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**NORTHEAST CHURCH ROCK MINE  
EASTERN DRAINAGE REMOVAL ACTION**

**CONSTRUCTION COMPLETION REPORT**

*March 13, 2013*

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## CERTIFICATION

Under penalty of law, I certify that to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of the report, the information submitted is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



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Lance Hauer  
GE, Corporate Environmental Programs  
Designated Project Coordinator

## 1.0 INTRODUCTION

This Eastern Drainage Removal Action (EDRA) Construction Completion Report provides information on the soil removal action and results of confirmation sampling and testing completed as part of EDRA activities north and northeast of the Northeast Church Rock (NECR) Mine (the mine site). The site is located approximately 16 miles northeast of Gallup, New Mexico, as shown on Drawing 1, *Cover and Index Sheet*. The original ground conditions that were present prior to the EDRA construction are shown on Drawing 2, *Original Conditions*. The Eastern Drainage area is located east of and adjacent to Red Water Pond Rd, as shown on Drawing 2.

The removal activities were performed in accordance with the *Administrative Settlement Agreement and Order on Consent for Time Critical Removal Action and Cost Recovery* (AOC) between General Electric Company (GE) and the U.S. Environmental Protection Agency, Region 9 (USEPA), dated September 26, 2011. Concurrent with the EDRA, Rio Algom performed a removal action to address impacts from the Quivira Mine to Red Water Pond Road and the road shoulders. The work was performed pursuant to an EPA Unilateral Administrative Order (EPA, 2012).

This report describes the activities that were performed to comply with the AOC and has been prepared to meet the requirements of Section 31 of the AOC and referenced regulations and guidance documents. This report is organized into five sections, as follows:

- Section 1 provides a brief introduction to the project, background summary and the major activities performed.
- Section 2 describes removal activities performed in the EDRA areas.
- Section 3 presents the results of the Interim and Final Status Surveys.
- Section 4 provides an estimate of the total costs incurred implementing the AOC.
- Section 5 lists the references cited.

### 1.1 SCOPE OF WORK

Removal activities were performed in accordance with the AOC and as described in the *Removal Action Construction Work Plan, Eastern Drainage Area* (Work Plan), dated August 30, 2012 (MWH). The removal activities required by the AOC are described in the Scope of Work (SOW) attached to the AOC and included the following:

- Removal of soils from the EDRA areas containing Radium-226 (Ra-226) in excess of the Removal Action Level (RAL) of 2.24 pCi/g consistent with the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM)(EPA, 2000).
- Consolidation and covering of excavated materials within the Consolidation Area located on the NECR-1 pad at the mine site.
- Installation and maintenance of erosion and sedimentation controls.
- Interim and final status surveys to demonstrate that the objectives of the EDRA were met.
- Applying organic mulch and reseeded of areas disturbed by the removal activities.
- Removal of commingled <sup>226</sup>Ra and diesel fuel in impacted soil area north of NECR-1 pad and placement at the NECR mine.
- Installation and operation of a bio-venting system and performing monitored natural attenuation to reduce total petroleum hydrocarbon concentrations in the subsurface on lands within the Navajo Reservation. This work is in progress and will be reported separately.
- Confirmation sampling and analysis.
- Returning disturbed areas to pre-removal conditions.

## 1.2 BACKGROUND SUMMARY

### 1.2.1 Ra-226 Impacted Soils

The areas of concern for the EDRA were investigated in 2011 as described in the document *Supplemental Removal Site Evaluation Report, East Drainage Area* (MWH, 2011). The results of that Supplemental Removal Site Evaluation (SRSE) indicated that elevated Ra-226 concentrations were present in soils within the Eastern Drainage channel between Red Water Pond Rd. and unnamed arroyo no. 2 and portions of the flats area to the north of this section of the channel. A supplemental RSE was previously conducted along Red Water Pond Rd. and the road shoulders and described in the document

*Removal Site Evaluation Report, Red Water Pond Rd.* (MWH, 2010c). The results of these supplemental RSEs are shown on Drawing 3, *Supplemental RSE Results and Preliminary Construction Zones*. Ra-226 concentrations were screened against the field screening level (FSL) for Ra-226 (2.24 pCi/g), which is based on an average background concentration of 1.0 pCi/g plus the Derived Concentration Guidance Level (DCGL<sub>w</sub>) of 1.24 pCi/g (MWH, 2006), in accordance with MARSSIM.

The Eastern Drainage SRSE was initially limited to the Eastern Drainage channel itself. However, during the gamma radiation survey of the north bank of the channel, it was observed that the flats area north of the channel appeared to have received runoff from the channel during high rainfall events or snowmelt runoff. Therefore, the Eastern Drainage SRSE was extended to the north into the flats area bounded by Red Water Pond Rd., unnamed arroyo no. 2 and the Eastern Drainage channel (see Drawing 3). The results of the SRSE confirmed that the flats area contained elevated levels of Ra-226 in shallow soils.

USEPA surveyed surface soil surrounding the home site located within the Eastern Drainage area. A continuous walk-over gamma radiation survey of the area was conducted and readings ranged up to 65,000 counts per minute (cpm). Soil samples were then collected on an approximately 80-ft triangular grid and submitted to a laboratory for analysis of Ra-226 by USEPA Method 903.1. Results ranged from non-detect (<0.03 pCi/g) to 9.16 pCi/g, as shown on Drawing 3.

The majority of soil impacts above the FSL were determined to be at or near the ground surface (0 to 6 inches below ground surface (bgs)). Some impacts were detected in the subsurface from 0.5 to less than 2 feet bgs in the Eastern Drainage flats area and to less than seven feet bgs within the Eastern Drainage channel. To delineate subsurface impacts, soil samples were collected below six inches in selected, representative locations where surface static gamma measurements indicated Ra-226 activities above the FSL. Subsurface soil samples were collected at multiple depths in some locations in order to fully delineate the vertical extent of impacts.

### **1.2.2 Petroleum Impacted Soils**

While removing Ra-226 impacted soils during the prior Interim Removal Action (IRA), petroleum impacted soils were encountered beneath and north of the NECR-1 pad, as discussed in the document *Completion Report, Interim Removal Action* (MWH, 2010a). Approximately 4,000 cubic yards of impacted soils were removed during the IRA.



Excavated materials were placed at the mine site in the TPH Stockpile Area east of Pond 3, as shown on Drawing 2. Excavation of the petroleum impacted soils was discontinued during the IRA due to the depth and to avoid causing instability to the slope of the NECR-1 pile. Consequently, these areas were covered with approximately six inches of clean borrow soil. Additional investigation into the extent of petroleum impacts and remaining Ra-226 impacts in this area were conducted in April 2010 and December, 2010, respectively. Alternatives for remediation of the petroleum impacts were evaluated and described in the report *Petroleum Investigation Results and Bioventing Pilot Study Plan* (MWH, 2010a). Since excavation in this area was discontinued during the IRA, Ra-226 impacted soil was left in place. Consequently, this area was included as part of the EDRA in order to address remaining impacted soils.

## 2.0 REMOVAL ACTION ACTIVITIES

Based on the results of the SRSE (MWH, 2011b) and the petroleum investigation (MWH, 2010a), as discussed in Section 1.2 and shown on Drawing 3, the EDRA areas were divided into 6 zones based on their location and expected excavation depths, as follows:

- Zone 1 – Eastern Drainage channel
- Zones 2-5 – Eastern Drainage flats area
- Zone 6 – Area North of NECR-1 (petroleum impacted soil area within step out area 1 addressed as part of 2009 IRA)

Zones 1 through 5 were located east of Red Water Pond Rd. within Step-out Area No. 2 and Zone 6 was located adjacent to the NECR-1 pile within Step-out Area No. 1, as shown on Drawing 3.

### 2.1 REMOVAL SCHEDULE

Weekly construction reports and field notes were prepared during construction that explain the sequence of events and the dates on which they occurred, by way of text and photographs. Copies of those reports are included in *Appendix A, Weekly Construction Reports and Field Notes*. Removal activities were implemented between August 15 and November 10, 2012. Baseline vegetation sampling was conducted on August 15 and 16, 2012. Equipment and personnel mobilization, and pre-construction activities were conducted September 3 through September 7, 2012. Major earthworks were conducted between September 10 and October 26, 2012. Seeding to revegetate the disturbed areas was conducted November 9 and 10, 2012.

### 2.2 RESIDENT HOUSING

Temporary, voluntary housing was provided by the USEPA to residents of households located in or near the EDRA, as well as the RWPR Removal Action.

### 2.3 PRE-CONSTRUCTION ACTIVITIES

#### 2.3.1 Erosion and Sedimentation Controls

Erosion and sediment (E&S) control methods were implemented during and after the EDRA construction in accordance with the approved *Construction Storm Water Pollution*

*Prevention Plan* (SWPPP) included in the Work Plan. The objective of the SWPPP was to isolate and control water at the source and minimize sediment transport offsite during construction activities. Surface water was controlled to limit flow velocities and route runoff away from regraded and revegetated slopes. The E&S control measures that were implemented included:

- silt fencing
- soil berms
- hay bales
- grading to maintain positive drainage in the preferred directions

In addition, field inspections were conducted following significant storm events. There were no major E&S issues encountered during the construction and all sedimentation was contained onsite.

### **2.3.2 Radiological Boundary Survey**

Prior to the start of excavation, the excavation boundaries were confirmed by conducting scan and static gamma radiation surveys. The methods and equipment that were used to conduct the boundary survey were the same as were used for excavation control surveying, as explained in Section 2.4.1. The results of the boundary survey indicated that the boundaries specified in the Work Plan were correctly located, except for a small area in the southwestern corner of the Eastern Drainage area, in which the boundary was extended south of the channel approximately 75 feet adjacent to Red Water Pond Rd.

### **2.3.3 Existing Conditions Topographic Survey**

Prior to the start of excavation, the EDRA areas were surveyed by Morris Surveying Engineering, LLC to determine the current topography. The original conditions topographic survey was used to ensure accurate elevation data and to calculate the volumes of soil removed and backfilled, by comparing to a post-construction topographic survey that was conducted, as discussed in Section 2.5.2.

### **2.3.4 Cultural Resources Inventories**

Two cultural resources inventories were conducted within Step-out Area No. 2, which encompasses the EDRA area east of Red Water Pond Rd. (Zones 1-5, as shown on Drawing 3). The surveys were conducted by Dinetahdoo Cultural Resources

Management (Dinetahdoo) in March 2011 and July 2012. The survey identified no significant cultural resources within the EDRA area, but two archaeological sites (NM-Q-21-100 and NM-Q-20-50) were identified to the south of the area. The results of those surveys are included in *Appendix B, Cultural Resource Survey Reports*.

One of the two sites identified, NM-Q-21-100, was directly adjacent to the south side of the Eastern Drainage channel. As requested by the Navajo Nation Historic Preservation Office, the boundary of this site was flagged by a qualified archaeologist prior to ground disturbing activities in the vicinity of the site. All disturbance activities were kept at least 50 feet away from the site boundary, except along its northern side. The northern side of the site was less than 50 feet from the southern edge of the Eastern Drainage channel excavation area. As such, extra caution was taken while excavating near the north side of the site and was overseen by an archeologist from Dinetahdoo. That site was fully preserved and no impacts occurred to the site during construction.

In addition to the surveys conducted in Step-Out Area No. 2, a cultural resources inventory was also conducted in Step-Out Area No. 1 in 2009 as part of the IRA (MWH, 2010b). Step-Out Area No. 1 encompasses Zone 6 located adjacent to the NECR Mine site, as shown on Drawing 3. No cultural resource sites were identified within or near (less than 100 feet) Zone 6.

### **2.3.5 Borrow Area**

The borrow material that was used to cover the Soil Consolidation Area and to backfill excavations, including the Eastern Drainage Channel, came from the same borrow pit used during the 2009 IRA, as shown on Drawing 2. The borrow pit was sampled and analyzed in 2009 for Ra-226, the results of which were below 2.24 pCi/g (MWH, 2010b).

## **2.4 CONSTRUCTION ACTIVITIES**

### **2.4.1 Perimeter Air Monitoring**

Perimeter air monitoring was conducted during the EDRA in accordance with the Work Plan and included monitoring for radiation exposure and airborne respirable dust. Engineering controls were used during construction order to ensure radiation protection and to limit doses to members of the public that are as low as reasonably achievable (ALARA), in accordance with the Code of Federal Regulations, Title 10, Part 20, Subpart D, Radiation Dose Limits for Members of the Public. Air monitoring was conducted at

upwind and downwind locations for internal and external radiation, as shown on Drawing 4, *Perimeter Air Monitoring Stations*.

The perimeter air monitoring program also included monitoring for respirable dust according to EPA's Primary National Ambient Air Quality Standard during.

#### **2.4.2 Excavation Control Surveying**

Radiological excavation control surveys were conducted during soil removal for the EDRA in a manner consistent with MARSSIM guidance (EPA, 2000). The objective of the excavation control surveys was to guide removal of impacted soils to confirm that the EDRA areas had been sufficiently excavated in accordance with MARSSIM, and to provide initial radiological data for the status surveys, which are presented in Section 3.0. Both in-situ and ex-situ excavation control surveys were used, as described below.

The in-situ excavation control surveys consisted of real-time direct gamma radiation level measurements in the field, as described in Section 5.4 of MARSSIM (EPA, 2000) for remedial action support surveys. The in-situ excavation control surveys were conducted within the shallow areas of Zones 2-6 (i.e., not within the Eastern Drainage channel or any excavations deeper than approximately two feet) using a 2x2-inch Sodium Iodide (NaI) gamma scintillation detector, as described in Appendix C. The excavation control surveying included both static and scan radiation surveys. Following the specified initial excavation lift within each area, the excavation control scan surveying was performed to identify any location that exceeded RAL. The scan survey for the excavation control was performed for 100% coverage in each excavation area. If no point or a location exceeding the RAL was identified within a 200-ft grid cell by the scan, the area was marked as <RAL in the Excavation Control Grid Forms, which are included in Appendix C. A one-minute static radiation measurement at several points in that grid area was then conducted and recorded in the Static Gamma Radiation Survey Field Forms, included in Appendix C. If the static radiation survey counts (cpm) were below the RAL in that grid cell, the grid cell was considered to meet the RAL and ready for the Interim Status Survey.

Ex-situ gamma radiation surveying was used for excavation control in the Eastern Drainage channel and other deeper excavations due to radiation shine interferences from the channel banks. Once the excavation of impacted channel bed sediments was completed to the depths estimated from the Eastern Drainage SRSE results (MWH, 2011b), a soil sample was collected from the base of the excavation and screened in the field using a 3x3 NaI detector fitted with a 1.5-inch lead collimator, as described in

Appendix C. The gamma counts (cpm) of the excavation samples were compared to the counts of a reference sample with a known Ra-226 concentration (near the RAL) to screen the excavation and evaluate the Ra-226 concentrations. Subsurface soil samples were collected for screening continuously during excavation, as needed, based on the results of the SRSE, field observations (e.g., soil color and texture) and the requirements of the excavator. Excavation of the channel bed, collection of soil samples, and ex-situ soil screening was continued at each location to confirm that soils had been sufficiently excavated in accordance with MARSSIM. Once this was complete for each segment of the channel, that segment was then considered finished and ready for a Final Status Survey, as explained in Section 3.0. The results of the ex-situ field screening measurements are included Appendix C.

The limits of excavation of soils from the Area North of NECR-1 (Zone 6) was determined in the field based on excavation control surveying, as discussed above, for the areas containing commingled TPH and Ra-226. For shallow soils (less than two feet bgs) containing only TPH-impacted soils, the excavation limits were determined by visual observation (e.g., dark staining).

#### **2.4.3 Excavation and Backfilling**

Excavation of materials from the Eastern Drainage flats area (Zones 2-5) that exceeded the RAL was conducted from north to south, starting with Zones 2, 3 and 5, and finishing with Zone 4. A number of methods were used to remove the material depending on the depth of removal and ground conditions in the area. Open areas with few obstacles (e.g., roads, utilities, and fences) were excavated by stockpiling surface materials with dozers, loaders, and a motor grader. Other areas including excavations to greater depth and/or around obstacles were excavated with an excavator. Depth of excavation varied from six inches to about five feet within discrete areas of the flats, as shown on Drawing 5, *Excavation Depths*. Areas within the Eastern Drainage channel and the head-cut erosion gully were excavated deeper, as shown on Drawing 5. Following the completion of status surveying (see Section 3.0), deep excavations were backfilled to the elevation of the surrounding grade with material from the borrow area. Excavated materials were hauled to the NECR-1 pile and placed in the Soil Consolidation Area, which is shown on Drawing 6, *Final Conditions* (see also Section 2.4.3). A total of 26,475 cubic yards (yd<sup>3</sup>) were excavated from Zones 2-5 and 3,100 yd<sup>3</sup> of borrow soil were used to backfill the deeper excavations and ensure the ground surface provided positive drainage. The final site conditions are shown on Drawing 6, *Final Conditions* and Drawing 7, *Detailed Final Conditions, Eastern Drainage Area*.

The Eastern Drainage channel was then excavated from the west end to the east end, using an excavator. The depth of excavation ranged from approximately 2 to 4 feet below the original grade along most of the channel length to as much as 10 feet adjacent to Red Water Pond Rd. A total of 2,210 yd<sup>3</sup> were excavated from the channel and a total of 2,250 yd<sup>3</sup> were used to backfill and reshape the channel.

The channel was reconstructed with a trapezoidal shaped cross-section, as shown on Drawing 8, *Plan and Profile, Eastern Drainage Channel*, and Drawing 9, *Profile Sections, Eastern Drainage Channel*. A filter/bedding gravel material was used between the native subgrade and an overlying layer of riprap, which provides erosion protection. The filter gravel was imported from offsite and was tracked into place, 6-inches thick, prior to placing a 12-inch riprap channel lining. The source of the filter gravel and riprap was the same as that used for the IRA, the General Rock Products' Thoreau Pit. A copy of the current gradation data from the rock supplier and the results of the 2009 gamma scanning of the material are included in Appendix D.

Following excavation of Zones 1-5, excavation of Zone 6 within Step-out Area 1 was conducted. A total of 3,695 yd<sup>3</sup> were excavated from Zone 6, and 2,268 yd<sup>3</sup> were used to backfill the excavation and bring it up to grade. TPH-impacted shallow soil that was shown by excavation control surveying and field observations to contain both TPH and Ra-226 above the RAL was excavated and placed in the Commingled TPH and Ra-226 Stockpile, which is located on top of the TPH Stockpile Area, as shown on 6. The Commingled TPH and Ra-226 Stockpile was covered with six-inches of clean borrow soil. Soils excavated from Zone 6 that did not contain TPH were placed in the Soil Consolidation Area, shown on Drawing 10, *Detailed Final Conditions, Soil Consolidation Area*.

#### **2.4.4 Soil Consolidation Area**

Excavated soils from Zones 1-5 were placed in the Soil Consolidation Area, which is shown in Drawing 10. The Soil Consolidation Area is located on top of the NECR-1 pile where the 2009 IRA soils were placed. The pile was constructed so that no slopes are greater than 3H:1V and the top surface slopes to the central channel at a grade of approximately 3.5 percent. Following completion of excavation, the Soil Consolidation Area was covered with six inches of clean soil.

## **2.5 POST-CONSTRUCTION ACTIVITIES**

### **2.5.1 Interim and Final Status Surveys**

Subsequent to the completion of excavation, each Removal Action area underwent an Interim Status Survey (Zones 2-6) or a Final Status Survey (Zone 1) in accordance with MARSSIM in order to confirm that excavation activities met the objectives of the EDRA. The Interim and Final Status Surveys are described in Section 3.0.

### **2.5.2 As-Built Topographic Survey**

At the completion of the excavation, backfilling and final grading, a final conditions topographic survey was conducted by Morris Surveying Engineering, LLC. The final conditions topography is shown on Drawing 6 and all of the subsequent drawings.

### **2.5.3 Revegetation**

The final restoration step for the EDRA was revegetation of the disturbed areas, which was conducted in accordance with the *2012 Eastern Drainage Revegetation Plan* (Cedar Creek, 2012), a copy of which is included in Appendix E, *Final Revegetation Plan and Seed Certificates*. Revegetation included planting of the designated seed mixes, which are shown in Table 1, *Primary Seed Mix* and Table 2, *Supplemental Seed Mix*. The primary seed mix is the same seed mix that was used for revegetation of the 2009 IRA areas. Seeding of the primary seed mix was used on all revegetated areas of the EDRA: Zones 2-6 and the borrow area. The supplemental seed mix was used in addition to the primary seed mix on all restored areas east of Red Water Pond Rd.: Zones 2-5 and the borrow area. Zone 1 was not revegetated because it was covered with riprap. Copies of the seed mix certification tags are included in Appendix E. Planting took place in November 2012 after surface preparation was completed.

Two preferred planting techniques were used in most areas, as indicated on the seed mix tables. These two methods were broadcast seeding with harrowing and drill seeding. Seed designated for broadcasting was applied first, followed by seed designated for drilling. On the steeper portions of the borrow area and the Area North of NECR-1 (Zone 6) the seed was mixed into a hydro mulch solution and sprayed onto the ground surface. One area high on the steepest portion of the borrow area was out of reach by the hydroseed method and so the seed was therefore broadcast by hand. The seed in all other areas was applied in accordance with the methods listed in Tables 1 and 2.



Broadcast seeding was accomplished by placing a cyclone spreader on the front of the equipment (tractor) that pulls the seed drill. The cyclone was adjusted to spread seed the approximate width of the drill. The action of the seed drill then acts as a harrow to lightly cover the broadcast seed with soil. Harrowing was very light so as not to overly bury distributed seed (i.e., no deeper than 2 to 3 mm). A very short length of chain-link fencing dragged over the broadcast area was used for light harrowing. Drilling of grass seed was accomplished by setting depth bands on a seed drill to place seed 5 to 8 mm below the surface. An experienced seed applicator was used in order to obtain proper distribution of the indicated amount of seed on a per acre basis, as indicated in Tables 1 and 2.

Areas exhibiting flatter slopes (<3:1) were not mulched and no areas received any straw. However, the steeper areas (e.g., the borrow area and Area North of NECR-1) were hydro-mulched with wood fiber that contained a pre-mixed tackifier.

As indicated on Tables 1 and 2, the seed mixes were comprised entirely of native species adapted to low-fertility soils and to the climactic regime of the project area. As stated above, the primary seed mix was the same seed mix that was used for revegetation of the 2009 IRA areas. Prior to seeding, four tons per acre of sterile organic cow manure was incorporated into the soil profile by disking. The manure amendment was added to improve the potential for revegetation success by increasing the organic content and improving the agronomic properties of the soil. Inorganic fertilizers were not used during the EDRA.

#### **2.5.4 Post-Removal Site Control**

The EDRA areas are surrounded by existing fencing. Any fencing that was removed or damaged during the EDRA was repaired. Fencing around the revegetated areas is necessary to restrict access to seeded areas by grazing animals to enable vegetative success. The alignment of the fences is shown on Drawing 6.

The fence consists of metal t-posts driven into the ground at approximately 10 foot centers. Hog wire was placed from ground level to four feet above ground. Two strands of barbed wire were installed above the hog wire. Total fence height is approximately five feet.

## 2.6 PERIMETER AIR MONITORING RESULTS

### 2.6.1 Monitoring for Radiation Exposure

Perimeter air monitoring for internal and external radiation exposure to individual members of the public was conducted during RA construction according to the methods described in the Work Plan. Perimeter air monitoring was conducted for:

- Internal radiation exposure from the radionuclides U-nat, Th-230 and Ra-226
- Internal radiation exposure from ambient radon concentrations
- External radiation dose

Perimeter air monitoring was conducted at an upwind location, near the school bus stop downwind of the Soil Consolidation Area and Zone 6, and along the north perimeter of the Eastern Drainage area downwind of construction activities in Zones 1-5.

The air monitoring was conducted for gross alpha activity to assess compliance with the U-nat, Th-230 and Ra-226 internal dose limits for individual member of the public, as specified in 10 CFR20.1302(b). Radiological air monitoring was conducted at the following frequency at each of the locations:

- Baseline - two days prior to any construction activities.
- Five days per week for the first week of excavation activities
- Three days per week for the second week of construction
- Two days per week for the third, fourth, fifth and sixth weeks of construction
- One day per week for the seventh and eighth weeks

The sampling results are summarized in Table 3, *Internal Radiation Monitoring Results*. The sampling and counting data are included in Appendix C. The baseline sampling conducted prior to construction activities showed the upwind and downwind concentrations to be similar. The results showed that U-nat, Ra-226 and Th-230 net concentrations (upwind subtracted) for all individual perimeter air samples at both downwind locations were less than their Derived Air Concentrations (DACs), except on one occasion. On 09/17/2012 Th-230 at the north perimeter location was at 2.54E-14 uCi/ml (119% of DAC). On this day, the air sampler was placed within the work zone, approximately 15 feet from the excavation activities in Zone 2 near the dust monitor to provide power to the dust monitor from the generator that was used for the perimeter air

sampler. When noticed, the perimeter air sampler was moved back to its north perimeter location. No air concentration exceeded any DAC thereafter. The results showed that the mean downwind net concentrations for U-nat, Ra-226 and Th-230 were less than 25% of their respective DACs for the EDRA activities.

Ambient radon concentrations during the NECR EDRA were monitored by placing Landauer radon trek etch detectors at the same three air monitoring stations discussed above. The radon trek etch detectors were exposed at the sampling stations during the EDRA and sent back to Landauer for analysis. The radon monitoring report is included in Appendix F. The results showed radon concentration of 1.5 pCi/l, 1.7 pCi/l and 2.1 pCi/l at the upwind location, the school bus stop location and the downwind north perimeter location, respectively, less than the 4.0 pCi/l *indoor* standard recommended by USEPA.

External radiation exposure rate monitoring was conducted by placing environmental dosimeters at the same stations as discussed above. The environmental dosimeter report is included in Appendix F. The results showed net exposure (ambient dose), after subtracting the control, of: (1) less than detection for the upwind station; (2) 1.6 mrem for the school bus stop station; and (3) 2.3 mrem for the downwind north perimeter station, respectively, which were all below the 4.0 pCi/l indoor level recommended by USEPA.

Additional monitoring was provided to on-site workers by the construction contractor. Breathing-zone air sampling was performed on a representative number of employees from September 7, 2012, to October 12, 2012. Individuals selected to be monitored, mainly equipment operators, were issued breathing-zone air samplers in the morning so that their breathing-zone exposures could be monitored and evaluated during the day. At the end of the workday, the sample filters were collected and analyzed using an on-site Ludlum 2929 alpha-beta counting system. Filter counting results were used to determine individual DAC values for the wearer for that day. DAC values were tracked for each individual monitored on a daily basis through the monitoring period. The monitoring period coincided with the period during which contaminated and suspect-contaminated soil was being handled by the equipment operators.

The highest daily single DAC assigned value for a wearer was 0.219. This equates to a dose of approximately 4.38 mrem for the day below the allowable 8-hr DAC of 20 mrem. The average daily DAC value assigned over the entire monitoring period for the group was 0.060 (~1.2 mrem/d).

## 2.6.2 Monitoring for Airborne Respirable Dust

Airborne respirable dust was also monitored during construction in accordance with the Work Plan. Respirable dust is defined by USEPA's Primary National Ambient Air Quality Standard (40 CFR 50) as dust less than or equal to 2.5  $\mu\text{m}$  in diameter (PM 2.5) and 10  $\mu\text{m}$  in diameter (PM 10). Monitoring was conducted at similar locations as described in Section 2.6.1: one upwind location and two downwind locations. The precise location of the monitoring station downwind of excavation activities in the Eastern Drainage area was based on the location of the excavation activities (i.e., the monitor was moved during construction to ensure that it was directly downwind of excavation activities). Dust monitoring was conducted using a Thermo DataRAM 4 Model DR-4000 ambient dust monitor and was conducted continuously during working hours.

Airborne dust monitoring was conducted 24 hrs/day at the upwind location for the first three days of significant earthmoving activities, and then continuously during working hours thereafter, alternating between PM 2.5 and PM 10. It was intended for the same to be done at the downwind location, but a malfunction of the monitor occurred during this initial period, and the 24-hr test was therefore repeated at the downwind station at a later time. The start of dust monitoring coincided with the start of major earthmoving activities in each area (i.e., September 10, 2012 for the upwind and Eastern Drainage area downwind locations, and October 1, 2012 for the bus stop downwind location when Zone 6 was being excavated).

The results of the dust monitoring were reviewed and assessed during construction to determine any potential health hazards or risks. The respirable dust standards used were the USEPA's Primary National Ambient Air Quality Standards at 24 hour Time Weighted Average (TWA) of:

PM 2.5: 35 micrograms/cubic meter ( $\mu\text{g}/\text{m}^3$ )

PM 10: 150  $\mu\text{g}/\text{m}^3$

A summary of the dust monitoring results is presented in Table 4, *Dust Monitoring Data Summary*. Complete data results and charts from select days are included in Appendix F. The results show that no exceedances of the standards occurred at any time during construction. Average (over the work periods) concentrations for PM 2.5 ranged from 1.5 to 24.4  $\mu\text{g}/\text{m}^3$  and for PM10 from 2.0 to 23.5  $\mu\text{g}/\text{m}^3$ , all below the standards, as shown on Table 4.

## 3.0 INTERIM AND FINAL STATUS SURVEY RESULTS

### 3.1 SUMMARY OF STATUS SURVEYS

Subsequent to the completion of excavation, each EDRA area underwent an Interim Status Survey (Zones 2-6) or a Final Status Survey (Zone 1) in accordance with MARSSIM. The objective of the Interim Status Survey conducted on Zones 2-6 was to demonstrate that soils with Ra-226 in excess of the 2.24 pCi/g RAL had been removed from the EDRA areas. Because the areas were being addressed due to Ra-226 impacts in excess of the RAL, they are considered Class 1 Areas under MARSSIM and will therefore require a Class 1 Final Status Survey subsequent to the final Non-Time-Critical Removal Action. The Interim Status Survey was performed to confirm that excavation activities met the objectives of the EDRA. The data collected during the Interim Status Survey will be included in the Final Status Survey at a later date.

Zone 6 was within the area addressed during the 2009 IRA, as discussed in Section 1.2. Therefore, the Interim Status Survey results from Zone 6 were evaluated with the results from the Post-IRA status survey conducted for the IRA. The IRA status survey results were presented in the document *Completion Report Addendum, Interim Removal Action* (MWH, 2011a).

The Interim Status Survey consisted of a direct gamma radiation static survey and confirmatory soil sampling for laboratory analysis of Ra-226. A direct gamma radiation static survey was designed for the NECR Removal Site Evaluation consistent with MARSSIM to support Data Quality Objectives for Class 1 areas (MWH, 2006). The instrumentation used for the gamma radiation static survey consisted of a 2x2 NaI scintillation detector (Eberline SPA-3) for detection of gamma radiation, connected to a portable ratemeter/scaler (Ludlum 2221), and a global positioning system (GPS) unit to locate static survey grid points from spatial coordinates. A detailed discussion of the methods and instrumentation used and the results of the gamma measurements and soil laboratory analyses are included in Appendix C. A discussion of the results of the Interim Status Survey is included in Section 3.1.2 below.

Because the area within the Eastern Drainage channel excavation (Zone 1) required backfilling and final restoration during implementation of the Removal Action, a Final Status Survey was conducted in the channel. The Final Status Survey consisted of ex-situ soil screening and soil analysis for Ra-226. The objective of the Final Status Survey was to demonstrate that the MARSSIM release criteria was achieved in the excavated areas.

The instrumentation used for the Final Status Survey gamma measurements consisted of a 3x3 NaI scintillation detector (Eberline SPA-3) for detection of gamma radiation connected to a portable ratemeter/scaler (Ludlum 2221) (see Appendix C).

### 3.1.1 Gamma Correlation Analysis

The static gamma results were converted to Ra-226 concentrations by developing a correlation using regression analysis between the gamma survey results and co-located surface soil samples analyzed for Ra-226. A direct gamma radiation level of 5,075 cpm for the collimated 2x2 detector equivalent to the RAL was used to assess the gamma scan results from the excavation control survey and was initially used to evaluate the gamma scan results from the Interim Status Survey. The gamma results were converted to Ra-226 concentrations using the most recent updated site-specific correlation ( $\text{Ra-226 pCi/g} = (0.0013\text{cpm} \times \text{gamma radiation level CPM}) - 4.3582$ ) that was conducted for the Eastern Drainage Supplemental RSE, as described in the *Supplemental Removal Site Evaluation Report, East Drainage Area* (MWH, 2011b). The value of 5,075 cpm is consistent with the 5,214 counts per minute (cpm) equivalent to the RAL that was determined for the IRA (MWH, 2010b).

The excavation and removal of contaminated soils during the EDRA resulted in changes to the Ra-226 distribution in soil (i.e., lower concentrations and more surficial), which likely changed the site-specific correlation between direct gamma radiation levels and Ra-226 concentrations in soil. Therefore, the April 2011 Eastern Drainage area supplemental RSE correlation for the collimated 2x2 NaI detector presented above was updated in accordance with the Work Plan using data from soil sampling and direct gamma radiation measurements at 15 locations collected during the EDRA Interim Status Survey. The EDRA updated correlation data are included in Appendix C. Regression analysis modeling for the updated correlation resulted in a regression equation,  $\text{Ra-226 pCi/g} = (0.0013 \times \text{gamma radiation level CPM}) - 4.4308$ , with an  $R^2$  value of 0.92, very similar to the Eastern Drainage Area SRSE regression equation shown above. This revised regression equation was used to update the gamma scan readings from the Interim Status Survey.

### 3.1.2 Interim Status Survey

The Interim Status Survey was conducted once the excavation control survey indicated that excavation and removal of impacted soil above the RAL was complete. The number of data points for the Interim Status Survey was determined using the Wilcoxon Rank Sum (WRS) test per MARSSIM guidance with statistical parameters selected to achieve a

low error rate. Since the areas that underwent the EDRA are Class 1 Areas, the Interim Status Survey was conducted consistent with the RSE Work Plan for Class 1 Areas (MWH, 2006), and was also consistent with the 2009 IRA (MWH, 2010b). Therefore, the Interim Status Survey conducted in the flats area consisted of direct gamma radiation static measurements (converted to Ra-226 soil concentration) conducted on an 80-foot grid. The Work Plan specified that confirmatory soil samples be collected for laboratory analysis at 5% of the static gamma survey points, or a minimum of 13 samples. Additionally, during implementation of the EDRA, excavation control radiation scan surveying was conducted at 100% coverage of the excavated areas, in accordance with the Work Plan, which augment the Interim Status Survey. Detailed results of the excavation control surveying are included in Appendix C.

The Interim Status Survey was performed in stages as each area within the excavation zones was determined to be ready for the status survey based on the excavation control survey. The purpose of performing the Interim Status Survey in stages was to allow backfilling and/or grading of excavated areas as soon they were completed. This was done to keep the construction on schedule and for project control, since no excavated area could be backfilled or graded until completion of the Interim Status Survey. The Interim Status Survey began with static gamma measurements on September 28, 2012 in Zone 2. The status survey began with locating each survey point (grid nodes) using geographic coordinate data. Then a one-minute direct gamma measurement was performed at each of the points.

The 80-ft triangular grid was cast from the origin of the Post-IRA Status Survey 80-ft triangular grid and resulted in a total of 159 grid points: 149 in the flats area (Zones 2-5) and 10 in the Area North of NECR-1 (Zone 6), as shown on Drawing 11, *Post-Excavation Static Gamma Survey Results - Zones 2-5* and Drawing 13, *Post-Excavation Static Gamma Survey Results – Zone 6*. The static gamma survey measurements and other information were recorded on the 80-ft Triangular Grid Status Static Gamma Radiation Survey Field Forms, which are included in Appendix C. Confirmatory soil samples then collected for laboratory analysis and co-located with 15 randomly selected gamma static survey points, as shown in Drawing 12, *Post-Excavation Surface Soil Analytical Results - Zones 2-5* and Drawing 14, *Post-Excavation Surface Soil Analytical Results – Zone 6*. Field QA/QC duplicate soil samples were collected from two locations. The soil sampling information was recorded in the EDRA Soil Sample Log, included in Appendix C. A total of 17 soil samples (15 primary and 2 duplicates) were submitted to ELI for Ra-226 analysis using USEPA Method 901.1 with a reporting limit of <0.6 pCi/g. The laboratory analytical Chain-of Custody (COCs) forms are included in Appendix C.

All of the confirmatory soil sample Ra-226 results were reported at less than the RAL, as discussed in Section 3.2.2, except for one sample, SSPT-033, for which the Ra-226 result was reported at 6.2 pCi/g. During the Interim Status Survey, the static gamma level at this location was measured at 4,997 cpm, below the 5,075 cpm RAL for the collimated 2x2 NaI detector (i.e., less than 2.24 pCi/g). The laboratory reported result of 6.2 pCi/g was equivalent to about 8,100 cpm direct gamma radiation level, significantly above the measured static gamma radiation level of 4,997 cpm. Therefore, the area was rescanned and another soil sample, SSPT-033R was collected from the exact same location. The static gamma level was measured at 4,787 cpm during re-scanning. Also, the scan gamma survey was extended to an approximately 20-foot radius around the point during the resampling, which showed gamma levels from about 4,200 to 4,900 cpm, all below the RAL. The replacement soil sample SSPT-033R was sent to the laboratory for Ra-226 analysis. The laboratory reported a Ra-226 result for SSPT-033R of 1.5 pCi/g, less than the RAL, and significantly lower than the 6.2 pCi/g reported for the initial sample SSPT-033, indicating that the 6.2 pCi/g value previously reported was likely an erroneous result.

### **3.1.3 Final Status Survey for Eastern Drainage Channel**

The Final Status Survey conducted within the Eastern Drainage Channel consisted of the results of the ex-situ soil screening conducted during construction (see Appendix C) and soil samples submitted for laboratory analysis of Ra-226. A soil sample was collected every 50 feet along the channel bed (29 locations) and channel sidewalls (29 locations) for excavation control by ex-situ gamma radiation soil screening, in accordance with the Work Plan. The Final Status Survey was conducted in segments of the excavation as it progressed along the length of the channel to facilitate backfilling of the excavation in a timely manner and to reduce safety risks. Once ex-situ field screening results indicated that the RAL had been achieved, as shown in Appendix C, and the excavation was deemed complete, every other soil sample collected for excavation control were selected for laboratory analysis of Ra-226 (EPA approved submittal of every other sample through a field change based on the initial scan results). A total of fifteen channel bed samples and 15 channel sidewall samples plus 4 duplicate samples were submitted for laboratory analysis.



## 3.2 INTERIM STATUS SURVEY RESULTS (ZONES 2-6)

### 3.2.1 Static Gamma Survey Results

The Interim Status Survey direct gamma radiation static survey one-minute readings were converted into Ra-226 surface soil concentrations using the updated correlation regression analysis equation, as discussed in Section 3.1.1. The Ra-226 concentrations in soil converted from the direct gamma radiation level measurements are included in Appendix C and shown on Drawing 11. The gamma static survey results indicated that Ra-226 concentrations in soil were below the RAL at 137 of the total 149 survey points in the Eastern Drainage flats area (Zones 2-5) and 8 of 10 survey points in the Area North of NECR-1 (Zone 6). Ra-226 concentrations at the remaining 14 locations that exceeded the RAL were all below the MARSSIM Derived Concentration Guidance Limit Elevated Measurement Comparison (DCGL<sub>EMC</sub>) level of 3.0 pCi/g, with the highest at 2.72 pCi/g.

The results showed Ra-226 concentrations for the 149 locations within the flats area as follows:

Average = 1.6 pCi/g  
Standard deviation = 0.5 pCi/g  
Median = 1.6 pCi/g  
Maximum = 2.7 pCi/g

The results showed Ra-226 concentrations for the 10 locations within the Area North of NECR-1 as follows:

Average = 2.0 pCi/g  
Standard deviation = 0.4 pCi/g  
Median = 2.1 pCi/g  
Maximum = 2.7 pCi/g

All gamma measurements were less than the DCGL<sub>EMC</sub> of 3.0 pCi.g. Since some of the results exceeded the RAL, but were less than the EMC value, statistical evaluations were conducted to demonstrate that the mean concentration in the EDRA areas is not statistically different than the mean of the background area, and that these areas still meet the MARSSIM release criterion. Zone 6 is part of the original IRA area, and so the statistical evaluation for Zone 6 included the Post-IRA Status Survey dataset (MWH, 2011a) with the Zone 6 data inserted. Each dataset (Zones 2-5 and Zone 6/IRA Area)

was statistically compared to the background dataset using the WRS test, in accordance with MARSSIM. The WRS test was used with the following parameters:

- Null Hypothesis (Ho): EDRA Area Mean/Median  $\geq$  Background Mean/Median Plus Substantial Difference, S (Form 2)
- Alternative Hypothesis (HA): EDRA Area Mean/Median  $<$  Background Mean/Median Plus Substantial Difference, S
- Substantial Difference (S): DCGL<sub>W</sub> (1.14 pCi/g)
- Confidence Level: 95 percent

The statistical analyses were conducted using the software ProUCL 4.1. The outputs from ProUCL showing the results of the tests are included in Appendix G, *Status Survey Results*.

The results for Zones 2-5 show that the p-value was less than 0.05, and so at a 95% confidence level ( $\alpha = 0.05$ ), the null hypothesis is rejected. The conclusion from the test is that the mean of the Zones 2-5 static gamma dataset is less than the mean of the background reference area plus the substantial difference and, therefore, the Zones 2-5 areas pass the MARSSIM release criterion based on the correlated gamma measurements.

The results for Zone 6/IRA Area show that the p-value was less than 0.05, and so at a 95% confidence level ( $\alpha = 0.05$ ), the null hypothesis is rejected. The conclusion from the test is that the mean of the Zone 6/IRA Area static gamma dataset is less than the mean of the background reference area plus the substantial difference and, therefore, the Zone 6/IRA Area areas pass the MARSSIM release criterion based on the correlated gamma measurements.

### **3.2.2 Surface Soil Analytical Results**

Surface soil samples were collected from 14 locations within the Zones 2-5 and one location from Zone 6, subsequent to completion of excavation activities. The surface soil samples were submitted to the laboratory and analyzed for Ra-226. The locations of each of the soil samples and analytical results are shown on Drawing 12. The laboratory analytical reports and the results of the data validation are included in Appendix C.

The results showed Ra-226 concentrations for the 14 Zones 2-5 samples as follows:

Mean = 1.6 pCi/g  
Standard deviation = 0.3 pCi/g  
Median = 1.5 pCi/g  
Maximum = 2.2 pCi/g

The one sample from Zone 6 indicated a Ra-226 concentration of 1.3 pCi/g, as shown on Drawing 14.

The Zones 2-5 results are consistent with the static gamma measurements and indicated that no sample results exceeded the RAL and that Zones 2-5 met the MARSSIM release criterion. The result for Zone 6 was also below the RAL.

### **3.3 FINAL STATUS SURVEY RESULTS (ZONE 1)**

#### **3.3.1 Ex-Situ Gamma Screening**

As discussed in Section 3.1, in-situ direct gamma radiation surveying was not used for excavation control in the Eastern Drainage channel due to radiation shine interferences from the channel banks or sidewalls. Ex-situ field soil screening was performed instead for excavation control in the Eastern Drainage channel (see Appendix C). Once the ex-situ soil screening results indicated that soils in excess of the RAL had been removed from the channel bed and the side walls one sample every 100 feet was collected along the channel bed and sidewalls and submitted to ELI for analysis of Ra-226. The results of the laboratory analyses are presented in Section 3.3.2. The results of the ex-situ soil screening indicated that all soils in excess of the RAL had been removed and excavation from the Eastern Drainage channel had met the objectives of the EDRA.

#### **3.3.2 Soil Analytical Results**

The results of the analyses for Ra-226 conducted on the subsurface soil samples collected from the channel are included in Appendix C and shown on Drawing 15, *Post-Excavation Subsurface Soil Analytical Results – Zone 1*. All of the channel bed and channel sidewall soil sample Ra-226 results reported from the laboratory were less than the 2.24 pCi/g RAL, except for one channel sidewall sample, EDC-29-NSW, for which the Ra-226 result was reported at  $3.0 \pm 0.6$  pCi/g. While this result was equal to the acceptable EMC level of 3.0 pCi/g, it is likely an erroneous value because the results of the ex-situ field soil screening indicated that it was less than the RAL and the analytical result for the

laboratory duplicate sample from the same location (EDC-DS4) was  $1.7 \pm 0.6$  pCi/g. Excluding sample EDC-29-NSW (i.e., using the duplicate sample instead), the results indicated Ra-226 concentrations as follows:

Mean = 1.3 pCi/g

Standard deviation = 0.3 pCi/g

Median value = 1.2 pCi/g

Maximum = 1.9 pCi/g

These results indicated that Ra-226 concentrations were all below the RAL and demonstrated that the Eastern Drainage channel excavation met the EDRA objectives.

## 4.0 ESTIMATE OF COSTS INCURRED

It is estimated that approximately \$1,647,000 was spent to comply with the AOC. This includes costs to conduct the EDRA RSE, prepare a design and work plans, removal, removal oversight, sampling and monitoring, and project management. This does not include costs incurred by USEPA and its contractors and consultants.

Removal Site Evaluation:	\$60,000
Construction Planning:	\$108,000
Construction Management:	\$75,000
Construction Oversight:	\$155,000
<u>Construction:</u>	<u>\$1,249,000</u>
<b>Total:</b>	<b>\$1,647,000</b>

These costs do not include planning and execution of the bioventing system for the Area North of NECR-1 Remediation included in the AOC. These costs will be reported following implementation of the bioventing remedy.

## 5.0 REFERENCES CITED

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- MWH, 2011a. *Completion Report Addendum, Interim Removal Action*, Northeast Church Rock Mine. March 4.
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- MWH, 2010a. *Petroleum Investigation Results and Bioventing Pilot Study Plan*, Northeast Church Rock Mine Site, July 22.
- MWH, 2010b. *Completion Report, Interim Removal Action*, Northeast Church Rock Mine, June 29.
- MWH, 2010c. *Removal Site Evaluation Report, Red Water Pond Road*, Northeast Church Rock Mine, January 26.
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## TABLES

**Table 1  
Primary Seed Mix**

Seed Names		Specifications					Comments
Common Name	Scientific Nomenclature	PLS / lb	Recommended PLS lbs/ac	PLS / ft <sup>2</sup>	% of Seeds in Mix	Method of Seeding	
Western wheatgrass	<i>Agropyron smithii</i>	110,000	1.00	2.5	2.0%	Drill	NRCS indicated climax species
Sand Dropseed	<i>Sporobolus cryptandrus</i>	5,298,000	0.50	60.8	47.9%	B-cast/Harrow	NRCS indicated climax species
Blue Grama	<i>Bouteloua gracilis</i>	825,000	0.50	9.5	7.5%	Drill	Stong component of native community
Galleta	<i>Hilaria jamesii</i>	159,000	0.50	1.8	1.4%	Drill	Stong component of native community
Thickspike Wheatgrass	<i>Agropyron dasystachyum</i>	154,000	0.50	1.8	1.4%	Drill	Fair performer - Offers diversity
Indian Ricegrass	<i>Oryzopsis hymenoides</i>	141,000	0.75	2.4	1.9%	Drill	Should do well in areas of sandy texture
Sideoats Grama	<i>Bouteloua curtipendula</i>	191,000	0.75	3.3	2.6%	Drill	Good performer - Offers diversity
Bottlebrush Squirreltail	<i>Sitanion hystrix</i>	192,000	0.25	1.1	0.9%	Drill	Fair performer - Offers diversity
<b>Subtotal</b>			<b>4.75</b>	<b>83.2</b>	<b>65.5%</b>		
Desert Globemallow	<i>Sphaeralcea ambigua</i>	500,000	0.75	8.6	6.8%	B-cast/Harrow	Sufficient performer for diversity
Palmer Penstemon	<i>Penstemon palmeri</i>	610,000	0.50	7.0	5.5%	B-cast/Harrow	Good performer - Offers diversity
Rocky Mountain Penstemo	<i>Penstemon strictus</i>	592,000	0.25	3.4	2.7%	B-cast/Harrow	Fair performer - Offers diversity
Lewis Flax	<i>Linum lewisii</i>	293,000	1.00	6.7	5.3%	B-cast/Harrow	Good performer - Offers diversity
<b>Subtotal</b>			<b>2.50</b>	<b>25.7</b>	<b>20.3%</b>		
Fourwing Saltbush	<i>Atriplex canescens</i>	52,000	0.75	0.9	0.7%	Drill	NRCS indicated climax species - good forage value
Wyoming Big Sagebrush	<i>Artemisia tridentata wyo.</i>	2,500,000	0.25	14.3	11.3%	B-cast/Harrow	Occasional performer - Offers diversity
Cliffrose	<i>Purshia mexicana</i>	64,600	1.00	1.5	1.2%	B-cast/Harrow	Fair performer - Offers diversity
Winterfat	<i>Ceratoides lanata</i>	56,700	1.00	1.3	1.0%	B-cast/Harrow	Good performer - good forage value
<b>Subtotal</b>			<b>3.00</b>	<b>18.0</b>	<b>14.2%</b>		
<b>Total</b>			<b>10.25</b>	<b>127.0</b>			

**Notes:**

1. This seed mix is for the disturbed areas on the mine site, Zone 6, the Eastern Drainage area, and the borrow area.
2. PLS = Pure Live Seed.
3. The amount of seed per acre used was 10.25 lb/ac mix for areas that were drill seeded for grasses. In areas where broadcast and harrow methods were used for grasses, the rate was increased 1.5 times, and where hydroseeding methods were used, the rate was doubled.



**Table 2  
Supplemental Seed Mix**

Names		Recommendations					Comment
Common Name	Scientific Nomenclature	PLS / lb	Recommnd . PLS lbs/ac	PLS / ft <sup>2</sup>	% of Seeds in Mix	Preferred Method of Seeding	
Alkali Sacaton	<i>Sporobolus airoides</i>	1,758,000	0.25	10.1	28.6%	B-cast/Harrow	NRCS indicated climax species
Blue Grama	<i>Bouteloua gracilis</i>	825,000	0.50	9.5	26.8%	Drill	Stong component of native community
	<b>Subtotal</b>		<b>0.75</b>	<b>19.6</b>	<b>55.4%</b>		
Scarlet Globemallow	<i>Sphaeralcea coccinea</i>	500,000	0.25	2.9	8.1%	B-cast/Harrow	Sufficient performer for diversity
Rocky Mtn. Bee Plant	<i>Cleome serrulata</i>	65,900	1.50	2.3	6.4%	B-cast/Harrow	Good performer - Offers diversity
Upright Prairie Coneflower	<i>Ratibida columnifera</i>	737,104	0.25	4.2	12.0%	B-cast/Harrow	Fair performer - Offers diversity
	<b>Subtotal</b>		<b>2.00</b>	<b>9.4</b>	<b>26.5%</b>		
Fourwing Saltbush	<i>Atriplex canescens</i>	52,000	1.50	1.8	5.1%	Drill	NRCS indicated climax species - good forage value
Rubber Rabbitbrush	<i>Chrysothamnus naseousus</i>	400,000	0.50	4.6	13.0%	B-cast/Harrow	NRCS indicated climax species
	<b>Subtotal</b>		<b>2.00</b>	<b>6.4</b>	<b>18.1%</b>		
	<b>Total</b>		<b>4.75</b>	<b>35.3</b>			

**Notes:**  
1. This seed mix was used as a supplement to the Primary Seed mix (see Table 1) in disturbed areas east of Red Water Pond Rd.  
2. PLS = Pure Live Seed.  
3. The amount of seed per acre used was 4.75 lb/ac for areas that were drill seeded for grasses. In areas where broadcast and harrow methods were used for grasses, the rate was increased 1.5 times, and where hydroseeding methods were used, the rate was doubled.

