike				Run: EGG-ORTEC_080925A				10/01/08 12:15
Polonium 210	120	pCi/L	1.0	60	70	130			S
- Spike response is outside of the acceptance range for this analysis. Since the LCS and the RPD for the MS MSD pair are acceptable, the response is considered to be matrix related. The batch is approved.									
Sample ID: C08090354-002FMSD	Sample Matrix Spike Duplicate				Run: EGG-ORTEC_080925A				10/01/08 12:15
Polonium 210	100	pCi/L	1.0	50	70	130	17	52.5	S
- Spike response is outside of the acceptance range for this analysis. Since the LCS and the RPD for the MS MSD pair are acceptable, the response is considered to be matrix related. The batch is approved.									
Sample ID: LCS-19814	Laboratory Control Sample				Run: EGG-ORTEC_080925A				10/01/08 12:15
Polonium 210	82	pCi/L	1.0	99	70	130			
Sample ID: MB-19814	Method Blank				Run: EGG-ORTEC_080925A				10/01/08 12:15
Polonium 210	ND	pCi/L							U
Method: SW6020									Batch: 19721
Sample ID: MB-19721	Method Blank				Run: ICPMS4-C_080909A				09/10/08 04:25
Uranium	0.02	mg/kg-dry	0.0006						
Sample ID: LCS1-19721	Laboratory Control Sample				Run: ICPMS4-C_080909A				09/10/08 04:32
Uranium	122	mg/kg-dry	0.50	118	91	133			
Sample ID: C08090095-040AMS3	Sample Matrix Spike				Run: ICPMS4-C_080909A				09/10/08 07:48
Uranium	19.2	mg/kg-dry	0.50	116	75	125			
Sample ID: C08090095-040AMSD3	Sample Matrix Spike Duplicate				Run: ICPMS4-C_080909A				09/10/08 07:55
Uranium	20.6	mg/kg-dry	0.50	121	75	125	7.5	20	

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

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

Page ____ of ____

PLEASE PRINT- Provide as much information as possible.

Company Name:	Project Name, PWS, Permit, Etc.	Sample Origin	EPA/State Compliance:
AATA Int'l	O-E-LC	State: WY	Yes ☑ No ☐

Report Mail Address:	Contact Name:	Phone/Fax:	Email:	Sampler: (Please Print)
300 E Boardwalk Ste 4A Ft. Collins, CO 80525	Duncan Eccleston	970-223-1333	duncan.eccleston@aatz.com	DTE/EB

Invoice Address:	Invoice Contact & Phone:	Purchase Order:	Quote/Bottle Order:
2240 Blake St. Ste. 200 Denver, CO 80205	Carol Collins 720-974-2530		C2889

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

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

ANALYSIS REQUESTED

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

NRC Vg analysis

SEE ATTACHED

Normal Turnaround (TAT)

RUSH

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

Comments:

Shipped by: DTE

Cooler ID(s): Box

Receipt Temp: 19 °C

On Ice: Yes (No)

Custody Seal (Y) N
Intact C (Y) N
Signature Match (Y) N

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	NRC Vg analysis	SEE ATTACHED	Normal Turnaround (TAT)	RUSH	Comments
1	LC-A Aug 20-08	8/20/08	13:00	✓			(20 working days) ✓		
2	LC-B Aug 20-08	↓	15:00	✓					
3	LC-C Aug 20-08	↓	17:00	✓					C0809047
4									
5									
6									
7									
8									
9									
10									

LABORATORY USE ONLY

Custody Record MUST be Signed

Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
Duncan Eccleston	8/27/08				
Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
			Received by Laboratory: Ashley Haynes	9-02-08 8:45	

Sample Disposal: Return to Client: _____ Lab Disposal: ✓

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

Energy Laboratories Inc
Workorder Receipt Checklist

AATA International Inc

C08090017

Login completed by: Kimberly Humiston

Date and Time Received: 9/2/2008 8:45 AM

Reviewed by:

Received by: ah

Reviewed Date:

Carrier name: Ground

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature:	19°C		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Contact and Corrective Action Comments:

None

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CLIENT: AATA International Inc
Project: URE-LC
Sample Delivery Group: C08090017

Date: 20-Oct-08

CASE NARRATIVE

The following Case Narrative contains exceptions or comments pertaining to the analysis of samples submitted by AATA International Inc on 9/2/2008 08:45:00. These samples were assigned ELI Workorder Number C08090017.

ORIGINAL SAMPLE SUBMITTAL(S)
All original sample submittals have been returned with the data package.

SAMPLE TEMPERATURE COMPLIANCE: 4°C (±2°C)
Temperature of samples received may not be considered properly preserved by accepted standards. Samples that are hand delivered immediately after collection shall be considered acceptable if there is evidence that the chilling process has begun.

GROSS ALPHA ANALYSIS
Method 900.0 for gross alpha and gross beta is intended as a drinking water method for low TDS waters. Data provided by this method for non potable waters should be viewed as inconsistent.

RADON IN AIR ANALYSIS
The desired exposure time is 48 hours (2 days). The time delay in returning the canister to the laboratory for processing should be as short as possible to avoid excessive decay. Maximum recommended delay between end of exposure to beginning of counting should not exceed 8 days.

SOIL/SOLID SAMPLES
All samples reported on an as received basis unless otherwise indicated.

ATRAZINE, SIMAZINE AND PCB ANALYSIS USING EPA 505
Data for Atrazine and Simazine are reported from EPA 525.2, not from EPA 505. Data reported by ELI using EPA method 505 reflects the results for seven individual Aroclors. When the results for all seven are ND (not detected), the sample meets EPA compliance criteria for PCB monitoring.

SUBCONTRACTING ANALYSIS
Subcontracting of sample analyses to an outside laboratory may be required. If so, ENERGY LABORATORIES will utilize its branch laboratories or qualified contract laboratories for this service. Any such laboratories will be indicated within the Laboratory Analytical Report.

BRANCH LABORATORY LOCATIONS
eli-b - Energy Laboratories, Inc. - Billings, MT
eli-g - Energy Laboratories, Inc. - Gillette, WY
eli-h - Energy Laboratories, Inc. - Helena, MT
eli-r - Energy Laboratories, Inc. - Rapid City, SD
eli-t - Energy Laboratories, Inc. - College Station, TX

CERTFICATIONS:
USEPA: WY00002; FL-DOH NELAC: E87641; California: 02118CA
Oregon: WY200001; Utah: 3072350515; Virginia: 00057; Washington: C1903

ISO 17025 DISCLAIMER:
The results of this Analytical Report relate only to the items submitted for analysis.

ENERGY LABORATORIES, INC. - CASPER,WY certifies that certain method selections contained in this report meet requirements as set forth by the above accrediting authorities. Some results requested by the client may not be covered under these certifications. All analysis data to be submitted for regulatory enforcement should be certified in the sample state of origin. Please verify ELI's certification coverage by visiting www.energylab.com

ELI appreciates the opportunity to provide you with this analytical service. For additional information and services visit our web page www.energylab.com.

THIS IS THE FINAL PAGE OF THE LABORATORY ANALYTICAL REPORT

TECHNICAL MEMORANDUM

TO: **Ur-Energy Inc.**

FROM: **AATA International, Inc.**

DATE: **January 16, 2009**

SUBJECT: **Radiological Air Particulate Sampling**

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List of Appendices

Appendix APS-1 - Laboratory Data Sheets
Appendix APS-2 - Energy Laboratories Explanation for Q2 Qualified Uranium Results

Introduction

Radiological air particulate sampling for the Lost Creek Project was initiated on November 30, 2007. Four quarters of continuous sampling was completed on December 2, 2008. Because the samplers were installed at the end of November 2007, Sampling Quarters 1, 2, 3, and 4 (Q1, Q2, Q3, and Q4) essentially correspond to winter, spring, summer, and fall.

Figure APS-1 shows the five sampling locations that were selected using criteria from NRC Regulatory Guide 4.14. Sampler HV-1 represented the closest residence, and was located about 15 miles northwest of the Lost Creek Project in Bairoil, Wyoming. The remaining sampling locations were within the Lost Creek Permit Area. Sampler HV-2 is located near the northern license area boundary, on the downwind eastern edge of the plant site enclosure. Sampler HV-3 is at the southwest corner of the License Area, upwind of all project activities, and represents background conditions. Samplers HV-4 and HV-5 represent the northern and eastern site boundaries, respectively.

Sample Collection

The air particulate samplers are digitally controlled low wattage F&J DF-40L-8 instruments, powered by solar panels with a gel battery backup, and housed in custom enclosures. **Figure APS-2** shows Sampler HV-4 with the enclosure door open, before the sampler was fenced to exclude cattle. Filter holders were set to a height of approximately five feet, and equipped with 47-mm fiberglass filters. The instruments were set for an actual (i.e. uncorrected for temperature and pressure) flow rate of 30 liters per minute (lpm).

Under optimal conditions, filters were changed on a weekly basis. However, during the winter quarter (Q1), the maximum period between filter changes ranged from 50 to 73 days, depending on the sampler location and whether blowing and drifting snow prevented safe access. During this long period, dust loading in the filters did not seriously impede sampling. The average flow rate for the five samplers during the long period was 28.6 lpm, which represents a reduction of about 2% relative to the mean flow rate for the shorter periods in Q1. At the end of the long period, a tracked vehicle was purchased that could provide safe and reliable on-site transportation despite the adverse conditions. After Q1, the time between filter changes was generally one week, and averaged less than ten days.

The flow rate on each sampler was calibrated and certified by the manufacturer prior to installation, and per manufacturer recommendation, the flow rates were checked in June 2008, after approximately seven months of operation. All the samplers were found to be operating within 4% of the reference instrument across the full scale, so the calibration certifications were updated.

Analytical Results

All filters from each instrument were composited on a quarterly basis and analyzed by Energy Laboratories, Inc. in Casper, Wyoming for the parameters listed in NRC Regulatory Guide 4.14. **Table APS-1** summarizes the analytical results from the air particulate sampling, and the original laboratory reports are included as **Appendix APS-1**. Field duplicate analysis was not possible due to the nature of air particulate sampling, however a set of field blank filters (labeled HV-B in the laboratory reports) were analyzed by Energy Laboratories along with both the Q3 and the Q4 filters.

As outlined below by parameter, all of the concentrations are low or non-detect. No consistent trends were noted by location.

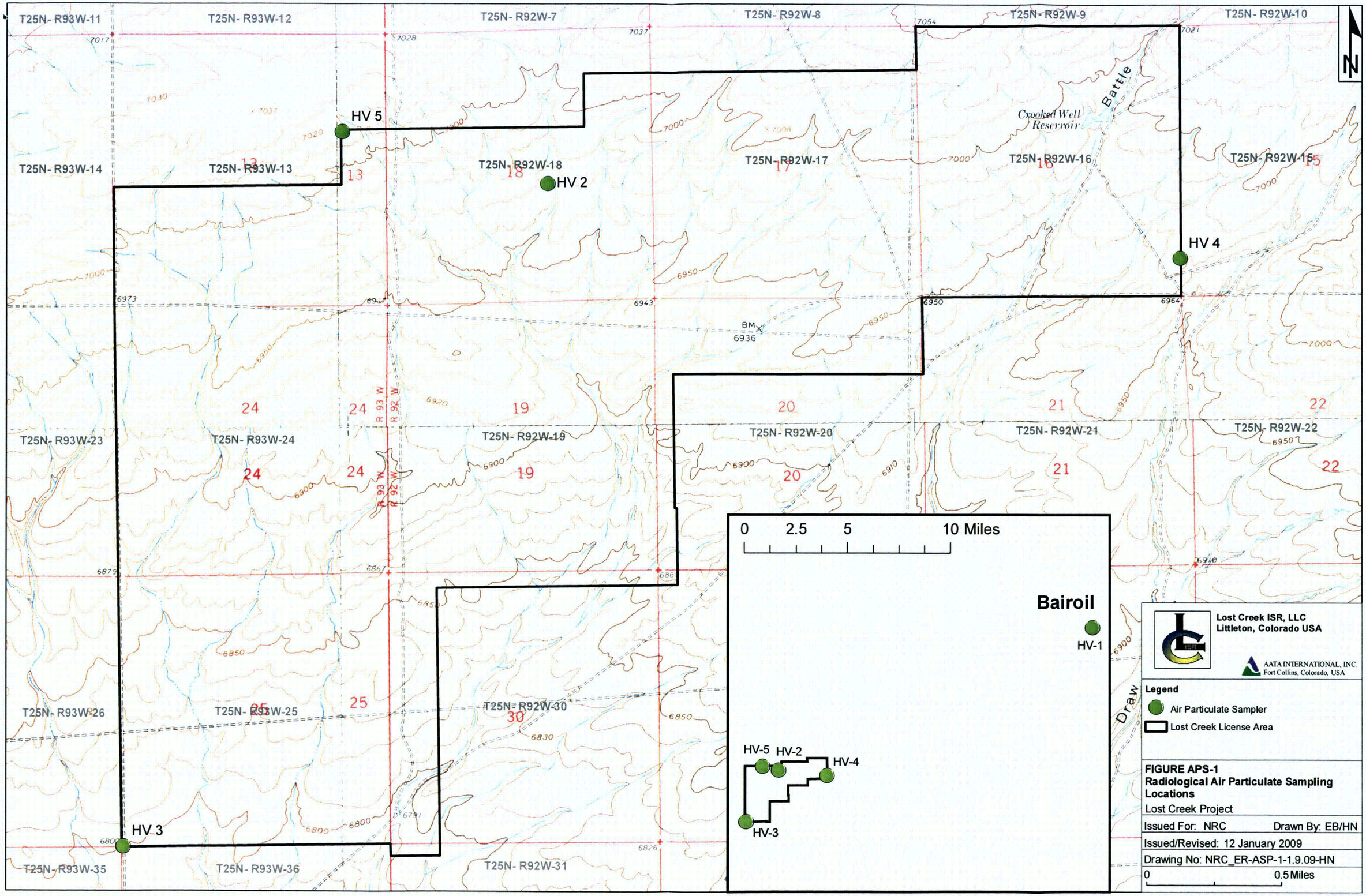
Uranium. Concentrations of natural uranium were less than the 1.00E-16 microCuries per milliLiter (μCi/mL) detection limit for all samples in Q1, Q2 and Q4. Natural uranium was present in low but detectable concentrations in four of the five samples from Q3, as well as in the field blank and the laboratory method blank. Energy Laboratories, Inc. believes that either the method blank or the entire batch was exposed to uranium

contamination during the digestion process, but the analysis could not be re-run because all filter material was consumed during the original digestion process. A memorandum from Energy Laboratories, Inc. explaining the issue is included in **Appendix APS-2**. Despite the apparent contamination, the highest recorded level was 5.61E-16 µCi/mL, which is less than 1% of the 9.00E-14 µCi/mL effluent concentration limit from Appendix B of 10 CFR 20.

Thorium. Thorium-230 (Th-230) concentrations were also less than the 1.00E-16 µCi/mL detection limit for sixteen of the twenty samples. All samples in both Q2 and Q4 were below the detection limit. Two samples in Q1 and two samples Q3 had Th-230 concentrations above the detection limit. The maximum concentration was 2.59E-16, which is less than 1% of the 3.00E-14 µCi/mL effluent concentration limit from Appendix B of 10 CFR 20.

Radium. Concentrations of Radium-226 (Ra-226) were less than the 1.00E-16 uCi/mL detection limit for all samples in Q2, Q3, and Q4. Ra-226 was present in all the samples from Q1, in concentrations ranging from 2.34E-16 to 2.23E-15 µCi/mL. The highest observed concentration is less than 1% of the 9.00E-13 uCi/mL effluent concentration limit from Appendix B of 10 CFR 20. Although detectable concentrations were present only during Q1, the laboratory QA/QC process did not flag any of Q1 Ra-226 results with qualifiers.

Lead. Lead-210 (Pb-210) was present in measurable concentrations in all samples, ranging from 3.02E-15 to 2.38E-14 µCi/mL. The Pb-210 concentrations were lower in Q2 than any other period. The maximum concentration occurred in Q1, and represented less than 4% of the 6.00E-13 µCi/mL effluent concentration limit from Appendix B of 10 CFR 20. Pb-210 concentrations were not consistently high or low at any of the individual sampling locations.


T25N- R93W-11
T25N- R93W-12
T25N- R92W-7
T25N- R92W-8
T25N- R92W-9
T25N- R92W-10
T25N- R93W-14
T25N- R93W-13
T25N- R92W-18
T25N- R92W-17
T25N- R92W-16
T25N- R92W-15
T25N- R93W-23
T25N- R93W-24
T25N- R92W-19
T25N- R92W-20
T25N- R92W-21
T25N- R92W-22
T25N- R93W-26
T25N- R93W-25
T25N- R92W-30
T25N- R93W-35
T25N- R93W-36
T25N- R92W-31
HV 5
HV 2
HV 4
HV 3
Crooked Well Reservoir
Battle
Draw
BM 6936
R 93 W
R 92 W
0 2.5 5 10 Miles
Bairoil
HV-1
HV-5
HV-2
HV-4
HV-3
Lost Creek ISR, LLC
Littleton, Colorado USA
AATA INTERNATIONAL, INC.
Fort Collins, Colorado, USA
Legend
Air Particulate Sampler
Lost Creek License Area
FIGURE APS-1
Radiological Air Particulate Sampling Locations
Lost Creek Project
Issued For: NRC
Drawn By: EB/HN
Issued/Revised: 12 January 2009
Drawing No: NRC_ER-ASP-1-1.9.09-HN
0 0.5 Miles

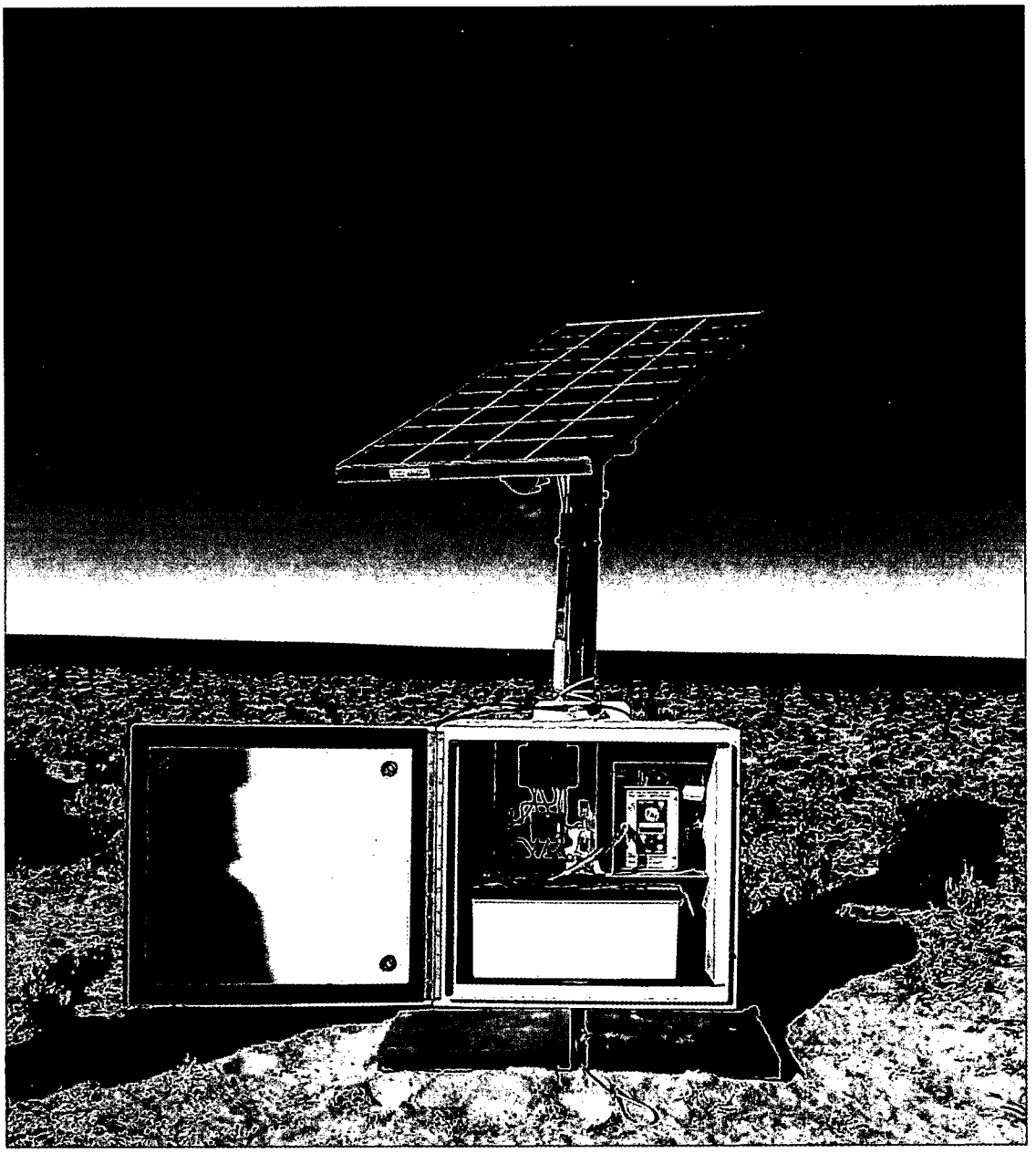


Figure APS-2
High Volume Air Particulate Sampler #HV-4
Lost Creek Project - Great Divide Basin, Wyoming
November 29, 2007

Table APS-1 Summary of Analytical Results - Radiological Air Particulate Sampling

Quarter	Location	Start Date	End Date	Volume (mL)	U-nat (µCi/mL)	Th-230 (µCi/mL)	Ra-226 (µCi/mL)	Pb-210 (µCi/mL)
Q1	HV1	11/30/2007	3/1/2008	3.85E+09	<1.00E-16	<1.00E-16	2.86E-16	1.78E-14
	HV2	11/30/2007	3/1/2008	3.84E+09	<1.00E-16	<1.00E-16	2.34E-16	1.53E-14
	HV3	11/30/2007	3/8/2008	4.08E+09	<1.00E-16	<1.00E-16	2.23E-15	1.31E-14
	HV4	11/30/2007	3/1/2008	3.70E+09	<1.00E-16	1.62E-16	3.51E-16	2.38E-14
	HV5	11/30/2007	3/1/2008	3.78E+09	<1.00E-16	2.38E-16	2.91E-16	1.81E-14
Q2	HV1	3/1/2008	6/5/2008	4.08E+09	<1.00E-16	<1.00E-16	<1.00E-16	6.81E-15
	HV2	3/1/2008	6/5/2008	3.70E+09	<1.00E-16	<1.00E-16	<1.00E-16	3.02E-15
	HV3	3/8/2008	6/5/2008	4.11E+09	<1.00E-16	<1.00E-16	<1.00E-16	5.01E-15
	HV4	3/1/2008	6/5/2008	4.11E+09	<1.00E-16	<1.00E-16	<1.00E-16	9.24E-15
	HV5	3/1/2008	6/5/2008	4.11E+09	<1.00E-16	<1.00E-16	<1.00E-16	5.28E-15
Q3	HV1	6/5/2008	8/29/2008	3.39E+09	5.61E-15 *	1.95E-16	<1.00E-16	2.22E-14
	HV2	6/5/2008	8/29/2008	3.39E+09	1.48E-15*	<1.00E-16	<1.00E-16	1.62E-14
	HV3	6/5/2008	8/29/2008	3.39E+09	1.18E-15*	2.59E-16	<1.00E-16	1.41E-14
	HV4	6/5/2008	8/29/2008	3.39E+09	<1.00E-16*	<1.00E-16	<1.00E-16	1.95E-14
	HV5	6/5/2008	8/29/2008	3.17E+09	2.21E-15*	<1.00E-16	<1.00E-16	1.51E-14
Q4	HV1	8/29/2008	12/2/2008	4.07E+09	<1.00E-16	<1.00E-16	<1.00E-16	1.69E-14
	HV2	8/29/2008	12/2/2008	4.08E+09	<1.00E-16	<1.00E-16	<1.00E-16	1.62E-14
	HV3	8/29/2008	12/2/2008	4.04E+09	<1.00E-16	<1.00E-16	<1.00E-16	1.91E-14
	HV4	8/29/2008	12/2/2008	4.08E+09	<1.00E-16	<1.00E-16	<1.00E-16	1.72E-14
	HV5	8/29/2008	12/2/2008	3.85E+09	<1.00E-16	<1.00E-16	<1.00E-16	2.31E-14

* Method blank or entire sample batch apparently exposed to uranium contamination during the digestion process.

Appendix APS-1

Laboratory Data Sheets
Baseline Radiological Air Particulate Sampling
Lost Creek In Situ Uranium Project

ENERGY LABORATORIES, INC. • 2393 Salt Creek Highway (82601) • P.O. Box 3258 • Casper, WY 82602
Toll Free 888.235.0515 • 307.235.0515 • Fax 307.234.1639 • casper@energylab.com • www.energylab.com

ANALYTICAL SUMMARY REPORT

June 09, 2008

AATA International Inc
300 E Boardwalk Dr STE 4A
Fort Collins, CO 80525

Workorder No.: C08040520 Quote ID: C2783 - UR Energy Lost Creek
Project Name: Lost Creek

Energy Laboratories, Inc. received the following 5 samples from AATA International Inc on 4/10/2008 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
C08040520-001	HV3Q1	03/08/08 00:00	04/10/08	Filter	Composite of two or more samples Metals, Total Digestion, Total Metals Lead 210 Radium 226 Thorium, Isotopic
C08040520-002	HV4Q1	03/01/08 00:00	04/10/08	Filter	Same As Above
C08040520-003	HV5Q1	03/01/08 00:00	04/10/08	Filter	Same As Above
C08040520-004	HV2Q1	03/01/08 00:00	04/10/08	Filter	Same As Above
C08040520-005	HV1Q1	03/01/08 00:00	04/10/08	Filter	Same As Above

As appropriate, any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

If you have any questions regarding these tests results, please call.

Report Approved By: STEVE CARLSTON

ENERGY LABORATORIES, INC. • 2393 Salt Creek Highway (82601) • P.O. Box 3258 • Casper, WY 82602
Toll Free 888.235.0515 • 307.235.0515 • Fax 307.234.1639 • casper@energylab.com • www.energylab.com

LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: Lost Creek
Lab ID: C08040520-001
Client Sample ID: HV3Q1

Report Date: 06/09/08
Collection Date: 03/08/08
DateReceived: 04/10/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	ND	mg/filter		0.0003		SW6020	04/28/08 03:56 / ts
Uranium, Activity	ND	pCi/Filter		0.2		SW6020	04/28/08 03:56 / ts
RADIONUCLIDES - TOTAL							
Lead 210	53.5	pCi/Filter		1.0		E909.0M	04/17/08 10:30 / dm
Lead 210 precision (±)	6.7	pCi/Filter				E909.0M	04/17/08 10:30 / dm
Thorium 230	0.1	pCi/Filter	U	0.2		E907.0	04/17/08 15:35 / dmf
Thorium 230 precision (±)	0.4	pCi/Filter				E907.0	04/17/08 15:35 / dmf
Radium 226	9.1	pCi/Filter				E903.0	04/25/08 07:03 / trs
Radium 226 precision (±)	2.5	pCi/Filter				E903.0	04/25/08 07:03 / trs
Radium 226 MDC	2.5	pCi/Filter				E903.0	04/25/08 07:03 / trs

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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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: June 9, 2008

SAMPLE ID: HV3Q1

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08040520-001	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
11/30/07-03/08/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	2.23E-15	6.13E-16	1.00E-16	9.00E-13	2.48E-01
4.08E+09	^{210}Pb	1.31E-14	1.64E-15	2.00E-15	6.00E-13	2.19E+00

LLD's are from Reg. Guide 4.14

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: Lost Creek
Lab ID: C08040520-002
Client Sample ID: HV4Q1

Report Date: 06/09/08
Collection Date: 03/01/08
DateReceived: 04/10/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	ND	mg/filter		0.0003		SW6020	04/29/08 11:24 / sml
Uranium, Activity	ND	pCi/Filter		0.2		SW6020	04/29/08 11:24 / sml
RADIONUCLIDES - TOTAL							
Lead 210	88.0	pCi/Filter		1.0		E909.0M	04/18/08 07:05 / dm
Lead 210 precision (±)	7.7	pCi/Filter				E909.0M	04/18/08 07:05 / dm
Thorium 230	0.6	pCi/Filter		0.2		E907.0	04/17/08 14:30 / dmf
Thorium 230 precision (±)	1.0	pCi/Filter				E907.0	04/17/08 14:30 / dmf
Radium 226	1.3	pCi/Filter				E903.0	05/12/08 15:13 / trs
Radium 226 precision (±)	0.6	pCi/Filter				E903.0	05/12/08 15:13 / trs
Radium 226 MDC	0.5	pCi/Filter				E903.0	05/12/08 15:13 / trs

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

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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: June 9, 2008

SAMPLE ID: HV4Q1

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08040520-002	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
11/30/07-03/01/08	^{230}Th	1.62E-16	2.70E-16	1.00E-16	3.00E-14	5.40E-01
Air Volume in mLs	^{226}Ra	3.51E-16	1.62E-16	1.00E-16	9.00E-13	3.90E-02
3.70E+09	^{210}Pb	2.38E-14	2.08E-15	2.00E-15	6.00E-13	3.96E+00

LLD's are from Reg. Guide 4.14

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: Lost Creek
Lab ID: C08040520-003
Client Sample ID: HV5Q1

Report Date: 06/09/08
Collection Date: 03/01/08
DateReceived: 04/10/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	ND	mg/filter		0.0003		SW6020	04/29/08 11:32 / sml
Uranium, Activity	ND	pCi/Filter		0.2		SW6020	04/29/08 11:32 / sml
RADIONUCLIDES - TOTAL							
Lead 210	68.4	pCi/Filter		1.0		E909.0M	04/18/08 07:05 / dm
Lead 210 precision (±)	6.8	pCi/Filter				E909.0M	04/18/08 07:05 / dm
Thorium 230	0.9	pCi/Filter		0.2		E907.0	04/17/08 14:30 / dmf
Thorium 230 precision (±)	0.6	pCi/Filter				E907.0	04/17/08 14:30 / dmf
Radium 226	1.1	pCi/Filter				E903.0	05/12/08 15:13 / trs
Radium 226 precision (±)	0.6	pCi/Filter				E903.0	05/12/08 15:13 / trs
Radium 226 MDC	0.5	pCi/Filter				E903.0	05/12/08 15:13 / trs

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

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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: June 9, 2008

SAMPLE ID: HV5Q1

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08040520-003	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
11/30/07-03/01/08	^{230}Th	2.38E-16	1.59E-16	1.00E-16	3.00E-14	7.95E-01
Air Volume in mLs	^{226}Ra	2.91E-16	1.59E-16	1.00E-16	9.00E-13	3.24E-02
3.78E+09	^{210}Pb	1.81E-14	1.80E-15	2.00E-15	6.00E-13	3.02E+00

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: Lost Creek
Lab ID: C08040520-004
Client Sample ID: HV2Q1

Report Date: 06/09/08
Collection Date: 03/01/08
DateReceived: 04/10/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	ND	mg/filter		0.0003		SW6020	04/29/08 11:37 / sml
Uranium, Activity	ND	pCi/Filter		0.2		SW6020	04/29/08 11:37 / sml
RADIONUCLIDES - TOTAL							
Lead 210	58.6	pCi/Filter		1.0		E909.0M	04/18/08 07:05 / dm
Lead 210 precision (±)	6.4	pCi/Filter				E909.0M	04/18/08 07:05 / dm
Thorium 230	0.0	pCi/Filter	U	0.2		E907.0	04/17/08 14:30 / dmf
Thorium 230 precision (±)	0.4	pCi/Filter				E907.0	04/17/08 14:30 / dmf
Radium 226	0.9	pCi/Filter				E903.0	05/12/08 15:13 / trs
Radium 226 precision (±)	0.5	pCi/Filter				E903.0	05/12/08 15:13 / trs
Radium 226 MDC	0.4	pCi/Filter				E903.0	05/12/08 15:13 / trs

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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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: June 9, 2008

SAMPLE ID: HV2Q1

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08040520-004	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
11/29/07-03/01/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	2.34E-16	1.30E-16	1.00E-16	9.00E-13	2.61E-02
3.84E+09	^{210}Pb	1.53E-14	1.67E-15	2.00E-15	6.00E-13	2.54E+00

LLD's are from Reg. Guide 4.14

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: Lost Creek
Lab ID: C08040520-005
Client Sample ID: HV1Q1

Report Date: 06/09/08
Collection Date: 03/01/08
DateReceived: 04/10/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	ND	mg/filter		0.0003		SW6020	04/29/08 11:53 / sml
Uranium, Activity	ND	pCi/Filter		0.2		SW6020	04/29/08 11:53 / sml
RADIONUCLIDES - TOTAL							
Lead 210	68.4	pCi/Filter		1.0		E909.0M	04/18/08 07:05 / dm
Lead 210 precision (±)	6.8	pCi/Filter				E909.0M	04/18/08 07:05 / dm
Thorium 230	0.2	pCi/Filter	U	0.2		E907.0	04/17/08 14:30 / dmf
Thorium 230 precision (±)	0.5	pCi/Filter				E907.0	04/17/08 14:30 / dmf
Radium 226	1.1	pCi/Filter				E903.0	05/12/08 15:13 / trs
Radium 226 precision (±)	0.6	pCi/Filter				E903.0	05/12/08 15:13 / trs
Radium 226 MDC	0.4	pCi/Filter				E903.0	05/12/08 15:13 / trs

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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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: June 9, 2008

SAMPLE ID: HV1Q1

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08040520-005	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
11/30/07-03/01/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	2.86E-16	1.56E-16	1.00E-16	9.00E-13	3.18E-02
3.85E+09	^{210}Pb	1.78E-14	1.77E-15	2.00E-15	6.00E-13	2.96E+00

LLD's are from Reg. Guide 4.14

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QA/QC Summary Report

Client: AATA International Inc
Project: Lost Creek

Report Date: 06/09/08
Work Order: C08040520

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E903.0									Batch: 18283
Sample ID: C08040356-001AMS	Sample Matrix Spike				Run: BERTHOLD 770_080417A				04/24/08 15:29
Radium 226	70.7	pCi/Filter		111	70	130			
Sample ID: C08040356-001AMSD	Sample Matrix Spike Duplicate				Run: BERTHOLD 770_080417A				04/24/08 17:25
Radium 226	60.7	pCi/Filter		95	70	130	15	26.7	
Sample ID: MB-18283	Method Blank				Run: BERTHOLD 770_080417A				04/25/08 07:03
Radium 226	-3	pCi/L							U
Sample ID: LCS-18283	Laboratory Control Sample				Run: BERTHOLD 770_080417A				04/25/08 07:03
Radium 226	11	pCi/L		98	70	130			
Method: E903.0									Batch: R101053
Sample ID: C08040520-002AMS	Sample Matrix Spike				Run: BERTHOLD 770_080425A				05/12/08 15:13
Radium 226	56.6	pCi/Filter		88	70	130			
Sample ID: C08040520-002AMSD	Sample Matrix Spike Duplicate				Run: BERTHOLD 770_080425A				05/12/08 15:13
Radium 226	69.4	pCi/Filter		108	70	130	20	23.9	
Sample ID: MB-18279	Method Blank				Run: BERTHOLD 770_080425A				05/12/08 15:13
Radium 226	0.002	pCi/g-dry							
Sample ID: LCS-18279	Laboratory Control Sample				Run: BERTHOLD 770_080425A				05/12/08 16:53
Radium 226	0.013	pCi/g-dry		82	70	130			
Method: E907.0									Batch: 18283
Sample ID: C08040302-005AMS	Sample Matrix Spike				Run: EGG-ORTEC_080417C				04/17/08 15:35
Thorium 230	75.7	pCi/Filter	0.20	68	70	130			S
- Spike response is outside of the acceptance range for this analysis. Since the LCS and the RPD for the MS MSD pair are acceptable, the low response is considered to be matrix related. The batch is approved.									
Sample ID: C08040302-005AMSD	Sample Matrix Spike Duplicate				Run: EGG-ORTEC_080417C				04/17/08 15:35
Thorium 230	79.7	pCi/Filter	0.20	69	70	130	5.1	30	S
- Spike response is outside of the acceptance range for this analysis. Since the LCS and the RPD for the MS MSD pair are acceptable, the low response is considered to be matrix related. The batch is approved.									
Sample ID: LCS-R100216	Laboratory Control Sample				Run: EGG-ORTEC_080417C				04/17/08 15:35
Thorium 230	49.0	pCi/Filter	0.20	102	70	130			
Sample ID: MB-R100216	Method Blank				Run: EGG-ORTEC_080417C				04/17/08 15:35
Thorium 230	0.1	pCi/Filter							

Qualifiers:

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

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QA/QC Summary Report

Client: AATA International Inc
Project: Lost Creek

Report Date: 06/09/08
Work Order: C08040520

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E907.0									Batch: R100072
Sample ID: C08040520-004AMS	Sample Matrix Spike				Run: EGG-ORTEC_080417A				04/17/08 14:30
Thorium 230	42.7	pCi/Filter	0.20	92	70	130			
Sample ID: C08040520-004AMSD	Sample Matrix Spike Duplicate				Run: EGG-ORTEC_080417A				04/17/08 14:30
Thorium 230	41.8	pCi/Filter	0.20	90	70	130	2.0	30	
Sample ID: LCS-R100072	Laboratory Control Sample				Run: EGG-ORTEC_080417A				04/17/08 14:30
Thorium 230	42.4	pCi/Filter	0.20	90	70	130			
Sample ID: MB-R100072	Method Blank				Run: EGG-ORTEC_080417A				04/17/08 14:30
Thorium 230	0.3	pCi/Filter							
Method: E909.0M									Batch: 18283
Sample ID: C08040302-001AMS	Sample Matrix Spike				Run: PACKARD 3100TR_080417A				04/17/08 10:30
Lead 210	1550	pCi/Filter	1.0	57	70	130			S
- Spike response is outside of the acceptance range for this analysis. Since the LCS and the MSD are acceptable the batch is approved.									
Sample ID: C08040302-001AMSD	Sample Matrix Spike Duplicate				Run: PACKARD 3100TR_080417A				04/17/08 10:30
Lead 210	2300	pCi/Filter	1.0	120	70	130	39	30	R
Sample ID: MB-R100552	Method Blank				Run: PACKARD 3100TR_080417A				04/17/08 10:30
Lead 210	ND	pCi/L							
Sample ID: LCS-R100552	Laboratory Control Sample				Run: PACKARD 3100TR_080417A				04/17/08 10:30
Lead 210	130	pCi/L	1.0	106	70	130			
Method: E909.0M									Batch: 18284
Sample ID: C08040520-005AMS	Sample Matrix Spike				Run: PACKARD 3100TR_080418B				04/18/08 07:05
Lead 210	1210	pCi/Filter	1.0	97	70	130			
Sample ID: C08040520-005AMSD	Sample Matrix Spike Duplicate				Run: PACKARD 3100TR_080418B				04/18/08 07:05
Lead 210	1070	pCi/Filter	1.0	85	70	130	12	30	
Sample ID: MB-R100646	Method Blank				Run: PACKARD 3100TR_080418B				04/18/08 07:05
Lead 210	ND	pCi/Filter							
Sample ID: LCS-R100646	Laboratory Control Sample				Run: PACKARD 3100TR_080418B				04/18/08 07:05
Lead 210	117	pCi/Filter	1.0	99	70	130			

Qualifiers:

- Analyte reporting limit.
- RPD exceeds advisory limit.

