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NORTHEAST CHURCH ROCK MINE SITE

**SUPPLEMENTAL REMOVAL SITE EVALUATION REPORT
EAST DRAINAGE AREA**

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1.0 INTRODUCTION

This report is a summary of the scope of work, field and analytical methods, and results of a Supplemental Removal Site Evaluation (SRSE) that was conducted in the area adjacent to the east side of Red Water Pond Rd. (hereafter referred to as the East Drainage Area). This SRSE was conducted as part of the Removal Site Evaluation of the Northeast Church Rock Mine Site (NECR) in Church Rock, New Mexico (the Site) pursuant to the Administrative Order on Consent with EPA Region 9, CERCLA Docket 2009-11. The SRSE was conducted in accordance with the *Supplemental Removal Site Evaluation Work Plan, East Drainage*, dated January 1, 2011 submitted to the U.S. Environmental Protection Agency, Region 9 (EPA) by MWH on behalf of United Nuclear Corporation (UNC). This investigation was conducted consistent with the EPA-approved *Removal Site Evaluation Work Plan* (MWH, 2006) and updated field screening methods (MWH, 2009) used in the Interim Removal Action (IRA) for subsurface soils (i.e., use of a portable gamma spectrometer).

2.0 FIELD INVESTIGATION METHODS

2.1 SUMMARY OF INVESTIGATION METHODS

The East Drainage SRSE was conducted using investigation methods consistent with the Removal Site Evaluation (MWH, 2006) and the updated methods used during the IRA (MWH, 2009). Static direct gamma measurements were first collected on a regular grid along the East Drainage channel and then the area to the north, referred to as the East Drainage flats area. Following gamma surveying, surface soil samples were collected at select locations for laboratory analysis of Ra-226 using EPA Method 901.1. Subsequent to gamma surveying and surface soil sampling, subsurface soil samples were collected at select locations from excavations advanced using a backhoe. Subsurface soil samples were screened in the field using a 3x3 NaI detector compared to a reference sample with a known concentration near the field screening level (FSL) of 2.24 pCi/g. Subsurface samples were also analyzed by AVM using a portable gamma spectrometer and submitted to the laboratory for analysis of Ra-226 using EPA Method 901.1. A detailed description of the gamma surveying and field screening methods that were used are included in the *Radiological Survey Report* included in Appendix A (AVM, 2011).

2.1 STATIC GAMMA RADIATION SURVEY

2.1.1 Analysis Methods and Instrumentation

The static direct gamma radiation level measurements consisted of one-minute static (stationary) gamma radiation counts per minute (CPM), with a 0.5-inch lead collimated Eberline SPA-3 2x2 NaI scintillation detector (SR#408522-30) and a Ludlum 2221 Scaler/Ratemeter (SR#68782). Details of the instrumentation configuration and Standard Operation Procedures (SOPs) are described in the *Removal Site Evaluation Work Plan* (MWH, 2006) and the *Removal Site Evaluation Report* (MWH, 2007). Calibration of instrumentation, including the minimum detectable concentration (MDC) calculation used during the supplemental field radiation survey, was performed in accordance with SOP-1. The one-minute static measurement survey MDC was calculated to be 0.6 pCi/g, similar to the 0.6 pCi/g MDC specified in the RSE Work Plan, for the collimated detector using the background counts at the Site during the field survey. Calibration documentations and daily function check logs for instrumentation used during this SRSE are provided in the *Radiologic Survey Report* (AVM, 2011), included in Appendix A. Field gamma radiation survey and appropriate instrumentation function checks were performed in accordance with SOP-3. The static gamma survey points were located using a Magellan Mobile Mapper Differential Global Positioning System (MMM DGPS) with built in data logger and TDS SOLO survey software. MMM DGPS performs a real-time differential position correction using WAAS signal. The data logger automatically logged the corresponding point number, date, time, coordinates with real-time differential correction, and the gamma radiation counts. The survey date, point ID, and gamma radiation readings in CPM, with comments, were recorded in the Static Gamma Radiation Survey Field Forms, included in Appendix A.

2.1.2 East Drainage Channel

Static gamma radiation measurements were conducted for surface soil across three-point transects spaced every 50 feet along the East Drainage channel for the first 500 feet and then every 100 feet thereafter, as shown in Figure 1, *Sample Locations*. Static gamma radiation measurements were conducted at a total of 20 transects. One static measurement was made at the midpoint of the transect (center of the channel) and one at each bank of the channel. Where the channel was not clearly defined, the measurements on each edge of the channel were either made five feet from the midpoint or were based on the field observation of the channel at that transect. A total of 60 static gamma radiation level measurements were performed for characterization of the East Drainage channel. The transect locations were established based on specified spacing and using the MMM DGPS.

2.1.3 East Drainage Flat Area

During the gamma radiation survey of the north bank of the East Drainage channel, it was observed that the flat area north of the channel appeared to be impacted (East Drainage flats area). A decision was made by the project management team in consultation with EPA to perform a general visual and radiation scan, which was performed April 26-27, 2011 and confirmed that the East Drainage flats area contained elevated gamma radiation levels. The project management team in consultation with EPA instructed the field team to perform a systematic gamma radiation level survey using a random sample grid to better understand the spatial distribution of impacts in that area. The static gamma radiation survey was conducted in the East Drainage flats area, which is the area bounded by the East Drainage channel, Arroyo #2 and Red Water Pond Rd., as shown on Figure 1. The static gamma survey in this area consisted of 0.1 minute counts, compared to the standard 1.0 minute counts, in order to collect information quickly for the project management team to make characterization decisions during the field activities. This survey was conducted on an initial grid spacing of 50-foot square in the southern portion of the area, and then increased to 100-foot spacing in the northern portion, in consultation with EPA (see Figure 1). The grid points were located using MMM DGPS. A total of 239 static gamma radiation level measurements were performed in East Drainage flats area for characterization.

2.1.4 Gamma Radiation Level to Surface Soil Ra-226 Concentration Correlation

The direct gamma radiation static measurements (CPM) were converted to Ra-226 concentrations (pCi/g) using a site-specific statistical correlation between measured gamma radiation levels and surface soil Ra-226 concentrations analyzed in the laboratory. Consistent with the SRSE Work Plan, the recent NECR IRA correlation for gamma radiation level to surface soil Ra-226 content was updated using surface soil samples collected during the East Drainage SRSE. The correlation was updated by developing a regression model after adding the East Drainage SRSE survey and analytical results to the IRA correlation database (see Appendix A).

2.2 SURFACE SOIL SAMPLING

Surface soil samples were collected from the East Drainage Area for Ra-226 analysis as follows from Red Water Pond Rd. to unnamed arroyo #2 (see Figure 1):

1. At the midpoint (bottom of the channel) of the 20 three-point transects spaced along the channel every 50 feet for the first 500 feet and then every 100 feet thereafter, co-located with static gamma radiation level measurements were conducted, for a total of 20 soil samples.
2. Every 200 feet from both channel banks (north and south), for a total of 16 surface soil samples.
3. Judgmental locations within the flats area selected to represent the range of activities (pCi/g) measured during the static gamma survey, and based on discussions with the project management team. A total of 15 surface soil samples were collected in the flats area.

Surface soil samples were collected from a total of 51 locations and field QA/QC samples (blind duplicates) were collected from six of these locations. The soil sample information was recorded in the Soil Sample Log Forms, included in Appendix A. Soil samples were analyzed in the laboratory for Ra-226 analysis using EPA Method 901.1.

2.3 SUBSURFACE SOIL SAMPLING

Consistent with the SRSE Work Plan (MWH, 2011), subsurface soil sampling was conducted to assess the vertical extent of Ra-226 concentrations. The subsurface soil samples were collected at the midpoint of the three-point transects along the East Drainage channel, starting with one at the upstream end adjacent to Red Water Pond Rd., then one every 100 feet for the first 200 feet, followed by one every 200 feet thereafter. The subsurface soil samples were collected from test pits that were excavated using a backhoe. A total of 14 subsurface soil samples were collected from nine locations along the East Drainage channel, as shown on Figure 1.

To help guide sampling depths, subsurface soil samples were field screened using a 2.5 inch lead collimated 3x3 NaI detector/Ludlum 2221 single channel analyzer. The samples were collected at regular intervals vertically based on observations made during excavation (e.g., at 2.5, 5.0 and 7.5 feet below ground surface (ft bgs)). The sample 609 KeV region gamma radiation counts for five minutes were compared to the counts for a 2.0 pCi/g Ra-226 reference soil sample to estimate if the soils at the bottom of each test pit were at or below the FSL (2.24 pCi/g). Once the field screening indicated that the soil at the bottom of the test pit was at or below the FSL, excavation was concluded. The field soil screening data and subsurface soil sample information were recorded in the Field Test Pit Forms and Soil Sample Log Forms, respectively, included in Appendix A. The bottom samples from each of the nine channel test pit locations plus two shallower samples from test pit locations 005 and 020 that showed field screening counts near the FSL were analyzed by onsite field gamma spectroscopy analysis. The field gamma

spectroscopy analysis was used as a supplementary field screening tool to confirm the field screening results. These results are included in Appendix A.

Additional subsurface soil samples were collected from the East Drainage flats area. Subsurface soil samples were collected from this area at one foot depth from 12 locations, as shown on Figure 1. Samples were collected from small pits approximately 1-foot deep and 1-by-1 foot wide that were excavated using a hand shovel. These subsurface soil samples were also analyzed for Ra-226 using EPA Method 901.1. The subsurface soil sample information for these samples was recorded in the Soil Sample Log Forms included in Appendix A. The field soil screening method (3x3 NaI detector) was used for these subsurface soil samples, which, showed that subsurface soils from eight locations were below the FSL. The counts for subsurface soil samples from the other two locations (SRSE-SB-264 and SRSE-SB-291) were above the FSL. Therefore, these locations were further excavated to a depth of 2.5 feet using a backhoe. The field soil screening of these two 2.5-foot samples showed counts below the FSL. The field soil screening data are included in Appendix A.

2.4 LABORATORY ANALYSIS AND DATA VALIDATION

The Ra-226 laboratory analysis on the soil samples was performed by Energy Laboratories, Inc. (ELI) using EPA Method 901.1. The data were validated by Laboratory Data Consultants (LDC), in accordance with the *Quality Assurance Project Plan* (QAPP), included in the RSE Work Plan (MWH, 2006). Data validation was conducted using EPA Level III/IV guidelines.

3.0 FINDINGS AND DISCUSSION

3.1 CORRELATION SAMPLING RESULTS AND REGRESSION ANALYSIS

The direct gamma radiation static measurements were converted to Ra-226 concentrations by site-specific gamma radiation level to surface soil Ra-226 concentration correlation, as described in Section 2.1.4. Data from direct static gamma radiation level measurements and surface soil samples from the channel bed (bottom) locations and two locations in the flats area that came from small depressions were not included in the updated correlation due to inconsistent survey geometry for correlation. The SRSE updated correlation regression data are shown in Appendix A. The resulting SRSE updated regression model has an R² value of 92% and yielded the following equation:

$$Ra-226 \text{ pCi/g} = (0.0013 \times \text{gamma radiation level, CPM}) - 4.358$$

This equation is similar to the IRA updated regression equation $Ra-226 \text{ pCi/g} = (0.0013 \times \text{gamma radiation level, CPM}) - 4.4967$. This SRSE updated correlation regression model equation was used to convert the static gamma radiation levels in CPM to equivalent surface soil Ra-226 concentrations (pCi/g) for the SRSE static gamma radiation level measurements, as shown in Table 1, *Surface Soil Analytical and Field Gamma Screening Results*. The surface soil Ra-226 concentrations determined using the static gamma radiation survey results are shown on Figure 2, *Results of Field Gamma Radiation Survey*.

3.2 STATIC GAMMA SURVEY RESULTS

A total of 299 static gamma radiation level measurements were collected April 25-29, 2011 within the East Drainage Area, as shown on Figure 2. The static gamma radiation measurements and equivalent Ra-226 concentrations were converted using the regression equation listed in Section 3.1 and are listed in Appendix A. A statistical summary of the results of these measurements as equivalent Ra-226 concentrations in pCi/g follows:

	Count	Average	St. Dev.	Minimum	Maximum
East Drainage Channel	60	6.3	5.1	1.1	27.4
East Drainage Flat Area	239	9	11.3	0.9	65.1

The static gamma radiation survey results shown in Figure 2 indicate that the most elevated concentrations of Ra-226 (25.1 to 65.1 pCi/g) are present in the central portion of the East Drainage flats area. The areas surrounding the central area (i.e., west towards Red Water Pond Rd. and the northern portion of the investigated area) were also elevated above 2.24 pCi/g, but distributed over a more general area (see Figure 2). Equivalent Ra-226 concentrations above 2.24 pCi/g were also observed along Red Water Pond Rd. and in a drainage feature from the road near the Quivira Mine.

3.3 SURFACE SOIL ANALYTICAL RESULTS

Surface soil samples were collected from 51 locations within the East Drainage and East Drainage flats areas and were analyzed for Ra-226. The locations of each of the soil samples and analytical results are shown on Figure 3, *Surface Soil Analytical Results*. The analytical results are tabulated in Table 1. Laboratory analytical reports and the results of the data validation are included in Appendix B. Data validation showed that the data are useable for their intended purposes, and no data were qualified. A statistical summary of the results of the Ra-226 analyses in pCi/g follows:

	Count	Average	St. Dev.	Minimum	Maximum
East Drainage Channel	36	8.6	10.3	0.8	63.1
East Drainage Flat Area	15	21.9	25.4	0.9	93.1

These data are consistent with the static direct gamma radiation measurements and indicated the presence of Ra-226 concentrations above 2.24 pCi/g along the East Drainage channel and channel banks and in the central and northern portions of the investigate area. Ra-226 concentrations along the downstream section of the East Drainage channel (i.e., downstream of the access road) were generally lower (0.8 to 7.3 pCi/g). Within the East Drainage flats area, Ra-226 concentrations were generally higher near the central portion (between the East Drainage channel and the secondary channel to the north), with a maximum Ra-226 concentration of 93 pCi/g. All three samples collected from the secondary drainage had Ra-226 concentrations below 2.24 pCi/g.

3.4 SUBSURFACE SOIL ANALYTICAL RESULTS

Subsurface soil samples were collected from 26 locations in the East Drainage Area and were analyzed for Ra-226. The subsurface soil sample locations and their analytical results (including sample depth, gamma counts per minute (cpm), and Ra-226 concentrations in pCi/g) are shown in Figure 4, *Subsurface Soil Survey Results*. The analytical results are shown in Table 2, *Subsurface Soil Analytical and Field Gamma Screening Results*. Laboratory analytical reports and the results of the data validation are included in Appendix B. Data validation showed that the data are useable for their intended purposes, and no data were qualified. A statistical summary of the results of the Ra-226 static gamma measurements (CPM) and Ra-226 analytical results (pCi/g) follows:

	Count	Units	Average	St. Dev.	Minimum	Maximum
East Drainage Channel	14	CPM	2,847	1,696	1,489	6,504
	12	pCi/g	1.2	1.2	<0.3	2.4
East Drainage Flats Area	12	CPM	3,377	4,775	1,357	17,719
	1	pCi/g	n/a	n/a	1.9	1.9

The results of these 26 survey points/samples indicated that there are impacts below the top six inches in the East Drainage channel, but generally no impacts at depth in the East Drainage flats area (see Figure 4).

Nine locations in the East Drainage channel were sampled and screened using the 3x3 NaI detector; four of these had readings that exceeded the reference soil level of 2,531 CPM, as shown on Figure 4. Of these four, the most upstream location (SRSE-001) indicated subsurface impacts at 2.5 and 5 ft bgs, but no impacts at 7.5 ft bgs. The other three locations indicated impacts at 2.5 ft bgs, but no impacts at 5 ft bgs. Only one of these four had FSL exceedances at depths of 2.5 feet and 5 feet, exceedances at the remaining three locations were limited to 2.5 feet. The subsurface soil samples were submitted to the laboratory for Ra-226 analysis, the results of which confirmed the field screening results, as shown on Figure 4 and in Table 2. These results indicate that impacts within the drainage channel are generally confined to surface soils, with localized impacts to 2.5 ft bgs at three locations, and to 5 ft bgs at one location (adjacent to Red Water Pond Rd.).

The results of the subsurface soil surveying in the flats area indicated levels above the FSL at only two locations, as shown on Figure 4. One location was in the central area, and the second was located close to Red Water Pond Rd., consistent with the results of the surface soil gamma surveying. Both of these samples were collected at 1 foot bgs. Samples collected from 2.5 feet bgs from these two locations were less than the FSL. These results indicated that impacted soil is generally confined to surface soils (0 to 6 inches) within the flats area.

4.0 CONCLUSIONS

This report presents the results of the SRSE conducted in the East Drainage Area, as per the SRSE Work Plan (MWH, 2011). The SRSE consisted of direct gamma radiation surveying, soil sampling and analysis, and development of a revised correlation between direct gamma radiation measurements and equivalent Ra-226 concentrations.

The results of the East Drainage SRSE were as follows:

- Ra-226 concentrations above 2.24 pCi/g were observed both in the East Drainage channel and in the East Drainage flats area, as determined from static gamma converted to Ra-226 concentrations and in soil samples analyzed in the laboratory for Ra-226.
- Equivalent Ra-226 concentrations above 2.24 pCi/g were observed along Red Water Pond Rd. and in a drainage feature from the road near the Quivira Mine. Based on the distribution of locations with equivalent Ra-226 concentrations above 2.24 pCi/g, the observed impacts, including along the road and in the flats area are also attributable to the Quivira Mine and its past use of Red Water Pond Rd. as a haul road. This is consistent with the results and conclusions of the Supplemental RSE that was conducted along Red Water Pond Rd. and within the buffers adjacent to the road (MWH, 2010).
- Equivalent Ra-226 concentrations (pCi/g) converted from the gamma readings (CPM) ranged from 0.9 to 65.1 pCi/g (averages by area were 6.3 and 9.0 pCi/g).
- Surface soil analytical results for Ra-226 ranged from 0.8 to 93.1 pCi/g (averages by area were 8.6 and 21.9 pCi/g).
- Subsurface soil analytical results for Ra-226 ranged from <0.3 (non-detect) to 2.4 pCi/g (average in East Drainage channel area 1.9 pCi/g).

The majority of soil impacts above the FSL (2.24 pCi/g) were determined to be at or near the ground surface (0 to 6 inches), with the highest concentrations being in the central area north of the East Drainage channel. Some impacts were detected in the subsurface (0.5 to 5 ft bgs), at four locations within the East Drainage channel (0.5 to 5 ft bgs) and two locations in the East Drainage flats area (0.5 to <2.5 ft bgs).

The East Drainage SRSE was sufficient to fully characterize this area. No further investigations are recommended.

5.0 REFERENCES

- AVM, 2011. *NECR RSE Radiologic Survey Report, Supplemental Removal Site Evaluation, East Drainage Area, North East Church Rock Mine Site.*
- MWH, 2011. *Supplemental Removal Site Evaluation Work Plan, East Drainage, Northeast Church Rock Mine Site, New Mexico, letter to EPA, January 7.*
- MWH, 2010. *(Supplemental) Removal Site Evaluation Report, Red Water Pond Rd., Northeast Church Rock Mine Site, New Mexico, January, 26.*
- MWH, 2009. *Sampling Procedure for the Unnamed Arroyo, letter to EPA, September 23.*
- MWH, 2007. *Removal Site Evaluation Report, Northeast Church Rock Mine Site, October.*
- MWH, 2006. *Removal Site Evaluation Work Plan, Northeast Church Rock Mine Site, August.*

TABLES

Table 1
Surface Soil Analytical and Field Gamma Screening Results
NECR East Drainage Supplemental Removal Site Evaluation

Location ID	Depth (ft bgs)	Sample ID ¹	Ra-226 Lab Result (pCi/g) ⁴	Gamma Screening Result (cpm) ²	Ra-226 Equivalent (pCi/g) ³
Surface Soil Samples from East Drainage - Channel Center (n=20)⁵					
SRSE-001	0-0.5	SRSE-SS-001 @0'	13.5	12,060	11.3
SRSE-002	0-0.5	SRSE-SS-002 @0'	7.6	10,953	9.9
SRSE-003	0-0.5	SRSE-SS-003 @0'	9.5	10,349	9.1
SRSE-004	0-0.5	SRSE-SS-004 @0'	8.4	11,024	10.0
SRSE-005	0-0.5	SRSE-SS-005 @0'	10.3	11,083	10.0
SRSE-006	0-0.5	SRSE-SS-006 @0'	7.8	9,742	8.3
SRSE-007	0-0.5	SRSE-SS-007 @0'	9.9	7,651	5.6
SRSE-008 ⁷	0-0.5	SRSE-SS-008 @0'	8.3	8,421	6.6
		SRSE-SD-001 @0'	9.7		
SRSE-009	0-0.5	SRSE-SS-009 @0'	10.6	9,465	7.9
SRSE-010	0-0.5	SRSE-SS-010 @0'	9.8	10,156	8.8
SRSE-011	0-0.5	SRSE-SS-011 @0'	9.8	7,753	5.7
SRSE-012	0-0.5	SRSE-SS-012 @0'	9.7	6,890	4.6
SRSE-013	0-0.5	SRSE-SS-013 @0'	9.4	14,817	14.9
SRSE-014	0-0.5	SRSE-SS-014 @0'	3.9	6,398	4.0
		SRSE-SD-002 @0'	3.5		
SRSE-015	0-0.5	SRSE-SS-015 @0'	4.4	7,495	5.4
SRSE-016	0-0.5	SRSE-SS-016 @0'	3.7	6,703	4.4
SRSE-017	0-0.5	SRSE-SS-017 @0'	0.8	11,368	10.4
SRSE-018	0-0.5	SRSE-SS-018 @0'	3.4	7,433	5.3
		SRSE-SD-003 @0'	3.7		
SRSE-019	0-0.5	SRSE-SS-019 @0'	2.3	5,859	3.3
SRSE-020	0-0.5	SRSE-SS-020 @0'	7.3	9,191	7.6
Surface Soil Samples from East Drainage - Channel Banks (n=16)⁵					
SRSE-021	0-0.5	SRSE-SS-021 @0'	13.4	11,705	10.9
SRSE-025	0-0.5	SRSE-SS-025 @0'	9.7	10,317	9.1
SRSE-029	0-0.5	SRSE-SS-029 @0'	2.6	4,919	2.0
SRSE-032	0-0.5	SRSE-SS-032 @0'	3.9	5,458	2.7
SRSE-034	0-0.5	SRSE-SS-034 @0'	3.7	7,054	4.8
SRSE-036	0-0.5	SRSE-SS-036 @0'	2.0	4,619	1.6
SRSE-038	0-0.5	SRSE-SS-038 @0'	1.5	4,434	1.4
SRSE-040	0-0.5	SRSE-SS-040 @0'	1.6	4,538	1.5
SRSE-041	0-0.5	SRSE-SS-041 @0'	21.9	18,331	19.5
		SRSE-SD-004 @0'	26.0		
SRSE-045	0-0.5	SRSE-SS-045 @0'	8.0	9,237	7.6
SRSE-049	0-0.5	SRSE-SS-049 @0'	10.2	11,335	10.4
SRSE-052	0-0.5	SRSE-SS-052 @0'	63.1	24,421	27.4
SRSE-054	0-0.5	SRSE-SS-054 @0'	2.1	4,741	1.8
SRSE-056	0-0.5	SRSE-SS-056 @0'	2.2	4,696	1.7
SRSE-058	0-0.5	SRSE-SS-058 @0'	1.9	4,515	1.5
SRSE-060	0-0.5	SRSE-SS-060 @0'	1.3	4,588	1.6
Surface Soil Samples from Flats to the North of East Drainage (n=15)⁵					
SRSE-065	0-0.5	SRSE-SS-065 @0'	5.9	5,856	3.3
SRSE-092	0-0.5	SRSE-SS-092 @0'	13.8	9,377	7.8
SRSE-101	0-0.5	SRSE-SS-101 @0'	64.5	53,436	65.1
SRSE-103	0-0.5	SRSE-SS-103 @0'	15.5	8,150	6.2
SRSE-123	0-0.5	SRSE-SS-123 @0'	21.5	10,441	9.2
SRSE-135	0-0.5	SRSE-SS-135 @0'	93.1	25,944	29.4
SRSE-198	0-0.5	SRSE-SS-198 @0'	25.3	13,661	13.4
SRSE-224	0-0.5	SRSE-SS-224 @0'	19.2	9,588	8.1
SRSE-237	0-0.5	SRSE-SS-237 @0'	3.6	6,159	3.6
SRSE-264	0-0.5	SRSE-SS-264 @0'	8.7	10,178	8.9
SRSE-279	0-0.5	SRSE-SS-279 @0'	1.9	5,104	2.3
SRSE-283	0-0.5	SRSE-SS-283 @0'	2.0	5,239	2.5
SRSE-287	0-0.5	SRSE-SS-287 @0'	0.9	4,805	1.9
SRSE-290	0-0.5	SRSE-SS-290 @0'	4.3	6,329	3.9
SRSE-291	0-0.5	SRSE-SS-291 @0'	34.5	30,731	35.6
		SRSE-SD-005 @0'	35.4		

Notes:

1. Samples collected on April 28, 2011 using a backhoe and submitted to Energy Labs, Inc. for analysis of Ra-226 by EPA Method 901.1.
2. Gamma screening conducted by AVM, Inc. using a shielded 2x2" NaI detector/Ludlum 2221 rate meter.
3. Based on IRA correlation updated with East Drainage SRSE results: Ra-226 pCi/g = 0.0013 x gamma level CPM – 4.3582
4. Analyzed by Energy Laboratories, Inc. using EPA Method 901.1.
5. Gamma measurements from drainage channel based on 1-min counts, whereas measurements in flats area based on 0.1-min counts.
6. Bold values indicate laboratory exceedance of field screening level (based on 2.24 pCi/g Ra-226 equivalent).
7. Sample ID's including "SD" are duplicates of the paired sample shown.