**Table 3  
Internal Radiological Exposure Data Summary**

						DAC (uCi/ml)10CFR20, AppB					
						Gross Alpha <sup>(4)</sup>	U-nat	Ra-226	Th-230		
						1.8E-12	9.0E-13	9.0E-13	2.0E-14		
Perimeter Air Station <sup>(5)</sup>	Sample Date	Sample ID	Airborne Particulate Activity (uCi/ml) <sup>(1)</sup>				% of DAC <sup>(3)</sup>				Comments
			Gross Alpha	U-nat	Ra-226	Th-230	Gross Alpha	U-nat	Ra-226	Th-230	
NECR-D1	Mean	D1 Baseline	6.5E-15	3.2E-15	1.6E-15	1.6E-15	0.1%	0.1%	0.0%	1.2%	Baseline Sampling, downwind and upwind essentially the same
NECR-D2	Mean	D2 Baseline	3.0E-15	1.5E-15	7.6E-16	7.6E-16	-0.1%	-0.1%	-0.1%	-3.1%	
NECR-D1	Mean	NECREDRA-D1 (Scool Bus Stop Area)	2.6E-15	1.3E-15	6.4E-16	6.4E-16	0.0%	0.0%	0.0%	-0.2%	Mean School Bus Stop air concentrations similar to upwind
	Max		1.2E-14	6.1E-15	3.0E-15	3.0E-15	1%	1%	0%	15%	
NECR-D2	Mean	NECREDRA-D2 (EDA Downwind (North Perimeter))	1.8E-14	9.1E-15	4.6E-15	4.6E-15	0.9%	0.9%	0.4%	19.4%	Mean Perimeter air concentrations less than 25% of DACs
	Max		9.8E-14	4.9E-14	2.5E-14	2.5E-14	5%	5%	3%	119%	
NECR-U1	Mean	NECREDRA-U1 (Upwind) Project Mean	2.7E-15	1.4E-15	6.8E-16	6.8E-16	-	-	-	-	

**Notes:**

- (1) U-nat, Ra-226 and Th-230 activity calculated from measured gross alpha activity @ faction of 0.5 for U-nat, 0.25 for Ra-226 and 0.25 for Th-230 of gross alpha activity
- (2) DACs from 10CFR20, Appendix B, Table 2 for control and assessment of dose to the public
- (3) Net % of DACs for downwind, i.e subtracting upwind concentration from downwind
- (4) Calculated DAC for gross alpha activity by summing U-nat, Ra-226 and Th-230 DACs for control measures, not a regulatory DAC.
- (5) Monitoring station: NECR-D1 = Downwind 1 (Scool Bus Stop); NECR-D2 = Downwind 2 (East Drainage Area North Perimeter); NECR-U1 = Upwind 1

**Table 4**  
**Airborne Dust Monitoring Results**

Maximum Particle Size ( $\mu\text{m}$ )	Dates	Average Concentration ( $\mu\text{g}/\text{m}^3$ ) <sup>1</sup>	Operating Hours <sup>2</sup>
<b>Upwind</b>			
10	9/10 to 9/13/12	2.6	76.5
10	9/14/12	5.3	7.8
2.5	9/18/12	6.1	6.7
10	9/19/12	5.6	8.4
2.5	9/20/12	7.6	7.9
10	9/21/12	10.3	7.3
2.5	9/24/12	4.6	7.8
10	9/25/12	3.5	8.8
2.5	9/26/12	3.6	8.4
10	9/27/12	2.8	8.9
2.5	9/28/12	1.8	5.9
10	10/1/12	3.8	7.8
2.5	10/2/12	4.5	8.0
10	10/3/12	4.1	8.8
2.5	10/4/12	6.0	3.1
<b>Downwind</b>			
2.5	9/10/12 to 9/14/12	Monitor malfunctioned	
10	9/17/12	16.7	8.5
10	9/19/12	12.2	8.4
2.5	9/20/12	13.8	8.4
10	9/21/12	17.2	7.8
10	9/24 to 9/27/12	10.3	72.0
2.5	9/27/12	4.1	8.0
10	9/28/12	2.9	5.9
2.5	10/1/12	4.6	8.3
10	10/2/12	23.5	8.6
2.5	10/3/12	12.5	8.8
10	10/4/12	17.5	7.7
10	10/5/12	10.0	7.7
2.5	10/8/12	4.7	8.5
10	10/9/12	6.2	9.0
2.5	10/10/12	3.0	8.9
2.5	10/11/12	3.9	8.2
10	10/12/12	4.5	2.7
10	10/15/12	4.1	5.8
2.5	10/16/12	7.4	8.6
10	10/17/12	6.5	8.7
2.5	10/18/12	20.8	8.7
10	10/22/12	23.0	6.7
2.5	10/23/12	24.4	8.7
10	10/24/12	14.3	8.6
2.5	10/25/12	24.1	8.4

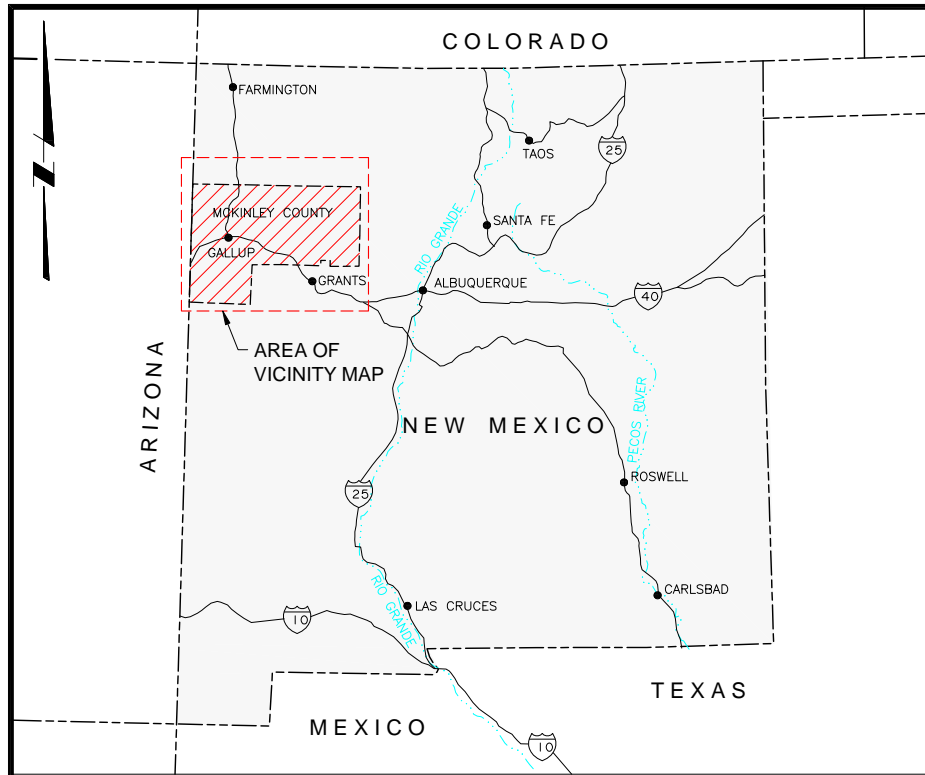
**Table 4  
Airborne Dust Monitoring Results**

Maximum Particle Size ( $\mu\text{m}$ )	Dates	Average Concentration ( $\mu\text{g}/\text{m}^3$ ) <sup>1</sup>	Operating Hours <sup>2</sup>
<b>Bus Stop<sup>3</sup></b>			
10	10/1/12	Data Rejected	
10	10/3/12	4.7	8.9
2.5	10/4/12	7.0	4.0
2.5	10/5/12	3.5	8.1
10	10/8/12	3.9	8.4
2.5	10/9/12	2.7	9.4
10	10/10/12	7.0	8.9
10	10/11/12	6.4	8.2
2.5	10/15/12	2.9	6.1
10	10/16/12	5.0	8.6
2.5	10/17/12	3.1	8.7
10	10/18/12	9.0	8.5
2.5	10/22/12	1.5	6.8
10	10/23/12	3.3	8.6
2.5	10/24/12	5.7	8.2
10	10/25/12	2.0	7.9

**Notes:**

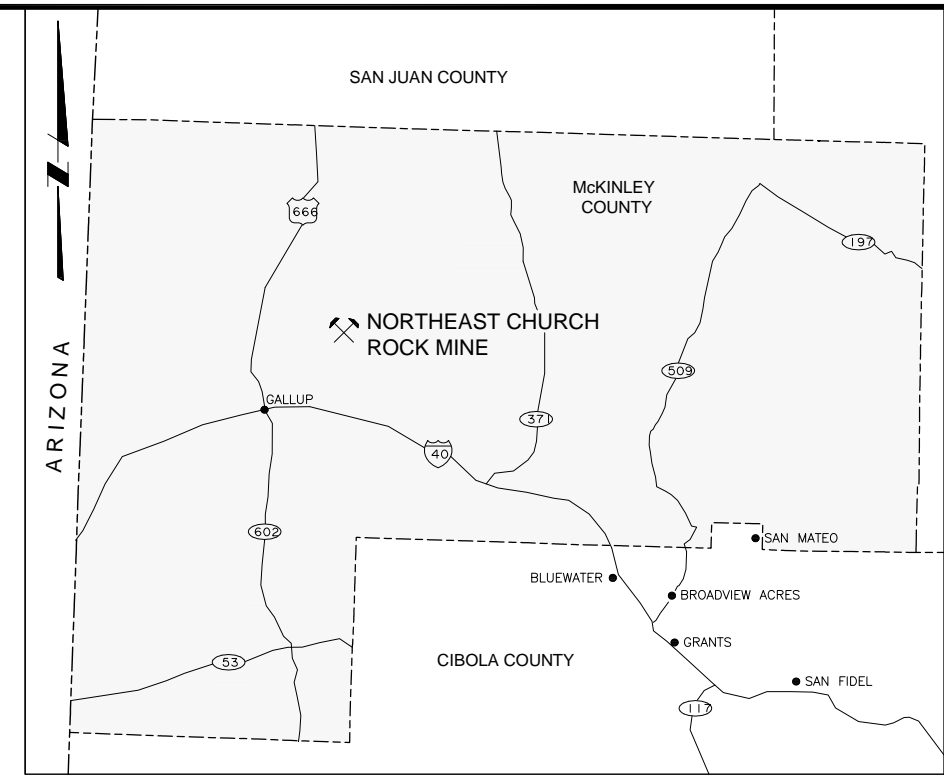
1. The standard for PM 2.5 is a 24-Hr TWA of 35  $\mu\text{g}/\text{m}^3$ . The standard for PM 10 is a 24-Hr TWA of 150  $\mu\text{g}/\text{m}^3$ .
2. Operating hours are the hours that the dust monitor was operating, which was normally limited to construction work hours, except for two 72+ hour periods, one each at the upwind and downwind stations.
3. Monitoring at the bus stop was started when construction at Zone 6 began, which was the week of 10/1/12.

## **DRAWINGS**



**LOCATION MAP**  
NOT TO SCALE

DRAWING INDEX	
No.	TITLE
1	COVER AND INDEX SHEET
2	ORIGINAL CONDITIONS
3	SUPPLEMENTAL RSE RESULTS AND PRELIMINARY CONSTRUCTION ZONES
4	PERIMETER AIR MONITORING STATIONS
5	EXCAVATION DEPTHS
6	FINAL CONDITIONS
7	DETAILED FINAL CONDITIONS EASTERN DRAINAGE AREA
8	PLAN AND PROFILE EASTERN DRAINAGE CHANNEL
9	PROFILE SECTIONS EASTERN DRAINAGE CHANNEL
10	DETAILED FINAL CONDITIONS SOIL CONSOLIDATION AREA
11	POST-EXCAVATION STATIC GAMMA SURVEY RESULTS - ZONES 2 - 5
12	POST-EXCAVATION SURFACE SOIL ANALYTICAL RESULTS - ZONES 2 - 5
13	POST-EXCAVATION STATIC GAMMA SURVEY RESULTS - ZONE 6
14	POST-EXCAVATION SURFACE SOIL ANALYTICAL RESULTS - ZONE 6
15	POST-EXCAVATION SUBSURFACE SOIL ANALYTICAL RESULTS - ZONE 1



**VICINITY MAP**  
NOT TO SCALE

# NECR EASTERN DRAINAGE CONSTRUCTION COMPLETION REPORT

Prepared for

**UNITED NUCLEAR CORPORATION**

N:\Design-Drafting\Clients\_O-Z\United Nuclear Corporation\NECR Eastern Drainage Construction Completion Report\013-Sheet SAN\10501302D002

ISSUE	DESCRIPTION	TECH	ENG	DATE
0	FINAL	CF	TL	03/13/13

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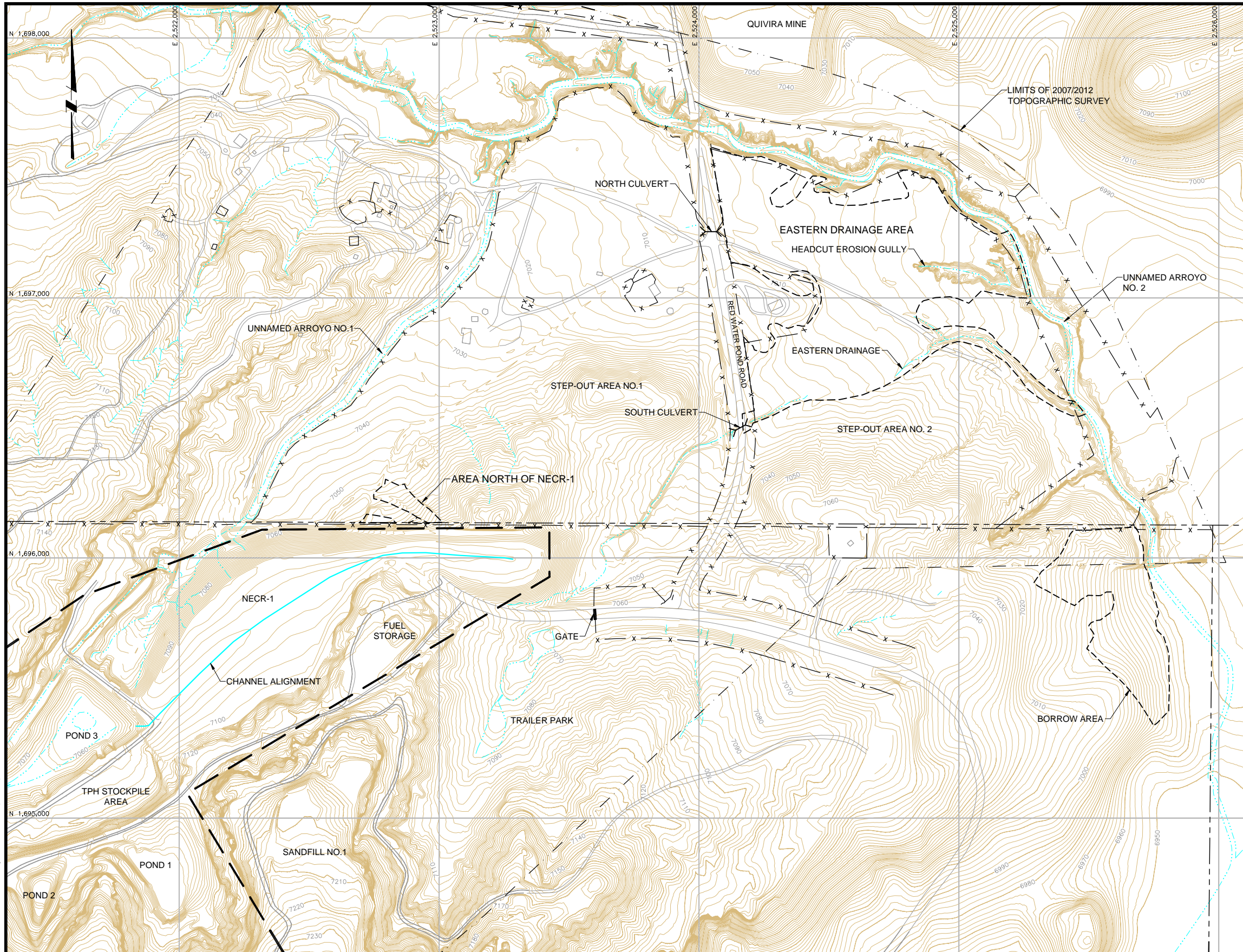
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DRAWN BY	C FOWLER	03/13/13
CHECKED BY	J REDMOND	03/13/13
APPROVED BY	T LEESON	03/13/13
PROJECT MANAGER	T LEESON	03/13/13
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P.O. BOX 3077  
Gallup, New Mexico 87305-3077

PROJECT LOCATION	NORTHEAST CHURCH ROCK MINE	
PROJECT	NECR EASTERN DRAINAGE CONSTRUCTION COMPLETION REPORT	
TITLE	COVER AND INDEX SHEET	
DRAWING	1	REVISION 0
FILE NAME	10501302D002	





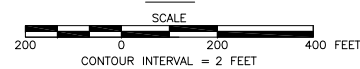
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- 7100 APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
- ROAD
- NATURAL DRAINAGE
- LIMITS OF 2007/2012 TOPOGRAPHIC SURVEY
- EXISTING FENCE
- APPROXIMATE NAVAJO NATION BOUNDARY
- NECR MINE PERMIT BOUNDARY
- REMOVAL ACTION BOUNDARY
- PHYSICAL STRUCTURE

**NOTES:**

1. STEP-OUT AREA NO.1 IS BOUNDED BY THE NAVAJO RESERVATION LINE, RED WATER POND ROAD, AND UNNAMED ARROYOS 1 AND 2.
2. STEP-OUT AREA NO.2 IS BOUNDED BY THE NAVAJO RESERVATION LINE, UNNAMED ARROYO NO. 2 AND RED WATER POND ROAD.

**PLAN**



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ISSUE	DESCRIPTION	TECH	ENG	DATE
0	FINAL	CF	TL	03/13/13

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**DRAWING REFERENCE(S):**  
1. ORIGINAL SURFACE TOPOGRAPHY GENERATED FROM AERIAL PHOTOGRAPHS DATED MAY 2007 BY COOPER AERIAL SURVEYS CO. AND USGS 10m DIGITAL ELEVATION MODELS (DEM).  
2. FINAL SURFACE TOPOGRAPHY SURVEY DATA PROVIDED BY MORRIS SURVEYING ENGINEERING, LLC, DATED DEC. 2012.

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

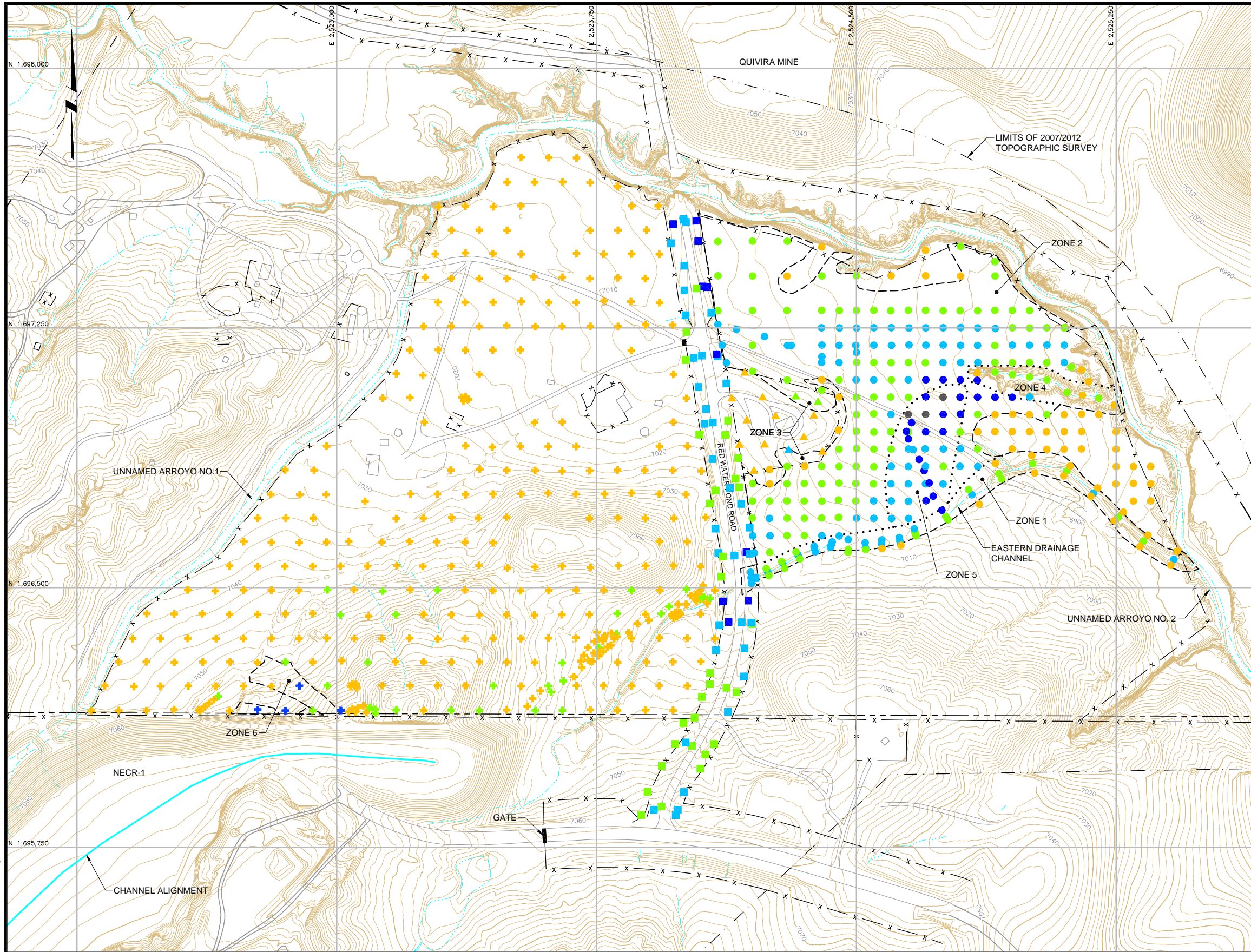
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PROJECT MANAGER	T LEESON	03/13/13
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PROJECT LOCATION	NORTHEAST CHURCH ROCK MINE	
PROJECT	NECR EASTERN DRAINAGE CONSTRUCTION COMPLETION REPORT	
TITLE	ORIGINAL CONDITIONS	

	DRAWING	2	REVISION	0
	FILE NAME	10501302D003		



**LEGEND:**

- 7100 APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
- ROAD
- NATURAL DRAINAGE
- LIMITS OF 2007/2012 TOPOGRAPHIC SURVEY
- EXISTING FENCE
- APPROXIMATE NAVAJO NATION BOUNDARY
- EXCAVATION AREA BOUNDARY
- ZONE AREA BOUNDARY
- PHYSICAL STRUCTURE

**2012 EPA SURVEY SHOWING Ra-226 (pCi/g) SURFACE SOIL CONCENTRATIONS**

- <2.24
- 2.24 ~ 6.0
- 6.1 ~ 9.1

**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

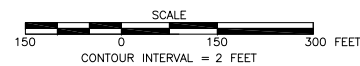
**2010 STATIC GAMMA MEASUREMENT LOCATIONS SHOWING EQUIVALENT Ra-226 (pCi/g) CONCENTRATION**

- <2.24
- 2.24 ~ 3.0
- > 3.0

**NOTE:**

1. A REMOVAL ACTION FOR IMPACTS ALONG AND ADJACENT TO RED WATER POND ROAD WAS CONCURRENTLY CONDUCTED BY RIO ALGOM.

**PLAN**



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2. FINAL SURFACE TOPOGRAPHY SURVEY DATA PROVIDED BY MORRIS SURVEYING ENGINEERING, LLC, DATED DEC. 2012.

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

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DRAWN BY	C FOWLER	03/13/13
CHECKED BY	J REDMOND	03/13/13
APPROVED BY	T LEESON	03/13/13
PROJECT MANAGER	T LEESON	03/13/13
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CLIENT REFERENCE NO.		

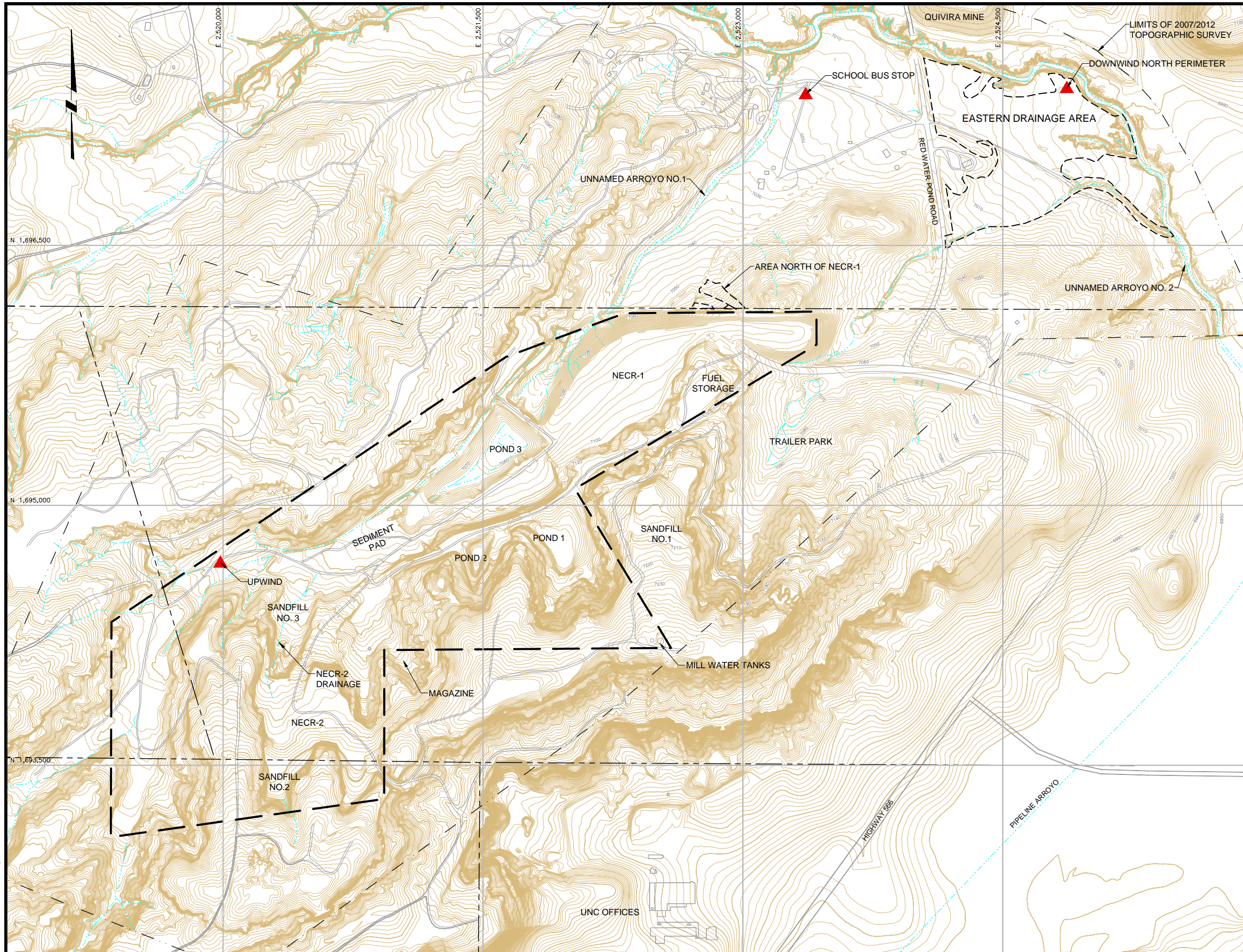


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PROJECT LOCATION	NORTHEAST CHURCH ROCK MINE	
PROJECT	NECR EASTERN DRAINAGE CONSTRUCTION COMPLETION REPORT	
TITLE	SUPPLEMENTAL RSE RESULTS AND PRELIMINARY CONSTRUCTION ZONES	

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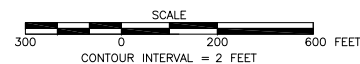




**LEGEND:**

- 7100 APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
- ROAD
- NATURAL DRAINAGE
- LIMITS OF 2007/2012 TOPOGRAPHIC SURVEY
- APPROXIMATE NAVAJO NATION BOUNDARY
- NECR MINE PERMIT BOUNDARY
- EDRA BOUNDARY
- PHYSICAL STRUCTURE
- AIR MONITORING STATION

**PLAN**



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ISSUE	REV	DESCRIPTION	TECH	ENG	DATE
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**PROJECTION:**  
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ZONE:  
NEW MEXICO WEST  
DATUM:  
NAD 83  
UNITS:  
US FEET

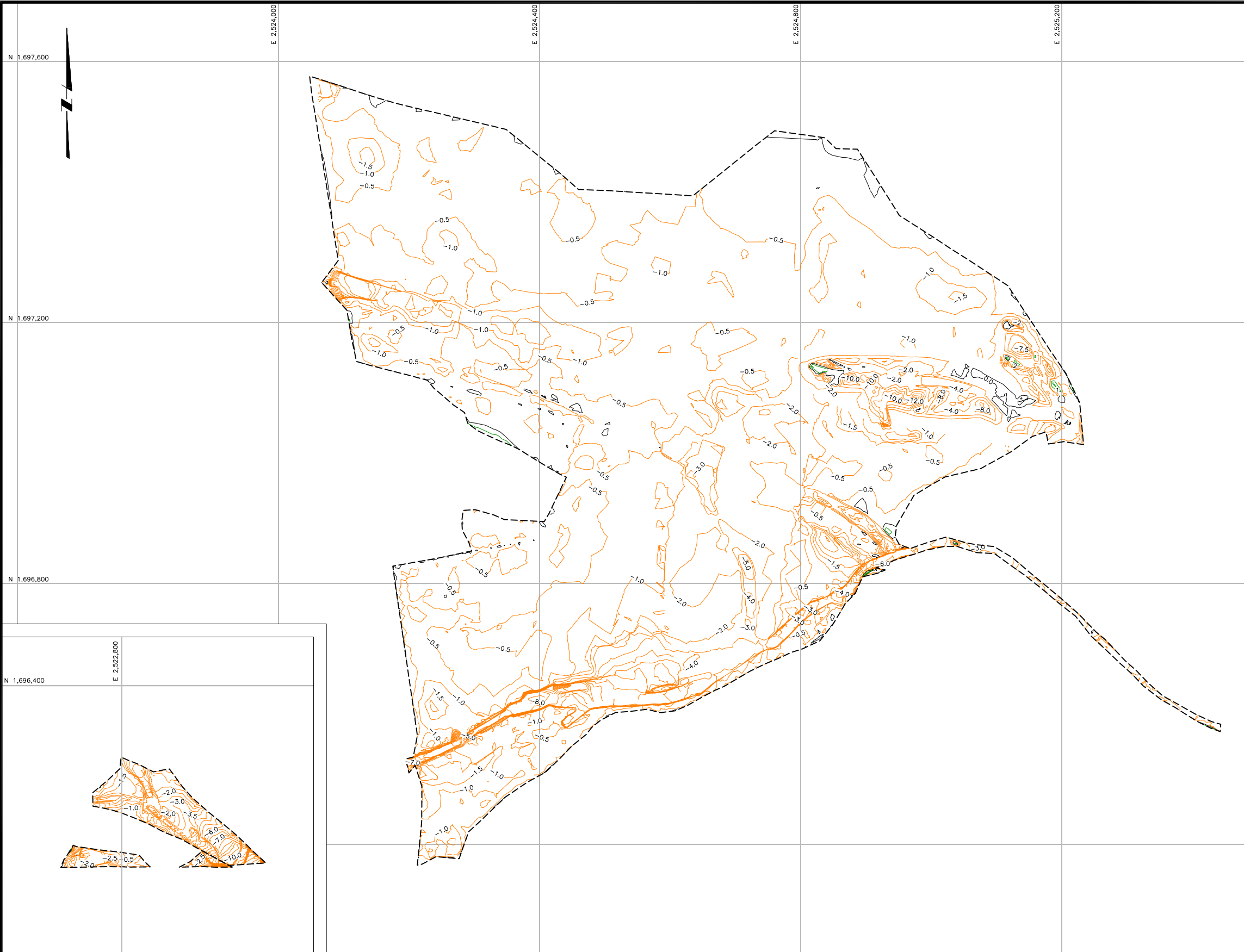
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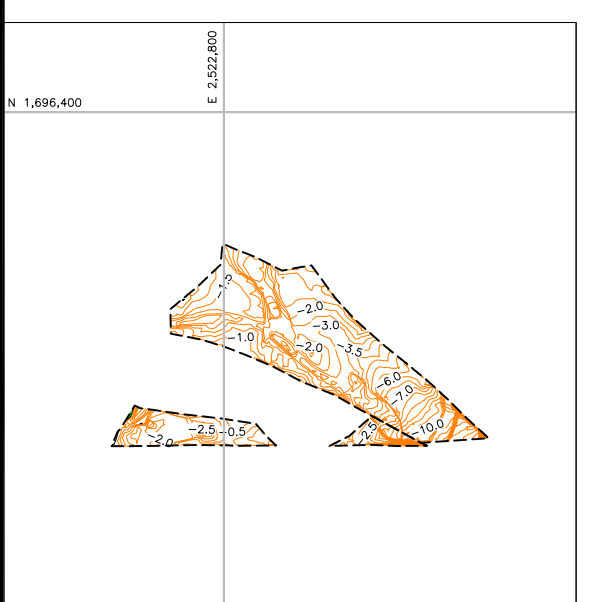
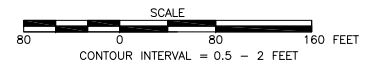
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PROJECT	NECR EASTERN DRAINAGE CONSTRUCTION COMPLETION REPORT	
TITLE	PERIMETER AIR MONITORING STATIONS	

	DRAWING	4	REVISION	0
	FILE NAME	10501302D015		



**LEGEND:**

- -0.5 ISOPACH CUT
- -0.5 ISOPACH FILL
- - - EXCAVATION AREA BOUNDARY



**AREA NORTH OF NECR-1 (ZONE 6)**  
(NOTE: SEE DRAWING 3 FOR LOCATION)

**EASTERN DRAINAGE AREA (ZONES 1 - 5)**

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ISSUE	DESCRIPTION	TECH	ENG	DATE
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2. FINAL SURFACE TOPOGRAPHY SURVEY DATA PROVIDED BY MORRIS SURVEYING ENGINEERING, LLC, DATED DEC. 2012.

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

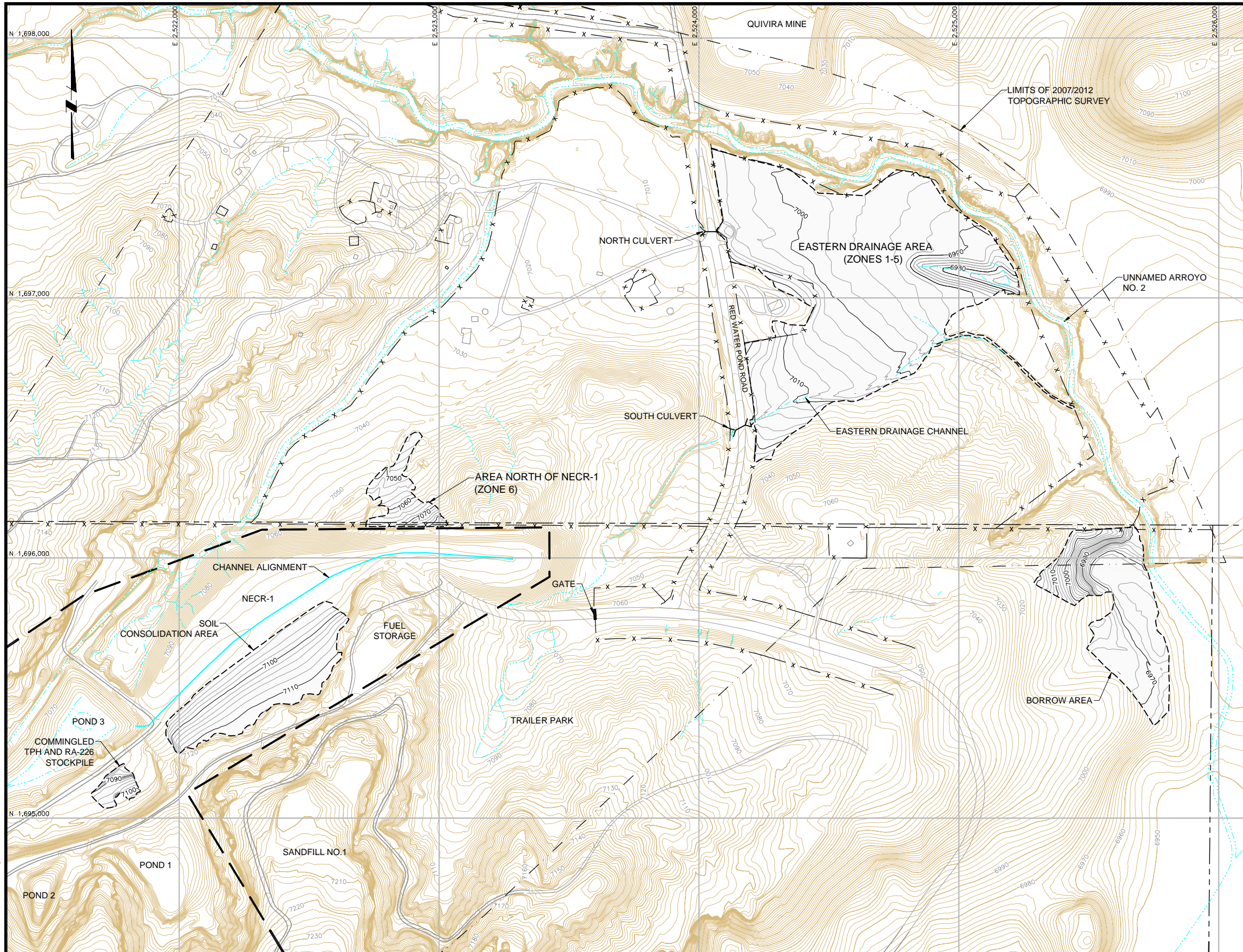
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CHECKED BY	J REDMOND	03/13/13
APPROVED BY	T LEESON	03/13/13
PROJECT MANAGER	T LEESON	03/13/13
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CLIENT REFERENCE NO.		



PROJECT LOCATION	NORTHEAST CHURCH ROCK MINE	
PROJECT	NECR EASTERN DRAINAGE CONSTRUCTION COMPLETION REPORT	
TITLE	EXCAVATION DEPTHS	

DRAWING	5	REVISION	0
	FILE NAME	10501302D016	

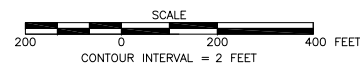




**LEGEND:**

	7100 APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
	7100 FINAL SURVEY TOPOGRAPHY AND ELEVATION, FEET
	ROAD
	NATURAL DRAINAGE
	LIMITS OF 2007/2012 TOPOGRAPHIC SURVEY
	EXISTING FENCE
	APPROXIMATE NAVAJO NATION BOUNDARY
	NECR MINE PERMIT BOUNDARY
	EXCAVATION AREA BOUNDARY
	PHYSICAL STRUCTURE
	DISTURBED AREA IN 2012

**PLAN**



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ISSUE	DESCRIPTION	TECH	ENG	DATE
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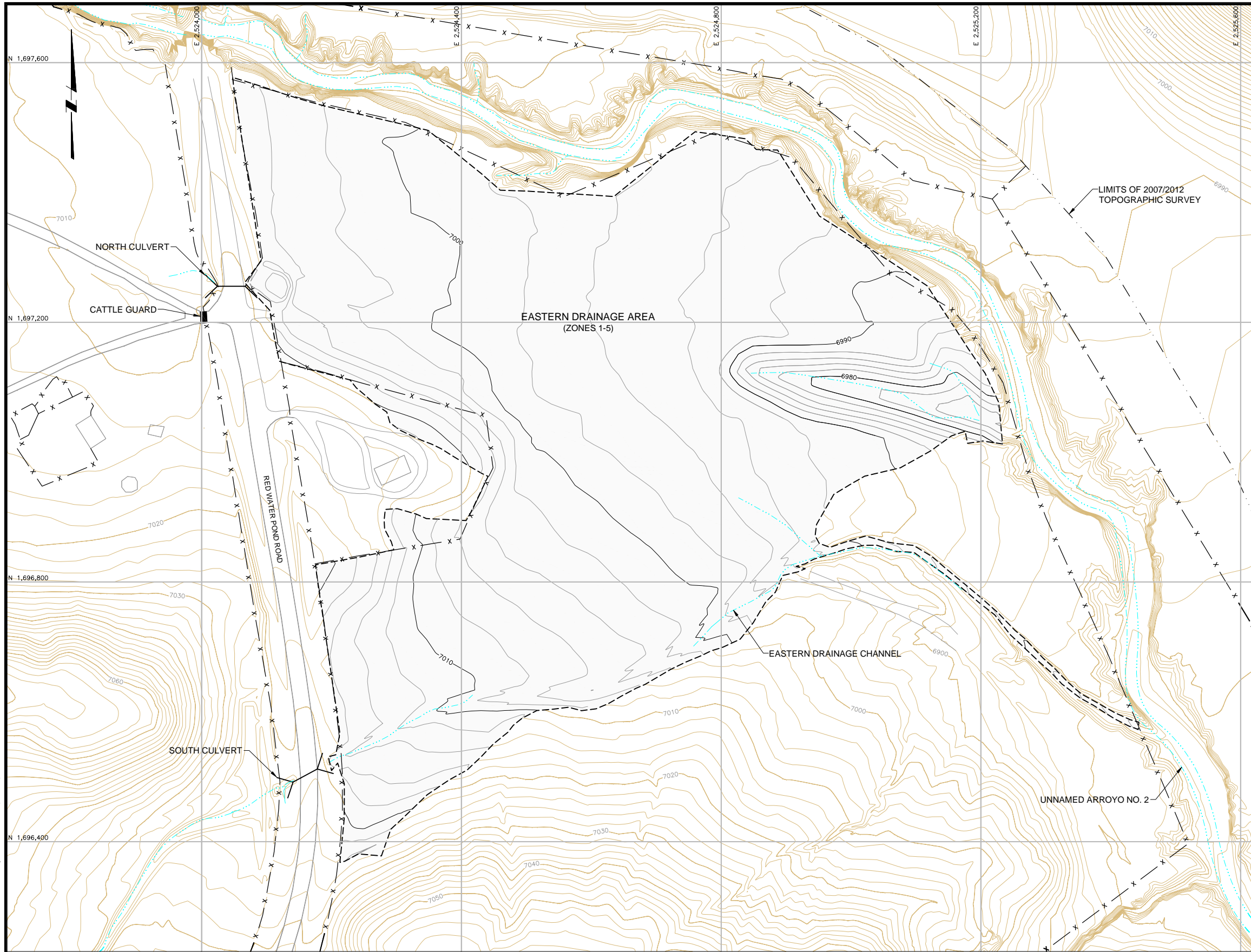
**PROJECTION:**  
STATE PLANE COORDINATES  
ZONE: NEW MEXICO WEST  
DATUM: NAD 83  
UNITS: US FEET

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DRAWN BY	C FOWLER	03/13/13
CHECKED BY	J REDMOND	03/13/13
APPROVED BY	T LEESON	03/13/13
PROJECT MANAGER	T LEESON	03/13/13
CLIENT APPROVAL		
CLIENT REFERENCE NO.		



PROJECT LOCATION	NORTHEAST CHURCH ROCK MINE	
PROJECT	NECR EASTERN DRAINAGE CONSTRUCTION COMPLETION REPORT	
TITLE	FINAL CONDITIONS	

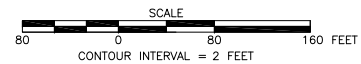
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	FILE NAME	10501302D004		



**LEGEND:**

- 7100 APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
- 7100 FINAL SURVEY TOPOGRAPHY AND ELEVATION, FEET
- ROAD
- NATURAL DRAINAGE
- - - LIMITS OF 2007/2012 TOPOGRAPHIC SURVEY
- x - EXISTING FENCE
- - - APPROXIMATE NAVAJO NATION BOUNDARY
- - - EXCAVATION AREA BOUNDARY
- PHYSICAL STRUCTURE

**PLAN**



N:\Design-Drawing\Clients\_Oz\United Nuclear Corporation\NECR Eastern Drainage Construction Completion\Rev\013-Sheet\_Series\10501302D005

ISSUE	DESCRIPTION	TECH	ENG	DATE
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**DRAWING REFERENCE(S):**  
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2. FINAL SURFACE TOPOGRAPHY SURVEY DATA PROVIDED BY MORRIS SURVEYING ENGINEERING, LLC, DATED DEC. 2012.

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

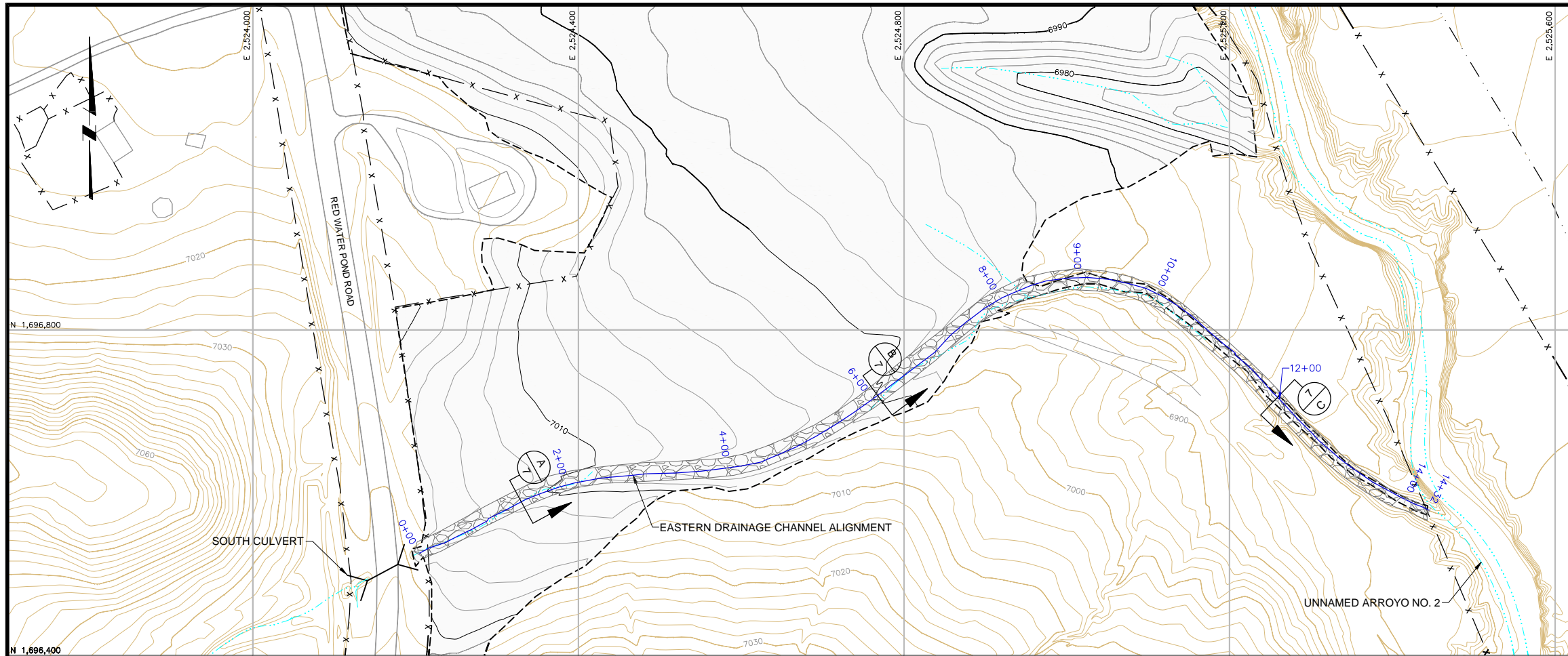
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DRAWN BY	C FOWLER	03/13/13
CHECKED BY	J REDMOND	03/13/13
APPROVED BY	T LEESON	03/13/13
PROJECT MANAGER	T LEESON	03/13/13
CLIENT APPROVAL		
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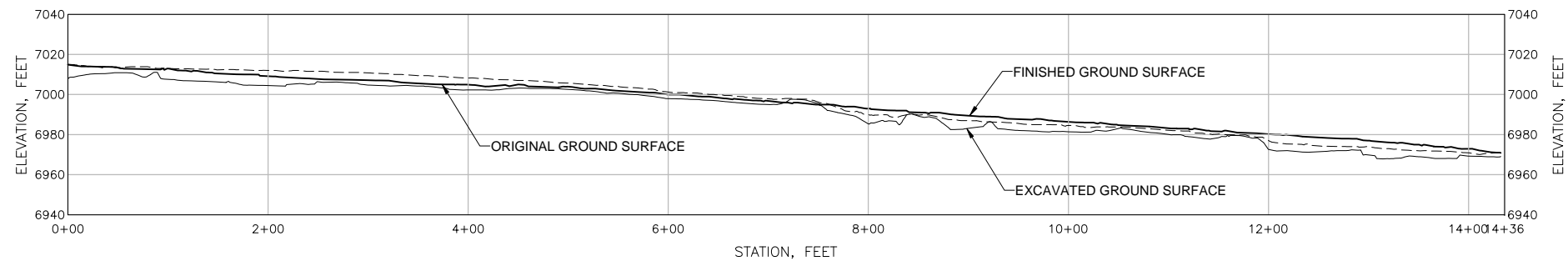
P.O. BOX 3077  
Gallup, New Mexico 87305-3077

PROJECT LOCATION	NORTHEAST CHURCH ROCK MINE	
PROJECT	NECR EASTERN DRAINAGE CONSTRUCTION COMPLETION REPORT	
TITLE	DETAILED FINAL CONDITIONS EASTERN DRAINAGE AREA	

	DRAWING	7	REVISION	0
	FILE NAME	10501302D005		



**PLAN**  
SCALE  
80 0 80 160 FEET  
CONTOUR INTERVAL = 2 FEET



**PROFILE**  
**EASTERN DRAINAGE CHANNEL**

VERTICAL SCALE      HORIZONTAL SCALE  
40 0 40 FEET 80      0 80 FEET  
VERTICAL EXAGGERATION = 2X

**NOTE:**

1. FINISHED GROUND SURFACE ALONG THE CHANNEL IS THE TOP OF THE RIP RAP LAYER.

N:\Design-Drawing\Clients\_Oz\United Nuclear Corporation\NECR Eastern Drainage Construction Completion Report\013-Sheet Set\10501302D006

0	FINAL	CF	TL	03/13/13
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2. FINAL SURFACE TOPOGRAPHY SURVEY DATA PROVIDED BY MORRIS SURVEYING ENGINEERING, LLC, DATED DEC. 2012.

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

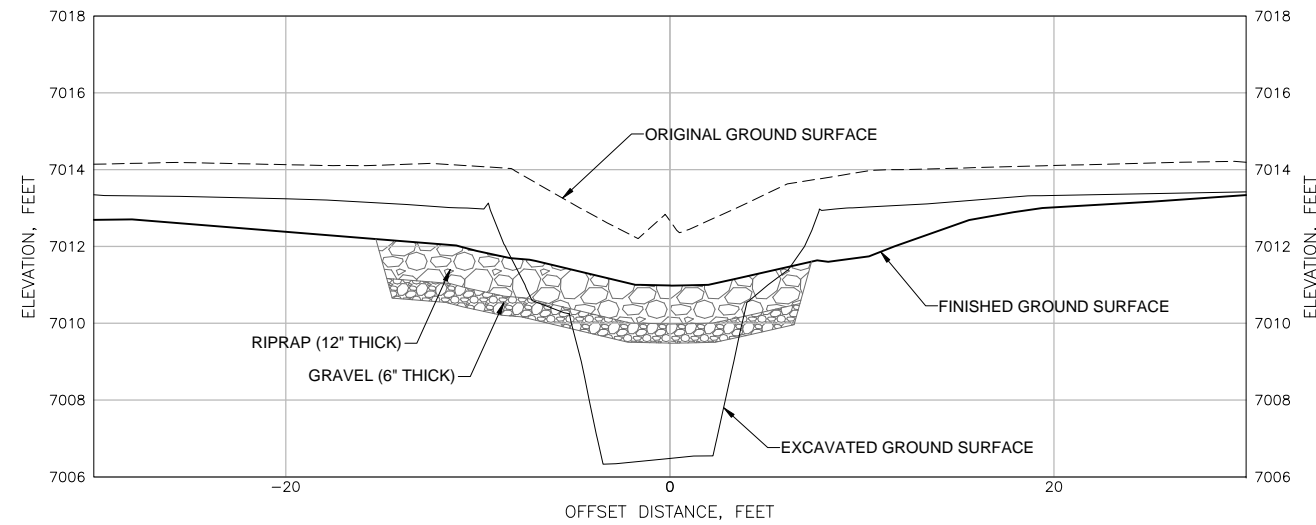
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DRAWN BY	C FOWLER	03/13/13
CHECKED BY	J REDMOND	03/13/13
APPROVED BY	T LEESON	03/13/13
PROJECT MANAGER	T LEESON	03/13/13
CLIENT APPROVAL		
CLIENT REFERENCE NO.		