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

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QA/QC Summary Report

Client: AATA International Inc
Project: Lost Creek

Report Date: 06/09/08
Work Order: C08040520

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020									Batch: 18283
Sample ID: MB-18283	Method Blank				Run: ICPMS2-C_080427A				04/28/08 02:00
Uranium	ND	mg/filter	6E-05						
Sample ID: LCS1-18283	Laboratory Control Sample				Run: ICPMS2-C_080427A				04/28/08 02:04
Uranium	0.0509	mg/filter	0.00030	97	75	125			
Sample ID: C08040520-001AMS	Sample Matrix Spike				Run: ICPMS2-C_080427A				04/28/08 04:00
Uranium	0.0497	mg/filter	0.00030	99	75	125			
Sample ID: C08040520-001AMSD	Sample Matrix Spike Duplicate				Run: ICPMS2-C_080427A				04/28/08 04:04
Uranium	0.0500	mg/filter	0.00030	100	75	125	0.6	20	
Method: SW6020									Batch: 18284
Sample ID: MB-18284	Method Blank				Run: ICPMS2-C_080428B				04/29/08 11:16
Uranium	ND	mg/filter	6E-05						
Sample ID: LCS-18284	Laboratory Control Sample				Run: ICPMS2-C_080428B				04/29/08 11:20
Uranium	0.514	mg/filter	0.00060	98	75	125			
Sample ID: C08040520-005AMS	Sample Matrix Spike				Run: ICPMS2-C_080428B				04/29/08 11:57
Uranium	0.0472	mg/filter	0.00030	94	75	125			
Sample ID: C08040520-005AMSD	Sample Matrix Spike Duplicate				Run: ICPMS2-C_080428B				04/29/08 12:01
Uranium	0.0476	mg/filter	0.00030	95	75	125	1.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

Page 1 / 1

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

Company Name: AATA INTERNATIONAL

Project Name, PWS #, Permit #, Etc.: LOST CREEK #301-807

Report Mail Address: 300 E BOARDWALK STE. 4A, FT COLLINS, CO 80525

Contact Name, Phone, Fax, E-mail: DUNCAN ECCLESTON 970-223-1333 duncan.eccleston@aata.com

Sampler Name if other than Contact: MARSHAL CLARK

Invoice Address: 2240 BLAKE ST STE. 210, DENVER, CO 80205

Invoice Contact & Phone #: CARA CALKINS 720-974-2550

Purchase Order #: 301-807

ELI Quote #: C2783R1

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

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

NELAC ☐ A2LA ☐ Level IV ☐

Other _____

EDD/EDT ☐ Format _____

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

Shipped by: FedExGround

Cooler ID(s): N/A

Receipt Temp: N/A °C

Custody Seal Intact: Y N

Signature Match: Y N

Lab ID

Comments:

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX (Number of Containers; Sample Type: A W S V B O; Air Water Soils/Solids Vegetation Bioassay Other)	E903.0	E907.0	E909.0M	SW3050	SW6020	SEE ATTACHED	Normal Turnaround (TAT)	RUSH Turnaround (TAT)	TOTAL FLOW (LITERS)
1	~~HV1Q1~~	~~11/30/07-3/1/08~~	~~5 FILTERS~~	~~1:A~~							✓		~~4,238,766 L~~
2	~~HV2Q1~~	~~11/29/07-3/4/08~~	~~3 FILTERS~~	~~1:A~~							✓		~~4,687,742 L~~
3	HV3Q1	11/30/07-3/8/08	3 FILTERS	1:A							✓		4,079,171 L
4	HV4Q1	11/30/07-3/1/08	2 FILTERS	1:A							✓		3,701,235 L
5	HV5Q1	11/30/07-3/1/08	2 FILTERS	1:A	✓	✓	✓	✓	✓		✓		3,775,189 L
6	~~HV7Q1~~	~~11/30/07-3/1/08~~	~~5 FILTERS~~	~~1:A~~							✓		~~3,848,248 L~~
7	HV2Q1	11/29/07-3/1/08	3 FILTERS	1:A	✓	✓	✓	✓	✓		✓		3,332,248 L
8	HV1Q1	11/30/07-3/1/08	5 FILTERS	1:A	✓	✓	✓	✓	✓		✓		3,846,803 L
9													
10													

C080405

LABORATORY USE ONLY

Custody Record MUST be Signed

Relinquished by (print): DUNCAN ECCLESTON Date/Time: 4/8/08 12:30 pm Signature:

Received by (print): Ashley Haynes Date/Time: 4-10-08 10:35 Signature:

Relinquished by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Sample Disposal: Return to client: _____ Lab Disposal: ✓

LABORATORY USE ONLY

Sample Type: _____ # of fractions _____

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

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

Energy Laboratories Inc
Workorder Receipt Checklist

C08040520

AATA International Inc

Login completed by: Kimberly Humiston

Date and Time Received: 4/10/2008 10:35 AM

Reviewed by:

Received by: ah

Reviewed Date:

Carrier name: FedEx

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	N/A°C
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Contact and Corrective Action Comments:

None

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Date: 09-Jun-08

CLIENT: AATA International Inc
Project: Lost Creek
Sample Delivery Group: C08040520

CASE NARRATIVE

THIS IS THE FINAL PAGE OF THE LABORATORY ANALYTICAL REPORT

ORIGINAL SAMPLE SUBMITTAL(S)
All original sample submittals have been returned with the data package.

SAMPLE TEMPERATURE COMPLIANCE: 4°C (±2°C)
Temperature of samples received may not be considered properly preserved by accepted standards. Samples that are hand delivered immediately after collection shall be considered acceptable if there is evidence that the chilling process has begun.

GROSS ALPHA ANALYSIS
Method 900.0 for gross alpha and gross beta is intended as a drinking water method for low TDS waters. Data provided by this method for non potable waters should be viewed as inconsistent.

RADON IN AIR ANALYSIS
The desired exposure time is 48 hours (2 days). The time delay in returning the canister to the laboratory for processing should be as short as possible to avoid excessive decay. Maximum recommended delay between end of exposure to beginning of counting should not exceed 8 days.

SOIL/SOLID SAMPLES
All samples reported on an as received basis unless otherwise indicated.

ATRAZINE, SIMAZINE AND PCB ANALYSIS USING EPA 505
Data for Atrazine and Simazine are reported from EPA 525.2, not from EPA 505. Data reported by ELI using EPA method 505 reflects the results for seven individual Aroclors. When the results for all seven are ND (not detected), the sample meets EPA compliance criteria for PCB monitoring.

SUBCONTRACTING ANALYSIS
Subcontracting of sample analyses to an outside laboratory may be required. If so, ENERGY LABORATORIES will utilize its branch laboratories or qualified contract laboratories for this service. Any such laboratories will be indicated within the Laboratory Analytical Report.

BRANCH LABORATORY LOCATIONS
eli-b - Energy Laboratories, Inc. - Billings, MT
eli-g - Energy Laboratories, Inc. - Gillette, WY
eli-h - Energy Laboratories, Inc. - Helena, MT
eli-r - Energy Laboratories, Inc. - Rapid City, SD
eli-t - Energy Laboratories, Inc. - College Station, TX

CERTFICATIONS:
USEPA: WY00002; FL-DOH NELAC: E87641; Arizona: AZ0699; California: 02118CA
Oregon: WY200001; Utah: 3072350515; Virginia: 00057; Washington: C1903

ISO 17025 DISCLAIMER:
The results of this Analytical Report relate only to the items submitted for analysis.

ENERGY LABORATORIES, INC. - CASPER,WY certifies that certain method selections contained in this report meet requirements as set forth by the above accrediting authorities. Some results requested by the client may not be covered under these certifications. All analysis data to be submitted for regulatory enforcement should be certified in the sample state of origin. Please verify ELI's certification coverage by visiting www.energylab.com

ELI appreciates the opportunity to provide you with this analytical service. For additional information and services visit our web page www.energylab.com.

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ANALYTICAL SUMMARY REPORT

August 08, 2008

AATA International Inc
300 E Boardwalk Dr STE 4A
Fort Collins, CO 80525

Workorder No.: C08070118 Quote ID: C2783 - UR Energy Lost Creek

Project Name: URE-Project 301-809

Energy Laboratories, Inc. received the following 5 samples from AATA International Inc on 7/2/2008 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
C08070118-001	HV-1	06/05/08 00:00	07/02/08	Filter	Composite of two or more samples Metals, Total Digestion, Total Metals Lead 210 Radium 226 Thorium, Isotopic
C08070118-002	HV-2	06/05/08 00:00	07/02/08	Filter	Same As Above
C08070118-003	HV-3	06/05/08 00:00	07/02/08	Filter	Same As Above
C08070118-004	HV-4	06/05/08 00:00	07/02/08	Filter	Same As Above
C08070118-005	HV-5	06/05/08 00:00	07/02/08	Filter	Same As Above

As appropriate, any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

If you have any questions regarding these tests results, please call.

Report Approved By: Stephanie Waldrop

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: URE-Project 301-809
Lab ID: C08070118-001
Client Sample ID: HV-1

Report Date: 08/08/08
Collection Date: 06/05/08
DateReceived: 07/02/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	ND	mg/filter	D	0.0006		SW6020	07/25/08 00:47 / ts
Uranium, Activity	ND	pCi/Filter	D	0.4		SW6020	07/25/08 00:47 / ts
RADIONUCLIDES - TOTAL							
Lead 210	27.8	pCi/Filter	U			E909.0M	07/17/08 09:30 / dm
Lead 210 precision (±)	24.0	pCi/Filter				E909.0M	07/17/08 09:30 / dm
Lead 210 MDC	39.4	pCi/Filter				E909.0M	07/17/08 09:30 / dm
Radium 226	0.1	pCi/Filter	U			E903.0	07/23/08 17:55 / trs
Radium 226 precision (±)	0.9	pCi/Filter				E903.0	07/23/08 17:55 / trs
Radium 226 MDC	1.6	pCi/Filter				E903.0	07/23/08 17:55 / trs
Thorium 230	0.0	pCi/Filter	U	0.2		E907.0	07/18/08 12:39 / dmf
Thorium 230 precision (±)	1.1	pCi/Filter				E907.0	07/18/08 12:39 / dmf

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
U - Not detected at minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
D - RL increased due to sample matrix interference.

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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: August 8, 2008

SAMPLE ID: HV-1

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08070118-001	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
3/1/08 - 6/5/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	< 1.00E-16	N/A	1.00E-16	9.00E-13	< 1.11E-02
4.08E+09	^{210}Pb	6.81E-15	5.88E-15	2.00E-15	6.00E-13	1.14E+00

LLD's are from Reg. Guide 4.14

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: URE-Project 301-809
Lab ID: C08070118-002
Client Sample ID: HV-2

Report Date: 08/08/08
Collection Date: 06/05/08
DateReceived: 07/02/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	ND	mg/filter	D	0.0006		SW6020	07/25/08 00:51 / ts
Uranium, Activity	ND	pCi/Filter	D	0.4		SW6020	07/25/08 00:51 / ts
RADIONUCLIDES - TOTAL							
Lead 210	12.4	pCi/Filter	U			E909.0M	07/17/08 09:30 / dm
Lead 210 precision (±)	24.7	pCi/Filter				E909.0M	07/17/08 09:30 / dm
Lead 210 MDC	41.0	pCi/Filter				E909.0M	07/17/08 09:30 / dm
Radium 226	-0.7	pCi/Filter	U			E903.0	07/23/08 21:14 / trs
Radium 226 precision (±)	0.8	pCi/Filter				E903.0	07/23/08 21:14 / trs
Radium 226 MDC	1.8	pCi/Filter				E903.0	07/23/08 21:14 / trs
Thorium 230	-0.1	pCi/Filter	U	0.2		E907.0	07/21/08 15:31 / dmf
Thorium 230 precision (±)	1.0	pCi/Filter				E907.0	07/21/08 15:31 / dmf

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
U - Not detected at minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
D - RL increased due to sample matrix interference.

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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: August 8, 2008

SAMPLE ID: HV-2

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08070118-002	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
3/1/08 - 6/5/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	< 1.00E-16	N/A	1.00E-16	9.00E-13	< 1.11E-02
4.11E+09	^{210}Pb	3.02E-15	6.01E-15	2.00E-15	6.00E-13	5.03E-01

LLD's are from Reg. Guide 4.14

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: URE-Project 301-809
Lab ID: C08070118-003
Client Sample ID: HV-3

Report Date: 08/08/08
Collection Date: 06/05/08
DateReceived: 07/02/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	ND	mg/filter	D	0.0006		SW6020	07/25/08 00:55 / ts
Uranium, Activity	ND	pCi/Filter	D	0.4		SW6020	07/25/08 00:55 / ts
RADIONUCLIDES - TOTAL							
Lead 210	44.2	pCi/Filter				E909.0M	07/17/08 09:30 / dm
Lead 210 precision (±)	26.3	pCi/Filter				E909.0M	07/17/08 09:30 / dm
Lead 210 MDC	42.6	pCi/Filter				E909.0M	07/17/08 09:30 / dm
Radium 226	-1.2	pCi/Filter	U			E903.0	07/23/08 21:14 / trs
Radium 226 precision (±)	0.7	pCi/Filter				E903.0	07/23/08 21:14 / trs
Radium 226 MDC	1.7	pCi/Filter				E903.0	07/23/08 21:14 / trs
Thorium 230	-0.6	pCi/Filter	U	0.2		E907.0	07/18/08 12:39 / dmf
Thorium 230 precision (±)	0.8	pCi/Filter				E907.0	07/18/08 12:39 / dmf

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
U - Not detected at minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
D - RL increased due to sample matrix interference.

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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: August 8, 2008

SAMPLE ID: HV-3

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08070118-003	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
3/8/08 - 6/5/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	< 1.00E-16	N/A	1.00E-16	9.00E-13	< 1.11E-02
8.81E+09	^{210}Pb	5.01E-15	2.98E-15	2.00E-15	6.00E-13	8.36E-01

LLD's are from Reg. Guide 4.14

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: URE-Project 301-809
Lab ID: C08070118-004
Client Sample ID: HV-4

Report Date: 08/08/08
Collection Date: 06/05/08
DateReceived: 07/02/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	ND	mg/filter	D	0.0006		SW6020	07/25/08 00:59 / ts
Uranium, Activity	ND	pCi/Filter	D	0.4		SW6020	07/25/08 00:59 / ts
RADIONUCLIDES - TOTAL							
Lead 210	38.0	pCi/Filter	U			E909.0M	07/17/08 09:30 / dm
Lead 210 precision (±)	24.7	pCi/Filter				E909.0M	07/17/08 09:30 / dm
Lead 210 MDC	40.1	pCi/Filter				E909.0M	07/17/08 09:30 / dm
Radium 226	-0.9	pCi/Filter	U			E903.0	07/23/08 21:14 / trs
Radium 226 precision (±)	0.7	pCi/Filter				E903.0	07/23/08 21:14 / trs
Radium 226 MDC	1.6	pCi/Filter				E903.0	07/23/08 21:14 / trs
Thorium 230	-0.1	pCi/Filter	U	0.2		E907.0	07/18/08 12:39 / dmf
Thorium 230 precision (±)	0.8	pCi/Filter				E907.0	07/18/08 12:39 / dmf

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
U - Not detected at minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
D - RL increased due to sample matrix interference.

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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: August 8, 2008

SAMPLE ID: HV-4

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08070118-004	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
3/1/08 - 6/5/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	< 1.00E-16	N/A	1.00E-16	9.00E-13	< 1.11E-02
4.11E+09	^{210}Pb	9.24E-15	6.01E-15	2.00E-15	6.00E-13	1.54E+00

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: URE-Project 301-809
Lab ID: C08070118-005
Client Sample ID: HV-5

Report Date: 08/08/08
Collection Date: 06/05/08
DateReceived: 07/02/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	ND	mg/filter	D	0.0006		SW6020	07/25/08 01:03 / ts
Uranium, Activity	ND	pCi/Filter	D	0.4		SW6020	07/25/08 01:03 / ts
RADIONUCLIDES - TOTAL							
Lead 210	21.7	pCi/Filter	U			E909.0M	07/17/08 09:30 / dm
Lead 210 precision (±)	26.2	pCi/Filter				E909.0M	07/17/08 09:30 / dm
Lead 210 MDC	43.1	pCi/Filter				E909.0M	07/17/08 09:30 / dm
Radium 226	-1.1	pCi/Filter	U			E903.0	07/23/08 21:14 / trs
Radium 226 precision (±)	0.7	pCi/Filter				E903.0	07/23/08 21:14 / trs
Radium 226 MDC	1.6	pCi/Filter				E903.0	07/23/08 21:14 / trs
Thorium 230	-0.1	pCi/Filter	U	0.2		E907.0	07/18/08 12:39 / dmf
Thorium 230 precision (±)	0.9	pCi/Filter				E907.0	07/18/08 12:39 / dmf

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
U - Not detected at minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
D - RL increased due to sample matrix interference.

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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: August 8, 2008

SAMPLE ID: HV-5

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08070118-005	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
3/1/08 - 6/5/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	< 1.00E-16	N/A	1.00E-16	9.00E-13	< 1.11E-02
4.11E+09	^{210}Pb	5.28E-15	6.37E-15	2.00E-15	6.00E-13	8.79E-01

LLD's are from Reg. Guide 4.14

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QA/QC Summary Report

Client: AATA International Inc
Project: URE-Project 301-809

Report Date: 08/08/08
Work Order: C08070118

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E903.0									Batch: 19031
Sample ID: C08070134-001EMS	Sample Matrix Spike				Run: BERTHOLD 770_080717C				07/23/08 21:14
Radium 226	81	pCi/L		104	70	130			
Sample ID: C08070134-001EMSD	Sample Matrix Spike Duplicate				Run: BERTHOLD 770_080717C				07/23/08 21:14
Radium 226	79	pCi/L		102	70	130	2.3	24.5	
Sample ID: MB-19031	Method Blank				Run: BERTHOLD 770_080717C				07/23/08 22:55
Radium 226	-0.6	pCi/L							U
Sample ID: LCS-19031	Laboratory Control Sample				Run: BERTHOLD 770_080717C				07/23/08 22:55
Radium 226	15	pCi/L		97	70	130			
Method: E907.0									Batch: 19031
Sample ID: C08070118-001AMS	Sample Matrix Spike				Run: EGG-ORTEC_080714B				07/21/08 15:28
Thorium 230	103	pCi/Filter	0.20	112	70	130			
Sample ID: C08070118-001AMSD	Sample Matrix Spike Duplicate				Run: EGG-ORTEC_080714B				07/21/08 15:30
Thorium 230	90.4	pCi/Filter	0.20	99	70	130	13	30	
Sample ID: LCS-19031	Laboratory Control Sample				Run: EGG-ORTEC_080714B				07/21/08 15:33
Thorium 230	52	pCi/L	0.20	104	70	130			
Sample ID: MB-19031	Method Blank				Run: EGG-ORTEC_080714B				07/18/08 12:39
Thorium 230	0.3	pCi/L							U
Method: E909.0M									Batch: R105519
Sample ID: MB-R105519	Method Blank				Run: PACKARD 3100TR_080717A				07/17/08 09:30
Lead 210	-4	pCi/L							U
Sample ID: LCS-R105519	Laboratory Control Sample				Run: PACKARD 3100TR_080717A				07/17/08 09:30
Lead 210	98	pCi/L		86	70	130			
Sample ID: C08070206-002AMS	Sample Matrix Spike				Run: PACKARD 3100TR_080717A				07/17/08 09:30
Lead 210	1020	pCi/Filter		81	70	130			
Sample ID: C08070206-002AMSD	Sample Matrix Spike Duplicate				Run: PACKARD 3100TR_080717A				07/17/08 09:30
Lead 210	1350	pCi/Filter		110	70	130	28	30	

Qualifiers:

L - Analyte reporting limit.
U - Not detected at minimum detectable concentration
ND - Not detected at the reporting limit.

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QA/QC Summary Report

Client: AATA International Inc
Project: URE-Project 301-809

Report Date: 08/08/08
Work Order: C08070118

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020									Batch: 19031
Sample ID: MB-19031	Method Blank				Run: ICPMS2-C_080721A				07/21/08 12:37
Uranium	4E-05	mg/filter	2E-05						
Sample ID: LCS1-19031	Laboratory Control Sample				Run: ICPMS2-C_080721A				07/21/08 12:43
Uranium	0.0528	mg/filter	0.00030	100	80	120			
Sample ID: C08070118-005AMS	Sample Matrix Spike				Run: ICPMS2-C_080724A				07/25/08 01:08
Uranium	0.468	mg/filter	0.00057	94	75	125			
Sample ID: C08070118-005AMSD	Sample Matrix Spike Duplicate				Run: ICPMS2-C_080724A				07/25/08 01:12
Uranium	0.493	mg/filter	0.00057	99	75	125	5.3	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

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Date: 08-Aug-08

CLIENT: AATA International Inc
Project: URE-Project 301-809
Sample Delivery Group: C08070118

CASE NARRATIVE

THIS IS THE FINAL PAGE OF THE LABORATORY ANALYTICAL REPORT

ORIGINAL SAMPLE SUBMITTAL(S)
All original sample submittals have been returned with the data package.

SAMPLE TEMPERATURE COMPLIANCE: 4°C (±2°C)
Temperature of samples received may not be considered properly preserved by accepted standards. Samples that are hand delivered immediately after collection shall be considered acceptable if there is evidence that the chilling process has begun.

GROSS ALPHA ANALYSIS
Method 900.0 for gross alpha and gross beta is intended as a drinking water method for low TDS waters. Data provided by this method for non potable waters should be viewed as inconsistent.

RADON IN AIR ANALYSIS
The desired exposure time is 48 hours (2 days). The time delay in returning the canister to the laboratory for processing should be as short as possible to avoid excessive decay. Maximum recommended delay between end of exposure to beginning of counting should not exceed 8 days.

SOIL/SOLID SAMPLES
All samples reported on an as received basis unless otherwise indicated.

ATRAZINE, SIMAZINE AND PCB ANALYSIS USING EPA 505
Data for Atrazine and Simazine are reported from EPA 525.2, not from EPA 505. Data reported by ELI using EPA method 505 reflects the results for seven individual Aroclors. When the results for all seven are ND (not detected), the sample meets EPA compliance criteria for PCB monitoring.

SUBCONTRACTING ANALYSIS
Subcontracting of sample analyses to an outside laboratory may be required. If so, ENERGY LABORATORIES will utilize its branch laboratories or qualified contract laboratories for this service. Any such laboratories will be indicated within the Laboratory Analytical Report.

BRANCH LABORATORY LOCATIONS
eli-b - Energy Laboratories, Inc. - Billings, MT
eli-g - Energy Laboratories, Inc. - Gillette, WY
eli-h - Energy Laboratories, Inc. - Helena, MT
eli-r - Energy Laboratories, Inc. - Rapid City, SD
eli-t - Energy Laboratories, Inc. - College Station, TX

CERTFICATIONS:
USEPA: WY00002; FL-DOH NELAC: E87641; Arizona: AZ0699; California: 02118CA
Oregon: WY200001; Utah: 3072350515; Virginia: 00057; Washington: C1903

ISO 17025 DISCLAIMER:
The results of this Analytical Report relate only to the items submitted for analysis.

ENERGY LABORATORIES, INC. - CASPER,WY certifies that certain method selections contained in this report meet requirements as set forth by the above accrediting authorities. Some results requested by the client may not be covered under these certifications. All analysis data to be submitted for regulatory enforcement should be certified in the sample state of origin. Please verify ELI's certification coverage by visiting www.energylab.com

ELI appreciates the opportunity to provide you with this analytical service. For additional information and services visit our web page www.energylab.com.

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ANALYTICAL SUMMARY REPORT

December 05, 2008

AATA International Inc
300 E Boardwalk Dr STE 4A
Fort Collins, CO 80525

Workorder No.: C08110642 Quote ID: C2783 - UR Energy Lost Creek

Project Name: UR Energy 301-809

Energy Laboratories, Inc. received the following 6 samples for AATA International Inc on 11/18/2008 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
C08110642-001	HV-1	08/29/08 00:00	11/18/08	Filter	Composite of two or more samples Metals, Total Digestion, Total Metals Lead 210 Radium 226 Thorium, Isotopic
C08110642-002	HV-2	08/29/08 00:00	11/18/08	Filter	Same As Above
C08110642-003	HV-3	08/29/08 00:00	11/18/08	Filter	Same As Above
C08110642-004	HV-4	08/29/08 00:00	11/18/08	Filter	Same As Above
C08110642-005	HV-5	08/29/08 00:00	11/18/08	Filter	Same As Above
C08110642-006	HV-B	08/29/08 00:00	11/18/08	Filter	Same As Above

As appropriate, any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

If you have any questions regarding these tests results, please call.

Report Approved By:
STEVE CARLSTON

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: UR Energy 301-809
Lab ID: C08110642-001
Client Sample ID: HV-1

Report Date: 12/05/08
Collection Date: 08/29/08
DateReceived: 11/18/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	0.0028	mg/filter	B	0.0003		SW6020	11/21/08 15:55 / ts
Uranium, Activity	1.9	pCi/Filter		0.2		SW6020	11/21/08 15:55 / ts
RADIONUCLIDES - TOTAL							
Lead 210	75	pCi/Filter				E909.0M	11/24/08 10:30 / dm
Lead 210 precision (±)	25	pCi/Filter				E909.0M	11/24/08 10:30 / dm
Lead 210 MDC	39	pCi/Filter				E909.0M	11/24/08 10:30 / dm
Radium 226	-0.1	pCi/Filter	U			E903.0	11/26/08 15:33 / trs
Radium 226 precision (±)	0.9	pCi/Filter				E903.0	11/26/08 15:33 / trs
Radium 226 MDC	1.6	pCi/Filter				E903.0	11/26/08 15:33 / trs
Thorium 230	0.66	pCi/Filter		0.20		E907.0	11/25/08 14:33 / dmf
Thorium 230 precision (±)	1	pCi/Filter				E907.0	11/25/08 14:33 / dmf

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
U - Not detected at minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
B - The analyte was detected in the method blank.

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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: December 5, 2008

SAMPLE ID: HV-1

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08110642-001	^{nat}U	5.61E-16	N/A	1.00E-16	9.00E-14	6.24E-01
6/5/08 - 8/29/08	^{230}Th	1.95E-16	2.95E-16	1.00E-16	3.00E-14	6.50E-01
Air Volume in mLs	^{226}Ra	< 1.00E-16	N/A	1.00E-16	9.00E-13	< 1.11E-02
3.39E+09	^{210}Pb	2.22E-14	7.38E-15	2.00E-15	6.00E-13	3.69E+00

LLD's are from Reg. Guide 4.14

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: UR Energy 301-809
Lab ID: C08110642-002
Client Sample ID: HV-2

Report Date: 12/05/08
Collection Date: 08/29/08
DateReceived: 11/18/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	0.0008	mg/filter	B	0.0003		SW6020	11/21/08 16:01 / ts
Uranium, Activity	0.5	pCi/Filter		0.2		SW6020	11/21/08 16:01 / ts
RADIONUCLIDES - TOTAL							
Lead 210	55	pCi/Filter				E909.0M	11/20/08 11:05 / dm
Lead 210 precision (±)	25	pCi/Filter				E909.0M	11/20/08 11:05 / dm
Lead 210 MDC	41	pCi/Filter				E909.0M	11/20/08 11:05 / dm
Radium 226	-1	pCi/Filter	U			E903.0	11/26/08 15:33 / trs
Radium 226 precision (±)	0.6	pCi/Filter				E903.0	11/26/08 15:33 / trs
Radium 226 MDC	1.6	pCi/Filter				E903.0	11/26/08 15:33 / trs
Thorium 230	-1.0	pCi/Filter	U	0.20		E907.0	11/25/08 14:33 / dmf
Thorium 230 precision (±)	0.7	pCi/Filter				E907.0	11/25/08 14:33 / dmf

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
U - Not detected at minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
B - The analyte was detected in the method blank.

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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: December 5, 2008

SAMPLE ID: HV-2

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08110642-002	^{nat}U	1.48E-16	N/A	1.00E-16	9.00E-14	1.64E-01
6/5/08 - 8/29/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	< 1.00E-16	N/A	1.00E-16	9.00E-13	< 1.11E-02
3.39E+09	^{210}Pb	1.62E-14	7.38E-15	2.00E-15	6.00E-13	2.70E+00

LLD's are from Reg. Guide 4.14

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: UR Energy 301-809
Lab ID: C08110642-003
Client Sample ID: HV-3

Report Date: 12/05/08
Collection Date: 08/29/08
DateReceived: 11/18/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	0.0006	mg/filter	B	0.0003		SW6020	11/21/08 16:08 / ts
Uranium, Activity	0.4	pCi/Filter		0.2		SW6020	11/21/08 16:08 / ts
RADIONUCLIDES - TOTAL							
Lead 210	48	pCi/Filter				E909.0M	11/20/08 11:05 / dm
Lead 210 precision (±)	25	pCi/Filter				E909.0M	11/20/08 11:05 / dm
Lead 210 MDC	41	pCi/Filter				E909.0M	11/20/08 11:05 / dm
Radium 226	-1	pCi/Filter	U			E903.0	11/26/08 15:33 / trs
Radium 226 precision (±)	0.7	pCi/Filter				E903.0	11/26/08 15:33 / trs
Radium 226 MDC	1.8	pCi/Filter				E903.0	11/26/08 15:33 / trs
Thorium 230	0.88	pCi/Filter		0.20		E907.0	11/25/08 14:33 / dmf
Thorium 230 precision (±)	1	pCi/Filter				E907.0	11/25/08 14:33 / dmf

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
U - Not detected at minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
B - The analyte was detected in the method blank.

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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: December 5, 2008

SAMPLE ID: HV-3

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08110642-003	^{nat}U	1.18E-16	N/A	1.00E-16	9.00E-14	1.31E-01
6/5/08 - 8/29/08	^{230}Th	2.59E-16	2.95E-16	1.00E-16	3.00E-14	8.64E-01
Air Volume in mLs	^{226}Ra	< 1.00E-16	N/A	1.00E-16	9.00E-13	< 1.11E-02
3.39E+09	^{210}Pb	1.41E-14	7.37E-15	2.00E-15	6.00E-13	2.36E+00

LLD's are from Reg. Guide 4.14

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: UR Energy 301-809
Lab ID: C08110642-004
Client Sample ID: HV-4

Report Date: 12/05/08
Collection Date: 08/29/08
DateReceived: 11/18/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	0.0005	mg/filter	B	0.0003		SW6020	11/21/08 16:14 / ts
Uranium, Activity	0.3	pCi/Filter		0.2		SW6020	11/21/08 16:14 / ts
RADIONUCLIDES - TOTAL							
Lead 210	66	pCi/Filter				E909.0M	11/20/08 11:05 / dm
Lead 210 precision (±)	25	pCi/Filter				E909.0M	11/20/08 11:05 / dm
Lead 210 MDC	41	pCi/Filter				E909.0M	11/20/08 11:05 / dm
Radium 226	-0.4	pCi/Filter	U			E903.0	11/26/08 15:33 / trs
Radium 226 precision (±)	0.9	pCi/Filter				E903.0	11/26/08 15:33 / trs
Radium 226 MDC	1.6	pCi/Filter				E903.0	11/26/08 15:33 / trs
Thorium 230	0.27	pCi/Filter		0.20		E907.0	11/25/08 14:33 / dmf
Thorium 230 precision (±)	0.6	pCi/Filter				E907.0	11/25/08 14:33 / dmf

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
U - Not detected at minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
B - The analyte was detected in the method blank.

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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: December 5, 2008

SAMPLE ID: HV-4

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08110642-004	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
6/5/08 - 8/29/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	< 1.00E-16	N/A	1.00E-16	9.00E-13	< 1.11E-02
3.39E+09	^{210}Pb	1.95E-14	7.38E-15	2.00E-15	6.00E-13	3.25E+00

LLD's are from Reg. Guide 4.14

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: UR Energy 301-809
Lab ID: C08110642-005
Client Sample ID: HV-5

Report Date: 12/05/08
Collection Date: 08/29/08
DateReceived: 11/18/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	0.0011	mg/filter	B	0.0003		SW6020	11/21/08 16:21 / ts
Uranium, Activity	0.7	pCi/Filter		0.2		SW6020	11/21/08 16:21 / ts
RADIONUCLIDES - TOTAL							
Lead 210	48	pCi/Filter				E909.0M	11/20/08 11:05 / dm
Lead 210 precision (±)	25	pCi/Filter				E909.0M	11/20/08 11:05 / dm
Lead 210 MDC	41	pCi/Filter				E909.0M	11/20/08 11:05 / dm
Radium 226	-0.2	pCi/Filter	U			E903.0	11/26/08 15:33 / trs
Radium 226 precision (±)	0.9	pCi/Filter				E903.0	11/26/08 15:33 / trs
Radium 226 MDC	1.6	pCi/Filter				E903.0	11/26/08 15:33 / trs
Thorium 230	0.28	pCi/Filter		0.20		E907.0	11/25/08 14:33 / dmf
Thorium 230 precision (±)	0.9	pCi/Filter				E907.0	11/25/08 14:33 / dmf

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
U - Not detected at minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
B - The analyte was detected in the method blank.

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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: December 5, 2008

SAMPLE ID: HV-5

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08110642-005	^{nat}U	2.21E-16	N/A	1.00E-16	9.00E-14	2.45E-01
6/5/08 - 8/29/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	< 1.00E-16	N/A	1.00E-16	9.00E-13	< 1.11E-02
3.17E+09	^{210}Pb	1.51E-14	7.88E-15	2.00E-15	6.00E-13	2.52E+00

LLD's are from Reg. Guide 4.14

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: UR Energy 301-809
Lab ID: C08110642-006
Client Sample ID: HV-B

Report Date: 12/05/08
Collection Date: 08/29/08
DateReceived: 11/18/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	0.0013	mg/filter	B	0.0003		SW6020	11/21/08 18:03 / ts
Uranium, Activity	0.9	pCi/Filter		0.2		SW6020	11/21/08 18:03 / ts
RADIONUCLIDES - TOTAL							
Lead 210	7.9	pCi/Filter	U			E909.0M	11/20/08 11:05 / dm
Lead 210 precision (±)	24	pCi/Filter				E909.0M	11/20/08 11:05 / dm
Lead 210 MDC	41	pCi/Filter				E909.0M	11/20/08 11:05 / dm
Radium 226	-0.3	pCi/Filter	U			E903.0	11/26/08 15:33 / trs
Radium 226 precision (±)	0.9	pCi/Filter				E903.0	11/26/08 15:33 / trs
Radium 226 MDC	1.6	pCi/Filter				E903.0	11/26/08 15:33 / trs
Thorium 230	-0.6	pCi/Filter	U	0.20		E907.0	11/25/08 14:33 / dmf
Thorium 230 precision (±)	0.9	pCi/Filter				E907.0	11/25/08 14:33 / dmf

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
U - Not detected at minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
B - The analyte was detected in the method blank.