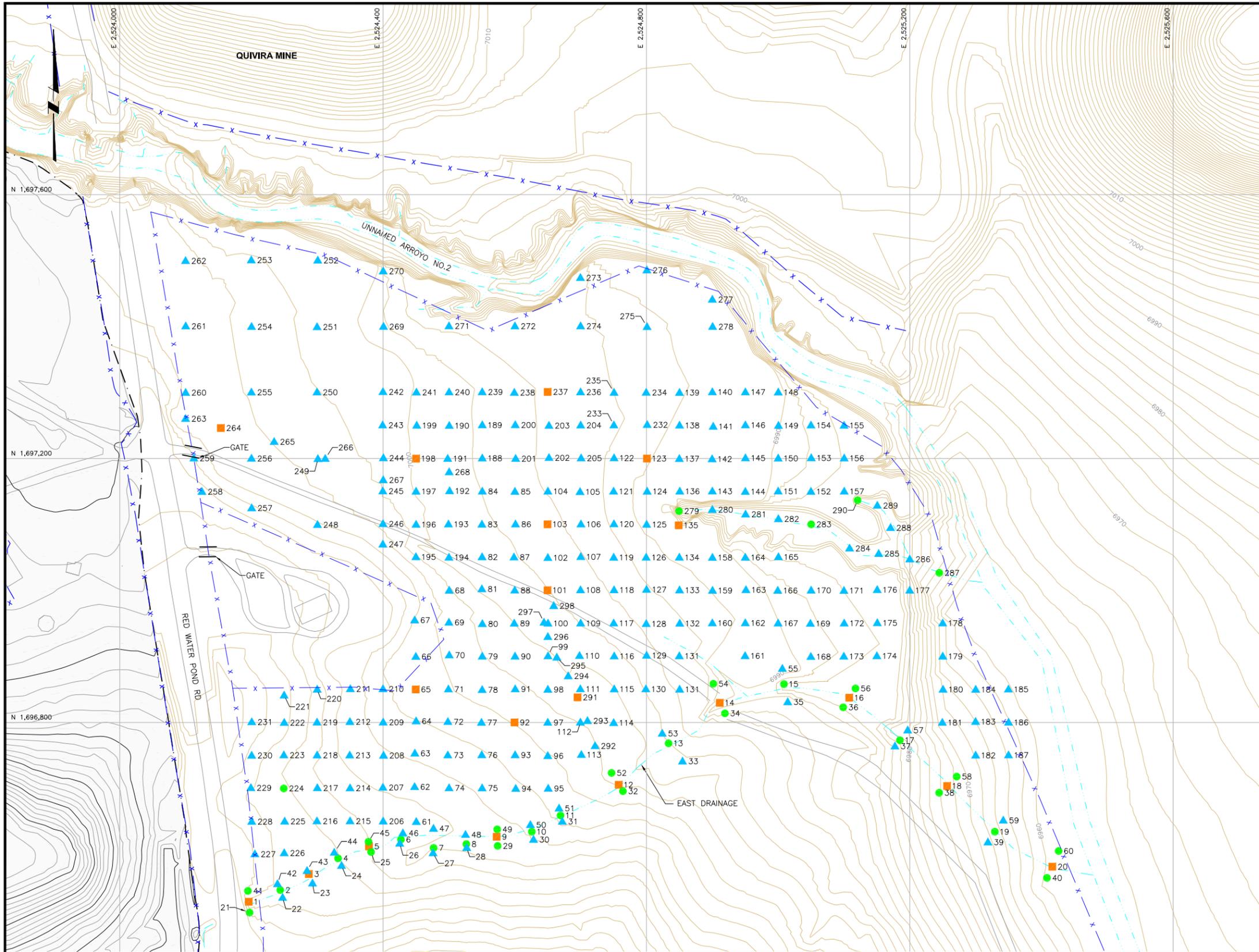
Table 2
Subsurface Soil Analytical and Field Gamma Screening Results
NECR East Drainage Supplemental Removal Site Evaluation

Location ID	Depth (ft bgs)	Sample ID ¹	Ra-226 Lab Result (pCi/g) ²	Gamma Screening Results (cp5m) ³	Gamma Spectroscopy Results,	
					Projected Concentration (pCi/g)	Uncertainty
Subsurface Soil Samples from East Drainage (n=14)						
Reference sample equivalent to 2.0 pCi/g Ra-226 = 2,402 cpm						
SRSE-001	2.5	SRSE-SB-001 @2.5'	n/a ⁵	6,504		
SRSE-001	5.0	SRSE-SB-001 @5.0'	n/a	5,554		
SRSE-001	7.5	SRSE-SB-001 @7.5'	0.4	1,976	1.7	+/-0.3
SRSE-003	2.5	SRSE-SB-003 @2.5'	<0.3	2,082	2.0	+/-0.3
SRSE-005	2.5	SRSE-SB-005 @2.5'	<0.3	2,513	1.9	+/-0.3
		SRSE-SD-006 @2.5'	1.6			
SRSE-005	5.0	SRSE-SB-005 @5.0'	<0.3	1,732	0.9	+/-0.3
SRSE-009	2.5	SRSE-SB-009 @2.5'	0.3	1,634	0.8	+/-0.3
SRSE-012	2.5	SRSE-SB-012 @2.5'	0.4	1,489	1.0	+/-0.3
SRSE-014	2.5	SRSE-SB-014 @2.5'	0.7	5,658		
SRSE-014	5.0	SRSE-SB-014 @5.0'	n/a	1,805	0.6	+/-0.2
SRSE-016	2.5	SRSE-SB-016 @2.5'	2.8	2,177	2.0	+/-0.3
SRSE-018	2.5	SRSE-SB-018 @2.5'	2.1	2,204	1.9	+/-0.3
SRSE-020	2.5	SRSE-SB-020 @2.5'	3.4	2,531	3.1	+/-0.4
SRSE-020	5.0	SRSE-SB-020 @5.0'	1.8	2,001	1.4	+/-0.3
Subsurface Soil Samples from Flats to the North of East Drainage (n=12)						
Reference sample equivalent to 2.0 pCi/g Ra-226 = 2,496 cpm						
SRSE-065	1.0	SRSE-SB-065 @1.0'	n/a	1,502		n/a
SRSE-092	1.0	SRSE-SB-092 @1.0'	n/a	1,378		n/a
SRSE-101	1.0	SRSE-SB-101 @1.0'	1.9	2,214		n/a
SRSE-103	1.0	SRSE-SB-103 @1.0'	n/a	1,459		n/a
SRSE-123	1.0	SRSE-SB-123 @1.0'	n/a	1,396		n/a
SRSE-135	1.0	SRSE-SB-135 @1.0'	n/a	1,610		n/a
SRSE-198	1.0	SRSE-SB-198 @1.0'	n/a	1,463		n/a
SRSE-237	1.0	SRSE-SB-237 @1.0'	n/a	1,357		n/a
SRSE-264	1.0	SRSE-SB-264 @1.0'	n/a	6,913		n/a
SRSE-264	2.5	SRSE-SB-264 @2.5'	n/a	1,571		n/a
SRSE-291	1.0	SRSE-SB-291 @1.0'	n/a	17,719		n/a
SRSE-291	2.5	SRSE-SB-291 @2.5'	n/a	1,941		n/a

Notes:

1. Samples collected on April 28, 2011 using a backhoe.
2. Analyzed by Energy Laboratories, Inc. using EPA Method 901.1.
3. Gamma screening conducted by AVM, Inc. using a 3x3" NaI detector/Ludlum 2221 rate meter shielded with a 1.5-inch lead
4. Analyses conducted by AVM, Inc. using a Canberra System 100 Gamma Spectroscopy System and a 5-day ingrowth period.
5. n/a = not analyzed in the laboratory or using the Canberra gamma spectrometer.
6. Bold values indicate exceedance of reference sample value.
7. Sample ID's including "SD" are duplicates of the paired sample shown.

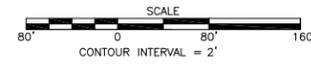
FIGURES



LEGEND:

- 7040 EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
- 7040 INTERIM REMOVAL ACTION REGRADE GROUND SURFACE CONTOUR AND ELEVATION, FEET
- LIMIT OF 2010 TOPOGRAPHIC SURVEY
- ROAD
- NATURAL DRAINAGE
- FENCE
- PHYSICAL STRUCTURE
- GAMMA STATIC SURVEY POINT
- SURFACE SOIL AND GAMMA LOCATION
- SUBSURFACE SOIL, SURFACE SOIL AND GAMMA LOCATION
- 276 LOCATION ID

PLAN

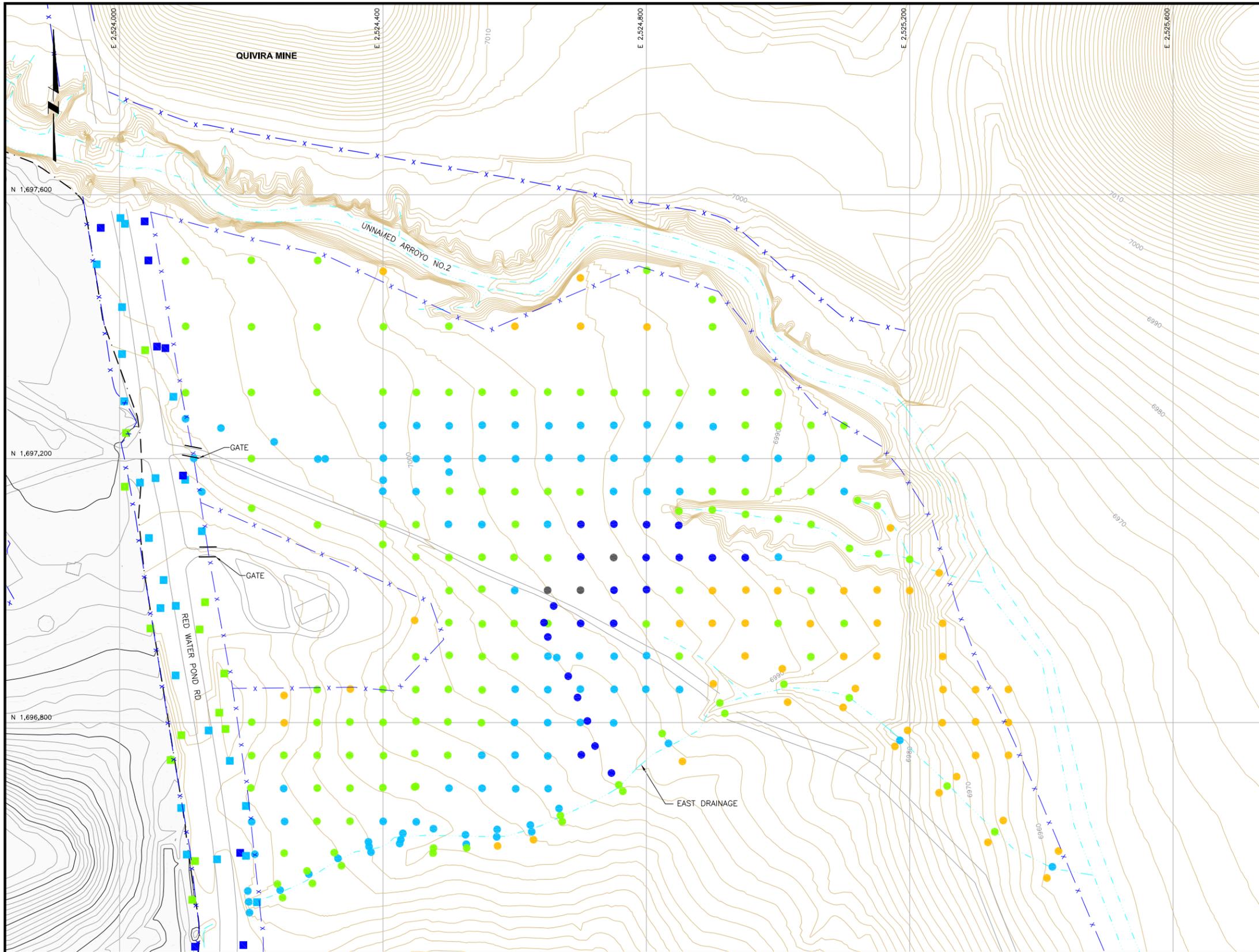


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					DESIGNED BY: T. LEESON 08/19/11 DRAWN BY: F. ANDRADE 08/19/11 CHECKED BY: D. RODRIGUEZ 08/19/11 APPROVED BY: T. LEESON 08/19/11 PROJECT MANAGER: T. LEESON 08/19/11 CLIENT APPROVAL: CLIENT REFERENCE NO.:



PROJECT LOCATION NORTHEAST CHURCH ROCK MINE		
PROJECT NECR SUPPLEMENTAL REMOVAL SITE EVALUATION EAST DRAINAGE		
TITLE SAMPLE LOCATIONS		FIGURE 1
FILE NAME 1010334D003		REVISION 1



LEGEND:

- 7040 EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
- 7040 INTERIM REMOVAL ACTION REGRADE GROUND SURFACE CONTOUR AND ELEVATION, FEET
- LIMIT OF 2010 TOPOGRAPHIC SURVEY
- ROAD
- NATURAL DRAINAGE
- FENCE
- PHYSICAL STRUCTURE

2011 STATIC GAMMA MEASUREMENT LOCATIONS SHOWING EQUIVALENT Ra-226 (pCi/g) CONCENTRATION

- <2.24
- 2.24 ~ 6.0
- 6.1 ~ 22.4
- 22.4 ~ 50
- >50

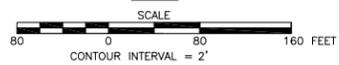
2007/2009 STATIC GAMMA MEASUREMENT LOCATIONS SHOWING EQUIVALENT Ra-226 (pCi/g) CONCENTRATION

- 2.24 ~ 6.0
- 6.1 ~ 22.4
- 22.4 ~ 50

NOTES:

1. THREE-SAMPLE TRANSECTS ALONG EAST DRAINAGE MEASURED WITH A 1-MIN COUNT TIME; ALL OTHERS MEASURED WITH A 0.1-MIN COUNT TIME.
2. 2007 - 2009 GAMMA MEASUREMENTS TAKEN DURING SUPPLEMENTAL RSES ALONG RED WATER POND RD.

PLAN



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PROJECTION:
STATE PLANE COORDINATES
ZONE:
NEW MEXICO WEST
DATUM:
NAD 83
UNITS:
US FEET

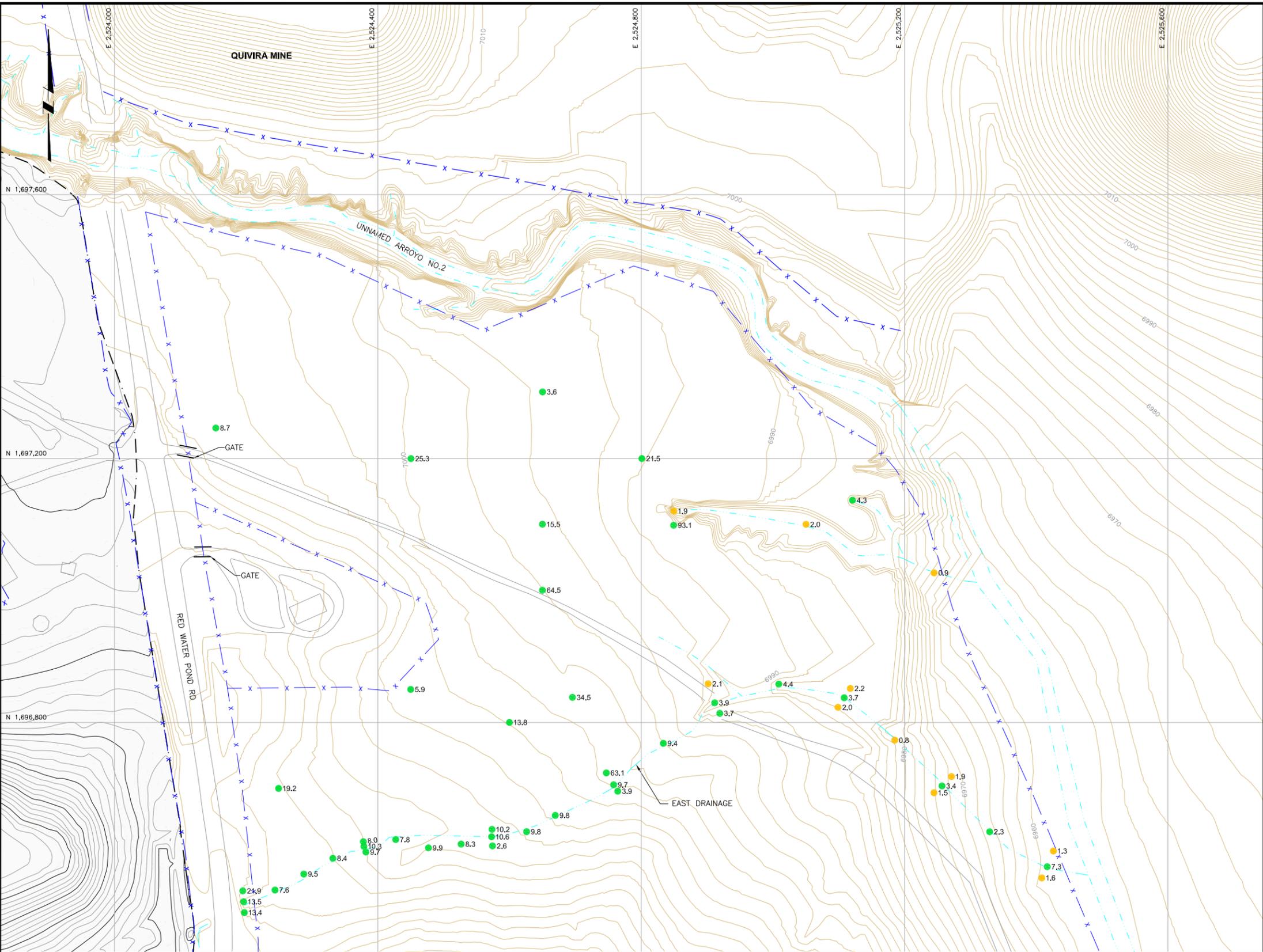
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DRAWN BY	F. ANDRADE	08/19/11
CHECKED BY	T. LEESON	08/19/11
APPROVED BY	T. LEESON	08/19/11
PROJECT MANAGER	T. LEESON	08/19/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		



PROJECT LOCATION	
NORTHEAST CHURCH ROCK MINE	
PROJECT	
NECR SUPPLEMENTAL REMOVAL SITE EVALUATION EAST DRAINAGE	
TITLE	
RESULTS OF FIELD GAMMA RADIATION SURVEY	

	FIGURE	2	REVISION	1
	FILE NAME	1010334D004		

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- LEGEND:**
- 7040 EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
 - 7040 INTERIM REMOVAL ACTION REGRADE GROUND SURFACE CONTOUR AND ELEVATION, FEET
 - LIMIT OF 2010 TOPOGRAPHIC SURVEY
 - ROAD
 - NATURAL DRAINAGE
 - FENCE
 - PHYSICAL STRUCTURE
 - SURFACE SOIL SAMPLE LOCATION ≤2.2 pCi/g
 - SURFACE SOIL SAMPLE LOCATION >2.2 pCi/g

- NOTES:**
1. SAMPLES COLLECTED FROM 0-0.5 FT bgs.
 2. SOIL SAMPLE ANALYZED FOR Ra-226 IN THE LABORATORY USING METHOD 901.1.

PLAN



ISSUE NO.	DESCRIPTION	TECH	ENG	DATE
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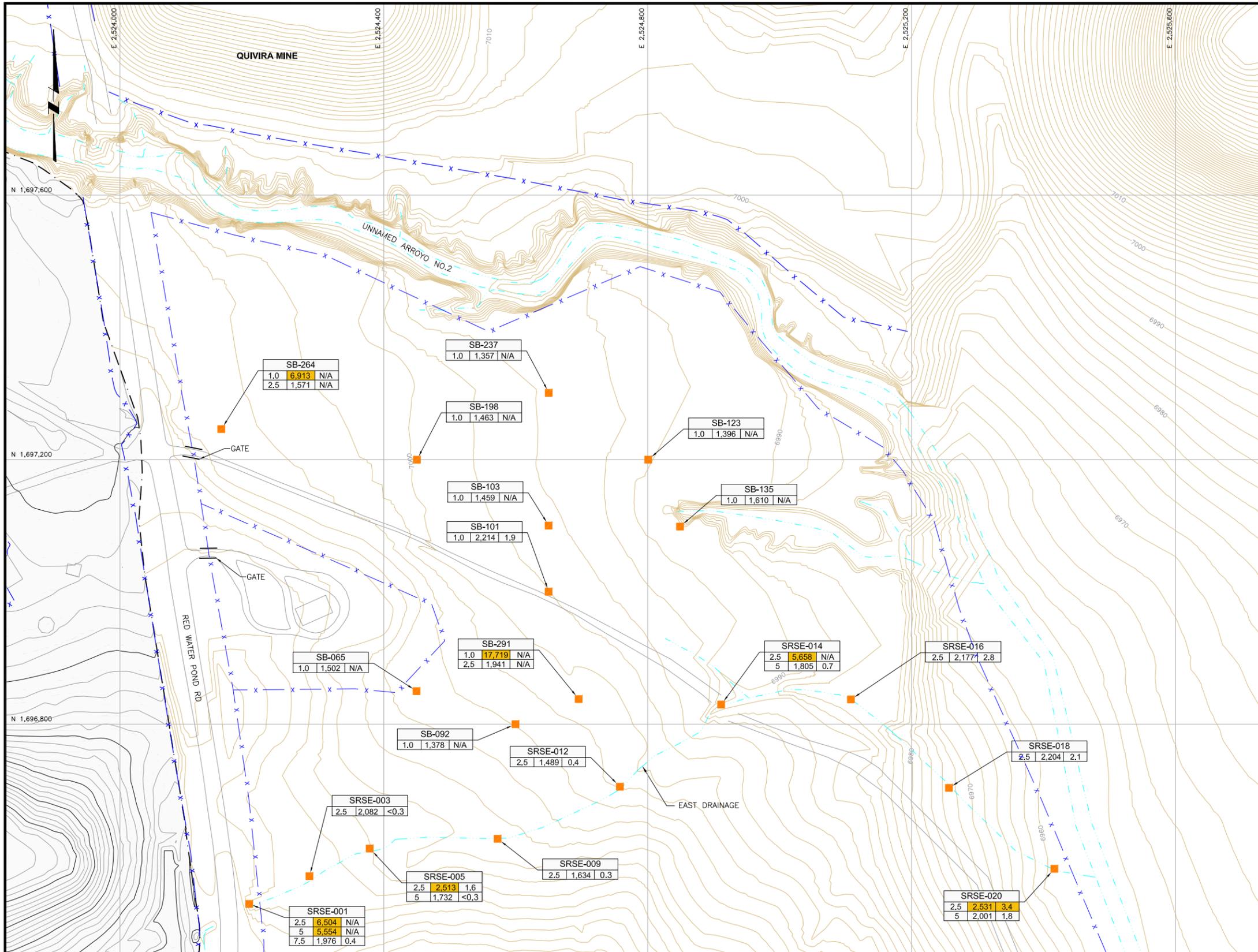
PROJECTION:
STATE PLANE COORDINATES
ZONE: NEW MEXICO WEST
DATUM: NAD 83
UNITS: US FEET

DESIGNED BY	T. LEESON	08/19/11
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CHECKED BY	T. LEESON	08/19/11
APPROVED BY	T. LEESON	08/19/11
PROJECT MANAGER	T. LEESON	08/19/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		



PROJECT LOCATION	
NORTHEAST CHURCH ROCK MINE	
PROJECT	
NECR SUPPLEMENTAL REMOVAL SITE EVALUATION EAST DRAINAGE	
TITLE	
SURFACE SOIL ANALYTICAL RESULTS	
FIGURE	3
REVISION	1
FILE NAME	1010334D012





LEGEND:

- 7040 EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
- 7040 INTERIM REMOVAL ACTION REGRADE GROUND SURFACE CONTOUR AND ELEVATION, FEET
- LIMIT OF 2010 TOPOGRAPHIC SURVEY
- ROAD
- NATURAL DRAINAGE
- FENCE
- PHYSICAL STRUCTURE
- SUBSURFACE SOIL SAMPLE LOCATION

SRSE-016	LOCATION ID
2.5 2,177 2,0	
	Ro-226 (pCi/g)
	GAMMA (cpm)
	DEPTH
N/A	NOT ANALYZED
2,531	HIGHLIGHTED VALUES INDICATE EXCEEDANCE OF REFERENCE SAMPLE (GAMMA) OR FIELD SCREENING LEVEL (Ro-226)

NOTE:

- SOIL SAMPLES ANALYZED FOR Ro-226 IN THE LABORATORY USING METHOD 901.1.

PLAN



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PROJECT LOCATION		NORTHEAST CHURCH ROCK MINE	
PROJECT		NECR SUPPLEMENTAL REMOVAL SITE EVALUATION EAST DRAINAGE	
TITLE		SUBSURFACE SOIL SURVEY RESULTS	
FIGURE	4	REVISION	1
FILE NAME	1010334D006		

APPENDIX A
RADIOLOGICAL SURVEY REPORT

**Radiologic Survey Report
Supplemental Removal Site Evaluation
East Drainage Area
North East Church Rock Mine Site**

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AVM Environmental Services, Inc.
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Grants, NM 87020**

**Prepared for:
MWH
1475 Pine Grove Road
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Steamboat Springs, CO 80487**

and

**United Nuclear Corporation
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Gallup, NM 87305**

September 1, 2011

1.0 Introduction

This data report presents the results of radiologic surveys conducted by AVM Environmental Services, Inc. (AVM) during the period April 25, 2011 to April 29, 2011 for a Supplemental Removal Site Evaluation (SRSE) conducted in the East Drainage Area east of the Northeast Church Rock mine site (NECR). The work was conducted consistent with the SRSE Work Plan, dated January 1, 2011 (MWH), and the Work Plan Addendum, dated May 16, 2011 (MWH). The SRSE Work Plan and Addendum were consistent with the EPA-approved *Removal Site Evaluation Work Plan* (MWH, 2006) methods and the updated field screening methods used during the *Interim Removal Action* (IRA) for subsurface soils (i.e., use of a portable gamma spectrometer). Radiologic surveys consisted of static gamma radiation level measurements for lateral surface soil Ra-226 concentration assessment, field subsurface soil screening for vertical extent of Ra-226 concentration assessment, and surface and subsurface soil sampling and analysis for Ra-226 concentrations used for statistical correlation and confirmation of the radiological survey results.