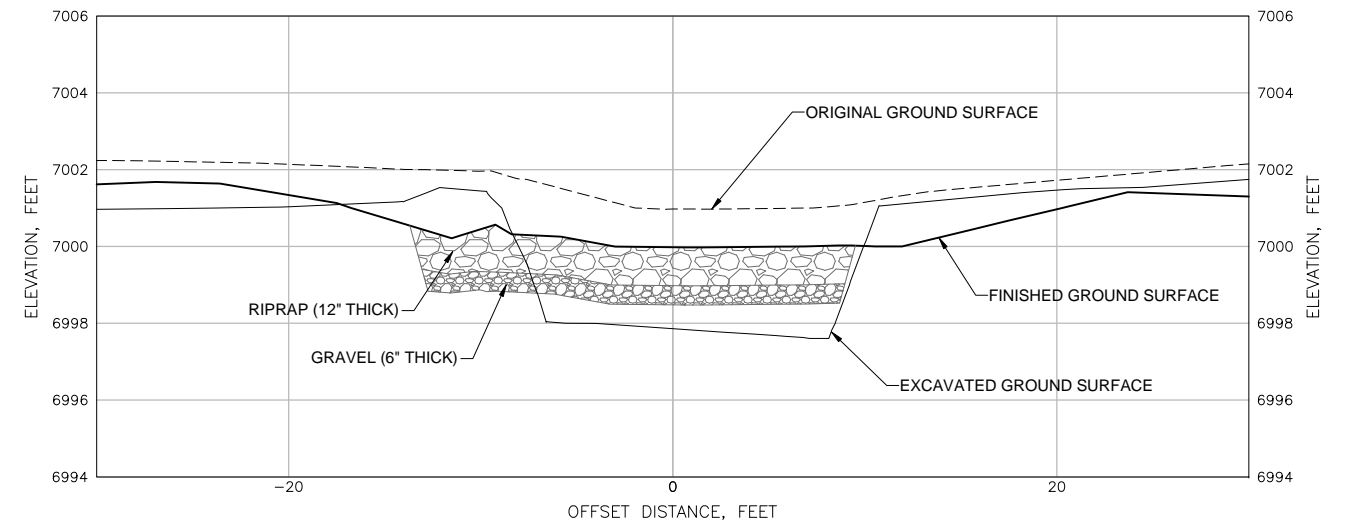
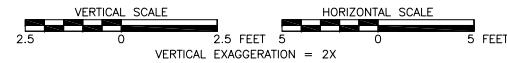
PROJECT LOCATION	NORTHEAST CHURCH ROCK MINE	
PROJECT	NECR EASTERN DRAINAGE CONSTRUCTION COMPLETION REPORT	
TITLE	PLAN AND PROFILE EASTERN DRAINAGE CHANNEL	

DRAWING	8	REVISION	0
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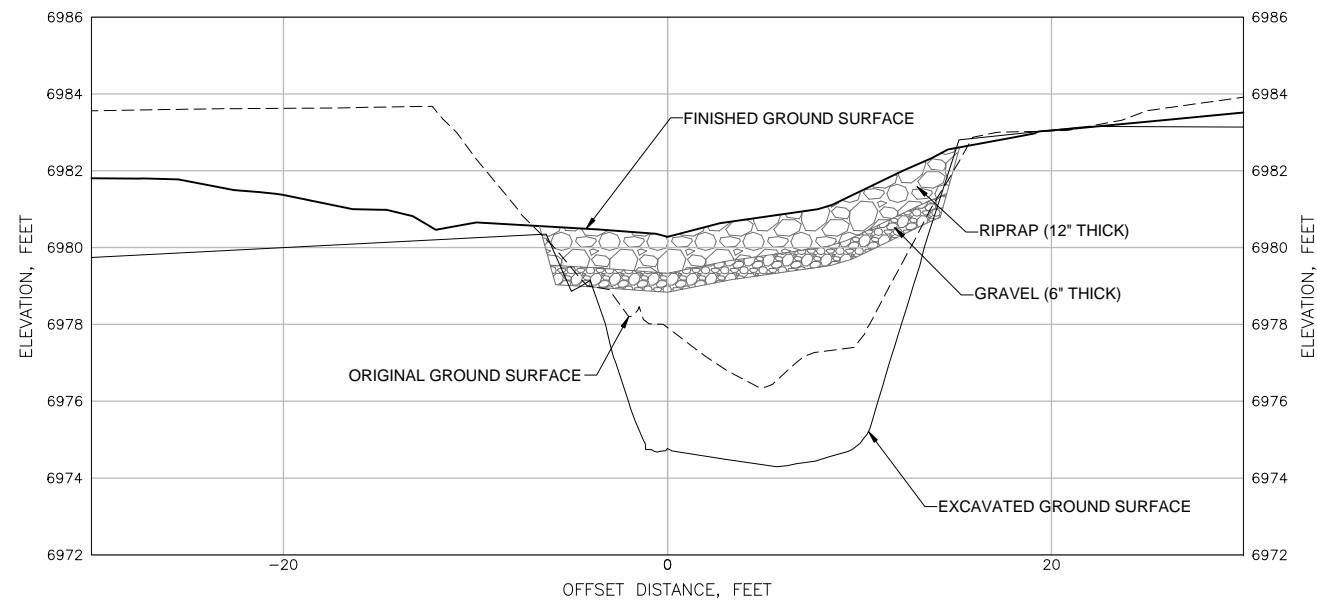




**A**  
SECTION  
**6**



**B**  
SECTION  
**6**



**C**  
SECTION  
**6**



**NOTES:**

- 1. RIPRAP D<sub>50</sub> = 6 IN.

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ISSUE	REV	DESCRIPTION	TECH	ENG	DATE
0		FINAL	CF	TL	03/13/13

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DESIGNED BY	T LEESON	03/13/13
DRAWN BY	C FOWLER	03/13/13
CHECKED BY	J REDMOND	03/13/13
APPROVED BY	T LEESON	03/13/13
PROJECT MANAGER	T LEESON	03/13/13
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

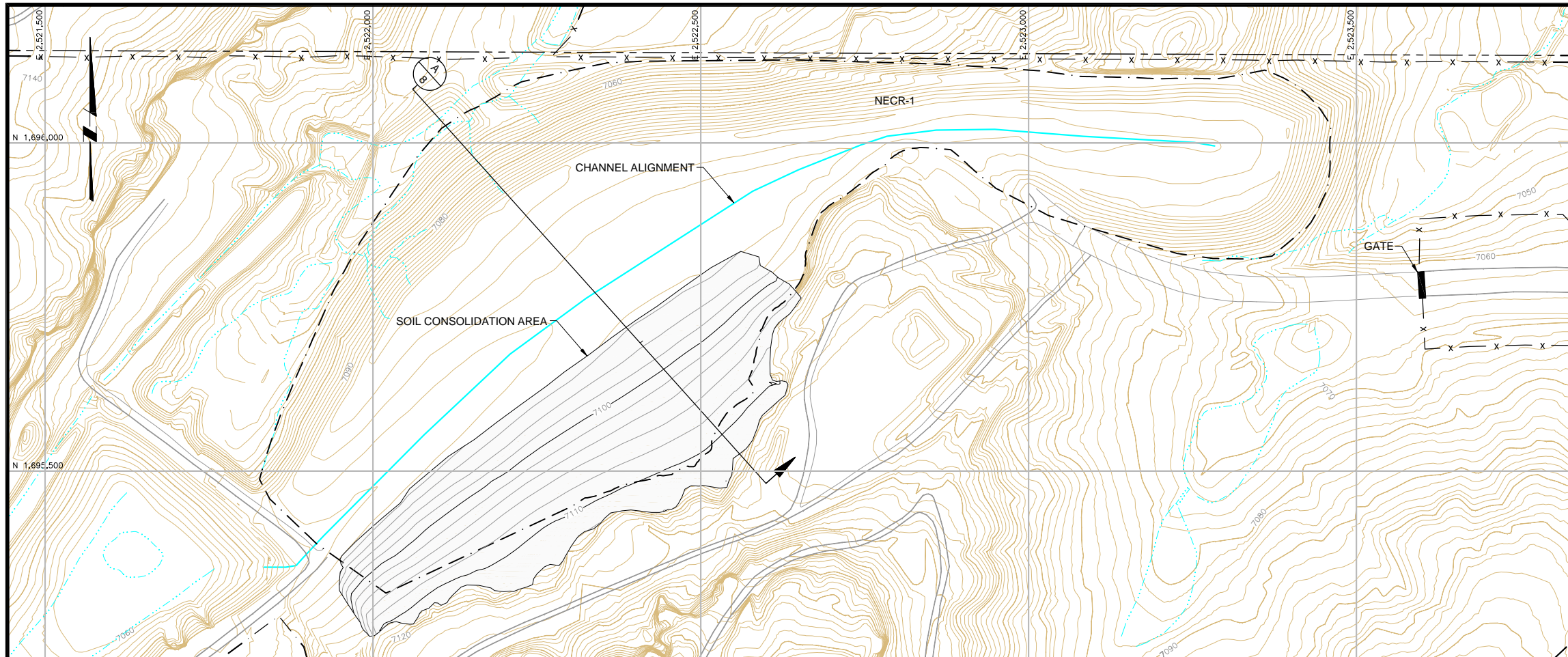


P.O. BOX 3077  
Gallup, New Mexico 87305-3077

PROJECT LOCATION	NORTHEAST CHURCH ROCK MINE	
PROJECT	NECR EASTERN DRAINAGE CONSTRUCTION COMPLETION REPORT	
TITLE	PROFILE SECTIONS EASTERN DRAINAGE CHANNEL	



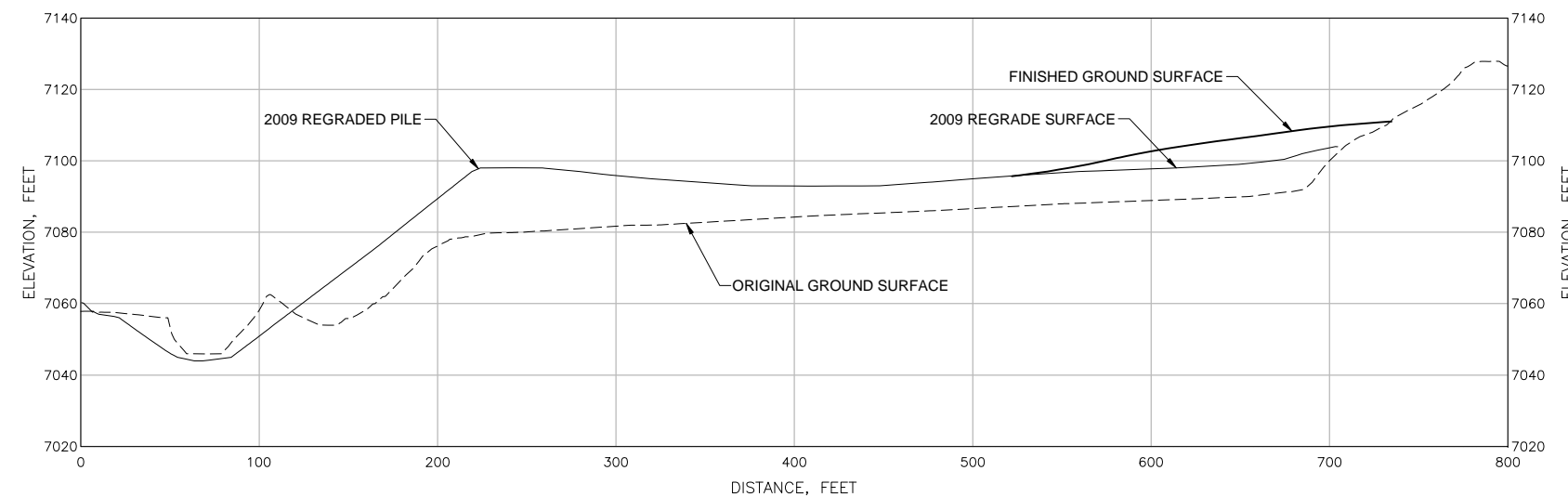
DRAWING	9	REVISION	0
FILE NAME	10501302D007		



**LEGEND:**

	7100	APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
	7100	FINAL SURVEY TOPOGRAPHY AND ELEVATION, FEET
		ROAD
		NATURAL DRAINAGE
		FACILITY BOUNDARY
		EXISTING FENCE
		APPROXIMATE NAVAJO NATION BOUNDARY
		PHYSICAL STRUCTURE

**PLAN**  
SCALE  
50 0 50 100 FEET  
CONTOUR INTERVAL = 2 FEET



**SECTION**  
**NECR-1**  
A  
8  
VERTICAL SCALE  
HORIZONTAL SCALE  
VERTICAL EXAGGERATION = 2X

**NOTE:**  
1. FINISHED GROUND SURFACE IS THE TOP OF THE SIX INCH SOIL COVER.

N:\Design-Drawing\Clients\_Oz\United Nuclear Corporation\NECR Eastern Drainage Construction Completion\Rev\013-Sheet\_SAA\10501302D008

0	FINAL	CF	TL	03/13/13
ISSUE	DESCRIPTION	TECH	ENG	DATE
REV				

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2. FINAL SURFACE TOPOGRAPHY SURVEY DATA PROVIDED BY MORRIS SURVEYING ENGINEERING, LLC, DATED DEC. 2012.

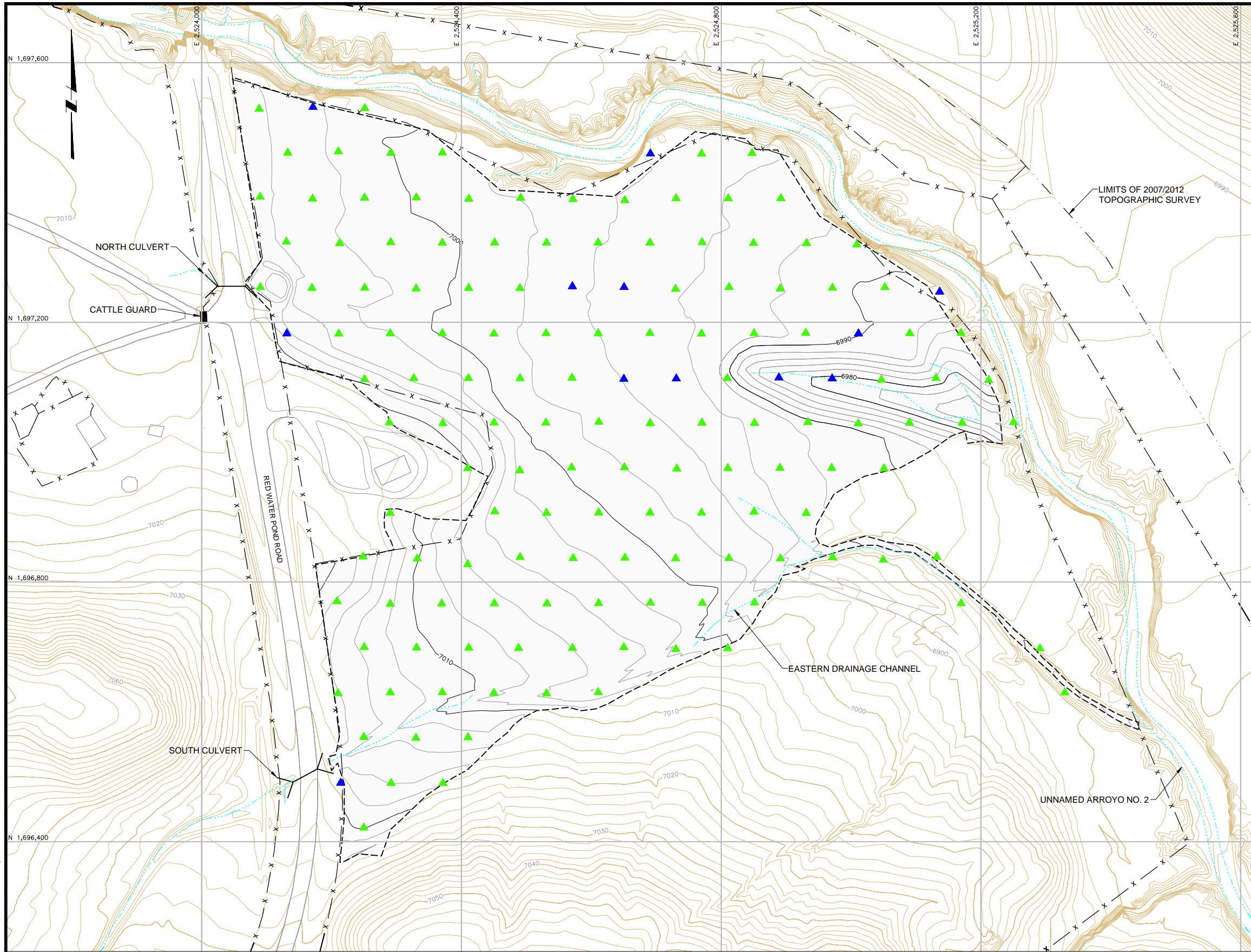
**PROJECTION:**  
STATE PLANE COORDINATES  
ZONE:  
NEW MEXICO WEST  
DATUM:  
NAD 83  
UNITS:  
US FEET

DESIGNED BY	T LEESON	03/13/13
DRAWN BY	C FOWLER	03/13/13
CHECKED BY	J REDMOND	03/13/13
APPROVED BY	T LEESON	03/13/13
PROJECT MANAGER	T LEESON	03/13/13
CLIENT APPROVAL		
CLIENT REFERENCE NO.		



PROJECT LOCATION	NORTHEAST CHURCH ROCK MINE	
PROJECT	NECR EASTERN DRAINAGE CONSTRUCTION COMPLETION REPORT	
TITLE	DETAILED FINAL CONDITIONS SOIL CONSOLIDATION AREA	

	DRAWING	10	REVISION	0
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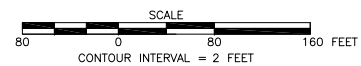


- LEGEND:**
- 7100 APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
  - 7100 FINAL SURVEY TOPOGRAPHY AND ELEVATION, FEET
  - ROAD
  - NATURAL DRAINAGE
  - LIMITS OF 2007/2012 TOPOGRAPHIC SURVEY
  - EXISTING FENCE
  - APPROXIMATE NAVAJO NATION BOUNDARY
  - EXCAVATION AREA BOUNDARY
  - PHYSICAL STRUCTURE

**POST-EXCAVATION STATIC GAMMA SAMPLE LOCATIONS SHOWING EQUIVALENT Ra-226 (pCi/g) CONCENTRATION**

- 0.3 - 2.2
- 2.3 - 2.7

**PLAN**



N:\Design-Drawing\Clients\_Oz\United Nuclear Corporation\NECR Eastern Drainage Construction Completion Rev\013-Sheet Set\10501302D009

ISSUE	DESCRIPTION	TECH	ENG	DATE
0	FINAL	CF	TL	03/13/13

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2. FINAL SURFACE TOPOGRAPHY SURVEY DATA PROVIDED BY MORRIS SURVEYING ENGINEERING, LLC, DATED DEC. 2012.

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

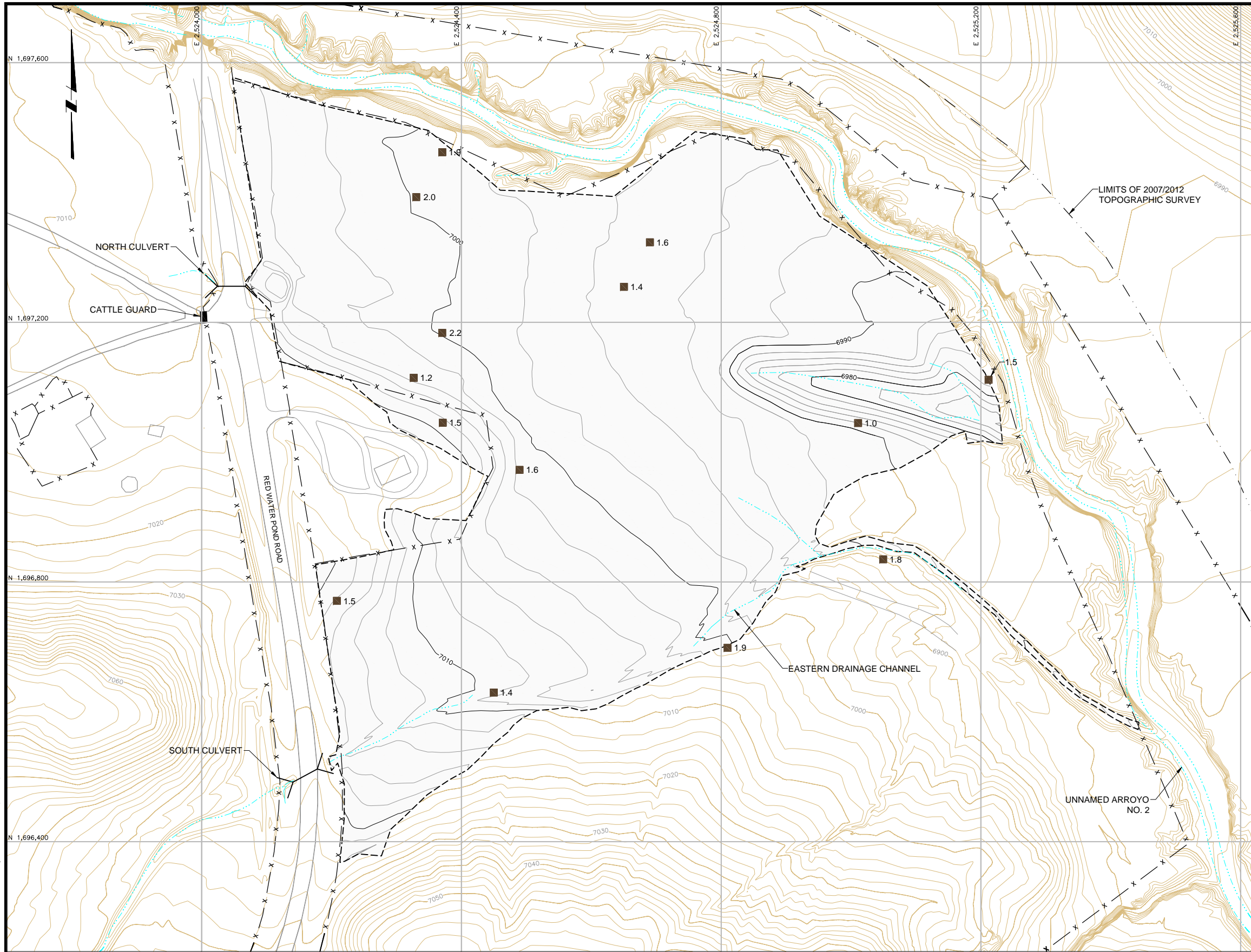
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DRAWN BY	C FOWLER	03/13/13
CHECKED BY	J REDMOND	03/13/13
APPROVED BY	T LEESON	03/13/13
PROJECT MANAGER	T LEESON	03/13/13
CLIENT APPROVAL		
CLIENT REFERENCE NO.		



PROJECT LOCATION	NORTHEAST CHURCH ROCK MINE	
PROJECT	NECR EASTERN DRAINAGE CONSTRUCTION COMPLETION REPORT	
TITLE	POST-EXCAVATION STATIC GAMMA SURVEY RESULTS - ZONES 2 - 5	

	DRAWING	11	REVISION	0
	FILE NAME	10501302D009		

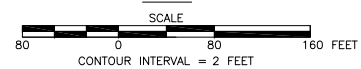




**LEGEND:**

- 7100 APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
- 7100 FINAL SURVEY TOPOGRAPHY AND ELEVATION, FEET
- ROAD
- NATURAL DRAINAGE
- LIMITS OF 2007/2012 TOPOGRAPHIC SURVEY
- EXISTING FENCE
- APPROXIMATE NAVAJO NATION BOUNDARY
- EXCAVATION AREA BOUNDARY
- PHYSICAL STRUCTURE
- 1.0 POST-EXCAVATION SURFACE SOIL SAMPLE LOCATION AND Ra-226 (pCi/g) CONCENTRATION

**PLAN**



N:\Design-Drawing\Clients\_Oz\United Nuclear Corporation\NECR Eastern Drainage Construction Completion Rev\013-Sheet Set\10501302D012

ISSUE	DESCRIPTION	TECH	ENG	DATE
0	FINAL	CF	TL	03/13/13

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2. FINAL SURFACE TOPOGRAPHY SURVEY DATA PROVIDED BY MORRIS SURVEYING ENGINEERING, LLC, DATED DEC. 2012.

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

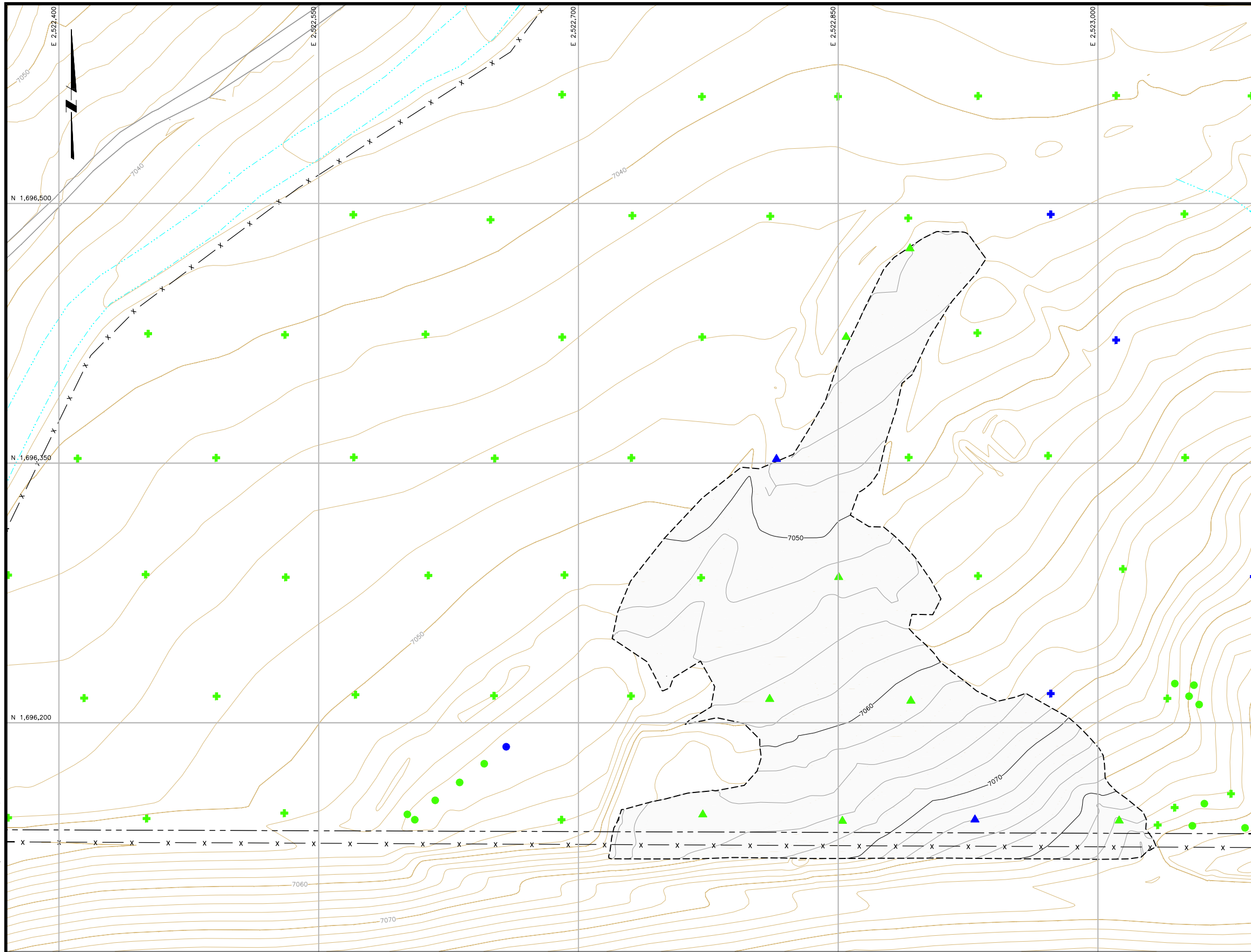
DESIGNED BY	T LEESON	03/13/13
DRAWN BY	C FOWLER	03/13/13
CHECKED BY	J REDMOND	03/13/13
APPROVED BY	T LEESON	03/13/13
PROJECT MANAGER	T LEESON	03/13/13
CLIENT APPROVAL		
CLIENT REFERENCE NO.		



P.O. BOX 3077  
Gallup, New Mexico 87305-3077

PROJECT LOCATION	NORTHEAST CHURCH ROCK MINE	
PROJECT	NECR EASTERN DRAINAGE CONSTRUCTION COMPLETION REPORT	
TITLE	POST-EXCAVATION SURFACE SOIL ANALYTICAL RESULTS - ZONES 2 - 5	

	DRAWING	12	REVISION	0
	FILE NAME	10501302D012		



**LEGEND:**

- 7100 APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
- 7100 FINAL SURVEY TOPOGRAPHY AND ELEVATION, FEET
- ROAD
- NATURAL DRAINAGE
- EXISTING FENCE
- APPROXIMATE NAVAJO NATION BOUNDARY
- EXCAVATION AREA BOUNDARY
- PHYSICAL STRUCTURE

**2009 IRA SURVEY SHOWING EQUIVALENT Ra-226 (pCi/g) CONCENTRATION**

- 0.6 - 2.2
- 2.3 - 2.8

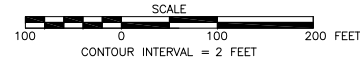
**2009 IRA RESURVEY SHOWING EQUIVALENT Ra-226 (pCi/g) CONCENTRATION**

- 0.6 - 2.2
- 2.3 - 2.8

**POST-EXCAVATION ZONE 6 EDRA SURVEY SHOWING EQUIVALENT Ra-226 (pCi/g) CONCENTRATION**

- 0.6 - 2.2
- 2.3 - 2.8

**PLAN**



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ISSUE NO.	DESCRIPTION	TECH	ENG	DATE
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2. FINAL SURFACE TOPOGRAPHY SURVEY DATA PROVIDED BY MORRIS SURVEYING ENGINEERING, LLC, DATED DEC. 2012.

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

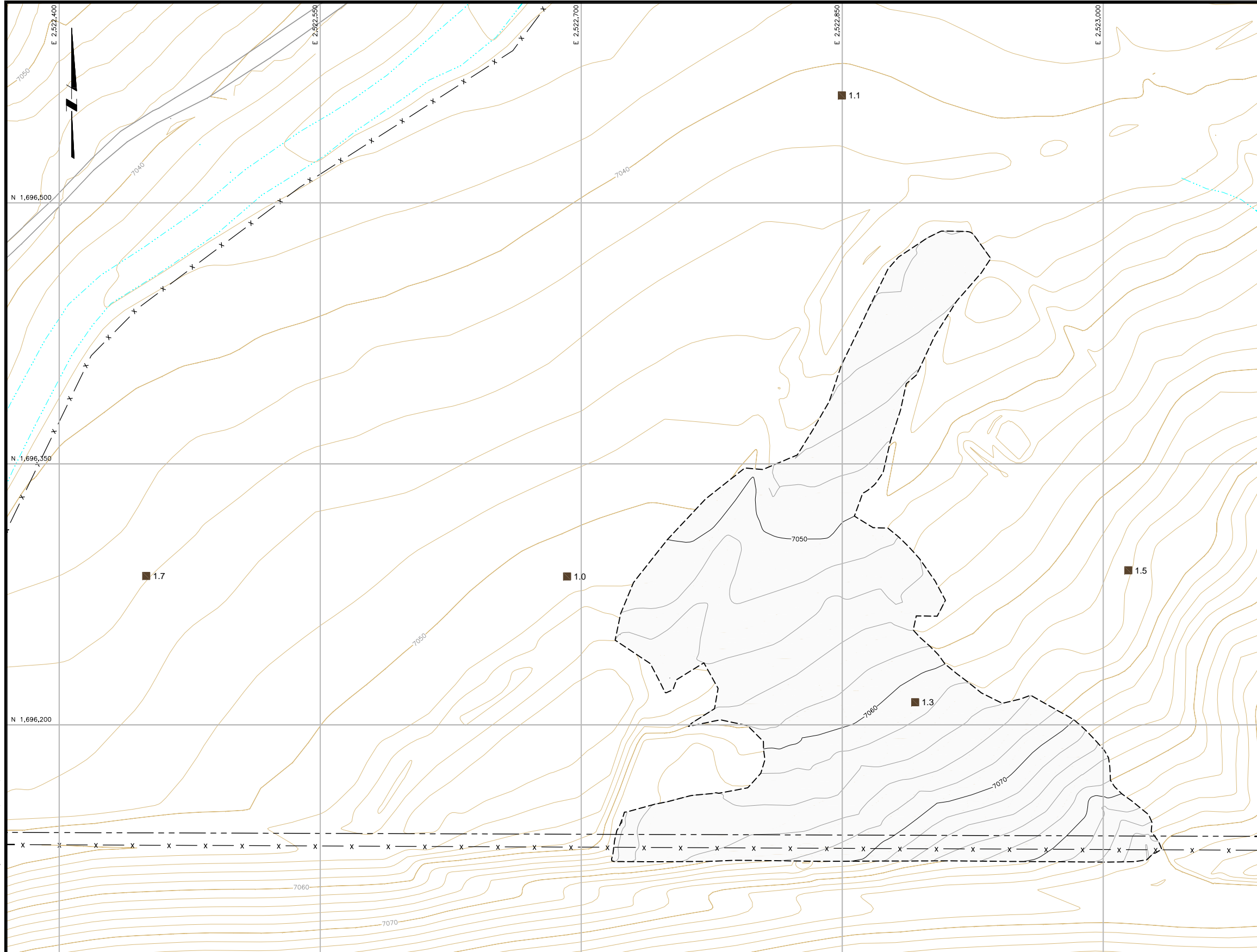
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DRAWN BY	C FOWLER	03/13/13
CHECKED BY	J REDMOND	03/13/13
APPROVED BY	T LEESON	03/13/13
PROJECT MANAGER	T LEESON	03/13/13
CLIENT APPROVAL		
CLIENT REFERENCE NO.		



PROJECT LOCATION	NORTHEAST CHURCH ROCK MINE	
PROJECT	NECR EASTERN DRAINAGE CONSTRUCTION COMPLETION REPORT	
TITLE	POST-EXCAVATION STATIC GAMMA SURVEY RESULTS - ZONE 6	

DRAWING	13	REVISION	0
	FILE NAME	10501302D011	





**LEGEND:**

	7100	APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
	7100	FINAL SURVEY TOPOGRAPHY AND ELEVATION, FEET
		ROAD
		NATURAL DRAINAGE
		EXISTING FENCE
		APPROXIMATE NAVAJO NATION BOUNDARY
		EXCAVATION AREA BOUNDARY
		PHYSICAL STRUCTURE
	1.0	POST-EXCAVATION SURFACE SOIL SAMPLE LOCATION AND Ra-226 (pCi/g) CONCENTRATION

**PLAN**  
SCALE  
100 0 100 200 FEET  
CONTOUR INTERVAL = 2 FEET

N:\Design-Drawing\Clients\_Oz\United Nuclear Corporation\NECR Eastern Drainage Construction Completion Report\013-Sheet Set\10501302D010

ISSUE	DESCRIPTION	TECH	ENG	DATE
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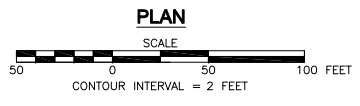
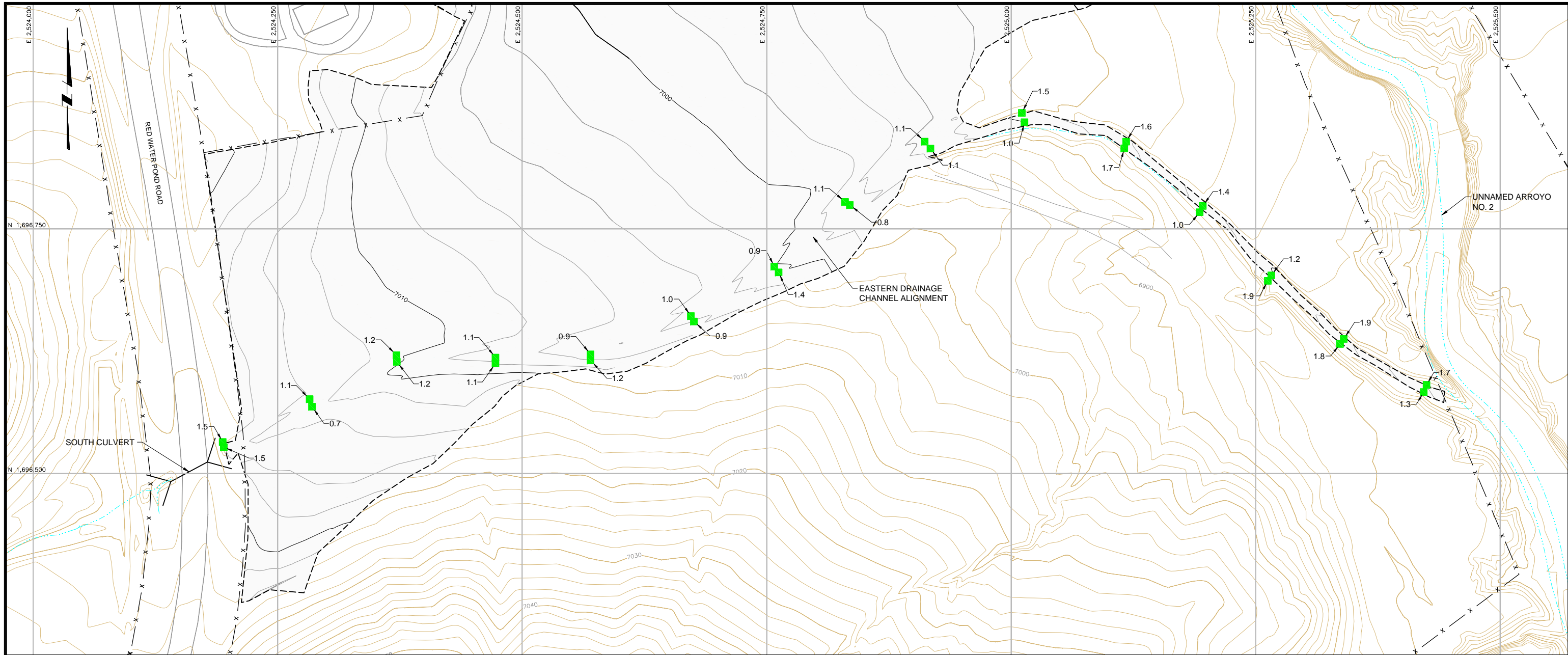
**PROJECTION:**  
STATE PLANE COORDINATES  
ZONE:  
NEW MEXICO WEST  
DATUM:  
NAD 83  
UNITS:  
US FEET

DESIGNED BY	T LEESON	03/13/13
DRAWN BY	C FOWLER	03/13/13
CHECKED BY	J REDMOND	03/13/13
APPROVED BY	T LEESON	03/13/13
PROJECT MANAGER	T LEESON	03/13/13
CLIENT APPROVAL		
CLIENT REFERENCE NO.		



PROJECT LOCATION	NORTHEAST CHURCH ROCK MINE	
PROJECT	NECR EASTERN DRAINAGE CONSTRUCTION COMPLETION REPORT	
TITLE	POST-EXCAVATION SURFACE SOIL ANALYTICAL RESULTS - ZONE 6	

	DRAWING	14	REVISION	0
	FILE NAME	10501302D010		



**LEGEND:**

- 7100- APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
- 7100- FINAL SURVEY TOPOGRAPHY AND ELEVATION, FEET
- ROAD
- NATURAL DRAINAGE
- EXISTING FENCE
- EXCAVATION AREA BOUNDARY
- 1.0 POST-EXCAVATION SUBSURFACE SOIL SAMPLE LOCATION AND Rg-226 (pCi/g) CONCENTRATION

N:\Design-Drawing\Clients\_Oz\United Nuclear Corporation\NECR Eastern Drainage Construction Completion Report\013-Sheet Set\01302D013

ISSUE	REV	DESCRIPTION	TECH	ENG	DATE
0		FINAL	CF	TL	03/13/13

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**DRAWING REFERENCE(S):**

- ORIGINAL SURFACE TOPOGRAPHY GENERATED FROM AERIAL PHOTOGRAPHS DATED MAY 2007 BY COOPER AERIAL SURVEYS CO. AND USGS 10m DIGITAL ELEVATION MODELS (DEM).
- FINAL SURFACE TOPOGRAPHY SURVEY DATA PROVIDED BY MORRIS SURVEYING ENGINEERING, LLC, DATED DEC. 2012.

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

DESIGNED BY	T LEESON	03/13/13
DRAWN BY	C FOWLER	03/13/13
CHECKED BY	J REDMOND	03/13/13
APPROVED BY	T LEESON	03/13/13
PROJECT MANAGER	T LEESON	03/13/13
CLIENT APPROVAL		
CLIENT REFERENCE NO.		



PROJECT LOCATION	NORTHEAST CHURCH ROCK MINE	
PROJECT	NECR EASTERN DRAINAGE CONSTRUCTION COMPLETION REPORT	
TITLE	POST-EXCAVATION SUBSURFACE SOIL ANALYTICAL RESULTS - ZONE 1	

	DRAWING	15	REVISION	0
	FILE NAME	10501302D013		

## APPENDICES

**APPENDIX A**  
**WEEKLY CONSTRUCTION REPORTS AND FIELD NOTES**

Date: Wednesday, September 6, 2012  
 Weather: Partly cloudy, 85 F  
 Weather impact on construction: none  
 Site conditions: good

<b>ON-SITE CONSTRUCTION STAFF</b>	<b>Superintendent</b>	<b>Foreman</b>	<b>Engineers</b>	<b>Equip. Operator</b>	<b>Truck Operator</b>	<b>Laborer</b>	<b>Mechanic</b>	<b>Administration</b>	<b>Surveyor</b>	<b>Other</b>	<b>Subtotal</b>
AMEC	1	1	2			6					10
Morris Survey									1		1
AVM											0
Dinetahdoo											0
Gallup Security										2	2
<b>TOTAL STAFF ON-SITE</b>											<b>13</b>

**MAJOR EQUIPMENT ON SITE**

Below

**RECORD OF MAJOR DELIVERIES**

- 1 - John Deere 350D trackhoe
- 1 - John Deere 670B motor grader
- 50 - straw bales

**DAILY OBSERVATION OF CONSTRUCTION OPERATIONS  
 NORTHEAST CHURCH ROCK MINE REMOVAL ACTION**


**WORK PERFORMED/PROGRESS**


<b>GENERAL SITE WORK</b>	<ul style="list-style-type: none"> <li>- Installation of silt fences</li> <li>- Surveying areas for pre-construction topography</li> <li>- Stakes placed for grading survey</li> <li>- Fence installed inside Zone 3 for septic lines</li> </ul>
<b>MWH/AVM</b>	<ul style="list-style-type: none"> <li>- Communication with Dinetahdoo and AMEC regarding arch buffer zone intersection with East Drainage.</li> <li>- Installation of dust monitoring equipment for baseline readings.</li> <li>- Meeting with construction crew to review safety issues and general scope of work.</li> </ul>

<b>DEFICIENCIES/ISSUES RESOLVED BY END OF SHIFT</b>	None
<b>DEFICIENCIES/ISSUES NOT RESOLVED BY END OF SHIFT</b>	- Jesse with Clear Creek is reviewing requests to alter the seed mix that will be used for revegetation.
<b>SAFETY/ ENVIRONMENTAL ISSUES</b>	None





<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID: 1</b>	
<b>Photo Location:</b> Western TPH area, Zone 6	
<b>Direction:</b> East	
<b>Survey Date:</b> 9/5/2012	
<b>Comments:</b>	


<b>Photograph ID: 2</b>	
<b>Photo Location:</b> Eastern TPH area, Zone 6	
<b>Direction:</b> West	
<b>Survey Date:</b> 9/5/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 3	
<b>Photo Location:</b> Borrow area	
<b>Direction:</b> North	
<b>Survey Date:</b> 9/5/2012	
<b>Comments:</b>	

<b>Photograph ID:</b> 4	
<b>Photo Location:</b> Soil Consolidation Area	
<b>Direction:</b> Southwest	
<b>Survey Date:</b> 9/5/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 5	
<b>Photo Location:</b> Commingled Area	
<b>Direction:</b> Southwest	
<b>Survey Date:</b> 9/5/2012	
<b>Comments:</b>	


<b>Photograph ID:</b> 6	
<b>Photo Location:</b> Hill west of RWPR	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 9/5/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID: 7</b>	
<b>Photo Location:</b> Hill west of RWPR	
<b>Direction:</b> East	
<b>Survey Date:</b> 9/5/2012	
<b>Comments:</b>	


<b>Photograph ID: 8</b>	
<b>Photo Location:</b> Residence north fence	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 9/5/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>


<b>Photograph ID:</b> 9	
<b>Photo Location:</b> Residence north fence	
<b>Direction:</b> North	
<b>Survey Date:</b> 9/7/2012	
<b>Comments:</b> Day 1 of material transport	

<b>Photograph ID:</b> 10	
<b>Photo Location:</b> South hill	
<b>Direction:</b> Northwest	
<b>Survey Date:</b> 9/5/2012	
<b>Comments:</b>	

<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID: 11</b>	
<b>Photo Location:</b> South hill	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 9/5/2012	
<b>Comments:</b>	

<b>Photograph ID: 12</b>	
<b>Photo Location:</b> South hill	
<b>Direction:</b> North	
<b>Survey Date:</b> 9/5/2012	
<b>Comments:</b>	

<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>
<b>Photograph ID:</b> 13			
<b>Photo Location:</b> East drainage			
<b>Direction:</b> East			
<b>Survey Date:</b> 9/5/2012			
<b>Comments:</b>			


NECR MINE SITE  
EASTERN DRAINAGE REMOVAL ACTION  
WEEKLY SUMMARY TABLE


WEEK ENDING: September 13, 2012 (Week 2)

DATE	DESCRIPTION OF ACTIVITIES
Monday 9/10/2012	<ul style="list-style-type: none"> <li>- Continuing material excavation and transport east from entrance along house fence line, north to arroyo fence (Zone 2).</li> <li>- Stockpiling excavated material on NECR-1 cap, 191 loads delivered total.</li> <li>- Improvement of silt fences at site perimeter to make them more effective for runoff control.</li> <li>- Dinetahdoo out to site to re-flag the archaeological site near the East Drainage.</li> <li>- Beginning of three-day continuous dust monitoring (72-hour).</li> </ul>
Tuesday 9/11/2012	<ul style="list-style-type: none"> <li>- Continuing material excavation and transport east from entrance along house fence line, north to arroyo fence (Zone 2).</li> <li>- 213 loads delivered to the stockpile area on the NECR-1 cap.</li> <li>- Preliminary scanning to the north of residence shows a few hot spots, especially around culvert and ditch. Hot spots indicated with flagging.</li> <li>- Continuing 72-hour dust monitoring.</li> <li>- Two machines needing maintenance had repairs completed by the end of the day.</li> </ul>
Wednesday 9/12/2012	<ul style="list-style-type: none"> <li>- Continuing material excavation and transport east from entrance along house fence line, north to arroyo fence (Zone 2).</li> <li>- 181 loads delivered to the stockpile area on the NECR-1 cap.</li> <li>- The debris pile on back of resident's property (east of house) was disposed of at his wish.</li> <li>- A SWPPP inspection conducted after recent rain event showed no deficiencies in the silt fences.</li> <li>- Scanning was not possible due to wet conditions onsite.</li> <li>- 72-hour dust monitoring continued.</li> <li>- The motor grader is down with a defective hydraulic hose and will be repaired tomorrow.</li> <li>- 6 loads of gravel were delivered to improve the site entrance and the road on the top of NECR-1.</li> <li>- A JD dozer D-5 700J was added to the equipment fleet.</li> </ul>
Thursday 9/13/2012	<ul style="list-style-type: none"> <li>- Continuing material excavation and transport east from entrance along house fence line, north to arroyo fence (Zone 2).</li> <li>- 185 loads were delivered to the stockpile area on the NECR-1 cap. Stockpiled soil is now being pushed back and consolidated against the hill behind it.</li> <li>- Last day of the three-day (72-hr) continuous dust monitoring.</li> <li>- A second water truck has been delivered and is now onsite.</li> <li>- A round of photos were taken of the construction areas.</li> <li>- Scanning of the Zone 2 areas where excavation has been conducted.</li> <li>- Approximately 50% of Zone 2 is complete and 30% of the total excavation has been completed to date.</li> <li>- Upwind dust monitoring showed an average concentration of 5.3 ug/m<sup>3</sup> over a 72-hour period.</li> </ul>





<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID: 1</b>	
<b>Photo Location:</b> Hill west of RWPR	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 9/13/2012	
<b>Comments:</b>	


<b>Photograph ID: 2</b>	
<b>Photo Location:</b> Hill west of RWPR	
<b>Direction:</b> East	
<b>Survey Date:</b> 9/13/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 3	
<b>Photo Location:</b> Residence north fence	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 9/13/2012	
<b>Comments:</b>	


<b>Photograph ID:</b> 4	
<b>Photo Location:</b> Residence north fence	
<b>Direction:</b> North	
<b>Survey Date:</b> 9/13/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID: 5</b>	
<b>Photo Location:</b> South hill	
<b>Direction:</b> Northwest	
<b>Survey Date:</b> 9/13/2012	
<b>Comments:</b>	

<b>Photograph ID: 6</b>	
<b>Photo Location:</b> South hill	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 9/13/2012	
<b>Comments:</b>	

<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 7	
<b>Photo Location:</b> South hill	
<b>Direction:</b> North	
<b>Survey Date:</b> 9/13/2012	
<b>Comments:</b>	


<b>Photograph ID:</b> 8	
<b>Photo Location:</b> North hill	
<b>Direction:</b> South	
<b>Survey Date:</b> 9/13/2012	
<b>Comments:</b>	


NECR MINE SITE  
EASTERN DRAINAGE REMOVAL ACTION  
WEEKLY SUMMARY TABLE

WEEK ENDING: September 20, 2012 (Week 3)


DATE	DESCRIPTION OF ACTIVITIES
Friday 9/14/2012	<ul style="list-style-type: none"> <li>- Material excavation and transport of Zone 2 continues, now east from residence east fence line, south to Zone 1.</li> <li>- Stockpiling on NECR cap and 197 loads total were delivered to NECR-1 stockpile today.</li> <li>- Dust monitoring and air sampling continue during working hours.</li> <li>- Scanning is taking place in the completed northern area of Zone 2.</li> </ul>
Monday 9/17/2012	<ul style="list-style-type: none"> <li>- Began material excavation and transport from Zone 5 and on both sides of the western end of Zone 1 in Zone 2.</li> <li>- Stockpiling material on NECR cap, 228 loads delivered to NECR-1 stockpile.</li> <li>- Scanning continues in completed areas of Zone 2, results of scanning determined that area in NE Zone 2 needs further material removal.</li> <li>- Two water towers now on site to assist with the pace of dust control.</li> </ul>
Tuesday 9/18/2012	<ul style="list-style-type: none"> <li>- Continuing material excavation and transport from Zone 5.</li> <li>- 261 loads were delivered to the NECR-1 stockpile.</li> <li>- Scanning continues in completed areas of Zone 2, areas in NE Zone 2 needs further material removal.</li> <li>- Continuing dust monitoring and air sampling. Now alternating days of PM<sub>2.5</sub> and PM<sub>10</sub> for dust monitoring. One dust monitor was not working properly and has been replaced.</li> <li>- A change request has been signed for excavation south of the East Drainage.</li> </ul>
Wednesday 9/19/2012	<ul style="list-style-type: none"> <li>- The initial excavation of Zone 5 was finished mid-day. Beginning to excavate and transport material from sides of Zone 4, also further excavating Zone 2.</li> <li>- Stockpiling on NECR cap, 197 loads delivered to NECR-1 total.</li> <li>- Scanning continues in areas of Zone 2 where excavation has recently been performed, mainly in areas east and south of residence. Approximately 2 acres in NE Zone 2 need to be further excavated.</li> <li>- Continuing dust monitoring and air sampling, PM<sub>10</sub> dust monitoring today.</li> <li>- Clear Creek's seed mixture has been approved and the request has been made to order it.</li> <li>- A new pump was installed in the well used to produce water for dust control.</li> <li>- The D-6 dozer has a broken belt and the new belt ordered was the wrong size. The correct belt has been ordered but will not arrive until tomorrow.</li> </ul>
Thursday 9/20/2012	<ul style="list-style-type: none"> <li>- Continuing material excavation and transport from sides of Zone 4 and second excavation of Zone 2. The second excavation of Zone 5 Began mid-day, motor grader is ripping the north area prior to excavation/transport.</li> <li>- Stockpiling on NECR-1 cap, 205 loads were delivered total. The current established elevation of the pile is to be maintained.</li> <li>- Scanning areas in Zone 2 where excavation has been performed, mainly in areas east of residence. Approximately 50% of Zone 5 needs to be further excavated. Approximately 25% of Zone 2 south needs to be re-excavated.</li> <li>- Continuing dust monitoring and air sampling, PM<sub>2.5</sub> dust monitoring today.</li> <li>- The production well is now on line with new pump.</li> <li>- The smaller water truck is down but repairs were made and it will be back and running tomorrow.</li> <li>- The D-6 dozer has a broken belt, unfortunately the second belt ordered was also the wrong size. The third belt has been ordered and will arrive tomorrow.</li> <li>- Dust monitoring showed an average concentration of 13.9 ug/m<sup>3</sup> downwind of construction ( PM<sub>2.5</sub>).</li> <li>- Approximately 70% of total excavation complete based on load tickets, 40% of overall contract complete.</li> </ul>