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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: December 5, 2008

SAMPLE ID: HV-B

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08110642-006	^{nat}U	2.73E-16	N/A	1.00E-16	9.00E-14	3.03E-01
6/5/08 - 8/29/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	< 1.00E-16	N/A	1.00E-16	9.00E-13	< 1.11E-02
3.30E+09	^{210}Pb	2.39E-15	7.27E-15	2.00E-15	6.00E-13	3.99E-01

LLD's are from Reg. Guide 4.14

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QA/QC Summary Report

Client: AATA International Inc
Project: UR Energy 301-809

Report Date: 12/05/08
Work Order: C08110642

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E903.0									Batch: R111656
Sample ID: C08110642-003AMS	Sample Matrix Spike				Run: BERTHOLD 770-1_081120A				11/26/08 15:33
Radium 226	136	pCi/Filter		89	70	130			
Sample ID: C08110642-003AMSD	Sample Matrix Spike Duplicate				Run: BERTHOLD 770-1_081120A				11/26/08 15:33
Radium 226	155	pCi/Filter		99	70	130	13	23.9	
Sample ID: MB-20606	Method Blank				Run: BERTHOLD 770-1_081120A				11/26/08 15:33
Radium 226	-1.0	pCi/Filter							U
Sample ID: LCS-20606	Laboratory Control Sample				Run: BERTHOLD 770-1_081120A				11/26/08 17:09
Radium 226	14.5	pCi/Filter		98	70	130			
Method: E907.0									Batch: 20606
Sample ID: C08110642-001AMS	Sample Matrix Spike				Run: EGG-ORTEC_081120A				11/25/08 14:33
Thorium 230	52	pCi/Filter	0.20	108	70	130			
Sample ID: C08110642-001AMSD	Sample Matrix Spike Duplicate				Run: EGG-ORTEC_081120A				11/25/08 14:33
Thorium 230	47	pCi/Filter	0.20	93	70	130	11	53.5	
Sample ID: LCS-20606	Laboratory Control Sample				Run: EGG-ORTEC_081120A				11/25/08 14:33
Thorium 230	27	pCi/Filter	0.20	109	70	130			
Sample ID: MB-20606	Method Blank				Run: EGG-ORTEC_081120A				11/25/08 14:33
Thorium 230	0.2	pCi/Filter							U
Method: E909.0M									Batch: R111690
Sample ID: C08110642-006AMS	Sample Matrix Spike				Run: PACKARD 3100TR_081120B				11/20/08 11:05
Lead 210	677	pCi/Filter		115	70	130			
Sample ID: C08110642-006AMSD	Sample Matrix Spike Duplicate				Run: PACKARD 3100TR_081120B				11/20/08 11:05
Lead 210	612	pCi/Filter		104	70	130	10	30	
Sample ID: MB-R111690	Method Blank				Run: PACKARD 3100TR_081120B				11/20/08 11:05
Lead 210	20	pCi/Filter							U
Sample ID: LCS-R111690	Laboratory Control Sample				Run: PACKARD 3100TR_081120B				11/20/08 11:05
Lead 210	534	pCi/Filter		89	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

U - Not detected at minimum detectable concentration

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QA/QC Summary Report

Client: AATA International Inc
Project: UR Energy 301-809

Report Date: 12/05/08
Work Order: C08110642

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E909.0M									Batch: R111857
Sample ID: C08110331-002AMS	Sample Matrix Spike				Run: PACKARD 3100TR_081124A				11/24/08 10:30
Lead 210	151	pCi/g-dry		146	70	130			S
- Spike response is outside of the acceptance range for this analysis. Since the LCS and the RPD for the MS MSD pair are acceptable, the response is considered to be matrix related. The batch is approved.									
Sample ID: C08110331-002AMSD	Sample Matrix Spike Duplicate				Run: PACKARD 3100TR_081124A				11/24/08 10:30
Lead 210	130	pCi/g-dry		126	70	130	15	30	
Sample ID: MB-R111857	Method Blank				Run: PACKARD 3100TR_081124A				11/24/08 10:30
Lead 210	-0.3	pCi/L							U
Sample ID: LCS-R111857	Laboratory Control Sample				Run: PACKARD 3100TR_081124A				11/24/08 10:30
Lead 210	68	pCi/L		118	70	130			
Method: SW6020									Batch: 20606
Sample ID: MB-20606	Method Blank				Run: ICPMS2-C_081121A				11/21/08 15:14
Uranium	0.002	mg/filter	6E-05						
Sample ID: LCS1-20606	Laboratory Control Sample				Run: ICPMS2-C_081121A				11/21/08 15:21
Uranium	0.0981	mg/filter	0.00030	96	75	125			
Sample ID: C08110642-006AMS	Sample Matrix Spike				Run: ICPMS2-C_081121A				11/21/08 18:10
Uranium	0.0498	mg/filter	0.00030	97	75	125			
Sample ID: C08110642-006AMSD	Sample Matrix Spike Duplicate				Run: ICPMS2-C_081121A				11/21/08 18:17
Uranium	0.0497	mg/filter	0.00030	97	75	125	0.3	20	
Sample ID: C08110642-006AMS	Sample Matrix Spike				Run: ICPMS4-C_081122A				11/22/08 07:05
Uranium	0.0524	mg/filter	0.00030	102	75	125			
Sample ID: C08110642-006AMSD	Sample Matrix Spike Duplicate				Run: ICPMS4-C_081122A				11/22/08 07:09
Uranium	0.0525	mg/filter	0.00030	103	75	125	0.3	20	

Qualifiers:

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

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CLIENT: AATA International Inc
Project: UR Energy 301-809
Sample Delivery Group: C08110642

Date: 05-Dec-08

CASE NARRATIVE

ORIGINAL SAMPLE SUBMITTAL(S)
All original sample submittals have been returned with the data package.

SAMPLE TEMPERATURE COMPLIANCE: 4°C (±2°C)
Temperature of samples received may not be considered properly preserved by accepted standards. Samples that are hand delivered immediately after collection shall be considered acceptable if there is evidence that the chilling process has begun.

GROSS ALPHA ANALYSIS
Method 900.0 for gross alpha and gross beta is intended as a drinking water method for low TDS waters. Data provided by this method for non potable waters should be viewed as inconsistent.

RADON IN AIR ANALYSIS
The desired exposure time is 48 hours (2 days). The time delay in returning the canister to the laboratory for processing should be as short as possible to avoid excessive decay. Maximum recommended delay between end of exposure to beginning of counting should not exceed 8 days.

SOIL/SOLID SAMPLES
All samples reported on an as received basis unless otherwise indicated.

ATRAZINE, SIMAZINE AND PCB ANALYSIS USING EPA 505
Data for Atrazine and Simazine are reported from EPA 525.2, not from EPA 505. Data reported by ELI using EPA method 505 reflects the results for seven individual Aroclors. When the results for all seven are ND (not detected), the sample meets EPA compliance criteria for PCB monitoring.

SUBCONTRACTING ANALYSIS
Subcontracting of sample analyses to an outside laboratory may be required. If so, ENERGY LABORATORIES will utilize its branch laboratories or qualified contract laboratories for this service. Any such laboratories will be indicated within the Laboratory Analytical Report.

BRANCH LABORATORY LOCATIONS
eli-b - Energy Laboratories, Inc. - Billings, MT
eli-g - Energy Laboratories, Inc. - Gillette, WY
eli-h - Energy Laboratories, Inc. - Helena, MT
eli-r - Energy Laboratories, Inc. - Rapid City, SD
eli-t - Energy Laboratories, Inc. - College Station, TX

CERTFICATIONS:
USEPA: WY00002; FL-DOH NELAC: E87641; California: 02118CA
Oregon: WY200001; Utah: 3072350515; Virginia: 00057; Washington: C1903

ISO 17025 DISCLAIMER:
The results of this Analytical Report relate only to the items submitted for analysis.

ENERGY LABORATORIES, INC. - CASPER,WY certifies that certain method selections contained in this report meet requirements as set forth by the above accrediting authorities. Some results requested by the client may not be covered under these certifications. All analysis data to be submitted for regulatory enforcement should be certified in the sample state of origin. Please verify ELI's certification coverage by visiting www.energylab.com

ELI appreciates the opportunity to provide you with this analytical service. For additional information and services visit our web page www.energylab.com.

THIS IS THE FINAL PAGE OF THE LABORATORY ANALYTICAL REPORT

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ANALYTICAL SUMMARY REPORT

December 30, 2008

AATA International Inc
300 E Boardwalk Dr STE 4A
Fort Collins, CO 80525

Workorder No.: C08120278 Quote ID: C2783 - UR Energy Lost Creek

Project Name: URE LC 301

Energy Laboratories, Inc. received the following 6 samples for AATA International Inc on 12/8/2008 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
C08120278-001	HV-1	12/02/08 00:00	12/08/08	Filter	Composite of two or more samples Metals, Total Digestion, Total Metals Lead 210 Radium 226 Thorium, Isotopic
C08120278-002	HV-2	12/02/08 00:00	12/08/08	Filter	Same As Above
C08120278-003	HV-3	12/02/08 00:00	12/08/08	Filter	Same As Above
C08120278-004	HV-4	12/02/08 00:00	12/08/08	Filter	Same As Above
C08120278-005	HV-5	12/02/08 00:00	12/08/08	Filter	Same As Above
C08120278-006	HV-B	12/02/08 00:00	12/08/08	Filter	Same As Above

As appropriate, any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

If you have any questions regarding these tests results, please call.

Report Approved By: STEVE CARLSTON

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: URE LC 301
Lab ID: C08120278-001
Client Sample ID: HV-1

Report Date: 12/30/08
Collection Date: 12/02/08
DateReceived: 12/08/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	ND	mg/filter		0.0003		SW6020	12/16/08 01:14 / sml
Uranium, Activity	ND	pCi/Filter		0.2		SW6020	12/16/08 01:14 / sml
RADIONUCLIDES - TOTAL							
Lead 210	69	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Lead 210 precision (±)	23	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Lead 210 MDC	37	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Radium 226	-0.3	pCi/Filter	U			E903.0	12/23/08 21:38 / trs
Radium 226 precision (±)	0.8	pCi/Filter				E903.0	12/23/08 21:38 / trs
Radium 226 MDC	1.4	pCi/Filter				E903.0	12/23/08 21:38 / trs
Thorium 230	-0.4	pCi/Filter	U	0.20		E907.0	12/12/08 15:00 / dmf
Thorium 230 precision (±)	0.19	pCi/Filter				E907.0	12/12/08 15:00 / dmf

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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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: December 30, 2008

SAMPLE ID: HV-1

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08120278-001	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
8/29/08 - 12/2/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	< 1.00E-16	N/A	1.00E-16	9.00E-13	< 1.11E-02
4.07E+09	^{210}Pb	1.69E-14	5.64E-15	2.00E-15	6.00E-13	2.82E+00

LLD's are from Reg. Guide 4.14

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: URE LC 301
Lab ID: C08120278-002
Client Sample ID: HV-2

Report Date: 12/30/08
Collection Date: 12/02/08
DateReceived: 12/08/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	ND	mg/filter		0.0003		SW6020	12/16/08 01:18 / sml
Uranium, Activity	ND	pCi/Filter		0.2		SW6020	12/16/08 01:18 / sml
RADIONUCLIDES - TOTAL							
Lead 210	66	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Lead 210 precision (±)	23	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Lead 210 MDC	37	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Radium 226	-0.8	pCi/Filter	U			E903.0	12/23/08 21:38 / trs
Radium 226 precision (±)	0.7	pCi/Filter				E903.0	12/23/08 21:38 / trs
Radium 226 MDC	1.4	pCi/Filter				E903.0	12/23/08 21:38 / trs
Thorium 230	-0.5	pCi/Filter	U	0.20		E907.0	12/12/08 15:00 / dmf
Thorium 230 precision (±)	0.19	pCi/Filter				E907.0	12/12/08 15:00 / dmf

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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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: December 30, 2008

SAMPLE ID: HV-2

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08120278-002	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
8/29/08 - 12/2/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	< 1.00E-16	N/A	1.00E-16	9.00E-13	< 1.11E-02
4.08E+09	^{210}Pb	1.62E-14	5.64E-15	2.00E-15	6.00E-13	2.70E+00

LLD's are from Reg. Guide 4.14

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: URE LC 301
Lab ID: C08120278-003
Client Sample ID: HV-3

Report Date: 12/30/08
Collection Date: 12/02/08
DateReceived: 12/08/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	ND	mg/filter		0.0003		SW6020	12/16/08 01:22 / sml
Uranium, Activity	ND	pCi/Filter		0.2		SW6020	12/16/08 01:22 / sml
RADIONUCLIDES - TOTAL							
Lead 210	77	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Lead 210 precision (±)	23	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Lead 210 MDC	37	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Radium 226	-0.8	pCi/Filter	U			E903.0	12/23/08 21:38 / trs
Radium 226 precision (±)	0.6	pCi/Filter				E903.0	12/23/08 21:38 / trs
Radium 226 MDC	1.4	pCi/Filter				E903.0	12/23/08 21:38 / trs
Thorium 230	-1.4	pCi/Filter	U	0.20		E907.0	12/12/08 15:00 / dmf
Thorium 230 precision (±)	0.19	pCi/Filter				E907 0	12/12/08 15:00 / dmf

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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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: December 30, 2008

SAMPLE ID: HV-3

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08120278-003	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
8/29/08 - 12/2/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	< 1.00E-16	N/A	1.00E-16	9.00E-13	< 1.11E-02
4.04E+09	^{210}Pb	1.91E-14	5.69E-15	2.00E-15	6.00E-13	3.18E+00

LLD's are from Reg. Guide 4.14

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: URE LC 301
Lab ID: C08120278-004
Client Sample ID: HV-4

Report Date: 12/30/08
Collection Date: 12/02/08
DateReceived: 12/08/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	0.0003	mg/filter		0.0003		SW6020	12/16/08 01:26 / sml
Uranium, Activity	0.2	pCi/Filter		0.2		SW6020	12/16/08 01:26 / sml
RADIONUCLIDES - TOTAL							
Lead 210	70	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Lead 210 precision (±)	23	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Lead 210 MDC	37	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Radium 226	-0.8	pCi/Filter	U			E903.0	12/23/08 21:38 / trs
Radium 226 precision (±)	0.7	pCi/Filter				E903.0	12/23/08 21:38 / trs
Radium 226 MDC	1.4	pCi/Filter				E903.0	12/23/08 21:38 / trs
Thorium 230	-0.8	pCi/Filter	U	0.20		E907.0	12/12/08 15:00 / dmf
Thorium 230 precision (±)	0.1	pCi/Filter				E907.0	12/12/08 15:00 / dmf

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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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: December 30, 2008

SAMPLE ID: HV-4

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08120278-004	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
8/29/08 - 12/2/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	< 1.00E-16	N/A	1.00E-16	9.00E-13	< 1.11E-02
4.08E+09	^{210}Pb	1.72E-14	5.64E-15	2.00E-15	6.00E-13	2.86E+00

LLD's are from Reg. Guide 4.14

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: URE LC 301
Lab ID: C08120278-005
Client Sample ID: HV-5

Report Date: 12/30/08
Collection Date: 12/02/08
DateReceived: 12/08/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	0.0003	mg/filter		0.0003		SW6020	12/16/08 01:46 / sml
Uranium, Activity	0.2	pCi/Filter		0.2		SW6020	12/16/08 01:46 / sml
RADIONUCLIDES - TOTAL							
Lead 210	89	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Lead 210 precision (±)	23	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Lead 210 MDC	37	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Radium 226	-0.7	pCi/Filter	U			E903.0	12/23/08 21:38 / trs
Radium 226 precision (±)	0.7	pCi/Filter				E903.0	12/23/08 21:38 / trs
Radium 226 MDC	1.4	pCi/Filter				E903.0	12/23/08 21:38 / trs
Thorium 230	-0.7	pCi/Filter	U	0.20		E907.0	12/12/08 15:00 / dmf
Thorium 230 precision (±)	0.19	pCi/Filter				E907.0	12/12/08 15:00 / dmf

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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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: December 30, 2008

SAMPLE ID: HV-5

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08120278-005	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
8/29/08 - 12/2/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	< 1.00E-16	N/A	1.00E-16	9.00E-13	< 1.11E-02
3.85E+09	^{210}Pb	2.31E-14	5.98E-15	2.00E-15	6.00E-13	3.86E+00

LLD's are from Reg. Guide 4.14

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LABORATORY ANALYTICAL REPORT

Client: AATA International Inc
Project: URE LC 301
Lab ID: C08120278-006
Client Sample ID: HV-B

Report Date: 12/30/08
Collection Date: 12/02/08
DateReceived: 12/08/08
Matrix: Filter

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
TRACE METALS							
Uranium	ND	mg/filter		0.0003		SW6020	12/16/08 01:50 / sml
Uranium, Activity	ND	pCi/Filter		0.2		SW6020	12/16/08 01:50 / sml
RADIONUCLIDES - TOTAL							
Lead 210	-1	pCi/Filter	U			E909.0M	12/18/08 09:00 / dm
Lead 210 precision (±)	22	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Lead 210 MDC	37	pCi/Filter				E909.0M	12/18/08 09:00 / dm
Radium 226	0.5	pCi/Filter	U			E903.0	12/23/08 21:38 / trs
Radium 226 precision (±)	0.9	pCi/Filter				E903.0	12/23/08 21:38 / trs
Radium 226 MDC	1.4	pCi/Filter				E903.0	12/23/08 21:38 / trs
Thorium 230	-0.9	pCi/Filter	U	0.20		E907.0	12/12/08 15:00 / dmf
Thorium 230 precision (±)	0.1	pCi/Filter				E907.0	12/12/08 15:00 / dmf

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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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: AATA International Inc.

REPORT DATE: December 30, 2008

SAMPLE ID: HV-B

Quarter/Date Sampled Air Volume	Radionuclide	Concentration µCi/mL	Error Estimate µCi/mL	L.L.D. µCi/mL	Effluent Conc.* µCi/mL	% Effluent Concentration
C08120278-006	^{nat}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
8/29/08 - 12/2/08	^{230}Th	< 1.00E-16	N/A	1.00E-16	3.00E-14	< 3.33E-01
Air Volume in mLs	^{226}Ra	1.23E-16	2.22E-16	1.00E-16	9.00E-13	1.37E-02
4.05E+09	^{210}Pb	< 2.00E-15	N/A	2.00E-15	6.00E-13	< 3.33E-01

LLD's are from Reg. Guide 4.14

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QA/QC Summary Report

Client: AATA International Inc
Project: URE LC 301

Report Date: 12/30/08
Work Order: C08120278

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E903.0									Batch: R112780
Sample ID: C08120259-002FDUP	Sample Duplicate				Run: BERTHOLD 770-2_081216A				12/23/08 21:38
Radium 226	-0.013	pCi/L			70	130	280	845	U
Sample ID: C08120278-006AMS	Sample Matrix Spike				Run: BERTHOLD 770-2_081216A				12/23/08 23:22
Radium 226	104	pCi/Filter		73	70	130			
Sample ID: LCS-20824	Laboratory Control Sample				Run: BERTHOLD 770-2_081216A				12/23/08 23:22
Radium 226	12	pCi/L		90	70	130			
Sample ID: MB-20824	Method Blank				Run: BERTHOLD 770-2_081216A				12/23/08 23:22
Radium 226	-0.9	pCi/L							U
Method: E907.0									Batch: RA-TH-ISO-0711
Sample ID: C08120222-001AMS	Sample Matrix Spike				Run: EGG-ORTEC_081212A				12/12/08 15:00
Thorium 230	61.9	pCi/Filter	0.20	124	70	130			
Sample ID: C08120222-001AMSD	Sample Matrix Spike Duplicate				Run: EGG-ORTEC_081212A				12/12/08 15:00
Thorium 230	56.6	pCi/Filter	0.20	110	70	130	9	30	
Sample ID: LCS-20767	Laboratory Control Sample				Run: EGG-ORTEC_081212A				12/12/08 15:00
Thorium 230	23.6	pCi/Filter	0.20	107	70	130			
Sample ID: MB-20767	Method Blank				Run: EGG-ORTEC_081212A				12/12/08 15:00
Thorium 230	0.10	pCi/Filter							U
Method: E909.0M									Batch: R112811
Sample ID: C08120278-001AMS	Sample Matrix Spike				Run: PACKARD 3100TR_081218B				12/18/08 09:00
Lead 210	1290	pCi/Filter		111	70	130			
Sample ID: C08120278-001AMSD	Sample Matrix Spike Duplicate				Run: PACKARD 3100TR_081218B				12/18/08 09:00
Lead 210	1050	pCi/Filter		89	70	130	21	30	
Sample ID: MB-R112811	Method Blank				Run: PACKARD 3100TR_081218B				12/18/08 09:00
Lead 210	-1	pCi/L							U
Sample ID: LCS-R112811	Laboratory Control Sample				Run: PACKARD 3100TR_081218B				12/18/08 09:00
Lead 210	110	pCi/L		98	70	130			

Qualifiers:

RL - Analyte reporting limit.
U - Not detected at minimum detectable concentration
ND - Not detected at the reporting limit.

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QA/QC Summary Report

Client: AATA International Inc
Project: URE LC 301

Report Date: 12/30/08
Work Order: C08120278

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020									Batch: 20797
Sample ID: MB-20797	Method Blank				Run: ICPMS4-C_081215A				12/16/08 00:54
Uranium	7E-05	mg/L							
Sample ID: LCS1-20797	Laboratory Control Sample				Run: ICPMS4-C_081215A				12/16/08 00:58
Uranium	0.0996	mg/L	0.00030	99	75	125			
Sample ID: C08120278-006AMS	Sample Matrix Spike				Run: ICPMS4-C_081215A				12/16/08 01:54
Uranium	0.0539	mg/filter	0.00030	108	75	125			
Sample ID: C08120278-006AMSD	Sample Matrix Spike Duplicate				Run: ICPMS4-C_081215A				12/16/08 01:58
Uranium	0.0543	mg/filter	0.00030	108	75	125	0.6	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

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CLIENT: AATA International Inc
Project: URE LC 301
Sample Delivery Group: C08120278

Date: *30-Dec-08*

CASE NARRATIVE

ORIGINAL SAMPLE SUBMITTAL(S)
All original sample submittals have been returned with the data package.

SAMPLE TEMPERATURE COMPLIANCE: 4°C (±2°C)
Temperature of samples received may not be considered properly preserved by accepted standards. Samples that are hand delivered immediately after collection shall be considered acceptable if there is evidence that the chilling process has begun.

GROSS ALPHA ANALYSIS
Method 900.0 for gross alpha and gross beta is intended as a drinking water method for low TDS waters. Data provided by this method for non potable waters should be viewed as inconsistent.

RADON IN AIR ANALYSIS
The desired exposure time is 48 hours (2 days). The time delay in returning the canister to the laboratory for processing should be as short as possible to avoid excessive decay. Maximum recommended delay between end of exposure to beginning of counting should not exceed 8 days.

SOIL/SOLID SAMPLES
All samples reported on an as received basis unless otherwise indicated.

ATRAZINE, SIMAZINE AND PCB ANALYSIS USING EPA 505
Data for Atrazine and Simazine are reported from EPA 525.2, not from EPA 505. Data reported by ELI using EPA method 505 reflects the results for seven individual Aroclors. When the results for all seven are ND (not detected), the sample meets EPA compliance criteria for PCB monitoring.

SUBCONTRACTING ANALYSIS
Subcontracting of sample analyses to an outside laboratory may be required. If so, ENERGY LABORATORIES will utilize its branch laboratories or qualified contract laboratories for this service. Any such laboratories will be indicated within the Laboratory Analytical Report.

BRANCH LABORATORY LOCATIONS
eli-b - Energy Laboratories, Inc. - Billings, MT
eli-g - Energy Laboratories, Inc. - Gillette, WY
eli-h - Energy Laboratories, Inc. - Helena, MT
eli-r - Energy Laboratories, Inc. - Rapid City, SD
eli-t - Energy Laboratories, Inc. - College Station, TX

CERTFICATIONS:
USEPA: WY00002; FL-DOH NELAC: E87641; California: 02118CA
Oregon: WY200001; Utah: 3072350515; Virginia: 00057; Washington: C1903

ISO 17025 DISCLAIMER:
The results of this Analytical Report relate only to the items submitted for analysis.

ENERGY LABORATORIES, INC. - CASPER,WY certifies that certain method selections contained in this report meet requirements as set forth by the above accrediting authorities. Some results requested by the client may not be covered under these certifications. All analysis data to be submitted for regulatory enforcement should be certified in the sample state of origin. Please verify ELI's certification coverage by visiting www.energylab.com

ELI appreciates the opportunity to provide you with this analytical service. For additional information and services visit our web page www.energylab.com.

THIS IS THE FINAL PAGE OF THE LABORATORY ANALYTICAL REPORT

Appendix APS-2

Energy Laboratories Explanation for Q2 Qualified Uranium Results
Baseline Radiological Air Particulate Sampling
Lost Creek In Situ Uranium Project

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December 10, 2008

Duncan Eccleston
AATA International Inc.
300 E Boardwalk Dr Ste 4A
Fort Collins, CO 80525

Subject: Explanation of contaminated Uranium Method Blank (MB) on High Volume air filter samples. Work Order - C08110642.

Dear Mr. Eccleston:

The following is an explanation of Energy Laboratories, Inc. (ELI) "best guess" of what might have occurred with the analysis of uranium on the air filters.

On November 18, 2008, six air filters were received at ELI requesting the analysis of NRC Reg. Guide, 4.14 radionuclides: U-nat, Th230, Ra226, and Pb210. On 11/20/08, the filters were digested to a final volume of 0.95 liters using EPA Method 3050. After filtration, a subsample of the filtrate was split into 50 ml conical tubes and given to the Metals Department for the analysis of uranium by EPA SW846 Method 6020.

All six samples including the batch QC (MB and LCS) were analyzed for uranium on 11/21/08. Since uranium was detected in the MB at 0.002 mg/L, the entire sample batch was re-analyzed on 11/22/08. A detect of 0.002 mg/L was again detected in the MB and all six samples were identified with a "B" qualifier indicating the MB contained contamination. In situations where additional sample is available the batch would have been re-digested and reanalyzed, but unfortunetly, in the case of air filters, it is not possible to re-digest as the filter is consumed in the original digest.

Therefore, since the filters cannot be re-digested, ELI is of the opinion that either the uranium MB itself got contaminated or the entire batch could have been exposed to uranium contamination during the digestion process. The former conjecture is based on the fact that all of the batch QC samples were within acceptable limits and replication of the duplicate analysis was also within specifications and the latter is explained by an apparent higher than historical field blank value in sample 006 (HV-B).

I hope this is of some value to you and ELI apologizes for the inconvenience this has caused.

Please feel free to contact me if you have any questions.

Sincerely,

Steve Dobos
Client Services Manager

Advances in radiological survey capabilities for large sites are discussed.

Radiological Site Characterizations: Gamma Surveys, Gamma/^{226}Ra Correlations, and Related Spatial Analysis Techniques

Randy Whicker, Paul Cartier,† Jim Cain,‡ Ken Milmine,§ and Michael Griffin§*

Abstract: *Radiological surveys of a uranium mill site in Colorado and several proposed uranium recovery sites in Wyoming were conducted in 2006 and 2007. Advancements in Global Positioning System (GPS)-based gamma scanning systems combined with gamma/^{226}Ra correlations and Geographic Information Systems (GIS)-based spatial analysis techniques produced comprehensive and detailed characterizations of the spatial distributions of gamma exposure rates and ^{226}Ra concentrations in surface soils across extensive study areas. Aside from limitations on gamma-based estimates of soil ^{226}Ra related to soil heterogeneity or gamma shine effects, soil sampling results to date show good general agreement between estimated and measured values. Spatial characterization aspects of the survey approach are clearly more effective than conventional grid sampling methods, particularly for such large sites. Example project applications, data collection and analysis methods, challenges encountered, and resulting mapped estimates of various aspects of these radiological parameters are presented. Health Phys. 95(Supplement 5): S180–S189; 2008*

Key words: *operational topics; surveys; ^{226}Ra; soil*

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INTRODUCTION

Remediation of uranium mining/milling sites or other sites where naturally occurring radioactive materials are present usually requires characterizations of gamma exposure rates and ^{226}Ra concentrations in soil. Establishing pre-operational (background) and post-operational conditions for these radiological parameters is important for assessment of areas requiring remediation. Past approaches include taking discrete gamma measurements and soil samples across a systematic grid pattern. A grid sampling approach is indicated by the U.S. Nuclear Regulatory Commission (U.S. NRC) in Regulatory Guide 4.14 for uranium mills (U.S. NRC 1980), with 40 soil samples collected along a radial grid and 80 individual discrete gamma measurements collected along a similar pattern.

More recent radiological survey guidelines found in MARSSIM, the Multi-Agency Radiation Survey and Site Investigation Manual (U.S. NRC 2000), also indicate grid-based designs for soil sampling and direct measurement of radionuclides in soil, but the number of soil samples needed varies according to statistical requirements and continuous gamma scanning (rather than discrete gamma measurements) is used to augment the soil sampling.

At some sites, natural background soil ^{226}Ra concentrations are quite variable and may exceed levels commonly used as cleanup criteria. If such areas are not identified prior to site operations, they can be misidentified during decommissioning as contaminated areas in need of remediation. Improvement in radiological characterization methods for background and potentially impacted areas can help improve assessment of areas in need of remediation and verification of the effectiveness of that remediation.

Since the above mentioned agency guidance documents were published, advanced Global Positioning System (GPS)-based gamma scanning systems with automated electronic data collection have been developed and used in the field (Meyer et al. 2005a and b; Johnson et al. 2006). These systems can record up to 3,600 individual gamma readings and corresponding GPS measurements per hour, providing

Randy Whicker holds an MS degree in the radiological health sciences with a specialization in radiochemistry and 13 years of radiological assessment work including a combination of applied research and environmental consulting projects. Currently, Randy is an Environmental Health Physicist with the Radiation Protection and Measurements Group at Tetra Tech, Inc. (Fort Collins, CO), providing expertise in project planning, experimental design, field sampling, analytical field and laboratory techniques, radiological measurements, and statistical analysis. His career efforts have supported entities both public and private in the areas of academic research, environmental assessments and remediation, radiation protection, and litigation cases. Randy's email is randy.whicker@tetratech.com.

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a detailed record of gamma exposure rate conditions across scanned areas. Multiple scanning systems mounted on vehicles can quickly survey large areas and provide a high spatial density of measurements. This gamma survey technology represents a substantial increase in the amount of radiological information that can be efficiently collected relative to technology available when earlier agency guidance documents were published.

Gamma surveys of a uranium mill site in Colorado and several proposed in-situ recovery (ISR) uranium project areas in Wyoming were conducted in 2006 and 2007 using multiple GPS-based gamma scanning systems mounted on off highway vehicles (OHVs). In conjunction with these surveys, correlations between gamma readings and ^{226}Ra concentrations in surface soils (0–15 cm) were established. These correlations enabled spatial and statistical information about soil ^{226}Ra concentrations to be extracted from the gamma survey data to help meet various project characterization objectives. Geographical Information Systems (GIS) software was used for statistical conversion of large survey data sets, interpolation with kriging methods, field sampling support, special investigation/analysis needs, and for data presentation purposes.

The objectives of surveys at the uranium mill site were to develop various probability-based estimates of the areal extent of surface soils having ^{226}Ra concentrations in excess of pre-specified cleanup criteria. At the proposed ISR uranium project areas, the objective was to establish pre-operational baseline gamma exposure rates and soil ^{226}Ra concentrations for licensing/permitting applications. These project objectives each have implications with respect to eventual site decommissioning and termination of radioactive source materials licenses. Continued improvement in methods to characterize gamma exposure rates and soil ^{226}Ra concentrations at such sites can benefit all stakeholders.

MATERIALS AND METHODS

Gamma surveys

Various automated, GPS-based scanning system configurations have been developed for different site conditions. For projects discussed in this paper, two Yamaha Rhino (Yamaha Motor Corp., 6555 Katella Avenue, Cypress, CA 90630) OHV-mounted systems were used (Fig. 1). Given the large size of these sites, along with occasional rugged terrain, tall vegetation and other obstacles, Rhino OHVs were well suited for these projects. Backpack scanning systems were also used in a few small areas inaccessible to OHVs.

These OHVs are equipped with adjustable outriggers designed to mount three 5 × 5 cm sodium iodide (NaI) scintillation gamma detectors (Ludlum Model 44-10; Ludlum Measurements, Inc., 501 Oak Street, Sweetwater, TX 79556) and paired GPS receivers. The gamma detectors are coupled to Ludlum Model 2350 rate meters housed in a container in the cargo bed. Simultaneous GPS and gamma exposure rate data are recorded every 1–2 s using an onboard PC with special data acquisition software (comReader; Tetra Tech, 3801 Automation Way, Fort Collins, CO 80525).

System configuration involves about 2.5 m spacing between detectors (measured perpendicular to direction of travel), with each detector positioned at either 1 or 1.4 m above the ground surface. For many of these projects a detector height of 1.4 m was the lowest practical height for the system under site conditions given the need for adequate clearance of frequently encountered obstacles such as tall vegetation, ravine crossings, and other features. As discussed later in this paper, experimental measurements were performed as needed to model approximate equivalent readings as measured by a high-pressure ionization chamber (HPIC) at 1 m above the ground surface (Fig. 1).

Based on qualitative field observations of detector response under similar measurement geometries, the scanning track width representing each vehicle's lateral range of general scanning sensitivity to elevated planar (non-point) source areas is estimated to be about 8 m across, perpendicular to the direction of travel. Vehicle scanning speeds range between 3 and 16 km h^{-1} depending on the roughness of the terrain, with a typical average speed of 6–10 km h^{-1}.

Data are downloaded daily into a project database and results are viewed each night with special field mapping software (Gamma Data Map Viewer; Tetra Tech, 3801 Automation Way, Fort Collins, CO

Figure 1. Three-detector OHV-mounted scanning systems (left) and static HPIC cross-calibration measurements (right).

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80525). This allows scan coverage assessment and planning on a daily basis and helps to identify any problems with systems performance.

For routine scanning across large areas, a target distance of 100 m between vehicles is estimated to achieve about 14% ground scanning coverage. For areas of particular interest, higher-density target coverages can range from 25–100% but typically involve a vehicle spacing of 20–30 m (35–45% coverage). Practical considerations such as safety, terrain, and natural obstructions often dictate actual distances maintained between survey vehicles.

HPIC/NaI cross-calibration

Gamma exposure rates measured by NaI detectors are only relative measurements as response characteristics of NaI detectors are energy dependent. True gamma exposure rates are best measured with a less energy dependent system such as the HPIC. Depending on the radiological characteristics of a given site, NaI detectors can have measurement values significantly different from corresponding HPIC measurement values. NaI detectors are typically calibrated against a ^{137}Cs source. At photon emission energies near that of ^{137}Cs (662 keV), relative detector response is close to 100% (Ludlum 2006). Under field scanning conditions at uranium recovery sites, a preponderance of lower photon energies can be present due to primary and secondary scattered photons from naturally occurring terrestrial radionuclides. At these lower photon energies, response of NaI detectors relative to ^{137}Cs is significantly greater than 100% and NaI detectors will overestimate true exposure rates. In some locations, terrestrial concentrations of gamma emitting radionuclides can be very low and higher-energy cosmic sources can dominate detector response resulting in underestimates of true exposure rates.

NaI systems are useful because they can quickly and effectively demonstrate relative differences between pre- and post-remediation gamma exposure rate conditions. Unless the same equipment and scanning geometry are used for both surveys, however, it is necessary to normalize the data to a common basis of comparison. This is the purpose of performing HPIC/NaI cross-calibration measurements. Cross-calibration ensures that the results of future gamma scans, which may use different detectors, detector types, or measurement geometries, can be meaningfully compared against the results of pre-operational gamma surveys. HPIC/NaI cross-calibrations are also necessary in cases where external dose assessments are part of survey objectives.

To perform HPIC/NaI cross-calibrations, static measurements are taken at various discrete locations covering a range of exposure rates representative of the site. At each measurement location, 10–20 individual readings from the HPIC and each OHV-mounted NaI detector are separately collected and averaged. A picture of this process is shown in Fig. 1 (right). The resulting paired HPIC/NaI data are analyzed by linear regression to enable conversion of NaI-based gamma survey data to approximate 1 m HPIC equivalents.

Gamma/^{226}Ra correlations

Depending on the nature and strength of the relationship between gamma exposure rates and soil ^{226}Ra concentrations at a given site, statistical correlations can be used to estimate approximate soil ^{226}Ra concentrations across the entire site based on gamma survey results.

Following methods described in Johnson et al. (2006), correlation soil sampling is conducted as composite sampling over 10 × 10 m plots. Correlation plot locations are selected to be representative of the range of exposure rates found at the site, with additional efforts made to select plots having relatively homogeneous gamma readings in the general area. Gamma survey maps are used to help determine appropriate locations. Within each plot, 10 soil sub-samples are collected to a depth of 15 cm then composited into a single sample to give an average ^{226}Ra concentration over each 100 m^2 plot. Samples are sent to a qualified laboratory for ^{226}Ra analysis.

Each 100 m^2 soil sampling plot is also scanned using the same OHV-mounted systems and detector configuration used to scan the entire study area. The average NaI gamma reading over each plot is paired with the corresponding average ^{226}Ra concentration for statistical regression analysis.

RESULTS AND DISCUSSION

General observations

Radiological survey study areas at individual sites ranged from 75–4,358 hectares (185–10,770 acres). Scanning rates ranged from about 12 to 135 acres h^{-1} depending on terrain and ground scanning coverage attained. In general, instrument quality control (QC) charts and field QC charts for scan systems demonstrated acceptable performance. In cases of unacceptable system performance, affected data were eliminated from the project database and the system was not used again until the issue was resolved.