2.0 Static Gamma Radiation Level Survey

The static gamma radiation level survey at the east drainage area at NECR was conducted consistent with the SRSE Work Plan and the Addendum mentioned above. The static gamma radiation level measurements consisted of one-minute static (stationary) gamma radiation counts per minute (CPM), with a 0.5-inch lead collimated Eberline SPA-3 2x2 NaI scintillation detector (SR#408522-30) and a Ludlum 2221 Scaler/Ratemeter (SR#68782). Details of the instrumentation configuration and SOPs are described in the *Removal Site Evaluation Work Plan* (RSEWP, MWH, 2006) and the *Removal Site Evaluation Report* (MWH, 2007). Calibration of instrumentation, including the minimum detectable concentration (MDC) calculation, used during the supplemental field radiation survey was performed in accordance with SOP-1. The one-minute static measurement survey MDC was calculated to be 0.6 pCi/g, similar to the 0.6 pCi/g MDC specified in the RSEWP, for the collimated detector using the background counts at the Site during the field survey. Calibration documentations and daily function check logs for instrumentation used during this SRSE are provided in Appendix A. Field gamma radiation survey and appropriate instrumentation function checks were performed in accordance with the SOP-3. The static gamma survey points were located using a Magellan Mobile Mapper Differential Global Positioning System (MMM DGPS) with built in data logger and TDS SOLO survey software. MMM DGPS performs a real-time differential position correction using WAAS signal. The data logger automatically logged the corresponding date, time and the actual survey point location coordinates with real time differential correction, which is used for mapping. The survey information, which included the point number and gamma radiation counts were also logged in the data logger. Also, the survey date, the survey point ID, and the gamma radiation readings in CPM, with any comment, were recorded in the Static Gamma Radiation Survey Field Forms, which are included in Appendix B.

2.1 Static Gamma Radiation Level Survey at the East Drainage Channel

Static gamma radiation measurements were conducted for surface soil across three-point transects spaced every 50 feet along the East Drainage channel for the first 500 feet and then every 100 feet thereafter. Static gamma radiation measurements were conducted at a total of 20 transects. One static measurement was made at the midpoint of the transect (center of the channel) and one at each bank of the channel. Where the channel was not clearly defined, the measurements on each edge of the channel were made 5 feet from the midpoint or based on the field observation of the channel at that transect. A total of 60 static gamma radiation level measurements were performed for characterization of the East Drainage channel. The transect locations were established based on specified spacing and using the MMM DGPS. The Static Gamma Radiation Survey Field Forms, which include the survey date, the survey point ID (points SRSE-GS-001 through SRSE-GS-061), and the gamma radiation readings in CPM, with any comment for the east drainage channel, are included in Appendix B. The static gamma survey locations at the east drainage channel are shown in Figure 1. The gamma radiation levels in CPM were converted into equivalent surface Ra-226 concentration using a site-specific correlation discussed in Section 4.0.

2.2 Static Gamma Radiation Level Survey at the East Drainage Flat (Step-out) Area

During the gamma radiation survey of the north bank of the East Drainage channel, it was observed that the flat area north of the channel appeared to be impacted from sediments carried out of the drainage by runoff overflow. A decision was made by the project management team in consultation with EPA to perform a general visual and radiation scan, which was performed on April 26, 2011 and indicated that the flat area to the north of the East Drainage channel had elevated gamma radiation levels. The project management team in consultation with EPA instructed AVM to perform a systematic gamma radiation level survey using a random sample grid to better understand the spatial distribution of any impacts in the area. A static gamma radiation survey was conducted April 26 and 27, 2011 in the area north of the East Drainage; the area surrounded by the East Drainage channel, Arroyo #2 and Red Water Pond Road. The static gamma survey in this area consisted of 0.1 minute counts, compared to the standard 1.0 minute counts, in order to collect information quickly for the project management team to make characterization decisions during the field activities. However, the grid spacing density for this survey was increased to 50-foot square grid point compared to the 80-foot triangular point to obtain a better spatial contamination distribution. The 50-foot square grid points were located using MMM DGPS. A total of 239 static gamma radiation level measurements were performed in the area north of the East Drainage for characterization. The Static Gamma Radiation Survey Field Forms, which include the survey date, the survey point ID (points SRSE-GS-061 to SRSE-GS-298), and the gamma radiation readings in CPM, with survey comments, are included in Appendix B. The static gamma survey locations at the east drainage channel are shown on Figure 1. The gamma radiation levels in CPM were converted into equilivant surface Ra-226 concentration using a site specific correlation, as discussed in Section 4.0.

3.0 Soil Sampling for Ra-226

Surface and subsurface soil samples for Ra-226 soil concentration were collected consistent with the Work Plan for:

- confirmation of the gamma radiation level survey results;
- the gamma radiation level to surface soil Ra-226 concentration correlation; and
- Ra-226 soil screening of subsurface soil.

3.1 Surface Soil Sampling for Ra-226

Surface soil samples from the East Drainage area were collected for Ra-226 analysis as follows:

1. A surface soil sample at the midpoint (bottom of the channel) of the 20 three-point transects along the channel where static gamma radiation level measurements were conducted. A total of 20 surface soil samples were collected from the bottom of the channel.
2. A surface soil sample every 200 feet from both channel banks (north and south). A total of 10 surface soil samples were collected from each of the channel banks.
3. Since the static gamma radiation survey consisting of 239 survey points in the flat area (step-outs) north of the drainage channel showed elevated activity, a total of 15 surface soil samples were collected as a part of the confirmation of the gamma survey and for use in the statistical correlation. The sample locations were selected to represent the range of activities measured during the static gamma survey and based on discussions with the project management team.

Surface soil samples were collected from a total of 55 locations with a field QA/QC samples (blind duplicates) from six locations. Surface soil sample locations are shown on Figure 1. The soil sample

information was recorded in the Soil Sample Log Forms, included in Appendix C. The soil samples were sent to Energy Laboratories, Inc. in Wyoming for Ra-226 analysis using EPA method 901.1. The laboratory Ra-226 analytical results for the surface soil samples are included in Table 1.

3.2 Subsurface Soil Sampling for Ra-226

Consistent with the SRSE Work Plan and the Addendum, the subsurface soil sampling was conducted for vertical extent of Ra-226 concentration assessment. Subsurface soil samples were collected from a total of nine locations (midpoint of three-point transects) at the bottom of the East Drainage channel (one at the upstream end adjacent to Red Water Pond Road, then one every 100 feet for the first 200 feet, followed by one every 200 feet thereafter). The drainage channel subsurface soil sample locations are shown in Figure 1. Test pits were excavated using a backhoe at these locations to collect subsurface soil samples. To help guide sampling depths, initial field screening of the subsurface soils were conducted using a 2.5 inch lead collimated 3x3 NaI detector/Ludlum 2221 single channel analyzer, using the field soil screening procedure included in Appendix D. The samples were collected at regular intervals vertically based on observations made during excavation (e.g., at 2.5, 5.0 and 7.5 feet below ground surface (ft bgs)). The sample 609 KeV region gamma radiation counts for five minutes were compared to the counts for the 2.0 pCi/g Ra-226 reference soil to estimate if the soils at the bottom of the test pit were close to the FSL. Once the field screening indicated that the soil at the bottom of the test pit was at or below the FSL, excavation was concluded. The field soil screening data were recorded in the Field Test Pit soil sample gamma radiation screening Form, included in Appendix D. The subsurface soil sample information for these samples was recorded in the Soil Sample Log Forms, included in Appendix C

The bottom samples from each of the nine channel test pit locations plus two shallower samples from test pit locations 005 and 020 that showed field screening counts near the FSL were analyzed by onsite field gamma spectroscopy analysis. The field gamma spectroscopy analysis was used as a supplementary field screening tool to confirm the field screening results. These results are included in Appendix D. These subsurface soil samples were also sent to ELI for Ra-226 analysis using EPA method 901.1 for confirmation. The laboratory Ra-226 analytical results are included in Table 2, which confirms the field soil screening results.

Subsurface soil samples at one foot depth were collected from 10 locations in the flats area north of the East Drainage channel. One-foot deep and one-by-one foot wide pits were excavated by using a shovel. The subsurface soil sample information for these samples was recorded in the Soil Sample Log Forms included in Appendix C. The field soil screening method (3x3 NaI detector) was used for these subsurface soil samples, which, showed that subsurface soils from eight locations were below the reference soil (2.0 pCi/g) 609 KeV region gamma radiation counts. The counts for the other two location (SRSE-SB-264 and SRSE-SB-291) subsurface soil samples were above the reference soil 609 KeV region gamma radiation counts. Therefore, these locations were further excavated to a depth of 2.5 using a backhoe. The field soil screening of these two 2.5-foot samples showed counts below the reference soil counts. The field soil screening field data are included in Appendix D.

4.0 Gamma Radiation Level to Ra-226 Concentration Correlation and Results Summary

The direct gamma radiation static measurements were converted to Ra-226 concentrations by site-specific gamma radiation level to surface soil Ra-226 concentration correlation. Consistent with the SRSE Work Plan, the recent NECR IRA correlation for gamma radiation level to surface soil Ra-226 content was updated using surface soil collected during the East Drainage SRSE. The correlation was updated by developing a regression model after adding the gamma survey measurements and co-located surface soil samples analyzed in the laboratory for Ra-226 in pCi/g for SRSE locations to the IRA correlation database. Data from gamma radiation level and surface soil samples from the channel bed (bottom) locations and two locations in the depressions in flats were not included in the updated correlation due to inconsistent survey geometry for correlation. The SRSE updated correlation regression data are shown in Appendix E. The resulting SRSE

updated regression model has an R^2 value of 92% and yielded the equation $Ra-226 \text{ pCi/g} = (0.0013 \times \text{gamma radiation level, CPM}) - 4.3582$, which is comparable to the IRA updated regression equation $Ra-226 \text{ pCi/g} = (0.0013 \times \text{gamma radiation level, CPM}) - 4.4967$.

This SRSE updated correlation regression model equation was used to convert the static gamma radiation levels in CPM to surface soil Ra-226 concentrations for SRSE static gamma radiation level measurements, which are shown in Table 1. The surface soil Ra-226 concentrations determined using the static gamma radiation survey results are also shown in Figure 2.

Tables

Table 1
NECR East Drainage Area SRSE Static Gamma Radiation Survey Results

Survey Area	Static Survey Point ID	Survey Point Location Coordinate (NAD 1983, NM West)		Static Gamma Radiation Level Survey Data (0.5-inch lead collimated 2x2 NaI Detector)				Soil Sample Laboratory Ra-226 Results	
		Northing (ft)	Easting (ft)	Gamma Radiation Counts (CPM)		Equivalent Soil Ra-226 Concentration (pCi/g)		Results (pCi/g)	Uncertainty (pCi/g)
				Count Reading	Counting Uncertainty ⁽¹⁾	Concentration	Uncertainty (95% CL)		
East Drainage Channel Bed	SRSE-GS-001	1,696,528.3	2,524,196.2	12,060	215	11.3	0.3	13.5	1.0
	SRSE-GS-002	1,696,546.0	2,524,243.8	10,953	205	9.9	0.3	7.6	0.7
	SRSE-GS-003	1,696,570.3	2,524,287.5	10,349	199	9.1	0.3	9.5	0.6
	SRSE-GS-004	1,696,594.1	2,524,331.6	11,024	206	10.0	0.3	8.4	0.9
	SRSE-GS-005	1,696,612.1	2,524,378.9	11,083	206	10.0	0.3	10.3	0.9
	SRSE-GS-006	1,696,622.5	2,524,427.2	9,742	193	8.3	0.3	7.8	0.8
	SRSE-GS-007	1,696,609.9	2,524,476.8	7,651	171	5.6	0.2	9.9	0.9
	SRSE-GS-008	1,696,615.6	2,524,526.5	8,421	180	6.6	0.2	8.3	0.8
	SRSE-GS-009	1,696,626.7	2,524,572.8	9,465	191	7.9	0.2	10.6	0.9
	SRSE-GS-010	1,696,634.4	2,524,625.9	10,156	198	8.8	0.3	9.8	0.8
	SRSE-GS-011	1,696,659.1	2,524,669.5	7,753	173	5.7	0.2	9.8	1.0
	SRSE-GS-012	1,696,705.5	2,524,758.1	6,890	163	4.6	0.2	9.7	0.9
	SRSE-GS-013	1,696,768.4	2,524,833.7	14,817	239	14.9	0.3	9.4	0.9
	SRSE-GS-014	1,696,829.8	2,524,911.7	6,398	157	4.0	0.2	3.9	0.6
	SRSE-GS-015	1,696,858.2	2,525,009.0	7,495	170	5.4	0.2	4.4	0.8
	SRSE-GS-016	1,696,837.5	2,525,108.3	6,703	160	4.4	0.2	3.7	0.6
	SRSE-GS-017	1,696,773.1	2,525,185.1	11,368	209	10.4	0.3	0.8	0.5
	SRSE-GS-018	1,696,703.8	2,525,256.9	7,433	169	5.3	0.2	3.4	0.6
	SRSE-GS-019	1,696,634.4	2,525,329.2	5,859	150	3.3	0.2	2.3	0.6
	SRSE-GS-020	1,696,581.3	2,525,416.7	9,191	188	7.6	0.2	7.3	0.8
East Drainage Channel South Bank	SRSE-GS-021	1,696,511.9	2,524,197.3	11,705	212	10.9	0.3	13.4	1.0
	SRSE-GS-022	1,696,534.5	2,524,247.5	7,363	168	5.2	0.2	N/S	N/S
	SRSE-GS-023	1,696,556.2	2,524,293.0	6,332	156	3.9	0.2	N/S	N/S
	SRSE-GS-024	1,696,582.9	2,524,337.0	5,730	148	3.1	0.2	N/S	N/S
	SRSE-GS-025	1,696,603.7	2,524,381.8	10,317	199	9.1	0.3	9.7	0.9
	SRSE-GS-026	1,696,616.7	2,524,425.4	9,559	192	8.1	0.2	N/S	N/S
	SRSE-GS-027	1,696,602.1	2,524,476.0	5,421	144	2.7	0.2	N/S	N/S
	SRSE-GS-028	1,696,609.9	2,524,527.2	5,815	149	3.2	0.2	N/S	N/S
	SRSE-GS-029	1,696,612.9	2,524,574.1	4,919	137	2.0	0.2	2.6	0.5
	SRSE-GS-030	1,696,622.4	2,524,628.7	4,789	136	1.9	0.2	N/S	N/S
	SRSE-GS-031	1,696,649.8	2,524,672.3	5,293	143	2.5	0.2	N/S	N/S
	SRSE-GS-032	1,696,695.8	2,524,764.4	5,458	145	2.7	0.2	3.9	0.6
	SRSE-GS-033	1,696,741.1	2,524,854.9	4,963	138	2.1	0.2	N/S	N/S
	SRSE-GS-034	1,696,813.8	2,524,919.3	7,054	165	4.8	0.2	3.7	0.6
	SRSE-GS-035	1,696,830.9	2,525,014.7	4,756	135	1.8	0.2	N/S	N/S
	SRSE-GS-036	1,696,823.0	2,525,098.9	4,619	133	1.6	0.2	2.0	0.6
	SRSE-GS-037	1,696,763.9	2,525,177.6	4,594	133	1.6	0.2	N/S	N/S
	SRSE-GS-038	1,696,693.5	2,525,244.7	4,434	131	1.4	0.2	1.5	0.5
	SRSE-GS-039	1,696,618.5	2,525,318.9	4,209	127	1.1	0.2	N/S	N/S
	SRSE-GS-040	1,696,564.4	2,525,408.4	4,538	132	1.5	0.2	1.6	0.5

Table 1 (Continued)
NECR East Drainage Area SRSE Static Gamma Radiation Survey Results

Survey Area	Static Survey Point ID	Survey Point Location Coordinate (NAD 1983, NM West)		Static Gamma Radiation Level Survey Data (0.5-inch lead collimated 2x2 NaI Detector)				Soil Sample Laboratory Ra-226 Results	
		Northing (ft)	Easting (ft)	Gamma Radiation Counts (CPM)		Equivalent Soil Ra-226 Concentration (pCi/g)		Results (pCi/g)	Uncertainty (pCi/g)
				Count Reading	Counting Uncertainty ⁽¹⁾	Concentration	Uncertainty (95% CL)		
East Drainage Channel North Bank	SRSE-GS-041	1,696,544.7	2,524,194.8	18,331	265	19.5	0.3	21.9	1.1
	SRSE-GS-042	1,696,555.2	2,524,239.8	7,670	172	5.6	0.2	N/S	N/S
	SRSE-GS-043	1,696,575.2	2,524,284.7	6,331	156	3.9	0.2	N/S	N/S
	SRSE-GS-044	1,696,602.9	2,524,326.0	6,572	159	4.2	0.2	N/S	N/S
	SRSE-GS-045	1,696,619.3	2,524,378.0	9,237	188	7.6	0.2	8.0	0.9
	SRSE-GS-046	1,696,632.2	2,524,430.2	10,823	204	9.7	0.3	N/S	N/S
	SRSE-GS-047	1,696,639.1	2,524,476.7	10,784	204	9.7	0.3	N/S	N/S
	SRSE-GS-048	1,696,629.9	2,524,525.3	10,713	203	9.6	0.3	N/S	N/S
	SRSE-GS-049	1,696,638.0	2,524,573.4	11,335	209	10.4	0.3	10.2	0.9
	SRSE-GS-050	1,696,644.7	2,524,623.9	15,567	245	15.9	0.3	N/S	N/S
	SRSE-GS-051	1,696,669.8	2,524,667.4	15,398	243	15.7	0.3	N/S	N/S
	SRSE-GS-052	1,696,723.5	2,524,747.0	24,421	306	27.4	0.4	63.1	2.1
	SRSE-GS-053	1,696,783.3	2,524,824.1	6,575	159	4.2	0.2	N/S	N/S
	SRSE-GS-054	1,696,858.7	2,524,901.7	4,741	135	1.8	0.2	2.1	0.5
	SRSE-GS-055	1,696,881.6	2,525,006.6	4,805	136	1.9	0.2	N/S	N/S
	SRSE-GS-056	1,696,851.6	2,525,117.6	4,696	134	1.7	0.2	2.2	0.5
	SRSE-GS-057	1,696,788.2	2,525,196.9	4,825	136	1.9	0.2	N/S	N/S
	SRSE-GS-058	1,696,718.0	2,525,271.3	4,515	132	1.5	0.2	1.9	0.6
	SRSE-GS-059	1,696,651.6	2,525,342.1	4,673	134	1.7	0.2	N/S	N/S
	SRSE-GS-060	1,696,605.2	2,525,426.1	4,588	133	1.6	0.2	1.3	0.4
Area North of the East Drainage Channel	SRSE-GS-061	1,696,649.4	2,524,450.5	10,152	197	8.8	0.3	N/S	N/S
	SRSE-GS-062	1,696,703.2	2,524,449.8	7,838	174	5.8	0.2	N/S	N/S
	SRSE-GS-063	1,696,753.2	2,524,448.4	7,485	170	5.4	0.2	N/S	N/S
	SRSE-GS-064	1,696,802.0	2,524,450.3	7,851	174	5.8	0.2	N/S	N/S
	SRSE-GS-065	1,696,850.1	2,524,449.9	5,856	150	3.3	0.2	5.9	0.8
	SRSE-GS-066	1,696,899.8	2,524,449.9	5,879	150	3.3	0.2	N/S	N/S
	SRSE-GS-067	1,696,955.0	2,524,448.1	4,997	139	2.1	0.2	N/S	N/S
	SRSE-GS-068	1,697,000.0	2,524,500.6	5,230	142	2.4	0.2	N/S	N/S
	SRSE-GS-069	1,696,951.6	2,524,500.1	6,067	153	3.5	0.2	N/S	N/S
	SRSE-GS-070	1,696,902.0	2,524,500.6	6,955	163	4.7	0.2	N/S	N/S
	SRSE-GS-071	1,696,850.4	2,524,499.4	6,860	162	4.6	0.2	N/S	N/S
	SRSE-GS-072	1,696,801.1	2,524,498.5	7,320	168	5.2	0.2	N/S	N/S
	SRSE-GS-073	1,696,750.4	2,524,498.4	7,962	175	6.0	0.2	N/S	N/S
	SRSE-GS-074	1,696,700.6	2,524,500.3	8,288	178	6.4	0.2	N/S	N/S
	SRSE-GS-075	1,696,700.5	2,524,550.6	14,257	234	14.2	0.3	N/S	N/S
	SRSE-GS-076	1,696,750.6	2,524,550.0	8,757	183	7.0	0.2	N/S	N/S
	SRSE-GS-077	1,696,799.8	2,524,549.6	6,340	156	3.9	0.2	N/S	N/S
	SRSE-GS-078	1,696,849.4	2,524,550.6	7,050	165	4.8	0.2	N/S	N/S
	SRSE-GS-079	1,696,900.2	2,524,550.8	6,591	159	4.2	0.2	N/S	N/S
	SRSE-GS-080	1,696,949.4	2,524,550.9	6,990	164	4.7	0.2	N/S	N/S

Table 1 (Continued)
NECR East Drainage Area SRSE Static Gamma Radiation Survey Results

Survey Area	Static Survey Point ID	Survey Point Location Coordinate (NAD 1983, NM West)		Static Gamma Radiation Level Survey Data (0.5-inch lead collimated 2x2 NaI Detector)				Soil Sample Laboratory Ra-226 Results	
		Northing (ft)	Easting (ft)	Gamma Radiation Counts (CPM)		Equivalent Soil Ra-226 Concentration (pCi/g)		Results (pCi/g)	Uncertainty (pCi/g)
				Count Reading	Counting Uncertainty ⁽¹⁾	Concentration	Uncertainty (95% CL)		
Area North of the East Drainage Channel	SRSE-GS-081	1,697,002.2	2,524,550.2	5,884	150	3.3	0.2	N/S	N/S
	SRSE-GS-082	1,697,050.7	2,524,550.5	5,308	143	2.5	0.2	N/S	N/S
	SRSE-GS-083	1,697,100.2	2,524,550.3	8,132	177	6.2	0.2	N/S	N/S
	SRSE-GS-084	1,697,150.2	2,524,550.8	5,834	150	3.2	0.2	N/S	N/S
	SRSE-GS-085	1,697,149.9	2,524,600.4	6,877	163	4.6	0.2	N/S	N/S
	SRSE-GS-086	1,697,100.4	2,524,601.2	6,905	163	4.6	0.2	N/S	N/S
	SRSE-GS-087	1,697,050.4	2,524,598.9	6,540	159	4.1	0.2	N/S	N/S
	SRSE-GS-088	1,697,000.2	2,524,600.1	14,395	235	14.4	0.3	N/S	N/S
	SRSE-GS-089	1,696,950.2	2,524,599.4	6,460	158	4.0	0.2	N/S	N/S
	SRSE-GS-090	1,696,900.1	2,524,600.6	6,699	160	4.4	0.2	N/S	N/S
	SRSE-GS-091	1,696,850.6	2,524,600.8	8,777	184	7.1	0.2	N/S	N/S
	SRSE-GS-092	1,696,800.1	2,524,599.9	9,377	190	7.8	0.2	13.8	1.0
	SRSE-GS-093	1,696,750.6	2,524,600.7	10,833	204	9.7	0.3	N/S	N/S
	SRSE-GS-094	1,696,699.7	2,524,601.6	17,481	259	18.4	0.3	N/S	N/S
	SRSE-GS-095	1,696,699.9	2,524,650.9	17,974	263	19.0	0.3	N/S	N/S
	SRSE-GS-096	1,696,749.4	2,524,650.3	16,247	250	16.8	0.3	N/S	N/S
	SRSE-GS-097	1,696,799.9	2,524,650.2	11,448	210	10.5	0.3	N/S	N/S
	SRSE-GS-098	1,696,849.9	2,524,650.4	11,079	206	10.0	0.3	N/S	N/S
	SRSE-GS-099	1,696,900.6	2,524,650.6	14,941	240	15.1	0.3	N/S	N/S
	SRSE-GS-100	1,696,950.2	2,524,650.6	7,027	164	4.8	0.2	N/S	N/S
	SRSE-GS-101	1,697,000.5	2,524,650.1	53,436	453	65.1	0.6	64.5	2.3
	SRSE-GS-102	1,697,049.6	2,524,650.4	6,059	153	3.5	0.2	N/S	N/S
	SRSE-GS-103	1,697,100.4	2,524,650.0	8,150	177	6.2	0.2	15.5	1.1
	SRSE-GS-104	1,697,150.3	2,524,650.5	5,857	150	3.3	0.2	N/S	N/S
	SRSE-GS-105	1,697,149.5	2,524,699.3	7,726	172	5.7	0.2	N/S	N/S
	SRSE-GS-106	1,697,100.4	2,524,700.7	30,002	339	34.6	0.4	N/S	N/S
	SRSE-GS-107	1,697,051.0	2,524,700.4	34,892	366	41.0	0.5	N/S	N/S
	SRSE-GS-108	1,697,000.7	2,524,700.0	50,422	440	61.2	0.6	N/S	N/S
	SRSE-GS-109	1,696,950.2	2,524,700.2	28,477	331	32.7	0.4	N/S	N/S
	SRSE-GS-110	1,696,901.0	2,524,698.5	9,160	188	7.5	0.2	N/S	N/S
SRSE-GS-111	1,696,850.6	2,524,699.8	9,608	192	8.1	0.2	N/S	N/S	
SRSE-GS-112	1,696,800.1	2,524,699.8	14,473	236	14.5	0.3	N/S	N/S	
SRSE-GS-113	1,696,751.1	2,524,701.3	20,919	283	22.8	0.4	N/S	N/S	
SRSE-GS-114	1,696,799.4	2,524,750.4	11,309	208	10.3	0.3	N/S	N/S	
SRSE-GS-115	1,696,850.4	2,524,751.1	8,007	175	6.1	0.2	N/S	N/S	
SRSE-GS-116	1,696,900.4	2,524,751.2	8,552	181	6.8	0.2	N/S	N/S	
SRSE-GS-117	1,696,950.4	2,524,750.4	27,428	325	31.3	0.4	N/S	N/S	
SRSE-GS-118	1,697,000.7	2,524,750.9	39,465	389	46.9	0.5	N/S	N/S	
SRSE-GS-119	1,697,050.1	2,524,750.4	46,929	425	56.6	0.6	N/S	N/S	
SRSE-GS-120	1,697,100.8	2,524,750.8	34,206	362	40.1	0.5	N/S	N/S	

Table 1 (Continued)
NECR East Drainage Area SRSE Static Gamma Radiation Survey Results