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID: 1</b>	
<b>Photo Location:</b> Hill west of RWPR	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 9/19/2012	
<b>Comments:</b>	


<b>Photograph ID: 2</b>	
<b>Photo Location:</b> Hill west of RWPR	
<b>Direction:</b> East	
<b>Survey Date:</b> 9/19/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 3	
<b>Photo Location:</b> Residence north fence	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 9/19/2012	
<b>Comments:</b>	

<b>Photograph ID:</b> 4	
<b>Photo Location:</b> Residence north fence	
<b>Direction:</b> North	
<b>Survey Date:</b> 9/19/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>


<b>Photograph ID:</b> 5	
<b>Photo Location:</b> South hill	
<b>Direction:</b> Northwest	
<b>Survey Date:</b> 9/19/2012	
<b>Comments:</b>	


<b>Photograph ID:</b> 6	
<b>Photo Location:</b> South hill	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 9/19/2012	
<b>Comments:</b>	



<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 7	
<b>Photo Location:</b> South hill	
<b>Direction:</b> North	
<b>Survey Date:</b> 9/19/2012	
<b>Comments:</b>	

<b>Photograph ID:</b> 8	
<b>Photo Location:</b> East drainage	
<b>Direction:</b> East	
<b>Survey Date:</b> 9/19/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>
<b>Photograph ID:</b> 9			
<b>Photo Location:</b> Soil Consolidation Area			
<b>Direction:</b> Southwest			
<b>Survey Date:</b> 9/19/2012			
<b>Comments:</b>			


NECR MINE SITE  
EASTERN DRAINAGE REMOVAL ACTION  
WEEKLY SUMMARY TABLE

WEEK ENDING: September 27, 2012 (Week 4)

DATE	DESCRIPTION OF ACTIVITIES
Friday 9/21/2012	<ul style="list-style-type: none"> <li>- Material excavation and transport of Zone 4 continues, now excavating channel bottom also. Continuing with the second excavation of elevated areas in Zones 2 and 5 and beginning excavation in Zone 2 between Zones 4, 5, and 1.</li> <li>- Stockpiling on NECR cap and 199 loads total were delivered to NECR-1 stockpile today.</li> <li>- Dust monitoring and air sampling continue during working hours.</li> <li>- Approximately 50% of Zone 5 needs to be further excavated. Approximately 25% of Zone 2 south needs to be re-excavated.</li> <li>- D-6 dozer with broken belt is now up and running.</li> </ul>
Monday 9/24/2012	<ul style="list-style-type: none"> <li>- Continuing material excavation and transport from Zone 4, primarily from channel bottom. Loading material out of the south end of Zone 2. Continuing excavation from Zone 2 between Zones 1, 4, and 5.</li> <li>- Stockpiling material on NECR-1, 225 loads delivered to NECR-1 stockpile.</li> <li>- Scanning continues in completed areas, approximately 40% needs to be re-excavated in Zone 5, 25% in southern Zone 2.</li> <li>- Site photos were taken from pre-selected locations.</li> </ul>
Tuesday 9/25/2012	<ul style="list-style-type: none"> <li>- Completed material excavation and transport from the initial cut of Zone 4. Continuing with excavation of Zone 2 between Zones 1, 4, and 5, re-excavation of Zone 5 and excavation of hot areas in Zone 2.</li> <li>- 218 loads delivered to NECR-1 stockpile.</li> <li>- Continuing dust monitoring and air sampling. Now alternating days of PM<sub>2.5</sub> and PM<sub>10</sub> for dust monitoring. Day 2 of 72-hour downwind monitor.</li> </ul>
Wednesday 9/26/2012	<ul style="list-style-type: none"> <li>- Beginning material re-excavation and transport from area of Zone 2 near 5 and 1, deeper excavation needed near channel. Further excavating Zone 5 in hot areas. Also excavating hot spots in Zone 4, mostly along southern edge and channel bottom.</li> <li>- Stockpiling continues on NECR-1, 129 loads delivered to NECR-1 total.</li> <li>- Scanning areas in Zone 2 where excavation has been performed, mainly in areas southeast of residence and near Zone 4.</li> <li>- Continuing dust monitoring and air sampling, 3rd day of 72-hour dust monitoring downwind.</li> <li>- The 3500 gallon water truck and motor grader are both having problems and are down today.</li> </ul>
Thursday 9/27/2012	<ul style="list-style-type: none"> <li>- Beginning second excavation of Zone 2, ripping prior to excavation/transport. Continuing further excavation of material from sides of Zone 4 from results of scanning.</li> <li>- Stockpiling on NECR cap, 171 loads delivered to NECR-1 total. Changing current elevation due to proximity to haul road.</li> <li>- Richard Morris has been contacted to make aware of work planned for next week in Zones 1-5.</li> <li>- Scanning is being performed in areas in Zones 2 and 4 where excavation has taken place.</li> <li>- Dinetahdoo has been contacted to be made aware of work planned for next week in Zone 1. They will need to be present on site during days where excavation in the area of the archaeological site near Zone 1 is taking place.</li> <li>- Results of 72-hour continuous downwind dust monitoring was an average concentration of 10.3 ug/m<sup>3</sup></li> <li>- An estimated completion of 90% has now been performed on Zones 2-5.</li> </ul>


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID: 1</b>	
<b>Photo Location:</b> Hill west of RWPR	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 9/27/2012	
<b>Comments:</b>	


<b>Photograph ID: 2</b>	
<b>Photo Location:</b> Hill west of RWPR	
<b>Direction:</b> East	
<b>Survey Date:</b> 9/27/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID: 3</b>	
<b>Photo Location:</b> Residence north fence	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 9/27/2012	
<b>Comments:</b>	


<b>Photograph ID: 4</b>	
<b>Photo Location:</b> Residence north fence	
<b>Direction:</b> North	
<b>Survey Date:</b> 9/27/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>


<b>Photograph ID: 5</b>	
<b>Photo Location:</b> South hill	
<b>Direction:</b> Northwest	
<b>Survey Date:</b> 9/27/2012	
<b>Comments:</b>	

<b>Photograph ID: 6</b>	
<b>Photo Location:</b> South hill	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 9/27/2012	
<b>Comments:</b>	

<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID: 7</b>	
<b>Photo Location:</b> South hill	
<b>Direction:</b> North	
<b>Survey Date:</b> 9/27/2012	
<b>Comments:</b>	

<b>Photograph ID: 8</b>	
<b>Photo Location:</b> East drainage	
<b>Direction:</b> East	
<b>Survey Date:</b> 9/27/2012	
<b>Comments:</b>	

<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>
<b>Photograph ID:</b> 9			
<b>Photo Location:</b> Soil Consolidation Area			
<b>Direction:</b> Southwest			
<b>Survey Date:</b> 9/27/2012			
<b>Comments:</b>			





NECR MINE SITE  
EASTERN DRAINAGE REMOVAL ACTION  
WEEKLY SUMMARY TABLE

WEEK ENDING: October 4, 2012 (Week 5)

DATE	DESCRIPTION OF ACTIVITIES
Friday 9/28/2012	<ul style="list-style-type: none"> <li>- Excavation continues in southern end of Zone 2, just outside of original channel definition, approximately 100'x40', up to 4' depth. The area near north culvert with elevated readings was re-excavated.</li> <li>- The re-excavation of Zone 4 down to action level is close to completion.</li> <li>- Zone 3 has been excavated and is now ready for scanning.</li> <li>- Stockpiling on NECR-1 cap, 134 loads delivered to NECR-1 total.</li> <li>- Arranged for Dinetahdoo to visit next week during channel excavation.</li> </ul>
Monday 10/01/2012	<ul style="list-style-type: none"> <li>- Continuing to excavate southern Zone 2 and Zone 4 in previous areas. Zone 3 completed and the excavation of the west end of Zone 1 began. 7' excavation near culvert in Zone 1.</li> <li>- Water truck cleaning Red Water Pond Road.</li> <li>- 195 loads delivered to NECR-1 stockpile.</li> <li>- Scanning continues in completed areas, Zone 3 scanned clean. Began field screening of material in Zone 1. 4' excavation down to far end of Zone 5 and 2' excavation from Zone 5 to east end is recommended. Areas on far side of North fence are clear.</li> <li>- Continuing dust monitoring and air sampling, new dust monitor location near school bus stop next to air sampler.</li> </ul>
Tuesday 10/02/2012	<ul style="list-style-type: none"> <li>- Excavation of south culvert area until it could not be further excavated without compromising the culvert itself. Deep and wide excavation is needed in section of Zone 1 approximately 100 m from west fence. Grader moved to the stockpile area to help the dozer, dozer/ripper and loader to borrow area to begin moving borrow material.</li> <li>- 142 loads delivered to NECR-1 stockpile.</li> <li>- Continuing dust monitoring and air sampling. Continuing to alternate days of PM<sub>2.5</sub> and PM<sub>10</sub> for dust monitoring.</li> <li>- Scans of Zone 1 after first excavation are mostly reading clean. Zones 3 and 5 are now clean.</li> <li>- CRA is onsite, they plan to begin their excavation of RWPR on Monday 10/8.</li> </ul>
Wednesday 10/03/2012	<ul style="list-style-type: none"> <li>- Re-excavating one foot from the bottom of Zone 4. Zone 1 excavation until excavator stopped working. Stockpiling borrow material in Zone 3.</li> <li>- Silt fence installed at Zone 6 to prepare for next week's excavation.</li> <li>- Zones 2, 3, and 5 have passed scanning.</li> <li>- Continuing dust monitoring and air sampling.</li> <li>- Took photos from predetermined locations.</li> <li>- Site visit from Sacred Wind, they took down the phone line in the stockpile area.</li> <li>- Excavator is having problems and was down today but running by the end of the day.</li> </ul>
Thursday 10/04/2012	<ul style="list-style-type: none"> <li>- Continuing further excavation of material from Zone 4. Continuing Zone 1 excavation, from archaeological site moving east. Backfill in areas of Zones 2 and 5, 96 loads hauled from borrow area.</li> <li>- Stockpiling on NECR cap, 69 loads delivered to NECR-1 total.</li> <li>- Surveying completed areas.</li> <li>- Scanning areas in Zones 2 and 4 where excavation has been performed. Zone 5 still needs to be cleared and the bottom of Zone 4 needs further excavation to reach the action level.</li> <li>- Continuing dust monitoring and air sampling, dust monitoring results downloaded.</li> <li>- Dinetahdoo visited site and was present in Zone 1 during excavation of area in vicinity of archaeological site.</li> <li>- Measured excavated areas that exceeded the design depth.</li> <li>- Dust monitoring downwind of construction measured an average concentration of 17.6 ug/m<sup>3</sup></li> </ul>


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID: 1</b>	
<b>Photo Location:</b> Hill west of RWPR	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 10/3/2012	
<b>Comments:</b>	


<b>Photograph ID: 2</b>	
<b>Photo Location:</b> Hill west of RWPR	
<b>Direction:</b> East	
<b>Survey Date:</b> 10/3/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 3	
<b>Photo Location:</b> Residence north fence	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 10/3/2012	
<b>Comments:</b>	


<b>Photograph ID:</b> 4	
<b>Photo Location:</b> Residence north fence	
<b>Direction:</b> North	
<b>Survey Date:</b> 10/3/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>


<b>Photograph ID:</b> 5	
<b>Photo Location:</b> South hill	
<b>Direction:</b> Northwest	
<b>Survey Date:</b> 10/3/2012	
<b>Comments:</b>	

<b>Photograph ID:</b> 6	
<b>Photo Location:</b> South hill	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 10/3/2012	
<b>Comments:</b>	

<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID: 7</b>	
<b>Photo Location:</b> South hill	
<b>Direction:</b> North	
<b>Survey Date:</b> 10/3/2012	
<b>Comments:</b>	

<b>Photograph ID: 8</b>	
<b>Photo Location:</b> East drainage	
<b>Direction:</b> East	
<b>Survey Date:</b> 10/3/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>
<b>Photograph ID:</b> 9			
<b>Photo Location:</b> Soil Consolidation Area			
<b>Direction:</b> Southwest			
<b>Survey Date:</b> 10/3/2012			
<b>Comments:</b>			

NECR MINE SITE  
EASTERN DRAINAGE REMOVAL ACTION  
WEEKLY SUMMARY TABLE

WEEK ENDING: October 11, 2012 (Week 6)

DATE	DESCRIPTION OF ACTIVITIES
Friday 10/5/2012	<ul style="list-style-type: none"> <li>- Excavation of Zone 1 continues, from the archaeological site to the east end of the channel.</li> <li>- Backfilling material from the borrow area into Zone 2. 123 loads hauled from the borrow area.</li> <li>- Stockpiling on NECR-1 cap, a total of 75 loads were delivered to NECR-1.</li> <li>- A small area of Zone 4 was excavated one foot deeper based on excavation control results.</li> <li>- Scanning completed in portions of Zone 1, one area (200' long) had readings above the action level and needed to be re-excavated.</li> <li>- Continuing dust monitoring and air sampling.</li> </ul>
Monday 10/08/2012	<ul style="list-style-type: none"> <li>- Continuing with the backfill of Zones 2 and 5 using borrow material.</li> <li>- Excavation of hot spots around the haul road within Zone 2</li> <li>- Photos were taken of Zone 4 for erosion and excavation control analysis.</li> <li>- Dust monitoring continues, still alternating days of the two particle sizes, 2.5 and 10.</li> <li>- Excavation control consists of mostly small areas ("hot spots"), mostly near the road used for material transport within Zone 2.</li> </ul>
Tuesday 10/09/2012	<ul style="list-style-type: none"> <li>- Continued with the backfill and grading of Zones 1, 2, and 5. 187 loads of backfill were delivered to Zones 1 and 5.</li> <li>- Began the excavation of soils in Zone 6. Stockpiling on the NECR cap, where obvious, rad soils were transported to the main pile and TPH-contaminated soils to the comingled pile. 24 loads of rad soil were removed from Zone 6.</li> <li>- Zone 4 slopes were graded to a minimum of slope ratio of 3:1.</li> <li>- Continuing dust monitoring and air sampling, Continuing to alternate days of PM<sub>2.5</sub> and PM<sub>10</sub> for dust monitoring.</li> <li>- Excavation control conducted in Zone 6.</li> <li>- Navajo community meeting with GE, BHP Billiton, MWH, EPA.</li> <li>- Material from adjacent Zones 2 and 5 is to be used as fill material in Zone 1.</li> </ul>
Wednesday 10/10/2012	<ul style="list-style-type: none"> <li>- Continued with the excavation of the rad material in zone 6, additional excavation may be required and is contingent upon excavation control results. 142 loads of soil were hauled from the TPH zone 6 area, this material was subsequently deposited in the comingled stockpile.</li> <li>- Began shaping the ditch in zone 1, dozer and water truck are using on-site fill to construct the ditch embankments.</li> <li>- Transported 78 loads of backfill from the borrow area to Zones 1 and 5.</li> <li>- Scanned Zone 6. Depths are exceeding the estimated 2 feet in areas, primarily in the southern end of the Zone.</li> <li>- Took photos from predetermined locations.</li> </ul>
Thursday 10/11/2012	<ul style="list-style-type: none"> <li>- Continuing further excavation of material from Zone 6, deeper excavation is required. Continuing Zone 1 shaping and construction. 23 loads of backfill were transported from the borrow area to areas of Zones 2 and 5</li> <li>- Stockpiling material from Zone 6 to the NECR cap, comingled area. 81 loads delivered to NECR-1 total.</li> <li>- Hauling material from the borrow area to cover the stockpile area.</li> <li>- Scanned Zone 6, depths are exceeding the estimated 2 feet in areas, primarily in the southern end of the Zone.</li> </ul>

<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>


<b>Photograph ID: 1</b>	
<b>Photo Location:</b> Hill west of RWPR	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 10/11/2012	
<b>Comments:</b>	

<b>Photograph ID: 2</b>	
<b>Photo Location:</b> Hill west of RWPR	
<b>Direction:</b> East	
<b>Survey Date:</b> 10/11/2012	
<b>Comments:</b>	





<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 3	
<b>Photo Location:</b> Residence north fence	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 10/11/2012	
<b>Comments:</b>	


<b>Photograph ID:</b> 4	
<b>Photo Location:</b> Residence north fence	
<b>Direction:</b> North	
<b>Survey Date:</b> 10/11/2012	
<b>Comments:</b>	

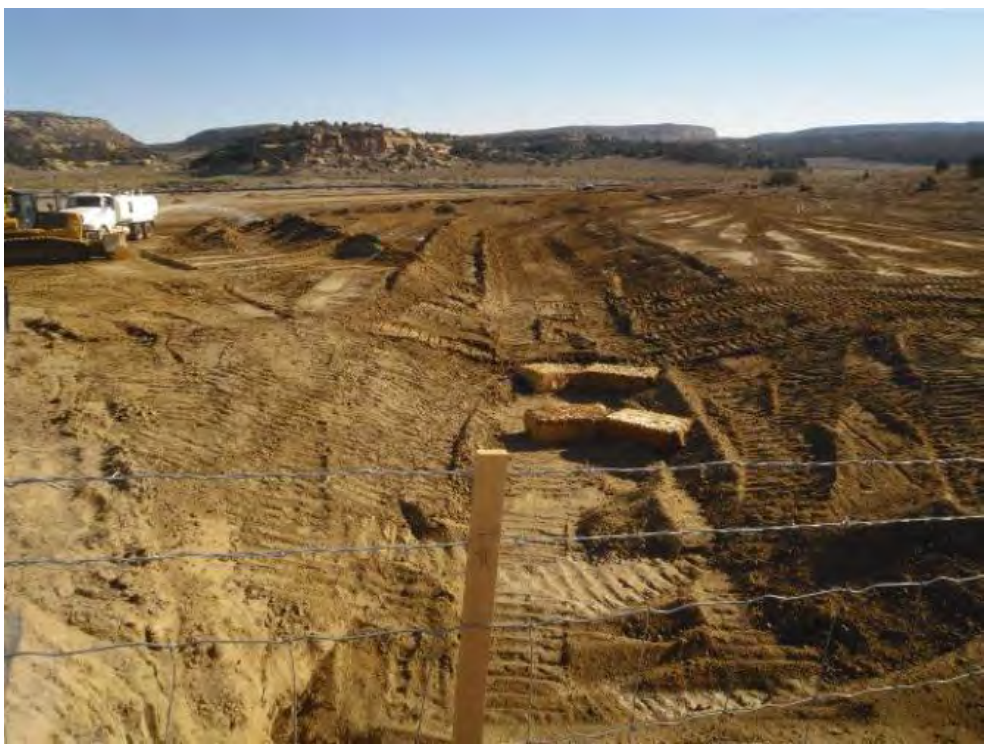
<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 5	
<b>Photo Location:</b> South hill	
<b>Direction:</b> Northwest	
<b>Survey Date:</b> 10/11/2012	
<b>Comments:</b>	


<b>Photograph ID:</b> 6	
<b>Photo Location:</b> South hill	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 10/11/2012	
<b>Comments:</b>	

<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID: 7</b>	
<b>Photo Location:</b> South hill	
<b>Direction:</b> North	
<b>Survey Date:</b> 10/11/2012	
<b>Comments:</b>	

<b>Photograph ID: 8</b>	
<b>Photo Location:</b> East drainage	
<b>Direction:</b> East	
<b>Survey Date:</b> 10/11/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 9	
<b>Photo Location:</b> Soil Consolidation Area	
<b>Direction:</b> Southwest	
<b>Survey Date:</b> 10/11/2012	
<b>Comments:</b>	


<b>Photograph ID:</b> 10	
<b>Photo Location:</b> Western TPH Area, Zone 6	
<b>Direction:</b> East	
<b>Survey Date:</b> 10/11/2012	
<b>Comments:</b>	

<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 11	
<b>Photo Location:</b> Eastern TPH Area, Zone 6	
<b>Direction:</b> West	
<b>Survey Date:</b> 10/11/2012	
<b>Comments:</b>	

<b>Photograph ID:</b> 12	
<b>Photo Location:</b> Borrow Area	
<b>Direction:</b> North	
<b>Survey Date:</b> 10/11/2012	
<b>Comments:</b>	

<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>


<b>Photograph ID:</b> 13	
<b>Photo Location:</b> Commingled Area	
<b>Direction:</b> Southwest	
<b>Survey Date:</b> 10/11/2012	
<b>Comments:</b>	

NECR MINE SITE  
EASTERN DRAINAGE REMOVAL ACTION  
WEEKLY SUMMARY TABLE

WEEK ENDING: October 18, 2012 (Week 7)

DATE	DESCRIPTION OF ACTIVITIES
Friday 10/12/2012	<ul style="list-style-type: none"> <li>- Continuing with Zone 6, greater excavation depths are required to reach soils below the action level. Continued constructing the embankments of the Zone 1 channel.</li> <li>- Stockpiling on NECR-1 cap, 16 loads were delivered from Zone 6 to the NECR-1 comingled area total. No TPH contamination was observed.</li> <li>- Continuing to conduct dust monitoring on a daily basis and air sampling twice a week.</li> <li>- No scanning due to inclement weather conditions.</li> </ul>
Monday 10/15/2012	<ul style="list-style-type: none"> <li>- Continued with the excavation of material from Zone 6. Deeper excavation is required at the south end. Construction of Zone 1 channel geometry continues.</li> <li>- 42 loads of soil transported were from Zone 6 to the stockpile area.</li> <li>- Continued to cover material in the stockpile with clean soil.</li> <li>- Excavation control was conducted in Zone 6, excavation depths are now to 10' in the southern part of this zone.</li> </ul>
Tuesday 10/16/2012	<ul style="list-style-type: none"> <li>- Continued with Zone 6, beginning to excavate small triangular area. Deeper excavation required at south end, further excavation at north end (outside original boundary).</li> <li>- Construction of Zone 1 channel geometry continues.</li> <li>- 53 loads of soil were transported from Zone 6 to the stockpile area.</li> <li>- Continuing to cover material in the stockpile with clean soil.</li> <li>- Excavation control in Zone 6, investigating area north for potentially contaminated soil beyond Zone 6 boundary.</li> <li>- Excavation outside Zone 6 footprint to the north, approximately 35'x35'x1'.</li> </ul>
Wednesday 10/17/2012	<ul style="list-style-type: none"> <li>- Continued the excavation of material in Zone 6, including the excavation of an area to the north of the original Zone 6 boundary. Hauled 43 loads of soil from the TPH zone 6 area to the stockpile area. No TPH contamination was observed.</li> <li>- Continued building the ditch in zone 1, dozer and water truck will be using on-site fill to construct the ditch embankments.</li> <li>- A ground surface survey of Zone 6 was conducted.</li> <li>- Scanned Zone 6, excavation areas are exceeding the original boundaries for the Zone to the north.</li> <li>- Excavation outside the original Zone 6 boundary to remove additional soils in exceedance of the action level.</li> </ul>
Thursday 10/11/2012	<ul style="list-style-type: none"> <li>- Completed final excavation of material from Zone 6. Continuing Zone 1 shaping and construction. No TPH contamination was observed.</li> <li>- Stockpiling the final loads of material from Zone 6, 6 loads delivered to NECR-1 total.</li> <li>- Morris Surveying conducting the survey of now-excavated Zone 6.</li> <li>- A scan of Zone 6 by AVM showed that it is now reading below the action level.</li> <li>- A sedimentation basin has been proposed for the north culvert to control material exiting the culvert.</li> </ul>

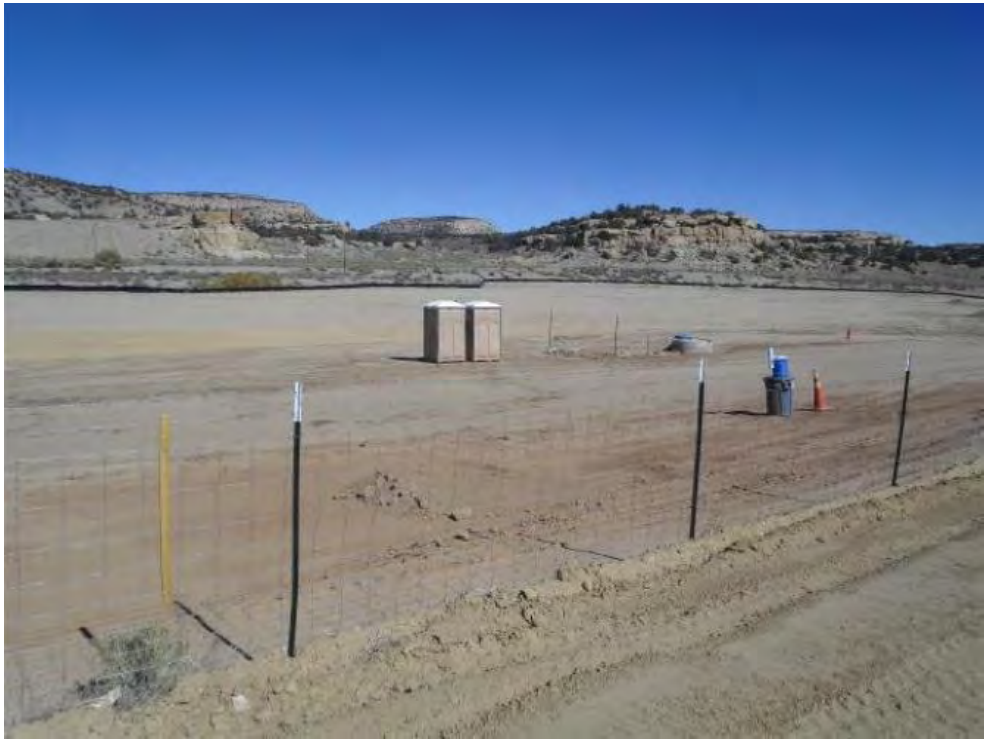
<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>


<b>Photograph ID:</b> 1	
<b>Photo Location:</b> Hill west of RWPR	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 10/17/2012	
<b>Comments:</b>	

<b>Photograph ID:</b> 2	
<b>Photo Location:</b> Hill west of RWPR	
<b>Direction:</b> East	
<b>Survey Date:</b> 10/17/2012	
<b>Comments:</b>	

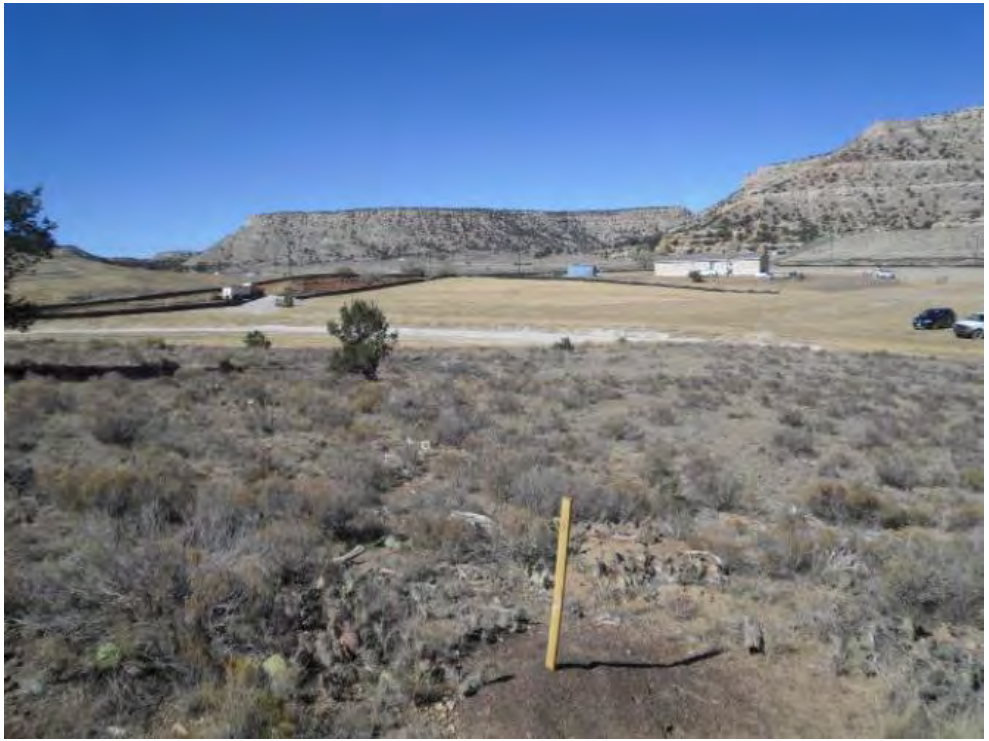



<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 3	
<b>Photo Location:</b> Residence north fence	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 10/18/2012	
<b>Comments:</b>	


<b>Photograph ID:</b> 4	
<b>Photo Location:</b> Residence north fence	
<b>Direction:</b> North	
<b>Survey Date:</b> 10/18/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID: 5</b>	
<b>Photo Location:</b> South hill	
<b>Direction:</b> Northwest	
<b>Survey Date:</b> 10/18/2012	
<b>Comments:</b>	


<b>Photograph ID: 6</b>	
<b>Photo Location:</b> South hill	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 10/18/2012	
<b>Comments:</b>	

<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 7	
<b>Photo Location:</b> South hill	
<b>Direction:</b> North	
<b>Survey Date:</b> 10/18/2012	
<b>Comments:</b>	


<b>Photograph ID:</b> 8	
<b>Photo Location:</b> East drainage	
<b>Direction:</b> East	
<b>Survey Date:</b> 10/18/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 9	
<b>Photo Location:</b> Soil Consolidation Area	
<b>Direction:</b> Southwest	
<b>Survey Date:</b> 10/18/2012	
<b>Comments:</b>	

<b>Photograph ID:</b> 10	
<b>Photo Location:</b> Western TPH Area, Zone 6	
<b>Direction:</b> East	
<b>Survey Date:</b> 10/18/2012	
<b>Comments:</b>	

<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 11	
<b>Photo Location:</b> Eastern TPH Area, Zone 6	
<b>Direction:</b> West	
<b>Survey Date:</b> 10/17/2012	
<b>Comments:</b>	

<b>Photograph ID:</b> 12	
<b>Photo Location:</b> Borrow Area	
<b>Direction:</b> North	
<b>Survey Date:</b> 10/18/2012	
<b>Comments:</b>	

<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>


<b>Photograph ID:</b> 13	
<b>Photo Location:</b> Commingled Area	
<b>Direction:</b> Southwest	
<b>Survey Date:</b> 10/18/2012	
<b>Comments:</b>	


NECR MINE SITE  
EASTERN DRAINAGE REMOVAL ACTION  
WEEKLY SUMMARY TABLE

WEEK ENDING: October 26, 2012 (Week 8)

DATE	DESCRIPTION OF ACTIVITIES
Friday 10/19/2012	<ul style="list-style-type: none"> <li>- Continued with the backfill of Zone 6 and completed this task by the end of the day.</li> <li>- Constructed the bottom and sides of the Zone 1 channel.</li> <li>- Continued to grade the cap on the consolidation stockpile and the low areas in Zones 2-5.</li> <li>- Four loads of base were delivered for use in the Zone 1 channel, 71.05 tons total.</li> <li>- Continuing dust monitoring and air sampling.</li> </ul>
Monday 10/22/2012	<ul style="list-style-type: none"> <li>- Continued to haul material for Zone 1, bedding material and rip rap. Twelve loads of rip rap were hauled to the site, 167.57 tons total. The crew is immediately placing this material upon its arrival.</li> <li>- Continued to grade the cap on the consolidation stockpile and the low areas in Zones 2-5.</li> <li>- Side slopes in Zone 4 were regraded to achieve a maximum of 3:1.</li> <li>- Backfilling complete for Zone 6.</li> <li>- Crew did not work over the weekend due to a disagreement over rip rap costs.</li> <li>- Continuing dust monitoring and air sampling, still alternating days of the two particle sizes, 2.5 and 10.</li> <li>- EPA is ok with the decision to construct a sed basin at the north culvert and agrees that rip rap is not necessary for the head of Zone 4.</li> </ul>
Tuesday 10/23/2012	<ul style="list-style-type: none"> <li>- Completed the hauling of bedding material (one load, 16.30 tons) and continued to haul rip rap (28 loads, 399.05 tons total) for Zone 1.</li> <li>- Continuing to grade the cover on the consolidation stockpile and grading low spots in Zones 2-5. Also grading the side slopes in Zone 4.</li> <li>- A conference call was conducted with GE, MWH, and AMEC. Decisions were made to leave the road approaching the TPH area as-is and to leave up the silt fencing that stands around the perimeter of the construction areas.</li> <li>- The EPA approved the use of the harrow and hydrostraw method for seeding the side slopes of Zone 4.</li> </ul>
Wednesday 10/24/2012	<ul style="list-style-type: none"> <li>- Hay bales were installed on the slopes in the southern end of Zone 6 and on the channel floor in Zone 4.</li> <li>- Eighteen loads of rip rap were hauled in for use in Zone 1, 249.26 tons total.</li> <li>- The grading of Zone 4 is now complete. Grading of low areas in Zones 2-5 continues.</li> <li>- Site photos were taken from predetermined locations to continue the ongoing photo series.</li> <li>- The crusher in Thoreau was down and undergoing repair. It was fixed by the end of the day but trucks spent several hours waiting for rip rap in Thoreau.</li> </ul>
Thursday 10/25/2012	<ul style="list-style-type: none"> <li>- Hauled the final 14 loads of rip rap for Zone 1, 207.40 tons total. Placed the new rip rap and worked on constructing the shape of the rip rap in the channel.</li> <li>- The grading efforts for the cover of the consolidation stockpiles is now complete.</li> <li>- Finished grading the low areas in Zones 2-5.</li> <li>- Conducted dust monitoring and air sampling and took photos of the site.</li> </ul>
Friday 10/26/2012	<ul style="list-style-type: none"> <li>- Completed Zone 1 channel rip rap shape construction and compaction of material.</li> <li>- Graded areas of substantial ground elevation differences near the western perimeter of Zone 2.</li> <li>- Completed the regrading of the borrow pit.</li> <li>- Dust monitoring data was downloaded for processing.</li> <li>- Today was the final day of construction activities. Surveying and seeing will begin next week.</li> </ul>

<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>


<b>Photograph ID: 1</b>	
<b>Photo Location:</b> Hill west of RWPR	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 10/24/2012	
<b>Comments:</b>	

<b>Photograph ID: 2</b>	
<b>Photo Location:</b> Hill west of RWPR	
<b>Direction:</b> East	
<b>Survey Date:</b> 10/24/2012	
<b>Comments:</b>	





<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 3	
<b>Photo Location:</b> Residence north fence	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 10/24/2012	
<b>Comments:</b>	


<b>Photograph ID:</b> 4	
<b>Photo Location:</b> Residence north fence	
<b>Direction:</b> North	
<b>Survey Date:</b> 10/24/2012	
<b>Comments:</b>	

<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 5	
<b>Photo Location:</b> South hill	
<b>Direction:</b> Northwest	
<b>Survey Date:</b> 10/24/2012	
<b>Comments:</b>	


<b>Photograph ID:</b> 6	
<b>Photo Location:</b> South hill	
<b>Direction:</b> Northeast	
<b>Survey Date:</b> 10/24/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID: 7</b>	
<b>Photo Location:</b> South hill	
<b>Direction:</b> North	
<b>Survey Date:</b> 10/24/2012	
<b>Comments:</b>	

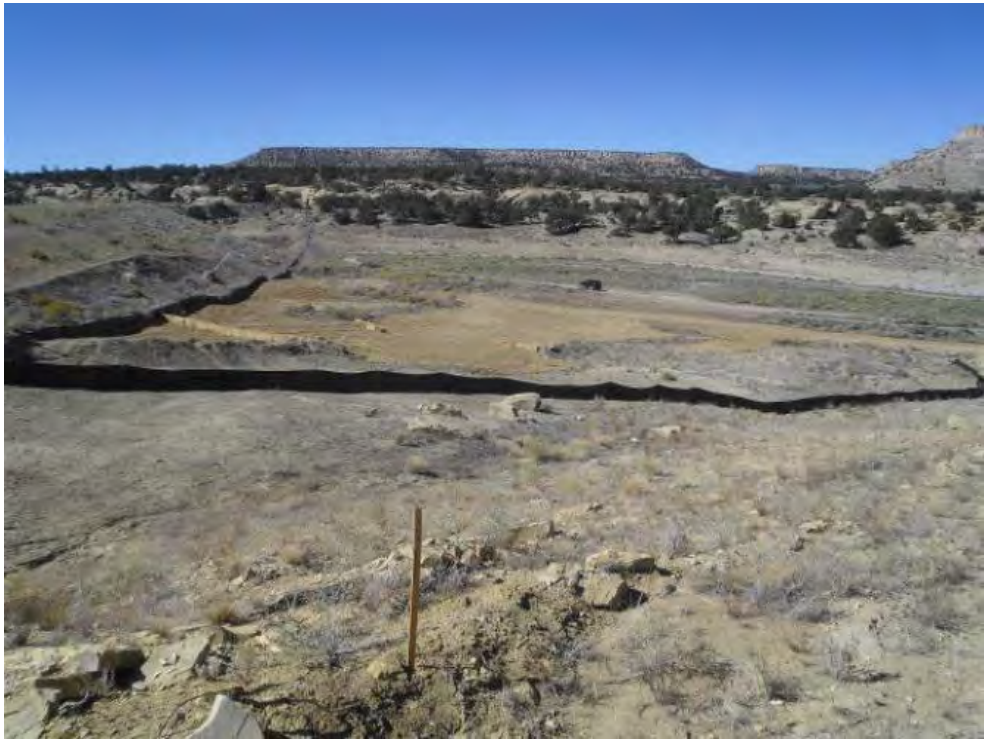
<b>Photograph ID: 8</b>	
<b>Photo Location:</b> East drainage	
<b>Direction:</b> East	
<b>Survey Date:</b> 10/25/2012	
<b>Comments:</b>	

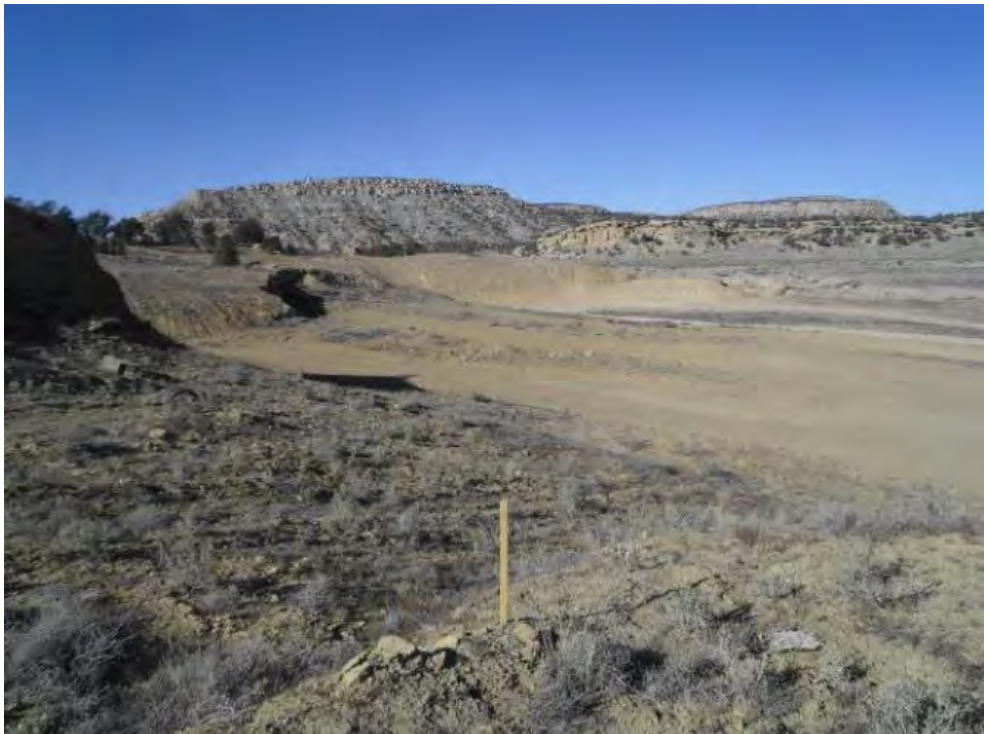
<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 9	
<b>Photo Location:</b> Soil Consolidation Area	
<b>Direction:</b> Southwest	
<b>Survey Date:</b> 10/24/2012	
<b>Comments:</b>	

<b>Photograph ID:</b> 10	
<b>Photo Location:</b> Western TPH Area, Zone 6	
<b>Direction:</b> East	
<b>Survey Date:</b> 10/24/2012	
<b>Comments:</b>	


<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 11	
<b>Photo Location:</b> Eastern TPH Area, Zone 6	
<b>Direction:</b> West	
<b>Survey Date:</b> 10/24/2012	
<b>Comments:</b>	

<b>Photograph ID:</b> 12	
<b>Photo Location:</b> Borrow Area	
<b>Direction:</b> North	
<b>Survey Date:</b> 10/24/2012	
<b>Comments:</b>	

<b>Client:</b>	<b>GE/UNC</b>	<b>Project:</b>	<b>Eastern Drainage Removal Action</b>
<b>Site Name:</b>	<b>NECR</b>	<b>Site Location:</b>	<b>Eastern Drainage</b>

<b>Photograph ID:</b> 13	
<b>Photo Location:</b> Commingled Area	
<b>Direction:</b> Southwest	
<b>Survey Date:</b> 10/24/2012	
<b>Comments:</b>	

<b>Photograph ID:</b> 14	
<b>Photo Location:</b> Eastern Drainage	
<b>Direction:</b> Southwest	
<b>Survey Date:</b> 10/26/2012	
<b>Comments:</b>	



9/5/12

0800 Into Gallup to pick up rental car, supplies

1010 On site. Per Toby, Dineschaba will be out on Friday to mark/fence areas. Met Johnny, is concerned about area growing larger / pace

Per Nat:

orange is actual boundary  
yellow: indicates side of contam,  
red: 5' 2.4'

→ orange stakes along boundary on E end of E Dmg. Mark asked for this area to be marked w/ red stakes to be consistent w/ rest of channel

→ Nat found additional soil contam on S side of E Dmg near RWPR culvert, Johnny and Nick (surveyor) are going to survey.

→ Numerous other areas where Nat found add'l contamination, where previously labeled as clean or deeper than before. Deeper in small drainage areas primarily.

- Nat may be able to further define depths to make removal more efficient
  - Fenceline acts as boundary along NE edge of area in places
  - Johnny's crew primarily working on silt fences
  - Mark Ripperts is ok with doing lab samples every 100' in E. Drainage chnl, agrees that 50' is overkill.
  - Lathe from Nat to mark photo spots
- 1230 Lunch @ UNC office

Photos at commingled area, #s on lathe

#1: 100-0186

#2: 100-0187

1330 Walking stockpile areas w/ Johnny, Nick, Richard

1400 Borrow area w/ same 3  
~11,000 yd<sup>3</sup>

#3: 100-0188

1420 #4: 100-0189: Soil Consol. Area

#5: 100-0190: Comingled SCA

1446 #6: 100-0191  
-0192

↳ from hill W of RWPR



100-0934: New boundary S of  
EDmg

1510 #7100, 85, 6: N, NE from residence

#8100-0197, 8, 9: NW, NE, N from  
south hill

#9100-0200: E from E. Ding  
culvert

1630 Fugitive dust monitoring equip  
changing in office

1715 Per Johnny, Dinechdos came out  
to site and set up pink flagging  
around arch sites intersecting  
the ED  
Security arrived at EOD

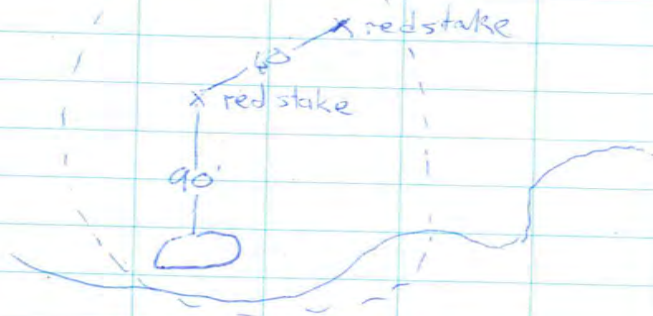
1730  
E offsite

9/6/12

0800 onsite

found radon cups at UNC office.  
Max already set up. Emailed  
Landauer about outdoor env  
and control badges.

0830 to arch site area with Mark  
Rippena



pink flagging appears to be  
set in a radius from the  
center of the 3 arch sites,  
maintaining a 50' buffer  
from the outside sites

Jeremy 505 686-5563

4485

Reva 505 801-5162

0930 Spoke w/ Jeremy, he says an archaeologist will be back out to fix the flagging... he will call to indicate when

1000 Keys to Conex, Front gate, Main gate from Rick

1020 left message with NIVA about getting water line marked.

Per Johnny, a tailgate safety meeting was conducted and signatures were collected.

Need to determine who will be taking air sampling readings and when, etc.

Per Rick, AVM conducted baseline airborne dust monitoring thru + Fri last week

Per Johnny, equipment will arrive tomorrow

1110 Spoke with Nat, Max will conduct air monitoring and send him the data, he will forward on to EPA and Toby

1200 Meeting with operators and supervisors to review job objectives and safety topics. Operators/laborers seemed somewhat concerned over dust inhalation and a portion of the conversation focused on this

1330 Meeting w/ Lance, TL, JV, AVM  
 → per Lance, the resident has signed an agreement and he'd like a copy of this. get from Mark Ripperda.

→ Need to make a field change request for 100' instead of 55' for lab samples in ED  
 → Walk with Dinatahdos when they come out on Monday to be clear on boundary.  
 → Jesse (clear ck) is reviewing community comments on seeding

15:30-16:30 Site walk w/ MR, TL, JV.  
Topics :- outside fence near  
arrays

- water line location
- debris / Zone 4
- arch site
- area S of ED

1725 Started Dust Monitor #1 <sup>SNO69</sup> near  
East side of flats area

1758 started Dust Monitor #2 <sup>SNO396</sup> near  
gate.

LF offsite 1800

9/7/12 1012217

0700 Tailgate meeting with crew

0710 Read dust monitor manual,  
find out sequence of power  
and how to handle filters

0730 Dust monitor #1 : 1/8 tank  
left in generator  
D.M. #2 : 3/8 tank

0830 Refueled both DM generators,  
left gas at #1

0900 ~~met~~ Met w/ TL, MR, NP  
MR gave me a copy of the signed  
resident's approval letter

1000 Filled out a design change request  
form to officially change lab  
verification in the ED to 100' from  
50'

1030 Construction has begun at site,  
scraper is working in area near  
entrance

Photo 100-0202 from RWR  
began at approximately 930

- 1045 pink spraypainted dash, need to determine ~~what~~ what it indicates
- 1130 Dorie sent signed agreement to Lance Max and John moving DM #1 and #2 to W side of RWPR, by bus stop and Teddy Nez's house.  $\rightarrow$  DM #1, SN0019
- 1223 #7: 100-0203, 0204 (NE, N)
- 1232 #6: 100-0205, 0206 (NE, E)
- 1242 #8: 100-0207, 0208, 0209 (NW, NE, N)
- 1300 #4: 100-0210
- 1307 Both dust monitors have been moved to the West side of RWPR to collect baseline away from what is now the construction area. DM #1 is now behind Teddy Nez's house, DM #2 near bus stop

$\rightarrow$  SN0396

Equipment onsite:

Komatsu G1PX ~~dozer~~ trackhoe

Peterbilt water truck

JD 350D excavator

JD 620B spreader

International dump trucks (2)

JD 624  
Dole dozer

- 1400 ordered <sup>5</sup> cables from ELI via Email (Tessa Ponke)
- 1500 Both generators still running, DM #1's generator about 1/2 full
- 1530 Most excavation taking place north of north fence around residence  
tires on water truck scanned/cleaned before leaving
- 1630 Refueled generators, Dust monitors still running
- 1700 Equipment and crew stopped to end day
- 1800 Security still not on site, called Dennis @ Gallup Security to inquire.
- 1830 Security arrived, instructed them to watch generators and Dust monitors as well as equipment.

1830 LF offsite

9/8/12

and collect  
 1800 Out to site to stop dust monitors. the monitor behind Teddy Nez's house may have had a problem... the hose appeared pinched when opening the case and its motor made a change in pitch.

Tried to leave monitors in UNC etc but unable to unlock front door.

0900 Downloaded data from Data monitors. DM that was behind Teddy Nez's house (#1) reads no higher than  $0.1 \mu\text{g}/\text{m}^3$ , likely due to the pinch observed in the line.

0915 Per Nat, Victor / Tony will be onsite Wed morning, ensure 6" cut. comm. with Victor about depth.

9/10/12

0700 Safety tailgate meeting  
 - Need dust monitors upwind/downwind  
 - Traffic control? re-read plan  
 - 2 water trucks?

1000 Silt fences inadequate in places had trucks' wheels coming in contact with dirty material

1103 began DM#1 up in canyon (upwind)

1215 began DM#2 between 24 and 25  
 John is bringing air monitor and generator to same location

- Rena w/ Dinetahdoo arrived, re-flagged burial feature

1530 Per Toby, Lance would like to see results of scanning once they are available to evaluate the thoroughness of excavation

1600 Per Toby, dust is getting significant and another water truck may be needed

1715 Refueled generators before leaving.

1735 ~~offsite~~

9/11/12

- 0700 Safety meeting  
 - silt fence not working, dust an issue → crew on silt fence while one water truck going?
- 0730 Dust monitor ok in downwind location, generator low but still running.  
 - silt fence being improved  
 - dust seems to be less of an issue with overnight rains keeping it down, working on getting a 2nd water truck
- 0900 - check with Max about scanning areas  
 - per Johnny, they will finish area btwn residence and N fence tomorrow
- 1050 - 100-0211, -0212 #6  
 1100 - #8 NW, NE N: -0213, -0214, -0215  
 1120 - #7 NE, NW: 100-0216, -0217  
 1130 #4 Moved uphill/East ~20yds for better vantage.  
 100-0218 complete
- 1230 - Lance: % from Johnny in weeklies  
 1400 Went with Bill Sass (EPA) to background location for scan readings
- ~~1500~~ - ordered prints of site photos to have when taking future photos

C

- 1500 Followed up with Landauer on env. badges and controls. 3rd time.  
 Need coolers from ELI ✓
- 1600 Scan + send Design change to Lance ✓
- 1730 Met w/Toby, Bill, Mark about dust onsite... Johnny will order a 2nd water truck  
 photos onto location map ✓  
 NECR photo locs  
 ↳ red flash drive  
 photo set for weekly ✓

LF offsite 17/15

9/12/12 Wednesday 50°F, rain

0700 Safety meeting: slick conditions due to steady rain overnight. Spoke with Mark and Bill about how to calculate dust particle sizes, etc. We need to order a part that will separate out the particle sizes (PM<sub>10</sub> and PM<sub>2.5</sub>)

0900 Question of whether to take away or leave a debris pile on the back of the homeowner's property. Mark R. says take it away, it's trash.

~~Left msg w/ Jesse Parke~~ <sup>Says</sup> ~~about~~ coolers will be sent out in the next day or so

1030 ~~Left msg~~ <sup>Spoke</sup> with Pine Environmental about ordering in line impactor head for 2.5 and 10 monitoring, their Denver sales people will call back with ordering info

1200 Per Victor, unable to scan today due to saturated conditions. Will return tomorrow or Friday... Max tomorrow!

1700 Significant rain over past 48 hours, unnamed Arrays to N has ~10 cfs, some standing water in N culvert from drainage on E side of RWPP, none in S culvert

1725 Gallup security onsite

LF offsite 1740

9/13/12

0700 Safety Meeting

0830 Per Nait, he and Max will stake out areas and scan today

- Do weekly reports Fri-Thurs

1000 1000-0224 thru -0229 from north hill

1030 Max and John scanning, mostly clean but hot spots up near N fence  
Per Johnny, he will work Saturday building borrow road (NE, E)1357 ~~1000~~ #6: 100-0230 -0231: W hill

1408 #8 (NW, NE): 100-0232, -0233, -0234

1419 #7 (NW, NE): 100-0236, -0237

1429 #4: 100-0238

- material in stock pile area being pushed back against hill, 2 dozers

- beginning work along E fence line in flats area

1541 stopped upwind dust monitor #105

1555 " downwind " " #101

- working east from east fence line toward channels

1700 downloaded DM data

Dust monitors for Friday:

set up one in downwind location and the other in upwind location

with the air monitor (ask ~~Max~~ Max or John if unfamiliar with this location)

Downwind will need tripod, upwind location is already set.