Although some cases of unexpected and problematic results were observed during the course of these projects, supplementary field investigations and/or additional data analyses revealed possible explanations and provided a basis for appropriate ways to address

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related issues. Final ^{226}Ra estimates based on gamma survey data have thus far generally agreed well with confirmatory soil sampling results.

Uranium mill site surveys

Survey activities at the uranium mill site included two separate projects. The first involved a 75-hectare portion of the site scheduled for remedial action. The survey objective was to estimate the extent of areas with greater than 80% statistical probability of having surface soil ^{226}Ra concentrations in excess of the respective cleanup criterion of 6 pCi g^{-1} (222 Bq kg^{-1}). Gamma scan results are shown in Fig. 2 (top).

A GIS-based spatial analysis program was used to krig the gamma survey data in order to provide continuous estimates of gamma exposure rate readings across the study area and better illustrate spatial distributions (Fig. 2, bottom). Kriging is a geostatistical interpolation procedure commonly used in various earth sciences.

Correlation plot measurements across the study area initially demonstrated a statistically weak linear relationship between gamma reading and ^{226}Ra soil concentration. Horizontal and vertical heterogeneity in soil ^{226}Ra concentrations and/or scattered photons reaching the gamma detectors from underlying subsurface sources or areas adjacent to the correlation plots (i.e., gamma "shine") may have been contributing factors to this result as the outliers all had unusually low concentration results relative to gamma readings.

To investigate potential reasons for weak initial correlation results, correlation plots were rescanned using a shielded (collimated) gamma detector. Shielded measurements improved the correlation and revealed evidence that 4 of the 14 correlation plots may have been significantly affected by gamma shine from adjacent areas and/or subsurface sources. When data from these potentially "shine impacted" plots were removed, the statistical strength of the unshielded correlation improved (Fig. 3) with an R-squared value nearly as high as the corresponding shielded correlation.

One-tailed upper and lower 80% prediction limits for the correlation were separately calculated and plotted along with the regression line (Fig. 3). Gamma values corresponding to the cleanup criterion for soil ^{226}Ra concentration (6 pCi g^{-1}) at these prediction limits were used to create a soil ^{226}Ra probability map as shown in Fig. 4. This spatial information is being used to help with remedial action planning. The small circular omitted portion of the study area represents a lined pond that could not be surveyed.

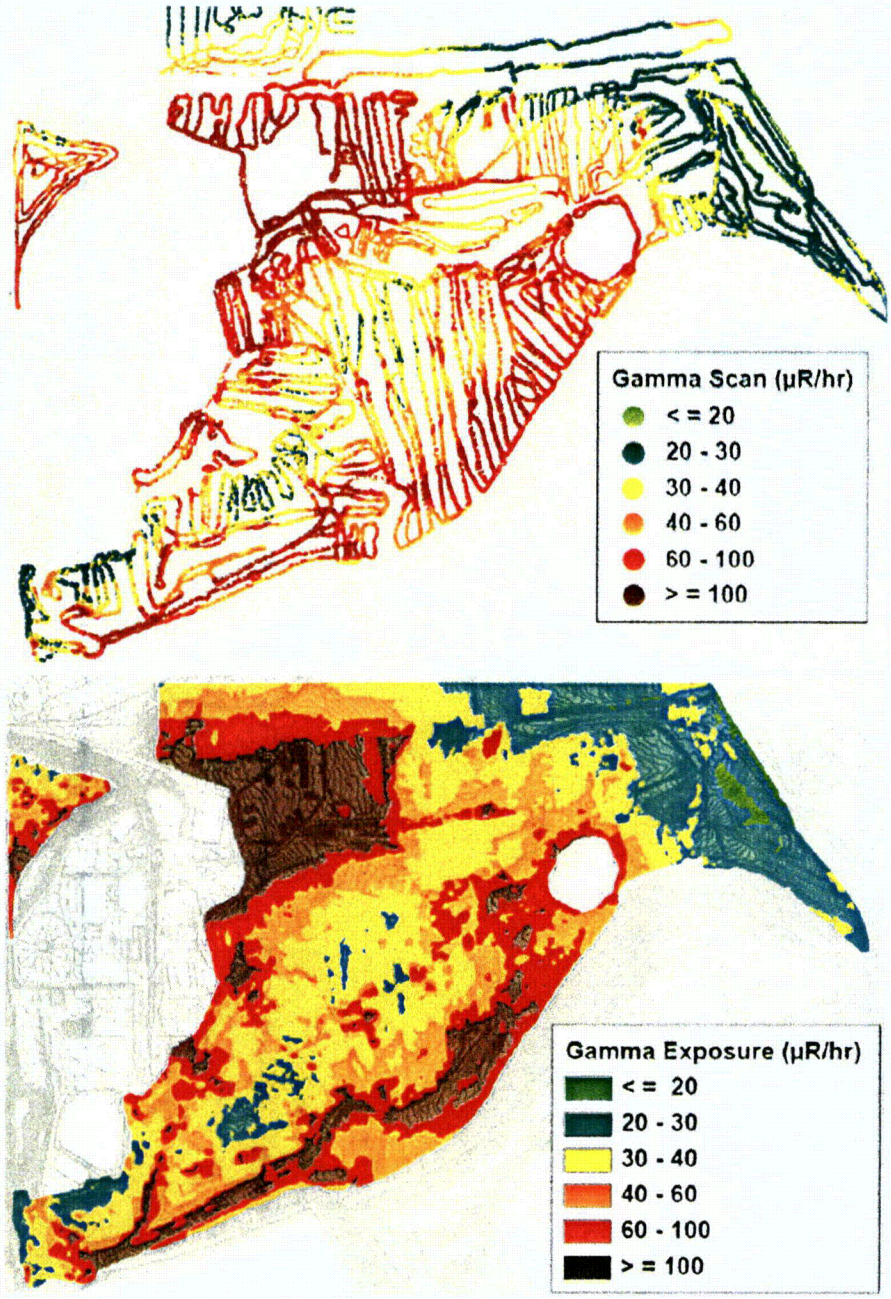

Figure 2. Gamma scan (top) and kriged mapping results (bottom) for the remedial action study area at the uranium mill site.

The second project at the uranium mill site involved a much larger portion of the site beyond the smaller remedial action study area. The objective for this project was also to estimate the areal extent of soil ^{226}Ra concentrations exceeding the 6 pCi g^{-1} cleanup criterion, but in this case the information was used to determine a conservative estimate of the volume of surface soils that could potentially require remediation upon site decommissioning. This volume estimate will be used to update remedial surety bonding and thus a more conservative 95% statistical probability for the estimate was needed.

As with the remedial action survey project, initial results of the gamma/^{226}Ra correlation developed for the volume study area were relatively weak. Again, however, comparisons between shielded and unshielded gamma data for correlation plots revealed a few locations where gamma shine may have contributed to this result. When those data were omitted from the analysis the statistical strength of the regression improved (Fig. 5).

The UPL line in Fig. 5 indicates that for this study area a gamma reading of about 23 μR h^{-1} has a 95% statistical probability of compliance with the 6 pCi g^{-1} criterion for soil ^{226}Ra. An approximate boundary corresponding to 23 μR h^{-1} was drawn on the kriged gamma survey map and confirmatory soil samples were collected just outside this line to verify the reliability of the estimate. Kriged survey results with overlays of the 95% UPL line and confirmatory sampling results are shown in Fig. 6. Areas outside the 95% UPL line above 23 μR h^{-1} were not included in the volume estimate because they are included in remediation plans. Note that the actual regression line in Fig. 5 (rather than the UPL line) predicts that on average, areas with gamma readings of 23 μR h^{-1} will have corresponding ^{226}Ra soil concentrations of about 3.2 pCi g^{-1}. This prediction agrees well with the confirmatory sampling results (Fig. 6).

Limitations on spatial and probabilistic estimates regarding soil ^{226}Ra concentrations for the uranium mill site study areas include uncertainty due to a limited number of correlation plots, analytical uncertainty in the measured correlation plot data, and significant potential for estimation error in areas where considerable gamma shine effects or soil ^{226}Ra heterogeneity exist. For areas significantly influenced by these latter conditions, characterization using conventional grid soil sampling approaches would likely prove more effective provided sufficient sampling density were used. The data suggest, however, that such areas represent a small fraction of overall study areas and that the correlation method was an effective overall approach.

An important lesson learned from all project examples presented in this paper is that correlation plot selection criteria are very important. Careful evaluation and planning must be exercised when selecting correlation plot locations to ensure that the data are representative of the range of gamma values found at the site, and that gamma readings in the general vicinity of each plot are as homogeneous as possible. This can be difficult to achieve for locations selected to represent higher readings as these areas tend to be small with a higher degree of small scale spatial variability. It is also desirable to try and avoid choosing locations with nearby regions of significantly higher readings to help avoid shine issues. A related problem that is more difficult to address is that it is seldom possible to predict areas that may be affected by shine from shallowly buried subsurface materials.

Proposed ISR uranium project area surveys

Because survey objectives at the various proposed ISR uranium project areas in Wyoming were focused on pre-operational baseline characterizations, NaI-based scan data were normalized to 1 m HPIC readings to approximate true gamma exposure rates

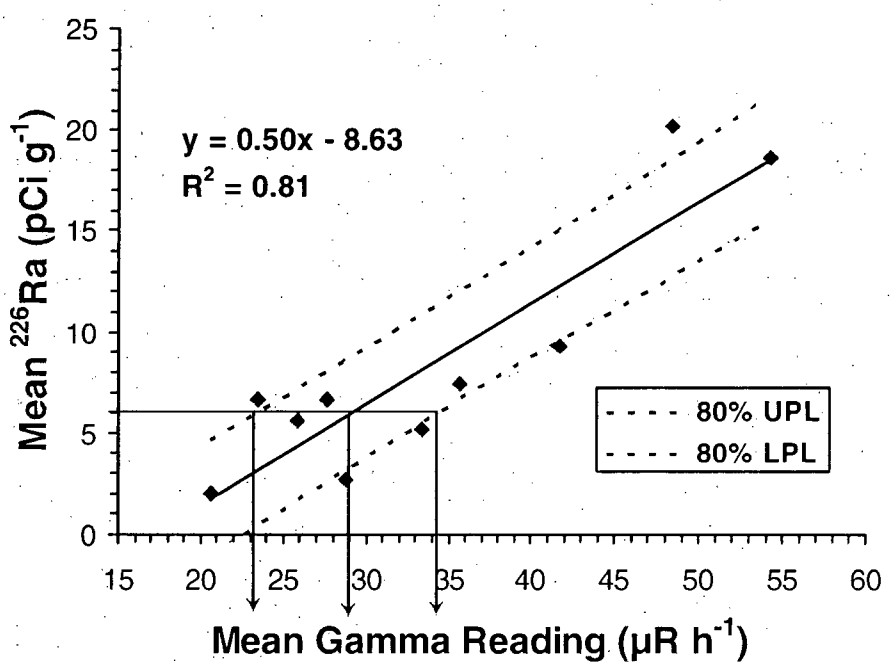

Figure 3. Correlation results for the remedial action study area at the uranium mill site.

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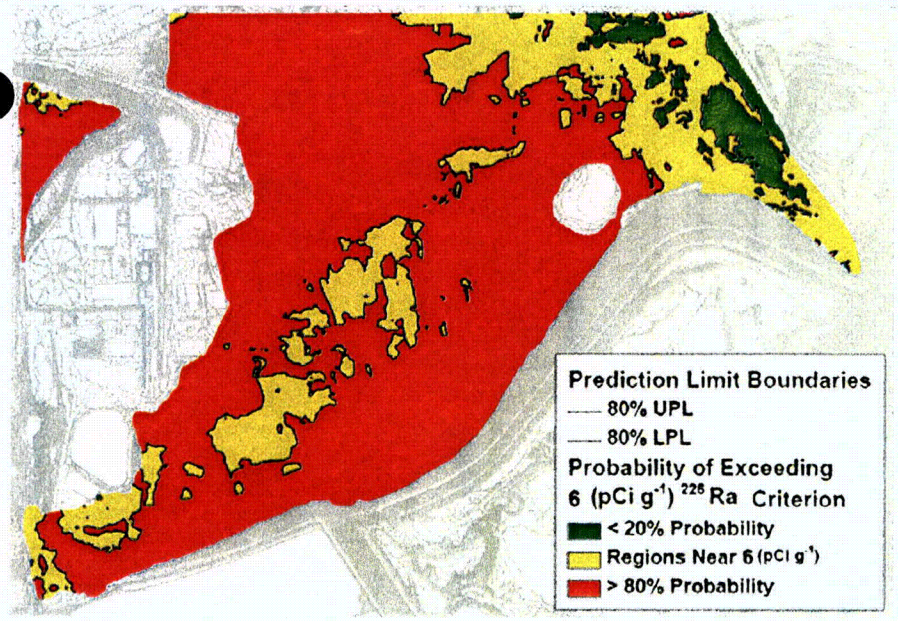

Figure 4. Soil ^{226}Ra probability map for the remedial action study area at the uranium mill site.

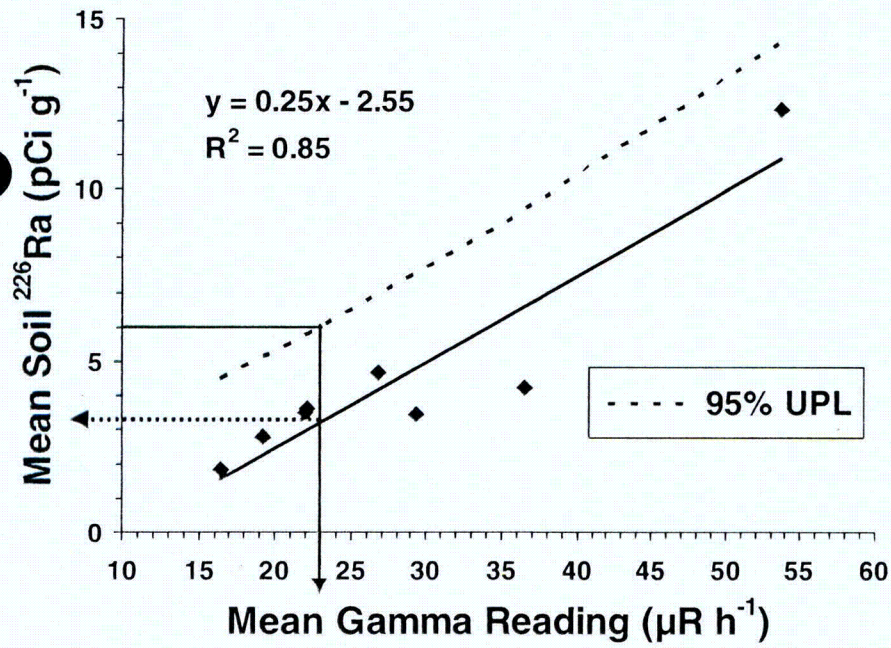

Figure 5. Gamma/^{226}Ra correlation results for the volume study area.

and provide a common basis of comparison for post-operational surveys. Typically, HPIC/NaI cross-calibration curves demonstrated highly significant linear relationships (Fig. 7, left). As illustrated at right in Fig. 7, the numerical difference between NaI readings and HPIC readings was proportional to the magnitude of exposure rate being measured (HPIC readings were modeled based on the regression equation shown at left in Fig. 7, and using a range of hypothetical NaI readings as the independent variable).

An example map of kriged HPIC equivalent gamma exposure rate survey data for a proposed ISR site in Wyoming is shown in Fig. 8. The use of kriged survey data overlays on aerial photos can be an effective way of illustrating distributional patterns of gamma exposure rates or soil ^{226}Ra concentrations in relation to certain geomorphic features. Note that the lowest gamma exposure rates at the site shown in Fig. 8 tend to coincide with drainage channel basins. Areas of higher gamma readings tend to coincide with areas of higher topographical relief such as ridges or hill tops.

For these proposed ISR sites, cases of apparent spatial relationships between geomorphic features and baseline gamma exposure rates are likely related to erosional and depositional processes that may expose elevated deposits of terrestrial radionuclide concentrations at the surface, bury such deposits, or gradually transport elevated materials off site. Sometimes, transitions between areas of consistently higher and lower gamma exposure rates are relatively abrupt. Such transitions can occasionally be associated with visible features like changes in slope, rock type, and soil color or texture (Fig. 9). In other cases, there are no obvious features associated with areas of higher or lower readings or with transition zones.

With respect to gamma-based estimates of baseline ^{226}Ra concentrations in surface soils at proposed ISR sites, conservative estimation using statistical prediction limits on correlations was not relevant. Instead, actual regression equations from correlation plot data were used to provide the average or "best" statistical estimates of soil ^{226}Ra concentrations based on the gamma survey data.

Relative to the Colorado mill site surveys, correlation plot measurements for proposed ISR sites in Wyoming tended to demonstrate stronger statistical relationships between gamma readings and soil ^{226}Ra soil concentrations. In general, fewer cases of unusually low ^{226}Ra concentrations in areas of high gamma readings were observed.

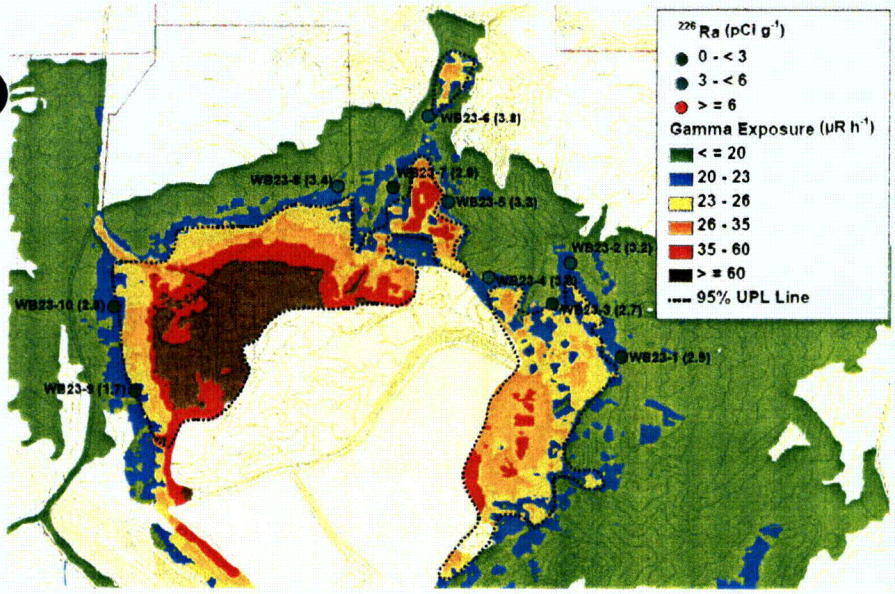

Figure 6. Gamma survey results for the volume study area showing approximate regions with gamma readings above and below 23 μR h^{-1}, the gamma value with a 95% statistical probability of compliance with the ^{226}Ra cleanup criterion. Confirmatory soil sampling locations and annotated ^{226}Ra results (pCi g^{-1}, in parentheses) are also shown.

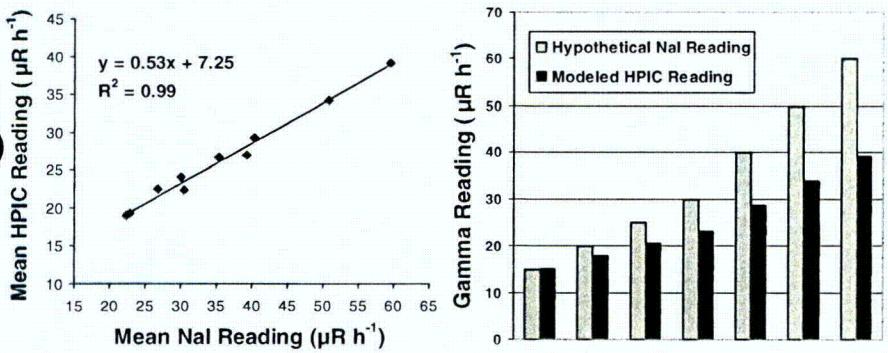

Figure 7. Example HPIC/NaI cross-calibration curve (left) and corresponding modeled differences between NaI and HPIC readings (right) for a proposed ISR uranium site in Wyoming.

Again, such cases are likely related to gamma shine from adjacent areas and/or subsurface sources and those data were not used for the correlations.

Another notable feature of correlation results for the Wyoming ISR sites was that the data sometimes demonstrated nonlinear characteristics (Fig. 10). This raised the possibility that use of nonlinear "best fit" models in such cases could reduce potential prediction error for soil ^{226}Ra estimates based on gamma survey data.

Reasons for apparent nonlinearity observed in correlation data from some sites appear to be related to a kind of threshold effect in the relationship between detector response and the ratio of terrestrial to cosmic sources of gamma radiation. Cosmic sources can dominate detector response until terrestrial sources become concentrated enough to have significant correlative impact on readings. This idea is consistent with a comparison of observed correlation data between various sites.

Sites with higher minimum measured soil ^{226}Ra concentrations (e.g., 4–5 pCi g^{-1}) tended to exhibit linear correlation characteristics. Sites with lower minimum measured soil ^{226}Ra concentrations (e.g., 1 pCi g^{-1}) tended to exhibit nonlinear correlation characteristics, with relatively little change in ^{226}Ra concentration over the lower range of measured gamma values until a kind of threshold is reached and ^{226}Ra begins to increase with increasing gamma readings.

Reasons for this threshold effect are likely partially related to those mentioned in the earlier discussion of differences between NaI detector and HPIC readings. At a given site, cosmic sources are relatively constant and variations in NaI readings are due to variations in terrestrial radionuclide concentrations. When terrestrial ^{226}Ra sources begin to exceed about 1 pCi g^{-1} at these sites, a greater percentage of lower energy photons interact with the NaI detectors and relative response appears to cross a threshold between underprediction and overprediction of true exposure rates. As gamma readings increase above this threshold, a more linear correlative relationship between ^{226}Ra and gamma readings becomes apparent.

Despite the potential explanations above for an apparent threshold effect, both linear and nonlinear models were used to convert gamma survey data to estimates of ^{226}Ra concentrations in surface soils. Both data sets were kriged and mapped to help assess which model at each site is best supported by subsequent radial grid soil sampling results (U.S. NRC Regulatory Guide 4.14 soil sampling protocols are also being implemented as part of baseline studies at these sites). This type of confirmation sampling can also help to assess the representativeness of correlation plot sampling locations.

Spatial differences in the distributions of estimated soil ^{226}Ra concentrations based on linear and nonlinear models for a proposed ISR site are shown in Fig. 11. In terms of remedial issues, the

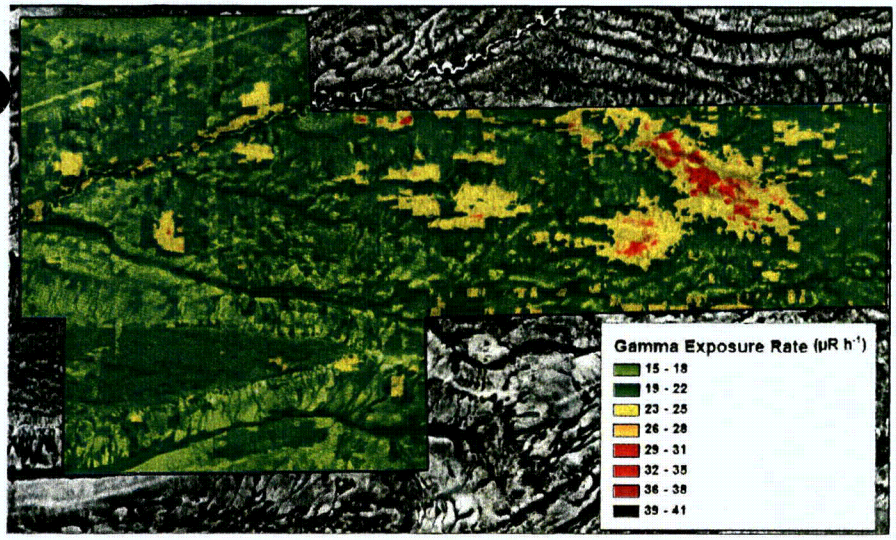

Figure 8. Kriged 1 m HPIC equivalent gamma survey map of a proposed 1,618 hectare (4,000 acre) ISR uranium project area in Wyoming.

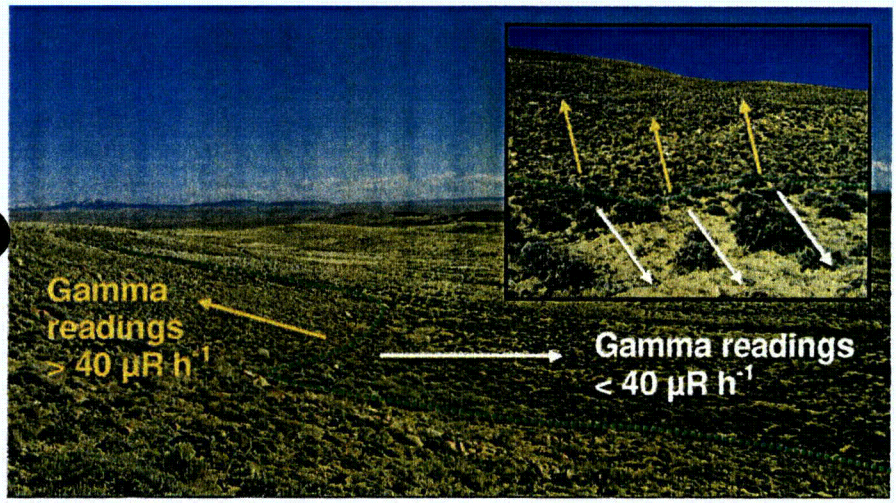

Figure 9. Visible, geomorphic boundary delineating abrupt transition in gamma exposure rates.

implications of which predictive model is used are quite apparent at this particular site. Regardless of what model is ultimately used, it is unlikely that areas with elevated radiological baseline conditions would be adequately characterized based solely on grid sampling as indicated by currently applicable regulatory guidelines. These elevated areas are generally downwind of the proposed plant location and often fall just outside of respective radial grid sampling locations as indicated in Regulatory Guide 4.14. This observation highlights a key advantage of using GPS-based, high-density gamma scanning and correlation techniques to characterize entire sites.

Available data to date have enabled one proposed ISR site to be evaluated with respect to which type of predictive model is most strongly supported by confirmatory soil sampling results. Overall, a nonlinear model predicted soil ^{226}Ra concentrations at this site more accurately than a linear model. Nonlinear modeling estimates and actual soil sampling results are shown in Fig. 12. Optimal spatial detail at individual sampling locations is not resolved in this figure but locally enlarged views of the data indicate that

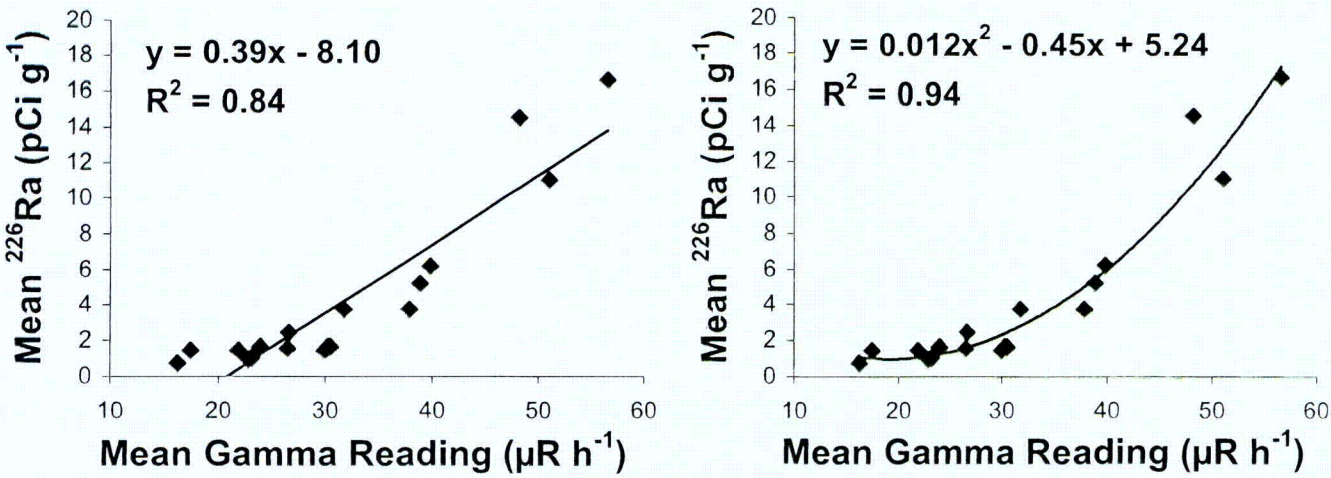

Figure 10. Comparison of linear (left) and nonlinear (right) models fitted to combined gamma/^{226}Ra correlation plot data from two nearby ISR sites in Wyoming.

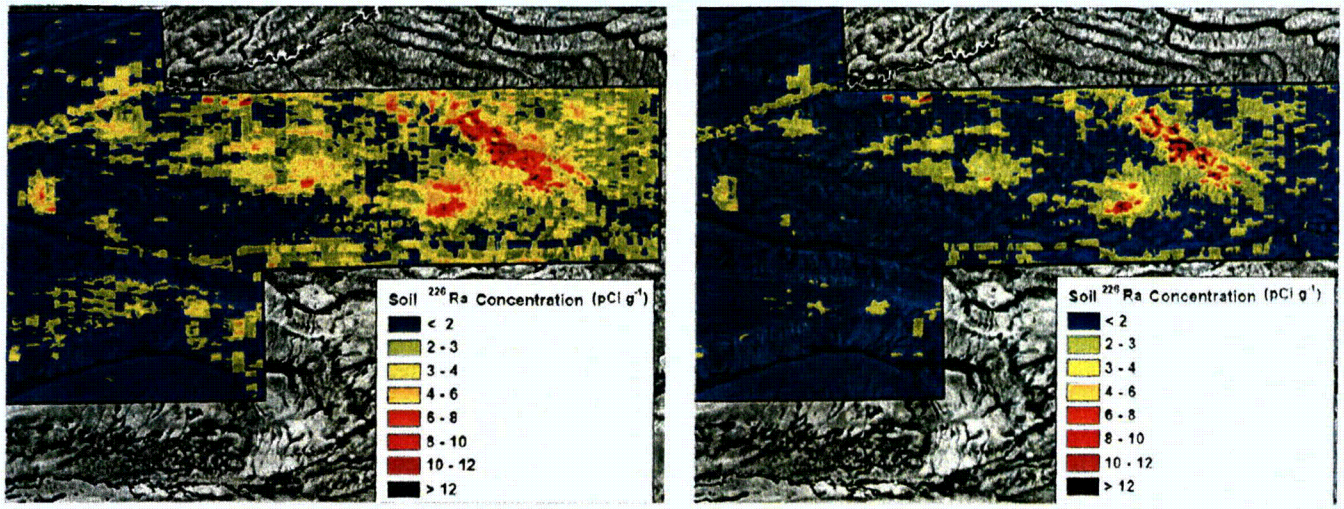

Figure 11. Comparison of continuously estimated soil ^{226}Ra concentrations based on linear (left) and nonlinear (right) models fitted to gamma/^{226}Ra correlation plot data for a proposed ISR site in Wyoming.

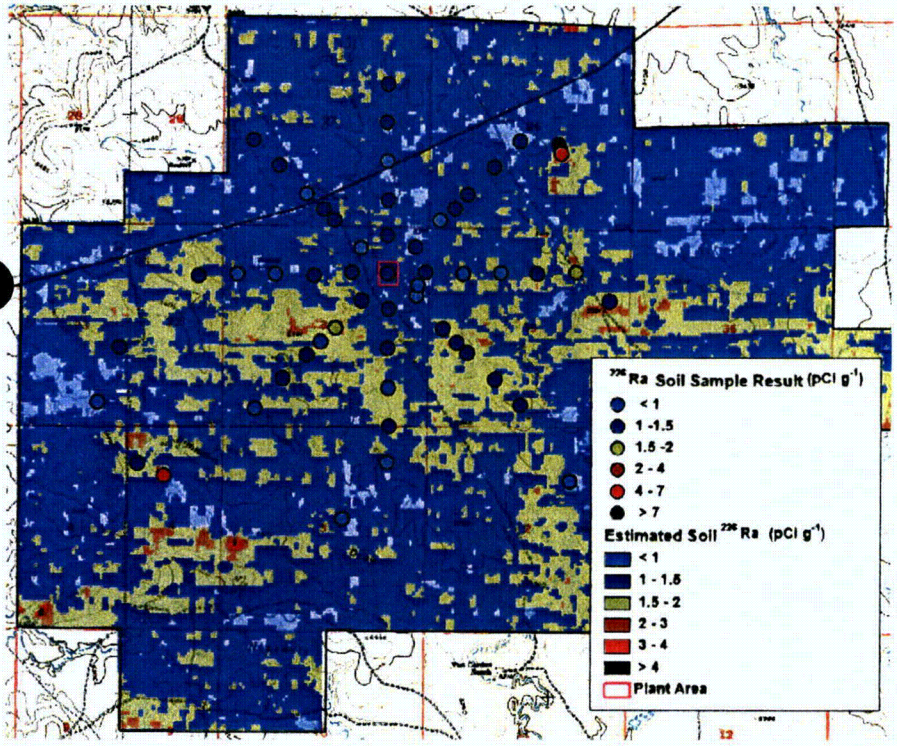

Figure 12. Comparison of continuous estimates of soil ^{226}Ra concentrations predicted with a nonlinear model vs. actual soil sampling results at a proposed ISR site in Wyoming.

differences between modeled and measured values are generally less than ± 1 pCi g^{-1}, not greatly different from analytical uncertainties reported by the laboratory (which ranged up to ± 0.6 pCi g^{-1}). As mentioned, however, not all sites demonstrate nonlinear correlation characteristics and correlation data need to be adequately representative to have the best chance of choosing the appropriate model.

Finally, caution must be exercised with respect to extrapolating predictive models beyond the range of measured correlation data. In these studies, prediction data outside this range were sometimes artificially truncated to avoid such extrapolation, depending on the nature of the correlation and respective potential to significantly impact kriging results. In all cases, the validity of gamma-based estimates of ^{226}Ra are limited to the range of measured correlation data and beyond that range only general qualitative statements such as "less than" or "greater than" are justified. Furthermore, limitations mentioned earlier for uranium mill site estimates also apply to estimates developed for the proposed ISR uranium project area studies.

CONCLUSION

Although gamma/^{226}Ra correlation techniques are not new, the GPS-based scanning systems used for these projects involve more recent technology that can quickly and efficiently collect large amounts of information about the spatial distribution of terrestrial sources of gamma radiation across extensive areas. Mapped data presentations and confirmatory soil sampling results suggest that high-density gamma scanning combined with correlation techniques was an effective overall survey approach for these projects and represents general improvement in characterization capabilities for large sites.

Limitations on correlation-based ^{226}Ra estimates include potential prediction error in areas with significant heterogeneity in soil ^{226}Ra concentrations, gamma shine effects, or areas beyond the range of measured correlation data. Poor correlation results can result from insufficient sample size, inadequate representativeness of correlation plot locations, soil ^{226}Ra heterogeneity, or gamma shine. Nonlinearity in correlation characteristics can result at sites where pervasively low ^{226}Ra concentrations are reflected in the measured correlation data, possibly due to a threshold effect between detector response and the ratio of terrestrial to cosmic gamma sources.

Integrating a full range of GIS spatial analysis capabilities into this radiological survey approach allows various and sometimes subtle types of information contained in the survey data to be successfully identified, interpreted, and assessed with respect to project objectives. Kriging results displayed on topographical contour maps or aerial photos can provide detailed and highly informative characterizations of various radiological parameters across entire sites. This information can have important implications with respect to site decommissioning and license termination.

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RESPONSES TO NRC COMMENTS
of 11/6/2008 on

SECTION 3.0
Description of the Proposed Facility

in the Technical Report for the
LOST CREEK PROJECT
Wyoming

Section 3.2 Mine Unit Process, Instrumentation and Control)

LCI has not provided sufficient information regarding the ISR mine unit operation and instrumentation and control to enable the staff to fully understand this topic and to support other reviews dependent on that understanding. Specifically, the following information should be provided:

1. ***A clarification and explanation for how selective completion of the mine unit monitoring well ring in specific sands in the HJ horizon will be sufficient to capture horizontal excursions outside the extraction zone. For example, if the monitoring ring well is only completed in the MHJ sand in the belief it is the only sand present at the location, an excursion may migrate through the LHJ or UHJ without detection. Furthermore, please justify the use of 500 feet for the monitoring well ring spacing.***

   Please see Lost Creek ISR, LLC's (LC ISR, LLC's) responses of December 12, 2008.

2. ***A monitoring strategy (number, location of wells) for detecting excursions into the FG sand when it is juxtaposed across the fault from the HJ extraction zone (figures 2.6-1 c-e).***

   Please see LC ISR, LLC's responses of December 12, 2008.

3. ***A monitoring strategy (number, location of wells) for detecting excursions into the KM sand when it is juxtaposed across the fault from the HJ extraction zone (figures 2.6-1 c-e).***

   Please see LC ISR, LLC's responses of December 12, 2008.