Survey Area	Static Survey Point ID	Survey Point Location Coordinate (NAD 1983, NM West)		Static Gamma Radiation Level Survey Data (0.5-inch lead collimated 2x2 NaI Detector)				Soil Sample Laboratory Ra-226 Results	
		Northing (ft)	Easting (ft)	Gamma Radiation Counts (CPM)		Equivalent Soil Ra-226 Concentration (pCi/g)		Results (pCi/g)	Uncertainty (pCi/g)
				Count Reading	Counting Uncertainty ⁽¹⁾	Concentration	Uncertainty (95% CL)		
Area North of the East Drainage Channel	SRSE-GS-121	1,697,150.2	2,524,750.2	15,890	247	16.3	0.3	N/S	N/S
	SRSE-GS-122	1,697,200.8	2,524,750.9	14,174	233	14.1	0.3	N/S	N/S
	SRSE-GS-123	1,697,200.0	2,524,801.0	10,441	200	9.2	0.3	21.5	1.3
	SRSE-GS-124	1,697,150.1	2,524,801.2	10,776	203	9.7	0.3	N/S	N/S
	SRSE-GS-125	1,697,100.0	2,524,800.4	39,735	391	47.3	0.5	N/S	N/S
	SRSE-GS-126	1,697,050.1	2,524,799.7	24,183	305	27.1	0.4	N/S	N/S
	SRSE-GS-127	1,697,001.4	2,524,800.3	30,418	342	35.2	0.4	N/S	N/S
	SRSE-GS-128	1,696,949.5	2,524,799.8	6,877	163	4.6	0.2	N/S	N/S
	SRSE-GS-129	1,696,901.5	2,524,800.4	10,648	202	9.5	0.3	N/S	N/S
	SRSE-GS-130	1,696,850.5	2,524,799.3	8,734	183	7.0	0.2	N/S	N/S
	SRSE-GS-131	1,696,850.1	2,524,850.6	8,499	181	6.7	0.2	N/S	N/S
	SRSE-GS-131a	1,696,900.6	2,524,850.1	5,391	144	2.7	0.2	N/S	N/S
	SRSE-GS-132	1,696,950.1	2,524,850.7	4,972	138	2.1	0.2	N/S	N/S
	SRSE-GS-133	1,697,000.5	2,524,850.4	7,761	173	5.7	0.2	N/S	N/S
	SRSE-GS-134	1,697,050.1	2,524,850.1	39,725	391	47.3	0.5	N/S	N/S
	SRSE-GS-135	1,697,098.9	2,524,849.3	25,944	316	29.4	0.4	93.1	2.6
	SRSE-GS-136	1,697,150.3	2,524,850.8	8,249	178	6.4	0.2	N/S	N/S
	SRSE-GS-137	1,697,199.6	2,524,850.1	10,141	197	8.8	0.3	N/S	N/S
	SRSE-GS-138	1,697,250.2	2,524,850.4	8,878	185	7.2	0.2	N/S	N/S
	SRSE-GS-139	1,697,299.8	2,524,850.3	6,186	154	3.7	0.2	N/S	N/S
	SRSE-GS-140	1,697,300.8	2,524,900.2	7,497	170	5.4	0.2	N/S	N/S
	SRSE-GS-141	1,697,248.6	2,524,901.5	8,628	182	6.9	0.2	N/S	N/S
	SRSE-GS-142	1,697,199.3	2,524,899.9	7,279	167	5.1	0.2	N/S	N/S
	SRSE-GS-143	1,697,150.4	2,524,900.2	7,432	169	5.3	0.2	N/S	N/S
	SRSE-GS-144	1,697,149.8	2,524,950.3	6,266	155	3.8	0.2	N/S	N/S
	SRSE-GS-145	1,697,200.7	2,524,950.5	8,816	184	7.1	0.2	N/S	N/S
	SRSE-GS-146	1,697,250.6	2,524,950.4	6,391	157	4.0	0.2	N/S	N/S
	SRSE-GS-147	1,697,300.6	2,524,950.4	5,730	148	3.1	0.2	N/S	N/S
	SRSE-GS-148	1,697,300.4	2,525,000.4	6,090	153	3.6	0.2	N/S	N/S
	SRSE-GS-149	1,697,249.9	2,525,000.6	7,044	164	4.8	0.2	N/S	N/S
	SRSE-GS-150	1,697,200.3	2,525,000.3	8,672	183	6.9	0.2	N/S	N/S
	SRSE-GS-151	1,697,150.4	2,525,000.2	5,651	147	3.0	0.2	N/S	N/S
	SRSE-GS-152	1,697,150.0	2,525,049.9	6,637	160	4.3	0.2	N/S	N/S
	SRSE-GS-153	1,697,200.8	2,525,050.4	8,811	184	7.1	0.2	N/S	N/S
	SRSE-GS-154	1,697,250.5	2,525,050.0	6,180	154	3.7	0.2	N/S	N/S
	SRSE-GS-155	1,697,250.2	2,525,100.3	6,052	152	3.5	0.2	N/S	N/S
SRSE-GS-156	1,697,200.5	2,525,100.5	9,205	188	7.6	0.2	N/S	N/S	
SRSE-GS-157	1,697,150.2	2,525,100.5	12,426	218	11.8	0.3	N/S	N/S	
SRSE-GS-158	1,697,049.9	2,524,900.4	32,213	352	37.5	0.5	N/S	N/S	
SRSE-GS-159	1,696,999.9	2,524,900.5	5,102	140	2.3	0.2	N/S	N/S	
SRSE-GS-160	1,696,950.6	2,524,900.2	4,961	138	2.1	0.2	N/S	N/S	

Table 1 (Continued)
NECR East Drainage Area SRSE Static Gamma Radiation Survey Results

Survey Area	Static Survey Point ID	Survey Point Location Coordinate (NAD 1983, NM West)		Static Gamma Radiation Level Survey Data (0.5-inch lead collimated 2x2 NaI Detector)				Soil Sample Laboratory Ra-226 Results	
		Northing (ft)	Easting (ft)	Gamma Radiation Counts (CPM)		Equivalent Soil Ra-226 Concentration (pCi/g)		Results (pCi/g)	Uncertainty (pCi/g)
				Count Reading	Counting Uncertainty ⁽¹⁾	Concentration	Uncertainty (95% CL)		
Area North of the East Drainage Channel	SRSE-GS-161	1,696,900.9	2,524,950.0	4,865	137	2.0	0.2	N/S	N/S
	SRSE-GS-162	1,696,950.7	2,524,950.3	4,724	135	1.8	0.2	N/S	N/S
	SRSE-GS-163	1,697,000.9	2,524,951.3	4,985	138	2.1	0.2	N/S	N/S
	SRSE-GS-164	1,697,050.0	2,524,950.3	24,472	307	27.5	0.4	N/S	N/S
	SRSE-GS-165	1,697,050.8	2,525,000.6	15,455	244	15.7	0.3	N/S	N/S
	SRSE-GS-166	1,696,999.9	2,524,999.6	4,858	137	2.0	0.2	N/S	N/S
	SRSE-GS-167	1,696,950.3	2,525,000.1	5,104	140	2.3	0.2	N/S	N/S
	SRSE-GS-168	1,696,899.7	2,525,049.9	5,060	139	2.2	0.2	N/S	N/S
	SRSE-GS-169	1,696,949.9	2,525,049.1	4,543	132	1.5	0.2	N/S	N/S
	SRSE-GS-170	1,697,000.2	2,525,050.3	6,400	157	4.0	0.2	N/S	N/S
	SRSE-GS-171	1,696,999.8	2,525,100.1	4,592	133	1.6	0.2	N/S	N/S
	SRSE-GS-172	1,696,950.3	2,525,100.5	5,068	140	2.2	0.2	N/S	N/S
	SRSE-GS-173	1,696,900.1	2,525,099.9	4,825	136	1.9	0.2	N/S	N/S
	SRSE-GS-174	1,696,900.7	2,525,150.1	4,592	133	1.6	0.2	N/S	N/S
	SRSE-GS-175	1,696,950.8	2,525,150.8	4,595	133	1.6	0.2	N/S	N/S
	SRSE-GS-176	1,697,001.0	2,525,150.7	5,103	140	2.3	0.2	N/S	N/S
	SRSE-GS-177	1,697,000.2	2,525,200.0	4,159	126	1.0	0.2	N/S	N/S
	SRSE-GS-178	1,696,950.4	2,525,250.1	4,151	126	1.0	0.2	N/S	N/S
	SRSE-GS-179	1,696,900.1	2,525,250.2	4,061	125	0.9	0.2	N/S	N/S
	SRSE-GS-180	1,696,850.0	2,525,250.6	4,506	132	1.5	0.2	N/S	N/S
	SRSE-GS-181	1,696,799.8	2,525,249.6	5,072	140	2.2	0.2	N/S	N/S
	SRSE-GS-182	1,696,750.1	2,525,300.2	4,864	137	2.0	0.2	N/S	N/S
	SRSE-GS-183	1,696,801.2	2,525,300.1	4,098	125	1.0	0.2	N/S	N/S
	SRSE-GS-184	1,696,849.8	2,525,300.2	4,246	128	1.2	0.2	N/S	N/S
	SRSE-GS-185	1,696,850.2	2,525,350.0	4,828	136	1.9	0.2	N/S	N/S
	SRSE-GS-186	1,696,800.0	2,525,350.1	4,851	137	1.9	0.2	N/S	N/S
	SRSE-GS-187	1,696,750.4	2,525,350.1	4,613	133	1.6	0.2	N/S	N/S
	SRSE-GS-188	1,697,200.5	2,524,550.8	15,734	246	16.1	0.3	N/S	N/S
	SRSE-GS-189	1,697,250.7	2,524,550.8	12,348	218	11.7	0.3	N/S	N/S
	SRSE-GS-190	1,697,249.8	2,524,500.7	9,458	191	7.9	0.2	N/S	N/S
	SRSE-GS-191	1,697,199.9	2,524,498.3	12,707	221	12.2	0.3	N/S	N/S
	SRSE-GS-192	1,697,150.9	2,524,501.1	6,327	156	3.9	0.2	N/S	N/S
SRSE-GS-193	1,697,100.5	2,524,499.4	10,931	205	9.9	0.3	N/S	N/S	
SRSE-GS-194	1,697,050.1	2,524,500.2	5,834	150	3.2	0.2	N/S	N/S	
SRSE-GS-195	1,697,050.9	2,524,450.0	5,106	140	2.3	0.2	N/S	N/S	
SRSE-GS-196	1,697,100.0	2,524,450.2	5,203	141	2.4	0.2	N/S	N/S	
SRSE-GS-197	1,697,150.2	2,524,450.2	11,380	209	10.4	0.3	N/S	N/S	
SRSE-GS-198	1,697,199.9	2,524,450.3	13,661	229	13.4	0.3	25.3	1.4	
SRSE-GS-199	1,697,250.1	2,524,451.2	10,041	196	8.7	0.3	N/S	N/S	
SRSE-GS-200	1,697,250.9	2,524,600.9	16,423	251	17.0	0.3	N/S	N/S	

Table 1 (Continued)
NECR East Drainage Area SRSE Static Gamma Radiation Survey Results

Survey Area	Static Survey Point ID	Survey Point Location Coordinate (NAD 1983, NM West)		Static Gamma Radiation Level Survey Data (0.5-inch lead collimated 2x2 NaI Detector)				Soil Sample Laboratory Ra-226 Results	
		Northing (ft)	Easting (ft)	Gamma Radiation Counts (CPM)		Equivalent Soil Ra-226 Concentration (pCi/g)		Results (pCi/g)	Uncertainty (pCi/g)
				Count Reading	Counting Uncertainty ⁽¹⁾	Concentration	Uncertainty (95% CL)		
Area North of the East Drainage Channel	SRSE-GS-201	1,697,199.8	2,524,601.5	14,371	235	14.3	0.3	N/S	N/S
	SRSE-GS-202	1,697,201.2	2,524,652.2	15,237	242	15.4	0.3	N/S	N/S
	SRSE-GS-203	1,697,250.0	2,524,652.1	12,372	218	11.7	0.3	N/S	N/S
	SRSE-GS-204	1,697,250.4	2,524,700.3	16,102	249	16.6	0.3	N/S	N/S
	SRSE-GS-205	1,697,200.5	2,524,700.9	11,992	215	11.2	0.3	N/S	N/S
	SRSE-GS-206	1,696,650.2	2,524,400.3	8,201	177	6.3	0.2	N/S	N/S
	SRSE-GS-207	1,696,701.4	2,524,399.9	6,353	156	3.9	0.2	N/S	N/S
	SRSE-GS-208	1,696,749.9	2,524,400.8	6,464	158	4.0	0.2	N/S	N/S
	SRSE-GS-209	1,696,800.2	2,524,400.3	6,980	164	4.7	0.2	N/S	N/S
	SRSE-GS-210	1,696,850.7	2,524,400.0	5,750	149	3.1	0.2	N/S	N/S
	SRSE-GS-211	1,696,850.8	2,524,350.5	4,874	137	2.0	0.2	N/S	N/S
	SRSE-GS-212	1,696,801.0	2,524,349.8	6,381	157	3.9	0.2	N/S	N/S
	SRSE-GS-213	1,696,750.2	2,524,349.4	7,068	165	4.8	0.2	N/S	N/S
	SRSE-GS-214	1,696,700.5	2,524,350.0	5,349	143	2.6	0.2	N/S	N/S
	SRSE-GS-215	1,696,650.5	2,524,350.0	6,104	153	3.6	0.2	N/S	N/S
	SRSE-GS-216	1,696,650.4	2,524,299.7	6,670	160	4.3	0.2	N/S	N/S
	SRSE-GS-217	1,696,700.7	2,524,300.3	6,667	160	4.3	0.2	N/S	N/S
	SRSE-GS-218	1,696,750.3	2,524,300.0	5,668	148	3.0	0.2	N/S	N/S
	SRSE-GS-219	1,696,800.2	2,524,299.8	5,641	147	3.0	0.2	N/S	N/S
	SRSE-GS-220	1,696,850.1	2,524,300.1	5,216	142	2.4	0.2	N/S	N/S
	SRSE-GS-221	1,696,841.1	2,524,249.8	4,299	129	1.2	0.2	N/S	N/S
	SRSE-GS-222	1,696,799.6	2,524,250.0	5,184	141	2.4	0.2	N/S	N/S
	SRSE-GS-223	1,696,750.5	2,524,249.4	6,144	154	3.6	0.2	N/S	N/S
	SRSE-GS-224	1,696,700.0	2,524,249.2	9,588	192	8.1	0.2	19.2	1.1
	SRSE-GS-225	1,696,650.1	2,524,250.7	8,234	178	6.3	0.2	N/S	N/S
	SRSE-GS-226	1,696,602.1	2,524,249.9	7,289	167	5.1	0.2	N/S	N/S
	SRSE-GS-227	1,696,600.4	2,524,205.4	10,673	202	9.5	0.3	N/S	N/S
	SRSE-GS-228	1,696,649.6	2,524,200.7	8,910	185	7.2	0.2	N/S	N/S
	SRSE-GS-229	1,696,700.9	2,524,199.3	7,227	167	5.0	0.2	N/S	N/S
	SRSE-GS-230	1,696,750.0	2,524,200.5	7,673	172	5.6	0.2	N/S	N/S
	SRSE-GS-231	1,696,800.7	2,524,200.7	5,222	142	2.4	0.2	N/S	N/S
	SRSE-GS-232	1,697,251.1	2,524,801.3	11,413	209	10.5	0.3	N/S	N/S
	SRSE-GS-233	1,697,250.5	2,524,750.7	17,311	258	18.1	0.3	N/S	N/S
	SRSE-GS-234	1,697,300.1	2,524,799.8	6,412	157	4.0	0.2	N/S	N/S
	SRSE-GS-235	1,697,300.0	2,524,750.9	7,684	172	5.6	0.2	N/S	N/S
	SRSE-GS-236	1,697,300.7	2,524,700.1	6,127	153	3.6	0.2	N/S	N/S
	SRSE-GS-237	1,697,301.0	2,524,650.2	6,159	154	3.6	0.2	3.6	0.6
	SRSE-GS-238	1,697,300.0	2,524,599.5	5,433	144	2.7	0.2	N/S	N/S
	SRSE-GS-239	1,697,300.9	2,524,550.7	5,210	141	2.4	0.2	N/S	N/S
	SRSE-GS-240	1,697,300.6	2,524,500.4	5,248	142	2.5	0.2	N/S	N/S

Table 1 (Continued)
NECR East Drainage Area SRSE Static Gamma Radiation Survey Results

Survey Area	Static Survey Point ID	Survey Point Location Coordinate (NAD 1983, NM West)		Static Gamma Radiation Level Survey Data (0.5-inch lead collimated 2x2 NaI Detector)				Soil Sample Laboratory Ra-226 Results	
		Northing (ft)	Easting (ft)	Gamma Radiation Counts (CPM)		Equivalent Soil Ra-226 Concentration (pCi/g)		Results (pCi/g)	Uncertainty (pCi/g)
				Count Reading	Counting Uncertainty ⁽¹⁾	Concentration	Uncertainty (95% CL)		
Area North of the East Drainage Channel	SRSE-GS-241	1,697,300.4	2,524,450.8	5,201	141	2.4	0.2	N/S	N/S
	SRSE-GS-242	1,697,301.0	2,524,400.0	5,365	144	2.6	0.2	N/S	N/S
	SRSE-GS-243	1,697,250.6	2,524,399.5	9,886	195	8.5	0.3	N/S	N/S
	SRSE-GS-244	1,697,200.8	2,524,400.6	14,335	235	14.3	0.3	N/S	N/S
	SRSE-GS-245	1,697,150.6	2,524,399.7	9,613	192	8.1	0.2	N/S	N/S
	SRSE-GS-246	1,697,101.0	2,524,400.1	5,085	140	2.3	0.2	N/S	N/S
	SRSE-GS-247	1,697,070.0	2,524,399.8	5,256	142	2.5	0.2	N/S	N/S
	SRSE-GS-248	1,697,099.6	2,524,300.5	5,217	142	2.4	0.2	N/S	N/S
	SRSE-GS-249	1,697,199.5	2,524,301.1	12,679	221	12.1	0.3	N/S	N/S
	SRSE-GS-250	1,697,300.5	2,524,299.7	5,488	145	2.8	0.2	N/S	N/S
	SRSE-GS-251	1,697,399.4	2,524,299.9	5,112	140	2.3	0.2	N/S	N/S
	SRSE-GS-252	1,697,500.4	2,524,300.9	5,658	147	3.0	0.2	N/S	N/S
	SRSE-GS-253	1,697,500.8	2,524,200.0	5,226	142	2.4	0.2	N/S	N/S
	SRSE-GS-254	1,697,399.8	2,524,200.4	5,256	142	2.5	0.2	N/S	N/S
	SRSE-GS-255	1,697,300.4	2,524,200.1	5,214	142	2.4	0.2	N/S	N/S
	SRSE-GS-256	1,697,200.1	2,524,200.2	6,565	159	4.2	0.2	N/S	N/S
	SRSE-GS-257	1,697,125.0	2,524,200.6	5,426	144	2.7	0.2	N/S	N/S
	SRSE-GS-258	1,697,149.8	2,524,125.0	8,296	179	6.4	0.2	N/S	N/S
	SRSE-GS-259	1,697,200.4	2,524,112.7	8,277	178	6.4	0.2	N/S	N/S
	SRSE-GS-260	1,697,299.9	2,524,100.3	7,702	172	5.7	0.2	N/S	N/S
	SRSE-GS-261	1,697,400.6	2,524,100.4	7,389	168	5.2	0.2	N/S	N/S
	SRSE-GS-262	1,697,499.7	2,524,100.1	6,696	160	4.3	0.2	N/S	N/S
	SRSE-GS-263	1,697,260.3	2,524,100.2	10,501	201	9.3	0.3	N/S	N/S
	SRSE-GS-264	1,697,246.3	2,524,154.0	10,178	198	8.9	0.3	8.7	0.9
	SRSE-GS-265	1,697,225.4	2,524,234.7	11,064	206	10.0	0.3	N/S	N/S
	SRSE-GS-266	1,697,199.7	2,524,312.3	10,668	202	9.5	0.3	N/S	N/S
	SRSE-GS-267	1,697,167.4	2,524,400.3	15,548	244	15.9	0.3	N/S	N/S
	SRSE-GS-268	1,697,179.5	2,524,500.5	14,003	232	13.8	0.3	N/S	N/S
	SRSE-GS-269	1,697,400.0	2,524,400.8	5,612	147	2.9	0.2	N/S	N/S
	SRSE-GS-270	1,697,484.0	2,524,400.3	4,972	138	2.1	0.2	N/S	N/S
	SRSE-GS-271	1,697,400.8	2,524,500.2	5,270	142	2.5	0.2	N/S	N/S
	SRSE-GS-272	1,697,400.6	2,524,600.4	4,526	132	1.5	0.2	N/S	N/S
SRSE-GS-273	1,697,474.0	2,524,699.9	5,026	139	2.2	0.2	N/S	N/S	
SRSE-GS-274	1,697,400.7	2,524,700.2	4,901	137	2.0	0.2	N/S	N/S	
SRSE-GS-275	1,697,399.6	2,524,801.1	4,884	137	2.0	0.2	N/S	N/S	
SRSE-GS-276	1,697,485.4	2,524,800.8	5,297	143	2.5	0.2	N/S	N/S	
SRSE-GS-277	1,697,441.0	2,524,900.2	5,249	142	2.5	0.2	N/S	N/S	
SRSE-GS-278	1,697,399.9	2,524,900.7	5,404	144	2.7	0.2	N/S	N/S	
SRSE-GS-279	1,697,120.4	2,524,849.6	5,104	140	2.3	0.2	1.9	0.4	
SRSE-GS-280	1,697,122.5	2,524,900.2	5,566	146	2.9	0.2	N/S	N/S	

Table 1 (Continued)
NECR East Drainage Area SRSE Static Gamma Radiation Survey Results

Survey Area	Static Survey Point ID	Survey Point Location Coordinate (NAD 1983, NM West)		Static Gamma Radiation Level Survey Data (0.5-inch lead collimated 2x2 NaI Detector)				Soil Sample Laboratory Ra-226 Results	
		Northing (ft)	Easting (ft)	Gamma Radiation Counts (CPM)		Equivalent Soil Ra-226 Concentration (pCi/g)		Results (pCi/g)	Uncertainty (pCi/g)
				Count Reading	Counting Uncertainty ⁽¹⁾	Concentration	Uncertainty (95% CL)		
Area North of the East Drainage Channel	SRSE-GS-281	1,697,115.5	2,524,950.7	5,960	151	3.4	0.2	N/S	N/S
	SRSE-GS-282	1,697,108.5	2,525,000.6	5,328	143	2.6	0.2	N/S	N/S
	SRSE-GS-283	1,697,100.3	2,525,050.3	5,239	142	2.5	0.2	2.0	0.5
	SRSE-GS-284	1,697,063.8	2,525,108.7	5,485	145	2.8	0.2	N/S	N/S
	SRSE-GS-285	1,697,055.8	2,525,152.9	5,142	141	2.3	0.2	N/S	N/S
	SRSE-GS-286	1,697,047.3	2,525,200.0	5,447	145	2.7	0.2	N/S	N/S
	SRSE-GS-287	1,697,026.8	2,525,244.9	4,805	136	1.9	0.2	0.9	0.5
	SRSE-GS-288	1,697,095.0	2,525,170.9	4,925	138	2.0	0.2	N/S	N/S
	SRSE-GS-289	1,697,128.8	2,525,150.8	5,152	141	2.3	0.2	N/S	N/S
	SRSE-GS-290	1,697,136.8	2,525,120.8	6,329	156	3.9	0.2	4.3	0.6
	SRSE-GS-291	1,696,838.0	2,524,695.6	30,731	344	35.6	0.4	34.5	1.7
	SRSE-GS-292	1,696,764.4	2,524,722.1	29,560	337	34.1	0.4	N/S	N/S
	SRSE-GS-293	1,696,802.4	2,524,710.6	26,246	318	29.8	0.4	N/S	N/S
	SRSE-GS-294	1,696,870.3	2,524,681.4	28,861	333	33.2	0.4	N/S	N/S
	SRSE-GS-295	1,696,898.6	2,524,664.0	18,554	267	19.8	0.3	N/S	N/S
	SRSE-GS-296	1,696,929.7	2,524,650.4	25,930	316	29.4	0.4	N/S	N/S
SRSE-GS-297	1,696,951.5	2,524,644.6	30,355	341	35.1	0.4	N/S	N/S	
SRSE-GS-298	1,696,976.7	2,524,659.3	41,453	399	49.5	0.5	N/S	N/S	

Noe (1) : 95% Counting uncertainty = 1.96σ, Square Root of counts was used as σ (standard deviation)

Table 2
Field Soil Radiation Screening
NECR SRSE East Drainage Channel Subsurface Soil

Soil Screening Date	East Drainage Channel Bottom Subsurface Soil Sample ID	3x3 NaI Detector/L2221 SCA Field Soil Screening Data		Onsite Gamma Spec Projected Ra-226 Results (pCi/g)	Vendor Laboratory (ELI) Ra-226 Results (pCi/g)
		609 KeV Region 5-Min Counts	Ra-226 Conc (pCi/g)		
4/28/2011	2.0 pCi/g Reference Soil	2402	2.0	-	-
4/28/2011	SRSE-SB-001 Soil sample at 2.5'	6504	>2.0	-	-
4/28/2011	SRSE-SB-001 Soil sample at 5.0'	5554	>2.0	-	-
4/28/2011	SRSE-SB-001 Soil sample at 7.5'	1976	<2.0	1.7	0.4
4/28/2011	SRSE-SB-003 Soil sample at 2.5'	2082	<2.0	2.0	0.2 U
4/28/2011	SRSE-SB-005 Soil sample at 2.5'	2513	2.0	1.9	0.2 U
4/28/2011	SRSE-SB-005 Soil sample at 5.0'	1732	<2.0	0.9	0.2 U
4/28/2011	SRSE-SB-009 Soil sample at 2.5'	1634	<2.0	0.8	0.3 U
4/28/2011	SRSE-SB-012 Soil sample at 2.5'	1489	<2.0	1.0	0.4
4/28/2011	SRSE-SB-014 Soil sample at 2.5'	5658	>2.0	-	-
4/28/2011	SRSE-SB-014 Soil sample at 5.0'	1805	<2.0	0.6	0.7
4/28/2011	SRSE-SB-016 Soil sample at 2.5'	2177	<2.0	2.0	2.8
4/28/2011	SRSE-SB-018 Soil sample at 2.5'	2204	<2.0	1.9	2.1
4/28/2011	SRSE-SB-020 Soil sample at 2.5'	2531	>2.0	3.1	3.4
4/28/2011	SRSE-SB-020 Soil sample at 5.0'	2001	<2.0	1.4	1.8

Table 3

Field Soil Radiation Screening
NECR SRSE East Drainage North (Flats) Area Subsurface Soil

Soil Screening Date	East Drainage North (Flats) Area Subsurface Soil Sample ID	3x3 NaI Detector/L2221 SCA Field Soil Screening Data	
		609 KeV Region 5-Min Counts	Ra-226 Conc (pCi/g)
4/28/2011	Reference Soil, 2.0 pCi/g	2496	2.0
4/28/2011	SRSE-SB-092 @ 1.0'	1378	<2.0
4/28/2011	SRSE-SB-065 @ 1.0'	1502	<2.0
4/28/2011	SRSE-SB-291 @ 1.0'	17719	>>2.0
4/28/2011	SRSE-SB-291 @ 2.5'	1941	<2.0
4/28/2011	SRSE-SB-264 @ 1.0'	6913	>>2.0
4/28/2011	SRSE-SB-264 @ 2.5'	1571	<2.0
4/28/2011	SRSE-SB-101 @ 1.0'	2214	<2.0
4/28/2011	SRSE-SB-198 @ 1.0'	1463	<2.0
4/28/2011	SRSE-SB-237 @ 1.0'	1357	<2.0
4/28/2011	SRSE-SB-123 @ 1.0'	1396	<2.0
4/28/2011	SRSE-SB-135 @ 1.0'	1610	<2.0
4/28/2011	SRSE-SB-103 @ 1.0'	1459	<2.0

Figures

Figures 1 and 2 intentionally left out of e-mailed version.
Will be included in hard copy.