WAAW - attach antenna to top of case

- screw case and tripod together (bottom of case)

- attach PVC to top of dust monitor unit

- power on dust monitor

- make note of VER number on opening screen (104 or 105)

- Press enter at "start run"

LF offsite 1700



9-14-12

0730 - Toby arrived onsite

0755 - Setup air sampler #104 downwind of construction. Construction crew just getting equipment warmed up. Excavating now east of residence. Setup sampler across from arch site at confluence of ED channel + small gully.

0805 - Setup air sampler #105 at upwind loc. Still clear + cool today (40°)

0900 - Driving around mine site, re-familiarizing myself w/site. There are many types of surface debris, such

as concrete structures + foundations, telephone poles, phone boxes, steel pipes, etc. They need to be mapped

1130 - Excavation east of residence still occurring. Doing a poor job of dust control, in excavation area + along RWR 1566.

1530 - Ass above. Light breeze today. 40s this morning, 68°F now.

1550 - Shut down upwind sampler.

1600 - Shutdown downwind sampler.

1615 - Done for day.

~~RSS 9/14/12~~

9/17/12 dust man  
0745 set up air sampler #105 downwind  
at confluence area. zero initialize  
prior

See Johnny, an a 2nd water truck  
is here, waiting for 2 towers today  
need operator for 2nd water truck

0818 started UW ~~monitor~~ dust man.  
#104 in zero/init before starting 2.5/10

Per Toby:

- AMEC dust control... RWPR too
- Landauer: controls + bridges???
- traffic control? Turning on to RWPR
- surface debris
- Weeklies only to Lance
- Thurs mtg w/ Lance ✓ emailed,  
set up

0930 Walked site w/ Nat, large area N  
of Zone 4 where still reading hot,  
grass showing through, needs  
revisiting. Excavation is now near  
blue-flagged Zone 5 and on the  
south side of Zone 1

Nat walked site w/ Johnny, pointed  
out areas that need to be redone

→ Bruce

1030 Talked to Landauer, sent 2 emails  
about our order

call Nat at around 4. Max injured  
hand over weekend and might be  
out.

Water towers have arrived, issue  
may be getting enough water to  
use...

PM 10? ELI coolers? + m/w

1230 called Tessa Burke to follow  
up on coolers

- follow up w/ Johnny on 2nd water  
truck operator
- Results of scanning to Lance
- dust monitoring readings?

1330 spoke w/ Pine Enviro, screw on  
hex bolts to regulate particle size  
PM<sub>10</sub> is default

1530 Max has a broken finger and will not  
likely be available this week. Johnny  
and Nat plan to re-scrub N zone 2  
and scan S Zone 2 on Wednesday,  
Nat will have S here to scan

1630 picked up dust monitors. UW  
monitor had stopped, out of power

- 1645 Per Toby, AMEC should have someone who can help with excavation control. Johnny doesn't know of anyone and says it'd be a conflict of interest.
- 1700 Nick downloading dust monitors, data from Fri + Mon on flash drive

LF 02 site 1740

9/18/12

- 0700 Safety meeting, brought up the importance of being cautious exiting onto RWPR
- 0745 Installed 2.54m fittings onto dust monitors
- 0805 Dust monitor to downwind location at E. drainage confluence w/ gully near arch site
- 0905 Dust monitor #105 to upwind location, zeroing
- 0930 Began reading #105
- 0945 Problems with dust monitor that has been recorded as #104. Swapping this one out with a back-up monitor, will be recorded by serial number, SN0599
- 1020 Started SN0599, readings look good and LAR flow rates 2 LPM
- 1100 Per Toby, Mark R, Jesse left for Australia and his boss is waiting for him to respond

1330 Per Toby, Field change request is needed for boundary delineation outside estimated area

Emailed Lance

1450 Zone 1? Dinetahdos

include dust results in weekly

1630 Stopped both Dust monitors.

Per email from Jesse, seed mix will be sent in morning.

Upwind: SN0619

dnwind: SN0599

both set to 2.5 um

Offsite 1745

9/19/12

0715 onsite

switching out PM<sub>2.5</sub> piece with PM<sub>10</sub>, switching whole unit since extra  
PM<sub>2.5</sub>: A02427

A02199

PM<sub>10</sub>: A02029

~~A014150~~

0745 Per Nick, only 4 loads of water available, <sup>today</sup> Johnny says 5 more are possible elsewhere. Will need to monitor throughout day

0800 Downwind monitor: SN0619, initializing/zeroing, PM<sub>10</sub> installed (014150)

0815 Upwind monitor: SN0599, initializing/zeroing, PM<sub>10</sub> (A02029) ... started after zeroed

0830 Dozer down for day, needs belt  
Nat marking G to start area Sof E ding less than 1/4 ac  
Motor grader fixed

1100 weekly in pdf ✓

1230 Sent weekly report w/photos to Lance, Toby

1300 Visited site w/Nat, Tony. Area along W side of Zone 5 needs to be redone. N half to 6", S very hot, at least 1'. Johnny's crew currently re-doing Zone 2 area w/blade, excavator starting Zone 4, laborers working on confluence trash.

1400 Per Toby, seed mixes have been ok'd.

1520 #6A, B: 100-0240, -0241 W of RWPR

#7A, B: 100-0242, -0243

#8A, B, C: 100-0244, -0245, -0246

#9: 100-0247

1630 Per Mark R, need to do 72-hr monitoring over for DW location

#11: 100-0248, -0249

1700 Retrieved dust monitors. Dust was a slight problem due to one water truck being down and limited water available but wind was very light (if any) so dust transport was minimal.

1720 Downloaded data from dust monitors. Both machines appear to have collected data today but SN0599 did not collect yesterday. Per Mark, 72-hour data needs to be re-collected next week. *let him know locations of monitors*

*SN0619 (DW)  
AVG = 12.26*

*LF offsite 1745*

- 7:20 LF on site Downwind  
Dust monitoring with PM2.5  
SN 0619 set up just S of zone 4 at  
08:10. Tag #4? Z/I'd before starting
- 08:20 Upwind dust monitor, SN 0599  
Z/I'd, reading Jan 25 2000?  
started at 8:32
- 10:30 Water available today, new pump was  
successfully installed. Still only one  
water truck, Znd has broken manifold O-ring.  
Wind is calm so far. Znd dozer  
waiting on new belt.  
Per Landauer, badges have been sent  
and should arrive soon. emailing  
fracking number.
- 12:30 Nat onsite, wanting to scan to  
make sure NE zone 2 is being done
- 13:00 conf call w/ Lance, Nick, Johnny.  
on schedule, Lance happy w/ progress
- 14:20 Nat and Johnny working on NE Z2  
wind still calm, not an issue  
grader ripping area where rad levels  
still high... wind picking up dust devils  
Nat not coming again until Monday  
brief, not steady

- 16:25 Stopped Upwind dust monitor (SN 0599)
- 16:35 Stopped Downwind dust mon (SN 0619)  
crew working on ripping zone 5 (N)  
- loading ripped Z2  
- excavating Z4.

LF off site 05:30

9/21/12

0715 onsite

Downloaded yesterday's DM data onto red flash drive, Z/I'd both

0750 Set up 0599 downwind w/ PM10

0812 " " 0619 upwind

1000 Per Nat, he will not be out today but will scan first thing Monday

1000- worked on reports and photo set

1500 for week 3, sent to Lance for review. Sent in expense sheet

1535 Stopped upwind monitor SNO619

1545 Stopped downwind monitor, SNO599

Crew working on Zone 4 excavation, Zone 5 N. end

Crew does not plan to work over the weekend.

LF offsite 1700

9/24/12

0715 onsite

0745 Dust monitors out to UWind DW locations, PM<sub>2.5</sub> monitoring today on upwind location. PM<sub>10</sub> monitoring over 72-hr period (continuous)

SNO599 beginning today. Replacement for inadequate data collected by dust monitor in first week. Generator will have to be maintained over this period. DM data collected on flash drive from 9/21

0830 Set up SNO599 downwind w/ PM10

0850 " " SNO619 upwind, PM<sub>2.5</sub>

1700 #8 A, B, C: 100-0252, -0253, -0254

#7 A, B: 100-0255, -0256

#9 = 100-0257

#6 A, B: 100-0258, -0259, -0260

#4 = 100-0261

1415 Storms picking up, wind/dust increasing but rain 5-10 mins later fixed dust problem somewhat.

1630 Picked up upwind dust monitor. Downwind monitor is on generator, running overnight.

LF offsite 1745

9/25/12

0720 onsite

Set up upwind dust monitor w/ PM<sub>10</sub>

0750 checked on downwind dust monitor, ok  
picking up windrow posts in Zone 2, #  
material along silt fence piled and  
ready for pick up. Silt fence  
will be inspected today post-rain,  
significant rain last night; wet  
conditions on site.

Crew also working on excavation of  
east end of Zone 4

still, calm morning, pt. cloudy, 50s

0800 Mark will check Silt fence and  
complete SWPPP inspection

1210 Nat leaving, Bill Sass on site today.  
SWPPP form 9/12/12 received from  
Johnny / Mark Spitz

clouds building, scattered showers

- Excavating east end of Zone 4, area  
border betwn Z's 1, 4, 5, (Zone 2), SE Zone 2

- Mark removing metal (M.G.)  
windrow stakes

1430 Picking up piles along W fence,  
anthills where metal stakes had been

1430 still excavating area on E end of Z<sub>4</sub>

1500 Air monitoring Mon + Wed this week

~~1500~~ Distant lightning, crew and leadets  
aware and watching storms

1630 Dust monitor (upwind) stopped and  
brought in to charge, downwind  
fueled to run overnight.

LF offsite 1730



9/26/12 Wednesday

0730 onsite

upwind dust monitor Z/I'd, started at 755. PM<sub>2.5</sub> SNOOBA

0810 checked on downwind dust monitor, has been running ~ 48 hrs, TWA = 12.1 ug/m<sup>3</sup> equipment/crew starting, excavator in Zone 5.

1200 touching up Zone 4 w/ excavator. water truck having electrical problems, motor grader down also.

1400 Zone 5 nearly clean, area of south zone 2 near channel needs 1-2' add'l excavation, Nat breaking into 6', 1', 2' sections

1630 stopped upwind dust monitor downloaded data for 9/24, 25, 26 (Tag #7, 8, 9) onto red flash drive

2:10:55 ~~DOWN~~ wind dust monitor running through morning for full 72-hr read

LF offsite 1745

9/27/12 Thursday

0715 onsite

PM<sub>10</sub> on upwind monitor today

0738 Started upwind DM after Z/I <sup>SWOP</sup>

0745 downwind dust monitor will finish 72-hr cycle at 8:35 SNOOBA

0835 Stopped DM to end 72-hr run.

SNOOBA Tag #3, stopped generator.

Zersing/initializing, starting new run w/ PM<sub>2.5</sub> using cap for Z/I

Crew working on hot areas of S Zone 4 edge, loader picking up S zone 2 material

1100 Per Bill, Mark would like another dust monitor at the bus stop

1245 Loader still working on south zone 2 excavator in zone 2, east of Z5

1330 Called Rena @ Dinehdress to make her aware of construction schedule, will need them onsite early next week most likely. Call Monday

1430 Landover Hedges finally arrived

1530 Walked fence line told Mark and Nick about breaks. SWPPP to be completed this week

1630 photos of site

#7 A, B: 100-0262, -0263

#8 A, B, C: 100-0264, -0265, -0266

#6 A, B: 100-0267, -0268

#9: 100-0269

#4: 100-0270, -0271

SW PPP inspection completed

Took down dust monitors, back to office to change

1800 LF offsite

9/28/12

0715 onsite

Downloaded dust monitor data, talked to Johnathan about talking down at end of day

8:45 SN0619 w/ PM<sub>10</sub> downwind, SN0519 w/ PM<sub>2.5</sub> upwind. Set up in the usual places.

- crew will continue to excavate SE Zone 2, deeper area near Zones 1 and 5; they will work on N fence line after.

1000 Preparing weekly report for Lance

1115 LF offsite

10/1/2012

0715 onsite

placing new dust monitor at School bus stop area, PM10 SNO198

0800 SNO619 w/ PM2.5 downwind

SNO599 w/ PM<sub>10</sub> upwind

0903 SNO198 - school stop - had to get tractor to begin.

scanning zone 3, N side of S side close. No additional areas of excavation.

Re-excavating zone around N culvert into zone 2 near entrance

Starting zone 1 excavation from W end going E (down gradient)

still some material in zone 2 near zones 1 and 5, zone 4 needing extra work

1015 Rena (Dinetahdas) will be out at 1 PM tomorrow to be present during zone 1 excavation

Nat recommends going 4 ft depth in zone 1 down to for intersection w/ zone 5, then 2 ft to E end

Measure deeper areas

1100 water truck working on cleaning RHR

closer to construction

1130 Moved dust monitor to west of arch site, S side of channel

- all areas on far side of N fence cleaned within reasonable degree of success without compromising fence or safety by reaching over with backhoe. Done

1200 Need to process dust monitoring data

1600 took down bustop dust monitor and upwind monitor.

crews working on e. drainage, N culvert channel.

Larry asked for the area under the culvert to be left for CRA, he will have them do it in exchange for water.

1630 Took down downwind dust monitor.

~~1715 LF offsite~~

10/2/2012

0730 onsite

Dust monitors:

0825 SNO619 w/PM<sub>2.5</sub> upwind0801 SNO599 w/PM<sub>10</sub> downwind0818 SNO198 w/PM<sub>2.5</sub> bus stop

Spoke with Johnny, deep/wide excavation needed in section of Zone 1 // appx. 100 m from W fence.

- Nat on site, he and Tony will do final scan of northern zone 2 today to start.
- Left msg w/Dinetahdas, they do not need to come until tomorrow, crew not likely to reach arch site today.

1000 equipment still working in W Zone 1 Nat + Tony scanning

1130 Scan complete, hot areas up high by N culvert and Zone 4.

1300 starting field screen of completed areas in zone 1. first 3 ok, hot after.

1447 CRA on site, they will start excavation of road on Monday.

1500 Nat's scans reading ok levels for first 450 ft except 2 around land bridge  
Assemble dust monitoring data for Mark R.

- 1630 Taking down dust monitors, SNO198 near bus stop never started properly and did not run today.
- SNO599 downwind, very close to excavator. TWA read ~23

LF off site 1730

10/3/12

0715 Onsite

Dust monitors:

0805 SNO198: Bus stop, PM<sub>10</sub>0757 SNO599: upwind, PM<sub>10</sub>0811 SNO619: downwind, PM<sub>2.5</sub>

moved downwind monitor just east of arch site

Per Johnny, Zone 4 has been excavated, will work on confluence area near arch site. Dine tahdas will be out of area

0930 Excavator down. Dine tahdas will come out tomorrow instead

1100 Excavator needs new <sup>hose</sup> belt. Making one in Gallup. Will begin decon of equip and start to haul in borrow material.

1430 Stockpiling borrow material in Zone 3.

1500 Photos #6 A, B: 100-0272, -0273

#8 A, B, C: 100-0275, -0276, -0277

#7 A, B: 100-0278, -0279

#9: 100-0280

1635 #3: could not find original, staked new location. 100-0281

1645 Stopped upwind dust monitor

- Crew is excavating ~6' x 80' x 1' area from Zone 4. Nat says area appx. North of S residence fence line is clean otherwise.
- Site visit by Sacred Wind, took down phone line in stockpile area

#4: 100-0282

1700 Look down bus stop dust monitor

charging dust monitors

1720 Spoke w/ David Canner about site work

~~LF off site 1P30~~

10/4/12

Mark 207  
885  
9100 PE

0700 onsite

Trying to find a 32-bit OS for the dust monitors to download data but having no luck.

Black 0917 SNO199: w/ PM2.5 upwind

Loran 0855 SNO599: w/ PM<sub>10</sub> downwind~~0905~~ SNO198: w/ PM2.5 bus stop

SNO198 with a source failure, going to try to fix at office.

1000 pulled off data from SNO198 from Rick's computer. Self test on machine indicates that the detector/sensor is going bad and we need a replacement.

1035 C. Clifford from Dinetahdoo arrived, introduced him to Mark Spitz and he intends to stay in area while they excavate zone 1.

1100 Zone 4 excavation has gone near 15' deep, Mark R. would like to stop but wants approval from Lance. Email sent, setting up a call.

1200 walked Zone 4 w/ Mark, Nat. Decided to take 1" from ~2m x 2m area instead of skip it.

1230 moved upwind <sup>dust</sup> monitor to bus stop location. Stopped / started monitor in location transition.

1300 Clifford @ Dinetahdoo offsite

1315 Spoke w/ Lance, told him about Zone 4.   
 → make sure site is looking good for next Tues.

- ① 150' long, from culvert, <sup>4' deep x 20' wide</sup> tapering into normal excavation.
- ② corner, 15'-2" deep, 15' x 25'
- ③ 8' deep (var), 75' x 75' (triangle).
- ④ zone 4. 20' deep from banks, 50' x 60'
- ⑤ notch where zone 5 flowed into <sup>across</sup> zone 4. odd-shaped, ~6' deep, 20' x 6'
- ⑥ zone 2. 1.5' deep, 15' x 60'
- ⑦ 2 headcut channels, both ~6' deep, 100' x 15' (tapering back)
- ⑧ N zone 5, 3' deep, 10' x 20'
- ⑨ " " " 3' deep, 15' x 20'
- ⑩ S zone 5, 3 1/2' deep, 15' x 150'
- ⑪ S zone 2, 2.5' deep, ~30' x 250'
- ⑫ 6"-12"

1630 took down bus stop dust monitor

1715 Downloaded 0599 and 0619 files  
 0599 thru tag #9  
 0619 thru tag #16

CF offsite 1730

"Rite in the Rain"  
 ALL-WEATHER WRITING PAPER



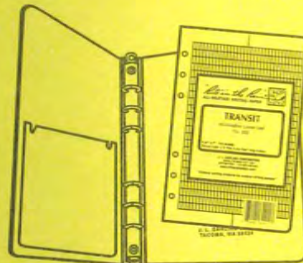
"Outdoor writing products...  
 ...for outdoor writing people."



Copier & Ink-Jet Paper



Bound Books



Loose Leaf / Ring Binders



Memo Books



All-Weather Pens



Notebooks

[www.RiteintheRain.com](http://www.RiteintheRain.com)

CM







10/5/2012

EMC 5900 counts/min cleanup req. 5%  
FSL 4500 " "

0720 LF, David Conner onsite  
Reviewed site procedures w/ David

0830 Dust monitors out to field locations

Black vents - SNO619 w/ PM<sub>2.5</sub> at bus stop  
Green vents - SNO599 w/ PM<sub>10</sub> downwind, just east of arch site

showed photo locations 6, 7, 8 to David  
#8A, B, C: 100-0283, -0284, -0285  
#7A, B: 100-0286, -0287  
#6A, B: 100-0288, -0289

1015 Mark R. needs dust monitoring files, downloaded onto his flash drive after sorting

14:30 Zone 1 excavation nearing completion  
Stormwater fence extension complete for Zone 2 extension.  
Zone 4 cleanup complete as noted

16:30 Crews started work in EDRA (SNO619)  
16:45 Stopped upwind dust monitor at bus stop  
16:55 Stopped upwind dust monitor east of arch site (SNO599)  
DC off site 17:30

10/8/2012

0730 DC onsite, ~~Coordinate~~ Plans for day w/ AMEC

0830 Dust monitors out to field locations  
Black vent SNO619 w/ PM<sub>2.5</sub> downwind

0830 Green vents SNO599 w/ PM<sub>10</sub> at bus stop  
0830 Filling Zones 2 & 5  
Excavating downstream of channel drain for

1020 Touch base w/ Nat 200' between #24.5 to #28.5  
Consult Toby on backfill approach for Zone 4 & possible route alternatives during Quivira construction on road

1200 Discussion photos for Toby re Zone 4 backfill & erosion/stabilization control.

1400 Also ramp to road still not from truck spillage  
Coord. w/ Nat. Area just north of house in EDRA under port-a-johns needed excavating (2+ feet) (Quivira site installed silt fence along road in morning (east side))  
26.5-27.5 excavated  
2.5' Rest of  
24.5 to 28.5 excavated 1.5'

Quivira grading office parking lot & haul road to Quivira pad. Added gravel to inclined part of road up to pad.  
Besides ramp to road, a few hot spots on road from spillage also marked by AUM w/ AMEC superintendent

17:30 DC off site

10/9/2012

0740 DC onsite

0815 Dust monitors out to field locations

Black vents SNO619 w/PM<sub>2.5</sub> - upwind atGreen vents SNO599 w/PM<sub>10</sub> downwind9:30 Coord w/ Mark Spitz regarding plans <sup>bus stop</sup> just east of Arch site

10:00 Drive site. Working on backfilling &amp; grading zones 2 &amp; 5

11:00 Inquire w/ Mark Spitz (AMEC Field Super) regarding secondary containment liner walking at front. Right water as it pertains to water & wind ~~risk~~ & tearing risk: very rigid material02:00 Lance Hauer of GE onsite. <sup>MWH</sup> provided escorted tour of site.- Continued ~~sump~~ <sup>silt</sup> ~~water~~ <sup>water</sup> fence improvements here & there

- Backfill &amp; backfill channel, beginning at west end. Dozer &amp; water truck

- Zone 4 is to be graded from  $> 2.5:1$  side slopes to  $4:1$  or  $3:1$ . Remove rock <sup>downstream</sup> & use as fill for northern1800 (stakeholder) Navajo community meeting <sup>finger</sup>

at bus stop w/ GE, Lance Hauer of BHP Billiton,

MWH (DC), EPA <sup>Lance Hauer</sup> (Mark Rippe) &

2000 DC offsite

10/10/2012

0730 DC onsite.

0800 Dust monitors out to field locations

Black vents SNO619 w/PM<sub>2.5</sub> - downwind justGreen vents SNO599 w/PM<sub>10</sub> - upwind at bus

stop.

0930 GE Lance Hauer onsite

1100 Walk/drive site w/ Lance &amp; Mark R. (EPA)

1B:30 AVIM onsite to rad. test SE corner of Zone 6

EPA (Mark R.) & GE (Lance) want to have Zone 6 excavated down to acceptable rad. limit or bedrock, whichever comes first. GE/EPA want to leave in silt fence & perimeter fence at base of NECR-1/Zone 6 for now. Observed sed. pond at northwest base of NECR-1: no present accumulation or historically significant historical accumulation or overflow into unnamed therope #1. Zone 4 being graded/filled beginning on <sup>west</sup> ~~east~~ end per ~~project~~ MWH/GE/EPA/AMEC discussion of  $\sim 10:1$  side slopes & wider channel bottom ( $\sim 10'$ ) than originally designed. Riprap west entry of Zone 4 as described in Toby's email & east exit

1730 DC offsite

today.

10/11/12

- 0725 DC onsite
- 0745 Dust monitors to field locations.  
~~0745~~ Black vents SNO619 w/ PM<sub>2.5</sub> (Downwind by Arc)  
 Green vents SNO599 w/ PM<sub>10</sub> (Upwind @ bus stop)
- 0810 Observed Zone 6 excavation w/ Mark Spitz, Larry Spitz, & excavator operator. Still working on SE corner of zone. Fluorescent yellow-green material observed in layers of bedrock - looks similar to Power Bait for fishing. Nick Dorrell (AMEC onsite safety officer) tested the Power Bait & it is quite hot. ~~Not tested in well~~
- 10:00 Coordinated w/ M. Spitz regarding approach for day. AMEC  
 Non-AMEC site (GE) welding butter bar  
 1030 Lance Hauer's onsite onto excavator
- 1045 Provide site tour to Lance, including Zone 6, 1, 2, 5, 4
- 10:15 Coord. w/ T. Buckhard of AMEC regarding continued Zone 1 & 2 grading. AMEC dozer & water trucks working on western edge of Zone 2 - saturating this area w/ water to get good compaction by culvert. Also grading & spraying water on side slopes of western 3rd of Zone 1. Also backfilling potholes in Zone 2 & delivered 2 dump trucks of fill to residence at EDRA.
- 10:50 Senator Udall & ~~from~~ his visitors arrive near site to observe EDRA from the residence property at EDRA, the road leading to Teddy Nez's & the former Hwy 566 entrance to the former tanks near the office.

Reflected same as yesterday

- 11:40 Senator Udall offsite
- 12:00 Lance Hauer (GE) offsite
- 13:00 EPA Mark Ripperda said to discontinue the up wind monitoring
- 15:00 DARE site again
- 16:20 Retrieve dust monitors
- 16:30 Download dust monitor data w/ Nick (AMEC)

~~17:20~~~~17:20~~

17:20 DC offsite

10/12/2012

- 0740 DC onsite <sup>shutdown after it started, so no data today</sup>
- 0800 Black vents SNO619 w/PM<sub>2.5</sub> Upwind at bus stop
- 0815 Green vents SNO599 w/PM<sub>10</sub> Downwind at
- 1000 Requested Mark Spitz fix the liner of the fuel berm on NEP-1
- 1100 Retrieve ~~monitors~~ <sup>dust monitors</sup> due to nearby rain/wind
- 1120 ~~Work~~ shutdown by Mark Spitz b/c too muddy which would track mud/soil onto roads

12:50 DC offsite

10/15/2012

- 0800 Picked up rental vehicle at Enterprise
- 0930 LF onsite
- 1000 Toured zone 6 w/ Nat, Mark. Deep excavation on SE end of zone 6, wall still hot. Working west, will likely finish tomorrow.
- Zeroed/initialized dust monitors, green vents SNO599 to downwind
- 1100 Zone 6 location. moved tripod
- 1035 SNO619 to bus stop
- 1300 Switched out rental vehicle, lunch.
- 1400 Toured site with Brian (EPA rep) spoke w/ Brian + Johnny, plan is to fill in deep excavation in zone 6. Small piece on s boundary is likely to be deep.
- 1630 Took down dust monitors
- 1700 catch up on notes tomorrow, Schmy will send his edited dailies
- LF offsite 1730

10/16/12

0730 LF onsite

Dust monitors out to previous locations,  
bus stop and east of Zone 6.

0745 zeroed/initialized

black vents, SNO619, to downwind  
green vents, SNO599 to bus stop

0800

Beginning excavation of small triangular  
area up against Zone 6

1000

Talked to Landauer about invoice,  
Appears that they are trying to  
forward-bill 12 months

1100

100-0425 : Sm. triangular area in Zone 6  
.0426 : face on S. end of Zone 6

1200

Lance would like to clean up area  
north of Zone 6, approx 25x20x1

1300

Out to site, Mark remembers area  
Nat is referring to as an area partially  
covered with backfill, could potentially  
get hotter with excavation

1500

excavating area north of Zone 6, cleaning  
up reasonably well

1530 Took badges to Fed Ex

1630 Took down dust monitors

1730 LF offsite

10/17/12

730 LF onsite

Setting up dust monitors,  
zeroing/initializing  
green vents, SNO<sub>59A</sub> to downwind  
black vents, SNO<sub>69A</sub> to bus stop

0800 picking up last of step-out area north  
of Zone 6, area ended up being  
approximately 35' x 65' x 1'

0915 Excavation of Zone 6 has ended, trucks  
now driving to Thoreau for riprap.  
Victor and Tony onsite, out to scan  
Zone 6. Richard will be here  
to survey soon.

1020 Spoke w/ Nat, some areas N of newly  
excavated area in Zone 6 w/ elevated  
readings but not exceptionally high, and  
This area is to be addressed in the  
final survey and is not necessary to  
chase for this effort.

1045 Toby is on board with the above plan  
and would like to end the excavation.

1130ish #2: photo, 100-0428

end of excavation

#6A, B 100-0430, -0431

Zone 6 photos: 100-0432 thru -0436

#1: 100-0437

1330 Brian scanned area w/ Victor, found  
hot areas and called Mark R. Need  
to excavate this area before ending.

1430 Spoke w/ Toby, he agrees with this  
Crew is now excavating north of Zone  
6 in area indicated. Appx. 100' x 35';

1530 Mark S. Indicated that it would  
take roughly a day to clean this  
area and haul.

1645 Scans of extended area indicate that  
excavation is complete and should be  
ready for scan in the AM. Nat will  
be onsite around 9.

- took down dust monitors

LF offsite 1745

10/18/12

0730 LF on site  
zeroing / initializing dust monitors  
black vents, SNOBPA to downwind  
green vents, SNO599 to bus stop

0800 sed basin @ n. culvert per  
Brian / Mark R, muck out w/ STOPPP  
rounds. Brian will have Rio Algom  
divert water out of it

0900 zone 6 complete, begin backfill / survey  
for entire area

1250 #3: 100-0438

1255 #4: 100-0439

1258 #5: 100-0440

1306 #9: 100-0441

1309 #1: 100-0442

1320 #8A,B: 100-0444, -0445, -0446

1325 #7A,B: 100-0447, 0448

Application of bedding material continues  
for East Drainage channel

1000 Gallup security employee hit a cow on  
the way to site last night. cow is dead  
and car likely totaled.

1530 Spoke w/ Toby regarding N. culvert  
and zone 4, etc, he would like  
a summary sent to Lance

1645 Backfill in zone 6, trucks / excav.  
stopped / picked up dust monitors

LF offsite 1730

10/22/12

0720 LF onsite

- Dust monitors did not charge ~~at~~ charging for one hour prior to taking into field.
- Crew did not work on Saturday due to disagreement over riprap costs.
- Weekly sett to Lance on Sunday afternoon

0845- Per Johnny, need to find out details on construction so ~~we~~ they can finish this week, seeder coming on Monday potentially.

- Talked to Landauer, explained that we had not had good service and were not willing to commit to a year with them.
- Mark Ripperda is ok with plans of sed basin at N. culvert and no riprap at head of Zone 4, 3:1 sides

0930 zone 6 has been backfilled

black vents, SNO619, to bus stop  
green vents, SNO599, to dam wind  
(zone 4)

1530 Emails w/ Lance, Toby. Lance is ok with proposed plans for sed basin and 3:1s w/o riprap on zone 4 but would like wattles on the side slopes and for CRA to clean out the culvert.

1630 took down dust monitors, charging at mine office.

LF offsite 1730



10/23/12

0730 LF onsite

Dust monitors to site,  
green vents, SNO599, to bus stop  
black vents, SNO619, to downwind

0830 - Crew working on grading sides of  
Zone 4, riprapping Zone 1, hauling riprap  
from quarry, grading stockpile  
- Some concern over availability of  
riprap at quarry

1300 Conf. call with Lance.

- In favor of CRA dealing w/culvert,  
vs doing sed basin
- leave RPH road
- Wattles on zone 4 headwall?
- leave silt fence up

1500 Spoke w/ Mark R, he is ok with  
no wattles, harrow and hydrostraws is  
OK, emailed Lance

1645 Took down dust monitors, Z4 YWA  
at downwind location

1745 LF offsite

10/24/12

0730 LF onsite

Dust monitors to site after Z/I,  
green vents, SNO599 to downwind  
black vents, SNO619 to bus stop  
→ loc moved from fence line N of  
Zone 4 to fence line btwn Z1 and  
Z4  
- windy today, need to stay on  
top of dust control

0930 Lance ok with no wattles

1200 Crusher down, no riprap until fixed

1245 Photos of site

Zones 4,1: 100-0452 thru -0458

#8A,B,C: 100-0459 thru -0461

Zone 6: thru -0465

#2: 100-0464

#1: 100-0462

1515 per Mark, stockpile is capped and  
finished. Crusher is running.

1600 #3: 100-0466

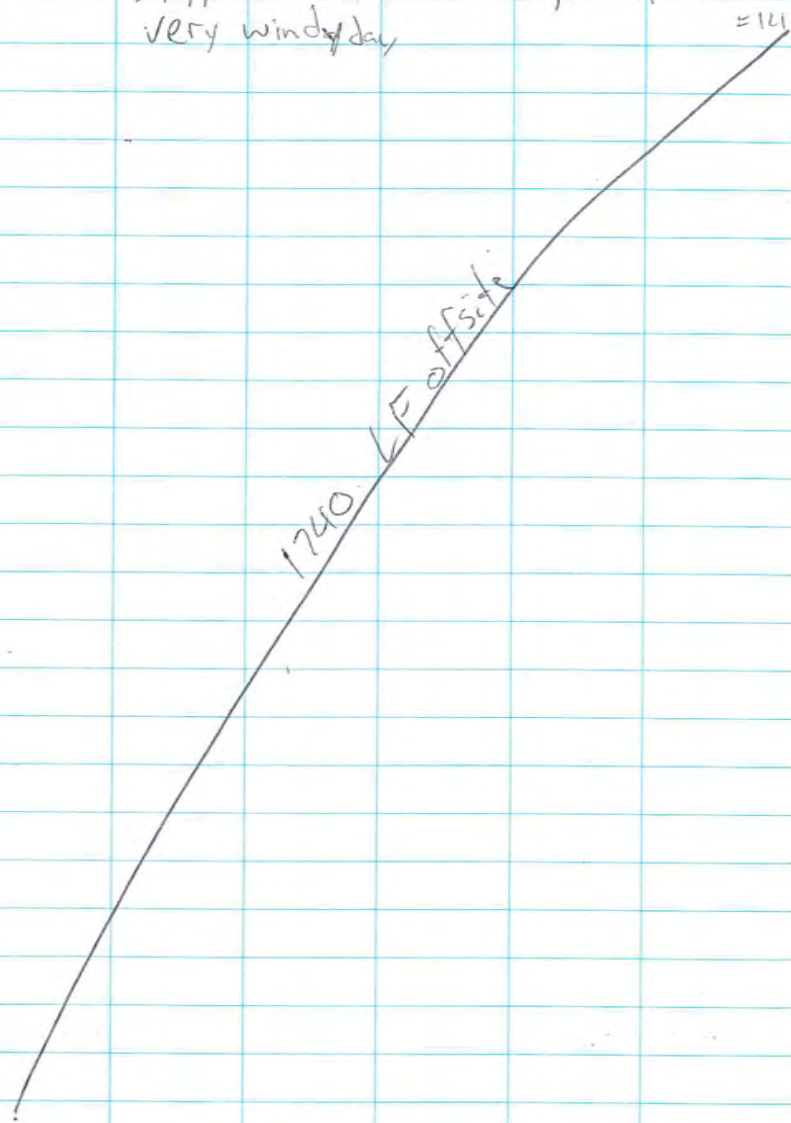
#7A,B: 100-0468, -0467

#6A,B: 100-0469, -0470

#4: 100-0471

#5: 100-0472

1630 Stopped dust monitors, TWA downwind  
very windy day



10/25/12

0700 Safety meeting

0800 dust monitors out to field  
green vents, SNO599 to bus stop  
black vents, SNO619 to downwind

0830 Crew hauling riprap from Thoreau,  
appx. 20 loads needed. ~500' left  
to cover East Drainage. Grading  
remainder of Stockpile cap and  
Flats area.

1030 Waiting on riprap to arrive

1200 Last 2 loads of rock arrived, missing  
riprap filled in. Indicated to  
Mark S that a channel in the  
center of the riprap needed to be  
achieved.

1430 Johnny confirmed that the minimum  
depth and width for the channel  
riprap has been met.

#9 100-0473

1630 Taking down bus stop dust monitor

1730 LF offsite

10/26/12

0730 LFonsite

downloading dust monitors

0599 (3 in vents)

Tag 23 → 10/25

22 → 10/24

21 → 10/23

20 → 10/22

19 → 10/18

18 → 10/17

17 → 10/16

16 → 10/15      15 → 10/12

0619 (black vents)

Tag 29 → 10/25

28 → 10/24

27 → 10/23

26 → 10/22

25 → 10/18

24 → 10/17

23 → 10/16

22 → 10/15

0940 Per Mark R, some warm areas  
(1.5 x bkgd) near entrance to flats  
area but he is not concerned, likes  
the work we've done and is  
content with us finishing.

Ed Balchlock

928 797-9360

**APPENDIX B**  
**CULTURAL RESOURCE SURVEY REPORTS**

# CULTURAL RESOURCES COMPLIANCE FORM

THE NAVAJO NATION  
HISTORIC PRESERVATION DEPARTMENT  
PO BOX 4950  
WINDOW ROCK, ARIZONA 86515

ROUTING: COPIES TO  
NM SHPO  
REAL PROPERTY MGT/330  
XX DCRM

NNHPD NO. HPD-11-340  
OTHER PROJECT NO.  
DCRM 2011-17

PROJECT TITLE: DCRM 2011-17: A Cultural Resource Inventory of 27.5 Acres of Land for Reclamation for MWH Global in Churchrock Mine, McKinley County, New Mexico

LEAD AGENCY: EPA

SPONSOR: Toby Leeson, MWH Global, Inc. 1475 Pine Grove Rd., Suite 109, Steamboat Springs, Colorado 80477

PROJECT DESCRIPTION: The proposed undertaking will involve reclaiming portions of the project area by excavating contaminated surface soils. Excavation will consist of removing 6-12 inches of dirt & replacing it with dirt from off-site. Erosion control measures will also be constructed to help prevent soil loss, and finally reestablishing the vegetation. Ground disturbance will be intensive and extensive with the use of heavy equipment.

LAND STATUS: Navajo Tribal Trust

CHAPTER: Coyote Canyon

LOCATION: Unplatted & Projected T.17N, R.16W - Sec. 36; Hard Ground Flats & Oak Spring Quadrangles, McKinley County, New Mexico NMPM

PROJECT ARCHAEOLOGIST: Jeremy Begay & Shane V. Wero

NAVAJO ANTIQUITIES PERMIT NO.: BI 1052

DATE INSPECTED: 03/29/11 - 03/31/11

DATE OF REPORT: 04/22/11

TOTAL ACREAGE INSPECTED: 27.5-ac

METHOD OF INVESTIGATION: Class III pedestrian inventory with transects spaced 10 m apart.

LIST OF CULTURAL RESOURCES FOUND: (2) Sites (NM-Q-21-100, NM-Q-20-50); (6) Isolated Occurrences (IO); (1) In-Use Site (IUS)

LIST OF ELIGIBLE PROPERTIES: (1) Site (NM-Q-21-100)

LIST OF NON-ELIGIBLE PROPERTIES: (1) Site (NM-Q-20-50); (6) IO; (1) IUS

LIST OF ARCHAEOLOGICAL RESOURCES: (1) Site (NM-Q-21-100)

EFFECT/CONDITIONS OF COMPLIANCE: **No historic properties will be affected with the following conditions:**

**Site NM-Q-21-100:**

1. Site boundary will be flagged by a qualified archaeologist prior to ground disturbing activities.
2. All reclamation activities will avoid the site by at least 50-ft. from the site boundary.

Site NM-Q-20-50:


- 1. Feature 3 of the site will be flagged by a qualified archaeologist prior to ground disturbing activities.
- 2. Reclamation activities may commence within the site boundary, avoiding Feature 3 of the site.

In the event of a discovery ["discovery" means any previously unidentified or incorrectly identified cultural resources including but not limited to archaeological deposits, human remains, or locations reportedly associated with Native American religious/traditional beliefs or practices], all operations in the immediate vicinity of the discovery must cease, and the Navajo Nation Historic Preservation Department must be notified at (928) 871-7148.

FORM PREPARED BY: Tamara Billie  
 FINALIZED: April 29, 2011

Notification to  
 Proceed Recommended:  
 Conditions:

Yes  No   
 Yes  No

  
 Alan S. Downer, Navajo Nation Historic Preservation Officer  
 Date 5-4-11

Navajo Region Approval:

Yes  No

  
 Acting BIA-Regional Director  
 Date 6/9/11

TLN 6.8.11

**CULTURAL RESOURCES INVENTORY REPORT DOCUMENTATION PAGE (HPD Oct/05)**

<b>1. HPD REPORT NO:</b>	<b>2. (FOR HPD USE ONLY)</b>	<b>3. RECIPIENT'S ACCESSION NO.</b>
<b>4. TITLE OF REPORT:</b> DCRM 2011-17: A Cultural Resource Inventory of 27.5 Acres of Land for Reclamation for MWH Global in Churchrock Mine in McKinley County, New Mexico.  Author (s): Jeremy Begay and Shane V. Wero		<b>5. FIELDWORK DATES:</b> March 29, 31 2011
<b>7. CONSULTANT'S NAME AND ADDRESS:</b> <b>Gen. Charge:</b> Mrs. Rena Martin and Ms. Loretta Chavez <b>Org. Name:</b> Dinétahdóó CRM <b>Org. Address:</b> P.O. Box 2012 Farmington, NM 87499  <b>Phone:</b> (505) 960-9478 or (505) 960-9749		<b>6. REPORT DATE:</b> 04/22/2011  <b>8. PERMIT NO.:</b> B11052
<b>10. SPONSOR'S NAME AND ADDRESS:</b> <b>Ind. Responsible:</b> Mr. Toby Leeson, P.G. Principle Hydrologist / Location Manager <b>Org. Name:</b> MWH Global, Inc. <b>Org. Address:</b> 1475 Pine Grove Rd., Suite 109 Steamboat Springs, CO 80477 <b>Phone:</b> (970) 871-4361 Cell: (970) 367-6022		<b>9. CONSULTANT'S REPORT NO.:</b> DCRM 2011-17  <b>11. SPONSOR'S PROJECT NO.:</b> N/A
<b>13. LOCATION (MAP ATTACHED)</b> a. <b>Chapter:</b> Coyote Canyon b. <b>Agency:</b> Fort Defiance c. <b>County:</b> McKinley d. <b>State:</b> New Mexico e. <b>Land Status:</b> Navajo Tribal Trust f. <b>UTM:</b> See Supplemental Sheet g. <b>Legal Description:</b> See Supplemental Sheet h. <b>USGS 7.5' Maps:</b> See Supplemental Sheet		
<b>14. REPORT /X/ OR SUMMARY (REPORT ATTACHED) // OR PRELIMINARY REPORT //</b> a. <b>Description of Undertaking:</b> See Supplemental Sheet b. <b>Area of Environmental &amp; Cultural Setting:</b> See Supplemental Sheet c. <b>Existing Data Review:</b> See Supplemental Sheet d. <b>Field Methods:</b> See Supplemental Sheet		
<b>15. CULTURAL RESOURCE FINDINGS:</b> a. <b>Location/Identification of Each Resource:</b> See Supplemental Sheet b. <b>Evaluation of Significance of Each Resource:</b> See Supplemental Sheet		
<b>16. MANAGEMENT SUMMARY (RECOMMENDATION):</b> See Supplemental Sheet		
<b>17. CERTIFICATION:</b> <b>SIGNATURE:</b> _____ <b>Date:</b> _____ <b>General Charge Name:</b> <u>Rena Martin, Anthropologist</u>  <b>SIGNATURE:</b> _____ <b>Date:</b> _____ <b>Direct Charge Name:</b> <u>Shane V. Wero, Archaeologist</u>		

### 13. LOCATION:

**Table 1.0. Designation, UTM Coordinates and Legal Descriptions for the Project Area.**

Designation	UTM Coordinates <sup>1</sup> Zone 12		Legal Description						USGS Map Name
	Northing	Easting	¼	¼	¼	Sec.	T	R	
<b>Churchrock 1</b>									Hard Ground Flats, N. Mex. 1963 P.R. 1979
A	3949275	0726026	*	*	*	*	17N	16W	
B	3949154	0726037	*	*	*	*	17N	16W	
C	3949156	0726461	*	*	*	*	17N	16W	
D	3949443	0726322	*	*	*	*	17N	16W	Oak Spring, N. Mex. 1963 P.I. 1978
<b>Churchrock 2</b>									Oak Spring, N. Mex. 1963 P.I. 1978
E	3948984	0726521	*	*	*	36	17N	16W	
F	3948911	0726568	*	*	*	36	17N	16W	
G	3948942	0726669	*	*	*	36	17N	16W	
H	3949097	0726797	*	*	*	36	17N	16W	
I	3949095	0726669	*	*	*	36	17N	16W	

**KEY:** BOL Denotes Beginning of Line    B Denotes Bend    EOL Denotes End of Line    \*Denotes Unplatted

Area

(1) UTM Coordinates in NAD 83

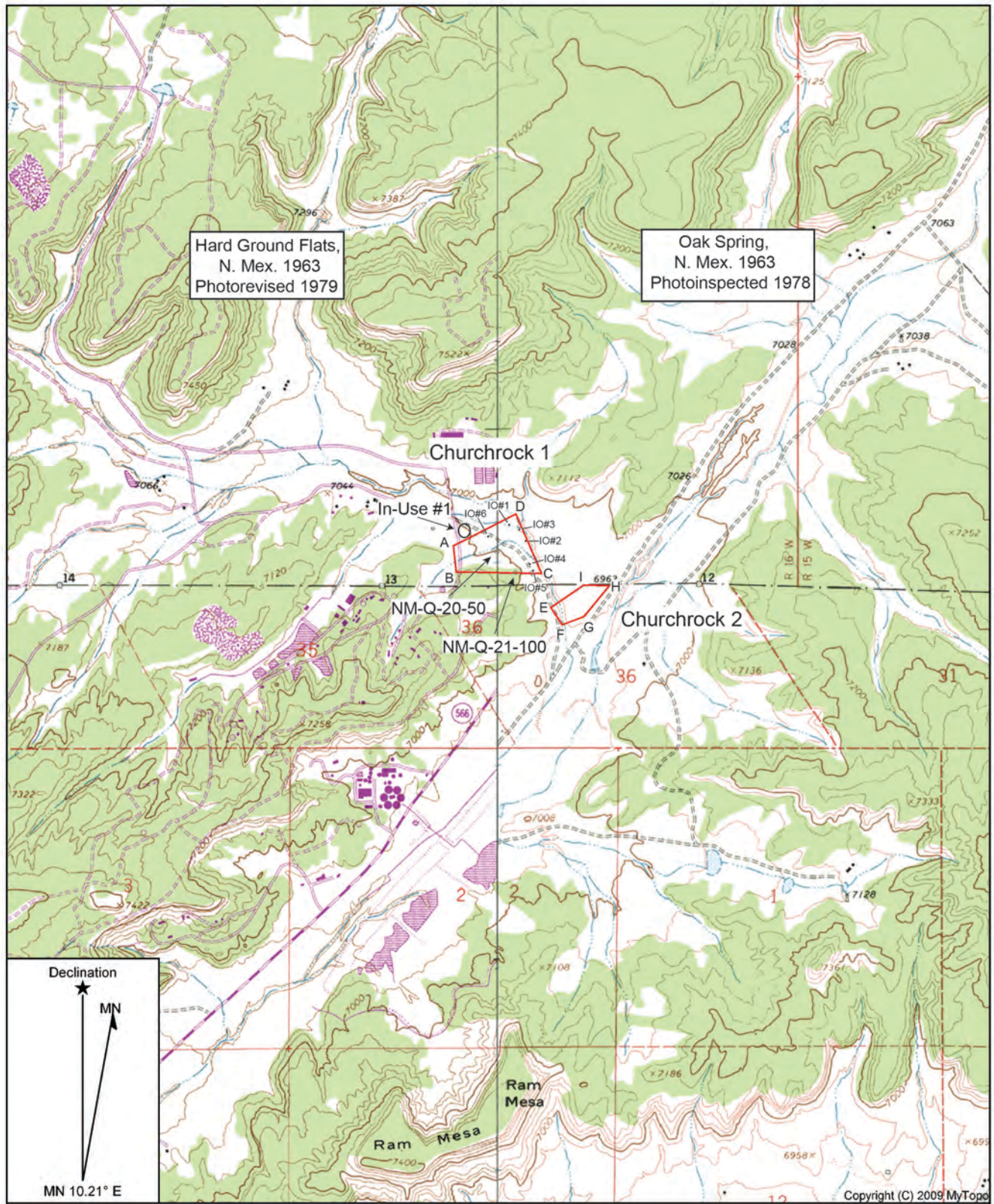
### 14. REPORT:

**a. Description of Undertaking:** MWH Global proposes to remediate portions of the project area by excavating contaminated surface soils from the survey area. The lead agency overseeing this project is under the Navajo Nation Environmental Protection Agency (EPA). Surface excavations will consist of removing 6 to 12 inches of dirt, while 6 to 12 feet of material will be removed from the unnamed arroyo located along the western and northern edge of the survey area. The contaminated soil will be removed from the project area and off-site soil will be brought in to replace the removed soil. In addition, some temporary erosion control measures will be constructed to prevent soil loss, and finally, vegetation will be re-established. Two parcels of land make-up the project area and are designated as Churchrock 1 and Churchrock 2. The irregular shaped project areas measures roughly 27.5 acres and is located north of Churchrock mine. A total of approximately 27.5 acres were surveyed. The total area of effect is potentially 27.5 acres.

**b. Area of Environmental & Cultural Setting:**

The project area locations are located on the canyon floors and slopes of a juniper-pinon forested mesa. Access to the location starts from the Red Rocks Park turnoff on Interstate 40 that heads north until the develop highway ends. The two locations, Churchrock 1 and Churchrock 2 are former uranium mines that are scheduled to be reclaimed and have been closed for a number of years. Both locations are located areas that contain juniper-pinon trees, ponderosa pine, gamble oak, crane’s bill, snakeweed, muhly grass, Russian thistle, hedgehog cactus, cholla cactus, sunflower, Rocky Mountain bee plant, prickly pear cactus, Indian ricegrass, horseweed, grama grass, rabbitbrush, and other native grasses. The surrounding area within the canyons, there are homesteads and parcels of land that have been reclaimed during previous clean-up projects for the uranium mine. A majority of the homes in this area have utilities from nearby electrical lines. A large pipeline maintained by Western Refinery runs in a north-south location near the Churchrock 2 parcel. The nearest drainage is an unnamed drainage that flows below and between the two survey areas which are located between Hard Ground Canyon and the Puerco River drainage. Although the nearby families vote in the Church Rock Chapter these survey areas are located in the Coyote Canyon Chapter.





Name: OAK SPRING  
Date: 04/05/11  
Scale: 1 inch = 2,000 ft.

Figure 1.0 Map showing specific location of Reclamation Parcels (Churchrock 1 & Churchrock 2), In-Use site, and identified cultural resources. T 17N R 16W (DCRM 2011-17)

Copyright (C) 2009 MyTopo

Coyote Canyon is where the famous Navajo chief, Manuelito, returned to after being incarcerated at Ft. Sumner, NM. His residence was located in the northern portion of the chapter area. Manuelito lived out the rest of his life there and eventually was buried there. Coyote Canyon is an isolated community that has limited utilities for its inhabitants. A trading post was established in the early 1900s. In 1930, the first chapter house was built and its delegates to the Navajo Tribal Council were Mr. Charles Damon and Mr. Billy Duncan. Between 1950 and 1980 health and social services were introduced to the Coyote Canyon community. In the 1980s, the Navajo Housing Authority built the first modern single-family housing complex in this area. The Coyote Canyon Chapter strongly believes that the local community needs the establishment of appropriate facilities in order for the community to thrive and grow. (LSR Innovations: 2004)

- b. Existing Data Review:** Prior to fieldwork, a literature search was conducted at the Navajo Nation Historic Preservation Department's (NNHPD) office, located in Window Rock, Arizona. The records search indicated that eight (8) previous inventories have been conducted within a 300 ft (91 m) of the project area, The previous archaeology inventories area as follows: HPD 99-311, HPD 05-133, HPD 05-855, HPD 76-213, HPD 09-454, HPD 02-482 and DCRM 2010-37. As a result of these surveys, two previous archaeological sites were recorded near the project areas, LA 160002 (Navajo Habitation-1940 A.D.) and NM-Q-20-22 (PII [900-1000 AD] Anasazi ceramic sherd scatter).

Further investigation of the existing information at the Navajo Nation Historic Preservation Department's Traditional Cultural Program's traditional cultural properties (TCP) database reveals that three TCPs were identified within over a 5-mile radius, Church Rock (*Tse li'ahi*), Red Water Pond (*To hask'idi*), and Togay Trail (*Tse'aah Chahalheel*).

Additionally, ethnographic interviews by Mr. Richard Begay with local families reveals two place names TCP's to be within a 1-mile radius of the project areas, Red Point (*Lichii deez'a*) and Horse Trail Up (*Lii ha'atiin*). The proposed project will not affect these two identified TCPs. Begay's interviews were conducted in conjunction with previous contaminated soil clean-up and reclamation activities related to this former mine.

Van Valkenburgh (1974) recorded the closest sacred place as a geological formation known as Churchrock / *Tse ii ahi* ("Standing Rock") located approximately 7 miles (11.3 km) south of the project area.

- d. Field Methods:** Between March 29 and April 7, 11, Jeremy Begay, Shane V. Wero, Rena Martin and Loretta Chavez, archaeologists with Dinetahdoo Cultural Resources Management conducted a field inventory of cultural resources and/or ethnographic interviews related to the Churchrock 1 and Churchrock 2 mine areas. Both locations are scheduled to be re-claimed. The project area was surveyed by walking parallel transects spaced no more than 10 ft apart. The area surveyed for the proposed reclamation survey for Churchrock 1 totals 20.5 acres and for Churchrock 2, the total equals 7 acres. The total square feet for both former uranium site boundaries equals 1,197,900 sq. ft (111,288 sq. m). A total area of approximately 27.5 acres (11.1 ha) is considered the area of effect. A total of approximately 27.5 acres (11.1 ha) was inventoried in conjunction with the project.