4. ***A description of which sands will be used to provide water for well drilling and completions and the total volume anticipated to be withdrawn. An evaluation of whether the water use in these sands will impact water levels in the overlying extraction or underlying aquifers.***

   The attached 'Water Supply Well' table includes information regarding each of the five water supply wells used for the Lost Creek Project. As shown in the table, four of the wells are completed in sands that are located at least 190 feet below the bottom of the Sage Brush Shale, which underlies the primary production zone, the HJ Horizon. There are four to seven clayey units, each of which is at least five feet thick, between the completion zone and the Sage Brush Shale in each of those wells. Based on the projected average rate of production from the water supply wells (3.6 gpm/well) it is unlikely that use of these sands for well drilling and completion activities will result in

significant impact in the production zone or overlying and underlying aquifers. The fifth well (LC1W) is completed within the Upper FG Sand (UFG), approximately one mile west of the western edge of Mine Unit 1. This well is completed 115 feet above the Lost Creek Shale that separates the Lower FG Sand (LFG) from the HJ Horizon. There are also two clayey intervals between the LC1W completion interval and the Lost Creek Shale. Based on the distance to the Mine Unit, the intervening clayey units, and the low projected pumping rate, it is not anticipated that withdrawal from the UFG for well drilling purposes will cause significant drawdown in the HJ Horizon. It is possible that pumping from the UFG may result in drawdown within the LFG, which is the overlying aquifer to the production zone. If drawdown becomes apparent within the LFG monitor wells inside the Mine Unit, the shallow water supply well will be temporarily shut-in and the water level response in the LFG monitor wells will be observed. If the water levels recover within the LFG wells once the pumping in the UFG is stopped, then the water supply well would be identified as the cause of water level decreases. If water level recovery does not occur in the LFG, then LC ISR, LLC would act on the assumption that operation of the Mine Unit is causing the drawdown and proceed accordingly with corrective action, if necessary.

5. ***Standard industry practice for MIT tests requires less than a 10 percent pressure drop of 20 minutes. Please justify the use of the standard of less than 5 percent pressure drop over 10 minutes.***

   Please see LC ISR, LLC's responses of December 12, 2008.

6. ***Methods for timely detection and cleanup of leaks in the wellfield at wellheads and in surface and buried lines in the wellfield.***

   Please see LC ISR, LLC's responses of December 12, 2008.

7. ***Descriptions of the process and wellfield instrumentation, controls and radiation safety monitoring instrumentation, including their minimum specifications and operating characteristics. LCI provides only a general commitment to have instrumentation and controls to monitor production, injection, and waste flows, and to have instrumentation to alarm for system failures. The descriptions of the process and wellfield instrumentation and controls and radiation safety monitoring instrumentation need to be more detailed and specific, including their minimum specifications and operating characteristics (alarms, interlocks, etc.). The descriptions should focus on how the instrumentation and controls are adequate to identify quickly and remedy all potential processing problems that can increase exposures to radiological and chemical hazards.***

   Please see LC ISR, LLC's responses of December 12, 2008.

8. ***Revised drawdown calculations for the extraction zone which include the impact of the fault as opposed to the infinite aquifer assumption during full capacity operation (6000 gpm) with groundwater sweep (original no-fault calculations on page 3-14 estimate 146 ft and 114 ft drawdown at 2 and 3 miles respectively). Please account for the fact that the fault, if it is sealing as described, will separate the extraction area into two zones. The consumptive use will exacerbate the drawdown in the presence of a sealing fault and change the impact of the drawdown on both sides of the fault. One may use an analytical model and account for the influence of the fault through superposition of image wells across the fault to estimate the drawdown.***

   Please see LC ISR, LLC's responses of December 12, 2008.

9. ***A potentiometric contour map showing the calculated drawdown for full capacity consumptive water use over a five mile radius and the wells within this radius which may be impacted.***

   A drawdown contour map showing the calculated drawdown for full capacity consumptive water use over a five-mile radius and the wells within that radius is provided in the attached 'Drawdown Map'. Data from the site indicate that the Lost Creek Fault does not extend beyond the License Area. The Lost Creek Fault will have minimal impact on drawdown at a distance of five miles from the license boundary. Therefore, the drawdown was calculated assuming no boundary conditions, with a single well at the centroid of the License Area pumping at a rate of 175 gpm for a period of eight years. The previously determined aquifer properties of transmissivity (144 ft^2/d) and storativity (7.0E-05) were used for the drawdown calculation (see LC ISR, LLC's response to Comment 3.2 #8 submitted on December 12, 2008). Results of that simulation are presented on the attached 'Drawdown Map'.

10. ***A comprehensive explanation of how LCI will operate the mine units in the HJ horizon to address the potentially large drawdowns that will occur near the fault when the operation is up to full capacity.***

    As previously described in the Response to Comment 2.7 #2c, the "effective" aquifer transmissivity, considering the impact of the fault as a no-flow barrier, is on the order of 70 ft^2/d. However, the actual transmissivity is approximately double that value at 140 to 150 ft^2/d. The projected production and restoration rates have accounted for the 'effective' transmissivity present near the fault. Although large drawdown is anticipated during production and restoration, there is sufficient hydraulic head to support the projected pumping rates.

The largest drawdown will occur during restoration when net rates of up to 160 gpm will be withdrawn from the aquifer. The Response to Comment 6.2 #5 (Section 6.2 - Plans and Schedules for Groundwater Quality Restoration) addresses the potential drawdown that may occur and demonstrates that there is sufficient hydraulic head above the HJ Horizon to maintain anticipated pumping rates for the projected duration of restoration. In the event that drawdown exceeds the calculated values, production and restoration rates will be adjusted accordingly to maintain sufficient hydraulic head for ISR operations.

11. ***A statement that LCI will submit all wellfield hydrologic packages to NRC for review and approval before extraction begins, as LCI does not have a record of performance with NRC.***

Please see LC ISR, LLC's responses of December 12, 2008.

12. ***Section 4.1.2 of the application discusses the ventilation systems that are planned for the facility. Please provide details on the type, size, and location of the ventilation systems.***

Please see LC ISR, LLC's responses of December 12, 2008.

13. ***Please discuss radiation safety monitoring devices and other process safety controls that will be used within the central processing plant. The discussion should focus on the availability and reliability of these systems. This should include a discussion of controls that are used to minimize or eliminate the hazards presented by radioactive materials or chemicals that may impact radiological safety.***

Please see the attached 'Risk Assessment' table for an evaluation of the operational risks associated with interaction of chemicals used in the operation and radioactive materials. The table consists of five parts. The first part is a description of the three scenarios that were evaluated in which a chemical/radiological interaction could occur (e.g., a fire). The second part indicates where within the plant a chemical could possibly react with piping or tank materials, potentially resulting in contact with radioactive materials (e.g., leakage due to pipe corrosion). The second, third, and fourth parts provide detail about each of the three scenarios, respectively. For each scenario, the detail includes a chart of the likelihood of interaction of the chemical with radioactive materials compared to the severity of the consequences of that interaction, from a radiological standpoint, should those events occur. The detail also includes discussion of the risks associated with the interactions and the operational procedures to help prevent those interactions and mitigate the consequences (e.g., selection of appropriate piping material).

14. ***Please provide details regarding the quantities and storage locations of chemicals that will be used at the facility. This should include a list of federal, state, and local regulations that LCI intends to use to ensure that chemicals that have the potential to impact radiological safety are handled in a safe and appropriate manner. Also, please provide a discussion of the operating conditions (temperature, pressures, and flow rates) that will exist during operation of the central processing plant for both radioactive and non-radioactive materials that may have an impact on radiological safety.***

Chemical	Maximum Amount in Storage (Approx.)	Location	Temperature	Pressure (Max)	Flow Rate (Max)	Regulations
50% H_2O_2	7850 gal	Plant	Ambient	120 psi	20 gpm	OSHA/WYPDES
37% HCl	10150 gal	Outside - secure area	Ambient	120 psi	20 gpm	OSHA/WYPDES
NaCl	15200 gal	Plant	Ambient	120 psi	20 gpm	OSHA/WYPDES
NaOH	16900 gal	Plant	> 55 ^{0}F	120 psi	20 gpm	OSHA/WYPDES
Soda Ash	16900 gal	Plant	> 55 ^{0}F	120 psi	20 gpm	OSHA/WYPDES
Bicarobonate	10150 gal	Plant	Ambient	120 psi	20 gpm	OSHA/WYPDES

<u>3.3 Plant Processes, Instrumentation and Control</u>

LCI did not provide sufficient information to assess the plant processes, instrumentation, and controls of the proposed facility. Such information is necessary to determine if LCI will be operating its central plant safely. Please provide the following information requested below.

Please see LC ISR, LLC's responses of December 12, 2008 for all the comments on Section 3.3 of the Lost Creek Technical Report.

List of Information Included with the Responses
to
NRC Comments on Lost Creek TR Section 3.0
January 16, 2009

For Comment 3.2 #4:
New Table - LC ISR, LLC Water Supply Wells

For Comment 3.2 #9:
New Figure - Simulated Drawdown in the HJ Horizon within Five Miles of the Permit Area

For Comment 3.2 #11:
New Table - Site Specific Risk Analysis of Potential Interactions between Chemical Systems and Radioactive Material

Response to Comment 3.2 #4 - LC ISR, LLC Water Supply Wells

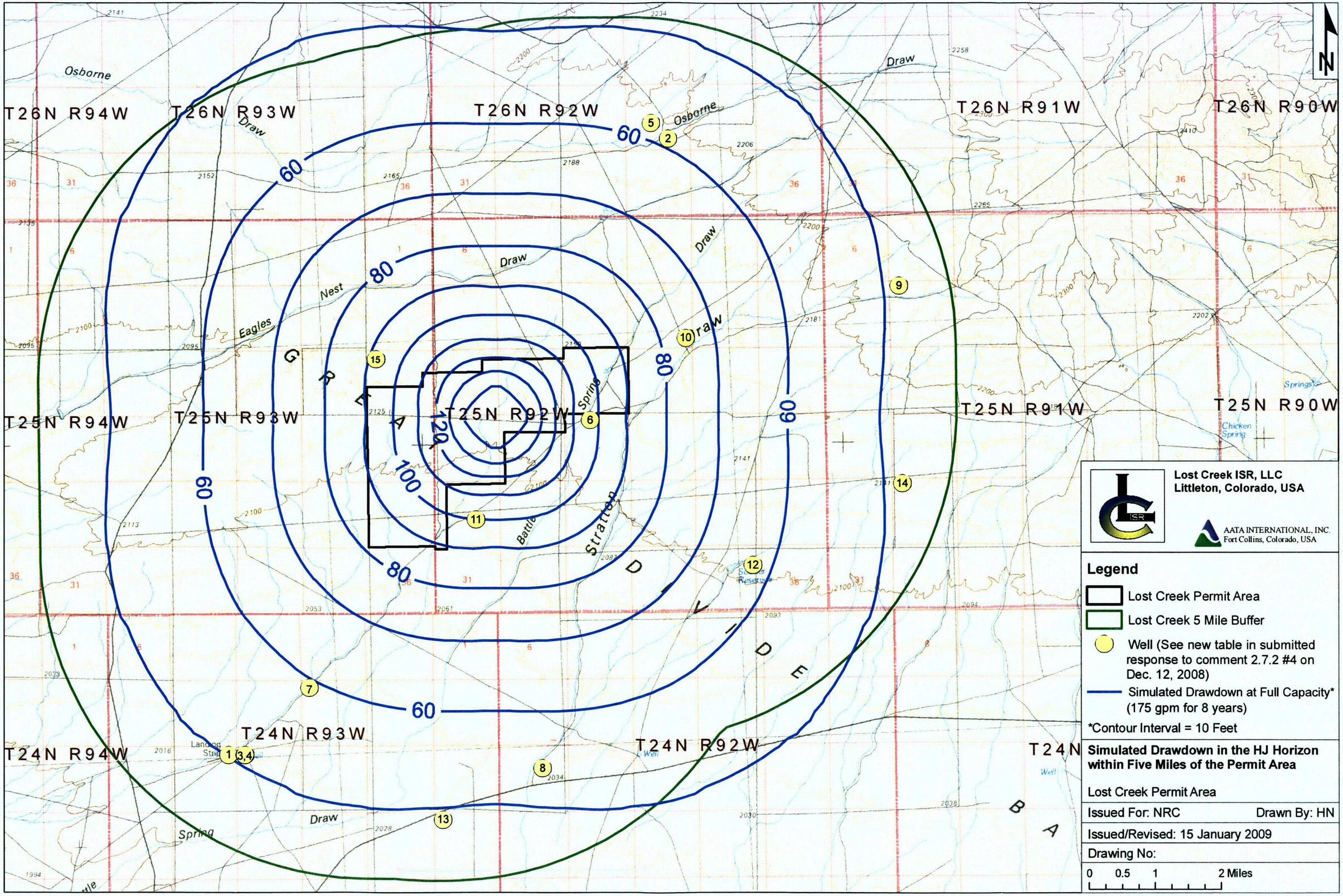
Well #	Date Completed	Completion Interval(s)	Horizon	Map Coordinates (NAD 83)		Comments
				Easting	Northing	
LC1W	09/30/05	300-360	Upper FG Horizon	2203585	595463	Completion interval is about 115 feet above Lost Creek Shale (LCS), with 2 aquicludes between LCS and completion interval. [1]
LC32W	05/01/07	737-845	Unnamed	2215385	597511	Completion interval is 240 ft below Sagebrush Shale (SBS), with 6 aquicludes between SBS and completion interval.
LC33W	07/17/07	800-895	Unnamed	2216487	595018	Completed interval is 330 ft below SBS, with 6 clay aquicludes between SBS and completion interval.
LC229W	06/03/08	863-888 915-945 955-985	Unnamed	2209390	598293	Completed interval is 310 ft below SBS, with 7 aquicludes between SBS and completion interval.
LC606W	10/09/08	670-685 690-715 735-740	Unnamed	2202739	586368	Completed interval is 190 ft below SBS, with 4 aquicludes between SBS and completion interval.

[1] Aquicludes imply predominantly clay lithology at least 5 feet thick.

Drilling Water Needs

Assumptions	
500	drill hole & wells per year (300 Delineation + 200 Wells)
650	average depth per hole
325,000	avg feet per year of drilling

Calculation	
0.52	avg # water loads per 100' of drilling (all hole types) Lost Creek - 2008 average
1690	# loads of water per year (total project)
135,200	# bbls of water per year (total project)
5,678,400	# gal of water per year (total project)
3	# of water wells used as supply
1,892,800	# gal of water per year per well
3.6	= avg gpm /per well [24:7 operation]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Eagles
Spring
Stratton
Battle
Chicken Spring
Springs
Landing Strip
Well
GRAND VALLEY BASIN
60
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Lost Creek ISR, LLC
Littleton, Colorado, USA
AATA INTERNATIONAL, INC.
Fort Collins, Colorado, USA
Legend
Lost Creek Permit Area
Lost Creek 5 Mile Buffer
Well (See new table in submitted response to comment 2.7.2 #4 on Dec. 12, 2008)
Simulated Drawdown at Full Capacity* (175 gpm for 8 years)
*Contour Interval = 10 Feet
Simulated Drawdown in the HJ Horizon within Five Miles of the Permit Area
Lost Creek Permit Area
Issued For: NRC
Drawn By: HN
Issued/Revised: 15 January 2009
Drawing No:
0 0.5 1 2 Miles

Response to Comment 3.2 #13
Site Specific Risk Analysis of Potential Interactions between Chemical Systems and Radioactive Material
(Page 1 of 8)

Credible Scenarios Involving Chemicals that Could Result in a Radiological Release

Scenario Number	Cause	Description
1	**Piping Break**	In this scenario, the broken chemical piping could allow the chemical to spill onto another material with which it is not compatible. The chemical reaction could result in the release of radioactive material.
2	**Fire/Excessive Heat**	In this scenario, the fire or excessive heat would increase the chance of a chemical reaction. Materials that were once suitable for the application are no longer suitable because of the increased heat. This would allow a reaction to occur and could cause piping material to fail. This could allow the chemical to come into contact with incompatible materials, possibly resulting in the release of radioactive material.
3	**Instrument Failure**	In this scenario, the instrumentation fails and allows the chemicals to overflow out of their storage tanks, or the process tank. Having the chemicals overflow could allow the chemicals to come into contact with incompatible materials. Again, this could possibly result the chemicals overflow could allow the chemicals to come into contact with incompatible materials. Again, this could possibly result in the release of radioactive material.

Response to Comment 3.2 #13

Site Specific Risk Analysis of Potential Interactions between Chemical Systems & Radioactive Material (Page 2 of 8)

Possible Interactions and Reactions

DNR	Does Not React
NC	No Contact

SR	Slight Reaction Possible
R	Reaction Possible

Possible Affected Components

		Construction Material [2]	Waste Water Tanks	De-Gassing Tanks	Restoration Pumps	Injection/ Production Pumps	Fresh Eluant Tanks	Permeate Tank	Precip Tanks*	RO Circuit Piping	Elution Piping	Waste Water Piping	Precip Piping [1]	Production Piping
Scenario	**Chemical**	Component / Chemical / System Piping	*Fiber-glass*	*PVC*	*Carbon Steel*	*Carbon Steel*	*Fiber-glass*	*Fiber-glass*	*Fiber-glass*	*PVC/ Carbon Steel*	*PE/ Carbon Steel*	*PE/ Stainless Steel*	*PE/ Carbon Steel*	*PE/ Carbon Steel*
Line Break	50% H_2O_2	Stainless Steel	NC	SR	R	R	DNR	DNR	DNR	SR/R	DNR/R	DNR/R	DNR/R	DNR/R
	Soda Ash	PVC	NC	NC	DNR	DNR	DNR	DNR	NC	DNR	DNR	DNR	NC	NC
	NaCl	PVC	DNR	DNR	SR	NC	DNR	DNR	NC	DNR/SR	DNR/SR	DNR/SR	NC	NC
	NaOH	PVC	DNR	DNR	SR	NC	DNR	DNR	DNR	DNR/SR	DNR/SR	DNR/SR	DNR/SR	DNR/SR
	37 % HCl	PVC	DNR	DNR	R	R	DNR	DNR	DNR	DNR/R	DNR/R	DNR/R	DNR/R	DNR/R
	Bicarbonate	PVC	NC	NC	SR	SR	NC	NC	NC	NC	NC	DNR/SR	NC	DNR/SR
Excessive Heat/Fire	50% H_2O_2	Stainless Steel	NC	R	R	R	R	R	R	R	R	R	R	R
	Soda Ash	PVC	NC	NC	DNR	DNR	SR	SR	NC	SR	SR	SR	SR	NC
	NaCl	PVC	DNR	SR	SR	NC	DNR	DNR	NC	SR	SR	SR	NC	NC
	NaOH	PVC	SR	SR	SR	NC	SR	SR	SR	SR	SR	SR	SR	SR
	37 % HCl	PVC	R	R	R	R	R	R	R	R	R	R	R	R
	Bicarbonate	PVC	NC	NC	SR	SR	NC	NC	NC	NC	NC	R	NC	R
Instrument Failure	50% H_2O_2	Stainless Steel	NC	NC	NC	NC	NC	NC	DNR	NC	NC	NC	DNR/R	NC
	Soda Ash	PVC	NC	NC	NC	NC	DNR	NC	NC	NC	DNR	NC	NC	NC
	NaCl	PVC	NC	NC	NC	NC	DNR	NC	NC	NC	DNR	NC	NC	NC
	NaOH	PVC	NC	NC	NC	NC	NC	NC	DNR	NC	NC	NC	DNR/SR	NC
	37 % HCl	PVC	NC	NC	NC	NC	NC	NC	DNR	NC	NC	NC	DNR/R	NC
	Bicarbonate	PVC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

[1] Precip = Precipitation.

[2] Construction materials are preliminary.

Response to Comment 3.2 #13
Site Specific Risk Analysis of Potential Interactions between Chemical Systems & Radioactive Material (Page 3 of 8)

Pipe/Line Break

Likelihood of Occurrence	1	2	3	4	5	6
A						
B						
C			H_2O_2 HCl			
D	Soda Ash Bicarb	NaCl NaOH				
E						
F						

Severity of Consequence

Legend/Key

Likelihood of Occurrence:

A: Event has more than a 90% chance of occurrence.
B: Event has between 70% and 90% chance of occurrence.
C: Event has between 50% and 70% chance of occurrence.
D: Event has between 30% and 50% chance of occurrence.
E: Event has between 10% and 30% chance of occurrence.
F: Event has less than a 10% chance of occurrence.

Severity of Consequence:

1: Event will result in no release of radioactive materials.
2: Event could release small amounts of radioactive material; exposures would have little or no change.
3: Event could release moderate amounts of radioactive material; exposures would be elevated but still considerably less than the regulatory limits.
4: Event could release large amounts of radioactive material; exposures could be approaching regulatory limits.
5: Event could release large amounts of radioactive material; exposures could exceed regulatory limits.
6: Event will result in a release of radioactive materials; exposure limits would be exceeded.

High Risk	Countermeasures will need to be taken.
Moderate Risk	Countermeasures will need to be considered.
Low Risk	No countermeasures will need to be taken.

Response to Comment 3.2 #13
Site Specific Risk Analysis of Potential Interactions between Chemical Systems & Radioactive Material (Page 4 of 8)

Analysis of Risks (Pipe/LineBreak):

Chemical	
H_2O_2	Hydrogen peroxide can be corrosive to both PVC and carbon steel. The piping material selected for use in the peroxide circuit will be non-reactive with the chemical. The flow for the peroxide service will be low (< 20 gallons per minute) and will be intermittent use. In order for peroxide to cause a release of radioactive material, it would have to leak/drip on the same section of pipe or tank undetected for an extended period of time in order to compromise the integrity of the other materials. The radioactive materials that peroxide could come in to contact with are injection fluid, production fluid, fresh eluate, RO permeate, RO concentrate, precipitation fluid, and waste water. All of these radioactive materials are in liquid form and would not cause exposures to exceed regulatory limits. With the selection of the proper peroxide piping material and the process control devices put in place, the risk associated with peroxide can be reduced (from cell C3 to cell D3 in the risk chart) and no other countermeasures would need to be taken.
HCl	Hydrochloric acid can be corrosive to carbon steel. The piping material selected for use in the acid circuit will be non-reactive with the chemical. The flow for the acid circuit will be low (< 20 gallons per minute) and will be intermittent use. In order for acid to cause a release of radioactive material, it would have to leak/drip on the same section of pipe or tank undetected for an extended period of time in order to compromise the integrity of the other materials. The radioactive materials that the acid could come into contact with are injection fluid, production fluid, fresh eluate, RO permeate, RO concentrate, precipitation fluid, and waste water. All of these radioactive materials are in liquid form and would not cause exposures to exceed regulatory limits. With the selection of the proper acid piping material and the process control devices put in place, the risk associated wtih the acid can be reduced (from cell C3 to cell D3 in the risk chart) and no other countermeasures will need to be taken.

Response to Comment 3.2 #13
Site Specific Risk Analysis of Potential Interactions between Chemical Systems & Radioactive Material (Page 5 of 8)

Excessive Heat/Fire

Likelihood of Occurrence	1	2	3	4	5	6
A						
B						
C						
D						
E						
F		Soda Ash NaCl	NaOH	Bicarb	H_2O_2 HCl	

Severity of Consequence

Legend/Key

Likelihood of Occurrence:

A: Event has more than a 90% chance of occurrence.
B: Event has between 70% and 90% chance of occurrence.
C: Event has between 50% and 70% chance of occurrence.
D: Event has between 30% and 50% chance of occurrence.
E: Event has between 10% and 30% chance of occurrence.
F: Event has less than a 10% chance of occurrence.

Severity of Consequence:

1: Event will result in no release of radioactive materials.
2: Event could release small amounts of radioactive material; exposures would have little or no change.
3: Event could release moderate amounts of radioactive material; exposures would be elevated but still considerably less than the regulatory limits.
4: Event could release large amounts of radioactive material; exposures could be approaching regulatory limits.
5: Event could release large amounts of radioactive material; exposures could exceed regulatory limits.
6: Event will result in a release of radioactive materials; exposure limits would be exceeded.

High Risk	Countermeasures will need to be taken.
Moderate Risk	Countermeasures will need to be considered.
Low Risk	No countermeasures will need to be taken.

Response to Comment 3.2 #13
Site Specific Risk Analysis of Potential Interactions between Chemical Systems & Radioactive Material (Page 6 of 8)

Analysis of Risks (Fire):

Chemical	
Bicarb	Bicarbonate - with excessive heat (above 120 F), there is an increased chance of a chemical reaction with carbon steel and polyethylene materials. In the plant, there is less than a 10% chance that a fire would be able to continue for a long period of time because the materials in the plant are non-combustible (concrete, steel, and fiberglass). No countermeasures are required.
H_2O_2	Hydrogen peroxide - with excessive heat (above 120 F), there is an increased chance of a chemical reaction with carbon steel, PVC, fiberglass, and polyethylene materials. In the plant, there is less than a 10% chance that a fire would be able to continue for a long period of time because the materials in the plant are non-combustible (concrete, steel, and fiberglass). No countermeasures are required.
HCl	Hydrochloric acid - with excessive heat (above 120 F), there is an increased chance of a chemical reaction with carbon steel, PVC, fiberglass, and polyethylene materials. In the plant, there is less than a 10% chance that a fire would be able to continue for a long period of time because the materials in the plant are non-combustible (concrete, steel, and fiberglass). No countermeasures are required.

Response to Comment 3.2 #13
Site Specific Risk Analysis of Potential Interactions between Chemical Systems & Radioactive Material (Page 7 of 8)

Instrument Failure

Likelihood of Occurrence	1	2	3	4	5	6
A						
B	Soda Ash NaCl Bicarb	NaOH	H_2O_2 HCl			
C						
D						
E						
F						

Severity of Consequence

Legend/Key

Likelihood of Occurrence:

A: Event has more than a 90% chance of occurrence.
B: Event has between 70% and 90% chance of occurrence.
C: Event has between 50% and 70% chance of occurrence.
D: Event has between 30% and 50% chance of occurrence.
E: Event has between 10% and 30% chance of occurrence.
F: Event has less than a 10% chance of occurrence.

Severity of Consequence:

1: Event will result in no release of radioactive materials.
2: Event could release small amounts of radioactive material; exposures would have little or no change.
3: Event could release moderate amounts of radioactive material; exposures would be elevated but still considerably less than the regulatory limits.
4: Event could release large amounts of radioactive material; exposures could be approaching regulatory limits.
5: Event could release large amounts of radioactive material; exposures could exceed regulatory limits.
6: Event will result in a release of radioactive materials; exposure limits would be exceeded.

High Risk	Countermeasures will need to be taken.
Moderate Risk	Countermeasures will need to be considered.
Low Risk	No countermeasures will need to be taken.

Response to Comment 3.2 #13
Site Specific Risk Analysis of Potential Interactions between Chemical Systems & Radioactive Material (Page 8 of 8)

Analysis of Risks (Instrument Failure):

Chemical	
All	It is likely that instrumentation will fail at some point. However, there will be redundant instrumentation on the chemical systems at the tank (i.e. level and flow) as well as at the destination point (i.e. level and pH). It is highly unlikely that all of the instrumentation would fail at once. Therefore, the likelihood of occurrence can be moved from the "B" level down to the "F" level in the risk chart. No further countermeasures are required.

RESPONSES TO NRC COMMENTS
of 11/6/2008 on

SECTION 4.0
Effluent Control Systems

in the Technical Report for the
LOST CREEK PROJECT
Wyoming

Section 4.0 Effluent Control Systems

LCI did not provide sufficient information to assess the effluent control systems for the proposed facility. Information regarding the workplace ventilation, radiation monitoring, effluent composition, liquid and solid wastes is necessary to allow the staff to assess the manner in which LCI is protecting public health and the environment. Please provide the following information requested below.

Section 4.1 Gaseous Emissions and Airborne Particulates

Please see Lost Creek ISR, LLC's (LC ISR, LLC's) responses of December 12, 2008 for all the comments on Section 4.1 of the Lost Creek Technical Report.

Section 4.2 Liquid Wastes

LCI needs to provide the following additional information related to the liquid effluents at the proposed facility:

1. ***Provide information on the expected chemical and radiological composition of the liquid waste stream to be disposed of in the deep wells.***

   Please see the attached table which outlines the anticipated composition of the waste stream.

2. ***Provide additional information related to releases on site. The discussion should address the following issues: the health and safety impacts of a spill, inspection practices, inspection frequencies, measures planned to contain spills on or below the ground surface within wellfields or near evaporation ponds, details of the planned fluid detection system, procedures for determining if a radiation work permit will be needed to address a release, notification, and recordkeeping efforts related to spills.***

   Please see LC ISR, LLC's responses of December 12, 2008.

3. ***The proposed storage ponds need to meet the applicable requirements of 10 CFR Part 40, Appendix A. LCI needs to provide the following additional information to allow for NRC staff to compare the proposed pond design to the applicable requirements of 10 CFR Part 40, Appendix A:***

   a. ***The results of the geotechnical investigation for the proposed pond location, including discussion of soil classification, grain size analysis, compaction, and density requirements. The results of the geotechnical investigation***

should also discuss the liquefaction potential of the soils that will be used to construct the storage pond embankments.

Two documents are attached on the design and specifications for the storage ponds ("Design Report, Ponds 1 & 2", dated January 2009, and "Technical Specification", dated April 2008, both by Western States Mining Consultants). Please refer to Section 5.0 of the Design Report for discussion of the liquefaction potential of the soils. In addition, Appendix B of the Design Report provides the results of the geotechnical investigation at the proposed pond location ("Subsurface Exploration and Geotechnical Engineering Report" by Inberg Miller Engineers dated September 2008).

b. ***Evaluations of both slope stability and settlement demonstrating that the pond will remain stable and that the liner system will not be compromised. The slope stability analysis should consider the critical section of the proposed embankment under the anticipated loading conditions. The settlement analysis should reflect the foundation soil conditions, liner system, and anticipated loading conditions.***

Two reports are attached on the design and specifications for the storage ponds ("Design Report, Ponds 1 & 2", dated January 2009, and "Technical Specification", dated April 2008, both by Western States Mining Consultants). Please refer to Section 2.0 of the Design Report for discussion of the evaluation of the slope stability and settlement. In addition, to support the conclusions of the Design Report, Appendix B of that report provides the results of the geotechnical investigation at the proposed pond location ("Subsurface Exploration and Geotechnical Engineering Report" by Inberg Miller Engineers dated September 2008).

c. ***An analysis of the required freeboard in the storage ponds. The storage ponds should have adequate freeboard to allow for transfer of liquids between the ponds in the event of a leak and prevent overtopping of the storage ponds by wave run-up or significant rainfall events. Note that wave run-up is dependent on the open area of the pond, the anticipated wind speeds, and the anticipated wind direction at the site.***

Two reports are attached on the design and specifications for the storage ponds ("Design Report, Ponds 1 & 2", dated January 2009, and "Technical Specification", dated April 2008, both by Western States Mining Consultants). Please refer to Section 3.0 of the Design Report for an analysis of the required freeboard.

d. Detailed discussion of the components of the liner system. The discussion should include: the required subgrade preparation techniques, the material and thickness for the impermeable liner, the anticipated liner seaming techniques, the permeability of the sand used in the leak detection layer, and chemical compatibility between the liner material and the liquids stored in the ponds.

Two reports are attached on the design and specifications for the storage ponds ("Design Report, Ponds 1 & 2", dated January 2009, and "Technical Specifications", dated April 2008, both by Western States Mining Consultants). Please refer to Section TS-4 of the Technical Specifications for a detailed discussion of the double liner with leak detection. Also, refer to "Ponds 1 & 2 Reservoir Construction Drawings" for detailed visual construction specifications.

e. A discussion of how the pond areas will be decommissioned and reclaimed.

The Bond Estimate submitted in Table 6.8-1, Worksheet 4 from the Technical Report details the decommissioning and reclamation costs (see Response to Comment 6.8 #4). Stage 1 will be removal of the liquid component and injecting it in the deep disposal wells. Stage 2 will involve removing the sludge via trackhoe, backhoe, loader, or other means and shipping it to an approved 11e-2 byproduct storage facility. Stage 3 will involve unkeying the liner, removing it and shipping it to an approved 11e-2 byproduct storage facility. Stage 4 will involve sampling the subsoil under the liner to insure it is not contaminated. Areas of contamination will be excavated and shipped to an approved 11e-2 byproduct storage facility. Stage 5 will involve sampling the leak detection piping for contamination. If contaminated, it will be shipped to an approved 11e-2 byproduct storage facility. Stage 6, the remaining subsoil will be surveyed for contamination and disposed of as necessary. Once the subsoil is shown to be clean, the pond areas will be recontoured, covered with topsoil and reseeded.

f. A set of detailed drawings showing the planned location of the storage ponds, cross section of the liner system, and construction details.

The attached drawings "Ponds 1 & 2 Reservoir Construction Drawings" by Western States Mining Consultants, dated April 2008, detail the construction specifications of the proposed ponds at the Lost Creek Project.

g. ***A set of construction specifications for the storage ponds. This should include a quality assurance plan for soil and liner installation.***

The attached report "Technical Specifications" by Western States Mining Consultants, dated April 2008, details the construction specifications of the proposed ponds at the Lost Creek Project.

h. ***The results of the preoperational monitoring program to provide a determination of the baseline groundwater quality data in the vicinity of the storage ponds.***

Please refer to Section 2.7.2 and Table 2.7-13 of the Lost Creek Technical Report for information on the overall geohydrologic and water quality conditions in the Lost Creek Permit Area. Several holes were also drilled for the specific purpose of geotechnical investigation and fluid detection in the immediate vicinity of the planned storage ponds. The attached geotechnical report details the subsurface conditions encountered in those borings. The geotechnical report ("Subsurface Exploration and Geotechnical Engineering Report" by Inberg- Miller Engineers, dated September 2008) is included in Appendix B of the Design Report by Western States Mining Consultants, dated January 2009.

As discussed on Pages 3 and 4 of the geotechnical report, no groundwater was encountered in any of the test borings, which were on the order of 20 to 45 feet deep. This is consistent with the observations of the overall geohydrologic conditions in the permit area. As described on Page 2.7-10 of the Technical Report, the shallowest occurrence of groundwater is in the DE Horizon, the top of which is generally at least 100 feet below ground surface. As a precaution, three monitor wells, ranging from 35 to 45 feet deep, were installed in the immediate vicinity of the ponds, even though it is anticipated that these wells will remain dry.

i. ***A detection monitoring program to identify if the storage ponds are leaking. This program should include: the frequency for monitoring the leak detection system, justification for the selection of indicator parameters for sampling liquids found in the leak detection layer and surrounding groundwater monitoring wells, action levels for obtaining chemical samples of liquids in the leak detection system, notifications to be made upon leak identification, and follow up actions after a leak has been identified. Note that the indicator parameters selected should allow for a clear distinction to be made between the liquids contained in the pond and groundwater.***

Please refer to Sections 4.2.5.5 and 5.7.8.3 of the Lost Creek Technical Report for the detection monitoring and pond inspection programs, respectively.

j. A discussion of the location of the ponds and the measures that will be taken to protect the ponds from surface water run on. This may require a review of the upstream catchment area and any diversion channels or slope protection around the embankments.

The ponds will be located in a relatively flat area with an embankment on all sides. The average height of the embankment is seven feet, which would prevent surface water from entering the ponds. The attached Drain Plans (3 sheets) by Western Water Consultants detail the drainage specifications for the proposed ponds at the Lost Creek Project.

k. A discussion of any anticipated maintenance activities that may be required over the life of the storage ponds.

The pond inspection program is detailed in Section 5.7.8.3 of the Technical Report. Regular inspections of the liner system will be required to ensure the edges remain keyed in and there are no tears in the liner. The downstream slopes will require inspection for possible erosional rills. If rills begin to appear, they will be repaired. Regular inspection of any appurtenances that may be added will also be required to ensure they are in proper working order and for repair of any defects such as leaking gaskets. If the leak detection system shows signs of leakage, the pond in question will be drained and inspected for damage. If damage is noted, then repairs will be made.

Section 4.2 - Comments 4 through 7

Please see LC ISR, LLC's responses of December 12, 2008.

Section 4.3 Solid Wastes

Please see LC ISR, LLC's responses of December 12, 2008.