Appendix A

Radiologic Instrumentation Calibration and Function Check Documentation

**AVM Environmental Services Inc.
Scaler/Ratemeter - Detector Calibration Form**

Scaler/Ratemeter Ludlum L2221, SR# 68782
 Detector SPA-3, SR# 408522-30

Source: U₃O₈ Ore Strength: 1%

Scaler/Ratemeter Threshold set @ 100 mV, Window IN/OUT out, Window 0 mV.

HV	Reading, CPM (Source)	Reading, CPM (Background)
500	7921	291
550	21062	511
600	41472	1002
650	58305	1412
700	69144	1754
750	80011	1839
800	89394	1855
850	93505	1899
900	94292	1906
950	94944	1954
1000	96408	1998
1050	98402	2089
1100	102655	2466
1150	110307	3005
1200	134565	3895
1250		5399
1300		
1350		
1400		

Background reading at designated function check location in office.

Count #	Reading (CPM)	
	Bare	Collimated
1	7718	2641
2	7635	2799
3	7550	2837
4	7418	2701
5	7641	2918
Average	7592	2779

Count Readings with 1 percent U₃O₈ can directly under collimated detector on designated function check location in office.

Count #	Reading (CPM)	
	Collimated	
1	94997	
2	94256	
3	94498	
4	94986	
5	94796	
Average	94706	

HV Set @ 900 VDC (Instrument) 900 VDC (DVM Fluke 8020B)

Input Sensitivity (THR), mV 100

Function Check with 1 percent U₃O₈ ore in can. Can Directly under the detector.
 Acceptable Function check range is: 75765 to 113647 CPM

Count Readings for Calibration Pad GPL (87.78 pCi/gm Ra-226)

Bare (Uncollimated)			Collimated		
872	#1	83682 cpm	#1	48390 cpm	
	#2	84522 cpm	#2	49042 cpm	
	#3	82821 cpm	#3	48811 cpm	
	#4	84189 cpm	#4	49231 cpm	
	#5	83431 cpm	#5	48891 cpm	
	Average	83729 cpm	Average	48813 cpm	
	Eff (avg cpm/87.78 pCi/gm)	954 cpm/pCi/gm	Eff	556 cpm/pCi/gm	

*GPL
96 uCi/gm exp. rate
@ 1-foot (model)*

Date 04/05/2011

By [Signature]
 0.00105 pCi/gm
 0.0018 pCi/g/cpm



Designer and Manufacturer
of
Scientific and Industrial
Instruments

CERTIFICATE OF CALIBRATION

LOUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CUSTOMER AVM ENVIRONMENTAL SERVICES ORDER NO. 20172118/361166
Mfg. Ludlum Measurements, Inc. Model 2221 Serial No. 68782
Mfg. _____ Model _____ Serial No. _____
Cal. Date 28-Mar-11 Cal Due Date 28-Mar-12 Cal. Interval 1 Year Meterface 202-159

Check mark applies to applicable instr. and/or detector IAW mfg. spec. T. 73 °F RH 28 % Alt 700.8 mm Hg
 New Instrument Instrument Received Within Toler. +-10% 10-20% Out of Tol. Requiring Repair Other-See comments
 Mechanical ck. Meter Zeroed Background Subtract Input Sens. Linearity
 F/S Resp. ck. Reset ck. Window Operation Geotropism
 Audio ck. Alarm Setting ck. Batt. ck. (Min. Volt) 4.4 VDC
 Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 900 V Input Sens. 10 mV Det. Oper. _____ V at _____ mV Threshold Dial Ratio 100 = 10 mV
 HV Readout (2 points) Ref./Inst. 500 / 499 V Ref./Inst. 2000 / 2001 V

COMMENTS:

Firmware:261072 Calibrated with window in OUT position.

Calibrated with 39" cable.

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
X 1K	400k cpm	NA	400
X 1K	100k cpm	}	100
X 100	40k cpm		400
X 100	10k cpm		100
X 10	4k cpm		400
X 10	1k cpm		100
X 1	400 cpm		400
X 1	100 cpm		100

*Uncertainty within ± 10% C.F. within ± 20%

ALL Range(s) Calibrated Electronically

REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*	Log Scale	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
400k cpm	NA	39973 (01)	}	500k cpm	NA	500K cpm
40k cpm	}	3977		50k cpm	}	50
4k cpm		399		5k cpm		5
400 cpm		40		500 cpm		500
40 cpm		4		50 cpm		50

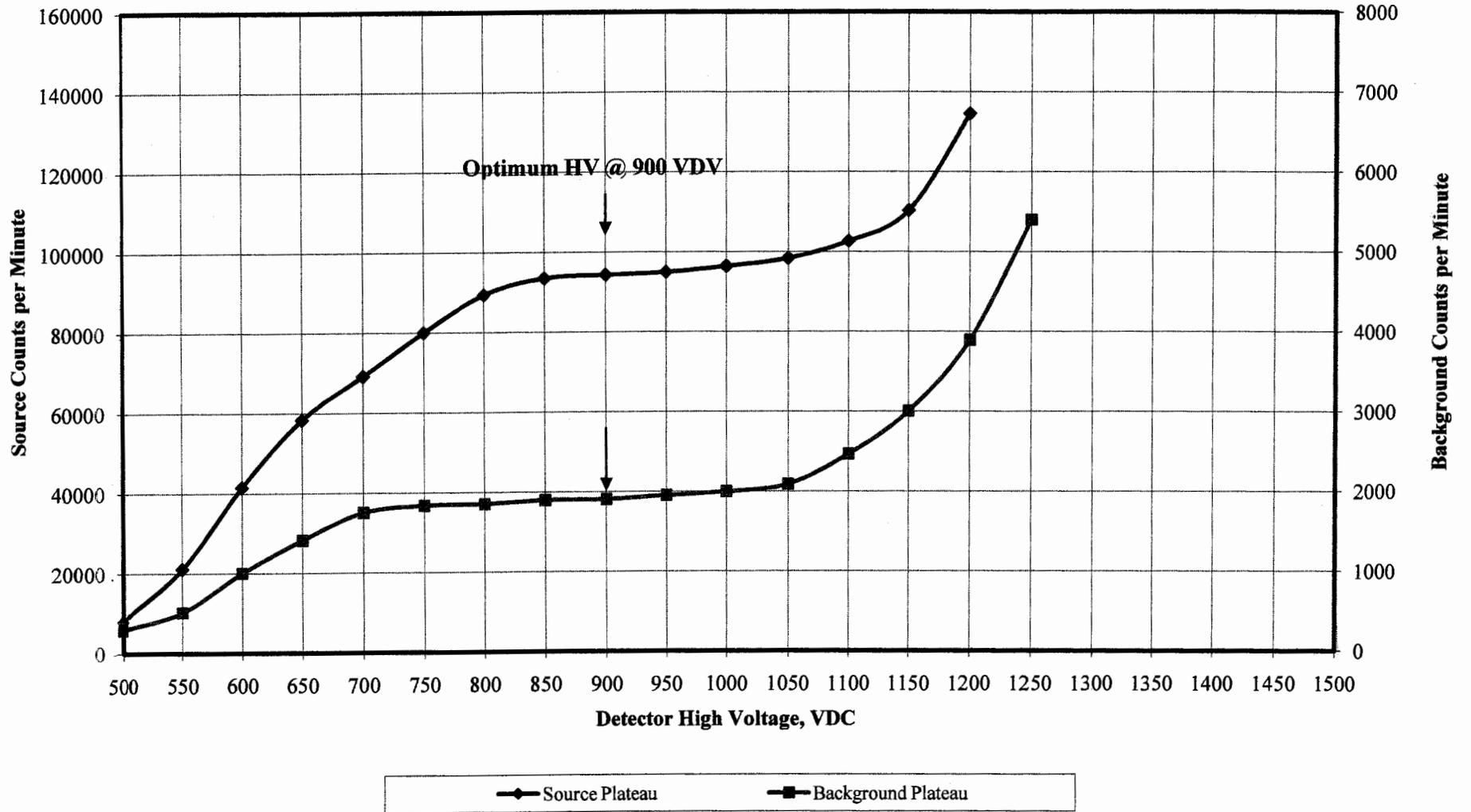
Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. This calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources: 73410 1131 781 059 280 60646 70897
 137 Gamma S/N 1162 G112 M565 5105 T1008 T879 E552 E551 720 734 1616 Neutron Am-241 Be S/N T-304
 Alpha S/N _____ Beta S/N _____ Other _____
 m 500 S/N 63893 Oscilloscope S/N _____ Multimeter S/N 93870637

Calibrated By: Jeremy Thompson Date 28 March 11
Reviewed By: Rhonda Hamlin Date 28 March 11

AC Inst. Only	<input type="checkbox"/> Passed Dielectric (Hi-Pot) and Continuity Test
	<input type="checkbox"/> Failed: _____

Detector High Voltage Plateau
SPA-3 #408522-30 with Ludlum 2221 #68782
1% Uranium Ore in Sealed Can
April 5, 2011



MDC Calculation

Detector: SPA-3, SR #408522-30 (2X2" NaI Scintillator), with Ludlum 2221, 04-05-2011

Unshielded 2x2 NaI Detector Background counts (cpm) = 7592	Bare Detector efficiency (cpm/pCi/gm) for Ra-226 (DOE Cal Pad GPL at Grants Site, 87.78 pCi/gm) = 954
Shielded 2x2 NaI Detector Background counts (cpm) = 2779	Collimated Detector efficiency (cpm/pCi/gm) for Ra-226 (DOE Cal Pad GPL at Grants Site, 87.78 pCi/gm) = 556

One Minute Static Measurement MDC

$L_D = 3 + 4.65 (B^{0.5})$ Equation 6-6 MARSSIM) for 0.05 for both alpha and beta, K = 1.645			
Where B is number of background counts that are expected to occur while performing actual measurement			
Bare 2x2 NaI Detector	$L_D =$	408 cpm	MDC (L _D /Eff)= 0.43 pCi/gm
Collimated 2x2 NaI Detector	$L_D =$	248 cpm	MDC (L _D /Eff)= 0.45 pCi/gm

Minimum Detectable Count Rate (MDCR) for Land Area Scan Survey

$MDCR = (d' \times b_i^{0.5}) \times (60/i)$ Equation 6-8, 6-9 MARSSIM			
Where d' is value for true positive (alpha) and false positive(beta) proportion (Table 6.5 MARSSIM)			
b _i is number background counts in the interval			
i is interval			
if b is in cpm, then b _i counts = cpm x 1 sec x 1 min/60 sec (1 sec is measurement time within the detector 3 ft dia area, therefore time is 3 ft/scan rate, fps, for 1 fps t=1, for 2 fps t=1.5, for 1.5 fps t=2)			
scan rate 3.0 ft/sec			
Unshielded 2x2 NaI Detector Background counts= 7592 cpm	b _i = 126.5 counts	d' = 1.38	MDCR = 931 cpm
Shielded 2x2 NaI Detector Background counts= 2779 cpm	b _i = 46.3 counts	d' = 1.38	MDCR = 564 cpm
$MDCR_{surveyor} = MDCR / (p^{0.5})$ where p is a surveyor efficiency			
surveyor efficiency (p) unshielded (active D)	p		
detector = 36	0.5	$MDCR_{surveyor} =$	1317 cpm
surveyor efficiency (p) shielded	p		
detector = 36	0.5	$MDCR_{surveyor} =$	797 cpm

Land Area Scan Minimum Detectable Concentration (MDC)

$Scan\ MDC\ pCi/gm = MDCR\ (cpm) / eff\ (cpm/pCi/gm)$ Equation 6-11 MARSSIM			
Bare detector efficiency= 954 cpm/pCi/gm	Scan MDC =	1.38 pCi/gm	
Collimated detector efficiency= 556 cpm/pCi/gm	Scan MDC =	1.43 pCi/gm	



CERTIFICATE OF CALIBRATION

CUSTOMER AVM ENVIRONMENTAL SERVICES ORDER NO. 20172118/361166
Mfg. Ludlum Measurements, Inc. Model 2221 Serial No. 68782
Mfg. _____ Model _____ Serial No. _____
Cal. Date 28-Mar-11 Cal Due Date 28-Mar-12 Cal. Interval 1 Year Meterface 202-159

Check mark applies to applicable instr. and/or detector IAW mfg. spec. T. 73 °F RH 28 % Alt 700.8 mm Hg
 New Instrument Instrument Received Within Toler. +10% 10-20% Out of Tol. Requiring Repair Other-See comments
 Mechanical ck. Meter Zeroed Background Subtract Input Sens. Linearity
 F/S Resp. ck. Reset ck. Window Operation Geotropism
 Audio ck. Alarm Setting ck. Batt. ck. (Min. Volt) 4.4 VDC
 Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.
 Instrument Volt Set 900 V Input Sens. 10 mV Def. Oper. _____ V at _____ mV Threshold Dial Ratio 100 = 10 mV
 HV Readout (2 points) Ref./Inst. 500 / 499 V Ref./Inst. 2000 / 2001 V

COMMENTS:
Firmware:261072 Calibrated with window in OUT position.
Calibrated with 39" cable.

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*	
X 1K	400k cpm	NA	400	
X 1K	100k cpm	}	100	
X 100	40k cpm		400	
X 100	10k cpm		100	
X 10	4k cpm		400	
X 10	1k cpm		100	
X 1	400 cpm		400	
X 1	100 cpm		100	

*Uncertainty within ± 10% C.F. within ± 20%

ALL Range(s) Calibrated Electronically

REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*	Log Scale	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
400k cpm	NA	39973 (6)	}	500k cpm	NA	500k cpm
40k cpm	}	3977		50k cpm	}	50
4k cpm		399		5k cpm		5
400 cpm		40		500 cpm		500
40 cpm		4		50 cpm		50

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources: 73410 1131 781 059 280 60646 70897
 Cs-137 Gamma S/N 1162 G112 M565 5105 T1008 T879 E552 E551 720 734 1616 Neutron Am-241 Be S/N T-304
 Alpha S/N _____ Beta S/N _____ Other _____
 m 500 S/N 63893 Oscilloscope S/N _____ Multimeter S/N 93870637

Calibrated By: Jeremy Thompson Date 28 March 11
Reviewed By: Rhain Ham Date 28 March 11

AC Inst. Passed Dielectric (Hi-Pot) and Continuity Test Only Failed: _____

AVM Environmental Services Inc.
L2221 SCA/L44-20 Energy Calibration Form

SCA: L2221, SR #68782

Detector: Ludlum 44-20 (3x3 NaI Scintillator) *SR# 295573*

Calibration Source: Cs-137 Check Source, 5 uCi (August 2008) For 662 KeV Peak Cal

Threshold (input sensitivity) **652**

Window, In/Out **IN** Window **20**

HV Initial **1**, At Peak **616**

Maximum CPM: **161,000** Background CPM: **25**

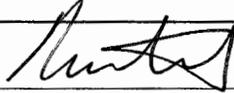
HV Set @ **616** VDC

For Bi-214 609.2 KeV Peak (559 - 659 KeV ROI), Set Threshold @ **559**, Window @ **100**

Calibration Check w 1% U3O8 Ore Check Source: _____ CPM

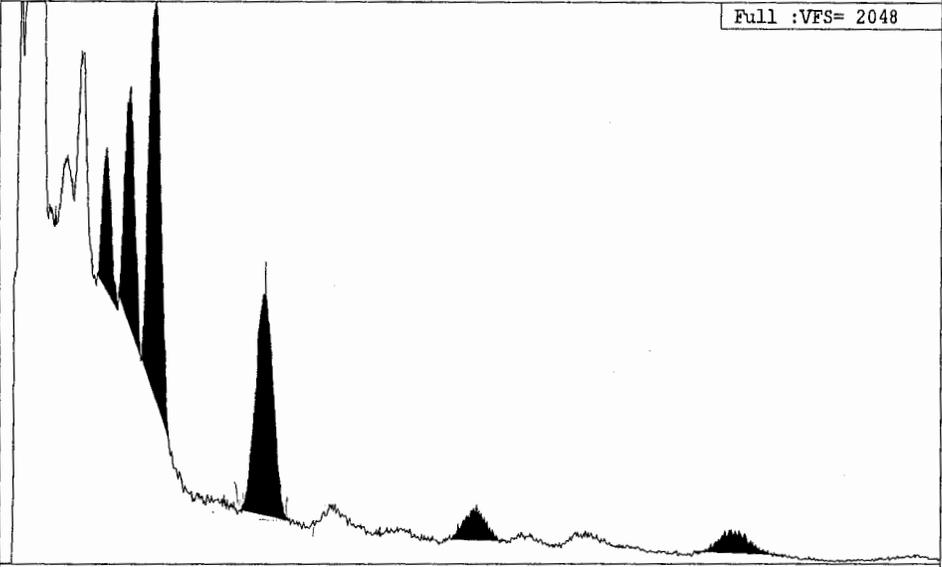
Thr @ 220 & Win @ 440 (240-609 KeV Range) - 77143 CPM w/Source
457 CPM BKG

Date **04-20-2011**

Calibrated By 

MCA #1 - Canberra S100 - RAS01STD.MCA - RAS01-1200, 100.1 pCi/g
Tag Number : 1979 Plotted On : Thu 11 Jun 2009 @ 10:02:02
Dead Time : 1.15% Acquire Started : Thu 11 Jun 2009 @ 09:38:34

Full :VFS= 2048



Cursor=608.6keV	From 549.8keV	To 664.3keV	Pset(Lm)=	20.00
Counts=980	Int=103257	Area=69365+-2.29%	Elap(Lm)=	20.00



CERTIFICATE OF CALIBRATION

CUSTOMER AVM ENVIRONMENTAL SERVICES ORDER NO. 20172118/361166

Mfg. Ludlum Measurements, Inc. Model 19 Serial No. 76248

Mfg. _____ Model _____ Serial No. _____

Cal. Date 28-Mar-11 Cal Due Date 28-Mar-12 Cal. Interval 1 Year Meterface 202-016

Check mark applies to applicable instr. and/or detector IAW mfg. spec. T. 73 °F RH 28 % Alt 700.8 mm Hg

New Instrument Instrument Received Within Toler. +10% 10-20% Out of Tol. Requiring Repair Other-See comments

Mechanical ck. Meter Zeroed Background Subtract Input Sens. Linearity

F/S Resp. ck. Reset ck. Window Operation Geotropism

Audio ck. Alarm Setting ck. Batt. ck. (Min. Volt) 2.2 VDC

Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 850 V Input Sens. 38 mV Det. Oper. _____ V at _____ mV Threshold Dial Ratio _____ = _____ mV

HV Readout (2 points) Ref./Inst. 500 / _____ V Ref./Inst. 1000 / _____ V

COMMENTS:

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
5000	4000 µR/hr	4200	4000
5000	1000 µR/hr	1000	1000
500	400 µR/hr = 72800 cpm	400	400
500	100 µR/hr	100	100
250	200 µR/hr = 37500 cpm	210	200
250	100 µR/hr	100	100
50	7280 cpm	40	40
50	1820 cpm	10	10
25	3750 cpm	21	20
25	940 cpm	5	5

*Uncertainty within ± 10% C.F. within ± 20%

50, 25 Range(s) Calibrated Electronically

REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*	Log Scale	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other international Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSS 2540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources: 73410 1131 781 059 280 60646 70897

Cs-137 Gamma S/N 1162 G112 M565 5105 T1008 T879 E552 E551 720 734 1616 Neutron Am-241 Be S/N T-304

Alpha S/N _____ Beta S/N _____ Other _____

m 500 S/N 63893 Oscilloscope S/N _____ Multimeter S/N 93870637

Calibrated By: Jeremy Thompson Date 28-March-11

Reviewed By: Rhonda Han Date 28 March 11

AC Inst. Passed Dielectric (Hi-Pot) and Continuity Test
Only Failed: _____

**AVM Environmental Services, Inc.
Micro R Meter Function Check Form**

Micro R Meter: Ludlum 19, SR#76248

Function Check Source ID: 1% U₃O₈ Ore in Sealed can

Function Check @ Calibration 95 uR/hr

Acceptable Function Check Reading (uR/hr) Range (20%) 76 to 114

Date	Physical Check	Cal Date	Battery ⁽¹⁾ Volts or OK	BKG Reading uR/hr	Source Reading ⁽²⁾ uR/hr	Within Acceptable Range Y or N	Cal Due	Tech
4-6-11	OK	3-28-11	OK	10-12	95	Y	3-28-12	JP
4-25-11	OK	3-28-11	OK	~10	100	Y	3-28-12	JP
4-26-11	OK	3-28-11	OK	10	95	Y	3-28-12	JP
4-27-11	OK	3-28-11	OK	10	95	Y	3-28-12	JP
4-28-11	OK	3-28-11	OK	10	100	Y	3-28-12	JP
4-29-11	OK	3-28-11	OK	10	100	Y	3-28-12	JP
5-2-11	OK	3-28-11	OK	10	100	Y	3-28-12	JP
5-3-11	OK	3-28-11	OK	10	100	Y	3-28-12	JP
5-4-11	OK	3-28-11	OK	10	100	Y	3-28-12	JP
5-10-11	OK	3-28-11	OK	10	100	Y	3-28-12	JP

Note: (1) Battery Voltage must be within BAT TEST Range (2) Function Check Source must be placed in the circle on the front side of the meter

Appendix B
Static Gamma Radiation Survey Field Forms

September 1, 2011

**Gamma Radiation Survey @ UNC's NECR Mine Site
Static Gamma Radiation Survey Field Form**

Instrumentation : Scaler/Ratemeter L2221 (68782), Detector SPA-3 #30

Instrument Calibration Date: 4-5-11, Instrument Daily Function Check Performed: Yes

2"x2" NaI Detector Collimated Yes or No.

Survey Area/Unit Description NECR East Ravine

Survey Date/Time	Survey Point ID/Description	Survey Point Coordinate		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
4-25-11	SRSE-GS-001	16965.28	2524.96	12060	Pit (G)
4-25-11	SRSE-GS-002	546.79	243.57	10953	B
	GS-003	570.15	287.20	10349	(G)
	GS-004	594.72	331.73	11024	B
	GS-005	611.99	379.18	11083	(G)
	GS-006	621.67	427.43	9742	B
	GS-007	611.45	477.21	7651	(G)
	GS-008	614.09	525.95	8421	B
	GS-009	625.63	576.40	9465	(G)
	GS-010	636.99	625.03	10156	B
	GS-011	660.55	669.25	7753	(G)
NP	GS-012	684.54	713.01		B
	GS-012	708.90	76.57	6890	B
	GS-013	770.22	832.74	14817	(G)
	GS-014	831.69	911.59	6398	B
	GS-015	859.06	500.861	7495	(G)
	GS-016	839.28	107.11	6703	B
	GS-017	774.88	133.71	11368	(G)
	GS-018	705.23	255.32	7433	B
	GS-019	634.67	327.53	5859	(G)
	GS-020	583.13	413.82	9191	B
	GS-021	512.40	197.24	11705	B
	GS-022	534.92	245.44	7363	R
	GS-023	556.30	293.40	6332	R
	GS-024	583.34	337.20	5730	R
	GS-025	603.54	381.90	10317	B

Technician Signature [Signature], Reviewed by [Signature]

**Gamma Radiation Survey @ UNC's NECR Mine Site
Static Gamma Radiation Survey Field Form**

Instrumentation : Scaler/Ratemeter L2221 (*68782) , Detector SPA-3 #30

Instrument Calibration Date: 4-5-11 , Instrument Daily Function Check Performed: Yes

2"x2" NaI Detector Collimated Yes or No.