Two archaeological sites (NM-Q-21-100 and NM-Q-20-50) were identified during the inventory. The sites were recorded using a hand-held GPS, measuring tape, and compass. Isolated occurrences were recorded upon discovery once they had been determined not to be associated with an archaeological site. Enough field notes were taken on the cultural resources to complete site forms in-house.

In accordance with NNHPD guidelines, Rena Martin and Loretta Chavez interviewed local residents to obtain information regarding local traditional cultural properties (TCPs) and any unmarked burials

in the area. Martin and Chavez made to trips to the homes located near the project areas and visited with Ms Katherine Duncan an elder who has an interest in the survey area. Attempts to locate another recommended family member proved to be unproductive. The interview with Ms Duncan resulted in locating a *jishchaa'*; a burned hogan found on site NM-Q-20-50. The hogan was found to be associated with a death and has been avoided by the family for decades. The burned structure is reported to not contain human remains but the family members contacted stated that the hogan should be avoided by all remediation activities. All of interviews were conducted in the Navajo language and conducted in the home of the interviewees. An Identification of Gravesites, Human Remains, and Funerary Items *and* Statement of Wishes form was completed with the interviewee and is attached as Confidential Appendix B.

Consultation was completed with the Red Rock Chapter house, although the project resides in the Coyote Canyon Chapter, Red Rock Chapter was closer and this chapter is familiar with the mine remediation activities. Ms. Michelle John, the office specialist was contacted regarding the project, any known TCPs or graves. Ms. John advised the archaeologists to visit with Mr. Teddy Nez and other local families regarding the project.

## 15. CULTURAL RESOURCES FINDING:

- a. **Location/Identification of Each Resource:** Two (2) archaeological sites, six (6) isolated occurrences and one (1) *Jishchaa'* property were identified in the Churchrock 1 parcel. All identified cultural resources were recorded in field.

### Archaeological Sites

Site NM-Q-21-100 (Figure 2.0)

USGS Map Reference: Oak Spring, N. Mex. 1963 P.I. 1978, USGS 7.5' Quadrangle Map

Legal Location: Township 17N, Range 16W, Section 32

UTM: (NAD 83) Zone 12: N 3949150, E 0726329

Land Status: Navajo Tribal Trust

State: New Mexico

County: McKinley County

Chapter: Coyote Canyon

Site Type: Anasazi Rubble Mound

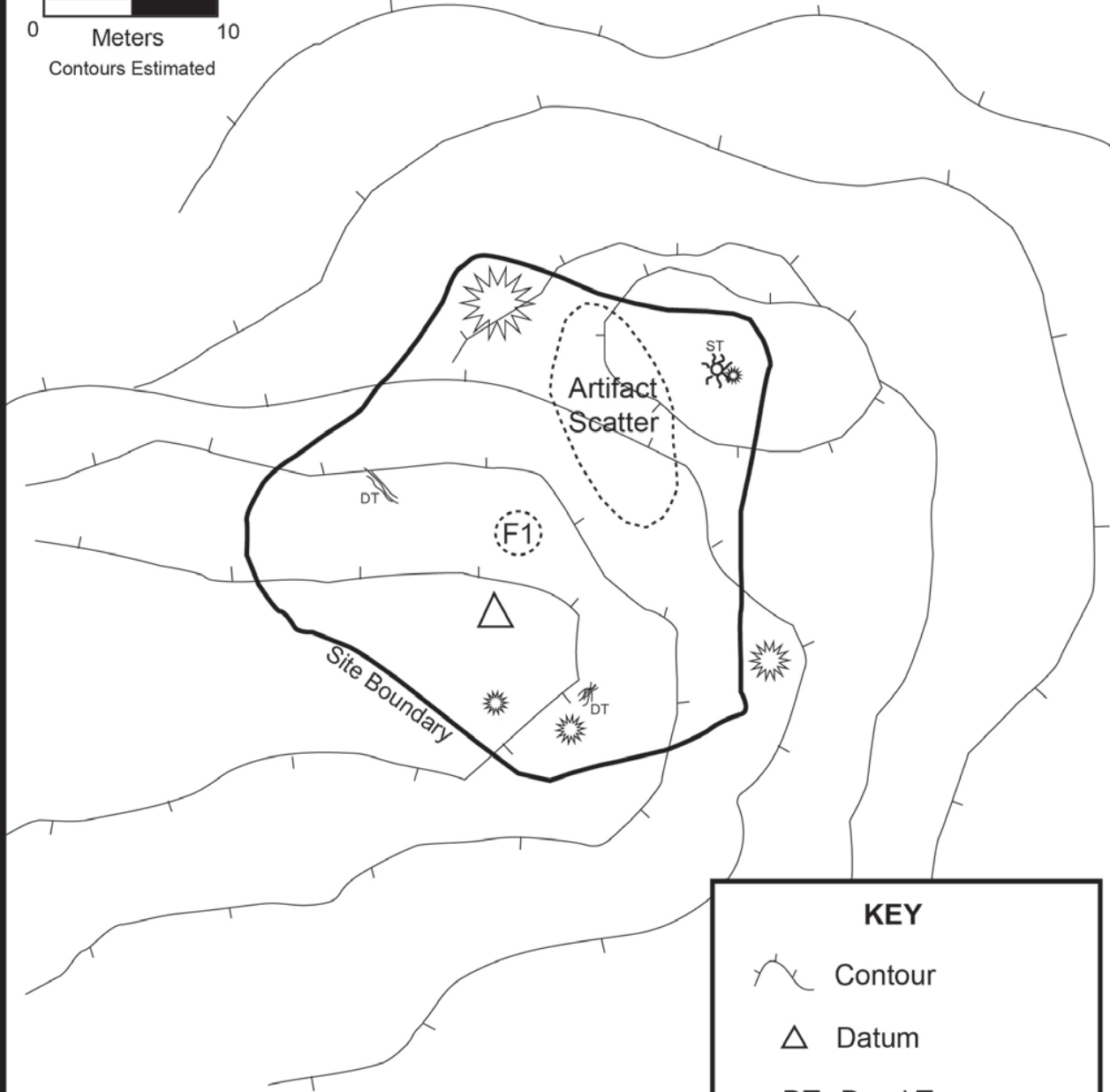
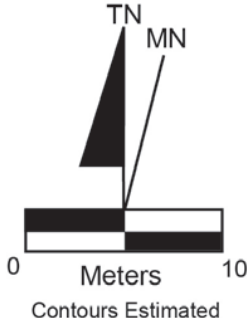
Site Size: 30m x 29m

Site Setting: Northward oriented ridge on west to east oriented terrace

Site Description: NM-Q-21-100 consists of an Anasazi PII habitation site. The site contains one feature was identified and a scatter of artifacts. Feature 1 is a rubble mound measuring approximately 2 by 3 meters. An area measuring approximately 1 meter square contains in-situ wall alignments and upright sandstone slabs, while the remainder of the feature contains a scatter of sandstone slabs and blocks. The feature contains subsurface depth. No additional features were identified. An in-field, non-intrusive assessment determined that NM-Q-21-100 may contain subsurface cultural deposits measuring up to 1.5 meters in depth.

Associated artifacts are scattered north and east of Feature 1, and consist of ceramic and lithic artifacts. The artifact assemblage consists of 100-plus ceramic artifacts including: Gallup and Escavada Black-on -whites, Chaco and Coolidge corrugated, and numerous other unidentified grey, white, and red ware sherds. Also observed were 20-plus lithic artifacts to including flakes at all stages of reduction and exhausted cores of green, brown, and Zuni spotted cherts, grey quartzite, brown silicified wood, and grey siltstone.

# NM-Q-21-100



KEY	
	Contour
	Datum
DT	Dead Tree
	Pinon/Juniper Tree
ST	Tree Stump

General Site Map of NM-Q-21-100 (DCRM 2011-17)

Site NM-Q-20-50 (Figure 3.0)

USGS Map Reference: Hard Ground Flats, N. Mex. 1963 P.R. 1979, USGS 7.5' Quadrangle Map

Legal Location: Township 17N, Range 16W, Unplatted

UTM: (NAD 83) Zone 12: N 3949249, E 0726240

Land Status: Navajo Tribal Trust

State: New Mexico

County: McKinley County

Chapter: Coyote Canyon

Site Type: Navajo Habitation / *Jishchaa'*

Site Size: 59m x 55m

Site Setting: The site is located on the northern slope of a west to east oriented terrace.

Site Description: Site NM-Q-20-50 is a historic Navajo habitation with four features. Feature 1 is the remains of a house measuring 8 by 13 meters. In one area the former house contains wall remains stacked two courses high. The rectangular feature contains a considerable amount of sandstone detritus scattered around the feature. A more recent addition of milled lumber is present in the former house along the southern wall. This add-on feature may have been served as an storage area or perhaps a pen after it was vacated as a house. Numerous rubber shoe sole fragments as well as scraps of leather are located near Feature 1.

Feature 2 is a concentration of ax cut pinyon pine logs and sandstone logs located in an area measuring 9 by 7 meters. The terrain surrounding this feature is devoid of vegetation suggesting that Feature 2 was utilized extensively as a *chaha'oh* (ramada). A small sandstone slab alignment is located in the western portion of Feature 2.

Feature 3 is a sandstone slab and block hogan measuring 7 meters in diameter. This feature is said to be a part of a *jishchaa'*. The feature consists of a circular shape wall alignment and is associated with milled lumber and ax cut pinyon pine fragments. It is obvious that the feature was burned since it contains ashy colored soil and dark red soil surrounds the feature.

Feature 4 contains the collapsed remains of two *bááh bighan* (hornos) in an area measuring 5 by 4 meters. Several visible upright sandstone slabs and scattered sandstone fragments exhibit oxidation.

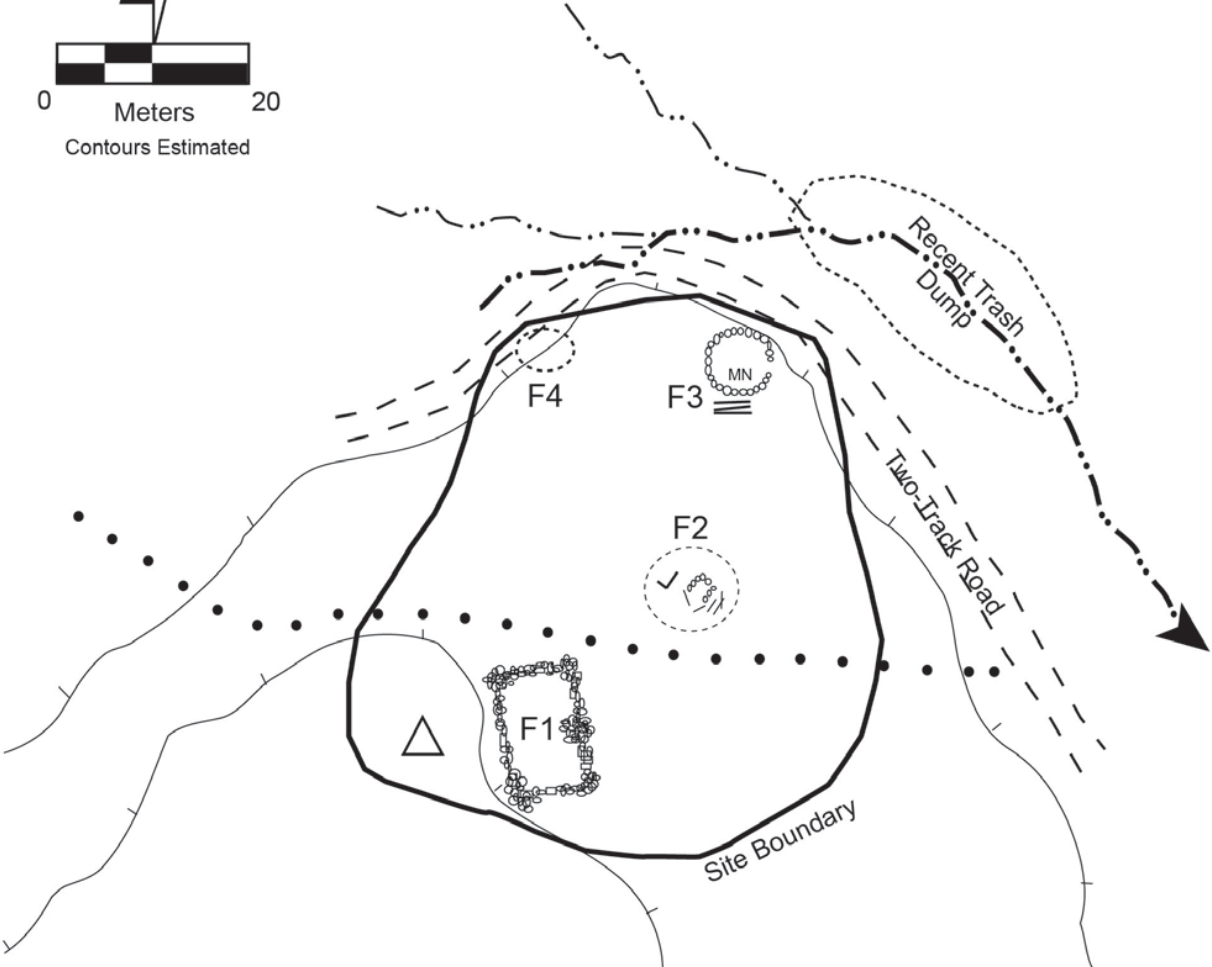
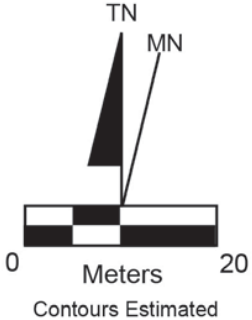
The artifact assemblage consists of 50-plus metal cans (sanitary seal, double locking side seam with church key and pull tab openings), 100-plus clear, blue, and brown glass fragments, 4 iron wagon parts, 1 metal trough, 100-plus milled lumber fragments, iron nails, 20-plus porcelain fragments, rubber shoe sole fragments, leather fragments, and 1 enamel pan. No additional features were identified or recorded. An in-field, non-intrusive assessment determined that site NM-Q-20-50 contains subsurface cultural deposits up to 1m in depth.

Ethnographic Data with Katherine Duncan:

The former homestead, NM-Q-20-50 was a permanent camp for Katherine's family who are of the *Kinlichinnii Dine'e* for many years. The site consisted of habitation structures, corrals, and other features. The site is located in the family's in-use area, which covers a fairly large area. Ms. Duncan stated that there are no graves or TCPs in the site area but a death hogan is present at the location. The family has been living in this area since the 1800's and built permanent homes in the early 1900's. Katherine was born at the camp in 1933.

Parts of the older camp was abandoned sometimes between the late 1930's or mid 1940's when Katherine's older sister died in childbirth in a hogan located on the site (Feature 3). The hogan the

# NM-Q-20-50



KEY	
	Contour
	Datum
	Drainage
	Livestock Trail

General Site Map of NM-Q-20-50 (DCRM 2011-17)

young woman died in was burned. The interviewee wants the hogan foundation to be left in place since it is associated with death and it should be left to deteriorate naturally. She also stressed that the hogan ring be avoided because the sister and baby’s remains have been destroyed by mining activities-the structure is all that remains of the *jishchaa*. The family had buried the deceased (mother and infant) in a rock crevice to south; the grave location was mined. After the deaths of the woman and infant, the family dismantled a sandstone house (Feature 1) that was located at the old camp and rebuilt the house around 1960 in its present location 900 ft (272 m) west of the project area.

Mrs. Duncan asked that the mine place a fence around the perimeter of the hogan ring prior to ground scraping. She also wanted the archeologist to state that “...the mine should only scrape contaminated soils from the contaminated areas and not remove rock during these clean-up activities.” She reported to the archeologist that a TCP (a sandstone bluff) has been partially impacted recently, although the TCP was reported and recorded by Clifford Werito, DCRM archaeologist. Martin and Chavez did not take Ms. Duncan to the TCP location due to the amount of time and the interviewee’s health.

### Isolated Occurrences

During the course of the pedestrian survey on the parcel known as Churchrock 1, six (6) isolated occurrences were identified. Descriptions and location information can be found on Table 2.0.

**Table 2.0 List of Identified Isolated Occurrences, description and location.**

IO Number #	Description	UTM Coordinates, Zone 12
IO #1	2 Coolidge Corrugated sherds and 1 unidentified Black-on-White Sherds	N 3949399, E 0726279
IO #2	1 unidentified greyware sherd and 1 quartzite core	N 3949300, E 0726385
IO #3	3 Coolidge Corrugated Sherds, 1 Gallup Black-on-White sherd, and 1 Red Mesa sherd	N 3949351, E 0726350
IO #4	1 greyware rim sherd	N 3949315, E 0726191
IO #5	1 quartzite secondary flake	N 3949180, E 0726412
IO #6	1 Gallup Black-on	N 3949199, E 0726388

### Jishchaa

During the course of the inventory a Navajo home associated with death or *Jishchaa* was identified. According to the Navajo Nation Historic Preservation Department’s policy (CRPA, CMY-19-88), “The Navajo Nation is committed to protecting all gravesites, human remains, and funerary items under its jurisdiction.” The Navajo word *Jishchaa* is “a term that refers to things that are associated with death as well as the burial itself.” In this case an historic Navajo homestead was identified within the boundaries of the parcel known as Churchrock 1. Ethnographic interviews conducted by Martin and Chavez revealed that the homestead was associated with death; a family member of Ms. Duncan’s died in Feature 3 in the mid-twentieth century. Following traditional protocols, the family buried the human remains; burned the hogan; and dismantle a sandstone house and rebuilt it nearby. What remains at the site today is an outline of the hogan that sits on burnt soil and a square-shaped house foundation that has been dismantle to its foundation. The family request that the burned hogan be left to deteriorate naturally. The family also requested that the outer perimeter of Feature 3 (NM-Q-20-50) be fenced-off from all nearby construction activities.

### **In-Use Sites**

One In-Use site (IUS 1) was encountered during the survey. The IUS was identified as Ms. Grace Cowboy's residence and her family's been living in the area for the past 25 years since the 1980's and consists of a double wide-mobile home with associated features. Grace Cowboy (IUS #1) currently lives the closest to the former site. Grace Cowboy is Ted Nez's wife's sister [Ted is an in-law to the *Kinlichinii Dine'e*].

### **b. Evaluation of Significance of Each Cultural Resource:**

#### **NM-Q-21-100 (Anasazi Rubble Mound)**

NM-Q-21-100 was determined to be eligible for protection under the National Register of Historic Places (NRHP). NM-Q-21-100 meets the 50-year age requirement under NRHP. NM-Q-21-100 retains some aspects of integrity that includes location, feeling, association, material, and setting. NM-Q-21-100 meets criteria (d) which states that the archaeological site, NM-Q-21-100, may provide insight to the Anasazi occupation and resource exploitation in the Hard Canyon Mesa region. NM-Q-21-100 does meet the requirements for protection under the Archaeological Resource Protection Act (ARPA). NM-Q-21-100 does meet the 100-year age requirement under ARPA. NM-Q-21-100 may merit protection under the American Indian Religious Freedom Act because ancestral extant indigenous groups may still hold the place in reverence, i.e. origin stories, migration stories, etc. NM-Q-21-100 may merit protection under the Native American Graves Protection and Repatriation Act due to the possibility of sub-surface features containing human remains and/or funerary objects.

#### **NM-Q-20-50 (Navajo Habitation [Jishchaa])**

NM-Q-20-50 was not determined to be eligible for protection under the National Register of Historic Places (NRHP). NM-Q-20-50 meets the 50-year age requirement under NRHP. NM-Q-20-50 retains integrity of location, feeling, material, association, and setting. NM-Q-20-50 meets criteria (d) which states that the archaeological site, NM-Q-20-50 may provide insight to Navajo occupation and resource exploitation in the Hard Canyon Mesa region. NM-Q-20-50 does not meet the requirements for protection under the Archaeological Resource Protection Act (ARPA) NM-Q-20-50 does not meet the 100-year age requirement under ARPA. NM-Q-20-50 does not merit protection under the American Indian Religious Freedom Act although features may have been blessed. NM-Q-20-50 does merit protection under the Native American Graves Protection and Repatriation Act due to ethnographic interviews revealing that the site is associated with *Jishchaa*. The site's association with death diminishes its possible protection under AIRFA or other laws.

#### **Isolated Occurrences**

All isolated occurrences identified are cultural items not eligible for protection under NRHP. Although all isolated occurrences are more than 50 years old, the isolated occurrences lack all aspects of integrity and future research potentials are exhausted upon recordation of the isolated occurrences. All isolated occurrences meet the 100-year age requirement under ARPA but are not cultural items considered for protection under ARPA. All isolated occurrences do not merit protection under the AIRFA due to the fact that most isolated occurrences are not ceremonial items associated with religious events. All isolated occurrences do not merit protection under the NAGPRA because the isolated occurrences are not associated with any burials and/or funerary items.

#### **In-Use Sites**

IUS 1 does not merit protection under the NRHP. The IUS does not meet the 50-year age requirement although it retains integrity of location, setting, association, workmanship, feeling,



design, and materials. The IUS does meet the 100-year age requirement of ARPA and is not archaeological interest. The In-Use sites may merit protection under the AIRFA. The In-Use sites do not merit protection under the Native American Graves Protection and Repatriation Act.

**Table 4.0. Description and evaluation of cultural resources**

Cultural Resource No.	Description	Evaluation	
NM-Q-21-100	Anasazi Rubble Mound	NRHP	Eligible ? Yes 1. 50-year guideline met 2. Retains integrity of location, setting, feeling and association 3. Does meet criteria d
		ARPA	Eligible ? Yes 1. 100-year guideline met 2. Is of archaeological interest
		AIRFA	May merit consideration
		NAGPRA	May merit consideration
NM-Q-20-50	Historic Navajo Habitation-Jishchaa	NRHP	Eligible ? No 1. 50-year guideline met 2. Retains integrity of location, setting, feeling, and association 3. Does meet criteria d
		ARPA	Eligible ? No 1. 100-year guideline not met 2. Is not of archaeological interest
		AIRFA	Does not merit consideration
		NAGPRA	Does merit consideration
IO's #1-6	Isolated Occurences	NRHP	Eligible? No 1. 50-year guideline met 2. Lacks Integrity 3. Does meet criteria a-d
		ARPA	Eligible ? No 1. 100-year guideline met 2. Are not of archaeological interest
		AIRFA	Do not merit consideration
		NAGPRA	Do not merit consideration
IUS #1	Mobile Home (2000)	NRHP	Eligible ? No 1. 50-year guideline not met 2. Retains integrity of location, setting, feeling, and association 3. Does meet criteria d
		ARPA	Eligible ? No 1. 100-year guideline not met 2. Is not of archaeological interest
		AIRFA	May merit consideration
		NAGPRA	Does not merit consideration

**Recommendations:**

Conditional Archaeological clearance is recommended for the proposed reclamation of the parcels Churchrock 1 and Churchrock 2, with the following stipulations for Churchrock 1.

All or portions of the two archaeological sites must be avoided. Avoidance is recommended for NM-Q-21-100. Feature 3 of site NM-Q-20-50 must be avoided.

1. NM-Q-21-100 must be flagged and fenced prior to any construction activities, all construction activities will avoid entering the site boundary during reclamation efforts.
2. Special considerations for NM-Q-20-50 is as follows as per family's request: The site area may be reclaimed on the condition that a fence is placed around the perimeter of Feature 3 (death hogan) and that all reclamation activities avoided the feature. Feature 3 should not be scraped or have any type of land-altering activities within the fenced area. This feature must be allowed to deteriorate naturally and succumb to natural elements.
3. An archaeologist must be present at both sites (NM-Q-21-100 and NM-Q-20-50) to monitor all reclamation activities.

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LSR Innovations

2004 Chapter Images: 2004 Edition. Produced for the Navajo Nation Division of Community Development, Window Rock, AZ.

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Werito, Clifford

2010 "A Cultural Resources Inventory of the Rio Algom Mining's Church Rock Site 1 and 1E, Fencing Repair Locations for BHP Billiton Base Metals in Church Rock, McKinley County, New Mexico", Report No. DCRM-2010-37, Dinetahdoo Cultural Resources Management, Farmington, NM.

Yazzie, Curtis

2002 "A Cultural Resource Inventory of Thirty-Five Scattered Homes and Proposed Waterline Extensions in Pinedale, McKinley County, New Mexico. NNAD 01-022/NNHPD 02-482.

**APPENDIX A**  
**(Site Forms)**

NAVAJO NATION HISTORIC PRESERVATION DEPARTMENT  
Site Survey and Management Form

SITE NO.: NM-Q-21-100

FIELD OR OTHER NO.: UMW-1

PROJECT NO. & NAME: DCRM 2011-17: A Cultural Resource Inventory of 27.5 Acres of Land for Reclamation for MWH Global in Churchrock Mine in McKinley County, New Mexico.

RECORDING ORGANIZATION: Dinétahdoo CRM

DATE RECORDED: 3/30/11

RECORDED BY: J. Begay, S. Wero

USGS 7.5' MAP REFERENCE: Oak Spring, N. Mex. 1963 P.I. 1978

LEGALS ( NMPM /  AZPM): Township: 17  N /  S, Range: 16  E /  W;  
Sec.: ; 1/4, 1/4, 1/4 ( Unplatted)

UTM COORDINATES (NAD): Zone: 12: 3949150 N, 0726329 E

STATE: NM, COUNTY: McKinley, CHAPTER: Coyote Canyon, AGENCY: Fort Defiance

LAND STATUS: Tribal Trust

GROUND VISIBILITY: 70 % Kind and extent of cover: 30% vegetation

TOPOGRAPHY: Northward oriented ridge on west to east oriented foothill.

NEAREST DRAINAGE: 440 ft (134m) north

ELEVATION (FT/M): 7039 ft / 2145 m SLOPE AND DIRECTION: 5 ° N

SEDIMENT TYPE: Fine-coarse alluvial, aeolian, and colluvial sand

OTHER: pebble-cobble sized sedimentary clasts

VEGETATION PRESENT: prickly pear and cholla cacti, joint fir, juniper, pinyon pine, rabbitbrush, snakeweed, grama grass, and ring muhly

CULTURAL AFFILIATION: Anasazi

SITE TYPE: Habitation

CURRENTLY IN-USE:  Yes,  No Comments:

PERIOD(S) OF OCCUPATION/CONSTRUCTION/USE (date if known): PII (AD 900-1100)

How Dated: Ceramic types

DIMENSIONS OF SITE (L x W): 30 x 29 m TOTAL AREA (sq. m.): 870

ARCHITECTURE PRESENT:  Yes,  No Describe: F1- rubble mound with several visible wall alignments and upright sandstone slabs

TYPES OF ARTIFACTS OBSERVED and QUANTITY OF EACH TYPE (give approximate numbers if not counted): 100+ ceramic sherds to include; Gallup and Escavada black on whites, Chaco and Coolidge corrugated, and numerous other unidentified grey, white, and red ware sherds. 20+ lithic artifacts to include; flakes of all stages of reduction and exhausted cores of green, brown, and Zuni spotted chert, grey quartzite, petrified wood, and grey siltstone.

COLLECTION MADE?  Yes,  No Of What? Method of Collection:

PHOTOS:  Yes,  No Photo ID:

PHYSICAL SITE DESCRIPTION: NM-Q-21-100 contains an Anasazi PII habitation structure located on a north oriented ridge on a west to east oriented terrace. One feature was identified and recorded. Feature 1 is a rubble mound measuring approximately 2 by 3 meters. An area measuring approximately 1 meter square contains in-situ wall alignments and upright sandstone slabs, while the remainder of the feature contains a scatter of sandstone slabs and blocks. The feature contains subsurface depth. No additional features were identified. An in-field, non-intrusive assessment determined that NM-Q-21-100 may contain subsurface cultural deposits measuring up to 1.5 meters in depth.

ETHNOGRAPHIC DATA (if any): n/a

CONDITION OF SITE: Good

CAUSES OF DISTURBANCE: erosion, livestock

LOCATION OF SITE RELATIVE TO PROJECT AREA and AREA OF POTENTIAL EFFECT: Site is located within southern sector.

EXTENT OF INVESTIGATIONS TO DATE: this recording

RESEARCH POTENTIAL/CULTURAL IMPORTANCE OF SITE: Site NM-Q-21-100 may yield data regarding the prehistoric Anasazi PII occupation, settlement patterns, subsistence strategies, and resource exploitation of the greater Pinedale region.

MANAGEMENT RECOMMENDATIONS: 1) The site must be avoided, 2) must be flagged prior to construction activities and 3) Archaeologist must monitor all construction activities nearby

SITE ASSESSMENT UNDER 36 CFR 60.4 (National Register of Historic Places)

REGISTER ELIGIBLE:  Yes,  No,  Potentially

Comments:

INTEGRITY: location , design , setting , materials , workmanship , feeling , association , unknown , none

CRITERIA: a , b , c , d , unknown , none

EXCLUSIONS:

SITE ASSESSMENT UNDER 36 CFR 7.3 (Archaeological Resources Protection Act):

Eligible for Protection?  Yes,  No

Meets 100-Year Guideline?  Yes,  No

Of Archaeological Interest?  Yes,  No

Comments: N/A

SITE ASSESSMENT UNDER P.L. 95-341 (American Indian Religious Freedom Act):

Merit Consideration?  Yes,  No,  N/A

Comments:

SITE ASSESSMENT UNDER NAVAJO NATION JISHCHAA' POLICY/NAGPRA:

Eligible for Protection?  Yes,  No,  Possibly (explain below)

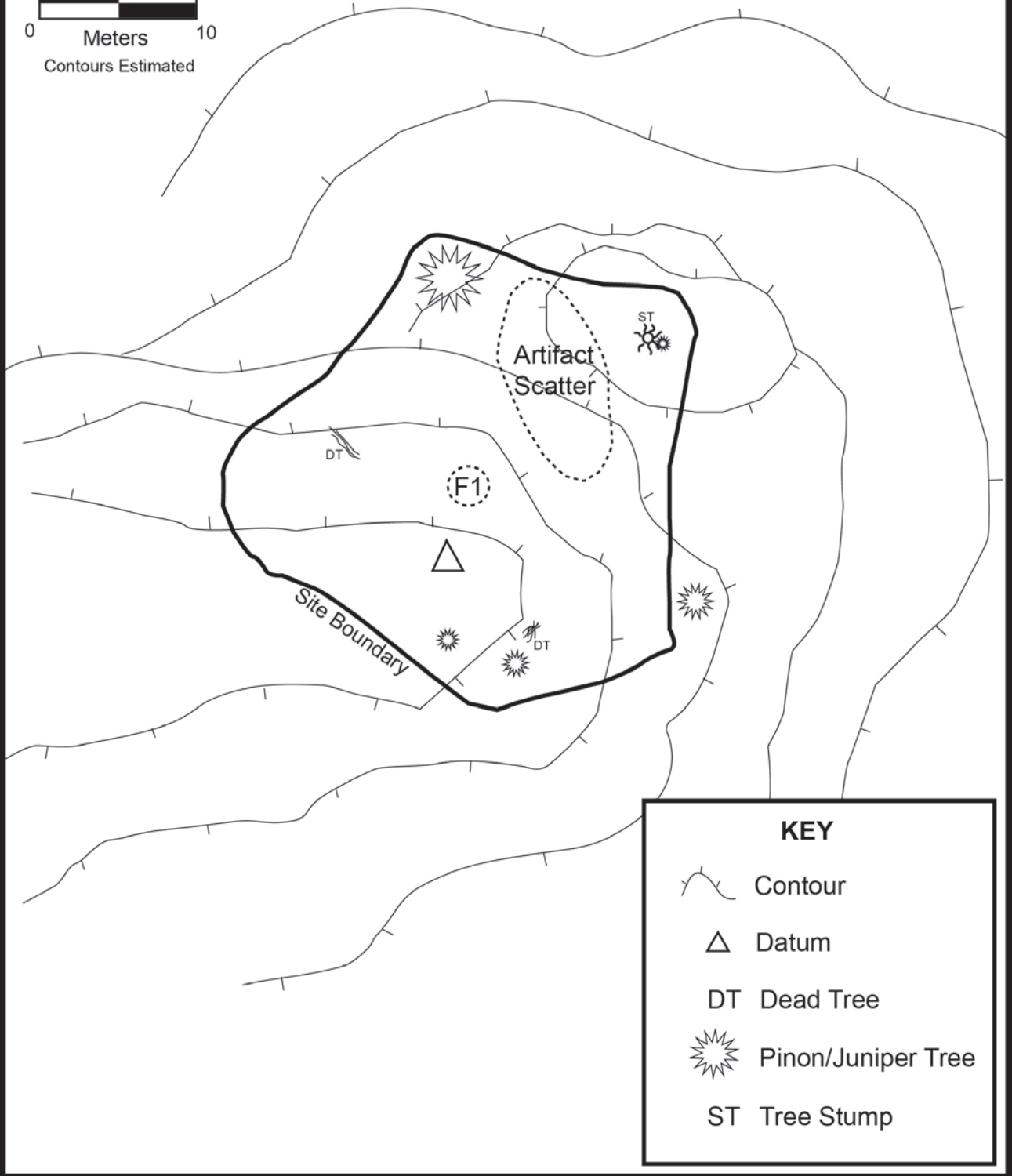
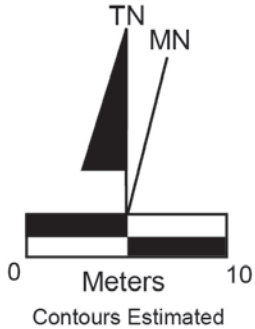
Comments: Site NM-Q-21-100 may contain buried human remains.

HOW CAN THE SITE BE REACHED (Provide a narrative description & refer to attached USGS quad map): See Map

PROVIDE A SITE MAP (Including site designation, site boundary, north arrow, scale, recognizable features, landmarks, and relationship to project area).

OTHER COMMENTS:

# NM-Q-21-100



KEY	
	Contour
	Datum
	DT Dead Tree
	Pinon/Juniper Tree
	ST Tree Stump

General Site Map of NM-Q-21-100 (DCRM 2011-17)

NAVAJO NATION HISTORIC PRESERVATION DEPARTMENT  
Site Survey and Management Form

SITE NO.: NM-Q-20-50 FIELD OR OTHER NO.: UMW-2  
PROJECT NO. & NAME: DCRM 2011-17: A Cultural Resource Inventory of 27.5 Acres of Land for Reclamation for MWH Global in Churchrock Mine in McKinley County, New Mexico.  
RECORDING ORGANIZATION: Dinétahdoo CRM  
DATE RECORDED: 3/30/11 RECORDED BY: J. Begay, S. Wero  
USGS 7.5' MAP REFERENCE: Hard Ground Flats, N. Mex. 1963 PR 1979  
LEGALS ( NMPM /  AZPM): Township: 17  N /  S, Range: 16  E /  W;  
Sec.: ; 1/4, 1/4, 1/4 ( Unplatted)  
UTM COORDINATES (NAD): Zone: 12: 3949249 N, 0726240 E  
STATE: NM, COUNTY: McKinley, CHAPTER: Coyote Canyon, AGENCY: Eastern Navajo  
LAND STATUS: Tribal Trust  
GROUND VISIBILITY: 70 % Kind and extent of cover: 30% Vegetation  
TOPOGRAPHY: North slope of west to east oriented foothill  
NEAREST DRAINAGE: 100 ft (30 m) to the north  
ELEVATION (FT/M): 7020 ft / 2139 m SLOPE AND DIRECTION: >2 ° N  
SEDIMENT TYPE: Fine-coarse grained alluvial and aeolian sand  
OTHER: pebble-boulder sized sedimentary clasts  
VEGETATION PRESENT: snakeweed, rabbitbrush, prickly pear and cholla cacti, ring muhly, grama grass.  
CULTURAL AFFILIATION: Navajo  
SITE TYPE: Habitation / Jishchaa'  
CURRENTLY IN-USE:  Yes,  No Comments:

PERIOD(S) OF OCCUPATION/CONSTRUCTION/USE (date if known): 1940s  
How Dated: Artifacts

DIMENSIONS OF SITE (L × W): 59 × 55 m TOTAL AREA (sq. m.): 3245  
ARCHITECTURE PRESENT:  Yes,  No Describe: F1- habitation structure with visible wall alignments and stacked sandstone slab masonry two courses high of simple construction. F3-corral with visible wall alignments. F4-Two (2) hornos with visible upright sandstone slab wall alignments.

TYPES OF ARTIFACTS OBSERVED and QUANTITY OF EACH TYPE (give approximate numbers if not counted): 50+ metal cans (sanitary seal, double locking side seam with church key and pull tab openings), 100+ clear, blue, and brown glass fragments, 4 iron wagon parts, 1 metal trough, 100+ milled lumber fragments, iron nails, 20+ porcelain fragments, rubber shoe sole fragments, leather fragments, and 1 enamel pan.

COLLECTION MADE?  Yes,  No Of What? Method of Collection:

PHOTOS:  Yes,  No Photo ID:

PHYSICAL SITE DESCRIPTION: Site NM-Q-20-50 is a historic Navajo habitation site containing four features. Feature 1 is a habitation structure measuring 8 x 13m. Feature 1 is the remains of a house measuring 8 by 13 meters. In one area the former house contains wall remains stacked two courses high. The rectangular feature contains a considerable amount of sandstone detritus scattered around the feature. A more recent addition of milled lumber is present in the former house along the southern wall. This add-on feature may have been served as an storage area or perhaps a pen after it was vacated as a house. Numerous rubber shoe sole fragments as well as scraps of leather are located near Feature 1.

Feature 2 is a concentration of ax cut pinyon pine logs and sandstone logs located in an area measuring 9 by 7 meters. The terrain surrounding this feature is devoid of vegetation suggesting that Feature 2 was utilized



extensively as a chaha'oh (ramada). A small sandstone slab alignment is located in the western portion of Feature 2.

Feature 3 is a sandstone slab and block hogan measuring 7 meters in diameter. This feature is said to be a part of a jishchaa'. The feature consists of a circular shape wall alignment and is associated with milled lumber and ax cut pinyon pine fragments. It is obvious that the feature was burned since it contains ashy colored soil and dark red soil surrounds the feature.

Feature 4 contains the collapsed remains of two bááh bighan (hornos) in an area measuring 5 by 4 meters. Several visible upright sandstone slabs and scattered sandstone fragments exhibit oxidation.

The artifact assemblage consists of 50-plus metal cans (sanitary seal, double locking side seam with church key and pull tab openings), 100-plus clear, blue, and brown glass fragments, 4 iron wagon parts, 1 metal trough, 100-plus milled lumber fragments, iron nails, 20-plus porcelain fragments, rubber shoe sole fragments, leather fragments, and 1 enamel pan. No additional features were identified or recorded. An in-field, non-intrusive assessment determined that site NM-Q-20-50 contains subsurface cultural deposits up to 1m in depth.

ETHNOGRAPHIC DATA (if any): Ethnographic Interview with Mrs. Katherine Duncan by Rena Martin and Loretta Chavez 4/11/2011: The former homestead, NM-Q-20-50 was a permanent camp for Katherine's family who are of the Kinlichinnii Dine'e for many years. The site consisted of habitation structures, corrals, and other features. The site is located in the family's in-use area, which covers a fairly large area. Ms. Duncan stated that there are no graves or TCPs in the site area but a death hogan is present at the location. The family has been living in this area since the 1800's and built permanent homes in the early 1900's. Katherine was born at the camp in 1933.

Parts of the older camp was abandoned sometimes between the late 1930's or mid 1940's when Katherine's older sister died in childbirth in a hogan located on the site (Feature #3). The hogan the young woman and baby died in, was burned. The interviewee wants the hogan foundation to be left in place since it is associated with death and it should be left to deteriorate naturally. She also stressed that the hogan ring be avoided because the sister and baby's remains have been destroyed by mining activities-the structure is all that remains of the jishchaa'. After the death of the young woman and infant, the family dismantled a sandstone house (Feature #1) that was located at the old camp and rebuilt the house around 1960 in its present location 900 ft (272 m) west of the project area.

Mrs. Duncan asked that the mine place a fence around the perimeter of the hogan ring prior to ground scraping. She also wanted the archeologist to state that "...the mine should only scape contaminated soil and not remove rock during these clean-up activities."

Ms. Duncan was also surprised that she was not informed of "this" project although she is home everyday, except for the days she visits the doctors. She stated that she is never informed of the clean-up projects.

CONDITION OF SITE: Good

CAUSES OF DISTURBANCE: erosion, livestock

LOCATION OF SITE RELATIVE TO PROJECT AREA and AREA OF POTENTIAL EFFECT: within project area

EXTENT OF INVESTIGATIONS TO DATE: This recording

RESEARCH POTENTIAL/CULTURAL IMPORTANCE OF SITE: Through ethnographic research with family members the site may yield data regarding the historic Navajo occupation, settlement patterns, herding methods and other subsistence strategies of local Navajo families.

MANAGEMENT RECOMMENDATIONS: Special considerations for NM-Q-20-50 is as follows as per family's request: The site area may be reclaimed on the condition that a fence is placed around the perimeter of Feature 3 and that all reclamation activities avoid this area. Feature 3 should not be scraped or have any type of land-altering activities within the fenced area. Feature 3 should be allowed to deteriorate naturally and succumb to natural elements. An Archaeologist must monitor all construction activities near the site as well.

SITE ASSESSMENT UNDER 36 CFR 60.4 (National Register of Historic Places)

REGISTER ELIGIBLE:  Yes,  No,  Potentially

Comments:

INTEGRITY: location , design , setting , materials , workmanship ,  
feeling , association , unknown , none

CRITERIA: a , b , c , d , unknown , none

EXCLUSIONS:

SITE ASSESSMENT UNDER 36 CFR 7.3 (Archaeological Resources Protection Act):

Eligible for Protection?  Yes,  No

Meets 100-Year Guideline?  Yes,  No

Of Archaeological Interest?  Yes,  No

Comments: N/A

SITE ASSESSMENT UNDER P.L. 95-341 (American Indian Religious Freedom Act):

Merit Consideration?  Yes,  No,  N/A

Comments:

SITE ASSESSMENT UNDER NAVAJO NATION JISHCHAA' POLICY/NAGPRA:

Eligible for Protection?  Yes,  No,  Possibly (explain below)

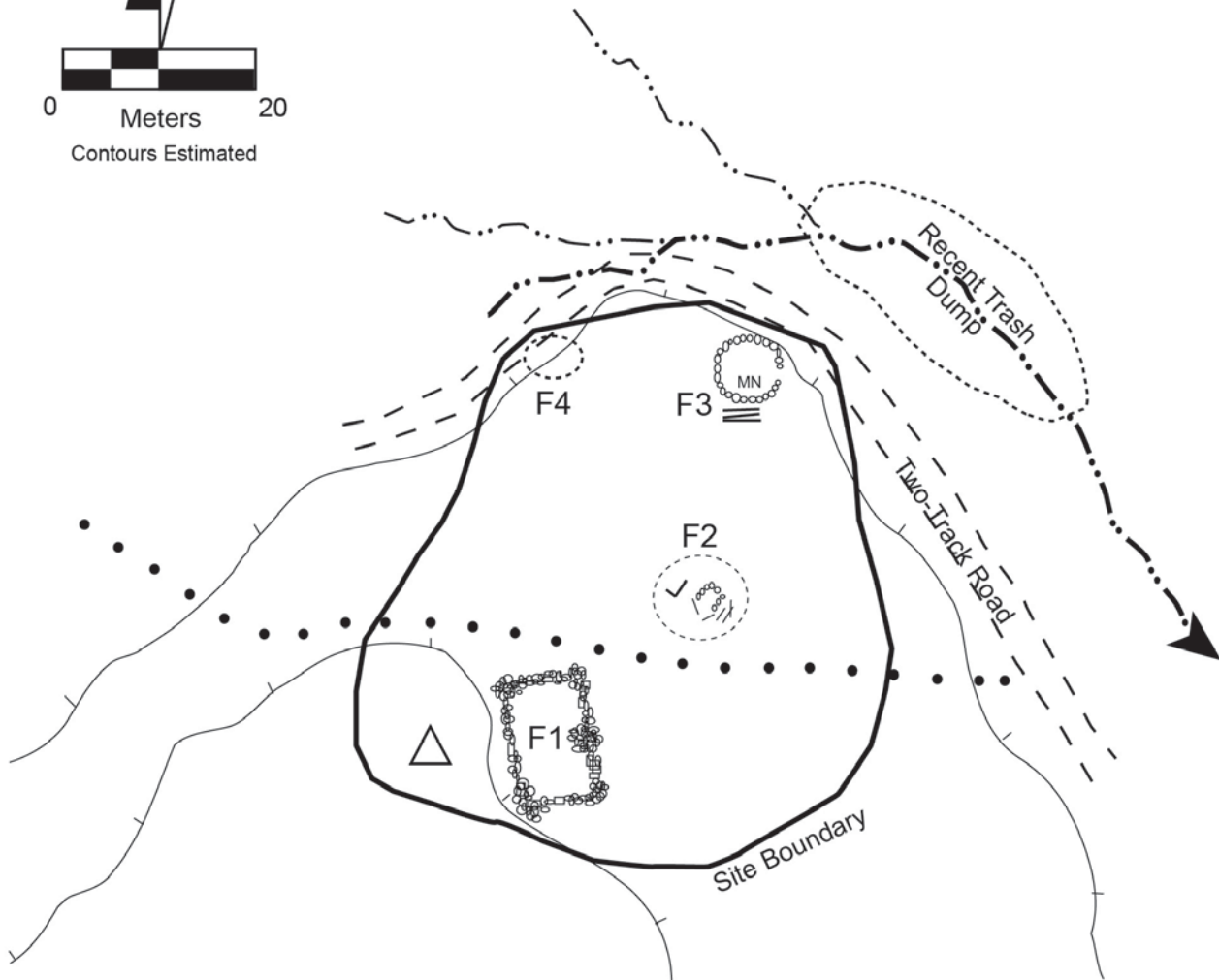
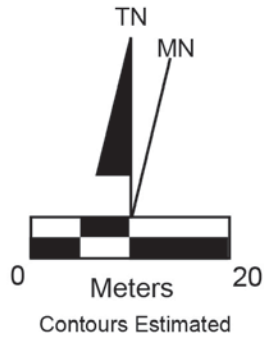
Comments: The site is associated with a deaths of a family members. The family ask that Feature 3 be avoided and fenced-off from any construction activities.

HOW CAN THE SITE BE REACHED (Provide a narrative description & refer to attached USGS quad map): See Map

PROVIDE A SITE MAP (Including site designation, site boundary, north arrow, scale, recognizable features, landmarks, and relationship to project area).

OTHER COMMENTS:

# NM-Q-20-50



KEY	
	Contour
	Datum
	Drainage
	Livestock Trail

General Site Map of NM-Q-20-50 (DCRM 2011-17)

# CULTURAL RESOURCES COMPLIANCE FORM

THE NAVAJO NATION  
HISTORIC PRESERVATION DEPARTMENT  
PO BOX 4950  
WINDOW ROCK, ARIZONA 86515

ROUTING: COPIES TO  
NM SHPO  
REAL PROPERTY MGT/330  
XX DCRM

NNHPD NO. HPD-11-340  
OTHER PROJECT NO.  
DCRM 2011-17

PROJECT TITLE: DCRM 2011-17: A Cultural Resource Inventory of 27.5 Acres of Land for Reclamation for MWH Global in Churchrock Mine, McKinley County, New Mexico

LEAD AGENCY: EPA

SPONSOR: Toby Leeson, MWH Global, Inc. 1475 Pine Grove Rd., Suite 109, Steamboat Springs, Colorado 80477

PROJECT DESCRIPTION: The proposed undertaking will involve reclaiming portions of the project area by excavating contaminated surface soils. Excavation will consist of removing 6-12 inches of dirt & replacing it with dirt from off-site. Erosion control measures will also be constructed to help prevent soil loss, and finally reestablishing the vegetation. Ground disturbance will be intensive and extensive with the use of heavy equipment.

LAND STATUS: Navajo Tribal Trust

CHAPTER: Coyote Canyon

LOCATION: Unplatted & Projected T.17N, R.16W - Sec. 36; Hard Ground Flats & Oak Spring Quadrangles, McKinley County, New Mexico NMPM

PROJECT ARCHAEOLOGIST: Jeremy Begay & Shane V. Wero

NAVAJO ANTIQUITIES PERMIT NO.: BI 1052

DATE INSPECTED: 03/29/11 - 03/31/11

DATE OF REPORT: 04/22/11

TOTAL ACREAGE INSPECTED: 27.5-ac

METHOD OF INVESTIGATION: Class III pedestrian inventory with transects spaced 10 m apart.

LIST OF CULTURAL RESOURCES FOUND: (2) Sites (NM-Q-21-100, NM-Q-20-50); (6) Isolated Occurrences (IO); (1) In-Use Site (IUS)

LIST OF ELIGIBLE PROPERTIES: (1) Site (NM-Q-21-100)

LIST OF NON-ELIGIBLE PROPERTIES: (1) Site (NM-Q-20-50); (6) IO; (1) IUS

LIST OF ARCHAEOLOGICAL RESOURCES: (1) Site (NM-Q-21-100)

EFFECT/CONDITIONS OF COMPLIANCE: **No historic properties will be affected with the following conditions:**

**Site NM-Q-21-100:**

1. Site boundary will be flagged by a qualified archaeologist prior to ground disturbing activities.
2. All reclamation activities will avoid the site by at least 50-ft. from the site boundary.

Site NM-Q-20-50:

- 1. Feature 3 of the site will be flagged by a qualified archaeologist prior to ground disturbing activities.
- 2. Reclamation activities may commence within the site boundary, avoiding Feature 3 of the site.


In the event of a discovery ["discovery" means any previously unidentified or incorrectly identified cultural resources including but not limited to archaeological deposits, human remains, or locations reportedly associated with Native American religious/traditional beliefs or practices], all operations in the immediate vicinity of the discovery must cease, and the Navajo Nation Historic Preservation Department must be notified at (928) 871-7148.