List of Information Included with the Responses
to
NRC Comments on Lost Creek TR Section 4.0
January 16, 2009

For Comment 4.2 #1:
New Table - Example of Waste Stream Composition for Deep Well Disposal

For Comment 4.2 #3a through #3k (under separate cover):
Design Report - Ponds 1 & 2 - Western States Mining Consultants (WSMC), January 2009 (Note: Appendix B of the Design Report is the Subsurface Exploration and Geotechnical Engineering Report - Inberg-Miller Engineers, September 2008)
Technical Specifications - WSMC, April 2008
Ponds 1 & 2 - Reservoir Construction Drawings - WSMC, April 2008
Drain Plans (3 Sheets) - WSMC, no date

Example of Waste Stream Composition for Deep Well Disposal [1]					
	RO Brine	**Resin Rinse**	**Elution Bleed**	**Yellowcake Wash Water**	**Restoration Wastes**
Flow Rate [2] (gallons/minute)	60	< 3	3	7	130
Inorganic Parameters (parts per million)					
Ammonia	-- [3]	--	<1 [4]	--	--
Arsenic	--	--	--	--	0.1 to 0.3
Bicarbonate		600 to 900			400 to 700
Calcium	3,000 to 5,000	--	--	--	--
Carbonate		500 to 800			300 to 600
Chloride	15,000 to 20,000	10,000 to 15,000	12,000 to 15,000	4,000 to 6,000	--
Magnesium	1,000 to 2,000	--	--	--	--
Sodium	10,000 to 15,000	6,000 to 11,000	6,000 to 8,000	3,000 to 4,000	380 to 720
Selenium	--	--	--	--	0.05 to 0.15
Sulfate	< 1	--	--	--	100 to 200
Radiological Parameters (picoCuries/Liter)					
Gross Alpha	--	--	--	--	2,000 to 3,000
Gross Beta	--	--	--	--	2,500 to 3,500
Radium-226	<5	100 to 200	100 to 300	20 to 50	50 to 100
Thorium-230 [5]	--	50 to 100	10 to 30	10 to 20	50 to 150
U, ppm		1 to 3	5 to 10	3 to 5	< 1

[1] Adapted from Table 2.7-3 on Page 2-36 of the NRC's Draft Generic Impact Statement (GEIS) for In Situ Uranium Mining. LC ISR, LLC will sample the waste stream components frequently, throughout the life of the mine, to ensure the disposal operations are conducted in accordance with the design and safety parameters of the deep wells.

[2] -- See Figures 3.2-5 and 6.2-1 for additional information on the water balance.

[3] -- Not expected to be present.

[4] Table 2.7-3 of the Draft GEIS shows ammonia concentrations of 180 to 640 ppm. However, LC ISR, LLC does not propose to use ammonia during the precipitation process, so the concentration of ammonia is expected to be minimal.

[5] Based on the Lost Creek ore characteristics, the Thorium-230 concentrations are expected to be less than those shown in the Draft GEIS.

RESPONSES TO NRC COMMENTS
of 11/6/2008 on

SECTION 5.0
Description of the Proposed Facility

in the Technical Report for the
LOST CREEK PROJECT
Wyoming

Sections 5.1 and 5.2

Please see Lost Creek ISR, LLC's (LC ISR, LLC's) responses of December 12, 2008 for all the comments on Sections 5.1 and 5.2 of the Lost Creek Technical Report.

Section 5.7.1 Effluent Control Techniques

LCI did not provide sufficient information regarding effluent controls for the proposed facility. This information is necessary for the NRC staff to assess the ability of LCI to control and monitor emissions, protect worker health, and collect the necessary data to calculate doses to the public. Please provide the following information:

Section 5.7.1 - Comments 1 and 2

Please see LC ISR, LLC's responses of December 12, 2008.

3. ***Regarding the release of pregnant lixiviant, LCI states: "NUREG/CR-6733 considers two conservative scenarios involving the release of pregnant lixiviant and loaded resin. In both scenarios, the authors determined that the spills would have no significant external radiological risks. The risks from associated radon releases are discussed in Section 5.7.1.1. All process and effluent liquids will be contained within pipelines, tanks, and storage ponds that are inaccessible to members of the public." NUREG/CR-6733, A Baseline Risk-Informed, Performance-Based Approach for In Situ Leach Uranium Extraction Licensees, is for guidance only. However, it does state that these types of spills cannot be discounted from risk assessment on the basis of probability and concludes that effluent levels and internal doses can be significant due to spills of pregnant lixiviant. LCI must analyze the risk regarding the release of pregnant lixiviant. Please provide a site-specific analysis for a spill of pregnant lixiviant in the field, including:***

   a. ***Mitigation against occurrence;***

      Please see the attached table for assessment of the operational risks associated with a spill of pregnant lixiviant. The table consists of four parts. The first part is a description of the three spill scenarios that were evaluated (e.g., leak in the production line in a header house). The second, third, and fourth parts provide detail about each of the three scenarios, respectively. That detail includes a chart of the likelihood of events occurring in a given scenario compared to the severity of the consequences, from a radiological standpoint, should those events occur. The detail also includes discussion of the risks associated with the events and the operational procedures to help prevent those events and mitigate the consequences (e.g., sump alarms in the header houses).

Section 5.7.1 - Comments 3b through 3d

Please see LC ISR, LLC's responses of December 12, 2008.

Sections 5.7.2 through 5.7.9

Please see LC ISR, LLC's responses of December 12, 2008 for all the comments on Sections 5.7.2 through 5.7.9 of the Lost Creek Technical Report.

List of Information Included with the Responses
to
NRC Comments on Lost Creek TR Section 5.0
January 16, 2009

For Comment 5.7.1 #3a:
New Table - Site Specific Risk Analysis for a Spill of Pregnant Lixiviant in the Field

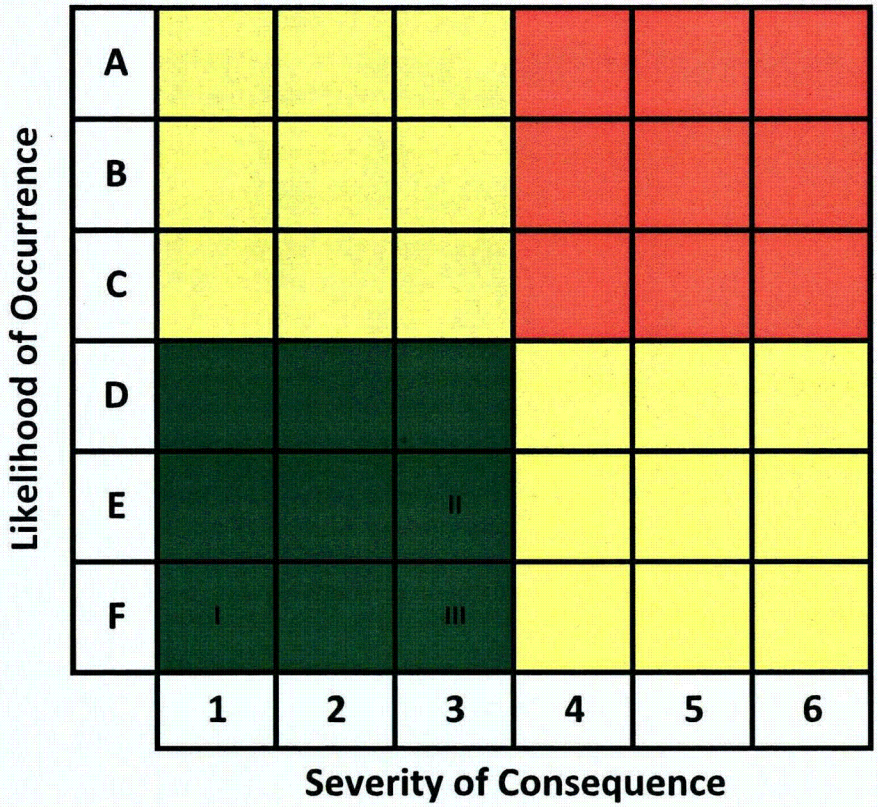
Response to Comment 5.7.3 #3a - Site Specific Risk Analysis for a Spill of Pregnant Lixiviant in the Field (Page 1 of 14)

Credible Scenarios for Release of Pregnant Lixiviant

Scenario Number	Location	Description
1	**Leak of Line From Production Well to Header House**	In this scenario, one of the pipe fittings or sections of high density polyethylene (hdpe) pipe would leak and pregnant lixiviant would spill onto the ground in the pattern area.
2	**Leak of Production Line in Header House**	In this scenario, one of the fittings, pieces of instrumentation or pieces of pipe would leak and pregnant lixiviant would spill onto the ground inside the header house.
3	**Leak of Production Pipeline Between Header House and Plant**	In this scenario, one of the pipe fittings or sections of high density polyethylene (hdpe) pipe would leak and pregnant lixiviant would spill onto the ground between the header houses and the plant.

Scenario 1

Leak of Line From Production Well to Header House



Event #	Description	Likelihood	Severity
I	Downhole piping failure	F	1
II	Wellhead fittings failure	E	3
III	Wellhead to header house piping failure	F	3

Legend/Key

Likelihood of Occurrence:

- A: Event has more than a 90% chance of occurrence.
- B: Event has between 70% and 90% chance of occurrence.
- C: Event has between 50% and 70% chance of occurrence.
- D: Event has between 30% and 50% chance of occurrence.
- E: Event has between 10% and 30% chance of occurrence.
- F: Event has less than a 10% chance of occurrence.

Severity of Consequence:

- 1: Event will result in no release of pregnant lixiviant.
- 2: Event could release a small volume of pregnant lixiviant; exposures would have little or no effect.
- 3: Event could release a moderate volume of pregnant lixiviant; exposures would be elevated but still considerably less than the regulatory limits.
- 4: Event could release a large volume of pregnant lixiviant; exposures could be approaching regulatory limits.
- 5: Event could release a large volume of pregnant lixiviant; exposures could exceed regulatory limits.
- 6: Event will result in a release of pregnant lixiviant; exposure limits would be exceeded.

High Risk	Countermeasures will need to be taken.
Moderate Risk	Countermeasures will need to be considered.
Low Risk	No countermeasures will need to be taken.

Response to Comment 5.7.3 #3a - Site Specific Risk Analysis for a Spill of Pregnant Lixiviant in the Field (Page 3 of 14)

Analysis of Risks (Leak of Line from Production Well to Header House):

Event # I	**Downhole Piping Failure:** A downhole piping failure can occur if the surface line is sealed for any reason. The pump pressure at zero flow will typically exceed the operating pressure of the subsurface piping the pump is set on and may cause a failure. In that event the discharged pregnant lixiviant will remain in the casing and will continue to be recirculated until the upset condition is noted by instrumentation and shutdown or is manually shut down by an Operator during routine daily inspections completed once per shift.
Event # II	**Production Wellhead Fitting Failure:** A wellhead fitting failure can occur if the fittings are flawed, are improperly installed, are damaged by surface activities or are subjected to excessive pressures above their design limitations.
	i) *Flawed Fittings:* As in any manufacturing process, faulty fittings may miss factory QA/QC inspection. Prior to installation, construction personnel will inspect fittings for cracks, splits or other defects. Defective or substandard fittings will not knowingly be utilized in construction of production systems. Initial startup procedures will require a check of each wellhead for leaks and operators will be required to regularly inspect wellhead fittings for defects and leaks. In the event a defective fitting or leak is found, the pump will be shut down, the pressure bled off and the faulty component replaced. In addition, fittings will be inspected anytime a maintenance event occurs at that wellhead.
	ii) *Improper Installation:* PVC, HDPE, Steel and other fittings may be specified in the construction of production wellheads as long as they are compatible with the pressure, temperature and corrosive nature of the production lixiviant and the wellhead operating environment. Each fitting will have specific installation limitations that should be adhered to. Exceedance of these limitations (overtightenging, improper gluing or lubrication) may be cause for failure and a potential leak of pregnant lixiviant. Initial startup procedures will require a check of each wellhead for leaks and operators will be required to regularly inspect wellhead fittings for defects and leaks. In the event a defective fitting or leak is found, the pump will be shut down, the pressure bled off and the faulty component replaced. In addition, fittings will be inspected anytime a maintenance event occurs at that wellhead.
	iii) *Damage by Surface Activities:* Although all injection and production wellheads will have protective covers, damage may occur from debris during wind storms or errant operational activities (particularly during adverse weather conditions). In the event that a wellhead cover is dislodged, the Operator will inspect the well casing and all wellhead fittings for defect or leak. In the event a defective fitting or leak is found, the pump will be shut down, the pressure bled off and the faulty component replaced. Operators will be required to regularly inspect wellhead fittings for defects and leaks. In addition, fittings will be inspected anytime a maintenance event occurs at that wellhead.

Analysis of Risks (Leak of Line from Production Well to Header House) - cont'd:

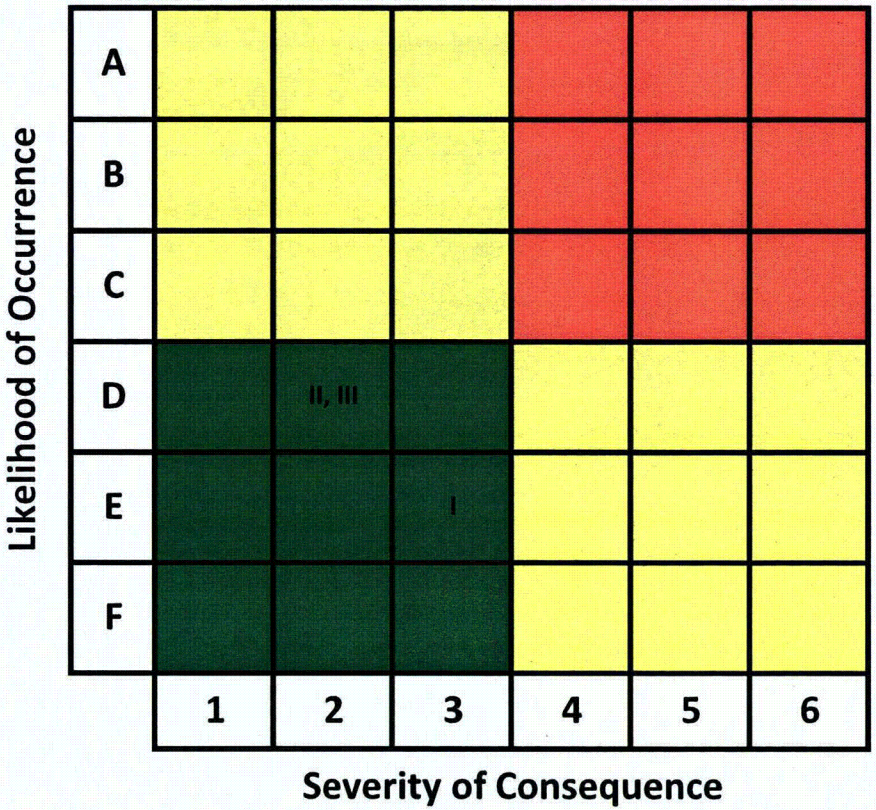
Event # II (cont'd)	**Production Wellhead Fitting Failure (cont'd):**
	iv) *Excessive Pressure:* Excessive pressure may occur at the wellhead in the event the downstream line is plugged or sealed off. As flow reduces, submersible pump pressure increases and, at zero flow, may exceed the operating pressure for the fittings. Instrumentation installed will provide the opportunity for shutdown based on pressure and flow rate as well as alarms. Exceedance of pressure set points and subsequent shut down may be cause for failure and a potential leak of pregnant lixiviant. Restart procedures will require a check of the upset condition wellhead for leaks and operators will be required to regularly inspect wellhead fittings for defects and leaks. In the event a defective fitting or leak is found, the pump will be shut down, the pressure bled off and the faulty component replaced. In addition, fittings will be inspected anytime a maintenance event occurs at that wellhead.
Event # III	**Production Wellhead to Header House Piping Failure:** Production well piping to the header house will typically be constructed from HDPE. The pipe will normally be designed for flow and pressure typical to that particular mine unit and its calculated operating parameters. The piping will typically be buried below the anticipated frost line to prevent freezing during a power outage or planned shutdown. A piping failure can occur if the line is damaged during backfilling, has a faulty fusion joint or is overpressured during operation.
	i) *Damage During Backfilling:* Each well to header house pipe will typically be buried below the frost line. After trenching is complete, the line(s) are normally laid into the trenches, the fittings fused on the ends and the trench backfilled with standard construction equipment (backhoe, motor grader, loader). Because of the sandy nature of the soil at the Lost Creek Project, it is unlikely to have sharp rocks or masses in the backfill material. Initial startup procedures will typically require a pressure check of each of the flow lines to insure no leaks are present. Operators will be required to regularly inspect the wellfield where they will look for signs of leakage such as wet, soft or abnormally green spots. Operators will also monitor flow and pressure data for anomalies as well as utilize instrumentation to alarm for upset conditions. In the event an anomalous reading or alarm is given, the Operator will normally review the well in question up to pressure testing the line for leaks. In addition, the wellfield area will be inspected anytime a maintenance event occurs.

Analysis of Risks (Leak of Line from Production Well to Header House) - cont'd:

Event #	Production Wellhead to Header House Piping Failure (cont'd):
III (cont'd)	ii) *Faulty Fusion Joint:* HDPE pipe requires melting or "fusion" to join threaded fittings to the ends and connect piping pieces together. Properly performed, fusion joints are the strongest sections of the pipe due to the increased density at the joint. Each pipe size has specific installation parameters for heat and pressure during fusion. The operator of the HDPE fusion unit will typically be required to complete task training on the device prior to operating it or be under the direct supervision of a trained operator. If a joint is improperly fused, it may leak. Initial startup procedures will typically require a pressure check of each of the flow lines to insure no leaks are present. Operators will be required to regularly inspect the wellfield where they will look for signs of leakage such as wet, soft or abnormally green spots. Operators will also monitor flow and pressure data for anomalies as well as utilize instrumentation to alarm for upset conditions. In the evant an anomolous reading or alarm is given, the Operator will normally review the well in question up to pressure testing the line for leaks. In addition, the wellfield area will be inspected anytime a maintenance event occurs.
	iii) *Excessive Pressure:* Excessive pipe pressure may occur in the event the downstream line is plugged or sealed off. As flow reduces, submersible pump pressure increases and, at zero flow, may exceed the operating pressure for the pipe. Instrumentation installed will normally provide the opportunity for shutdown based on pressure and flow rate as well as alarms. Exceedance of pressure set points and subsequent shut down may be cause for failure and a potential leak of pregnant lixiviant. Restart procedures will require a check of the upset condition flowline for leaks and operators will be required to regularly inspect wellfields for evidence of leaks, i.e.: signs of leakage such as wet, soft or abnormally green spots. In the event a leak is found, the pump will be shut down, the pressure bled off and the faulty piping replaced. In addition, the wellfield will be inspected anytime a maintenance event occurs at that wellhead.

Scenario 2

Leak of Production Line in Header House



Legend/Key

Likelihood of Occurrence:

A: Event has more than a 90% chance of occurrence.
B: Event has between 70% and 90% chance of occurrence.
C: Event has between 50% and 70% chance of occurrence.
D: Event has between 30% and 50% chance of occurrence.
E: Event has between 10% and 30% chance of occurrence.
F: Event has less than a 10% chance of occurrence.

Severity of Consequence:

1: Event will result in no release of pregnant lixiviant.
2: Event could release a small volume of pregnant lixiviant; exposures would have little or no effect.
3: Event could release a moderate volume of pregnant lixiviant; exposures would be elevated but still considerably less than the regulatory limits.
4: Event could release a large volume of pregnant lixiviant; exposures could be approaching regulatory limits.
5: Event could release a large volume of pregnant lixiviant; exposures could exceed regulatory limits.
6: Event will result in a release of pregnant lixiviant; exposure limits would be exceeded.

Event #	Description	Likelihood	Severity
I	Piping/Fitting Failure in Header House	E	3
II	Instrument Failure in Header House	D	2
III	Control Failure in Header House	D	2

High Risk	Countermeasures will need to be taken.
Moderate Risk	Countermeasures will need to be considered.
Low Risk	No countermeasures will need to be taken.

Analysis of Risks (Leak of Production Line in Header House):

Event #	
I	**Piping/Fitting Failure in Header House:** A piping/fitting failure in the header house can occur if the design criteria are exceeded for any reason. Plausible causes for failure are flawed components, improper installation, abnormal stress or excessive pressure.
	i) *Flawed Fittings:* As in any manufacturing process, faulty fittings may miss factory QA/QC inspection. Prior to installation, construction personnel will typically inspect fittings for cracks, splits or other defects. Defective or substandard fittings will not knowingly be utilized in construction of production systems. Initial startup procedures will normally require a check of header house piping for leaks and operators should be required to regularly inspect the same for defects and leaks. In the event a defective fitting or leak is found, the piping will be typically be shut down, the pressure bled off and the faulty component replaced. In addition, fittings will normally be inspected anytime a maintenance event occurs at that point. In addition, leak detection equipment and a liner are planned for installation in all header houses. In the event of a major discharge of production lixiviant, the sump instrumentation will normally alarm and shut down flow to and from the house.
	ii) *Improper Installation:* PVC, HDPE, Steel, Stainless Steel, Brass and other fittings may be specified in the construction of header house production piping systems as long as they are compatible with the pressure, temperature and corrosive nature of the production lixiviant. Each fitting will have specific installation limitations that should be adhered to. Exceedance of these limitations (overtightening, improper gluing or lubrication) may be cause for failure and a potential leak of pregnant lixiviant. Initial startup procedures will normally require a check of header house piping for leaks and operators should be required to regularly inspect the same for defects and leaks. In the event a defective fitting or leak is found, the piping will be typically be shut down, the pressure bled off and the faulty component replaced. In addition, fittings will normally be inspected anytime a maintenance event occurs at that point. In addition, leak detection equipment and a liner are planned for installation in all header houses. In the event of a major discharge of production lixiviant, the sump instrumentation will normally alarm and shut down flow to and from the house.
	iii) *Abnormal Stress:* Although all initial construction typically insures components and piping are plumb and true with respect to supports and the header house, settling may occur over time which could apply abnormal stress to piping components in particular. The Operator will normally inspect the header house and its components for defect or leak at least once per shift. In the event abnormal stress is noted, the Operator would typically generate a work order for modification of the piping, supports or both. In circumstances where the Operator may feel that the stress could create a leak in the near term, he would typically shut the header house down for immediate repairs. In addition, leak detection equipment and a liner are planned for installation in all header houses. In the event of a major discharge of production lixiviant, the sump instrumentation will normally alarm and shut down flow to and from the house.

Analysis of Risks (Leak of Production Line in Header House) - cont'd:

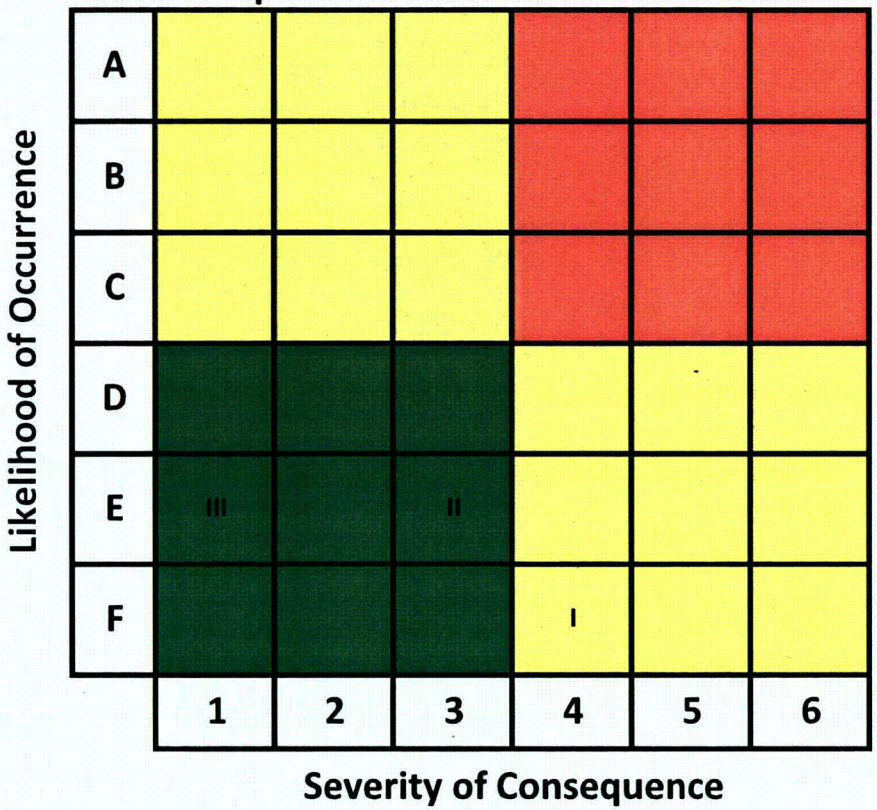
Event #	Piping/Fitting Failure in Header House (cont'd):
I (cont'd)	iv) *Excessive Pressure:* Excessive pressure may occur in the header house production piping in the event flow in a downstream line is impeded. This can include changes in pumping systems in the plant or plugging in the ion exchange columns. Each header house instrumentation system is planned to have pressure switches on the main headers to shut down the pumps in the event an upset condition occurs. Each production well is also planned to have check valves off the main header. In the event of an individual pump or full system shutdown, flow will be stopped from re-entering the production wells. In the case of an abrupt pressure exceedance (water hammer), instrumentation systems will also typically shutdown pumps and valves, but piping allowable pressures may be exceeded and damage may occur. If pregnant lixiviant is discharged in the header house, the sump instrumentation will normally alarm and shut down flow to and from the house as well. Restart procedures will normally require a check of the upset condition for leaks and operators will be required to regularly inspect header house components for defects and leaks. In the event additional defective fittings or leaks are found, the header house will be shut down, the pressure bled off, and the faulty component replaced. In addition, fittings will typically be inspected anytime a maintenance event occurs in the header house.
Event # II	**Instrument Failure in a Header House:** Instrumentation for the pregnant lixiviant piping will be designed to monitor flow and pressure for the purpose of data acquisition and notification. Flow and pressure data will typically be used to record production volumes and determine if upset conditions exist. If flow or pressure readings are outside the set points, then alarms/shutdowns will normally be incorporated to control a problem. The Operator will typically receive an alarm that the instrumentation is not functioning and may be required to review the upset condition. A power outage will shut down pumping systems, control valves and instrumentation and will typically require a remote or local restart by the Operator.

Analysis of Risks (Leak of Production Line in Header House) - cont'd:

Event # III	**Control Failure in a Header House:** Certain systems within the header house are planned to have control instrumentation. The production pumps are planned to have remote start/stop. The main valves for both the injection and production stream are also planned to be control valves reliant on pressure readings. If the remote start/stop for the pumps fails, it will not affect the integrity of the production piping or the pressure seen within the system. It will require the Operator to complete the start or stop sequence locally. The control valves are set to fail close and therefore do not require redundant valving. Other control aspects within the header house include pressure switches on the main injection and production headers which will typically be tied to alarms and local shutdown instrumentation. The pressure switches are planned to be redundant and will have high and low settings which tie in with a shunt trip to shut down pumps within the header house. These will normally be interlocked with oxygen injection systems to insure all flow systems are closed when water is not flowing. The sump system is another area where alarms will typically be activated at the first sign of fluid and shutdown initiated at high level. The sump will normally be interlocked with the pumping system to insure no operation with fluid in the sump. A power outage will shut down pumping systems, control valves and instrumentation and will typically require a remote or local restart by the Operator.

Scenario 3

Leak of Pipeline From Header House to Plant



Event #	Description	Likelihood	Severity
I	Pipeline failure	F	4
II	Fittings failure	E	3
III	Valve failure	E	1

Legend/Key

Likelihood of Occurrence:

A: Event has more than a 90% chance of occurrence.
B: Event has between 70% and 90% chance of occurrence.
C: Event has between 50% and 70% chance of occurrence.
D: Event has between 30% and 50% chance of occurrence.
E: Event has between 10% and 30% chance of occurrence.
F: Event has less than a 10% chance of occurrence.

Severity of Consequence:

1: Event will result in no release of pregnant lixiviant.
2: Event could release a small volume of pregnant lixiviant; exposures would have little or no effect.
3: Event could release a moderate volume of pregnant lixiviant; exposures would be elevated but still considerably less than the regulatory limits.
4: Event could release a large volume of pregnant lixiviant; exposures could be approaching regulatory limits.
5: Event could release a large volume of pregnant lixiviant; exposures could exceed regulatory limits.
6: Event will result in a release of pregnant lixiviant; exposure limits would be exceeded.

High Risk	Countermeasures will need to be taken.
Moderate Risk	Countermeasures will need to be considered.
Low Risk	No countermeasures will need to be taken.

Analysis of Risks (Leak in Production Line from Header House to Plant):

Event # I	**Production Pipeline Failure:** Pregnant lixiviant is gathered at each of the header houses and pumped to the plant. Production piping from the header house to the plant will typically be constructed from high density polyethylene (HDPE) pipe. This pipe is chosen because of its durability, flexibility, ease of installation and wide range of operating characteristics. The pipe will normally be designed for a wide range of flow and pressure to allow for startup through full operation. The piping will typically be buried below the anticipated frost line to prevent freezing during a power outage or planned shutdown. A piping failure can occur if the line is damaged during backfilling, has a faulty fusion joint or is over pressured during operation. Analysis shows moderate risk, but with the mitigating factors incorporated below, it can be brought into the low risk category.
	i) *Damage During Backfilling:* Each main pipeline will typically be buried below the frost line. After trenching is complete, the line(s) are normally laid into the trenches, the fittings fused on the ends and the trench backfilled with standard construction equipment (backhoe, motor grader, loader). Because of the sandy nature of the soil at the Lost Creek Project, it is unlikely to have sharp rocks or masses in the backfill material. Construction procedures will typically require a pressure check of each of the flow lines to insure no leaks are present. Operators will be required to regularly inspect the pipeline right-of-way where they will look for signs of leakage such as wet, soft or abnormally green spots. Operators will also monitor flow and pressure data for anomalies as well as utilize alarms for upset conditions. In the event an anomalous reading or an alarm, the Operator will normally perform a visual inspection of the right-of-way as well as the valve stations. In addition, the pipelines will be inspected anytime a maintenance event occurs.
	ii) *Faulty Fusion Joint:* HDPE pipe requires melting or "fusion" to join fittings to the ends and connect piping pieces together. Properly performed, fusion joints are the strongest sections of the pipe due to the increased density at the joint. Each pipe size has specific installation parameters for heat and pressure during fusion. The operator of the HDPE fusion unit will typically be required to complete task training on the device prior to operating it or be under the direct supervision of a trained operator. If a joint is improperly fused, it may leak. Initial construction procedures will typically require a pressure check of each of the pipelines to insure no leaks are present. This is usually done prior to backfilling to allow for visual inspection. Operators will be required to regularly inspect the pipeline right-of-way where they will look for signs of leakage such as wet, soft or abnormally green spots. Operators will also monitor flow and pressure data for anomalies as well as utilize alarms for upset conditions. In the event an anomalous reading or an alarm, the Operator will normally perform a visual inspection of the right-of-way as well as the valve stations. In addition, the pipelines will be inspected anytime a maintenance event occurs.

Analysis of Risks (Leak in Production Line from Header House to Plant) - cont'd:

Event # I (cont'd)	**Production Pipeline Failure (cont'd):**
	iv) *Excessive Pressure:* Excessive pressure may occur in the production pipeline in the event flow downstream is impeded. This can include changes in pumping systems in the plant or plugging in the ion exchange columns. Instrumentation installed will provide the pressure and flow data at pipeline nodes and alarm the Operator or shut down flow systems as is appropriate. Exceedance of pressure set points and subsequent shut down may be cause for failure and a potential leak of pregnant lixiviant. In the case of an abrupt pressure exceedance (water hammer), instrumentation systems will also typically shutdown pumps and valves, but piping allowable pressures may be exceeded and damage may occur. Restart procedures will require a check of the upset condition pipeline for leaks and operators will be required to regularly inspect pipeline right-of-ways and valve stations for defects and leaks, i.e.: signs of leakage such as wet, soft or abnormally green spots. In the event a leak is found, the pipeline will be shut down, the pressure bled off and the faulty piping replaced. In addition, the wellfield will be inspected anytime a maintenance event occurs at that wellhead.
Event # II	**Production Pipeline Fitting Failure:** A pipeline fitting failure can occur if the fittings are flawed, are improperly installed, are damaged by corrosion or are subjected to excessive pressures above their design limitations.
	i) *Flawed Fittings:* As in any manufacturing process, faulty fittings may miss factory QA/QC inspection. Prior to installation, construction personnel will inspect fittings for cracks, splits or other defects. Defective or substandard fittings will not knowingly be utilized in construction of production systems. In addition, fittings will not normally be buried, thus allowing for routine inspection and leak detection. Initial startup procedures will require a check of each valve station for leaks and operators will be required to regularly inspect the same for defects and leaks. In the event a defective fitting or leak is found, the pipeline will be shut down, the pressure bled off and the faulty component replaced. In addition, fittings will be inspected anytime a maintenance event occurs.
	ii) *Improper Installation:* HDPE, steel, stainless steel, ductile iron and other fittings may be specified in the construction of production pipelines as long as they are compatible with the pressure, temperature and corrosive nature of the production lixiviant and the operating environment. Each fitting will have specific installation limitations that should be adhered to. Exceedance of these limitations (overtightening, improper welding or alignment) may be cause for failure and a potential leak of pregnant lixiviant. Prior to startup, pipelines will normally be pressure tested for leaks. Initial startup procedures will require a check of each valve station for leaks and operators will be required to regularly inspect valve stations for defects and leaks. In the event a defective fitting or leak is found, the operator will shut down the pipeline, bleed the pressure off and the faulty component replaced. In addition, fittings will be inspected anytime a maintenance event occurs.

Response to Comment 5.7.3 #3a - Site Specific Risk Analysis for a Spill of Pregnant Lixiviant in the Field (Page 13 of 14)

Analysis of Risks (Leak in Production Line from Header House to Plant) - cont'd:

Event # II (cont'd)	**Production Pipeline Failure (cont'd):**
	iii) *Damage from Corrosion:* Materials of construction for pipeline fittings will typically be chosen based on their pressure, flow and corrosion characteristics. Because most HDPE fittings do not mate up with larger valves, it may be necessary to utilize steel or stainless steel to crossover from the HDPE flange adapter to the valve. The mildly corrosive nature of pregnant lixiviant is typically mitigated by installing coated steel or stainless steel. Erosion of these components from production sand may be mitigated through the installation of downhole well screens and/or surface filtration. In addition, fittings will not normally be buried, thus allowing for routine inspection and leak detection. Initial startup procedures will require a check of each valve station for leaks and operators will be required to regularly inspect the same for defects and leaks. In the event a defective fitting or leak is found, the pipeline will be shut down, the pressure bled off and the faulty component replaced. In addition, fittings will be inspected anytime a maintenance event occurs.
	iv) *Excessive Pressure* : Excessive pressure may occur in production pipeline fittings in the event flow downstream is impeded. This can include changes in pumping systems in the plant or plugging in the ion exchange columns. Instrumentation installed will provide the pressure and flow data at pipeline nodes and alarm the Operator or shut down flow systems as is appropriate. Exceedance of pressure set points and subsequent shut down may be cause for failure and a potential leak of pregnant lixiviant. In the case of an abrupt pressure exceedance (water hammer), instrumentation systems will also typically shutdown pumps and valves, but fitting allowable pressures may be exceeded and damage may occur. Restart procedures will require a check of the upset condition pipeline fittings for leaks and operators will be required to regularly inspect pipeline valve stations for defects and leaks, i.e.: signs of leakage such as wet, soft or abnormally green spots. In the event a leak is found, the pipeline will be shut down, the pressure bled off and the faulty fittings replaced. In addition, the wellfield will be inspected anytime a maintenance event occurs at that wellhead.
Event # III	**Production Pipeline Valve Failure:** A pipeline valve failure can occur if the valves are flawed, are improperly installed, are damaged by corrosion or are subjected to excessive pressures above their design limitations.
	i) *Flawed Fittings:* As in any manufacturing process, faulty valves may miss factory QA/QC inspection. Prior to installation, construction personnel will inspect valves for cracks, splits, defective seats, bad operators or other defects. Defective or substandard valves will not knowingly be utilized in construction of production systems. In addition, valves will not normally be buried, thus allowing for routine operation, inspection and leak detection. Initial startup procedures will require a check of each valve station for proper operation, leaks and Operators will be required to regularly inspect the same for defects and leaks. In the event a defective valve or leak is found, the pipeline will be shut down, the pressure bled off and the faulty valve replaced. In addition, fittings will be inspected anytime a maintenance event occurs. One piece stems and discs will normally be specified to minimize failure of the operating mechanism.

Analysis of Risks (Leak in Production Line from Header House to Plant) - cont'd:

Event	Production Pipeline Valve Failure (cont'd):
# III	ii) *Improper Installation:* Steel, stainless steel, ductile iron and other materials may be specified for installation in production pipeline valve stations as long as they are compatible with the pressure, temperature and corrosive nature of the production lixiviant and the operating environment. Each valve will have specific installation limitations that should be adhered to. Exceedance of these limitations (overtightening or misalignment) may be cause for failure and a potential leak of pregnant lixiviant. Prior to startup, pipelines will normally be pressure tested for leaks. Initial startup procedures will require a check of each valve station for leaks and operators will be required to regularly inspect valve stations for defects and leaks. In the event a defective valve or leak is found, the operator will shut down the pipeline, bleed the pressure off and the faulty component replaced. In addition, fittings will be inspected anytime a maintenance event occurs.
	iii) *Damage from Corrosion:* Materials of construction for pipeline valves will typically be chosen based on their pressure, flow and corrosion characteristics. The mildly corrosive nature of pregnant lixiviant is typically mitigated by installing stainless steel, one piece stems and discs along with corrosion resistant wetted components. Erosion of these components from production sand may be mitigated through the installation of downhole well screens and/or surface filtration. In addition, valves will not normally be buried, thus allowing for routine inspection and leak detection. Initial startup procedures will require a check of each valve station for leaks and operators will be required to regularly inspect the same for defects and leaks. In the event a defective valve or leak is found, the pipeline will be shut down, the pressure bled off and the faulty component replaced. In addition, fittings will be inspected anytime a maintenance event occurs.
	iv) *Excessive Pressure:* Excessive pressure may occur in production pipeline valves in the event flow downstream is impeded. This can include changes in pumping systems in the plant or plugging in the ion exchange columns. Instrumentation installed will provide the pressure and flow data at pipeline nodes and alarm the Operator or shut down flow systems as is appropriate. Exceedance of pressure set points and subsequent shut down may be cause for failure and a potential leak of pregnant lixiviant. In the case of an abrupt pressure exceedance (water hammer), instrumentation systems will also typically shutdown pumps and valves, but valve allowable pressures may be exceeded and damage may occur. Restart procedures will require a check of the upset condition pipeline valves for leaks/proper operation and operators will be required to regularly inspect pipeline valve stations for defects and leaks, i.e.: signs of leakage such as wet, soft or abnormally green spots. In the event a leak is found, the pipeline will be shut down, the pressure bled off and the faulty fittings replaced.