Survey Area/Unit Description NECR East Drainage Ravine

Survey Date/Time	Survey Point ID/Description	Survey Point Coordinate		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
4-25-11	SRS E-65 -026	616.77	425.56	9559	R
	-027	601.56	476.40	5421	R
	-028	609.89	527.11	5815	R
	-029	614.79	574.57	4919	B
	-030	623.71	626.67	4789	R
	-031	648.03	672.50	5243	R
	-032	696.14	762.92	5458	B
	-033	757.99 839.60	839.60	4963	R 742.00 855.40
	-034	813.14	918.44	7054	B
	-035	830.39	5013.99	4756	R
	-036	823.02	098.78	4619	B
	-037	763.88	177.49	4594	R
	-038	693.30	244.45	4434	B
	-039	618.84	318.76	4209	R
	-040	564.48	407.81	4538	B
	-041	544.60	194.64	18331	B
	-042	555.12	239.72	7670	R
	043	574.84	284.66	6331	R
	044	6004.40	326.20	6572	R
	045	618.73	377.74	9237	B
	046	632.20	429.97	10823	R
	047	638.14	477.20	10784	R
	048	630.17	525.56	10713	R
	049	637.55	573.34	11335	B
	050	644.91	623.99	15567	R
	051	669.85	666.99	15398	R

Technician Signature [Signature] , Reviewed by [Signature]

**Gamma Radiation Survey @ UNC's NECR Mine Site
Static Gamma Radiation Survey Field Form**

Instrumentation : Scaler/Ratemeter L2221 (# 68782), Detector SP-3 #30
 Instrument Calibration Date: 4-5-11, Instrument Daily Function Check Performed: yes
 2"x2" NaI Detector Collimated Yes or No.
 Survey Area/Unit Description East Drainage, Step out (Flats)

Survey Date/Time	Survey Point ID/Description	Survey Point Coordinate		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
4-26-11	SRSE-65-061	1196650.00	2524450	10152	
	-062	7033	449.7	7838	
	-063	752	448	7485	
	-064	801	450	7851	
	-065	850	450	5837	
	-066	900	450	5879	
	-067	955	448	4997	
	-068	999	500	5230	
	-069	951	500	6067	
	-070	902	500	6955	
	-071	850	500	6860	
	-072	801	499	7320	
	-073	750	499	7962	
	-074	700	500	8288	
	-075	701	550	14257	
	-076	750	550	8757	
	-077	800	550	6340	
	-078	850	550	7050	
	-079	900	550	6591	
	-080	950	550	6990	
	-081	7002	550	5884	
	-082	005	550	5308	
	-083	100	550	8132	
	-084	150	550	5834	
	-085	150	600	6877	
	-086	150	600	6905	

Technician Signature [Signature], Reviewed by [Signature]

**Gamma Radiation Survey @ UNC's NECR Mine Site
Static Gamma Radiation Survey Field Form**

Instrumentation : Scaler/Ratemeter L2221 (# 68783), Detector SPA-3, #30
 Instrument Calibration Date: 4-5-11, Instrument Daily Function Check Performed: Yes
 2"x2" NaI Detector Collimated Yes or No.
 Survey Area/Unit Description Drainage Stepout (Flats)

Survey Date/Time	Survey Point ID/Description	Survey Point Coordinate		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
4-26-11	SRSE-6S-087	50	600	6540	
	-088	00	600	14395	
	-089	950	600	6460	
	-090	900	600	6699	
	-091	850	600	8777	
	-092	800	600	9535	
	-093	750	600	10833	
	-094	700	600	17481	
	-095	700	850	17974	
	-096	750	650	16247	
	-097	800	650	11448	
	-098	850	650	11079	
	-099	900	650	14941	
	-100	950	650	7027	
	-101	000	650	63249	
	-102	50	650	6059	
	-103	100	650	8826.	
	-104	150	650	5857	
	-105	150	700	7720	
	-106	100	700	30002	
	-107	50	700	34892	
	-108	000	700	50422	
	-109	950	700	28477	
	-110	900	700	9160	
	-111	850	700	9608	
	-112	800	700	14473	

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**Gamma Radiation Survey @ UNC's NECR Mine Site
Static Gamma Radiation Survey Field Form**

Instrumentation : Scaler/Ratemeter L2221 (#18782) , Detector SPA-3 #30
 Instrument Calibration Date: 4-5-11 , Instrument Daily Function Check Performed: Yes
 2"x2" NaI Detector Collimated Yes or No.
 Survey Area/Unit Description SRSE East Drainage, Step out (Flats)

Survey Date/Time	Survey Point ID/Description	Survey Point Coordinate		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
4-26-11	SRSE-GS-113	750	700	20919	20919
	-114	800	750	11309	
	-115	850	750	8007	
	-116	900	750	8552	
	-117	950	750	27428	
	-118	000	750	39465	
	-119	50	750	46929	
	-120	100	750	34200	
	-121	150	750	15890	
	-122	200	750	14174	
	-123	200	800	11180	
	-124	150	800	10776	
	-125	100	800	39735	
	-126	50	800	24183	
	-127	000	800	30418	
	-128	950	800	6877	
	-129	900	800	10648	
	-130	850	800	8734	
	-131	850	850	8499	
	-131A	900	850	5391	
	-132	950	850	4972	
	-133	000	850	7761	
	-134	050	850	39725	
	-135	100	850	21915	
	-136	150	850	8249	
	-137	200	850	10141	

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**Gamma Radiation Survey @ UNC's NECR Mine Site
Static Gamma Radiation Survey Field Form**

Instrumentation : Scaler/Ratemeter L2221 SN#68782, Detector SPA-3 #30

Instrument Calibration Date: 4-5-11, Instrument Daily Function Check Performed: y

2"x2" NaI Detector Collimated Yes or No.

Survey Area/Unit Description SRSE Drainage Stepout (Flats)

Survey Date/Time	Survey Point ID/Description	Survey Point Coordinate		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
4-26-11	SRSE-GS-138	250	850	8878	
	-139	300	850	6186	
	-140	300	900	7497	
	-141	250	900	8628	
	-142	200	900	7279	
	-143	150	900	7432	
	-144	150	950	6266	
	-145	200	950	8816	
	-146	250	950	6391	
	-147	300	950	5730	
	-148	300	000	6090	
	-149	250	000	7044	
	-150	200	000	8672	
	-151	150	000	5651	
	-152	150	050	6637	
	-153	200	050	8811	
	-154	250	050	6180	
	-155	250	100	6052	
	-156	200	100	9205	
	-157	150	100	12426	
	-158	050	900	32213	
	-159	006	900	5102	
	-160	950	900	4961	
	-161	900	950	4865	
	-162	950	950	4724	
	-163	000	950	4985	

Technician Signature [Signature], Reviewed by [Signature]

Gamma Radiation Survey @ UNC's NECR Mine Site
Static Gamma Radiation Survey Field Form

Instrumentation : Scaler/Ratemeter L2221 (# 68782), Detector SPA-3 #30
 Instrument Calibration Date: 4-5-11, Instrument Daily Function Check Performed: Yes
 2"x2" NaI Detector Collimated Yes or No.
 Survey Area/Unit Description East Drainage Steepout (Flats)

Survey Date/Time	Survey Point ID/Description	Survey Point Coordinate		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
4-26-11	SRSB 65-164	050	950	24472	
	-165	050	000	15455	
	-166	000	000	4858	
	-167	950	000	5104	
	-168	900	050	5060	
	-169	950	050	4543	
	-170	000	050	6400	
	-171	000	100	4592	
	-172	950	100	5068	
	-173	900	100	4825	
	-174	900	150	4592	
	-175	950	150	4595	
	-176	000	150	5103	
	-177	000	200	4159	
	-178	950	250	4151	
	-179	900	250	4061	
	-180	850	250	4506	
	-181	800	250	5072	GPS note
	-182	750	300	4864	
	-183	800	300	4098	
	-184	850	300	4246	
	-185	850	350	4828	
	-186	800	350	4851	
	-187	750	350	4613	
	-188	200	550	15734	
	-189	250	550	12348	

Technician Signature [Signature], Reviewed by [Signature]

**Gamma Radiation Survey @ UNC's NECR Mine Site
Static Gamma Radiation Survey Field Form**

Instrumentation : Scaler/Ratemeter L2221 (# 68782), Detector SPA-3 #30
 Instrument Calibration Date: 4-5-11, Instrument Daily Function Check Performed: Yes
 2"x2" NaI Detector Collimated Yes or No.
 Survey Area/Unit Description SRSE East Draining Steep (Plats)

Survey Date/Time	Survey Point ID/Description	Survey Point Coordinate		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
4-26-11	SRSE-65-190	250	500	9458	
	-191	200	500	12707	
	-192	150	500	6327	
	-193	100	500	10931	
	-194	050	500	5834	
	-195	050	450	5106	
	-196	100	450	5203	
	-197	150	450	11380	
	-198	200	450	14932	
	-199	250	450	10041	
	-200	250	600	16423	
	-201	200	600	14371	
	-202	200	650	15237	
	-203	250	650	12372	
	-204	250	700	16102	
	-205	200	700	11992	
	-206	650	400	8201	
	-207	700	400	6353	
	-208	750	400	6464	
	-209	800	400	6980	
	-210	850	400	5750	
	-211	850	350	4874	
	-212	800	350	6381	
	-213	750	350	7068	
	-214	700	350	5349	
	-215	650	350	6104	

Technician Signature [Signature], Reviewed by [Signature]

Gamma Radiation Survey @ UNC's NECR Mine Site
Static Gamma Radiation Survey Field Form

Instrumentation : Scaler/Ratemeter 12221 (#68782), Detector SPA-3 #30
 Instrument Calibration Date: 4-5-11, Instrument Daily Function Check Performed: Yes
 2"x2" NaI Detector Collimated Yes or No.
 Survey Area/Unit Description SRSE East Drainage Steep (Flats)

Survey Date/Time	Survey Point ID/Description	Survey Point Coordinate		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
4-26-11	SRSE-GS-216	650	300	6670	
	-217	700	300	6667	
	-218	750	300	5668	
	-219	800	300	5641	
	-220	850	300	5216	
	-221	840	250	4299	
	-222	800	250	5784	
	-223	750	250	6144	
	-224	700	250	9199	
	-225	650	250	8234	
	-226	600	250	7289	
	-227	600	265	10673	Fence
	-228	650	200	8910	
	-229	700	200	7227	
	-230	750	200	7673	
	-231	800	200	5222	
	-232	250	800	11413	
	-233	250	750	10311	
	-234	300	800	6412	
	-235	300	750	7684	
	-236	300	700	6127	
-237	300	650	6159		
-238	300	600	5433		
-239	300	550	5210		
-240	300	500	5248		
-241	300	450	5201		

Technician Signature [Signature], Reviewed by [Signature]

Gamma Radiation Survey @ UNC's NECR Mine Site
Static Gamma Radiation Survey Field Form

Instrumentation : Scaler/Ratemeter L2221 (#68782), Detector SPA-3 #30
 Instrument Calibration Date: 4-5-11, Instrument Daily Function Check Performed: Yes
 2"x2" NaI Detector Collimated Yes or No.
 Survey Area/Unit Description SRSE East Drainage Separts (Flats)

Survey Date/Time	Survey Point ID/Description	Survey Point Coordinate		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
4-27-11	SRSE-65-242	300	400	5365	
	-243	250	400	9886	
	-244	200	400	14335	
	-245	150	400	9613	
	-246	100	400	5085	Road
	-247	70	400	5256	Fence
	-248	100	300	5217	Fence
	-249	200	300	12679	
	-250	300	300	5488	
	-251	400	300	5115	
	-252	500	300	5658	
	-253	500	200	5226	
	-254	400	200	5256	
	-255	300	200	5214	
	-256	200	200	6565	
	-257	125	200	5426	
	-258	150	125	8296	
	-259	200	113	8237	
	-260	300	100	7702	
	-261	400	100	7389	
	-262	500	100	6696	
	-263	260	100	10501	
	-264	246	153	9392	10178
	-265	225	835	11064	
	-266	200	312	10668	
	-267	167	406	15548	

Technician Signature [Signature], Reviewed by [Signature]

Gamma Radiation Survey @ UNC's NECR Mine Site
Static Gamma Radiation Survey Field Form

Instrumentation : Scaler/Ratemeter L2221 (#68782), Detector SPA-3
 Instrument Calibration Date: 4-5-11, Instrument Daily Function Check Performed: Yes
 2"x2" NaI Detector Collimated Yes or No.
 Survey Area/Unit Description SR56 East Drainage Segment (Flats)

Survey Date/Time	Survey Point ID/Description	Survey Point Coordinate		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
4-27-11	SR56-05-268	180	500	14003	
	-269	400	400	5612	
	-270	484	400	4972	
	-271	400	500	5270	
	-272	400	600	4526	
	-273	474	700	5026	
	-274	400	700	4901	
	-275	400	800	4884	
	-276	485	800	5297	
	-277	440	900	5249	
	-278	400	900	5404	
	✓ X -279	121	850	5486	Arroyo 5104
	-280	123	900	5566	Arroyo
	-281	115	950	5960	Arroyo
	-282	108	000	5328	Arroyo
	✓ X -283	100	50	5224	Arroyo 5239
	-284	62	108	5485	Arroyo GPS Note.
	-285	56	152	5142	Arroyo
	-286	47	200	5447	Arroyo
	✓ X -287	27	245	5004	Arroyo 4803
	-288	95	170	4925	Arroyo
	-289	129	150	5152	Arroyo
	✓ X -290	137	120	6154	Arroyo 6329
	✗ -291	838	696	30731	Planned
	-292	764	722	29560	"
	-293	802	711	26246	"

Technician Signature [Signature], Reviewed by [Signature]

Appendix C
Soil Sample Logs

September 1, 2011

NECR East Drainage SRSE
Soil Sample Log Form

Sample ID	Sample Date	Sample Description	Comments/Notes	Tech
SRSE-SS-001	4-25-11 1600	Surface Soil Sample at Pt. SRSE-001 (Ravine bed)	Depth Test Pit	VP
SRSE-SS-002	4-25-11 1615	Surface Soil Sample at Pt. SRSE-002 (Ravine bed)		VP
SRSE-SS-003	4-25-11 1625	Surface Soil Sample at Pt. SRSE-003 (Ravine Bed)	Depth Test Pit	VP
SRSE-SS-004	4-25-11 1635	Surface Soil Sample at Pt. SRSE-004 (Ravine Bed)		VP
SRSE-SS-005	4-25-11 1647	Surface Soil Sample at Pt. SRSE-005 (Ravine Bed)	Depth Test Pit	VP
SRSE-SS-006	4-25-11 1658	Surface Soil Sample at Pt. SRSE-006 (Ravine Bed)		VP
SRSE-SS-007	4-25-11 1710	Surface Soil Sample at Pt. SRSE-007 (Ravine Bed)		VP
SRSE-SS-008	4-25-11 1721	Surface Soil Sample at Pt. SRSE-008 (Ravine Bed)		VP
SRSE-SD-001	4-25-11 1700	Dup. Soil Sample at Pt. SRSE-008		VP
SRSE-SS-009	4-25-11 1735	Surface Soil Sample at Pt. SRSE-009 (Ravine Bed)	To Depth Test Pit	VP
SRSE-SS-010	4-25-11 1748	Surface Soil Sample at Pt. SRSE-010 (Ravine Bed)		VP
SRSE-SS-025	4-27-11 1210	Surface Soil Sample at Pt. SRSE-025 (South Bank)		VP

NECR East Drainage SRSE
Soil Sample Log Form

Sample ID	Sample Date	Sample Description	Comments/Notes	Tech
SRSE-SS-045	4-27-11 1215	Surface Soil Sample at Pt. SRSE-045 (North Bank)		VP
SRSE-SS-029	4-27-11 1218	Surface Soil Sample at Pt. SRSE-029 (South Bank)		VP
SRSE-SS-011	4-27-11 1223	Surface Soil Sample at Pt. SRSE-011 (Ravine Bed)		VP
SRSE-SS-012	4-27-11 1235	Surface Soil Sample at Pt. SRSE-012 (Ravine Bed)	Depth Test Pit	VP
SRSE-SS-032	4-27-11 1240	Surface Soil Sample at Pt. SRSE-032 (South Bank)		VP
SRSE-SS-052	4-27-11 1242	Surface Soil Sample at Pt. SRSE-052 (North Bank)		VP
SRSE-SS-013	4-27-11 1245	Surface Soil Sample at Pt. SRSE-013 (Ravine Bed)		VP
SRSE-SS-014	4-27-11 1254	Surface Soil Sample at Pt. SRSE-014 (Ravine Bed)	Depth Test Pit	VP
SRSE-SS-002	4-27-11 1255	Dup. Soil Sample at Pt. SRSE-014		VP
SRSE-SS-034	4-27-11 1258	Surface Soil Sample at Pt. SRSE-034 (South Bank)		VP
SRSE-SS-015	4-27-11 1302	Surface Soil Sample at Pt. SRSE-015 (Ravine Bed)		VP
SRSE-SS-036	4-27-11 1305	Surface Soil Sample at Pt. SRSE-036 (South Bank)		VP

NECR East Drainage SRSE
Soil Sample Log Form

Sample ID	Sample Date	Sample Description	Comments/Notes	Tech
SRSE-SS-054	4-27-11 1260	Surface Soil Sample at Pt. SRSE-054 (North Bank)		VP
SRSE-SS-016	4-27-11 1307	Surface Soil Sample at Pt. SRSE-016 (Ravine Bed)	Depth Test Pit	VP
SRSE-SS-056	4-27-11 1311	Surface Soil Sample at Pt. SRSE-056 (North Bank)		VP
SRSE-SS-017	4-27-11 1320	Surface Soil Sample at SRSE-017 (Ravine Bed)		VP
SRSE-SS-038	4-27-11 1323	Surface Soil Sample at SRSE-038 (South Bank)		VP
SRSE-SS-058	4-27-11 1326	Surface Soil Sample @ SRSE-058 (North Bank)		VP
SRSE-SS-018	4-27-11 1328	Surface Soil Sample @ Point SRSE-018 (Ravine Bed)		VP
SRSE-SD-003	4-27-11 1330	Field dup of SRSE-SS-018		VP
SRSE-SS-019	4-27-11 1332	Surface Soil Sample @ Point SRSE-019 (Ravine Bed)	Depth Test Pit	VP
SRSE-SS-20	4-27-11 1335	Surface Soil Sample @ Point SRSE-20 (Ravine Bed)	Depth Test Pit	VP
SRSE-SS-040	4-27-11 1338	Surface Soil Sample at Point SRSE-040 (South Bank)		VP
SRSE-SS-060	4-27-11 1341	Surface Soil Sample at Point SRSE-060 (North Bank)		VP

NECR East Drainage SRSE
Soil Sample Log Form

Sample ID	Sample Date	Sample Description	Comments/Notes	Tech
SRSE-SS-021	4-27-11 1351	Surface Soil Sample at point SRSE-021 (South Bank)		VP
SRSE-SS-041	4-27-11 1354	Surface Soil Sample at point SS-041 (North Bank)		VP
SRSE-SD-004	4-27-11 1357	Field Duplicate of SRSE-SS-041	QA/QC	VP
SRSE-SS-049	4-27-11 1220	Surface Soil Sample @ Point SRSE-049 Step out		VP
SRSE-SS-290	4-27-11 @ 1430	Surface Soil Sample @ step out Point SRSE-290		VP
SRSE-SS-287	4-27-11 @ 1435	Surface Soil Sample @ Step out (Flats) Pt - SRSE - 287		VP
SRSE-SS-283	4-27-11 @ 1440	" Pt - SRSE - 283		VP
SRSE-SS-279	4-27-11 @ 1445	" Pt - SRSE - 279		VP
SRSE-SS-135	4-27-11 @ 1456	" Pt - SRSE - 135	Depth Test	VP
SRSE-SS-123	4-27-11 @ 1502	" Pt - SRSE - 123	Depth Test Pt	VP
SRSE-SS-237	4-27-11 @ 1507	" Pt - SRSE - 237	Depth Test	VP
SRSE-SS-103	4-27-11 @ 1518	" Pt - SRSE - 103	Depth Test	VP

**NECR East Drainage SRSE
Soil Sample Log Form**

Sample ID	Sample Date	Sample Description	Comments/Notes	Tech
SRSE-SS-101	4-27-11 @ 1523	Surface Soil Sample @ Stepout (Flat) Point - SRSE-101	Depth Test	✓P
SRSE-SS-291	4-27-11 @ 1533	" " - SRSE-291	Depth Test	✓P
SRSE-SD-005	4-27-11 @ 1534	Field Dup Sample of SRSE-SS-291		✓P
SRSE-SS-092	4-27-11 @ 1543	Surface Soil Sample @ Stepout (Flat) Point SRSE-092	Depth Test	✓P
SRSE-SS-065	4-27-11 @ 1549	" " - SRSE-065	Depth Test	✓P
SRSE-SS-224	4-27-11 @ 1553	" " - SRSE-224		✓P
SRSE-SS-198	4-27-11 @ 1604	" " SRSE-198	Depth Test	✓P
SRSE-SS-264	4-27-11 @ 1616	" " - SRSE-264	Depth Test	✓P
IRA-SS-F01	4-29-11 @ 1315	Surface Soil Sample @ Pt F-01 IRA, NGR-1 base Drainage Area cleaned in Dec 2010		✓P
IRA-SS-F05	4-29-11 @ 1325	" " " @ Pt F02		✓P

NECR East Drainage SRSE
Soil Sample Log Form

Sample ID	Sample Date	Sample Description	Comments/Notes	Tech
SRSE-SB-001 @ 2.5'	4-28-11 0955	Soil Sample @ SRSE-GS-001 @ 2.5'		VP
SRSE-SB-001 @ 5'	4-28-11 1005	Sub Surface Soil Sample @ SRSE-001 @ 5' depth	Gravel	VP
SRSE-SB-001 @ 7.5'	4-28-11 1015	Subsurface Soil Sample @ SRSE-001 @ 7.5'	Sample Split for Lab Clay	VP
SRSE-SB-003 @ 2.5'	4-28-11 1037	Subsurface Soil Sample @ SRSE-003 @ 2.5'	Split for Lab	VP
SRSE-SB-005 @ 2.5'	4-28-11 1053	Subsurface Soil Sample @ SRSE-005 @ 2.5'	Split for Lab	VP
SRSE-SB-005 @ 5.0'	4-28-11 1105	Subsurface Soil Sample @ SRSE-005 @ 5.0'	Split for Lab	VP
SRSE-SB-009 @ 2.5'	4-28-11 1125	Subsurface Soil Sample. @ SRSE-009 @ 2.5'	Split for Lab	VP
SRSE-SB-012 @ 2.5'	4-28-11 1136	Subsurface Soil Sample @ SRSE-012 @ 2.5'	Split for Lab	VP
SRSE-SB-014 @ 2.5'	4-28-11 1155	Subsurface Soil Sample at SRSE-014 A 2.5 feet depth		VP
SRSE-SB-014 @ 5.0'	4-28-11 1204	Subsurface soil sample at Point SRSE-014 @ 5.0' depth	Split for Lab	VP
SRSE-SB-016 @ 2.5'	4-28-11 1226	subsurface Soil Sample at Point SRSE-016 at 2.5' depth	Split for Lab	VP
SRSE-SB-019 @ 2.5'	4-28-11 1242	Sub surface Soil Sample at Point SRSE-019 at 2.5' deep	Split for Lab	VP

NECR East Drainage SRSE
Soil Sample Log Form

Sample ID	Sample Date	Sample Description	Comments/Notes	Tech
SRSE-SB-092, 1.0'	4-28-11 @ 1045	Subsurface Soil Sample @ pt SRSE-092 @ 1.0' depth	Vertical Contaminant Assessment	VP
SRSE-SB-065, 1.0'	4-28-11 @ 1113	" " " @ pt SRSE-065 @ 1.0' depth	"	VP
SRSE-SB-291, 1.0'	4-28-11 @ 1118	" " " @ pt SRSE-291 @ 1.0' depth	"	VP
SRSE-SB-101, 1.0'	4-28-11 @ 1150	" " " @ pt SRSE-101 @ 1.0' deep	"	VP
SRSE-SB-198, 1.0'	4-28-11 @ 1200 NP	" " " @ pt SRSE-198 @ 1.0' deep	"	VP
SRSE-SB-264, 1.0'	4-28-11 @ 1230	" " " @ pt SRSE-264 @ 1.0' deep	"	VP
SRSE-SB-237, 1.0'	4-28-11 @ 1237	" " " @ pt SRSE-237 1.0' deep	"	VP
SRSE-SB-123, 1.0'	4-28-11 @ 1242	" " " @ pt SRSE-123 1.0' deep	"	VP
SRSE-SB-135, 1.0'	4-28-11 @ 1255	" " " @ pt SRSE-135 1.0' deep	"	VP
SRSE-SB-103, 1.0'	4-28-11 @ 1310	" " " @ pt SRSE-103 1.0' deep	"	VP

Appendix D

Field Soil Gamma Radiation Screening Procedure

Field Soil Gamma Radiation Screening Forms

Onsite Gamma Spectroscopy Results

Field Soil Gamma Radiation Screening Procedure

1.0 Introduction

This field soil screening procedure for Ra-226 consists of measuring 609 KeV peak gamma radiations of Bi-214, a decay product of Ra-226 through Rn-222. The 609 KeV gamma radiation counts of the sample soil is compared to a reference soil from the Site with a known Ra-226 concentration for field screening. Although the Rn-222 is a gas and the soil is not sealed, the soil retains over 70% of Rn-222 gas within the soil matrix, resulting in a significant amount of Bi-214 decay product and its gamma radiations. Bi-214 609 KeV gamma radiation is at fairly high intensity (46%) and isolated, which minimizes interference from other energy gamma radiations. For a quick estimate of Ra-226 in soil, a reference soil with a known Ra-226 concentration (similar to screening level), which is not previously sealed, the 609 KeV gamma radiation level of Bi-214 can be measured (pulse height analysis) for field screening. A single channel analyzer (SCA), such as Ludlum L221 integrated with Ludlum 44-20 3x3 NaI scintillation detector can be used to measure radiation of a particular energy of Bi-214. The sample is then placed in a counting chamber (plastic bag lined 1.5 inch thick x 7.5 Inch ID x 12 inch tall lead ring collimator with a 1.5 inch thick lead bottom shield). The heavily shielded counting chamber lowers the background counts thus lowers the detectable concentration. The 3x3 NaI detector lined with a plastic sheet is then placed on the sample inside the chamber and 609 KeV gamma radiation counts are obtained and compared to the reference soil and sample soil for field screening.

2.0 L2221/44-20 Window Operation and Energy Calibration Procedure

The following procedure calibrates threshold directly in keV.

1. Place RATEMETER multiplier switch to LOG position.
2. Unscrew and remove CAL cover.
3. Press HV pushbutton. The HV should read out on the display directly in volts. While depressing the HV pushbutton, turn HV potentiometer maximum counterclockwise. The HV should be less than 50 volts.
4. Depress the THR pushbutton. Turn the THR potentiometer clockwise until 652 displays.
5. With WIN IN/OUT switch IN, depress the WIN pushbutton. Turn the WIN potentiometer until 20 appears on the display.
6. Switch WIN IN/OUT to OUT.
7. Connect the probe (Ludlum 44-20) and expose to Cs-137 source.
8. Increase HV (if HV potentiometer is at minimum, it will take approximately 3 turns before any change is indicated). While increasing the HV, observe the log scale of the ratemeter. Increase HV until ratemeter indication occurs.
9. Switch WIN IN/OUT switch to IN.

10. Turn the HV control until maximum reading occurs on the log scale. Increase HV until reading starts to drop off, then decrease the HV for maximum reading.
11. Turn RATEMETER selector switch to the X1K position.
12. Press ZERO pushbutton and release. If meter does not read, switch to a lower range until a reading occurs.
13. Carefully adjust HV potentiometer until maximum reading is achieved on the range scale. The instrument is now peaked for Cs137 on both the LOG and Linear scales. Record HV for energy calibration.

NOTE: When the THR control is adjusted, the effective window width remains constant. As an example, if the THR is set at 559, the WIN at 100, a 609 KeV peak +559 (100 divided by 2) will be centered in the window. Then the threshold point is equivalent to 559 KeV with a 100 KeV window and calibrated for 100 KeV per turn. Now if the threshold is reduced to 250, the threshold is equivalent to 250 KeV, but the window (100) is still equal to 100 KeV. Proportionally, this represents a broader window.