FORM PREPARED BY: Tamara Billie

FINALIZED: April 29, 2011

Notification to  
Proceed Recommended:  
Conditions:

Yes  No   
Yes  No

  
Alan S. Downer, Navajo Nation Historic Preservation Officer  
Date 5-4-11

Navajo Region Approval:

Yes  No

  
Acting BIA-Regional Director  
Date 6/9/11

TLN 6.8.11

**CULTURAL RESOURCES INVENTORY REPORT DOCUMENTATION PAGE (HPD Oct/05)**

<b>1. HPD REPORT NO:</b>	<b>2. (FOR HPD USE ONLY)</b>	<b>3. RECIPIENT'S ACCESSION NO.</b>
<b>4. TITLE OF REPORT:</b> DCRM 2011-17: A Cultural Resource Inventory of 27.5 Acres of Land for Reclamation for MWH Global in Churchrock Mine in McKinley County, New Mexico.  Author (s): Jeremy Begay and Shane V. Wero		<b>5. FIELDWORK DATES:</b> March 29, 31 2011
<b>7. CONSULTANT'S NAME AND ADDRESS:</b> <b>Gen. Charge:</b> Mrs. Rena Martin and Ms. Loretta Chavez <b>Org. Name:</b> Dinétahdóó CRM <b>Org. Address:</b> P.O. Box 2012 Farmington, NM 87499  <b>Phone:</b> (505) 960-9478 or (505) 960-9749		<b>6. REPORT DATE:</b> 04/22/2011
<b>10. SPONSOR'S NAME AND ADDRESS:</b> <b>Ind. Responsible:</b> Mr. Toby Leeson, P.G. Principle Hydrologist / Location Manager <b>Org. Name:</b> MWH Global, Inc. <b>Org. Address:</b> 1475 Pine Grove Rd., Suite 109 Steamboat Springs, CO 80477 <b>Phone:</b> (970) 871-4361 Cell: (970) 367-6022		<b>8. PERMIT NO.:</b> B11052
<b>13. LOCATION (MAP ATTACHED)</b> <b>a. Chapter:</b> Coyote Canyon <b>b. Agency:</b> Fort Defiance <b>c. County:</b> McKinley <b>d. State:</b> New Mexico		<b>9. CONSULTANT'S REPORT NO.:</b> DCRM 2011-17
<b>14. REPORT /X/ OR SUMMARY (REPORT ATTACHED) // OR PRELIMINARY REPORT //</b> <b>a. Description of Undertaking:</b> See Supplemental Sheet <b>b. Area of Environmental &amp; Cultural Setting:</b> See Supplemental Sheet <b>c. Existing Data Review:</b> See Supplemental Sheet <b>d. Field Methods:</b> See Supplemental Sheet		<b>11. SPONSOR'S PROJECT NO.:</b> N/A
<b>15. CULTURAL RESOURCE FINDINGS:</b> <b>a. Location/Identification of Each Resource:</b> See Supplemental Sheet <b>b. Evaluation of Significance of Each Resource:</b> See Supplemental Sheet		<b>12. AREA OF EFFECT:</b> 27.5 acres (11.1 ha) <b>AREA SURVEYED:</b> 27.5 acres (11.1 ha)
<b>16. MANAGEMENT SUMMARY (RECOMMENDATION):</b> See Supplemental Sheet		
<b>17. CERTIFICATION:</b> <b>SIGNATURE:</b> _____ <b>Date:</b> _____ <b>General Charge Name:</b> <u>Rena Martin, Anthropologist</u>  <b>SIGNATURE:</b> _____ <b>Date:</b> _____ <b>Direct Charge Name:</b> <u>Shane V. Wero, Archaeologist</u>		

### 13. LOCATION:

**Table 1.0. Designation, UTM Coordinates and Legal Descriptions for the Project Area.**

Designation	UTM Coordinates <sup>1</sup> Zone 12		Legal Description						USGS Map Name
	Northing	Easting	¼	¼	¼	Sec.	T	R	
<b>Churchrock 1</b>									
A	3949275	0726026	*	*	*	*	17N	16W	Hard Ground Flats, N. Mex. 1963 P.R. 1979
B	3949154	0726037	*	*	*	*	17N	16W	
C	3949156	0726461	*	*	*	*	17N	16W	Oak Spring, N. Mex. 1963 P.I. 1978
D	3949443	0726322	*	*	*	*	17N	16W	
<b>Churchrock 2</b>									
E	3948984	0726521	*	*	*	36	17N	16W	Oak Spring, N. Mex. 1963 P.I. 1978
F	3948911	0726568	*	*	*	36	17N	16W	
G	3948942	0726669	*	*	*	36	17N	16W	
H	3949097	0726797	*	*	*	36	17N	16W	
I	3949095	0726669	*	*	*	36	17N	16W	

**KEY:** BOL Denotes Beginning of Line    B Denotes Bend    EOL Denotes End of Line    \*Denotes Unplatted

Area

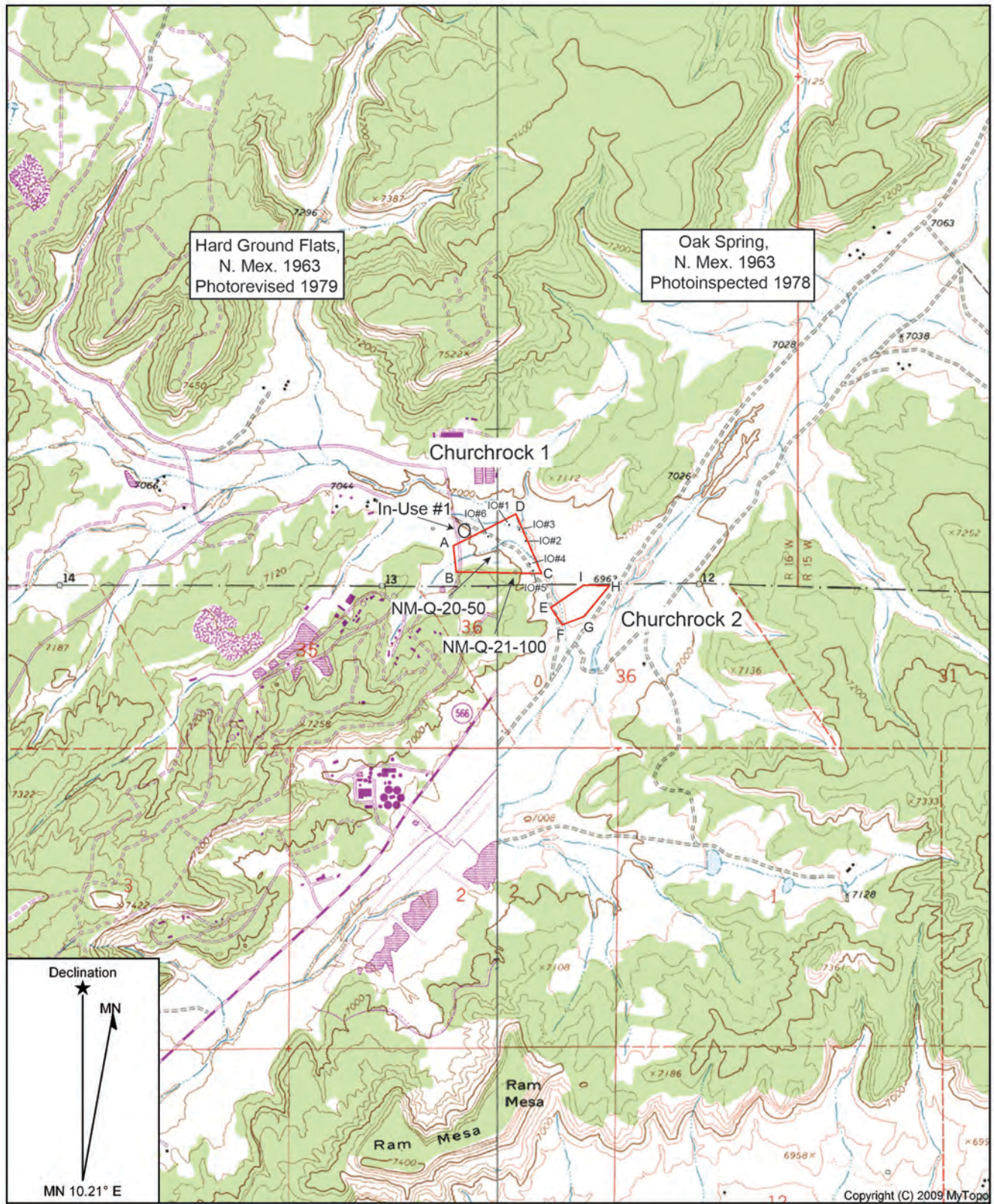
(1) UTM Coordinates in NAD 83

### 14. REPORT:

**a. Description of Undertaking:** MWH Global proposes to remediate portions of the project area by excavating contaminated surface soils from the survey area. The lead agency overseeing this project is under the Navajo Nation Environmental Protection Agency (EPA). Surface excavations will consist of removing 6 to 12 inches of dirt, while 6 to 12 feet of material will be removed from the unnamed arroyo located along the western and northern edge of the survey area. The contaminated soil will be removed from the project area and off-site soil will be brought in to replace the removed soil. In addition, some temporary erosion control measures will be constructed to prevent soil loss, and finally, vegetation will be re-established. Two parcels of land make-up the project area and are designated as Churchrock 1 and Churchrock 2. The irregular shaped project areas measures roughly 27.5 acres and is located north of Churchrock mine. A total of approximately 27.5 acres were surveyed. The total area of effect is potentially 27.5 acres.

**b. Area of Environmental & Cultural Setting:**

The project area locations are located on the canyon floors and slopes of a juniper-pinon forested mesa. Access to the location starts from the Red Rocks Park turnoff on Interstate 40 that heads north until the develop highway ends. The two locations, Churchrock 1 and Churchrock 2 are former uranium mines that are scheduled to be reclaimed and have been closed for a number of years. Both locations are located areas that contain juniper-pinon trees, ponderosa pine, gamble oak, crane’s bill, snakeweed, muhly grass, Russian thistle, hedgehog cactus, cholla cactus, sunflower, Rocky Mountain bee plant, prickly pear cactus, Indian ricegrass, horseweed, grama grass, rabbitbrush, and other native grasses. The surrounding area within the canyons, there are homesteads and parcels of land that have been reclaimed during previous clean-up projects for the uranium mine. A majority of the homes in this area have utilities from nearby electrical lines. A large pipeline maintained by Western Refinery runs in a north-south location near the Churchrock 2 parcel. The nearest drainage is an unnamed drainage that flows below and between the two survey areas which are located between Hard Ground Canyon and the Puerco River drainage. Although the nearby families vote in the Church Rock Chapter these survey areas are located in the Coyote Canyon Chapter.



Name: OAK SPRING  
 Date: 04/05/11  
 Scale: 1 inch = 2,000 ft.

Figure 1.0 Map showing specific location of Reclamation Parcels (Churchrock 1 & Churchrock 2), In-Use site, and identified cultural resources. T 17N R 16W (DCRM 2011-17)

Copyright (C) 2009 MyTopo



Coyote Canyon is where the famous Navajo chief, Manuelito, returned to after being incarcerated at Ft. Sumner, NM. His residence was located in the northern portion of the chapter area. Manuelito lived out the rest of his life there and eventually was buried there. Coyote Canyon is an isolated community that has limited utilities for its inhabitants. A trading post was established in the early 1900s. In 1930, the first chapter house was built and its delegates to the Navajo Tribal Council were Mr. Charles Damon and Mr. Billy Duncan. Between 1950 and 1980 health and social services were introduced to the Coyote Canyon community. In the 1980s, the Navajo Housing Authority built the first modern single-family housing complex in this area. The Coyote Canyon Chapter strongly believes that the local community needs the establishment of appropriate facilities in order for the community to thrive and grow. (LSR Innovations: 2004)

- b. Existing Data Review:** Prior to fieldwork, a literature search was conducted at the Navajo Nation Historic Preservation Department's (NNHPD) office, located in Window Rock, Arizona. The records search indicated that eight (8) previous inventories have been conducted within a 300 ft (91 m) of the project area, The previous archaeology inventories area as follows: HPD 99-311, HPD 05-133, HPD 05-855, HPD 76-213, HPD 09-454, HPD 02-482 and DCRM 2010-37. As a result of these surveys, two previous archaeological sites were recorded near the project areas, LA 160002 (Navajo Habitation-1940 A.D.) and NM-Q-20-22 (PII [900-1000 AD] Anasazi ceramic sherd scatter).

Further investigation of the existing information at the Navajo Nation Historic Preservation Department's Traditional Cultural Program's traditional cultural properties (TCP) database reveals that three TCPs were identified within over a 5-mile radius, Church Rock (*Tse li'ahi*), Red Water Pond (*To hask'idi*), and Togay Trail (*Tse'aah Chahalheel*).

Additionally, ethnographic interviews by Mr. Richard Begay with local families reveals two place names TCP's to be within a 1-mile radius of the project areas, Red Point (*Lichii deez'a*) and Horse Trail Up (*Lii ha'atiin*). The proposed project will not affect these two identified TCPs. Begay's interviews were conducted in conjunction with previous contaminated soil clean-up and reclamation activities related to this former mine.

Van Valkenburgh (1974) recorded the closest sacred place as a geological formation known as Churchrock / *Tse ii ahi* ("Standing Rock") located approximately 7 miles (11.3 km) south of the project area.

- d. Field Methods:** Between March 29 and April 7, 11, Jeremy Begay, Shane V. Wero, Rena Martin and Loretta Chavez, archaeologists with Dinetahdoo Cultural Resources Management conducted a field inventory of cultural resources and/or ethnographic interviews related to the Churchrock 1 and Churchrock 2 mine areas. Both locations are scheduled to be re-claimed. The project area was surveyed by walking parallel transects spaced no more than 10 ft apart. The area surveyed for the proposed reclamation survey for Churchrock 1 totals 20.5 acres and for Churchrock 2, the total equals 7 acres. The total square feet for both former uranium site boundaries equals 1,197,900 sq. ft (111,288 sq. m). A total area of approximately 27.5 acres (11.1 ha) is considered the area of effect. A total of approximately 27.5 acres (11.1 ha) was inventoried in conjunction with the project.

Two archaeological sites (NM-Q-21-100 and NM-Q-20-50) were identified during the inventory. The sites were recorded using a hand-held GPS, measuring tape, and compass. Isolated occurrences were recorded upon discovery once they had been determined not to be associated with an archaeological site. Enough field notes were taken on the cultural resources to complete site forms in-house.

In accordance with NNHPD guidelines, Rena Martin and Loretta Chavez interviewed local residents to obtain information regarding local traditional cultural properties (TCPs) and any unmarked burials

in the area. Martin and Chavez made to trips to the homes located near the project areas and visited with Ms Katherine Duncan an elder who has an interest in the survey area. Attempts to locate another recommended family member proved to be unproductive. The interview with Ms Duncan resulted in locating a *jishchaa'*; a burned hogan found on site NM-Q-20-50. The hogan was found to be associated with a death and has been avoided by the family for decades. The burned structure is reported to not contain human remains but the family members contacted stated that the hogan should be avoided by all remediation activities. All of interviews were conducted in the Navajo language and conducted in the home of the interviewees. An Identification of Gravesites, Human Remains, and Funerary Items *and* Statement of Wishes form was completed with the interviewee and is attached as Confidential Appendix B.

Consultation was completed with the Red Rock Chapter house, although the project resides in the Coyote Canyon Chapter, Red Rock Chapter was closer and this chapter is familiar with the mine remediation activities. Ms. Michelle John, the office specialist was contacted regarding the project, any known TCPs or graves. Ms. John advised the archaeologists to visit with Mr. Teddy Nez and other local families regarding the project.

## 15. CULTURAL RESOURCES FINDING:

- a. **Location/Identification of Each Resource:** Two (2) archaeological sites, six (6) isolated occurrences and one (1) *Jishchaa'* property were identified in the Churchrock 1 parcel. All identified cultural resources were recorded in field.

### Archaeological Sites

Site NM-Q-21-100 (Figure 2.0)

USGS Map Reference: Oak Spring, N. Mex. 1963 P.I. 1978, USGS 7.5' Quadrangle Map

Legal Location: Township 17N, Range 16W, Section 32

UTM: (NAD 83) Zone 12: N 3949150, E 0726329

Land Status: Navajo Tribal Trust

State: New Mexico

County: McKinley County

Chapter: Coyote Canyon

Site Type: Anasazi Rubble Mound

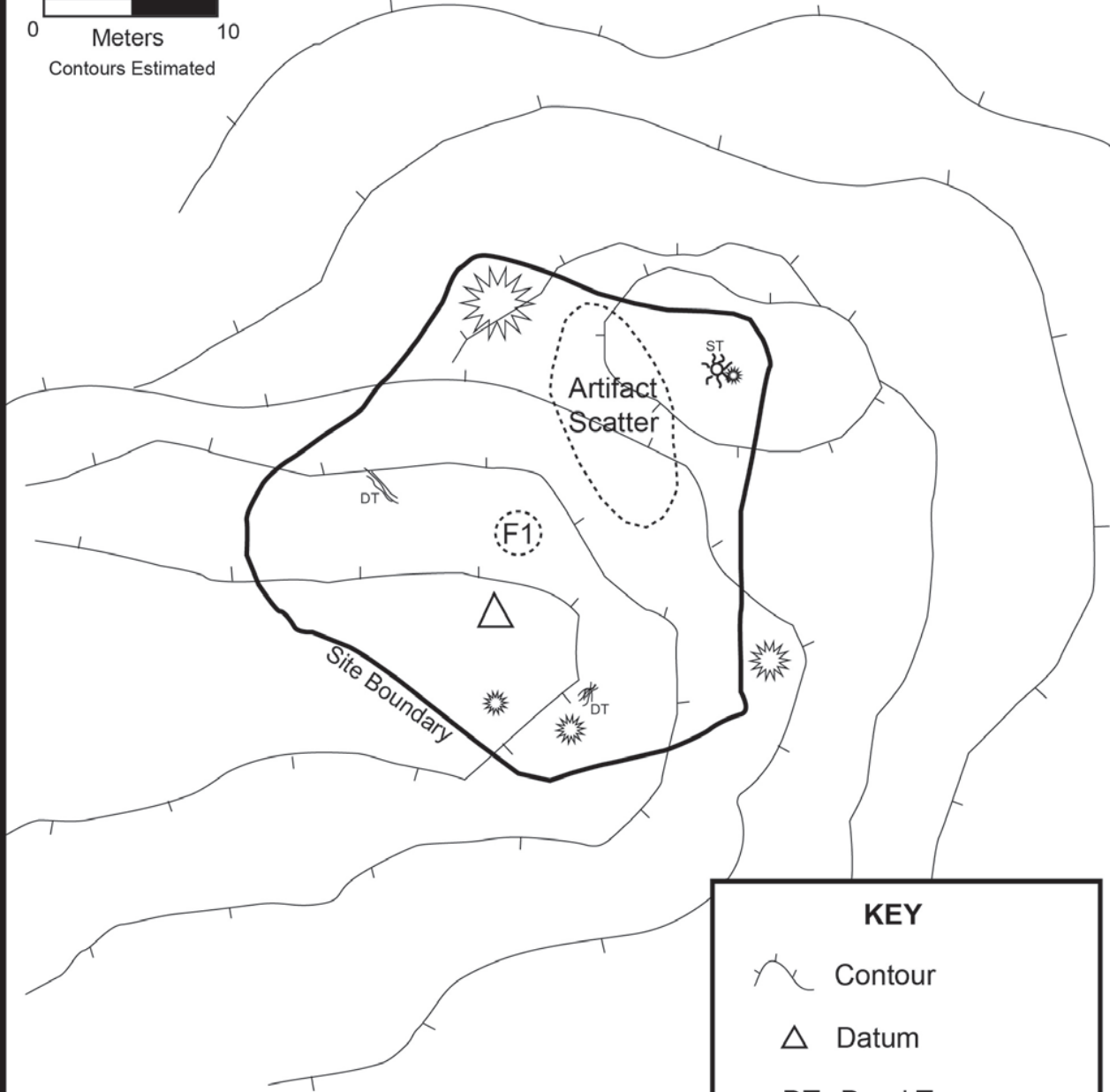
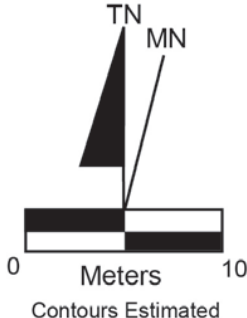
Site Size: 30m x 29m

Site Setting: Northward oriented ridge on west to east oriented terrace

Site Description: NM-Q-21-100 consists of an Anasazi PII habitation site. The site contains one feature was identified and a scatter of artifacts. Feature 1 is a rubble mound measuring approximately 2 by 3 meters. An area measuring approximately 1 meter square contains in-situ wall alignments and upright sandstone slabs, while the remainder of the feature contains a scatter of sandstone slabs and blocks. The feature contains subsurface depth. No additional features were identified. An in-field, non-intrusive assessment determined that NM-Q-21-100 may contain subsurface cultural deposits measuring up to 1.5 meters in depth.

Associated artifacts are scattered north and east of Feature 1, and consist of ceramic and lithic artifacts. The artifact assemblage consists of 100-plus ceramic artifacts including: Gallup and Escavada Black-on -whites, Chaco and Coolidge corrugated, and numerous other unidentified grey, white, and red ware sherds. Also observed were 20-plus lithic artifacts to including flakes at all stages of reduction and exhausted cores of green, brown, and Zuni spotted cherts, grey quartzite, brown silicified wood, and grey siltstone.

# NM-Q-21-100



KEY	
	Contour
	Datum
DT	Dead Tree
	Pinon/Juniper Tree
ST	Tree Stump

General Site Map of NM-Q-21-100 (DCRM 2011-17)

Site NM-Q-20-50 (Figure 3.0)

USGS Map Reference: Hard Ground Flats, N. Mex. 1963 P.R. 1979, USGS 7.5' Quadrangle Map

Legal Location: Township 17N, Range 16W, Unplatted

UTM: (NAD 83) Zone 12: N 3949249, E 0726240

Land Status: Navajo Tribal Trust

State: New Mexico

County: McKinley County

Chapter: Coyote Canyon

Site Type: Navajo Habitation / *Jishchaa'*

Site Size: 59m x 55m

Site Setting: The site is located on the northern slope of a west to east oriented terrace.

Site Description: Site NM-Q-20-50 is a historic Navajo habitation with four features. Feature 1 is the remains of a house measuring 8 by 13 meters. In one area the former house contains wall remains stacked two courses high. The rectangular feature contains a considerable amount of sandstone detritus scattered around the feature. A more recent addition of milled lumber is present in the former house along the southern wall. This add-on feature may have been served as an storage area or perhaps a pen after it was vacated as a house. Numerous rubber shoe sole fragments as well as scraps of leather are located near Feature 1.

Feature 2 is a concentration of ax cut pinyon pine logs and sandstone logs located in an area measuring 9 by 7 meters. The terrain surrounding this feature is devoid of vegetation suggesting that Feature 2 was utilized extensively as a *chaha'oh* (ramada). A small sandstone slab alignment is located in the western portion of Feature 2.

Feature 3 is a sandstone slab and block hogan measuring 7 meters in diameter. This feature is said to be a part of a *jishchaa'*. The feature consists of a circular shape wall alignment and is associated with milled lumber and ax cut pinyon pine fragments. It is obvious that the feature was burned since it contains ashy colored soil and dark red soil surrounds the feature.

Feature 4 contains the collapsed remains of two *bááh bighan* (hornos) in an area measuring 5 by 4 meters. Several visible upright sandstone slabs and scattered sandstone fragments exhibit oxidation.

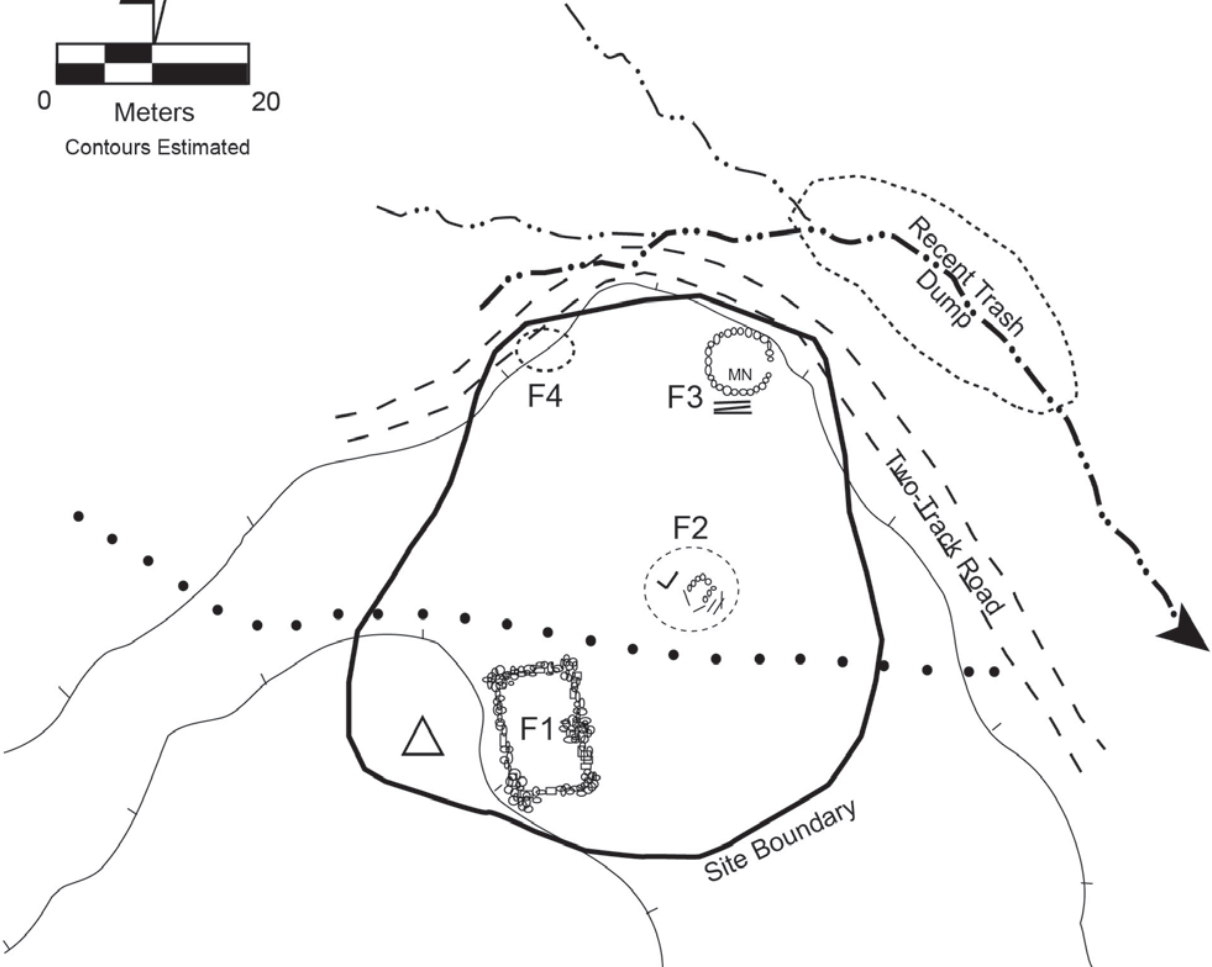
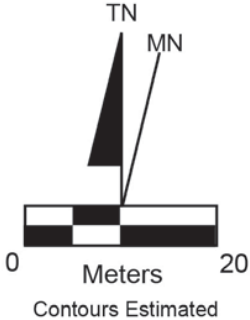
The artifact assemblage consists of 50-plus metal cans (sanitary seal, double locking side seam with church key and pull tab openings), 100-plus clear, blue, and brown glass fragments, 4 iron wagon parts, 1 metal trough, 100-plus milled lumber fragments, iron nails, 20-plus porcelain fragments, rubber shoe sole fragments, leather fragments, and 1 enamel pan. No additional features were identified or recorded. An in-field, non-intrusive assessment determined that site NM-Q-20-50 contains subsurface cultural deposits up to 1m in depth.

Ethnographic Data with Katherine Duncan:

The former homestead, NM-Q-20-50 was a permanent camp for Katherine's family who are of the *Kinlichinnii Dine'e* for many years. The site consisted of habitation structures, corrals, and other features. The site is located in the family's in-use area, which covers a fairly large area. Ms. Duncan stated that there are no graves or TCPs in the site area but a death hogan is present at the location. The family has been living in this area since the 1800's and built permanent homes in the early 1900's. Katherine was born at the camp in 1933.

Parts of the older camp was abandoned sometimes between the late 1930's or mid 1940's when Katherine's older sister died in childbirth in a hogan located on the site (Feature 3). The hogan the

# NM-Q-20-50



KEY	
	Contour
	Datum
	Drainage
	Livestock Trail

General Site Map of NM-Q-20-50 (DCRM 2011-17)

young woman died in was burned. The interviewee wants the hogan foundation to be left in place since it is associated with death and it should be left to deteriorate naturally. She also stressed that the hogan ring be avoided because the sister and baby’s remains have been destroyed by mining activities-the structure is all that remains of the *jishchaa*. The family had buried the deceased (mother and infant) in a rock crevice to south; the grave location was mined. After the deaths of the woman and infant, the family dismantled a sandstone house (Feature 1) that was located at the old camp and rebuilt the house around 1960 in its present location 900 ft (272 m) west of the project area.

Mrs. Duncan asked that the mine place a fence around the perimeter of the hogan ring prior to ground scraping. She also wanted the archeologist to state that “...the mine should only scrape contaminated soils from the contaminated areas and not remove rock during these clean-up activities.” She reported to the archeologist that a TCP (a sandstone bluff) has been partially impacted recently, although the TCP was reported and recorded by Clifford Werito, DCRM archaeologist. Martin and Chavez did not take Ms. Duncan to the TCP location due to the amount of time and the interviewee’s health.

### Isolated Occurrences

During the course of the pedestrian survey on the parcel known as Churchrock 1, six (6) isolated occurrences were identified. Descriptions and location information can be found on Table 2.0.

**Table 2.0 List of Identified Isolated Occurrences, description and location.**

IO Number #	Description	UTM Coordinates, Zone 12
IO #1	2 Coolidge Corrugated sherds and 1 unidentified Black-on-White Sherds	N 3949399, E 0726279
IO #2	1 unidentified greyware sherd and 1 quartzite core	N 3949300, E 0726385
IO #3	3 Coolidge Corrugated Sherds, 1 Gallup Black-on-White sherd, and 1 Red Mesa sherd	N 3949351, E 0726350
IO #4	1 greyware rim sherd	N 3949315, E 0726191
IO #5	1 quartzite secondary flake	N 3949180, E 0726412
IO #6	1 Gallup Black-on	N 3949199, E 0726388

### Jishchaa

During the course of the inventory a Navajo home associated with death or *Jishchaa* was identified. According to the Navajo Nation Historic Preservation Department’s policy (CRPA, CMY-19-88), “The Navajo Nation is committed to protecting all gravesites, human remains, and funerary items under its jurisdiction.” The Navajo word *Jishchaa* is “a term that refers to things that are associated with death as well as the burial itself.” In this case an historic Navajo homestead was identified within the boundaries of the parcel known as Churchrock 1. Ethnographic interviews conducted by Martin and Chavez revealed that the homestead was associated with death; a family member of Ms. Duncan’s died in Feature 3 in the mid-twentieth century. Following traditional protocols, the family buried the human remains; burned the hogan; and dismantle a sandstone house and rebuilt it nearby. What remains at the site today is an outline of the hogan that sits on burnt soil and a square-shaped house foundation that has been dismantle to its foundation. The family request that the burned hogan be left to deteriorate naturally. The family also requested that the outer perimeter of Feature 3 (NM-Q-20-50) be fenced-off from all nearby construction activities.

### **In-Use Sites**

One In-Use site (IUS 1) was encountered during the survey. The IUS was identified as Ms. Grace Cowboy's residence and her family's been living in the area for the past 25 years since the 1980's and consists of a double wide-mobile home with associated features. Grace Cowboy (IUS #1) currently lives the closest to the former site. Grace Cowboy is Ted Nez's wife's sister [Ted is an in-law to the *Kinlichinii Dine'e*].

### **b. Evaluation of Significance of Each Cultural Resource:**

#### **NM-Q-21-100 (Anasazi Rubble Mound)**

NM-Q-21-100 was determined to be eligible for protection under the National Register of Historic Places (NRHP). NM-Q-21-100 meets the 50-year age requirement under NRHP. NM-Q-21-100 retains some aspects of integrity that includes location, feeling, association, material, and setting. NM-Q-21-100 meets criteria (d) which states that the archaeological site, NM-Q-21-100, may provide insight to the Anasazi occupation and resource exploitation in the Hard Canyon Mesa region. NM-Q-21-100 does meet the requirements for protection under the Archaeological Resource Protection Act (ARPA). NM-Q-21-100 does meet the 100-year age requirement under ARPA. NM-Q-21-100 may merit protection under the American Indian Religious Freedom Act because ancestral extant indigenous groups may still hold the place in reverence, i.e. origin stories, migration stories, etc. NM-Q-21-100 may merit protection under the Native American Graves Protection and Repatriation Act due to the possibility of sub-surface features containing human remains and/or funerary objects.

#### **NM-Q-20-50 (Navajo Habitation [Jishchaa])**

NM-Q-20-50 was not determined to be eligible for protection under the National Register of Historic Places (NRHP). NM-Q-20-50 meets the 50-year age requirement under NRHP. NM-Q-20-50 retains integrity of location, feeling, material, association, and setting. NM-Q-20-50 meets criteria (d) which states that the archaeological site, NM-Q-20-50 may provide insight to Navajo occupation and resource exploitation in the Hard Canyon Mesa region. NM-Q-20-50 does not meet the requirements for protection under the Archaeological Resource Protection Act (ARPA) NM-Q-20-50 does not meet the 100-year age requirement under ARPA. NM-Q-20-50 does not merit protection under the American Indian Religious Freedom Act although features may have been blessed. NM-Q-20-50 does merit protection under the Native American Graves Protection and Repatriation Act due to ethnographic interviews revealing that the site is associated with *Jishchaa*. The site's association with death diminishes its possible protection under AIRFA or other laws.

#### **Isolated Occurrences**

All isolated occurrences identified are cultural items not eligible for protection under NRHP. Although all isolated occurrences are more than 50 years old, the isolated occurrences lack all aspects of integrity and future research potentials are exhausted upon recordation of the isolated occurrences. All isolated occurrences meet the 100-year age requirement under ARPA but are not cultural items considered for protection under ARPA. All isolated occurrences do not merit protection under the AIRFA due to the fact that most isolated occurrences are not ceremonial items associated with religious events. All isolated occurrences do not merit protection under the NAGPRA because the isolated occurrences are not associated with any burials and/or funerary items.

#### **In-Use Sites**

IUS 1 does not merit protection under the NRHP. The IUS does not meet the 50-year age requirement although it retains integrity of location, setting, association, workmanship, feeling,

design, and materials. The IUS does meet the 100-year age requirement of ARPA and is not archaeological interest. The In-Use sites may merit protection under the AIRFA. The In-Use sites do not merit protection under the Native American Graves Protection and Repatriation Act.

**Table 4.0. Description and evaluation of cultural resources**

Cultural Resource No.	Description	Evaluation	
NM-Q-21-100	Anasazi Rubble Mound	NRHP	Eligible ? Yes 1. 50-year guideline met 2. Retains integrity of location, setting, feeling and association 3. Does meet criteria d
		ARPA	Eligible ? Yes 1. 100-year guideline met 2. Is of archaeological interest
		AIRFA	May merit consideration
		NAGPRA	May merit consideration
NM-Q-20-50	Historic Navajo Habitation-Jishchaa	NRHP	Eligible ? No 1. 50-year guideline met 2. Retains integrity of location, setting, feeling, and association 3. Does meet criteria d
		ARPA	Eligible ? No 1. 100-year guideline not met 2. Is not of archaeological interest
		AIRFA	Does not merit consideration
		NAGPRA	Does merit consideration
IO's #1-6	Isolated Occurences	NRHP	Eligible? No 1. 50-year guideline met 2. Lacks Integrity 3. Does meet criteria a-d
		ARPA	Eligible ? No 1. 100-year guideline met 2. Are not of archaeological interest
		AIRFA	Do not merit consideration
		NAGPRA	Do not merit consideration
IUS #1	Mobile Home (2000)	NRHP	Eligible ? No 1. 50-year guideline not met 2. Retains integrity of location, setting, feeling, and association 3. Does meet criteria d
		ARPA	Eligible ? No 1. 100-year guideline not met 2. Is not of archaeological interest
		AIRFA	May merit consideration
		NAGPRA	Does not merit consideration



**Recommendations:**

Conditional Archaeological clearance is recommended for the proposed reclamation of the parcels Churchrock 1 and Churchrock 2, with the following stipulations for Churchrock 1.

All or portions of the two archaeological sites must be avoided. Avoidance is recommended for NM-Q-21-100. Feature 3 of site NM-Q-20-50 must be avoided.

1. NM-Q-21-100 must be flagged and fenced prior to any construction activities, all construction activities will avoid entering the site boundary during reclamation efforts.
2. Special considerations for NM-Q-20-50 is as follows as per family's request: The site area may be reclaimed on the condition that a fence is placed around the perimeter of Feature 3 (death hogan) and that all reclamation activities avoided the feature. Feature 3 should not be scraped or have any type of land-altering activities within the fenced area. This feature must be allowed to deteriorate naturally and succumb to natural elements.
3. An archaeologist must be present at both sites (NM-Q-21-100 and NM-Q-20-50) to monitor all reclamation activities.

## References Cited:

LSR Innovations

2004 Chapter Images: 2004 Edition. Produced for the Navajo Nation Division of Community Development, Window Rock, AZ.

Martin, Rena and Richard M. Begay

2009 "A Cultural Resources Inventory of 68.87 Acres of Proposed Reclamation North of the Church Rock Mine, McKinley County, New Mexico", Report No. DCRM-2009-25 (NNHPD-09-454), Dinetahdoo Cultural Resources Management, Farmington, NM.

Van Valkenburgh, Richard F., ed.

1974 "Navajo Sacred Places", in *Navajo Indians III*, edited by C. Kluckhohn, pp. 9-99. Garland Publishing New York.

Werito, Clifford

2010 "A Cultural Resources Inventory of the Rio Algom Mining's Church Rock Site 1 and 1E, Fencing Repair Locations for BHP Billiton Base Metals in Church Rock, McKinley County, New Mexico", Report No. DCRM-2010-37, Dinetahdoo Cultural Resources Management, Farmington, NM.

Yazzie, Curtis

2002 "A Cultural Resource Inventory of Thirty-Five Scattered Homes and Proposed Waterline Extensions in Pinedale, McKinley County, New Mexico. NNAD 01-022/NNHPD 02-482.

**APPENDIX A**  
**(Site Forms)**

NAVAJO NATION HISTORIC PRESERVATION DEPARTMENT  
Site Survey and Management Form

SITE NO.: NM-Q-21-100

FIELD OR OTHER NO.: UMW-1

PROJECT NO. & NAME: DCRM 2011-17: A Cultural Resource Inventory of 27.5 Acres of Land for Reclamation for MWH Global in Churchrock Mine in McKinley County, New Mexico.

RECORDING ORGANIZATION: Dinétahdoo CRM

DATE RECORDED: 3/30/11

RECORDED BY: J. Begay, S. Wero

USGS 7.5' MAP REFERENCE: Oak Spring, N. Mex. 1963 P.I. 1978

LEGALS ( NMPM /  AZPM): Township: 17  N /  S, Range: 16  E /  W;  
Sec.: ; 1/4, 1/4, 1/4 ( Unplatted)

UTM COORDINATES (NAD): Zone: 12: 3949150 N, 0726329 E

STATE: NM, COUNTY: McKinley, CHAPTER: Coyote Canyon, AGENCY: Fort Defiance

LAND STATUS: Tribal Trust

GROUND VISIBILITY: 70 % Kind and extent of cover: 30% vegetation

TOPOGRAPHY: Northward oriented ridge on west to east oriented foothill.

NEAREST DRAINAGE: 440 ft (134m) north

ELEVATION (FT/M): 7039 ft / 2145 m SLOPE AND DIRECTION: 5 ° N

SEDIMENT TYPE: Fine-coarse alluvial, aeolian, and colluvial sand

OTHER: pebble-cobble sized sedimentary clasts

VEGETATION PRESENT: prickly pear and cholla cacti, joint fir, juniper, pinyon pine, rabbitbrush, snakeweed, grama grass, and ring muhly

CULTURAL AFFILIATION: Anasazi

SITE TYPE: Habitation

CURRENTLY IN-USE:  Yes,  No Comments:

PERIOD(S) OF OCCUPATION/CONSTRUCTION/USE (date if known): PII (AD 900-1100)

How Dated: Ceramic types

DIMENSIONS OF SITE (L x W): 30 x 29 m TOTAL AREA (sq. m.): 870

ARCHITECTURE PRESENT:  Yes,  No Describe: F1- rubble mound with several visible wall alignments and upright sandstone slabs

TYPES OF ARTIFACTS OBSERVED and QUANTITY OF EACH TYPE (give approximate numbers if not counted): 100+ ceramic sherds to include; Gallup and Escavada black on whites, Chaco and Coolidge corrugated, and numerous other unidentified grey, white, and red ware sherds. 20+ lithic artifacts to include; flakes of all stages of reduction and exhausted cores of green, brown, and Zuni spotted chert, grey quartzite, petrified wood, and grey siltstone.

COLLECTION MADE?  Yes,  No Of What? Method of Collection:

PHOTOS:  Yes,  No Photo ID:

PHYSICAL SITE DESCRIPTION: NM-Q-21-100 contains an Anasazi PII habitation structure located on a north oriented ridge on a west to east oriented terrace. One feature was identified and recorded. Feature 1 is a rubble mound measuring approximately 2 by 3 meters. An area measuring approximately 1 meter square contains in-situ wall alignments and upright sandstone slabs, while the remainder of the feature contains a scatter of sandstone slabs and blocks. The feature contains subsurface depth. No additional features were identified. An in-field, non-intrusive assessment determined that NM-Q-21-100 may contain subsurface cultural deposits measuring up to 1.5 meters in depth.

ETHNOGRAPHIC DATA (if any): n/a

CONDITION OF SITE: Good

CAUSES OF DISTURBANCE: erosion, livestock

LOCATION OF SITE RELATIVE TO PROJECT AREA and AREA OF POTENTIAL EFFECT: Site is located within southern sector.

EXTENT OF INVESTIGATIONS TO DATE: this recording

RESEARCH POTENTIAL/CULTURAL IMPORTANCE OF SITE: Site NM-Q-21-100 may yield data regarding the prehistoric Anasazi PII occupation, settlement patterns, subsistence strategies, and resource exploitation of the greater Pinedale region.

MANAGEMENT RECOMMENDATIONS: 1) The site must be avoided, 2) must be flagged prior to construction activities and 3) Archaeologist must monitor all construction activities nearby

SITE ASSESSMENT UNDER 36 CFR 60.4 (National Register of Historic Places)

REGISTER ELIGIBLE:  Yes,  No,  Potentially

Comments:

INTEGRITY: location , design , setting , materials , workmanship , feeling , association , unknown , none

CRITERIA: a , b , c , d , unknown , none

EXCLUSIONS:

SITE ASSESSMENT UNDER 36 CFR 7.3 (Archaeological Resources Protection Act):

Eligible for Protection?  Yes,  No

Meets 100-Year Guideline?  Yes,  No

Of Archaeological Interest?  Yes,  No

Comments: N/A

SITE ASSESSMENT UNDER P.L. 95-341 (American Indian Religious Freedom Act):

Merit Consideration?  Yes,  No,  N/A

Comments:

SITE ASSESSMENT UNDER NAVAJO NATION JISHCHAA' POLICY/NAGPRA:

Eligible for Protection?  Yes,  No,  Possibly (explain below)

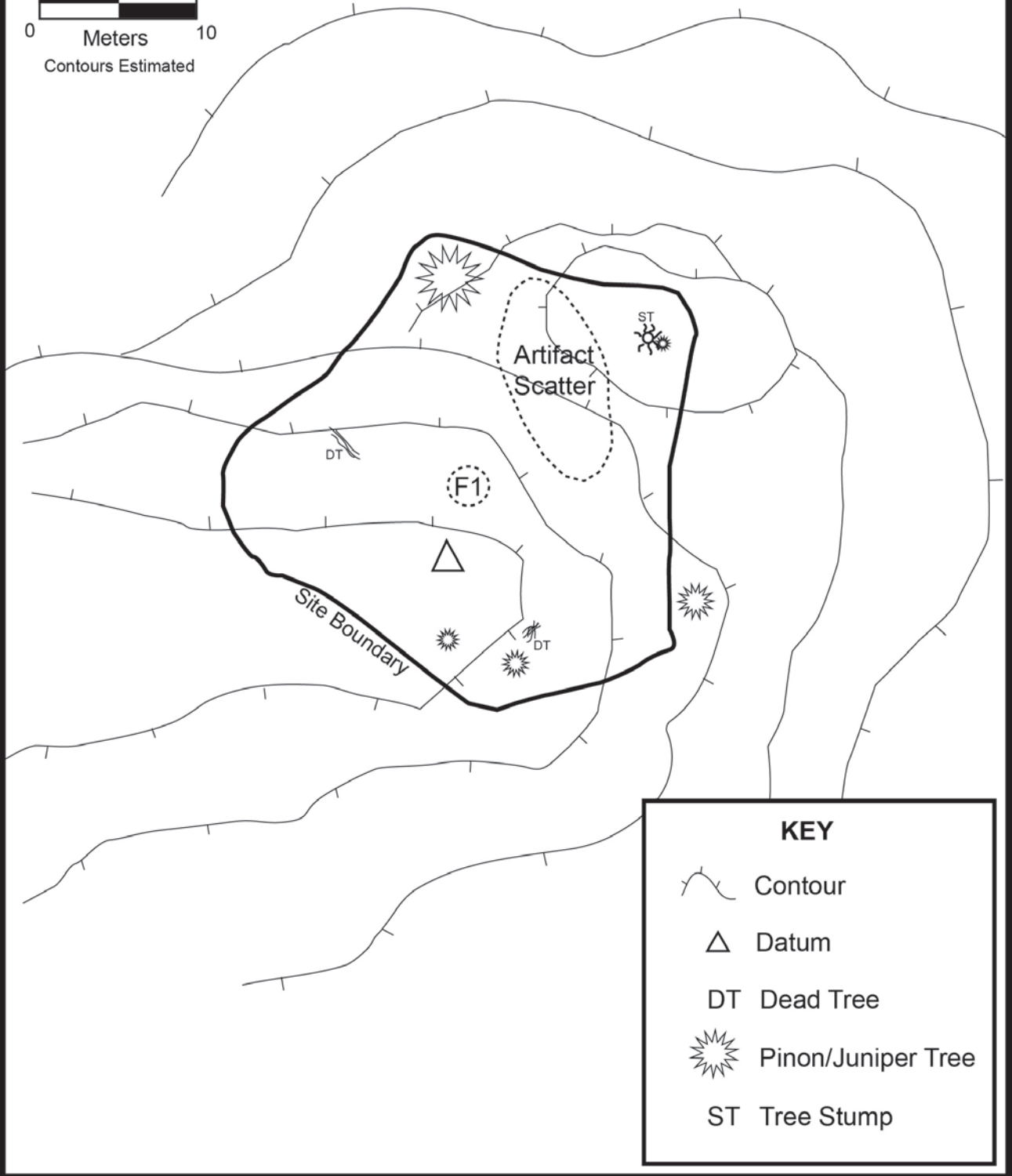
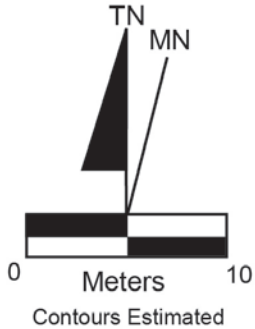
Comments: Site NM-Q-21-100 may contain buried human remains.

HOW CAN THE SITE BE REACHED (Provide a narrative description & refer to attached USGS quad map): See Map

PROVIDE A SITE MAP (Including site designation, site boundary, north arrow, scale, recognizable features, landmarks, and relationship to project area).

OTHER COMMENTS:

# NM-Q-21-100



KEY	
	Contour
	Datum
	DT Dead Tree
	Pinon/Juniper Tree
	ST Tree Stump

General Site Map of NM-Q-21-100 (DCRM 2011-17)

NAVAJO NATION HISTORIC PRESERVATION DEPARTMENT  
Site Survey and Management Form

SITE NO.: NM-Q-20-50 FIELD OR OTHER NO.: UMW-2  
PROJECT NO. & NAME: DCRM 2011-17: A Cultural Resource Inventory of 27.5 Acres of Land for Reclamation for MWH Global in Churchrock Mine in McKinley County, New Mexico.  
RECORDING ORGANIZATION: Dinétahdoo CRM  
DATE RECORDED: 3/30/11 RECORDED BY: J. Begay, S. Wero  
USGS 7.5' MAP REFERENCE: Hard Ground Flats, N. Mex. 1963 PR 1979  
LEGALS ( NMPM /  AZPM): Township: 17  N /  S, Range: 16  E /  W;  
Sec.: ; 1/4, 1/4, 1/4 ( Unplatted)  
UTM COORDINATES (NAD): Zone: 12: 3949249 N, 0726240 E  
STATE: NM, COUNTY: McKinley, CHAPTER: Coyote Canyon, AGENCY: Eastern Navajo  
LAND STATUS: Tribal Trust  
GROUND VISIBILITY: 70 % Kind and extent of cover: 30% Vegetation  
TOPOGRAPHY: North slope of west to east oriented foothill  
NEAREST DRAINAGE: 100 ft (30 m) to the north  
ELEVATION (FT/M): 7020 ft / 2139 m SLOPE AND DIRECTION: >2 ° N  
SEDIMENT TYPE: Fine-coarse grained alluvial and aeolian sand  
OTHER: pebble-boulder sized sedimentary clasts  
VEGETATION PRESENT: snakeweed, rabbitbrush, prickly pear and cholla cacti, ring muhly, grama grass.  
CULTURAL AFFILIATION: Navajo  
SITE TYPE: Habitation / Jishchaa'  
CURRENTLY IN-USE:  Yes,  No Comments:  
PERIOD(S) OF OCCUPATION/CONSTRUCTION/USE (date if known): 1940s  
How Dated: Artifacts  
DIMENSIONS OF SITE (L x W): 59 x 55 m TOTAL AREA (sq. m.): 3245  
ARCHITECTURE PRESENT:  Yes,  No Describe: F1- habitation structure with visible wall alignments and stacked sandstone slab masonry two courses high of simple construction. F3-corral with visible wall alignments. F4-Two (2) hornos with visible upright sandstone slab wall alignments.  
TYPES OF ARTIFACTS OBSERVED and QUANTITY OF EACH TYPE (give approximate numbers if not counted): 50+ metal cans (sanitary seal, double locking side seam with church key and pull tab openings), 100+ clear, blue, and brown glass fragments, 4 iron wagon parts, 1 metal trough, 100+ milled lumber fragments, iron nails, 20+ porcelain fragments, rubber shoe sole fragments, leather fragments, and 1 enamel pan.  
COLLECTION MADE?  Yes,  No Of What? Method of Collection:  
PHOTOS:  Yes,  No Photo ID:  
PHYSICAL SITE DESCRIPTION: Site NM-Q-20-50 is a historic Navajo habitation site containing four features. Feature 1 is a habitation structure measuring 8 x 13m. Feature 1 is the remains of a house measuring 8 by 13 meters. In one area the former house contains wall remains stacked two courses high. The rectangular feature contains a considerable amount of sandstone detritus scattered around the feature. A more recent addition of milled lumber is present in the former house along the southern wall. This add-on feature may have been served as an storage area or perhaps a pen after it was vacated as a house. Numerous rubber shoe sole fragments as well as scraps of leather are located near Feature 1.

Feature 2 is a concentration of ax cut pinyon pine logs and sandstone logs located in an area measuring 9 by 7 meters. The terrain surrounding this feature is devoid of vegetation suggesting that Feature 2 was utilized

extensively as a chaha'oh (ramada). A small sandstone slab alignment is located in the western portion of Feature 2.

Feature 3 is a sandstone slab and block hogan measuring 7 meters in diameter. This feature is said to be a part of a jishchaa'. The feature consists of a circular shape wall alignment and is associated with milled lumber and ax cut pinyon pine fragments. It is obvious that the feature was burned since it contains ashy colored soil and dark red soil surrounds the feature.

Feature 4 contains the collapsed remains of two bááh bighan (hornos) in an area measuring 5 by 4 meters. Several visible upright sandstone slabs and scattered sandstone fragments exhibit oxidation.

The artifact assemblage consists of 50-plus metal cans (sanitary seal, double locking side seam with church key and pull tab openings), 100-plus clear, blue, and brown glass fragments, 4 iron wagon parts, 1 metal trough, 100-plus milled lumber fragments, iron nails, 20-plus porcelain fragments, rubber shoe sole fragments, leather fragments, and 1 enamel pan. No additional features were identified or recorded. An in-field, non-intrusive assessment determined that site NM-Q-20-50 contains subsurface cultural deposits up to 1m in depth.

ETHNOGRAPHIC DATA (if any): Ethnographic Interview with Mrs. Katherine Duncan by Rena Martin and Loretta Chavez 4/11/2011: The former homestead, NM-Q-20-50 was a permanent camp for Katherine's family who are of the Kinlichinnii Dine'e for many years. The site consisted of habitation structures, corrals, and other features. The site is located in the family's in-use area, which covers a fairly large area. Ms. Duncan stated that there are no graves or TCPs in the site area but a death hogan is present at the location. The family has been living in this area since the 1800's and built permanent homes in the early 1900's. Katherine was born at the camp in 1933.

Parts of the older camp was abandoned sometimes between the late 1930's or mid 1940's when Katherine's older sister died in childbirth in a hogan located on the site (Feature #3). The hogan the young woman and baby died in, was burned. The interviewee wants the hogan foundation to be left in place since it is associated with death and it should be left to deteriorate naturally. She also stressed that the hogan ring be avoided because the sister and baby's remains have been destroyed by mining activities-the structure is all that remains of the jishchaa'. After the death of the young woman and infant, the family dismantled a sandstone house (Feature #1) that was located at the old camp and rebuilt the house around 1960 in its present location 900 ft (272 m) west of the project area.

Mrs. Duncan asked that the mine place a fence around the perimeter of the hogan ring prior to ground scraping. She also wanted the archeologist to state that "...the mine should only scape contaminated soil and not remove rock during these clean-up activities."

Ms. Duncan was also surprised that she was not informed of "this" project although she is home everyday, except for the days she visits the doctors. She stated that she is never informed of the clean-up projects.

CONDITION OF SITE: Good

CAUSES OF DISTURBANCE: erosion, livestock

LOCATION OF SITE RELATIVE TO PROJECT AREA and AREA OF POTENTIAL EFFECT: within project area

EXTENT OF INVESTIGATIONS TO DATE: This recording

RESEARCH POTENTIAL/CULTURAL IMPORTANCE OF SITE: Through ethnographic research with family members the site may yield data regarding the historic Navajo occupation, settlement patterns, herding methods and other subsistence strategies of local Navajo families.



MANAGEMENT RECOMMENDATIONS: Special considerations for NM-Q-20-50 is as follows as per family's request: The site area may be reclaimed on the condition that a fence is placed around the perimeter of Feature 3 and that all reclamation activities avoid this area. Feature 3 should not be scraped or have any type of land-altering activities within the fenced area. Feature 3 should be allowed to deteriorate naturally and succumb to natural elements. An Archaeologist must monitor all construction activities near the site as well.