RESPONSES TO NRC COMMENTS
of 11/6/2008 on

SECTION 6.0
Groundwater Quality Restoration, Surface Reclamation, and Facility Decommissioning

in the Technical Report for the
LOST CREEK PROJECT
Wyoming

Section 6.2 Plans and Schedules for Groundwater Quality Restoration

The plans and schedules for groundwater quality restoration have not been sufficiently described to determine if they will achieve the required goals of restoration. Considering the timeliness in decommissioning requirements of 10 CFR 40.42, the schedule provided by LCI constitutes an alternate restoration schedule and is an important component of the restoration discussion. Provide the following information:

Comments 1 and 2

Please see Lost Creek ISR, LLC's (LC ISR, LLC's) responses of December 12, 2008.

3. ***A technical basis for LCI's ability to meet the standards in Criterion 5B(5) of 10 CFR Part 40, Appendix A, through restoration.***

   Please see LC ISR, LLC's December 12, 2008 response to Comment 6.2 #10 regarding restoration for a technical basis demonstrating the ability to restore groundwater in compliance with 10 CFR Part 40 Appendix A Criterion 5(B)(5).

   Based on e-mail discussions with Mr. Ron Burrows of the NRC on January 9, 2009, LC ISR, LLC understands the *"point of compliance"* referred to in Criterion 5(B)(5) of 10 CFR part 40 Appendix A, includes each of the baseline monitor wells in the ore zone and in the overlying and underlying aquifers. The analytes measured to demonstrate compliance with Criterion 5(B)(5) are listed in Table 6.2-1 of the Lost Creek Technical Report and are based on WDEQ requirements. LC ISR, LLC proposes that baseline for the production zone be established on a wellfield basis and be equal to the average value of all measurements plus/minus 3 standard deviations. The baseline for the monitor ring and overlying and underlying monitor wells will be established on an individual well basis. Before determining the baseline values, all outliers will be removed from the data set as determined by the Loftis Method described in WDEQ Land Quality Division Guideline 4 Attachment 1 Section 1(D).

4. ***A description of the expected water quality in the mine unit at the beginning of restoration.***

   Please see LC ISR, LLC's responses of December 12, 2008.

5. ***An explanation of the timeline for restoration of nine months for sweep, nine months of RO, and one month for homogenization considering the low conductivity of the HJ horizon and the described stacked sand restoration approach.***

   The timeline for each stage of restoration is based on a series of factors including: expected flow rate as determined from pumping tests; the expected number of pore

volumes required to complete each stage of restoration; and waste water disposal capacity. There seems to some confusion about the characteristics of the HJ Horizon (see LC ISR, LLC's response of December 12, 2008 to Comment 6.2 #6), and the proposed mining and restoration approach for that horizon. LC ISR, LLC is reviewing the text of the Mine and Reclamation Plans and will clarify the text, as necessary. LC ISR, LLC anticipates completing this process in the near future.

Section 6.2 (Plans and Schedules for Groundwater Quality Restoration) - Comments 6 and 7.

Please see LC ISR, LLC's responses of December 12, 2008.

8. ***A justification for the method to estimate well field pore volume and the assumed 20 percent vertical and horizontal flare (No technical details are provided for estimating the well field pore volume and the associated horizontal and vertical flare.) Also please explain why a 10 percent vertical and 10 percent horizontal flare estimate was used in the surety calculations, when each flare was stated to be 20 percent.***

A flare factor of 1.44 (20% horizontal flare with 20% vertical flare) is consistent with approved permit applications at Wyoming in-situ recovery facilities. Based on historical operations and data, actual values for horizontal and vertical flare may be lower, especially in groups of patterns such as those making up a Header House or Mine Unit.

The 10% horizontal flare with 10% vertical flare was a typographical error and has been revised. The revised reclamation bond is attached.

Finally, the Bond calculation will be reviewed and revised annually. The review will incorporate not only economic and physical changes at the property but experience as well. Therefore, as the project becomes more mature, the estimates will become more accurate as site specific experience is incorporated.

9. ***A comprehensive discussion and justification for the estimate of six pore volumes (1 sweep, 5 RO) for restoration of MU1, which appears very low, using a basis of comparable field experience.***

Please see LC ISR, LLC's response of December 12, 2008 to Comment 6.2 #10 for a comprehensive discussion, including an analog comparison, of the number of pore volumes estimated to complete groundwater restoration.

Section 6.2 (Plans and Schedules for Groundwater Quality Restoration)
Comments 10 through 17

Please see LC ISR, LLC's responses of December 12, 2008.

Section 6.2 (Plans for Reclaiming Disturbed Lands)

Please see LC ISR, LLC's responses of December 12, 2008 for all comments on Section 6.2 (Plans for Reclaiming Disturbed Lands) of the Lost Creek Technical Report.

Section 6.3 Mine Unit Reclamation

Please see LC ISR, LLC's responses of December 12, 2008 for the comment on Section 6.3 of the Lost Creek Technical Report.

Section 6.5 Post-Reclamation and Decommissioning Radiological Surveys

Please see LC ISR, LLC's responses of December 12, 2008 for all comments on Section 6.5 of the Lost Creek Technical Report.

6.8 Financial Assurance

During its review, the staff determined that the information regarding financial assurance was insufficient to determine if LCI appropriately estimated the surety amount. A proper surety amount is necessary to ensure that the LCI facility can be property restored and decommissioned in the event LCI becomes insolvent. Please provide the following information:

1. ***The current financial assurance information indicates the estimate is provided in current dollars, but does not indicate if this is 2007 or 2008 dollars. Please indicate the year that the costs are referenced to. The estimate should be adjusted for inflation at the time of license issuance and should include an adjustment for annual inflation in future years.***

   The financial assurance information was recently updated (see Comment 6.2 #8) and is in 2009 dollars. The reclamation bond must be approved by NRC prior to issuance of the license, and if approval is delayed beyond 2009, the bond amount can be adjusted for inflation as necessary. Future adjustments to the reclamation bond,

whether for revised operations and/or inflation, will be submitted to NRC and WDEQ for review and approval as part of the required Annual Report.

Section 6.8 Comments 2 through 4.

Please see LC ISR, LLC's responses of December 12, 2008.

5. ***Worksheet 7, Page 25 of 35, provides an estimate of potential costs related to surface reclamation in the mine units. The cost estimate indicates that there will be no surface spills requiring cleanup in the mine unit. Please provide justification for this assumption, or revise the spill cleanup portion based on a likely occurrence of spills.***

At this time, the cost estimate does not include specific costs for spills that may occur during operations, in part because LC ISR, LLC intends a proactive management approach (including up-to-date equipment and personnel training) to help prevent the occurrence of spills and minimize the size of any spills. In addition, based on operator experience, most spills result in negligible damage to the soil/subsoil underlying the spill for the following reasons:

a) Spills, once detected, will be reported and cleaned up at the time of the spill. The cleanup will typically include capture of the spilled fluid and disposal in the proper area for disposal as well as testing of the affected area for radiological or environmental constituents outside the acceptable limits. If the soils tests show levels above what is acceptable, then the affected soil/subsoil will be gathered and either cleaned or shipped to an approved waste area.
b) At the completion of operations and groundwater restoration, all operational areas will be scanned and cleaned up as required as a secondary measure.
c) The majority of historical, in-situ industry spills have been from injection (IC) fluid. IC typically has a uranium concentration of less than 5 ppm, thus reducing the radiological and environmental concerns.

Therefore, costs for most spill cleanups would be minimal in comparison with the bond as a whole. In addition, the bond estimate will be reviewed annually, by LC ISR, LLC and the regulatory agencies, and revised as necessary. (For example, the Wyoming Department of Environmental Quality has required bond increases at other sites to address specific spill issues.) The bond review will incorporate not only economic and physical changes at the property but experience as well. Therefore, as the project becomes more mature, the estimates will become more accurate as site specific experience is incorporated.

6. ***The financial assurance cost estimate does not appear to include operational costs that would need to be continued during restoration. Items such as sampling and testing of the monitoring wells and mechanical integrity testing (MIT) of all the wells will need to be continued during groundwater restoration. Please discuss where these costs are included in Table 6.8-1 or revise the financial assurance estimate to include these costs.***

   Table 6.8-1, Worksheet 1 (Pages 10 of 35 and 11 of 35) includes the operational costs that need to be continued during restoration. The Operators will be required to take samples as part of their daily/weekly routine, and there are funds noted in the bond estimate for the sampling and laboratory analyses.

   Figure 3.1-3 shows the maximum life of any injection well should be no more than 4¾ years, with use of most wells for mining and/or restoration completed before then. Therefore, costs for MITs were not included in the bond estimate based on the five-year MIT requirement of the EPA Underground Injection Control program.

   As noted in the Response to Comment 6.8 #5, the bond estimate will be reviewed annually and revised as necessary. Therefore, the bond estimate can be adjusted in the future to account for increased (or decreased) field and laboratory costs or for MIT costs if unanticipated conditions are encountered or if NRC requires MITs on wells that are idle (e.g., while waiting for regulatory approval of wellfield restoration).

TABLE 6.8-1 2009 Surety Estimate (Page 1 of 35)

Lost Creek ISR, LLC
SUMMARY OF RECLAMATION/RESTORATION BOND ESTIMATE

I GROUNDWATER RESTORATION - Worksheet 1:	$1,748,869
II DECOMMISSIONING AND SURFACE RECLAMATION:	
A. Plant Equipment Removal and Disposal Worksheet 2	$73,968
B. Plant Building Demolition and Disposal Worksheet 3	$357,441
C. Storage Pond Sludge and Liner Handling Worksheet 4	$417,612
D. Well Abandonment Worksheet 5	$426,069
E. Wellfield Equipment Removal and Disposal Worksheet 6	$271,982
F. Topsoil Replacement and Revegation Worksheet 7	$72,944
G. Miscellaneous Reclamation Activities Worksheet 8	$73,347
Sub Total - Decommissioning and Surface Reclamation	$1,693,364
SUBTOTAL RESTORATION AND RECLAMATION	$3,442,233

TABLE 6.8-1 2009 Surety Estimate (Page 2 of 35)

Lost Creek ISR, LLC
SUMMARY OF RECLAMATION/RESTORATION BOND ESTIMATE

Miscellaneous Costs Associated with Third Party Contractors		
Project Design	2%	
Contractor Profit & Mobilization	8%	
Pre-construction Investigation	1%	
Project Management	5%	
On-site monitoring	0.5%	
Site Security & Liability Assurance	1%	
Longterm Administration	2%	
Contingency	15%	
TOTAL CONTINGENCY	34.5%	$1,187,570
TOTAL RESTORATION AND RECLAMATION		$4,629,804

TABLE 6.8-1 2009 Surety Estimate (Page 3 of 35)

Lost Creek ISR, LLC
Restoration and Reclamation Costs

WORKSHEET 1
GROUNDWATER RESTORATION

	Mine Unit #1	Explanation	Source
Technical Assumptions:			
Wellfield Area (Ft^2)	1,784,484	Proposed area	Data
Wellfield Area (Acres)	40.97		Calculated
Affected Ore Zone Area (Ft^2)	1,784,484	Proposed area affected	Data
Avg Completed Thickness (Ft)	12.0	Proposed thickness	Data
Affected Volume:			
Factor For Vertical Flare	20%	Vertical flare estimate	Estimated
Factor For Horizontal Flare	20%	Horizontal flare estimate	Estimated
Total Volume (Ft^3)	30,835,884	=A * T * Vert Flare * Hor Flare	Calculated
Porosity	26.0%	Typical value for host sand	Data
Gallons Per Cubic Foot	7.48		Conversion Factor
Gallons Per Pore Volume	59,969,626	=Volume * Porosity * Gal/ft^3	Calculated
Number of Wells in Unit(s)			
Production Wells	180	Proposed well count	Data
Injection Wells	360	Proposed well count	Data
Monitor Wells	64	Proposed well count	Data
Average Well Spacing (Ft)	95	Proposed well spacing	Data
Average Well Depth (Ft)	500	Proposed well depth	Data

TABLE 6.8-1 2009 Surety Estimate (Page 4 of 35)

Lost Creek ISR, LLC
Restoration and Reclamation Costs

WORKSHEET 1
GROUNDWATER RESTORATION

	Mine Unit #1	Explanation	Source
I GROUNDWATER SWEEP			
A. PLANT & OFFICE			
Operating Assumptions:			
Flowrate (gpm)	160	Planned flow	Data
PV's Required	1.0	Required value	Data
Total Gallons For Treatment	59,969,626	=Gal/Pore Volume * # Pore Volumes	Calculated
Total KGals for Treatment	59,970		Calculated
Cost Assumptions:			
Power			
Avg Connected Hp	40.00	Proposed pump horsepower	Data
Kwh's/Hp	0.746		Conversion Factor
$/Kwh	$0.060	Estimate based on tarriff	Unit Rate
Gallons Per Minute	160	Planned rate	Data
Gallons Per Hour	9600		Calculated
Cost Per Hour	$1.79		Calculated
Cost Per Gallon	$0.00019		Calculated
Cost Per KGal ($)	$0.187		Calculated
Chemicals			
Antiscalent ($/Kgals)	$0.120	Based on req'd dosage/estimated cost	Unit Rate
Repair & Maintenance ($/KGals)	$0.070	Estimate	Unit Rate
Analysis ($/KGals)	$0.060	On site laboratory analysis	Unit Rate
Total Cost Per KGal	$0.437		Calculated
Total Treatment Cost	$26,177		Calculated

TABLE 6.8-1 2009 Surety Estimate (Page 5 of 35)

Lost Creek ISR, LLC
Restoration and Reclamation Costs

WORKSHEET 1
GROUNDWATER RESTORATION

	Mine Unit #1	Explanation	Source
I GROUNDWATER SWEEP (cont.)			
Utilities			
Power ($/Month)	$225	Estimate	Unit Rate
Propane ($/Month	$225	Estimate	Unit Rate
Time For Treatment			
Minutes For Treatment	374,810	=Total Gal for treatment / Flowrate (gpm)	Calculated
Hours For Treatment	6,247		Calculated
Days For Treatment	260		Calculated
Average Days Per Month	30.4		Calculated
Months For Treatment	8.6		Calculated
Utilities Cost ($)	$3,851		Calculated
TOTAL PLANT & OFFICE COST	$30,028		
B. WELLFIELD			
Cost Assumptions:			
Power			
Avg Flow/Pump (gpm)	32	Estimate from pumping	Data
Avg Hp/Pump	5.00	Estimate from pumping	Data
Avg # of Pumps Required	5.0	Estimate from pumping	Data
Avg Connected Hp	30.0	Pumps plus 5 hp for HH	Data
Kwh's/Hp	0.746		Conversion Factor
$/Kwh	$0.060	Estimate based on tarriff	Unit Rate
Gallons Per Minute	160	Planned flow	Data
Gallons Per Hour	9600		Calculated
Cost Per Hour ($)	$1.34		Calculated
Cost Per Gallon ($)	$0.0001		Calculated
Cost Per KGal ($)	0.140		Calculated
Repair & Maintenance ($/KGals)	$0.230	Estimate	Unit Rate
Total Cost Per KGal	$0.370		Calculated
TOTAL WELLFIELD COST	$22,181		Calculated
TOTAL GROUND WATER SWEEP COST	$52,209		Calculated

TABLE 6.8-1 2009 Surety Estimate (Page 6 of 35)

Lost Creek ISR, LLC
Restoration and Reclamation Costs

WORKSHEET 1
GROUNDWATER RESTORATION

	Mine Unit #1	Explanation	Source
II REVERSE OSMOSIS			
A. PLANT & OFFICE			
Operating Assumptions:			
Flowrate (gpm)	640	Estimate from pumping	Data
PV's Required	5.0	Required value	Data
Total Gallons For Treatment	299,848,131	=Gal/Pore Volume * # of Pore Volume	Calculated
Total KGals for Treatment	299,848		Calculated
Feed to RO (gpm)	640	Planned flow	Data
Permeate Flow (gpm)	480	=Planned flow * Avg RO Recovery	Calculated
Brine Flow (gpm)	160	= Planned flow - Permeate flow	Calculated
Average RO Recovery	75.0%	RO design	Data
Cost Assumptions:			
Power			
Avg Connected Hp	300.00	Average value for each area	Data
Kwh's/Hp	0.746		Conversion Factor
$/Kwh	$0.060	Estimate based on tarriff	Unit Rate
Gallons Per Minute	640	Planned flow	Data
Gallons Per Hour	38400		Calculated
Cost Per Hour ($)	$13.43		Calculated
Cost Per Gallon ($)	$0.00035		Calculated
Cost Per KGal ($)	$0.350		Calculated

TABLE 6.8-1 2009 Surety Estimate (Page 7 of 35)

Lost Creek ISR, LLC
Restoration and Reclamation Costs

WORKSHEET 1
GROUNDWATER RESTORATION

	Mine Unit #1	Explanation	Source
II REVERSE OSMOSIS (cont.)			
Chemicals			
Sulfuric Acid ($/KGals)	$0.090	Estimate	Unit Rate
Caustic Soda ($/KGals)	$0.023	Estimate	Unit Rate
Reductant ($/KGals)	$0.113	Estimate	Unit Rate
Antiscalent ($/Kgals)	$0.124	Based on required dosage/estimated cost	Unit Rate
Repair & Maintenance ($/KGals)	$0.135	Estimate	Unit Rate
Sampling & Analysis ($/KGals)	$0.060	Estimate	Unit Rate
Total Cost Per KGal ($)	$0.895		Calculated
Total Pumping Cost ($)	$268,270		Calculated
Utilities			
Power ($/Month)	$560	Estimate	Unit Rate
Propane ($/Month	$225	Estimate	Unit Rate
Time For Treatment			
Minutes For Treatment	468,513		Calculated
Hours For Treatment	7,809		Calculated
Days For Treatment	325		Calculated
Average Days Per Month	30.4		Calculated
Months For Treatment	10.7		Calculated
Utilities Cost ($)	$8,400		Calculated
TOTAL PLANT & OFFICE COST	$276,670		Calculated

TABLE 6.8-1 2009 Surety Estimate (Page 8 of 35)

Lost Creek ISR, LLC
Restoration and Reclamation Costs

WORKSHEET 1
GROUNDWATER RESTORATION

	Mine Unit #1	Explanation	Source
B. WELLFIELD			
Cost Assumptions:			
Power			
Avg Flow/Pump (gpm)	32.00	Average value for each area	Data
Avg Hp/Pump	5.00	Average value for each area	Data
Avg # of Pumps Required	20.0	Average value for each area	Data
Avg Connected Hp	110.0		Calculated
Kwh's/Hp	0.746		Conversion Factor
$/Kwh	$0.060	Estimate based on tarriff	Unit Rate
Gallons Per Minute	640	Planned flow	Data
Gallons Per Hour	38,400		Calculated
Cost Per Hour ($)	$4.92		Calculated
Cost Per Gallon ($)	$0.0001		Calculated
Cost Per KGal ($)	$0.128		Calculated
Repair & Maintenance ($/KGals)	$0.230	Estimate	Unit Rate
Total Cost Per KGal	$0.358		Calculated
TOTAL WELLFIELD COST	$107,411		Calculated
TOTAL REVERSE OSMOSIS COST	$384,081		Calculated

TABLE 6.8-1 2009 Surety Estimate (Page 9 of 35)

Lost Creek ISR, LLC
Restoration and Reclamation Costs

WORKSHEET 1
GROUNDWATER RESTORATION

	Mine Unit #1	Explanation	Source
III WASTE DISPOSAL WELL			
Operating Assumptions:			
Annual Evaporation Capacity (Gals)	0		Data
Avg. Monthly Evap. Capacity (Gals)	0		Calculated
Total Disposal Requirement			
RO Brine Total Gallons	74,962,033	=Treatment Gal * (1- RO Recvry)	Calculated
RO Brine Total KGallons	74,962		Calculated
Brine Concentration Factor	50%	RO design	Data
Total Concentrated Brine (Gals)	37,481,016	=RO Brine Gallons * Brine Conc. Factor	Calculated
Months of RO Operation	10.7		Calculated
Average Monthly Reqm't (Gallons)	3,502,899	=Total Conc Brine / Months RO Ops.	Calculated
Monthly Balance for DDW (Gals)	3,502,899	=Avg Monthly Reqm't - Avg Monthly Evap	Calculated
Total WDW Disposal (Gallons)	37,481,016		Calculated
Total WDW Disposal (KGals)	37,481		Calculated
Cost Assumptions:			
Power			
Avg Connected Hp	100.0	Estimate	Data
WDW Avg Connected Hp	200.0	Estimate	Data
Kwh's/Hp	0.746		Conversion Factor
$/Kwh	$0.060	Estimate based on tarriff	Unit Rate
Gallons Per Minute	150.0	Planned flow	Data
Gallons Per Hour	9000		Calculated
Cost Per Hour ($)	$13.43		Calculated
Cost Per Gallon ($)	$0.0015		Calculated
Cost Per KGal ($)	$1.492		Calculated

TABLE 6.8-1 2009 Surety Estimate (Page 10 of 35)

Lost Creek ISR, LLC
Restoration and Reclamation Costs

WORKSHEET 1
GROUNDWATER RESTORATION

	Mine Unit #1	Explanation	Source
III WASTEDISPOSAL WELL (cont.)			
Chemicals ($/Kgals)			
RO Antiscalent ($/Kgals)	$0.225	Based on required dosage and cost	Unit Rate
WDW Antiscalent ($/Kgals)	$0.254	Based on required dosage and cost	Unit Rate
Sulfuric Acid ($/Kgals)	$0.315	Estimate	Unit Rate
Corrosion Inhibitor	$0.244	Estimate	Unit Rate
Repair & Maint ($/Kgals)	$0.259	Estimate	Unit Rate
Total Cost Per KGal	$2.789		Calculated
TOTAL WASTE DISPOSAL WELL COST	$104,535		Calculated
IV STABILIZATION MONITORING			
Operating Assumptions:			
Time of Stabilization (mos)	9	Time frame required	Data
Frequency of Analysis (mos)	3	Required sampling	Data
Total Sets of Analysis	3	Required sampling	Data
Cost Assumptions:			
Power ($/Month)	$1,125	Estimate	Unit Rate
Total Power Cost	$10,125		Calculated
Sampling & Analysis (each set)	$4,050	Estimate	Unit Rate
Total Sampling & Analysis Cost ($)	$12,150		Calculated
Utilities ($/Month)	$2,250	Estimate	Unit Rate
Total Utilities Cost ($)	$20,250		Calculated
TOTAL STABILIZATION COST	$42,525		Calculated

TABLE 6.8-1 2009 Surety Estimate (Page 11 of 35)

Lost Creek ISR, LLC
Restoration and Reclamation Costs

WORKSHEET 1
GROUNDWATER RESTORATION

	Mine Unit #1			Explanation	Source
V LABOR					
Cost Assumptions	Cost/Hour	Hours/Year	Cost		
Crew:					
1 Supervisor	$25.00	2080	$52,000	Anticipated operations crew	Data
4 Operators	$20.00	2080	$166,400	Anticipated operations crew	Data
2 Maintenance	$20.00	2080	$83,200	Anticipated operations crew	Data
2 Vehicles	$13.50	2080	$56,160	Anticipated operations crew	Data
Cost per Year			$357,760		
Time Required - Years (After Prod + Stability)	2.0				
TOTAL RESTORATION LABOR COST	$715,520				

VI RESTORATION CAPITAL REQUIREMENTS	
I Plug and Abandon DDW (2)	$450,000
Total	$450,000

	Mine Unit #1	TOTAL
SUMMARY:		
I GROUNDWATER SWEEP	$52,209	
II REVERSE OSMOSIS	$384,081	
III WASTE DISPOSAL WELL	$104,535	
IV STABILIZATION	$42,525	
SUB TOTAL	$583,349	$583,349
V LABOR		$715,520
VI CAPITAL		$450,000
TOTAL GROUNDWATER RESTORATION COST		$1,748,869
GRAND TOTAL		**$1,748,869**

Table 6.8-1 2009 Surety Estimate (Page 12 of 35)

WORKSHEET 2
PLANT EQUIPMENT REMOVAL AND DISPOSAL

	Shop / Lab Office	Precipitation Section	Chemical Section	Ion Exchange Section	Restoration Section	Total	Explanation	Source
Volume (Yds³)	68	46	17	111	96		Estimate of equipment to be removed	Data
Quantity Per Truck Load (Yds³)	20	20	20	20	20		Typical load for shipping	Data
Number of Truck Loads	3.4	2.3	0.9	5.6	4.8			Calculated
I Decontamination Cost								
Decontamination Cost ($/Load)	$620	$620	$620	$620	$620		Estimated average decontaminate	Unit Rate
Percent Requiring Decontamination	50.0%	100.0%	0.0%	100.0%	100.0%		% Expected	Data
Total Cost	$1,054	$1,426	$0	$3,441	$2,976	$8,897		Calculated
II Dismantle and Loading Cost								
Cost Per Truck Load ($)	$805	$805	$805	$805	$805		Estimated average dismantle cost	Unit Rate
Total Cost	$2,737	$1,852	$684	$4,468	$3,864	$13,605		Calculated
III Oversize Charges								
Percent Requiring Permits	10.0%	10.0%	10.0%	10.0%	10.0%			Data
Cost Per Truck Load ($)	$367	$367	$367	$367	$367			Unit Rate
Total Cost	$125	$84	$31	$204	$176	$620		Calculated
IV Transportation & Disposal								
A. Landfill								
Percent To Be Shipped	90.0%	50.0%	100.0%	50.0%	50.0%		% acceptable at landfill	Data
Distance (Miles)	48	48	48	48	48		Distance to landfill	Data
Cost Per Mile ($)	$2.90	$2.90	$2.90	$2.90	$2.90		Current Transport rate	Unit Rate
Transportation Cost	$426	$160	$118	$386	$334			Calculated
Disposal Fee Per Cubic Yard	$13.50	$13.50	$13.50	$13.50	$13.50		Landfill fee	Unit Rate
Disposal Cost ($)	$826	$311	$230	$749	$648			Calculated
Total Cost	$1,252	$471	$348	$1,136	$982			Calculated
B. Licensed Site								
Percent To Be Shipped	10.0%	50.0%	0.0%	50.0%	50.0%		% requiring disposal at licensed site	Calculated
Distance (Miles)	105	105	105	105	105		Distance to Shirley Basin	Data
Cost Per Mile ($)	$2.90	$2.90	$2.90	$2.90	$2.90		Current Transport rate	Unit Rate
Transportation Cost	$104	$350	$0	$845	$731			Calculated
Disposal Cost Per Cubic Foot ($)	$12.40	$12.40	$12.40	$12.40	$12.40		Licensed site fee	Unit Rate
Quantity Per Truck Load (Yds³)	20.0	20.0	20.0	20.0	20.0		Typical load for shipping	Data
Quantity Per Truck Load (Ft³)	540	540	540	540	540			Calculated
Disposal Cost	$2,277	$7,700	$0	$18,581	$16,070			Calculated
Total Cost Licensed Site	$2,380	$8,051	$0	$19,426	$16,801			Calculated
Total Cost Transportation & Disposal	$3,632	$8,521	$348	$20,562	$17,783	$50,846		Calculated
TOTAL COST	$7,548	$11,883	$1,063	$28,674	$24,799	$73,968		Calculated

TABLE 6.8-1 2009 Surety Estimate (Page 13 of 35)

WORKSHEET 3
PLANT BUILDING DEMOLITION AND DISPOSAL

	Plant	Header Houses	Booster Pump Bldgs.	Total	Explanation	
BUILDING DEMOLITION AND DISPOSAL						
Structural Character	2 Story Steel Frame	1 Story Pre Fab (9)	1 Story Pre Fab (2)			
Demolition Volume (ft³)	1,248,000	29,430	6,540		Estimated Volume of Structures	Data
Cost of Demolition Per ft³	$0.1474	$0.1474	$0.1474			Unit Rate
Demolition Cost ($)	$183,955	$4,338	$964	$189,257		Calculation
Factor For Gutting	20.0%	10.0%	10.0%			Data
Cost For Gutting ($)	$36,791	$434	$96	$37,321		Calculation
Weight (pounds)	196,750	99,000	22,000		Estimated weight of building components [1]	Data
Weight per Truckload	40,000	40,000	40,000		Typical load for shipping	Data
Number of Truckloads	4.9	2.5	0.6			Calculation
Distance to Landfill	48	48	48		Distance to landfill	Data
Cost per Mile	$2.90	$2.90	$2.90		Current Transport rate	Unit Rate
Transportation Cost	$685	$345	$77	$1,106		
Disposal Cost per Ton	$40.20	$40.20	$40.20		Landfill fee	Unit Rate
Disposal Cost	$3,955	$1,990	$442	$6,387		Calculation
TOTAL COST	$225,386	$7,106	$1,579	$234,071		Calculation

TABLE 6.8-1 2009 Surety Estimate (Page 14 of 35)

WORKSHEET 3
PLANT BUILDING DEMOLITION AND DISPOSAL

	Plant	Header Houses	Booster Pump Bldgs.	Total	Explanation	
CONCRETE DECONTAMINATION, DEMOLITION & DISPOSAL						
Area (ft²)	30,050	424	94		Building concrete area	Data
Average Thickness (ft)	1	1.0	1.0			Data
Volume (ft³)	30,050	424	94			Calculation
Percent Requiring Decontamination	75.0%	50.0%	50.0%			Data
Percent Decontaminated	75.0%	75.0%	75.0%			Data
Decontamination ($/ft²)	$0.191	$0.191	$0.191			Unit Rate
Decontamination Cost	$4,305	$61	$13	$4,379		Calculation
Demolition ($/ft²)	$2.124	$2.124	$2.124			Unit Rate
Demolition Cost	$63,826	$901	$200	$64,926		Calculation
Transportation & Disposal						
A. Onsite Disposal						
Percent to be Disposed Onsite	90%	90%	90%			Data
Transportation Cost	$0	$0	$0			Data
Disposal Cost per Cubic Foot	$0.055	$0.055	$0.055			Unit Rate
Disposal Cost ($)	$1,487	$21	$5	$1,513		Calculation
B. Licensed Site						
Percent to be Shipped	10%	10%	10%			Calculation
Distance (Miles)	105	105	105			Data
Cost per Mile ($)	$2.90	$2.90	$2.90		Current Transport rate	Unit Rate
Transportation Cost	$1,694	$24	$5	$1,724		Calculation
Disposal Cost per Cubic Foot	$4.16	$4.16	$4.16			Unit Rate
Quantity Per Truck Load (Yds³)	20	20	20			Data
Quantity Per Truck Load (ft³)	540	540	540			Calculation
Disposal Cost ($)	$12,501	$176	$39	$12,716		Calculation
TOTAL COST	$83,814	$1,183	$262	$85,258		Calculation

TABLE 6.8-1 2009 Surety Estimate (Page 15 of 35)

WORKSHEET 3
PLANT BUILDING DEMOLITION AND DISPOSAL

	Plant	Header Houses	Booster Pump Bldgs.	Total	Explanation	
SOIL REMOVAL & DISPOSAL	Assume removal of 3" of Contaminated Soil Under Primary Areas, Disposal at a Licensed Facility					
Removal, Front End Loader ($50/hr)	$800	$800	$200	$1,800		Data
Quantity to be Shipped (ft³)	6600	810	180			Data
Distance (Miles)	105	105	105			Data
Cost Per Mile ($)	$2.90	$2.90	$2.90			Unit Rate
Transportation Cost ($)	$3,722	$457	$102	$4,280		Calculation
Disposal fee Per Cubic Foot($)	$4.16	$4.16	$4.16			Unit Rate
Quantity per Truckload (ft³)	540	540	540			Data
Disposal Cost ($)	$27,456	$3,370	$749	$31,574		Calculation
TOTAL COST	$31,978	$4,626	$1,050	$37,654		Calculation

RADIATION SURVEY						
Area required (acres)	0.69	0.01	0.00			Data
Survey Cost ($/acre)	$653.00	$653.00	$653.00			Unit Rate
TOTAL SURVEY COST ($)	$450	$6	$1	$457		Calculation

TOTAL COST	$341,627	$12,921	$2,893	$357,441		Calculation

[1] Building Weight Calculation

Ends	2	1	4800	9600
Roof	2	82.5	260	42900
Sidewall	2	20	260	10400
Internal Wall	1	20	460	9200
Internal Wall	1	30	220	6600
				78700
Density	2.5	#/sq. ft.		196750

TABLE 6.8-1 2009 Surety Estimate (Page 16 of 35)

WORKSHEET 4
POND RECLAMATION COST

	Storage Pond 1	Storage Pond 2	Total	
POND SLUDGE:				
Average Sludge Depth (ft)	0.250	0.250		Data
Average Area of Sludge (ft^2)	40,300	40,300		Data
Volume of Sludge (ft^3)	10,075	10,075		Calculated
Volume of Sludge (Yds^3)	373	373		Calculated
Volume of Sludge Per Truck Load (Yds^3)	20.0	20.0		Data
# of Truck Loads of Sludge	18.7	18.7		Calculated
Sludge Handling Cost Per Load ($)	$268.00	$268.00		Unit Rate
Total Sludge Handling Cost ($)	$5,012	$5,012	$10,023	Calculated
Transportation & Disposal				
Percent To Be Shipped	100.0%	100.0%		Data
Distance (Miles)	105	105		Data
Cost Per Mile ($)	$2.90	$2.90		Unit Rate
Transportation Cost ($)	$5,694	$5,694		Calculated
Disposal Cost Per Cubic Foot ($)	$12.38	$12.38		Unit Rate
Quantity Per Truck Load (Yds^3)	20.0	20.0		Data
Quantity Per Truck Load (ft^3)	540	540		Calculated
Disposal Cost ($)	$125,013	$125,013		Calculated
Total Transportation & Disposal ($)	$130,707	$130,707	$261,414	Calculated
TOTAL SLUDGE COST ($)	$135,719	$135,719	$271,438	Calculated

POND LINER:				
Total Pond Area (Acres)	0.93	0.93		Data
Total Pond Area (ft^2)	40,300	40,300		Calculated
Factor For Sloping Sides	20.0%	20.0%		Data
Total Liner Area (ft^2)	48360	48360		Calculated
Liner Thickness (Millimeters)	30	30		Data
Liner Thickness (Inches)	0.1181	0.1181		Calculated
Liner Thickness (ft)	0.0098	0.0098		Calculated
"Swell" Factor	25.0%	25.0%		Data
Liner Volume (ft^3)	592	592		Calculated
Truck Loads of Liner	1.1	1.1		Calculated
Liner Handling Cost ($)				
Labor Crew Cost per Hour ($)	$135	$135		Unit Rate
Hours per Load	2.0	2.0		Unit Rate
Liner Handling Cost Per Load ($)	$270.00	$270.00		Calculated
Total Liner Handling Cost ($)	$297	$297	$594	Calculated
Transportation & Disposal				
Percent To Be Shipped	100.0%	100.0%		Data
Distance (Miles)	105	105		Data
Cost Per Mile ($)	$2.90	$2.90		Unit Rate
Transportation Cost ($)	$335	$335		Calculated
Disposal Cost Per Cubic Foot ($)	$12.38	$12.38		Unit Rate
Quantity Per Truck Load (ft^3)	540	540		Data
Disposal Cost ($)	$7,354	$7,354		Calculated
Total Transportation & Disposal ($)	$7,689	$7,689	$15,377	Calculated
TOTAL LINER COST ($)	$7,986	$7,986	$15,971	Calculated

WORKSHEET 4
POND RECLAMATION COST

	Storage Pond 1	Storage Pond 2	Total	
POND BACKFILL:				
Backfill required (Yds³)	10,448	10,448		Data
Backfill Cost ($/Yd³)	$1.13	$1.13		Unit Rate
TOTAL BACKFILL COST ($)	$11,806	$11,806	$23,612	Calculated
RADIATION SURVEY				
Areal required (acres)	1.02	1.02		Data
Survey Cost ($/acre)	$653.00	$653.00		Unit Rate
TOTAL SURVEY COST ($)	$665	$665	$1,330	Calculated
LEAK DETECTION SYSTEM REMOVAL				
Volume of Gravel and Piping (ft³) (Assume 3")	10075	10075		Data
Quantity per Truckload (ft³)	540	540		Data
Quantity to be Shipped (Loads)	18.7	18.7		Calculated
Distance (Miles)	105	105		Data
Cost per Mile ($)	$2.90	$2.90		Unit Rate
Transportation Cost ($)	$5,681	$5,681		Calculated
Handling Cost	$5,038	$5,038		Unit Rate (Imbedded)
Disposal Fee per Cubic Foot ($)	$4.16	$4.16		Unit Rate
Disposal Cost ($)	$41,912	$41,912		Calculated
TOTAL LEAK DETECTION SYSTEM REMOVAL	$52,631	$52,631	$105,261	Calculated
TOTAL POND RECLAMATION COST	$208,806	$208,806	$417,612	Calculated