14. Set THR at 559 and window at 100 for Bi-214 609 KeV (559 to 669 KeV ROI) gamma radiation measurement. Expose the detector with a 1% Uranium ore function check source and obtain a one minute counts. Remove the function check source and obtain a one minute background counts.

3.0 Field Soil Screening Procedure

1. Setup the L2221 parameters (HV, Threshold and Window) obtained during energy calibration above and connect the 44-20 detector. Make sure the window toggle switch is in the IN position.
2. Setup the counting chamber shield in back of pick-up truck.
3. Perform function check with 1% Uranium ore function check source.
4. Line the counting chamber by inserting a plastic bag to prevent cross contamination.
5. Obtain one gallon of reference soil. Place approximately 1 inch of soil at the bottom of the lined chamber. Place plastic sheet lined (to prevent cross contamination) 44-20 detector facing crystal down and on top of the one inch soil bed in the center of the chamber. Place remainder of the one gallon soil around the detector without any void. Sample is wrapped around the detector crystal, similar to the Marinelli Beaker geometry to provide the best counting efficiency.
6. Obtain a 5-minute integrated count with L2221 in Scaler mode and record.
7. Remove detector, and the soil with liner bag. Insert new plastic bag in the chamber for liner, and re-line detector with new plastic sheet. Repeat step 5 and 6 for sample soil (one gallon). Change counting chamber liner and detector liner between every sample.

AVM Environmental Services, Inc.
 Field Test Pit soil sample Gamma Radiation Screening Form
 NECR East Drainage SRSE

Instrumentation : Scaler/Ratemeter L2221 #68782 , Detector 44-20 PR 259573

Instrument Calibration Date: 4-5-11 , Instrument Function Check Performed: y.

1 Gallon Soil sample in lined 1.5 inch thick lead Ring (collimator) with 3 inch thick steel bottom shield

Survey Area/Unit Description SRSE Drainage Ravine East. BKG 85 cpm (Blank)

Date/Time	Soil Sample ID	609 (559-669) Kev Gamma Radiation Counts CPSM	Note 609 Kev Gamma Radiation CPM	Comments
4-28-11 944	Ref Soil 2.0 pl/g	2353 2402	476	
4-28-11 955	SRSE-SB-001 @ 2.5'	6504	1301	> 2.0
4-28-11 1005	SRSE-SB-001 @ 5'	5554	1111	Gravel/Soil > 2.0
4-28-11 1015	SRSE-SB-001 @ 7.5'	1976	395	Clay Soil < 2.0
4-28-11 1037	SRSE-SB-003 @ 2.5'	2082	414	< 2.0
4-28-11 1053	SRSE-SB-005 @ 2.5'	2513	503	≈ 2.0
4-28-11 1105	SRSE-SB-005 @ 5.0'	1732	346	< 2.0
4-28-11 1125	SRSE-SB-009 @ 2.5'	1634	327	< 2.0
4-28-11 1136	SRSE-SB-012 @ 2.5'	1489	298	< 2.0
4-28-11 1155	SRSE-SB-014 @ 2.5'	5658	1132	> 2.0
4-28-11 1204	SRSE-SB-014 @ 5.0'	1805	361	< 2.0
4-28-11 1226	SRSE-SB-016 @ 2.5'	2177	435	< 2.0
4-28-11 1242	SRSE-SB-018 @ 2.5'	2204	441	< 2.0
4-28-11 1306	SRSE-SB-020 @ 2.5'	2531	506	≈ 2.0
4-28-11 1330	SRSE-SB-020 @ 5.0'	2001	400	< 2.0

Technician Signature

[Handwritten Signature]

Reviewed by

[Handwritten Signature]

AVM Environmental Services, Inc.
 Field Test Pit soil sample Gamma Radiation Screening Form
 NECR East Drainage SRSE

Instrumentation : Scaler/Ratemeter: 12221 (#68782) , Detector L 44-20 # PR 259573
 Instrument Calibration Date: 4-5-11 , Instrument Function Check Performed: Y/C
 1 Gallon Soil sample in lined 1.5 inch thick lead Ring (collimator) with 3 inch thick steel bottom shield
 Survey Area/Unit Description NECR SRSE, East Drainage Ravine

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Date/Time	Soil Sample ID	609 (559-669) Kev Gamma Radiation Counts CP5M	609 Kev Gamma Radiation CPM	Comments
4-28-11 1045	SRSE-SB-092 @ 1.0'	1378	275	
4-28-11 1113	SRSE-SB-065 @ 1.0'	1502	300	<SSL 2.0
4-28-11 1118	SRSE-SB-291 @ 1.0'	17719	3544	>SSL "
4-28-11 1230	SRSE-SB-264 @ 1.0'	6913	1383	>SSL "
4-28-11 @ 1406	SRSE-SB-291 @ 2.5'	1941	388	<SSL "
4-28-11 @ 1150	SRSE-SB-101 @ 1.0'	2214	443	<SSL "
4-28-11 1424	SRSE-SB-264 @ 2.5'	1571	314	<SSL "
4-28-11 1206	SRSE-SB-198 @ 1.0'	1463	293	<SSL "
4-28-11 @ 1237	SRSE-SB-237 @ 1.0'	1357	271	<SSL "
4-28-11 @ 1242	SRSE-SB-123 @ 1.0'	1394	279	<SSL "
4-28-11 1253	SRSE-SB-135 @ 1.0'	1610	322	<SSL "
4-28-11 1310	SRSE-SB-103 @ 1.0'	1459	292	<SSL "
4-28-11 1320	NECR Ref soil 2.0 pCi/g	2538 2496	503	STD Ref.

Technician Signature [Signature] , Reviewed by [Signature]

AVM Environmental Services, Inc.

NECR SRSE Gamma Spectroscopy Run Data

Technician VP

MB #	Sample ID	Sample Date	Sample Seal Date & Time	Sample Count Date & Time	Sample Results, Ra-226 pCi/gm		
					Conc @ Ingrowth	MDC	Projected Conc
1	SRSE-SB-001 @7.5'	4/28/2011	4/29/11 12:51	5/4/11 15:00	1.5	0.5	1.7+/-0.3
2	SRSE-SB-003 @2.5'	4/28/2011	4/29/11 12:51	5/4/11 15:23	1.8	0.5	2.0+/-0.3
3	SRSE-SB-005 @2.5'	4/28/2011	4/29/11 12:51	5/4/11 15:44	1.7	0.5	1.9+/-0.3
4	SRSE-SB-005 @5.0'	4/28/2011	4/29/11 12:51	5/4/11 16:06	0.8	0.5	0.9+/-0.3
5	SRSE-SB-009 @2.5'	4/28/2011	4/29/11 12:51	5/4/11 16:27	0.7	0.5	0.8+/-0.3
6	SRSE-SB-012 @2.5'	4/28/2011	4/29/11 12:51	5/4/11 16:49	0.9	0.5	1.0+/-0.3
7	SRSE-SB-014 @5.0'	4/28/2011	4/29/11 12:51	5/4/11 17:10	0.5	0.5	0.6+/-0.2
8	SRSE-SB-016 @2.5'	4/28/2011	4/29/11 12:51	5/4/11 17:32	1.8	0.5	2.0+/-0.3
9	SRSE-SB-018 @2.5'	4/28/2011	4/29/11 12:51	5/4/11 17:53	1.7	0.5	1.9+/-0.3
10	SRSE-SB-020 @2.5'	4/28/2011	4/29/11 12:51	5/4/11 18:15	2.8	0.5	3.1+/-0.4
11	SRSE-SB-020 @5.0'	4/28/2011	4/29/11 12:51	5/4/11 18:36	1.2	0.5	1.4+/-0.3

IP0,0,1016,1016;SC0,300,0,300;
INSP1PP1TROWUOPW0

MCA #1 - Canberra S100 - RAS3.MCA - RAS3, 99.2 pCi/g std

Tag Number: 2373 Readout: Wed 04 May 2011 @ 14:35:12
Report Group: Full Acquire Started: Wed 04 May 2011 @ 14:08:53
Group Size: 4096

Elapsed Live Time: 20.00 min.
Elapsed True Time: 20.35 min.
Dead Time: 1.70 %

REGION OF INTEREST REPORT

ROI #	From(keV) To (keV)	Integral CPS	Area %Error	Peak (keV) FWHM (keV)
1	217.5 265.3	91706 76.42	20701 7.02	241.6 21.60
2	269.9 319.9	106119 88.43	37601 3.92	295.0 24.49
3	323.0 390.4	142201 118.50	79882 2.10	352.6 29.23
4	554.8 667.9	94456 78.71	64517 2.34	610.6 42.19
5	1051.3 1185.5	28765 23.97	12642 9.21	1116.7 53.21
6	1663.2 1942.5	23269 19.39	12037 11.51	1767.1 49.01

MCA #1 - Canberra S100 - BK050411.MCA - BKG Sugar 800 g

Tag Number: 2374
Report Group: Full
Group Size: 4096

Readout: Wed 04 May 2011 @ 14:58:30
Acquire Started: Wed 04 May 2011 @ 14:36:44

Elapsed Live Time: 20.00 min.
Elapsed True Time: 20.01 min.
Dead Time: 0.06 %

REGION OF INTEREST REPORT

ROI #	From(keV) To (keV)	Integral CPS	Area %Error	Peak(keV) FWHM(keV)
1	217.5 265.3	546 0.46	-0 33523.43	221.1 0.69
2	269.9 319.9	469 0.39	-89 145.40	271.0 0.64
3	323.0 390.4	632 0.53	145 99.41	346.5 0.82
4	554.8 667.9	666 0.56	48 436.52	588.2 0.82
5	1051.3 1185.5	418 0.35	76 222.39	1093.3 1.34
6	1663.2 1942.5	337 0.28	23 988.40	1836.8 0.77

MCA #1 - Canberra S100 - SRSE0175.MCA - SRSE-SB-001@7.5' 4-28-11

Tag Number: 2375 Readout: Wed 04 May 2011 @ 15:22:23
Report Group: Full Acquire Started: Wed 04 May 2011 @ 15:00:31
Group Size: 4096

Elapsed Live Time: 20.00 min.
Elapsed True Time: 20.03 min.
Dead Time: 0.13 %

REGION OF INTEREST REPORT

ROI #	From(keV) To (keV)	Integral CPS	Area %Error	Peak(keV) FWHM(keV)
1	217.5 265.3	5871 4.89	1907 18.16	236.1 8.74
2	269.9 319.9	3262 2.72	449 65.47	308.5 0.82
3	323.0 390.4	3864 3.22	955 36.77	353.6 3.08
4	554.8 667.9	3403 2.84	1361 28.24	593.2 5.62
5	1051.3 1185.5	1504 1.25	166 200.45	1114.8 0.51
6	1663.2 1942.5	737 0.61	361 70.33	1860.6 0.51

MCA #1 - Canberra S100 - SRSE0325.MCA - SRSE-SB-003@2.5' 4-28-11

Tag Number: 2376
Report Group: Full
Group Size: 4096

Readout: Wed 04 May 2011 @ 15:43:49
Acquire Started: Wed 04 May 2011 @ 15:23:13

Elapsed Live Time: 20.00 min.
Elapsed True Time: 20.03 min.
Dead Time: 0.13 %

REGION OF INTEREST REPORT

ROI #	From (keV) To (keV)	Integral CPS	Area %Error	Peak (keV) FWHM (keV)
1	217.5 265.3	4790 3.99	1465 21.60	236.3 18.16
2	269.9 319.9	3169 2.64	502 57.15	291.8 1.03
3	323.0 390.4	3848 3.21	1297 25.51	353.0 6.05
4	554.8 667.9	3258 2.71	1538 23.02	598.8 6.92
5	1051.3 1185.5	1416 1.18	451 62.84	1065.3 0.78
6	1663.2 1942.5	701 0.58	262 104.32	1734.4 0.51

MCA #1 - Canberra S100 - SRSE0525.MCA - SRSE-SB-005@2.5' 4-28-11

Tag Number: 2377 Readout: Wed 04 May 2011 @ 16:05:27
Report Group: Full Acquire Started: Wed 04 May 2011 @ 15:44:47
Group Size: 4096

Elapsed Live Time: 20.00 min.
Elapsed True Time: 20.03 min.
Dead Time: 0.13 %

REGION OF INTEREST REPORT

ROI #	From(keV) To (keV)	Integral CPS	Area %Error	Peak(keV) FWHM(keV)
1	217.5 265.3	5033 4.19	1743 18.13	235.1 17.55
2	269.9 319.9	3227 2.69	341 87.09	286.4 0.67
3	323.0 390.4	3810 3.17	950 36.67	349.4 3.01
4	554.8 667.9	3348 2.79	1171 33.78	612.3 1.56
5	1051.3 1185.5	1385 1.15	233 132.13	1122.1 1.03
6	1663.2 1942.5	787 0.66	662 22.88	1813.3 0.75

MCA #1 - Canberra S100 - SRSE0550.MCA - SRSE-SB-005@5.0' 4-28-11

Tag Number: 2378
Report Group: Full
Group Size: 4096

Readout: Wed 04 May 2011 @ 16:26:42
Acquire Started: Wed 04 May 2011 @ 16:06:11

Elapsed Live Time: 20.00 min.
Elapsed True Time: 20.02 min.
Dead Time: 0.12 %

REGION OF INTEREST REPORT

ROI #	From(keV) To (keV)	Integral CPS	Area %Error	Peak(keV) FWHM(keV)
1	217.5 265.3	4446 3.70	1447 20.82	236.0 12.69
2	269.9 319.9	2793 2.33	514 51.69	289.4 1.90
3	323.0 390.4	3249 2.71	649 51.04	348.8 1.70
4	554.8 667.9	2839 2.37	662 59.49	604.6 7.23
5	1051.3 1185.5	1303 1.09	27 1204.20	1061.8 0.85
6	1663.2 1942.5	640 0.53	-176 210.34	1898.3 0.68

MCA #1 - Canberra S100 - SRSE0925.MCA - SRSE-SB-009@2.5' 4-28-11

Tag Number: 2379 Readout: Wed 04 May 2011 @ 16:48:44
Report Group: Full Acquire Started: Wed 04 May 2011 @ 16:27:41
Group Size: 4096

Elapsed Live Time: 20.00 min.
Elapsed True Time: 20.02 min.
Dead Time: 0.11 %

REGION OF INTEREST REPORT

ROI #	From(keV) To (keV)	Integral CPS	Area %Error	Peak(keV) FWHM(keV)
1	217.5 265.3	4461 3.72	1566 18.94	236.4 20.89
2	269.9 319.9	2648 2.21	114 243.78	295.7 0.77
3	323.0 390.4	3212 2.68	645 51.07	342.9 4.44
4	554.8 667.9	2758 2.30	581 67.73	589.6 1.03
5	1051.3 1185.5	1301 1.08	25 1300.98	1130.8 0.68
6	1663.2 1942.5	680 0.57	115 267.80	1795.0 0.77

MCA #1 - Canberra S100 - SRSE1225.MCA - SRSE-SB-012@2.5' 4-28-11

Tag Number: 2380 Readout: Wed 04 May 2011 @ 17:10:06
Report Group: Full Acquire Started: Wed 04 May 2011 @ 16:49:31
Group Size: 4096

Elapsed Live Time: 20.00 min.
Elapsed True Time: 20.02 min.
Dead Time: 0.11 %

REGION OF INTEREST REPORT

ROI #	From(keV) To (keV)	Integral CPS	Area %Error	Peak(keV) FWHM(keV)
1	217.5 265.3	3912 3.26	983 30.09	234.6 12.31
2	269.9 319.9	2482 2.07	360 70.93	278.5 0.71
3	323.0 390.4	2947 2.46	867 34.35	348.1 3.64
4	554.8 667.9	2531 2.11	650 56.40	612.3 1.48
5	1051.3 1185.5	1166 0.97	-266 128.55	1147.6 0.68
6	1663.2 1942.5	640 0.53	264 96.02	1770.7 1.28

IP0,0,1016,1016;SC0,300,0,300;
INSP1PP1TROWUOPWO

MCA #1 - Canberra S100 - SRSE1450.MCA - SRSE-SB-014@5.0' 4-28-11

Tag Number: 2381 Readout: Wed 04 May 2011 @ 17:31:28
Report Group: Full Acquire Started: Wed 04 May 2011 @ 17:10:56
Group Size: 4096

Elapsed Live Time: 20.00 min.
Elapsed True Time: 20.02 min.
Dead Time: 0.10 %

REGION OF INTEREST REPORT

ROI #	From(keV) To (keV)	Integral CPS	Area %Error	Peak (keV) FWHM(keV)
1	217.5 265.3	3855 3.21	1321 21.00	235.7 14.78
2	269.9 319.9	2305 1.92	195 130.00	272.0 0.51
3	323.0 390.4	2639 2.20	267 118.20	354.8 1.32
4	554.8 667.9	2313 1.93	190 204.03	592.4 0.90
5	1051.3 1185.5	1112 0.93	241 111.67	1091.0 1.11
6	1663.2 1942.5	565 0.47	-125 271.57	1767.7 0.69

MCA #1 - Canberra S100 - SRSE1625.MCA - SRSE-SB-016@2.5' 4-28-11

Tag Number: 2382 Readout: Wed 04 May 2011 @ 17:52:58
Report Group: Full Acquire Started: Wed 04 May 2011 @ 17:32:23
Group Size: 4096

Elapsed Live Time: 20.00 min.
Elapsed True Time: 20.03 min.
Dead Time: 0.14 %

REGION OF INTEREST REPORT

ROI #	From(keV) To (keV)	Integral CPS	Area %Error	Peak(keV) FWHM(keV)
1	217.5 265.3	5802 4.84	2082 16.17	234.3 12.44
2	269.9 319.9	4127 3.44	611 53.85	286.8 0.94
3	323.0 390.4	5163 4.30	1328 30.39	349.1 7.32
4	554.8 667.9	4019 3.35	1412 30.66	605.9 4.10
5	1051.3 1185.5	1751 1.46	226 156.96	1150.1 0.95
6	1663.2 1942.5	925 0.77	235 145.51	1748.0 0.51

MCA #1 - Canberra S100 - SRSE1825.MCA - SRSE-SB-018@2.5' 4-28-11

Tag Number: 2383
Report Group: Full
Group Size: 4096

Readout: Wed 04 May 2011 @ 18:16:29
Acquire Started: Wed 04 May 2011 @ 17:53:41

Elapsed Live Time: 20.00 min.
Elapsed True Time: 20.02 min.
Dead Time: 0.12 %

REGION OF INTEREST REPORT

ROI #	From(keV) To (keV)	Integral CPS	Area %Error	Peak(keV) FWHM(keV)
1	217.5 265.3	4509 3.76	1487 20.35	234.8 19.29
2	269.9 319.9	3666 3.06	186 174.84	291.0 1.54
3	323.0 390.4	4424 3.69	1694 20.27	347.1 14.45
4	554.8 667.9	3583 2.99	1003 42.82	603.0 7.16
5	1051.3 1185.5	1396 1.16	525 51.48	1124.8 0.86
6	1663.2 1942.5	933 0.78	306 106.73	1781.2 0.51

MCA #1 - Canberra S100 - SRSE2025.MCA - SRSE-SB-020@2.5' 4-28-11

Tag Number: 2384 Readout: Wed 04 May 2011 @ 18:35:44
Report Group: Full Acquire Started: Wed 04 May 2011 @ 18:15:04
Group Size: 4096

Elapsed Live Time: 20.00 min.
Elapsed True Time: 20.03 min.
Dead Time: 0.15 %

REGION OF INTEREST REPORT

ROI #	From(keV) To (keV)	Integral CPS	Area %Error	Peak (keV) FWHM(keV)
1	217.5 265.3	6313 5.26	1849 19.81	235.5 9.03
2	269.9 319.9	4799 4.00	1283 25.85	293.3 7.32
3	323.0 390.4	5957 4.96	2155 18.78	340.6 8.28
4	554.8 667.9	4780 3.98	2039 21.86	589.3 6.95
5	1051.3 1185.5	1939 1.62	196 193.26	1076.4 0.95
6	1663.2 1942.5	1133 0.94	443 77.34	1729.6 0.86

MCA #1 - Canberra S100 - SRSE2050.MCA - SRSE-SB-020@5.0' 4-28-11

Tag Number: 2385 Readout: Wed 04 May 2011 @ 19:20:27
Report Group: Full Acquire Started: Wed 04 May 2011 @ 18:36:35
Group Size: 4096

Elapsed Live Time: 20.00 min.
Elapsed True Time: 20.03 min.
Dead Time: 0.13 %

REGION OF INTEREST REPORT

ROI #	From (keV) To (keV)	Integral CPS	Area %Error	Peak (keV) FWHM (keV)
1	217.5 265.3	5033 4.19	1580 20.42	235.2 13.67
2	269.9 319.9	3158 2.63	200 150.50	284.2 0.86
3	323.0 390.4	3846 3.20	694 52.54	346.0 4.59
4	554.8 667.9	3346 2.79	1223 31.97	593.5 1.90
5	1051.3 1185.5	1483 1.24	300 104.17	1132.6 0.51
6	1663.2 1942.5	744 0.62	-135 285.37	1764.9 0.85

Appendix E

SRSE Gamma Radiation Level to Soil Ra-226 Concentration Correlation Data

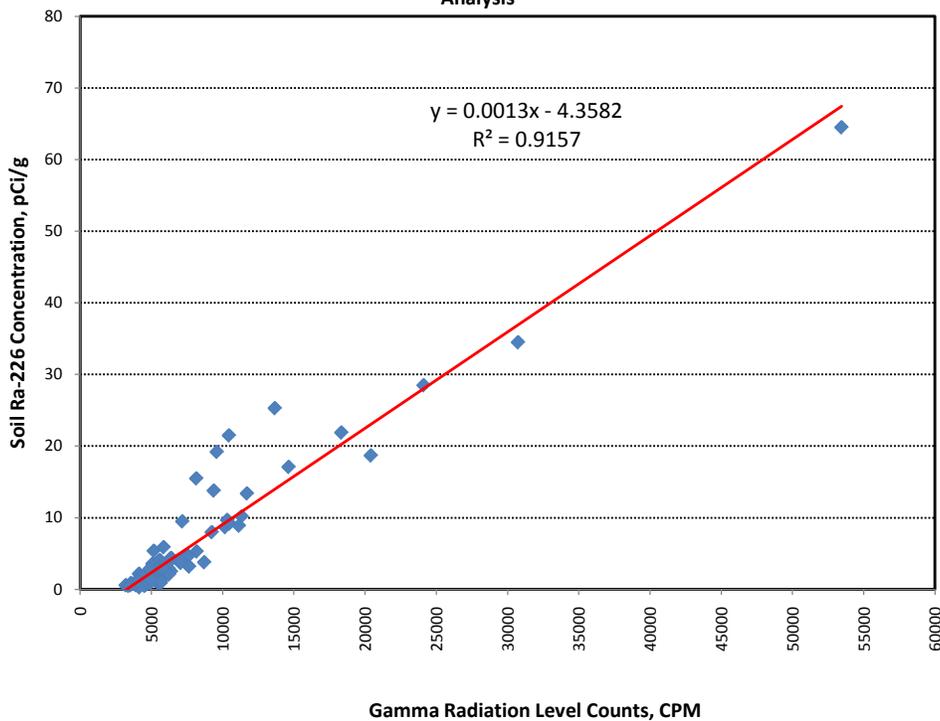
SRSE Updated Gamma Radiation Level to Surface Soil Ra-226 Concentration Correlation Data

2011 East Drainage Area SRSE Correlation Data		
Survey Point ID	Gamma Radiation Level (CPM)	Laboratory Soil Ra-226 Conc (pCi/g)
SRSE-GS-021	11,705	13.4
SRSE-GS-025	10,317	9.7
SRSE-GS-029	4,919	2.6
SRSE-GS-032	5,458	3.9
SRSE-GS-034	7,054	3.7
SRSE-GS-036	4,619	2.0
SRSE-GS-038	4,434	1.5
SRSE-GS-040	4,538	1.6
SRSE-GS-041	18,331	21.9
SRSE-GS-045	9,237	8.0
SRSE-GS-049	11,335	10.2
SRSE-GS-054	4,741	2.1
SRSE-GS-056	4,696	2.2
SRSE-GS-058	4,515	1.9
SRSE-GS-090	4,588	1.3
SRSE-GS-065	5,856	5.9
SRSE-GS-092	9,377	13.8
SRSE-GS-101	53,436	64.5
SRSE-GS-103	8,150	15.5
SRSE-GS-123	10,441	21.5
SRSE-GS-198	13,661	25.3
SRSE-GS-224	9,588	19.2
SRSE-GS-237	6,159	3.6
SRSE-GS-264	10,178	8.7
SRSE-GS-279	5,104	1.9
SRSE-GS-283	5,239	2.0
SRSE-GS-288	4,925	0.9
SRSE-GS-290	6,329	4.3
SRSE-GS-291	30,731	34.5

IRA Correlation Data		
Survey Point ID	Gamma Radiation Level (CPM)	Laboratory Soil Ra-226 Conc (pCi/g)
SSPT-046	4523	1.7
SSPT-049	4644	1.0
SSPT-053	5155	1.5
SSPT-057	4829	1.5
SSPT-061	5565	2.3
SSPT-064	5070	2.1
SSPT-132	4617	1.1
SSPT-136	4730	1.5
SSPT-140	4651	1.8
SSPT-144	4131	2.2
SSPT-147	4131	0.7
SSPT-172	4924	1.1
SSPT-181	4660	1.1
SSPT-185	4473	1.2
SSPT-189	4518	0.5
SSPT-213	5077	3.6
SSPT-215	4222	1.5
SSPT-235	4190	1.2
SSPT-239	4634	1.7
SSPT-243	4317	1.3
SSPT-264	4562	1.0
SSPT-269	4630	2.0
Z4NSS01	4491	1.2
Z4NSS02	4680	0.9
Z4NSS07	4838	2.0
Z4NSS08	4567	1.2
Z4NSS09	4769	0.9

2008 SRSE Correlation Data		
Survey Point ID	Gamma Radiation Level (CPM)	Laboratory Soil Ra-226 Conc (pCi/g)
home-014	10488	9.2
home-105	20401	18.7
home-112	5606	3.4
home-130	24105	28.5
home-146	8176	5.3
home-148	5697	2.5
home-149	4846	2.0
home-151	5169	5.4
home-153	5522	0.9
home-154	5186	2.5
home-155	4649	0.7
home-156	5064	1.5
home-157	5678	2.0
home-158	5794	2.9
home-159	4860	1.3
home-160	5121	1.7
home-161	5551	2.5
home-162	14628	17.1
home-163	4692	1.1
home-164	4461	0.9
home-165	4650	1.1
home-167	5588	4.1
home-168	5563	3.2
home-170	7166	9.5
home-171	4810	1.8
home-172	6388	4.4
home-173	5355	1.4
home-174	6374	2.5
home-175	4939	1.9
home-176	5291	1.2
home-177	5821	1.7
home-182	7526	4.8
home-57	7577	4.6
home-86	6206	2.9
tp-103	7650	3.2
tp-107	4781	0.9
tp-115	5663	0.9
tp-125	5628	2.9
tp-127	6995	4.1
tp-129	6246	2.1
tp-133	8706	3.8
tp-137	11143	8.9
vent-103	3915	0.6
vent-104	3565	0.9
vent-112	4884	2.9
vent-113	3791	0.8
vent-124	4432	1.2
vent-136	4155	0.3
vent-147	5661	1.1
vent-148	3195	0.6
vent-160	4222	1.9
vent-166	5758	3.1
vent-170	3384	0.5
vent-179	4901	1.4
vent-180	4315	1.8
vent-185	3800	0.8
vent-192	3546	0.6
vent-196	4039	1.1

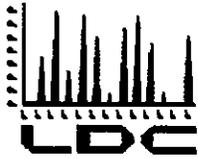
SRSE Updated Gamma Radiation Level to Soil Ra-226 Concentration Regression Analysis



APPENDIX B

LABORATORY ANALYTICAL AND DATA VALIDATION REPORTS

LABORATORY DATA VALIDATION REPORT



Laboratory Data Consultants, Inc.