WORKSHEET 5
WELL ABANDONMENT

	Mine Unit # 1	Source
Number of Wells	605	Data
Average Depth (feet)	500	Data
Average Diameter (inches)	4.5	Data

Materials		
Class G Neat Cement Required (ft^3/Well)	55.2	Data
Sacks of Cement Required/Well [1]	43.1	Data
Cost Per Sack Cement ($)	$12.00	Unit Rate
Cost/Well Cement ($)	$517.72	Calculated
Sacks of Betonies Required/Well	1.2	Data
Cost Per Bag Betonite ($)	$2.90	Calculated
Cost/Well Betonies ($)	$3.53	Unit Rate
Total Materials Cost per Well	$521.25	Calculated
Labor		
Hours Required per Well	3.0	Data
Labor Cost per Hour	$45.00	Unit Rate
Total Labor Cost per Well ($)	$135.00	Calculated
Equipment Rental		
Hours Required per Well	1.0	Data
Backhoe w/Operator Cost/Hr ($)	$48.00	Unit Rate
Total Equipment Cost per Well ($)	$48.00	Calculated
Total Cost per Well ($)	$704.25	Calculated

TOTAL WELL ABANDONMENT COST ($)	$426,069	Calculated

[1] 15 ppg Class G cement requires 6 gallons water per sack cement and 1-1/2% betonite by weight

WORKSHEET 6
WELLFIELD EQUIPMENT REMOVAL & DISPOSAL

				Mine Unit # 1	Source
I	Wellfield Piping				
	A.	Removal			
		Surface Length/Well (Ft)		250	
		Downhole Length/Well (Ft)		350	
		Total Number of Wells		540	
		Total Quantity (Ft)		324,000	Calculated
		Cost of Removal ($/Ft)		$0.217	Unit Rate
		Cost of Removal ($)		$70,308	Calculated
		Average OD (Inches)		1.6	
		Chipped Volume Reduction (Ft^3/Ft)		0.008	Unit Rate
		Chipped Volume (Ft^3)		2,592	Calculated
		Quantity Per Truck Load (Ft^3)		540	
		Total Number of Truck Loads		4.8	Calculated
	B.	Survey & Decontamination			
		Percent Requiring Decontamination		0%	
		Loads for Decontamination		0.0	Calculated
		Cost for Decontamination ($/Load)		$620.00	Unit Rate
		Cost for Decontamination ($)		$0	Calculated
	C.	Transport & Disposal			
		1.)	Landfill		
			a. Transportation		
			Percent To Be Shipped	0.0%	
			Loads To Be Shipped	0.0	Calculated
			Distance (Miles)	48	
			Transportation Cost ($/mile)	$2.90	Unit Rate
			Transportation Cost ($)	$0	Calculated
			b. Disposal		
			Disposal Fee Per Yd^3	$13.50	Unit Rate
			Yds^3 Per Load	20	
			Disposal Cost ($)	$0	Calculated
		Total Cost - Landfill		$0	Calculated
		2.)	Licensed Site		
			a. Transportation		
			Percent To Be Shipped	100.0%	Calculated
			Loads To Be Shipped	4.8	Calculated
			Distance (Miles)	105	
			Cost Per Mile ($/mile)	$2.90	Unit Rate
			Transportation Cost ($)	$1,462	Calculated
			b. Disposal		
			Disposal Cost Per Ft^3	$12.38	Unit Rate
			Disposal Fee Per Yd^3	$334.26	Calculated
			Quantity Per Truck Load (Yds^3)	20	
			Disposal Cost ($)	$32,089	Calculated
		Total Cost - Licensed Site		$33,551	Calculated
	Total Cost - Transport & Disposal			$33,551	Calculated
Total Cost - WF Piping Removal & Disposal				$103,859	Calculated

WORKSHEET 6
WELLFIELD EQUIPMENT REMOVAL & DISPOSAL

				Mine Unit # 1	Source
II	Production Well Pumps				
	A.	Pump and Tubing Removal			
		Number of Production Wells		180	
		Cost of Removal ($/well)		$24.13	Unit Rate
		Cost of Removal ($)		$4,343	Calculated
		Number of Pumps Per Truck Load		180	
		Number of Truck Loads (Pumps)		1.0	Calculated
	B.	Survey & Decontamination (Pumps)			
		Percent Requiring Decontamination		100.0%	
		Loads for Decontamination		1.0	Calculated
		Cost for Decontamination ($/Load)		$620.00	Unit Rate
		Cost for Decontamination ($)		$620	Calculated
	C.	Tubing Volume Reduction & Loading			
		Length per Well (Ft)		400	
		Total Quantity (Ft)		72,000	Calculated
		Cost of Removal ($/Ft)		$0.027	Unit Rate
		Cost of Removal ($)		$1,944	Calculated
		Average OD (Inches)		2.0	
		Chipped Volume Reduction (Ft^3/Ft)		0.012	
		Chipped Volume (Ft^3)		864	Calculated
		Quantity per Truckload (Ft^3)		540	
		Number of Truck Loads		1.6	Calculated
	D.	Transport & Disposal			
		1.)	Landfill		
			a. Transportation		
			Percent To Be Shipped (Pumps)	0.0%	
			Loads To Be Shipped	0.0	Calculated
			Distance (Miles)	48	
			Cost Per Mile ($/mile)	$2.90	Unit Rate
			Transportation Cost ($)	$0	Calculated
			b. Disposal		
			Disposal Fee Per Yd^3	$13.50	Unit Rate
			Yds^3 Per Load	20	
			Disposal Cost ($)	$0	Calculated
		Total Cost - Landfill		$0	Calculated
		2.)	Licensed Site		
			a. Transportation		
			Percent To Be Shipped (Pumps)	100.0%	
			Percent To Be Shipped (Tubing)	100.0%	
			Loads To Be Shipped	2.6	Calculated
			Distance (Miles)	105	
			Cost Per Mile ($/mile)	$2.90	Unit Rate
			Transportation Cost ($)	$792	Calculated
			b. Disposal		
			Disposal Cost Per Ft^3	$12.38	Unit Rate
			Disposal Fee Per Yd^3	$334.26	Calculated
			Quantity Per Truck Load (Yds^3)	20	
			Disposal Cost ($)	$17,382	Calculated
		Total Cost - Licensed Site		$18,173	Calculated
	Total Cost - Transport & Disposal			$18,173	Calculated
	Total Cost - Pump Removal & Disposal			$25,081	Calculated

WORKSHEET 6
WELLFIELD EQUIPMENT REMOVAL & DISPOSAL

				Mine Unit # 1	Source
III	Surface Trunkline Piping				
	A.	Removal			
		Total Quantity (Ft)		0	
		Cost of Removal ($/Ft)		$0.161	Unit Rate
		Cost of Removal ($)		$0	Calculated
		Average OD (Inches)		8.750	
		Chipped Volume Reduction (Ft^3/Ft)		0.088	Unit Rate
		Chipped Volume (Ft^3)		0	Calculated
		Quantity Per Truck Load (Ft^3)		540	
		Total Number of Truck Loads		0.0	Calculated
	B.	Survey & Decontamination			
		Percent Requiring Decontamination		0.0%	
		Loads for Decontamination		0.0	Calculated
		Cost for Decontamination ($/Load)		$620.00	Unit Rate
		Cost for Decontamination ($)		$0	Calculated
	C.	Transport & Disposal			
		1.)	Landfill		
			a. Transportation		
			Percent To Be Shipped	0.0%	
			Loads To Be Shipped	0.0	Calculated
			Distance (Miles)	48	
			Cost Per Mile ($/mile)	$2.90	Unit Rate
			Transportation Cost ($)	$0	Calculated
			b. Disposal		
			Disposal Fee Per Yd^3	$13.50	Unit Rate
			Yds^3 Per Load	20	
			Disposal Cost ($)	$0	Calculated
		Total Cost - Landfill		$0	Calculated
		2.)	Licensed Site		
			a. Transportation		
			Percent To Be Shipped	100.0%	Calculated
			Loads To Be Shipped	0.0	Calculated
			Distance (Miles)	105	
			Cost Per Mile ($/mile)	$2.90	Unit Rate
			Transportation Cost ($)	$0	Calculated
			b. Disposal		
			Disposal Cost Per Ft^3	$12.38	Unit Rate
			Disposal Fee Per Yd^3	$334.26	Calculated
			Quantity Per Truck Load (Yds^3)	20	
			Disposal Cost ($)	$0	Calculated
		Total Cost - Licensed Site		$0	Calculated
		Total Cost - Transport & Disposal		$0	Calculated
	Total Cost - Surface Trunkline Removal & Disposal			$0	Calculated

WORKSHEET 6
WELLFIELD EQUIPMENT REMOVAL & DISPOSAL

					Mine Unit # 1	Source
IV	Buried Trunkline					
	A.	Removal				
		Total Quantity (Ft)			24,304	
		Cost of Removal ($/Buried Ft)			$3.15	Unit Rate
		Cost of Removal ($)			$38,279	Calculated
		Average OD (Inches)			9.635	
		Chipped Volume Reduction (Ft^3/Ft)			0.309	Unit Rate
		Chipped Volume (Ft^3)			7,510	Calculated
		Quantity Per Truck Load (Ft^3)			540	
		Number of Truck Loads			13.9	Calculated
	B.	Survey & Decontamination				
		Percent Requiring Decontamination			0.0%	
		Loads for Decontamination			0.0	Calculated
		Cost for Decontamination. ($/Load)			$620.00	Unit Rate
		Cost for Decontamination. ($)			$0	Calculated
	C.	Transport & Disposal				
		1.)	Landfill			
			a.	Transportation		
				Percent To Be Shipped	0.0%	
				Loads To Be Shipped	0.0	Calculated
				Distance (Miles)	48	
				Cost Per Mile ($/mile)	$2.90	Unit Rate
				Transportation Cost ($)	$0	Calculated
			b.	Disposal		
				Disposal Fee Per Yd^3	$13.50	Unit Rate
				Yds^3 Per Load	20	
				Disposal Cost ($)	$0	Calculated
			Total Cost - Landfill		$0	Calculated
		2.)	Licensed Site			
			a.	Transportation		
				Percent To Be Shipped	100.0%	Calculated
				Loads To Be Shipped	13.9	Calculated
				Distance (Miles)	105	
				Cost Per Mile ($/mile)	$2.90	Unit Rate
				Transportation Cost ($)	$4,233	Calculated
			b.	Disposal		
				Disposal Cost Per Ft^3	$12.38	Unit Rate
				Disposal Fee Per Yd^3	$334.26	Calculated
				Quantity Per Truck Load (Yds^3)	20	
				Disposal Cost ($)	$92,924	Calculated
			Total Cost - Licensed Site		$97,157	Calculated
		Total Cost - Transport & Disposal			$97,157	Calculated
	Total Cost - Buried Trunkline Removal & Disposal				$135,436	Calculated

WORKSHEET 6
WELLFIELD EQUIPMENT REMOVAL & DISPOSAL

				Mine Unit # 1	Source
V	Manholes				
	A.	Removal			
		Total Quantity		9	
		Cost of Removal ($ Each)		$146.32	Unit Rate
		Cost of Removal ($)		$1,317	Calculated
		Quantity Per Truck Load		10	
		Number of Truck Loads		0.9	Calculated
	B.	Survey & Decontamination			
		Percent Requiring Decontamination		0.0%	
		Loads for Decontamination		0.0	Calculated
		Cost for Decontamination ($/Load)		$620.00	Unit Rate
		Cost for Decontamination ($)		$0	Calculated
	C.	Transport & Disposal			
		1.)	Landfill		
			a. Transportation		
			Percent To Be Shipped	0.0%	
			Loads To Be Shipped	0.0	Calculated
			Distance (Miles)	48	Unit Rate
			Cost Per Mile ($/mile)	$2.90	Calculated
			Transportation Cost ($)	$0	
			b. Disposal		
			Disposal Fee Per Yd³ ($)	$13.50	Unit Rate
			Yds³ Per Load	20	
			Disposal Cost ($)	$0	Calculated
		Total Cost - Landfill		$0	Calculated
		2.)	Licensed Site		
			a. Transportation		
			Percent To Be Shipped	100.0%	Calculated
			Loads To Be Shipped	0.9	Calculated
			Distance (Miles)	105	
			Cost Per Mile ($/mile)	$2.90	Unit Rate
			Transportation Cost ($)	$274	Calculated
			b. Disposal		
			Disposal Cost Per Ft³	$12.38	Unit Rate
			Disposal Fee Per Yd³	$334.26	Calculated
			Quantity Per Truck Load (Yds³)	20	
			Disposal Cost ($)	$6,017	Calculated
		Total Cost - Licensed Site		$6,291	Calculated
		Total Cost - Transport & Disposal		$6,291	Calculated
	Total Cost Manhole Removal & Disposal			$7,608	Calculated
TOTAL COST - WELLFIELD EQUIP REMOVAL & DISP.				$271,982	Calculated

WORKSHEET 7
TOPSOIL REPLACEMENT & REVEGETATION

	Mine Unit # 1	
I Plant		
A. Topsoil Handling & Grading		
Affected Area (Acres)	5.0	
Average Affected Thickness (Ins)	12.0	
Topsoil Volume (Yds³)	8,067	Calculated
Unit Cost - Haul/Place ($/Yd³)	$1.13	Unit Cost
Topsoil Handling Cost ($)	$9,115	Calculated
Unit Cost - Grading ($/Ac)	$56.28	Unit Cost
Grading Cost ($)	$281	Calculated
Sub Total - Topsoil	$9,397	Calculated
B. Radiation Survey & Soil Analysis		
Unit Cost ($/Ac)	$653.00	Unit Cost
Sub Total - Survey & Analysis	$3,265	Calculated
C. Revegetation		
Fertilizer ($/Ac)	$52.33	Unit Cost
Seeding Prep & Seeding ($/Ac)	$189.85	Unit Cost
Mulching & Crimping ($/Ac)	$311.25	Unit Cost
Sub Total Cost/Acre	$553.43	Calculated
Sub Total - Revegation	$2,767	Calculated
Sub Total - Plant	$15,429	Calculated

II Ponds		
A. Topsoil Handling & Grading		
Affected Area (Acres)	5.0	
Average Affected Thickness (Ins)	12	
Topsoil Volume (Yds³)	8,067	Calculated
Unit Cost - Haul/Place ($/Yd³)	$1.13	Unit Cost
Topsoil Handling Cost ($)	$9,115	Calculated
Unit Cost - Grading ($/Ac)	$56.28	Unit Cost
Grading Cost ($)	$281	Calculated
Sub Total - Topsoil	$9,397	Calculated
B. Radiation Survey & Soil Analysis		
Unit Cost ($/Ac)	$653.00	Unit Cost
Sub Total - Survey & Analysis	$3,265	Calculated
C. Revegation		
Fertilizer ($/Ac)	$52.33	Unit Cost
Seeding Prep & Seeding ($/Ac)	$189.85	Unit Cost
Mulching & Crimping ($/Ac)	$311.25	Unit Cost
Sub Total Cost/Acre	$553.43	Calculated
Sub Total - Revegation	$2,767	Calculated
Sub Total - Ponds	$15,429	Calculated

WORKSHEET 7
TOPSOIL REPLACEMENT & REVEGETATION

	Mine Unit # 1	
III Wellfields		
A. Topsoil Handling & Grading		
Affected Area (Acres)	0.0	
Average Affected Thickness (Ins)	3.5	
Topsoil Volume (Yds³)	0	Calculated
Unit Cost - Haul/Place ($/Yd³)	$1.13	Unit Cost
Topsoil Handling Cost ($)	$0	Calculated
Unit Cost - Grading ($/Ac)	$56.28	Unit Cost
Grading Cost ($)	$0	Calculated
Sub Total - Topsoil	$0	Calculated
B. Radiation Survey & Soil Analysis		
Unit Cost ($/Ac)	$653.00	Unit Cost
Sub Total - Survey & Analysis	$0	Calculated
C: Spill Cleanup		
Affected Area (Acres)	-	Calculated
Affected Area (ft²)	-	
Average Affected Thickness (ft)	0.25	
Affected Volume (ft³)	-	Calculated
Quantity per Truckload (ft³)	540	
Quantity to be Shipped (Loads)	0.0	Calculated
Distance (Miles)	105	
Cost per Mile ($)	$2.90	Unit Cost
Transportation Cost ($)	$0	Calculated
Handling Cost ($200/Load)	$0	Calculated
Disposal Fee per Cubic Foot ($)	$4.16	Unit Cost
Disposal Cost ($)	$0	Calculated
Sub Total - Spill Cleanup	$0	Calculated
D. Revegation		
Fertilizer ($/Ac)	$52.33	Unit Cost
Seeding Prep & Seeding ($/Ac)	$189.85	Unit Cost
Mulching & Crimping ($/Ac)	$311.25	Unit Cost
Sub Total Cost/Acre	$553.43	Calculated
Sub Total - Revegation	$0	Calculated
Sub Total - Wellfields ($)	$0	Calculated

WORKSHEET 7
TOPSOIL REPLACEMENT & REVEGETATION

	Mine Unit # 1		
IV Roads			
A. Topsoil Handling & Grading			
Affected Area (Acres)	11.1		
Average Affected Thickness (Ins)	12		
Topsoil Volume (Yds³)	17,908	Calculated	width (feet)
Unit Cost - Haul/Place ($/Yd³)	$1.13	Unit Cost	borrow (feet)
Topsoil Handling Cost ($)	$20,236	Calculated	total
Unit Cost - Grading ($/Ac)	$56.28	Unit Cost	acres
Grading Cost ($)	$625	Calculated	
Sub Total - Topsoil	$20,861	Calculated	
B. Radiation Survey & Soil Analysis			
Unit Cost ($/Ac)	$653.00	Unit Cost	
Sub Total - Survey & Analysis	$7,248	Calculated	
C. Revegation			
Fertilizer ($/Ac)	$52.33	Unit Cost	
Seeding Prep & Seeding ($/Ac)	$189.85	Unit Cost	
Mulching & Crimping ($/Ac)	$311.25	Unit Cost	
Sub Total Cost/Acre	$553.43	Calculated	
Sub Total - Revegation	$6,143	Calculated	
Sub Total - Roads ($)	$34,252	Calculated	

Main Road Lengths (ft)	Secondary Road Lengths (ft)	
1556		
594		
228		
356	966	
362	391	
211	276	
2309	291	
1260	311	
244	257	
1029	330	
5049	323	
13198	3145	
20	12	
12	8	Total Road
32	20	Area
9.695500459	1.443985308	11.13948577

WORKSHEET 7
TOPSOIL REPLACEMENT & REVEGETATION

	Mine Unit # 1	
V Other		
A. Topsoil Handling & Grading		
Affected Area (Acres)	1.0	
Average Affected Thickness (Ins)	3.0	
Topsoil Volume (Yds³)	403.33	Calculated
Unit Cost - Haul/Place ($/Yd³)	$1.13	Unit Cost
Topsoil Handling Cost ($)	$456	Calculated
Unit Cost - Grading ($/Ac)	$56.28	Unit Cost
Grading Cost ($)	$56	Calculated
Sub Total - Topsoil	$512	Calculated
B. Radiation Survey & Soil Analysis		
Unit Cost ($/Ac)	$653.00	Unit Cost
Sub Total - Survey & Analysis	$653	Calculated
C. Revegation		
Fertilizer ($/Ac)	$52.33	Unit Cost
Seeding Prep & Seeding ($/Ac)	$189.85	Unit Cost
Mulching & Crimping ($/Ac)	$311.25	Unit Cost
Sub Total Cost/Acre	$553.43	Calculated
Sub Total - Revegation	$553	Calculated
Sub Total - Other	$1,718	Calculated

VI Remedial Action		
A. Topsoil Handling & Grading		
Affected Area (Acres)	11.1	
Average Affected Thickness (Ins)	0.0	
Topsoil Volume (Yds³)	0	Calculated
Unit Cost - Haul/Place ($/Yd³)	$1.13	Unit Cost
Topsoil Handling Cost ($)	$0	Calculated
Unit Cost - Grading ($/Ac)	$0.00	Unit Cost
Grading Cost ($)	$0	Calculated
Sub Total - Topsoil	$0	Calculated
B. Radiation Survey & Soil Analysis		
Unit Cost ($/Ac)	$0.00	Unit Cost
Sub Total - Survey & Analysis	$0	Calculated
C. Revegation		
Fertilizer ($/Ac)	$52.33	Unit Cost
Seeding Prep & Seeding ($/Ac)	$189.85	Unit Cost
Mulching & Crimping ($/Ac)	$311.25	Unit Cost
Sub Total Cost/Acre	$553.43	Calculated
Sub Total - Revegation	$6,115	Calculated
Sub Total - Remedial Action	$6,115	Calculated

TOTAL COST - TOPSOIL & REVEGETATION	$72,944

Table 6.8-1 2009 Surety Estimate (Page 28 of 35)

WORKSHEET 8
MISCELLANEOUS RECLAMATION

I	Fence Removal & Disposal		
	Quantity (Feet)	9,500	
	Cost of Removal/Disposal ($/Ft)	$0.68	Unit Cost
	Cost of Removal/Disposal ($)	$6,460	Calculated
II	Powerline Removal & Disposal		
	Quantity (Feet)	15,300	
	Cost of Removal/Disposal ($/Ft)	$1.00	Unit Cost
	Cost of Removal/Disposal ($)	$15,300	Calculated
III	Powerpole Removal & Disposal		
	Quantity	51	
	Cost of Removal/Disposal ($/Each)	$100.00	Unit Cost
	Cost of Removal/Disposal ($)	$5,100	Calculated
IV	Transformer Removal & Disposal		
	Quantity	12	
	Cost of Removal/Disposal ($/Each)	$2,428	Unit Cost
	Cost of Removal/Disposal ($)	$29,131	Calculated
V	Booster Pump Assembly Removal & Disposal		
	Quantity	8	
	Cost of Removal/Disposal ($/Each)	$298	Unit Cost
	Cost of Removal/Disposal ($)	$2,380	Calculated
VI	Culvert Removal & Disposal		
	Quantity (Feet)	200	
	Cost of Removal/Disposal ($/Ft)	$3.48	Unit Cost
	Cost of Removal/Disposal ($)	$696	Calculated
IX	Utilities Cost		
	Quantity (Mos)	6	
	Cost Per Month ($/Month)	$2,380	Unit Cost
	Total Cost ($)	$14,280	Calculated
	TOTAL MISCELLANEOUS COST	$73,347	Calculated

Lost Creek ISR, LLC
Equipment and Tank List

Plant Section: **1** **Shop / Lab / Office** **% contamination:** **10%**

Concrete:	Quantity (each)	Length (feet)	Width or Area (feet)/(sq ft)	Thickness (feet)	Volume (cu. Feet)	Volume (cu. Yds.)	Contam.	Contam. Volume	
Shop Floor	1	180	40	0.5	3600	133.3	N	0.0	
Lab Floor	1	40	40.5	0.5	810	30.0	Y	30.0	
Office Floor	1	40	80	0.5	1600	59.3	N	0.0	
Perimeter Beam	1	340	1	4	1360	50.4	N	0.0	
Internal Perimeter	1	300	1	2	600	22.2	N	0.0	
					7970	295.2		30.0	10%

Equipment:	Quantity (each)	Length (feet)	Width or Area (feet)/(sq ft)	Thickness (feet)	Volume (cu. Feet)	Volume (cu. Yds.)	Contam.	Contam. Volume	
Lab Tables	1	1	435	3	1305	48.3	Y	48.3	
Air Compressor	1	3	3	2	18	0.7	N	0.0	
Water Heater	2	3	3	6	108	4.0	N	0.0	
Generator	1	6	4	4	96	3.6	N	0.0	
MCC	1	20	2	8	320	11.9	N	0.0	
					1847	68.4		48.3	71%

Lost Creek ISR, LLC
Equipment and Tank List

Plant Section: **2** **Precipitation** **% contamination:** **100%**

Concrete:		Quantity (each)	Length (feet)	Width or Area (feet)/(sq ft)	Thickness (feet)	Volume (cu. Feet)	Volume (cu. Yds.)	Contam.	Contam. Volume	
	Precip Floor	1	180	40	0.5	3600	133.3	Y	133.3	
	Perimeter Beam	1	40	1	4	160	5.9	Y	5.9	
	Internal Perimeter	1	400	1	2	800	29.6	Y	29.6	
	Tank Base	6	1	140	1	840	31.1	Y	31.1	
	Pump Base	4	5	5	1	100	3.7	Y	3.7	
						5500	203.7		203.7	100%

Equipment:		Quantity (each)	Length (feet)	Width or Area (feet)/(sq ft)	Thickness (feet)	Volume (cu. Feet)	Volume (cu. Yds.)	Contam.	Contam. Volume	
	Filter Press	2	12	3	4	288	10.7	Y	10.7	
	YC Slurry Tank	2	1	89.1	1	178.2	6.6	Y	6.6	
	YC Slurry Trailer	2	1	189	1	378	14.0	Y	14.0	
	Precip. Tank	4	1	91.8	1	367.2	13.6	Y	13.6	
	Pumps	8	2	2	1	32	1.2	Y	1.2	
						1243.4	46.1		46.1	100%

Lost Creek ISR, LLC
Equipment and Tank List

Plant Section: 3 **Chemical Storage** **% contamination:** 0%

Concrete:	Quantity (each)	Length (feet)	Width or Area (feet)/(sq ft)	Thickness (feet)	Volume (cu. Feet)	Volume (cu. Yds.)	Contam.	Contam. Volume	
Chem. Floor	1	80	40	0.5	1600	59.3	N	0.0	
Perimeter Beam	1	120	1	4	480	17.8	N	0.0	
Internal Perimeter	1	120	1	2	240	8.9	N	0.0	
Acid Floor	2	16	16	1	512	19.0	N	0.0	
Acid Perimeter	2	64	1	2	256	9.5	N	0.0	
Tank Base	4	1	140	1	560	20.7	N	0.0	
Pump Base	4	5	5	1	100	3.7	N	0.0	
					3748	138.8		0.0	0%

Equipment:	Quantity (each)	Length (feet)	Width or Area (feet)/(sq ft)	Thickness (feet)	Volume (cu. Feet)	Volume (cu. Yds.)	Contam.	Contam. Volume	
Soda Ash Tank	1	1	81	1	81	3.0	N	0.0	
Bicarb Tank	1	1	56.7	1	56.7	2.1	N	0.0	
NaOH Tank	1	1	81	1	81	3.0	N	0.0	
NaCl Saturator	1	1	75.6	1	75.6	2.8	N	0.0	
Peroxide Tank	1	1	18.9	1	18.9	0.7	N	0.0	
HCl Tank	1	1	2.7	1	2.7	0.1	N	0.0	
Acid Tank	2	1	56.7	1	113.4	4.2	N	0.0	
Pumps	6	2	2	1	24	0.9	N	0.0	
					453.3	16.8		0.0	0%

Lost Creek ISR, LLC
Equipment and Tank List

Plant Section: 4 **Ion Exchange** **% contamination:** **100%**

Concrete:	Quantity (each)	Length (feet)	Width or Area (feet)/(sq ft)	Thickness (feet)	Volume (cu. Feet)	Volume (cu. Yds.)	Contam.	Contam. Volume	
IX Floor A	1	180	80	0.5	7200	266.7	Y	266.7	
IX Floor B	1	40	40	0.5	800	29.6	Y	29.6	
Perimeter Beam	1	300	1	4	1200	44.4	Y	44.4	
Tank Base	12	1	140	1	1680	62.2	Y	62.2	
IX Base	56	1	1	2	112	4.1	Y	4.1	
Pump Base	8	5	5	1	200	7.4	Y	7.4	
					11192	414.5		414.5	100%

Equipment:	Quantity (each)	Length (feet)	Width or Area (feet)/(sq ft)	Thickness (feet)	Volume (cu. Feet)	Volume (cu. Yds.)	Contam.	Contam. Volume	
IX Column	10	1	86.4	1	864	32.0	Y	32.0	
Guard Column	2	1	64.8	1	129.6	4.8	Y	4.8	
Elution Vessel	2	1	86.4	1	172.8	6.4	Y	6.4	
Fresh Eluate Tank	2	1	91.8	1	183.6	6.8	Y	6.8	
Eluate Tank	2	1	91.8	1	183.6	6.8	Y	6.8	
Rich Eluate Tank	2	1	99.9	1	199.8	7.4	Y	7.4	
Fresh Water Tank	2	1	91.8	1	183.6	6.8	Y	6.8	
Resin Water Decant	1	1	35.1	1	35.1	1.3	Y	1.3	
Resin Water Tank	1	1	91.8	1	91.8	3.4	Y	3.4	
Waste Water Tank	2	1	91.8	1	183.6	6.8	Y	6.8	
RW Sand Filter	1	1	13.5	1	13.5	0.5	Y	0.5	
RW Bag Filter	4	1	0.8	1	3.2	0.1	Y	0.1	
RW Element Filter	4	1	0.8	1	3.2	0.1	Y	0.1	
Eluate Sump Filter	4	1	0.8	1	3.2	0.1	Y	0.1	
Eluate Bag Filter	6	1	0.8	1	4.8	0.2	Y	0.2	
Eluate Element Filter	4	1	0.8	1	3.2	0.1	Y	0.1	
Resin Screen	4	8	4	1	128	4.7	Y	4.7	
RO Unit	1	20	4	6	480	17.8	Y	17.8	
RO Pump	1	1	3.7	1	3.7	0.1	Y	0.1	
IC/PC Pump	12	1	3.7	1	44.4	1.6	Y	1.6	
WDW Pump	1	4	6	2	48	1.8	Y	1.8	
Sump Pump	4	1	1	3	12	0.4	Y	0.4	
Pumps	6	2	2	1	24	0.9	Y	0.9	
					2998.7	111.1		111.1	100%

Lost Creek ISR, LLC
Equipment and Tank List

Plant Section: **5** **Restoration** **% contamination:** **100%**

Concrete:		Quantity (each)	Length (feet)	Width or Area (feet)/(sq ft)	Thickness (feet)	Volume (cu. Feet)	Volume (cu. Yds.)	Contam.	Contam. Volume	
	Rest. Floor	1	40	80	0.5	1600	59.3	Y	59.3	
	IX Base	8	1	1	2	16	0.6	Y	0.6	
	Pump Base	1	5	5	1	25	0.9	Y	0.9	
						1641	60.8		60.8	100%

Equipment:		Quantity (each)	Length (feet)	Width or Area (feet)/(sq ft)	Thickness (feet)	Volume (cu. Feet)	Volume (cu. Yds.)	Contam.	Contam. Volume	
	Rest. Column	2	1	75.6	1	151.2	5.6	Y	5.6	
	RO Unit	5	20	4	6	2400	88.9	Y	88.9	
	RO Pump	5	1	3.7	1	18.5	0.7	Y	0.7	
	Sump Pump	1	1	1	3	3	0.1	Y	0.1	
	Pumps	2	2	2	1	8	0.3	Y	0.3	
						2580.7	95.6		95.6	100%

Table 6.8-1 2009 Surety Estimate(Page 34 of 35)

Lost Creek ISR, LLC
Equipment and Tank List

Plant	CS = Qty (each)	Type	Material	ID (feet)	Height (feet)	Unit Volume (cu. Ft)	Total Volume (cu. Ft)	Thickness (inches)	Unit Dry Wt. (pounds)	Total Dry Wt. (pounds)	Unit Crushed Volume (cu. yd.)	Total Crushed Volume (cu. yd.)	Vessel Numbers
Pressure Vessels													
Ion Exchange Columns	10	Ellip Hd	CS	11.5	9	3739	37393	0.750	25000	250000	3.2	32.3	IX-1 to 10
Guard Columns	2	Ellip Hd	CS	6.5	9	1195	2389	0.500	9200	18400	2.4	4.8	IX-11, 12
Restoration Columns	2	Ellip Hd	CS	10	8	2513	5027	0.625	13700	27400	2.8	5.6	IX-13, 14
Elution Vessels	2	Ellip Hd	CS	11.5	9	3739	7479	0.750	25000	50000	3.2	6.5	E-1, 2
Tanks													
Fresh Eluate Tanks	2	Flat Btm	FRP	14	18	11084	22167	1.000	10,450	20,900	3.4	6.8	T-210A, B
Eluate Tanks	2	Flat Btm	FRP	14	18	11084	22167	1.000	10,450	20,900	3.4	6.8	T-211A, B
Rich Eluate Tanks	2	Flat Btm	FRP	14	20	12315	24630	1.000	11,286	22,572	3.7	7.3	T-212A, B
Fresh Water Tanks	2	Flat Btm	FRP	14	18	11084	22167	1.000	10,450	20,900	3.4	6.8	T-200A, B
Resin Water Decant	1	Cone Btm	FRP	12	8.5	3845	3845	0.750	3,896	3,896	1.3	1.3	T-201
Resin Water Tank	1	Flat Btm	FRP	14	18	11084	11084	1.000	10,450	10,450	3.4	3.4	T-202
Waste Water Tanks	2	Flat Btm	FRP	14	18	11084	22167	1.000	10,450	20,900	3.4	6.8	T-203A, B
Precipitation Tanks	4	Flat Btm	FRP	14	18	11084	44334	1.000	10,450	41,801	3.4	13.6	T-213A - D
Y/C Slurry Storage	2	Cone Btm	CS - RL	12.5	15	7363	14726	0.500	8,242	16,484	3.3	6.6	T-220A, B
Soda Ash Tank	1	Flat Btm	FRP	12	20	9048	9048	1.000	9,316	9,316	3.0	3.0	T-214
Bicarb Mix Tank	1	Flat Btm	FRP	12	12	5429	5429	1.000	6,449	6,449	2.1	2.1	T-215
NaCl Saturator	1	Flat Btm	FRP	12	18	8143	8143	1.000	8,599	8,599	2.8	2.8	T-216
NaOH Tank	1	Flat Btm	FRP	12	20	9048	9048	1.000	9,316	9,316	3.0	3.0	T-219
H2O2 Tank	1	Hor Tank	Alum	9	16.5	4199	4199	0.375	2,396	2,396	0.7	0.7	T-220
Acid Day Tank	1	Flat Btm	CS	5.5	6	570	570	0.250	773	773	0.1	0.1	T-217
Acid Tanks	2	Flat Btm	FRP	12	12	5429	10857	1.000	6,449	12,899	2.1	4.2	T-218A, B
Filtration													
RW Sand Filter	1	Ellip Hd	CS	6	12.5	1414	1414	0.500	7,450	7,450	0.5	0.5	
RW Bag Filter	2		316ss	2	3	38	75	0.375	175	351	0.03	0.1	
RW Element Filter	2		304ss	2	3	38	75	0.375	175	351	0.03	0.1	
Eluate Sump Filter	2		316ss	2	3	38	75	0.375	175	351	0.03	0.1	
Eluate Bag Filter	6		316ss	2	3	38	226	0.375	175	1,052	0.03	0.2	
Eluate Element Filter	2		304ss	2	3	38	75	0.375	175	351	0.03	0.1	
Slurry Filter Press	2						0			0	0.00	0.0	

Lost Creek ISR, LLC
Equipment and Tank List

Plant	CS = Qty (each)	Type	Material	ID (feet)	Height (feet)	Unit Volume (cu. Ft)	Total Volume (cu. Ft)	Thickness (inches)	Unit Dry Wt. (pounds)	Total Dry Wt. (pounds)	Unit Crushed Volume (cu. yd.)	Total Crushed Volume (cu. yd.)	Vessel Numbers
Pumps													
IC Pumps (75 hp submersible)	6		SS			3.7	22		560	3,360			P-206A - F
PC Pumps (75 hp submersible)	6		SS			3.7	22		560	3,360			P-207A - F
RO Pumps (75 hp horizontal)	6		CS/SS			3.7	22		560	3,360			
Waste Water Pumps (25 hp centrifugal)	2		SS				0		100	200			P-203A/B
Resin Water Pumps (20 hp centrifugal)	4		SS				0		265	1,060			P-201A/B, 202A/B
Waste Disposal Pump (Plunger)	2		CS/SS			23	46		2,400	4,800			
Sump Pumps (5 hp)	4		SS				0		295	1,180			
Reverse Osmosis													
200 GPM Unit	6						0			0			
Other													
Resin Screens	4		CS/SS				0			0			S-1A, B, S-2A, B
Water Heater							0			0			
Air Compressor							0			0			
Slurry Trailer	2		CS				0	0.375	15,000	30,000	7	14.0	TR-1, 2
Generator	2						0			0			
MCC							0			0			

FRP =	0.06
CS =	0.28
SS =	0.29
Al =	0.097
Accy Fact	1.1

RESPONSES TO NRC COMMENTS
of 11/6/2008 on

SECTION 7.0
Environmental Effects

in the Technical Report for the
LOST CREEK PROJECT
Wyoming

7.2 Radiological Effects

Please see LC ISR, LLC's responses of December 12, 2008 for all comments on Section 7.2 of the Lost Creek Technical Report.

Section 7.4 Effects of Accidents

Please see LC ISR, LLC's responses of December 12, 2008 for all comments on Section 7.4 of the Lost Creek Technical Report.