7750 El Camino Real, Ste. 2L Carlsbad, CA 92009

Phone 760.634.0437

Web www.lab-data.com

Fax 760.634.0439

MWH Americas, Inc.
10619 South Jordan Gateway, S-100
Salt Lake City, Utah 84124
ATTN: Mr. Craig Moore

July 25, 2011

SUBJECT: NE Church Rock Site, SRSE East Ravine, Data Validation

Dear Mr. Moore,

Enclosed are the final validation reports for the fraction listed below. These SDGs were received on July 7, 2011. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project # 25807:

<u>SDG #</u>	<u>Fraction</u>
C11050032, C11050892, C11050626	Radium-226

The data validation was performed under EPA Level III/IV guidelines. The analyses were validated using the following documents, as applicable to each method:

- USEPA, Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, January 2010
- Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual, July 2004

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

Sincerely,

Erlinda T. Rauto
Operations Manager/Senior Chemist

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: NE Church Rock Site, SRSE East Ravine
Collection Date: April 25 through April 27, 2011
LDC Report Date: July 19, 2011
Matrix: Soil
Parameters: Radium-226
Validation Level: EPA Level III
Laboratory: ENERGY Laboratories
Sample Delivery Group (SDG): C11050032

Sample Identification

SRSE-SS-001	SRSE-SS014	SRSE-SS-290	SRSE-SS-291DUP
SRSE-SS-002	SRSE-SD-002	SRSE-SS-287	
SRSE-SS-003	SRSE-SS-034	SRSE-SS-283	
SRSE-SS-004	SRSE-SS-015	SRSE-SS-279	
SRSE-SS-005	SRSE-SS-036	SRSE-SS-135	
SRSE-SS-006	SRSE-SS-054	SRSE-SS-123	
SRSE-SS-007	SRSE-SS-016	SRSE-SS-237	
SRSE-SS-008	SRSE-SS-056	SRSE-SS-103	
SRSE-SD-001	SRSE-SS-017	SRSE-SS-101	
SRSE-SS-009	SRSE-SS-038	SRSE-SS-291	
SRSE-SS-010	SRSE-SS-058	SRSE-SD-005	
SRSE-SS-025	SRSE-SS-018	SRSE-SS-092	
SRSE-SS045	SRSE-SD-003	SRSE-SS-065	
SRSE-SS-029	SRSE-SS-019	SRSE-SS-224	
SRSE-SS011	SRSE-SS-020	SRSE-SS-198	
SRSE-SS012	SRSE-SS-040	SRSE-SS-264	
SRSE-SS032	SRSE-SS-060	SRSE-SS-009DUP	
SRSE-SS052	SRSE-SS-021	SRSE-SS049DUP	
SRSE-SS013	SRSE-SS-041	SRSE-SS-038DUP	
SRSE-SS049	SRSE-SD-004	SRSE-SD-004DUP	

Introduction

This data review covers 61 soil samples listed on the cover sheet. The analyses were per EPA Method 901.1 for Radium-226.

This review follows the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004) and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (January 2010).

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each detector and each radionuclide.

Self absorption factors were determined for each sample when applicable.

III. Continuing Calibration

Continuing calibration and background determination were performed at the required frequencies. Results were within laboratory control limits.

IV. Blanks

Method blanks were reviewed for each matrix as applicable with the following exceptions:

Sample	Isotope	Finding	Criteria	Flag	A or P
All samples in SDG C11050032	Radium-226	More than twenty samples associated to a method blank.	No more than twenty samples to be associated to a method blank.	None	P

Blank results were less than the reported detection limits.

No field blanks were identified in this SDG.

V. Matrix Spike/Matrix Spike Duplicates

A matrix spike (MS) analysis was not required by the method.

VI. Duplicates

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable with the following exceptions:

Sample	Isotope	Finding	Criteria	Flag	A or P
All samples in SDG C11050032	Radium-226	More than twenty samples associated to a laboratory control sample.	No more than twenty samples to be associated to laboratory control sample.	None	P

Percent recoveries (%R) were within QC limits.

VIII. Minimum Detectable Activity (MDA)

All minimum detectable activities met required detection limits.

IX. Sample Result Verification

Raw data were not reviewed for this SDG.

X. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

XI. Field Duplicates

Samples SRSE-SS-008 and SRSE-SD-001, samples SRSE-SS014 and SRSE-SD-002, samples SRSE-SS-018 and SRSE-SD-003, samples SRSE-SS-041 and SRSE-SD-004, and samples SRSE-SS-291 and SRSE-SD-005 were identified as field duplicates. No radium-226 was detected in any of the samples with the following exceptions:

Isotope	Activity (pCi/g)		RPD (Limits)
	SRSE-SS-008	SRSE-SD-001	
Radium-226	8.3	9.7	16 (≤30)

Isotope	Activity (pCi/g)		RPD (Limits)
	SRSE-SS014	SRSE-SD-002	
Radium-226	3.9	3.5	11 (≤30)

Isotope	Activity (pCi/g)		RPD (Limits)
	SRSE-SS-018	SRSE-SD-003	
Radium-226	3.4	3.7	8 (≤30)

Isotope	Activity (pCi/g)		RPD (Limits)
	SRSE-SS-041	SRSE-SD-004	
Radium-226	21.9	26.0	17 (≤ 30)

Isotope	Activity (pCi/g)		RPD (Limits)
	SRSE-SS-291	SRSE-SD-005	
Radium-226	34.5	35.4	3 (≤ 30)

**NE Church Rock Site, SRSE East Ravine
Radium-226 - Data Qualification Summary - SDG C11050032**

SDG	Sample	Isotope	Flag	A or P	Reason
C11050032	SRSE-SS-001 SRSE-SS-002 SRSE-SS-003 SRSE-SS-004 SRSE-SS-005 SRSE-SS-006 SRSE-SS-007 SRSE-SS-008 SRSE-SD-001 SRSE-SS-009 SRSE-SS-010 SRSE-SS-025 SRSE-SS045 SRSE-SS-029 SRSE-SS011 SRSE-SS012 SRSE-SS032 SRSE-SS052 SRSE-SS013 SRSE-SS049 SRSE-SS014 SRSE-SD-002 SRSE-SS-034 SRSE-SS-015 SRSE-SS-036 SRSE-SS-054 SRSE-SS-016 SRSE-SS-056 SRSE-SS-017 SRSE-SS-038 SRSE-SS-058 SRSE-SS-018 SRSE-SD-003 SRSE-SS-019 SRSE-SS-020 SRSE-SS-040 SRSE-SS-060 SRSE-SS-021 SRSE-SS-041 SRSE-SD-004 SRSE-SS-290 SRSE-SS-287 SRSE-SS-283 SRSE-SS-279 SRSE-SS-135 SRSE-SS-123 SRSE-SS-237 SRSE-SS-103 SRSE-SS-101 SRSE-SS-291 SRSE-SD-005 SRSE-SS-092 SRSE-SS-065 SRSE-SS-224 SRSE-SS-198 SRSE-SS-264	Radium-226	None	P	Method blanks

SDG	Sample	Isotope	Flag	A or P	Reason
C11050032	SRSE-SS-001 SRSE-SS-002 SRSE-SS-003 SRSE-SS-004 SRSE-SS-005 SRSE-SS-006 SRSE-SS-007 SRSE-SS-008 SRSE-SD-001 SRSE-SS-009 SRSE-SS-010 SRSE-SS-025 SRSE-SS045 SRSE-SS-029 SRSE-SS011 SRSE-SS012 SRSE-SS032 SRSE-SS052 SRSE-SS013 SRSE-SS049 SRSE-SS014 SRSE-SD-002 SRSE-SS-034 SRSE-SS-015 SRSE-SS-036 SRSE-SS-054 SRSE-SS-016 SRSE-SS-056 SRSE-SS-017 SRSE-SS-038 SRSE-SS-058 SRSE-SS-018 SRSE-SD-003 SRSE-SS-019 SRSE-SS-020 SRSE-SS-040 SRSE-SS-060 SRSE-SS-021 SRSE-SS-041 SRSE-SD-004 SRSE-SS-290 SRSE-SS-287 SRSE-SS-283 SRSE-SS-279 SRSE-SS-135 SRSE-SS-123 SRSE-SS-237 SRSE-SS-103 SRSE-SS-101 SRSE-SS-291 SRSE-SD-005 SRSE-SS-092 SRSE-SS-065 SRSE-SS-224 SRSE-SS-198 SRSE-SS-264	Radium-226	None	P	Laboratory control samples

**NE Church Rock Site, SRSE East Ravine
Radium-226 - Laboratory Blank Data Qualification Summary - SDG C11050032**

No Sample Data Qualified in this SDG

**NE Church Rock Site, SRSE East Ravine
Radium-226 - Field Blank Data Qualification Summary - SDG C11050032**

No Sample Data Qualified in this SDG

LDC #: 25807A29a

VALIDATION COMPLETENESS WORKSHEET

Date: 7-19-11

SDG #: C11050032

Level III

Page: 1 of 2

Laboratory: Energy Laboratories

Reviewer: MG

2nd Reviewer: [Signature]

METHOD: Radium 226 (EPA Method 901.1)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 4-25-11 through 4-27-11
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Blanks	SW	
V.	Matrix Spike/(Matrix Spike) Duplicates	A	DUP
VI.	Laboratory control samples	SW	LCS
VII.	Chemical recovery	N	not required
VIII.	Sample result verification	N	
IX.	Minimum detectable activity (MDA)	A	* see below SDG: C11050626
X.	Overall assessment of data	A	D = 6 + SRSE-SD-006
XI.	Field duplicates	SW N SW	D = 1+9, D = 2+22, 3+33, 4+40, 5+51
XII.	Field blanks	N	

Note: A = Acceptable
 N = Not provided/applicable
 SW = See worksheet

ND = No compounds detected
 R = Rinstate
 FB = Field blank

D = Duplicate
 TB = Trip blank
 EB = Equipment blank

Validated Samples: all soil

1	SRSE-SS-001	11	SRSE-SS-010	21	SRSE-SS014	31	SRSE-SS-058
2	SRSE-SS-002	12	SRSE-SS-025	22	SRSE-SD-002	32	SRSE-SS-018
3	SRSE-SS-003	13	SRSE-SS045	23	SRSE-SS-034	33	SRSE-SD-003
4	SRSE-SS-004	14	SRSE-SS-029	24	SRSE-SS-015	34	SRSE-SS-019
5	SRSE-SS-005	15	SRSE-SS011	25	SRSE-SS-036	35	SRSE-SS-020
6	SRSE-SS-006	16	SRSE-SS012	26	SRSE-SS-054	36	SRSE-SS-040
7	SRSE-SS-007	17	SRSE-SS032	27	SRSE-SS-016	37	SRSE-SS-060
8	SRSE-SS-008	18	SRSE-SS052	28	SRSE-SS-056	38	SRSE-SS-021
9	SRSE-SD-001	19	SRSE-SS013	29	SRSE-SS-017	39	SRSE-SS-041
10	SRSE-SS-009	20	SRSE-SS049	30	SRSE-SS-038	40	SRSE-SD-004

Notes: * Dup = D = 8+9, D = 21+22, D = 32+33, D = 39+40, D = 50+51

VALIDATION COMPLETENESS WORKSHEET

Level III

METHOD: Radium 226 (EPA Method 901.1)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times		Sampling dates:
II.	Initial calibration		
III.	Calibration verification		
IV.	Blanks		
V.	Matrix Spike/(Matrix Spike) Duplicates		
VI.	Laboratory control samples		
VII.	Chemical recovery		
VIII.	Sample result verification	N	
IX.	Minimum detectable activity (MDA)		
X.	Overall assessment of data		
XI.	Field duplicates		
XII.	Field blanks		

See page 1 of 2

Note: A = Acceptable
 N = Not provided/applicable
 SW = See worksheet
 ND = No compounds detected
 R = Rinstate
 FB = Field blank
 D = Duplicate
 TB = Trip blank
 EB = Equipment blank

Validated Samples:

41	SRSE-SS-290	51	SRSE-SD-005	61	SRSE-SS-291DUP	71	
42	SRSE-SS-287	52	SRSE-SS-092	62		72	
43	SRSE-SS-283	53	SRSE-SS-065	63		73	
44	SRSE-SS-279	54	SRSE-SS-224	64		74	
45	SRSE-SS-135	55	SRSE-SS-198	65		75	
46	SRSE-SS-123	56	SRSE-SS-264	66		76	
47	SRSE-SS-237	57	SRSE-SS-009DUP	67		77	
48	SRSE-SS-103	58	SRSE-SS049DUP	68		78	
49	SRSE-SS-101	59	SRSE-SS-038DUP	69		79	
50	SRSE-SS-291	60	SRSE-SD-004DUP	70		80	PBS

Notes: _____

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Radiochemistry, Method 901.1

Y N NA
Y N NA

Were field duplicate pairs identified in this SDG?
 Were target analytes detected in the field duplicate pairs?

Isotope	Activity (pCi/g)		RPD (≤30)
	8	9	
Ra-226	8.3	9.7	16

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Isotope	Activity (pCi/g)		RPD (≤30)
	21	22	
Ra-226	3.9	3.5	11

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Isotope	Activity (pCi/g)		RPD (≤30)
	32	33	
Ra-226	3.4	3.7	8

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Isotope	Activity (pCi/g)		RPD (≤30)
	39	40	
Ra-226	21.9	26.0	17

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Isotope	Activity (pCi/g)		RPD (≤30)
	50	51	
Ra-226	34.5	35.4	3

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**Laboratory Data Consultants, Inc.
Data Validation Report**

Project/Site Name: NE Church Rock Site, SRSE East Ravine
Collection Date: May 24, 2011
LDC Report Date: July 19, 2011
Matrix: Soil
Parameters: Radium-226
Validation Level: EPA Level III
Laboratory: ENERGY Laboratories
Sample Delivery Group (SDG): C11050892

Sample Identification

IRA-SSPT-062R
IRA-VD-002
IRA-SSPT-084R
IRA-SSPT-084RDUP

Introduction

This data review covers 4 soil samples listed on the cover sheet. The analyses were per EPA Method 901.1 for Radium-226.

This review follows the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004) and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (January 2010).

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each detector and each radionuclide.

Self absorption factors were determined for each sample when applicable.

III. Continuing Calibration

Continuing calibration and background determination were performed at the required frequencies. Results were within laboratory control limits.

IV. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results were less than the reported detection limits.

No field blanks were identified in this SDG.

V. Matrix Spike/Matrix Spike Duplicates

A matrix spike (MS) analysis was not required by the method.

VI. Duplicates

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

VIII. Minimum Detectable Activity (MDA)

All minimum detectable activities met required detection limits.

IX. Sample Result Verification

Raw data were not reviewed for this SDG.

X. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

XI. Field Duplicates

Samples IRA-SSPT-062R and IRA-VD-002 were identified as field duplicates. No radium-226 was detected in any of the samples with the following exceptions:

Isotope	Activity (pCi/g)		RPD (Limits)
	IRA-SSPT-062R	IRA-VD-002	
Radium-226	1.0	1.2	18 (≤ 30)

**NE Church Rock Site, SRSE East Ravine
Radium-226 - Data Qualification Summary - SDG C11050892**

No Sample Data Qualified in this SDG

**NE Church Rock Site, SRSE East Ravine
Radium-226 - Laboratory Blank Data Qualification Summary - SDG C11050892**

No Sample Data Qualified in this SDG

**NE Church Rock Site, SRSE East Ravine
Radium-226 - Field Blank Data Qualification Summary - SDG C11050892**

No Sample Data Qualified in this SDG

LDC #: 25807B29a

VALIDATION COMPLETENESS WORKSHEET

Date: 7-19-11

SDG #: C11050892

Level III

Page: 1 of 1

Laboratory: Energy Laboratories

Reviewer: MG

2nd Reviewer: *la***METHOD:** Radium 226 (EPA Method 901.1)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 5-24-11
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Blanks	A	
V.	Matrix Spike/(Matrix Spike) Duplicates	A	DUP (SDG: C11050626)
VI.	Laboratory control samples	A	LCS
VII.	Chemical recovery	N	not required
VIII.	Sample result verification	N	
IX.	Minimum detectable activity (MDA)	A	
X.	Overall assessment of data	A	
XI.	Field duplicates	SW	D= 1+2
XII.	Field blanks	N	

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet

ND = No compounds detected
R = Rinsate
FB = Field blank

D = Duplicate
TB = Trip blank
EB = Equipment blank

Validated Samples: *all soil*

1	IRA-SSPT-062R	11		21		31	
2	IRA-VD-002	12		22		32	
3	IRA-SSPT-084R	13		23		33	
4	IRA-SSPT-084RDUP	14		24		34	
5		15		25		35	
6		16		26		36	
7		17		27		37	
8		18		28		38	
9		19		29		39	
10		20	PBS	30		40	

Notes: _____

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Radiochemistry, Method 901.1

- ~~Y~~ ~~N~~ ~~NA~~ Were field duplicate pairs identified in this SDG?
- ~~Y~~ ~~N~~ ~~NA~~ Were target analytes detected in the field duplicate pairs?

Isotope	Activity (pCi/g)		RPD (≤30)	
	1	2		
Ra-226	1.0	1.2	18	

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**Laboratory Data Consultants, Inc.
Data Validation Report**

Project/Site Name: NE Church Rock Site, SRSE East Ravine
Collection Date: April 28, 2011
LDC Report Date: July 19, 2011
Matrix: Soil
Parameters: Radium-226
Validation Level: EPA Level III & IV
Laboratory: ENERGY Laboratories
Sample Delivery Group (SDG): C11050626

Sample Identification

SRSE-SB-001@7.5'
SRSE-SB-003@2.5'***
SRSE-SB-005@2.5'***
SRSE-SB-005@5.0'***
SRSE-SB-009@2.5'
SRSE-SB-012@2.5'
SRSE-SB-101@1.0'***
SRSE-SB-014@5.0'***
SRSE-SB-016@2.5'
SRSE-SB-018@2.5'
SRSE-SB-020@2.5'***
SRSE-SB-020@5.0'***
SRSE-SD-006
SRSE-SB-018@2.5'DUP

**Indicates sample underwent EPA Level IV review

Introduction

This data review covers 14 soil samples listed on the cover sheet. The analyses were per EPA Method 901.1 for Radium-226.

This review follows the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004) and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (January 2010).

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Samples indicated by a double asterisk on the front cover underwent a EPA Level IV review. A EPA Level III review was performed on all other samples. Raw data were not evaluated for the samples reviewed by Level III criteria since this review is based on QC data.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each detector and each radionuclide.

Self absorption factors were determined for each sample when applicable.

III. Continuing Calibration

Continuing calibration and background determination were performed at the required frequencies. Results were within laboratory control limits.

IV. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results were less than the reported detection limits.

No field blanks were identified in this SDG.

V. Matrix Spike/Matrix Spike Duplicates

A matrix spike (MS) analysis was not required by the method.

VI. Duplicates

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

VIII. Minimum Detectable Activity (MDA)

All minimum detectable activities met required detection limits.

IX. Sample Result Verification

All sample result verifications were acceptable for samples on which a EPA Level IV review was performed. Raw data were not evaluated for the samples reviewed by EPA Level III criteria.

X. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

XI. Field Duplicates

Samples SRSE-SB-020@5.0' and SRSE-SD-006 were identified as field duplicates. No radium-226 was detected in any of the samples with the following exceptions:

Isotope	Activity (pCi/g)		RPD (Limits)
	SRSE-SB-020@5.0'	SRSE-SD-006	
Radium-226	1.8	1.6	12 (≤30)

**NE Church Rock Site, SRSE East Ravine
Radium-226 - Data Qualification Summary - SDG C11050626**

No Sample Data Qualified in this SDG

**NE Church Rock Site, SRSE East Ravine
Radium-226 - Laboratory Blank Data Qualification Summary - SDG C11050626**

No Sample Data Qualified in this SDG

**NE Church Rock Site, SRSE East Ravine
Radium-226 - Field Blank Data Qualification Summary - SDG C11050626**

No Sample Data Qualified in this SDG

LDC #: 25807C29

VALIDATION COMPLETENESS WORKSHEET

Date: 7-19-11

SDG #: C11050626

Level III/IV

Page: 1 of 1

Laboratory: ENERGY Laboratories

Reviewer: MG

2nd Reviewer: 

METHOD: Radium-226 (EPA Method 901.1)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 4-28-11
IIa.	Initial calibration	A	
IIb.	Calibration verification	A	
III.	Blanks	A	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	A	DUP (SDG: C11050892)
IVb.	Laboratory control samples	A	LCS
IVc.	Chemical recovery	N	not required
V.	Sample result verification	A	Not reviewed for Level III validation.
VI.	Minimum detectable activity (MDA)	A	
VII.	Overall assessment of data	A	See below
VIII.	Field duplicates	* SW SW	D-13 + SRSE-SS-006 (SDG: C11050032)
XIV.	Field blanks	N	

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet

ND = No compounds detected
R = Rinsate
FB = Field blank

D = Duplicate
TB = Trip blank
EB = Equipment blank

Validated Samples: ** Indicates sample underwent Level IV validation

all soil

1	SRSE-SB-001@7.5'	11	SRSE-SB-020@2.5**	21		31	
2	SRSE-SB-003@2.5**	12	SRSE-SB-020@5.0**	22		32	
3	SRSE-SB-005@2.5**	13	SRSE-SD-006	23		33	
4	SRSE-SB-005@5.0**	14	SRSE-SB-018@2.5'DUP	24		34	
5	SRSE-SB-009@2.5'	15		25		35	
6	SRSE-SB-012@2.5'	16		26		36	
7	SRSE-SB-101@1.0**	17		27		37	
8	SRSE-SB-014@5.0**	18		28		38	
9	SRSE-SB-016@2.5'	19		29		39	
10	SRSE-SB-018@2.5'	20		30	PBS	40	

Notes: * Dup = 12+13

LDC #: 25807C29
 SDG #: -

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
 Reviewer: MG
 2nd Reviewer: [Signature]

Method: Radiochemistry(EPA Method 901.1)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
II. Calibration				
Were all instruments and detectors calibration as required?	✓			
Were NIST traceable standards used for all calibrations?	✓			
Was the check source identified by activity and radionuclide?	✓			
Were check sources including background counts analyzed at the required frequency and within laboratory control limits?	✓			
III. Blanks				
Were blank analyses performed as required?	✓			
Were any activities detected in the blanks greater than the minimum detectable activity (MDA)? If yes, please see the Blanks validation completeness worksheet.		✓		
IV. Matrix spikes and Duplicates				
Were a matrix spike (MS) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. (Soil) Water.		✓		
Were the MS percent recoveries (%R) within the QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.			✓	
Was a duplicate sample analyzed at the required frequency of 5% in this SDG?	✓			
Were all duplicate sample duplicate error ratios (DER) ≤ 1.42 ?	✓			
V. Laboratory control samples				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%?	✓			
VI. Sample Chemical/Carrier Recovery				
Was a tracer/carrier added to each sample?		✓		
Were tracer/carrier recoveries within the QC limits?			✓	
VII. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
VIII. Sample Result Verification				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were the Minimum Detectable Activities (MDA) $< RL$?	✓			

LDC #: 25807C29
SDG #: -

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
Reviewer: MG
2nd Reviewer: [Signature]

Validation Area	Yes	No	NA	Findings/Comments
IX. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
X. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
XI. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Radiochemistry, Method 901.1

Y N NA
Y N NA

Were field duplicate pairs identified in this SDG?

Were target analytes detected in the field duplicate pairs?

Isotope	Activity (pCi/g)		RPD (≤ 30)	
	12	13		
Ra-226	1.8	1.6	12	

V:\FIELD DUPLICATES\FD_inorganic\25807C29.wpd

LDC #: 25807C29

SDG #: —

VALIDATION FINDINGS WORKSHEET Level IV Recalculation Worksheet

Page: 1 of 1
Reviewer: MG
2nd Reviewer: [Signature]

METHOD: Radiochemistry (Method: 901.1)

Percent recoveries (%R) for a laboratory control sample, a matrix spike and a matrix spike duplicate sample were recalculated using the following formula:

$$\%R = \frac{\text{Found}}{\text{True}} \times 100$$

Where, Found = activity of each analyte measured in the analysis of the sample.
True = activity of each analyte in the source.

A matrix spike and matrix spike duplicate relative percent difference (RPD) was recalculated using the following formula:

$$RPD = \frac{|S-D|}{(S+D)/2} \times 100$$

Where, S = Original sample activity
D = Duplicate sample activity

Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	Recalculated		Acceptable (Y/N)
					%R or RPD	Reported %R or RPD	
LCS	Laboratory control sample	Ra-226	8.0752 (pci/g)	8.67 (pci/g)	93	93	Y
—	Matrix spike sample	—	—	—	—	—	—
14	Duplicate RPD	Ra-226	2.1334 (pci/g)	2.1801 (pci/g)	2.2	4.7	Y
—	Chemical recovery	—	—	—	—	—	—

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LABORATORY ANALYTICAL DATA REPORTS

Laboratory analytical reports will be included in hard copy.