SITE ASSESSMENT UNDER 36 CFR 60.4 (National Register of Historic Places)

REGISTER ELIGIBLE:  Yes,  No,  Potentially

Comments:

INTEGRITY: location , design , setting , materials , workmanship ,  
feeling , association , unknown , none

CRITERIA: a , b , c , d , unknown , none

EXCLUSIONS:

SITE ASSESSMENT UNDER 36 CFR 7.3 (Archaeological Resources Protection Act):

Eligible for Protection?  Yes,  No

Meets 100-Year Guideline?  Yes,  No

Of Archaeological Interest?  Yes,  No

Comments: N/A

SITE ASSESSMENT UNDER P.L. 95-341 (American Indian Religious Freedom Act):

Merit Consideration?  Yes,  No,  N/A

Comments:

SITE ASSESSMENT UNDER NAVAJO NATION JISHCHAA' POLICY/NAGPRA:

Eligible for Protection?  Yes,  No,  Possibly (explain below)

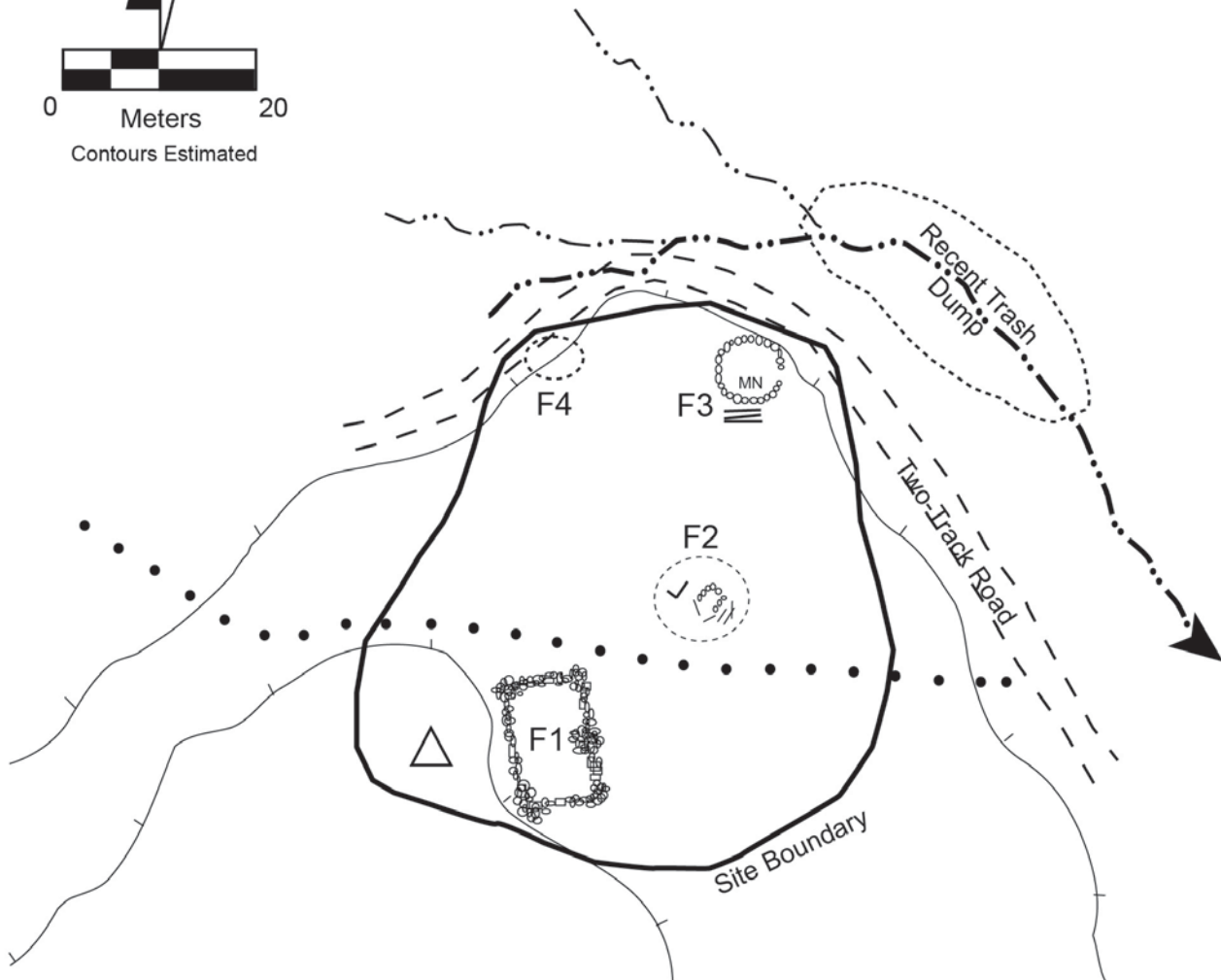
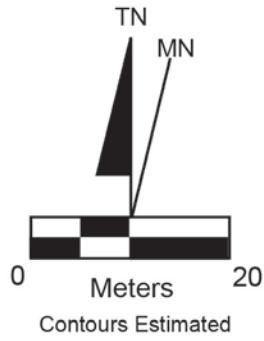
Comments: The site is associated with a deaths of a family members. The family ask that Feature 3 be avoided and fenced-off from any construction activities.

HOW CAN THE SITE BE REACHED (Provide a narrative description & refer to attached USGS quad map): See Map

PROVIDE A SITE MAP (Including site designation, site boundary, north arrow, scale, recognizable features, landmarks, and relationship to project area).

OTHER COMMENTS:

# NM-Q-20-50



KEY	
	Contour
	Datum
	Drainage
	Livestock Trail

General Site Map of NM-Q-20-50 (DCRM 2011-17)

**APPENDIX C**  
**GAMMA SURVEY RESULTS AND LABORATORY ANALYTICAL**  
**REPORTS**

**Radiological Survey Report  
Eastern Drainage Removal Action  
Northeast Church Rock Mine Site**

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**January 10, 2013**

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## 1.0 Radiological Surveys

Radiological surveys consisting of direct gamma radiation level measurements were conducted consistent with MARSSIM guidance (EPA, 2000) during the Eastern Drainage Removal Action (EDRA) at the Northeast Church Rock (NECR) Mine Site. This document is included in the EDRA Construction Completion Report (MWH, 2013) to document the gamma radiation surveys, soil sampling and analysis that were conducted during the EDRA.

The purpose of the direct gamma radiation survey was to estimate Ra-226 concentration in surface soil. Ra-226 is primarily an alpha emitting radionuclide with a gamma radiation emission of 186 KeV at about 4% intensity. Direct in-situ measurement of alpha radiation in the field is not practical or appropriate due to self adsorption of alpha radiation in the soil matrix. The low energy and intensity of the Ra-226 gamma radiation emission makes it impractical to determine Ra-226 in the field by direct gamma radiation measurement. However Pb-214 and Bi-214, Ra-226 decay products, emit high energy gamma radiations, which can be easily measured directly in the field utilizing a sodium-iodide (NaI) scintillation detector, such as a 2x2 NaI Scintillation detector having high gamma radiation sensitivity. The Ra-226 concentrations in soil could be measured as a surrogate for gamma measurement of Pb-214 and Bi-214 gamma radiation levels, consistent with Section 5.4 of the MARSSIM for remedial action support surveys.

Pb-214 and Bi-214 are decay products of Ra-226 through radon-222, a gaseous form, some of which emanates from soil. This phenomenon results in activity disequilibrium between Ra-226 and its decay products Pb-214 and Bi-214 in the soil. The Rn-222 gas emanation fraction from the soil varies with different geometric characteristics of a particular soil. Therefore, a site-specific calibration is necessary. Previous studies have shown that about 30% of the Rn-222 gas decayed from Ra-226 in soil emanates out of the surface soil, indicating that a significant (about 70%) portion of Rn-222 is retained within the soil matrix and decays into gamma radiation emitting decay products Pb-214 and Bi-214. If the soil geometry and other parameters, such as moisture, radon emanation fraction, constituent distribution profile, gamma ray shine from nearby sources, and land topography are consistent, the ratio of Pb-214 and Bi-214 to Ra-226 would also be consistent. This means there would be a direct correlation between Pb-214/Bi-214 gamma radiation levels and Ra-226 concentrations in the soil, allowing measurement of Ra-226 in soil by direct gamma radiation level measurements.

### 1.1 Gamma Radiation Survey Instrumentation

Similar to the instrumentation used for direct gamma radiation level measurements during the NECR Removal Site Evaluation (RSE) and the Eastern Drainage Area Supplemental RSE characterization, 2x2

Nal scintillation detectors (Eberline SPA-3 and Ludlum 44-10) for detection of gamma radiation and a ratemeter/scaler (Ludlum 2221 and L2241) for processing and counting the detected gamma radiation were used during the NECR EDRA. This instrument configuration has been used widely for this type of application, and is recommended by the MARSSIM. These scintillation detectors are rugged with high sensitivity gamma radiation detection for field application for this type of field survey. The objective of the excavation control and status surveys during the EDRA was to detect the presence of any residual Ra-226 in soil at or below the 2.24 pCi/g Removal Action Level (RAL). This instrument configuration is designed to meet that objective. In order to minimize gamma radiation shine interference from nearby areas and to focus measurements in an area under the detector, the 2x2 Nal scintillation detectors were installed in a 0.5 inch lead collimator as needed. The detector collimator was contained within a protective marlex housing. During the survey, the collimated detectors were held approximately 12 inches above ground surface level to focus and be most sensitive to an approximately 36 inch diameter area under the detector. Direct gamma radiation surveys during the EDRA were conducted with 2x2 Nal bare and collimated detectors as appropriate during the EDRA.

The instrumentation was calibrated as per Standard Operating Procedure (SOP)-3 included in the EDRA Construction Work Plan (Work Plan). Instrument calibration documentation is included in Appendix A. The Minimum Detection Concentration (MDC) for both the static and scan gamma radiation surveys were calculated as discussed in SOP-1 included in the Work Plan. The instrument MDCs during the EDRA were at or near 0.6 pCi/g (50% of the 1.24 pCi/g  $DCGL_w$ ) for the static survey and 1.1 pCi/g (50% of 2.0 pCi/g  $DCGL_{EMC}$ ) for the scan survey. Daily function checks of the instruments were performed to assure proper operation. Daily function check documentation with instrument MDCs is included in Appendix A.

## 1.2 Site Specific Correlation and Direct Gamma Radiation Action Level

The direct gamma radiation level (in detector count rate) used during the NECR EDRA for the collimated and bare detectors below which there is an acceptable level of assurance that the established RAL has been attained were based on the site-specific correlations between gamma radiation count rates and surface soil Ra-226 activity. The direct gamma radiation level of 5,075 cpm for the collimated 2x2 detector equivalent to the 2.24 pCi/g RAL was used and was based on the most recent updated site-specific correlation between gamma count rates and Ra-226 activity ( $Ra-226 \text{ pCi/g} = 0.0013\text{cpm} - 4.3582$ ) that was conducted for the East Drainage Supplemental RSE, as described in the *Supplemental Removal Site Evaluation Report, East Drainage Area* (MWH, 2011). The value of 5,075 cpm is consistent with the 5,214 counts per minute (cpm) equivalent to the 2.24 pCi/g Ra-226 that was determined for the Interim Status Survey of the 2009 Interim Removal Action (IRA) Area (Step-out Area No. 1) (MWH, 2010). In the flat areas of the Eastern Drainage Area where gamma radiation shine is not a concern, a bare 2x2 Nal detector was also used for excavation control. The direct gamma radiation level of 16,600

cpm for the bare 2x2 detector equivalent to the 2.24 pCi/g RAL was determined from a correlation ( $\text{Ra-226 pCi/g} = 0.0005\text{cpm} - 6.0697$ ) with an  $R^2$  value of 0.85 that was developed during the 2006 NECR RSE for background to 10 pCi/g level surface soil, which is appropriate for low level of Ra-226 soil concentrations following EDRA soil excavation. This correlation was described in Appendix B of the *Final Removal Site Evaluation Report, Northeast Church Rock Mine Site* (MWH, 2007).

The excavation and removal of contaminated soils during the EDRA resulted in changes to the Ra-226 distribution in soil, lower and more surficial, which likely changed the site-specific correlation between direct gamma radiation levels and Ra-226 concentrations in soil. Therefore, the April 2011 Eastern Drainage area supplemental RSE correlation for the collimated 2x2 NaI detector consisting of 87 samples was updated in accordance with the SOP-1 included in the Work Plan using data from soil sampling and direct gamma radiation measurements at 15 locations collected during the EDRA Interim Status Survey to convert direct gamma radiation level measurements for the Interim Status Survey. This EDRA updated correlation data are included in Appendix B. Regression analysis modeling for the updated correlation resulted in a regression equation,  $\text{Ra-226 pCi/g} = (0.0013 \times \text{gamma radiation level CPM}) - 4.4308$ , with an  $R^2$  value of 0.92, which was used to convert direct gamma radiation levels in cpm measured by the 2x2 NaI collimated detector to Ra-226 in pCi/g in soil in Section 3.1. This EDRA updated regression analysis model is comparable to the NECR Eastern Drainage Area SRSE updated regression equation  $(0.0013 \times \text{gamma radiation level CPM}) - 4.3582$ .

### **1.3 Field Direct Gamma Radiation Surveys**

The direct gamma radiation level survey for Ra-226 in surface soil were conducted either as scan survey (walkthrough) or static survey (stationary) measurements consistent with SOP-2 included in the Work Plan for excavation control and Interim Status Surveys. Scan radiation surveys (walkthrough surveys) were performed by walking with the detector at about 12 inches from the ground surface with the scaler/rate meter in count RATE MODE. Scan surveys were performed within each survey area by walking in a serpentine shape along transects in excavation areas to identify and locate any hot spots and contaminated area boundaries during the excavation control survey. Static radiation surveys (stationary) were performed at points or locations of interest during excavation control survey and at specified grid nodes within survey areas for the post-excavation Interim Status Survey. The detector was held at about 12 inches from the ground surface. The scaler/rate meter was set in the count SCALER MODE. A one-minute count (cpm) of gamma radiation level was obtained at each location for the direct gamma radiation static survey. For the status survey, the detector with 0.5-inch lead collimator was used.



## **2.0 Excavation Control Survey**

Excavation control surveys were conducted to: 1) support excavation and removal of impacted soil; 2) determine when an area or a survey unit was ready for the Interim Status Survey; and 3) provide initial radiological data for planning the Interim Status Survey. The objective of the excavation control survey was to detect the presence of residual Ra-226 in soil at or below the 2.24 pCi/g RAL. The excavation control survey enabled monitoring the effectiveness of soil excavation efforts that were intended to reduce residual Ra-226 in soil to RAL. The excavation control survey was designed to guide the soil excavation in real-time for expediency and cost effectiveness. In order to provide real-time excavation guidance, the excavation control survey consisted of direct gamma radiation level measurements in the field, consistent with the remedial action support surveys described in Section 5.4 of the MARSSIM.

### **2.1 Excavation Boundary Delineation**

Prior to the start of excavation activities, the RAL boundary for the EDRA excavation was field located and marked with pin flags utilizing the results from the Eastern Drainage Area SRSE and a differential global positioning system (DGPS) during August 27-30, 2012. Additional scan radiation surveys were conducted in the field during the RAL delineation to more accurately delineate the RAL boundary prior to the start of excavation. The RAL boundary expanded slightly at the southwest corner of the Eastern Drainage Area. The excavation for the EDRA was divided into zones consistent with the Excavation Plan drawing included in the Work Plan. The Eastern Drainage Channel was designated as Zone 1. The Eastern Drainage flats area was divided into Zone 2, 3, 4, and 5 based on expected excavation depths. The total petroleum hydrocarbon (TPH) area was designated as Zone 6. The entire Eastern Drainage excavation area was further divided into smaller subareas (200' x 200' grids cells) to more efficiently perform excavation control surveys.

### **2.2 Flats Area Excavation Control**

The construction contractor began soil excavation and removal in 6 - 12 inch lifts from Zone 2 on September 10, 2012. Following the specified initial excavation lift within an area, once the excavation equipment was cleared from the excavation area and the area was safe to operate in, excavation control gamma radiation scan survey was performed to identify any location that exceeded RAL.

The scan survey for the excavation control was performed for 100% coverage in each excavation area. If no point or a location exceeding the RAL was identified within a 200' grid cell by the scan, the area was marked as <RAL in the Excavation Control Grid Forms, included in Appendix C. A one-minute static radiation measurement at several points in that grid area was then conducted and recorded in the Static

Gamma Radiation Survey Field Forms, included in Appendix D. If the static radiation survey counts (cpm) were below the RAL in that grid cell, the grid cell was considered to meet the RAL and ready for the Interim Status Survey.

When the excavation control radiation scan following the initial soil excavation lift showed any location or a portion of the area above the RAL, those areas were marked with pin flags and marking paint in the field, and noted in the Excavation Control Grid Forms. The field marked areas were reviewed with the construction contractor for the additional excavation of contaminated soil as necessary at those locations. Additional excavation was conducted in these areas in lifts and additional excavation control scan was performed. This process was repeated as necessary until the excavation control scan survey showed no points or locations above the RAL. These areas were marked as <RAL in the Excavation Control Grid Forms, followed by a one-minute static gamma radiation survey. If the static radiation survey counts (cpm) were below the RAL, the areas with additional excavation were considered to meet the RAL and ready for the Interim Status Survey. Excavation of soil in areas along the fence line in the Eastern Drainage Area was conducted as close to the fence line, about 12 to 18 inches from the fence, as practical for the excavation equipment, which was approved by the EPA. Excavation in the Eastern Drainage flats areas (Zones 2-5) and the TPH Area (Zone 6) was completed October 18, 2012.

### **2.3 Eastern Drainage Channel Excavation Control**

In-situ direct gamma radiation surveying was not used for excavation control in the Eastern Drainage channel due to radiation shine interferences from the channel banks or sidewalls. Ex-situ field soil screening was performed instead for excavation control in the Eastern Drainage channel. Eastern Drainage channel bed sediment excavation began on October 1, 2012. As the excavation of portions of the channel bed sediments at the depths specified in the work plan was completed, a soil sample was collected every 50' feet along the bed channel (29 locations) and along the sidewalls (29 locations), as shown in Figure 1 (Eastern Drainage Channel Field Soil Screening Sample Locations and Results), and recorded in the Soil Sample Log Forms provided in Appendix E. Field gamma radiation soil screening was performed on the channel bed soil samples following the procedures in SOP-4 included in the Work Plan. If the soil screening results showed <RAL, channel bed excavation at 25 feet channel segments on both side of the soil sample location was considered to meet the RAL. If the field soil screening results showed >RAL, channel bed at 25 feet channel segments on both side of the soil sample location were further excavated until the soil screening showed that the soils were below the RAL.

Once the channel bed soil sample screening indicated levels <RAL at a location, a sample of the channel sidewall was collected at every 50 feet alternating between north and south sidewalls. There was no channel north sidewall from about 200' to 600' from Red Water Pond Road (RWPR) due to deep

excavation in the adjacent Zones 2 and 5. The sidewall samples were not alternated, but were collected from the south sidewalls at this segment of the channel. Gamma radiation soil screening was performed on the channel sidewall soil samples. If the soil screening results showed <RAL, channel sidewall excavation at 25 feet channel segments on both sides of the soil sample location was considered to meet the RAL. All soil screening field data and results were recorded in the Field Soil Sample Gamma Radiation Screening Forms, included in Appendix F, and are summarized in Table 1, which shows that the Eastern Drainage Channel excavation met the Removal Action (RA) objectives.

Once the soil sample field screening results showed that the soils were below the RAL, the soil samples from locations at every 100 feet along the channel bed and sidewalls were submitted to Energy Laboratories Inc (ELI), a vendor laboratory, in Casper, Wyoming for Ra-226 analysis using EPA Method 901.1 with a reporting limit of <0.6 pCi/g. A total of 34 soil samples (15 channel bed, 15 Channel Sidewalls, and 4 field QA/QC field duplicates) were submitted to ELI. Eastern Drainage Channel bed sediment excavation and field soil screening for excavation control was completed on October 8, 2012.

#### **2.4 Documentation and Evaluation of the Excavation Control Survey Results**

Since the Ra-226 soil RAL is evaluated based on the instrumentation count rate of the direct gamma radiation level (cpm) using the site-specific correlation, conversion of the scan radiation survey counts during the excavation control survey data to Ra-226 concentration in pCi/g is not necessary. The excavation and removal field decisions were made based on the count rates observed by the instrument. The excavations were controlled using a gamma radiation level of 5,075 cpm for the collimated detector and 16,600 cpm for the bare detector. Following the final scan radiation survey showing that soils within the excavated area were below the RAL, notations were made in the Excavation Control Grid Forms (Appendix C) indicating gamma radiation levels <RAL. One-minute static gamma radiation measurement were conducted at several points following scan excavation survey in grid areas and recorded in the Static Gamma Radiation Survey Field Forms (Appendix D). Ex-situ field soil screening performed for excavation control in the Eastern Drainage channel was documented in the Field Soil Sample Gamma Radiation Screening Forms (Appendix F).

#### **3.0 Interim and Final Status Surveys**

Subsequent to completion of excavation activities, an Interim Status Survey was implemented consistent with MARSSIM guidance (EPA, 2000), as described in the Work Plan. The objective of the Interim Status Survey was to demonstrate that soils with Ra-226 in excess of the 2.24 pCi/g RAL had been removed from the EDRA areas. Because the areas were being addressed due to Ra-226 impacts in excess of the RAL, they are considered Class 1 Areas under MARSSIM and will therefore require a Class 1 Final Status

Survey subsequent to the final Removal Action. This Interim Status Survey is meant to confirm that excavation activities met the objectives of the EDRA. The data collected during the Interim Status Survey will be included in the Final Status Survey at a later date.

The Interim Status Survey consisted of a direct gamma radiation static survey and confirmatory soil sampling. A direct gamma radiation static survey was designed for the NECR Removal Site Evaluation consistent with MARSSIM to support Data Quality Objectives (DQOs) for Class 1 areas. The SOP-2, which includes the static direct gamma radiation survey for the Interim Status Survey was included in the Work Plan. Instrumentation used for the Interim Status Static gamma radiation survey was the same as that used for the excavation control survey, included in SOP-2 and discussed in Section 1.1 The instrumentation consisted of a 2x2 NaI scintillation detector (Eberline SPA-3) for detection of gamma radiation, connected to a portable ratemeter/scaler (such as Ludlum 2221), and a DGPS system to locate static survey grid points from spatial coordinates.

Because the area within the Eastern Drainage channel excavation needed to be backfilled and restored, a Final Status Survey was conducted for the channel. The Final Status Survey consisted of the results of the ex-situ soil screening and soil samples submitted to the laboratory for Ra-226 analysis, as described in Section 3.2 below.

### **3.1 Flats Area Interim Status Survey**

The number of data points for the Interim Status Survey was determined using the Wilcoxon Rank Sum (WRS) test per MARSSIM guidance with statistical parameters selected to achieve a low error rate. Since the areas undergoing the EDRA are Class 1 Areas, the interim status survey was conducted consistent with the RSE Work Plan for Class 1 Areas (MWH, 2006), and was also consistent with the 2009 IRA (MWH, 2010). Therefore, the Interim Status Survey conducted in the flats area consisted of Ra-226 soil concentration measurement by direct gamma radiation static measurements conducted on an 80-foot grid. The Work Plan specified confirmatory soil samples to be collected for laboratory analysis at 5% of the static gamma survey points, or a minimum of 13 samples. The Interim Status Survey was implemented once the excavation control survey indicated that excavation and removal of impacted soil above the RAL was complete.

The excavation control radiation scan survey conducted at 100% coverage in areas during excavation, as discussed in Section 2.2, augments the interim status survey. The direct gamma radiation static surveys conducted as a part of the excavation control survey following the scan radiation survey, also augment the Interim Status Survey.

The 80-ft triangular grid was cast from the 2009 IRA 80-ft triangular grid origin, which generated a total of 149 points based on the total area of the excavation in the Eastern Drainage area for interim status direct gamma survey. In Zone 6 (TPH area) direct gamma static survey for the interim status survey was performed at the same 10 points as the original 2009 IRA 80-ft triangular grid points within and around the excavation done during the EDRA. The flats area interim status survey consisting of one-minute gamma static survey at a total of 159 points and confirmatory soil samples at 15 of the gamma static survey points, as shown in Figure 2 (EDRA Flat Area Interim Status Survey Point Locations), was performed.

The Interim Status Survey was performed in stages as an area or a zone was determined ready for the status survey based on the excavation control survey. The purpose of performing the Interim Status Survey in stages was to allow backfilling or grading of excavated areas as they were completed for the EDRA construction schedule and project control, since no excavated area was to be backfilled or graded prior to the Interim Status Survey. The Interim Status Survey for the Eastern Drainage flats area began with static gamma survey measurements on September 28, 2012 in Zone 2. The status survey began with locating the status survey points (grid nodes) using survey point location figures, the static survey point coordinate data, and the DGPS system, as described in SOP-2. Then a one-minute direct gamma radiation static survey was performed at each of the points. A direct gamma radiation static measurement was performed at a total of 159 80-ft grid points for the interim status survey. The static gamma survey measurements and other information were recorded in the 80-ft Triangular Grid Status Static Gamma Radiation Survey Field Forms, which are included in Appendix G. Confirmation surface soil samples were collected from 15 static gamma survey locations as shown in Figure 2, Interim Status Gamma Static Survey Point Locations. Field QA/QC duplicate samples were collected from two locations. The soil sampling information was recorded in the EDRA Soil Sample Log, included in Appendix E. A total of 17 soil samples were submitted to ELI for Ra-226 analysis using EPA Method 901.1 with a reporting limit of <0.6 pCi/g for EDRA Flat Area Interim Status Survey. The Chain-of Custody (COCs) forms are included in Appendix E.

The laboratory analytical reports are included in the Construction Completion Report, and the results are summarized in Table 2 of this report. All of the confirmatory soil sample Ra-226 results were reported at less than the 2.24 pCi/g RAL, except for one sample, SSPT-033, for which the Ra-226 result was reported at 6.2 +/- 0.7 pCi/g. During the Interim Status Survey conducted on October 5, 2012, the static gamma level at this location was measured at 4,997 cpm, below the 5,075 cpm RAL for the collimated 2x2 NaI detector (i.e., less than 2.24 pCi/g). The reported result of 6.2 pCi/g is equivalent to about 8,100 cpm direct gamma radiation level, significantly above the measured static gamma radiation level of 4,997 cpm. Therefore, on December 4, 2012, another soil sample, SSPT-033R was collected from the exact same location (N1696769.8, E2524210.6). The static gamma level was measured at 4,787 cpm

during re-sampling. Also, a scan gamma survey was performed over an approximately 20-foot radius area around the point during the re-sampling on December 4, 2012, which showed gamma levels from about 4,200 to 4,900 cpm. The replacement soil sample SSPT-033R was sent to laboratory for Ra-226 analysis on December 4, 2102. On January 3, 2013, the laboratories reported a Ra-226 result for SSPT-033R of 1.5 +/- 0.6 pCi/g, less than the 2.24 pCi/g RAL, and significantly lower than the 6.2 pCi/g reported for the initial sample SSPT-033, indicating that the 6.2 pCi/g value previously reported was likely an erroneous result.

The Interim Status Survey direct gamma radiation static survey one-minute readings were converted into Ra-226 surface soil concentrations using an updated correlation regression analysis equation, Ra-226 pCi/g = (0.0013 x gamma radiation level CPM) – 4.4308, with an R<sup>2</sup> value of 0.92 as discussed in Section 1.2. The Ra-226 concentrations in soil converted from the direct gamma radiation level measurements are summarized in Table 3 and shown in Figure 3 (EDRA Flat Area Interim Status Gamma Survey Results Summary). The gamma static survey results show that Ra-226 concentrations in soil are below the 2.24 pCi/g RAL at 137 of the total 149 survey points in the Eastern Drainage flats area (Zones 2-5) and 8 of 10 survey points in the TPH Area (Zone 6). Ra-226 concentrations at 14 locations that exceeded the 2.24 pCi/g RAL were all below the 3.0 pCi/g elevated measurement comparison (emc) Level with the highest at 2.72 pCi/g. As shown in Table 2, mean Ra-226 concentrations for all 149 locations within the Eastern Drainage flat area was 1.58 pCi/g with a standard deviation of 0.47 pCi/g and median value of 1.56 pCi/g.

### **3.2 Eastern Drainage Channel Final Status Survey**

Since the Eastern Drainage Channel required backfilling and restoration following the excavation, a Final Status Survey was conducted within the Eastern Drainage channel excavation. The Final Status Survey consisted of the results of the ex-situ soil screening conducted during construction (see Section 2.3) and soil samples submitted for laboratory analysis of Ra-226. As discussed in Section 2.3, a soil sample was collected every 50' feet along the channel bed (29 locations) and channel sidewalls (29 locations) from the excavated channel for excavation control by ex-situ gamma radiation soil screening. The Final Status Survey was conducted in segments of the excavation as it progressed along the length of the channel to facilitate backfilling of the excavation in a timely manner and to reduce safety risks. Once ex-situ field screening results indicated that the RA Action Level had been achieved, as shown in Table 1, and the excavation was deemed complete, every other soil sample collected for excavation control plus four field QA/QC duplicate samples were selected for analysis by of Ra-226 ELI. This resulted in 15 channel bed samples and 15 channel sidewall samples plus the 4 duplicate samples. Initially, the Work Plan specified soil samples for offsite laboratory analysis be collected at every 50 feet along the Channel bed and sidewalls. However, the channel bed and sidewall soil samples from every 100 feet were submitted

to the laboratory instead at the direction and approval of the EPA.

The laboratory soil sample results are summarized in Table 1 and shown in Figure 4 (Eastern Drainage Channel Bed Final Status Survey Soil Sample Results) and Figure 5 (Eastern Drainage Channel Sidewall Final Status Survey Soil Sample Results). As shown in Table 1, all of the channel bed and channel sidewall soil sample Ra-226 results reported from the laboratory at less than the 2.24 pCi/g RAL, except for one channel sidewall sample, EDC-29-NSW channel north sidewall sample @1400', for which the Ra-226 result was reported at 3.0 +/- 0.6 pCi/g. Although, this results is at the acceptable emc level of 3.0 pCi/g for the Site, it is likely to be either an outlier or an erroneous value because this soil sample screened <RAL during the field soil screening as shown in Table 1, and the laboratory reported a Ra-226 result of 1.7 +/- 0.6 pCi/g for the field QA/QC duplicate sample (EDC-DS4) of the EDC-29-NSW. The ex-situ soil screening results and soil sample laboratory results show Ra-226 levels below the RAL and demonstrate that the Eastern Drainage Channel excavation met the EDRA objectives.

## **TABLES**



**Table 1: Eastern Drainage Channel Excavation Control and Final Status Survey Summary**

Soil Sample ID	Sample Description	Sample Date/Time	Location Coordinates (NAD83, State Plane, NM West, Feet)		Field Soil Gamma Rad Screening Data (1.5-Inch Pb Shielded 3x3 NaI/L2221 SCA)				Comments	Soil Sample Lab Ra-226 Results (pCi/g)	
			Northing	Easting	Date	Ref Soil (2.0 pCi/g) CP5M	Soil Sample CP5M	Results		Concentration	Uncertainty
EDC-01	Channel Bed Sample @ 0', 7.0' depth	10/2/12 13:17	1,696,527.0	2,524,195.0	10/2/2012	2,103	1,330	<RAL	sample sent to Lab	1.5	0.5
EDC-01-NSW	Channel North Side Wall Sample @ 0'	10/3/12 11:00	1,696,532.3	2,524,193.9	10/3/2012	2,126	1,405	<RAL	sample sent to Lab	1.5	0.5
EDC-02	Channel Bed Sample @ 50', 6.1' depth	10/2/12 13:21	1,696,545.9	2,524,241.5	10/2/2012	2,103	1,663	<RAL	-	-	-
EDC-02-SSW	Channel South Side Wall Sample @ 50'	10/3/12 11:05	1,696,539.5	2,524,242.0	10/3/2012	2,126	1,598	<RAL	-	-	-
EDC-03	Channel Bed Sample @ 100', 7.5' depth	10/2/12 13:27	1,696,568.4	2,524,285.2	10/2/2012	2,103	1,357	<RAL	sample sent to Lab	0.7	0.4
EDC-03-NSW	Channel North Side Wall Sample @ 100'	10/3/12 11:15	1,696,576.1	2,524,282.8	10/3/2012	2,126	1,488	<RAL	sample sent to Lab	1.1	0.4
EDC-04	Channel Bed Sample @ 150', 5.5' depth	10/2/12 13:36	1,696,593.9	2,524,328.0	10/2/2012	2,103	3,033	>RAL	Channel bed area to be further excavated	-	-
EDC-04	Channel Bed Sample @ 150', 6.5' depth	10/5/12 14:18			10/6/2012	2,103	1,701	<RAL	Sampled after second excavation	-	-
EDC-04-SSW	Channel South Side Wall Sample @ 150'	10/8/12 9:30	1,696,587.6	2,524,327.7	10/8/2012	2,411	1,560	<RAL	-	-	-
EDC-05	Channel Bed Sample @ 200', 5.0' depth	10/2/12 13:47	1,696,614.3	2,524,372.0	10/2/2012	2,103	3,945	>RAL	Channel bed area to be further excavated	-	-
EDC-05	Channel Bed Sample @ 200', 5.0' depth	10/5/12 14:35			10/6/2012	2,198	1,503	<RAL	Sampled after second excavation, sample sent to lab	1.2	0.5
EDC-DS2	Field QA/QC Duplicate of EDC-05	10/5/12 14:50	-	-	-	-	-	-	Field Duplicate for Lab QA/QC	1.0	0.4
EDC-05-NSW	Channel North Side Wall Sample @ 200'	10/8/12 9:38	1,696,621.0	2,524,371.6	10/8/2012	2,411	1,448	<RAL	sample sent to Lab	1.2	0.5
EDC-06	Channel Bed Sample @ 250', 4.5' depth	10/5/12 14:42	1,696,623.2	2,524,423.9	10/6/2012	2,198	1,703	<RAL	-	-	-
EDC-06-SSW	Channel South Side Wall Sample @ 250'	10/8/12 9:45	1,696,616.8	2,524,423.8	10/8/2012	2,411	1,662	<RAL	-	-	-
EDC-07	Channel Bed Sample @ 300', 5.0' depth	10/2/12 13:54	1,696,618.6	2,524,472.9	10/2/2012	2,103	1,696	<RAL	sample sent to Lab	1.1	0.4
EDC-07-SSW	Channel South Side Wall Sample @ 300'	10/3/12 11:27	1,696,612.6	2,524,472.9	10/3/2012	2,126	1,665	<RAL	sample sent to Lab	1.1	0.5
EDC-DS3	Field QA/QC Dup of EDC-07-SSW	10/3/12 11:30	-	-	-	-	-	-	Field Duplicate for Lab QA/QC	1.3	0.5

**Table 1: Eastern Drainage Channel Excavation Control and Final Status Survey Summary**

Soil Sample ID	Sample Description	Sample Date/Time	Location Coordinates (NAD83, State Plane, NM West, Feet)		Field Soil Gamma Rad Screening Data (1.5-Inch Pb Shielded 3x3 NaI/L2221 SCA)			Comments	Soil Sample Lab Ra-226 Results (pCi/g)		
			Northing	Easting	Date	Ref Soil (2.0 pCi/g) CP5M	Soil Sample CP5M		Results	Concentration	Uncertainty
EDC-08	Channel Bed Sample @ 350', 5.5' depth	10/2/12 13:58	1,696,619.6	2,524,516.8	10/2/2012	2,103	1,662	<RAL	-	-	-
EDC-08-SSW	Channel South Side Wall Sample @ 350'	10/3/12 11:35	1,696,613.7	2,524,516.8	10/3/2012	2,126	1,516	<RAL	-	-	-
EDC-09	Channel Bed Sample @ 400', 5.5' depth	10/2/12 14:02	1,696,621.9	2,524,570.1	10/2/2012	2,103	1,487	<RAL	sample sent to Lab	0.9	0.5
EDC-09-SSW	Channel South Side Wall Sample @ 400'	10/3/12 11:45	1,696,615.8	2,524,570.1	10/3/2012	2,126	1,529	<RAL	sample sent to Lab	1.2	0.4
EDC-10	Channel Bed Sample @ 450', 3.5' depth	10/2/12 14:07	1,696,637.0	2,524,629.5	10/2/2012	2,103	1,895	<RAL	-	-	-
EDC-10-SSW	Channel South Side Wall Sample @ 450'	10/3/12 11:52	1,696,630.4	2,524,627.6	10/3/2012	2,126	1,908	<RAL	-	-	-
EDC-11	Channel Bed Sample @ 500', 2.8' depth	10/3/12 9:20	1,696,661.0	2,524,672.6	10/3/2012	2,126	1,887	<RAL	sample sent to Lab	1.0	0.5
EDC-11-SSW	Channel South Side Wall Sample @ 500'	10/3/12 12:00	1,696,655.5	2,524,675.7	10/3/2012	2,126	1,919	<RAL	sample sent to Lab	0.9	0.5
EDC-12	Channel Bed Sample @ 550', 2.8' depth	10/3/12 9:30	1,696,688.1	2,524,713.8	10/3/2012	2,126	1,659	<RAL	-	-	-
EDC-12-SSW	Channel South Side Wall Sample @ 550'	10/3/12 12:08	1,696,681.6	2,524,717.5	10/3/2012	2,126	1,758	<RAL	-	-	-
EDC-13	Channel Bed Sample @ 600', 3.8' depth	10/3/12 9:35	1,696,711.6	2,524,757.9	10/3/2012	2,126	1,685	<RAL	sample sent to Lab	0.9	0.4
EDC-13-SSW	Channel South Side Wall Sample @ 600'	10/3/12 12:17	1,696,705.6	2,524,762.4	10/3/2012	2,126	1,601	<RAL	sample sent to Lab	1.4	0.5
EDC-14	Channel Bed Sample @ 650', 4.0' depth	10/3/12 9:40	1,696,745.7	2,524,794.0	10/3/2012	2,126	1,444	<RAL	-	-	-
EDC-14-SSW	Channel South Side Wall Sample @ 650'	10/3/12 12:25	1,696,740.1	2,524,800.0	10/3/2012	2,126	1,537	<RAL	-	-	-
EDC-15	Channel Bed Sample @ 700', 3.0' depth	10/4/12 12:20	1,696,774.5	2,524,835.2	10/4/2012	2,108	1,560	<RAL	sample sent to Lab	0.8	0.5
EDC-15-NSW	Channel North Side Wall Sample @ 700'	10/4/12 13:10	1,696,777.7	2,524,830.3	10/5/2012	2,167	1,520	<RAL	sample sent to Lab	1.1	0.4
EDC-16	Channel Bed Sample @ 750', 4.0' depth	10/4/12 12:30	1,696,802.4	2,524,877.6	10/4/2012	2,108	1,400	<RAL	-	-	-
EDC-16-SSW	Channel South Side Wall Sample @ 750'	10/4/12 13:17	1,696,799.7	2,524,883.6	10/5/2012	2,167	1,391	<RAL	-	-	-

**Table 1: Eastern Drainage Channel Excavation Control and Final Status Survey Summary**

Soil Sample ID	Sample Description	Sample Date/Time	Location Coordinates (NAD83, State Plane, NM West, Feet)		Field Soil Gamma Rad Screening Data (1.5-Inch Pb Shielded3x3 NaI/L2221 SCA)				Comments	Soil Sample Lab Ra-226 Results (pCi/g)	
			Northing	Easting	Date	Ref Soil (2.0 pCi/g) CP5M	Soil Sample CP5M	Results		Concentration	Uncertainty
EDC-17	Channel Bed Sample @ 800', 7.0' depth	10/4/12 13:26	1,696,832.2	2,524,917.6	10/4/2012	2,108	1,908	<RAL	sample sent to Lab	1.1	0.5
EDC-17-NSW	Channel North Side Wall Sample @ 800	10/4/12 13:27	1,696,839.4	2,524,911.8	10/5/2012	2,167	1,814	<RAL	sample sent to Lab	1.1	0.4
EDC-18	Channel Bed Sample @ 850', 8.0' depth	10/4/12 14:49	1,696,845.3	2,524,967.5	10/4/2012	2,108	1,408	<RAL	-	-	-
EDC-18-SSW	Channel South Side Wall Sample @ 850'	10/4/12 16:10	1,696,838.4	2,524,971.4	10/5/2012	2,167	1,405	<RAL	-	-	-
EDC-19	Channel Bed Sample @ 900', 3.9' depth	10/4/12 13:28	1,696,859.2	2,525,013.9	10/4/2012	2,108	1,854	<RAL	sample sent to Lab	1.0	0.4
EDC-19-NSW	Channel North Side Wall Sample @ 900'	10/4/12 14:20	1,696,868.7	2,525,011.1	10/5/2012	2,167	1,796	<RAL	sample sent to Lab	1.5	0.5
EDC-20	Channel Bed Sample @ 950', 3.5' depth	10/4/12 13:55	1,696,852.5	2,525,061.3	10/4/2012	2,108	1,759	<RAL	-	-	-
EDC-20-SSW	Channel South Side Wall Sample @ 950'	10/4/12 14:28	1,696,843.6	2,525,059.2	10/5/2012	2,167	1,711	<RAL	-	-	-
EDC-21	Channel Bed Sample @ 1000', 4.0' depth	10/4/12 15:41	1,696,832.5	2,525,115.9	10/4/2012	2,108	1,673	<RAL	sample sent to Lab	1.7	0.7
EDC-DS1	Field QA/QC Duplicate of EDC-21	10/4/12 16:00	-	-	-	-	-	-	Field Duplicate for Lab QA/QC	1.2	0.6
EDC-21-NSW	Channel North Side Wall Sample @ 1000'	10/4/12 16:26	1,696,839.4	2,525,117.7	10/5/2012	2,167	1,578	<RAL	sample sent to Lab	1.6	0.6
EDC-22	Channel Bed Sample @ 1050', 2.5' depth	10/5/12 10:10	1,696,800.7	2,525,156.1	10/6/2012	2,198	2,102	<RAL	-	-	-
EDC-22-SSW	Channel South Side Wall Sample @ 1050'	10/8/12 8:45	1,696,794.5	2,525,152.2	10/8/2012	2,411	1,722	<RAL	-	-	-
EDC-23	Channel Bed Sample @ 1100', 2.8' depth	10/5/12 10:21	1,696,767.1	2,525,193.0	10/6/2012	2,198	1,752	<RAL	sample sent to Lab	1.0	0.4
EDC-23-NSW	Channel North Side Wall Sample @ 1100'	10/8/12 8:53	1,696,773.6	2,525,196.1	10/8/2012	2,411	1,650	<RAL	sample sent to Lab	1.4	0.5
EDC-24	Channel Bed Sample @ 1150', 2.5' depth	10/5/12 10:30	1,696,735.4	2,525,229.4	10/6/2012	2,198	1,801	<RAL	-	-	-
EDC-24-SSW	Channel South Side Wall Sample @ 1150'	10/8/12 9:00	1,696,731.1	2,525,223.2	10/8/2012	2,411	1,698	<RAL	-	-	-

**Table 1: Eastern Drainage Channel Excavation Control and Final Status Survey Summary**

Soil Sample ID	Sample Description	Sample Date/Time	Location Coordinates (NAD83, State Plane, NM West, Feet)		Field Soil Gamma Rad Screening Data (1.5-Inch Pb Shielded 3x3 NaI/L2221 SCA)				Comments	Soil Sample Lab Ra-226 Results (pCi/g)	
			Northing	Easting	Date	Ref Soil (2.0 pCi/g) CP5M	Soil Sample CP5M	Results		Concentration	Uncertainty
EDC-25	Channel Bed Sample @ 1200', 4.0' depth	10/5/12 10:40	1,696,697.0	2,525,262.6	10/6/2012	2,198	3,573	>RAL	Channel bed area to be further excavated	-	-
EDC-25	Channel Bed Sample @ 1200', 4.5' depth	10/8/12 10:45			10/8/2012	2,411	2,103	<RAL	Sampled after second excavation, sample sent to lab	1.9	0.5
EDC-25-NSW	Channel North Side Wall Sample @ 1200'	10/8/12 11:40	1,696,702.5	2,525,266.1	10/8/2012	2,411	1,902	<RAL	sample sent to Lab	1.2	0.5
EDC-26	Channel Bed Sample @ 1250', 3.0' depth	10/5/12 10:47	1,696,665.1	2,525,297.6	10/6/2012	2,198	5,318	>RAL	Area further excavated	-	-
EDC-26	Channel Bed Sample @ 1250', 4.0' depth	10/8/12 10:45			10/8/2012	2,411	2,389	<RAL	Sampled after further excavation	-	-
EDC-26-SSW	Channel South Side Wall Sample @ 1250'	10/8/12 11:50	1,696,657.6	2,525,294.3	10/8/2012	2,411	1,890	<RAL	-	-	-
EDC-27	Channel Bed Sample @ 1300', 3.0' depth	10/5/12 10:55	1,696,632.5	2,525,336.5	10/6/2012	2,198	5,863	>RAL	Channel bed area to be further excavated	-	-
EDC-27	Channel Bed Sample @ 1300', 5.5' depth	10/8/12 10:50			10/8/2012	2,411	4,171	>RAL	Sampled after second excavation	-	-
EDC-27	Channel Bed Sample @ 1300', 6.5' depth	10/8/12 12:54			10/8/2012	2,411	2,107	<RAL	Sampled after third excavation, sample sent to lab	1.8	0.6
EDC-27-NSW	Channel North Side Wall Sample @ 1300'	10/8/12 13:20	1,696,637.7	2,525,340.3	10/8/2012	2,411	2,017	<RAL	sample sent to Lab	1.9	0.6
EDC-28	Channel Bed Sample @ 1350', 2.5' depth	10/5/12 11:03	1,696,604.9	2,525,376.8	10/6/2012	2,198	4,271	>RAL	Channel bed area to be further excavated	-	-
EDC-28	Channel Bed Sample @ 1350', 5.0' depth	10/8/12 10:57			10/8/2012	2,411	2,105	<RAL	Sampled after second excavation	-	-
EDC-28-SSW	Channel South Side Wall Sample @ 1350'	10/8/12 11:56	1,696,599.0	2,525,373.7	10/8/2012	2,411	1,909	<RAL	-	-	-
EDC-29	Channel Bed Sample @ 1400', 2.5' depth	10/5/12 11:15	1,696,583.4	2,525,422.1	10/6/2012	2,411	1,881	<RAL	sample sent to Lab	1.3	0.5
EDC-29-NSW	Channel North Side Wall Sample @ 1400'	10/8/12 9:12	1,696,590.7	2,525,424.9	10/8/2012	2,411	1,701	<RAL	sample sent to Lab	1.7	0.6
EDC-DS4	Field QA/QC Dup of EDC-29-NSW	10/8/12 9:20	-	-	-	-	-	-	Field Duplicate for Lab QA/QC	3.0	0.6

**Table 2: NECR EDRA Flat Area Interim Status Survey Confirmatory Soil Sample Results Summary**

EDRA Soil Sample ID	Sample Date	Point Coordinates (NAD83, State Plane, NM West, feet)		Gamma Radiation Level, 2x2 NaI Collimated detector SPA 3 #30 (EDRA Updated Correlation, pCi/g = 0.0013cpm-4.4308)				Confirmatory Soil Sample Lab Ra-226 Results (pCi/g)	
		Northing	Easting	CPM	Uncertainty <sup>(1)</sup> CPM	Ra-226 (pCi/g)	Uncertainty (pCi/g)	Ra-226	Uncertainty (+/-)
SSPT-011	10/05/12	1,696,629.8	2,524,450.2	4575	133	1.5	0.2	1.4	0.5
SSPT-022	10/05/12	1,696,698.6	2,524,810.2	4997	139	2.1	0.2	1.9	0.6
SSPT-033	10/05/12	1,696,771.0	2,524,208.5	4997	139	2.1	0.2	6.2	0.7
SSPT-033R	12/04/12	1,696,771.0	2,524,208.5	Re-sample at location SSPT-033				1.5	0.5
SSPT-044	10/05/12	1,696,835.0	2,525,049.7	4661	134	1.6	0.2	1.8	0.5
SSPT-DS2	10/05/12	1,696,835.0	2,525,049.7	Field QA/QC Duplicate Sample of SSPT-044				2.5	0.5
SSPT-055	10/03/12	1,696,972.7	2,524,489.8	4394	130	1.3	0.2	1.6	0.4
SSPT-DS1	10/03/12	1,696,972.7	2,524,489.8	Field QA/QC Duplicate Sample of SSPT-055				1.6	0.4
SSPT-066	10/03/12	1,697,044.9	2,525,011.2	4573	133	1.5	0.2	1.0	0.5
SSPT-074	10/03/12	1,697,045.3	2,524,371.5	4773	135	1.8	0.2	1.5	0.4
SSPT-077	10/03/12	1,697,114.5	2,524,326.9	4698	134	1.7	0.2	1.2	0.4
SSPT-088	10/03/12	1,697,111.7	2,525,212.2	4982	138	2.0	0.2	1.5	0.5
SSPT-099	10/03/12	1,697,183.9	2,524,370.8	4984	138	2.0	0.2	2.2	0.6
SSPT-110	10/03/12	1,697,254.8	2,524,650.7	5211	141	2.3	0.2	1.4	0.5
SSPT-121	10/03/12	1,697,323.2	2,524,690.6	4386	130	1.3	0.2	1.6	0.5
SSPT-132	10/03/12	1,697,392.9	2,524,330.8	4773	135	1.8	0.2	2.0	0.5
SSPT-143	10/03/12	1,697,462.0	2,524,370.8	4964	138	2.0	0.2	1.9	0.5
SSPT-030Z-6	10/17/12	1,696,213.1	2,522,892.0	4557	132	1.5	0.2	1.3	0.6

Note: (1) 95% CL uncertainty calculated for a single measurement as  $1.96\sigma$ , where  $\sigma$ , standard deviatio, is  $\sqrt{v}$  of the measurement (CPM)

**Table 3: NECR EDRA Flat Area Interim Status Gamma Satic Survey Results Summary**

EDRA Static Survey Point ID	Survey Date	Point Coordinates (NAD83, State Plane, NM West, feet)		Gamma Radiation Level, 2x2 NaI Collimated detector SPA-3 #30 (EDRA Updated Correlation, pCi/g = 0.0013cpm-4.4308)			
		Northing	Easting	CPM	Uncertainty <sup>(1)</sup> CPM	Ra-226 (pCi/g)	Uncertainty (pCi/g)
001	10/05/12	1,696,422.4	2,524,249.8	4403	130	1.29	0.17
002	10/05/12	1,696,490.8	2,524,371.6	4947	138	2.00	0.18
003	10/05/12	1,696,491.0	2,524,291.8	4316	129	1.18	0.17
004	10/05/12	1,696,491.3	2,524,214.2	5414	144	2.61	0.19
005	10/05/12	1,696,561.7	2,524,249.8	4489	131	1.40	0.17
006	10/05/12	1,696,560.5	2,524,330.0	4728	135	1.72	0.18
007	10/05/12	1,696,561.3	2,524,410.3	4513	132	1.44	0.17
008	10/05/12	1,696,630.6	2,525,329.5	4517	132	1.44	0.17
009	10/05/12	1,696,630.8	2,524,610.8	3780	121	<0.60	-
010	10/05/12	1,696,629.0	2,524,531.2	3679	119	<0.60	-
011	10/05/12	1,696,629.8	2,524,450.2	4575	133	1.52	0.17
012	10/05/12	1,696,630.7	2,524,370.8	4884	137	1.92	0.18
013	10/05/12	1,696,630.5	2,524,290.6	4629	133	1.59	0.17
014	10/05/12	1,696,629.3	2,524,210.0	5039	139	2.12	0.18
015	10/05/12	1,696,700.4	2,524,250.5	4947	138	2.00	0.18
016	10/05/12	1,696,699.6	2,524,331.0	4433	130	1.33	0.17
017	10/05/12	1,696,699.5	2,524,411.5	4939	138	1.99	0.18
018	10/05/12	1,696,699.0	2,524,488.2	4302	129	1.16	0.17
019	10/05/12	1,696,699.0	2,524,571.1	4417	130	1.31	0.17
020	10/05/12	1,696,700.3	2,524,650.4	4673	134	1.64	0.17
021	10/05/12	1,696,697.3	2,524,730.5	3916	123	0.66	0.16
022	10/05/12	1,696,698.6	2,524,810.2	4997	139	2.07	0.18
023	10/05/12	1,696,698.3	2,525,291.2	4514	132	1.44	0.17
024	10/05/12	1,696,767.9	2,525,169.7	4366	130	1.25	0.17
025	10/05/12	1,696,768.9	2,524,851.5	5061	139	2.15	0.18
026	10/05/12	1,696,768.5	2,524,771.3	4657	134	1.62	0.17
027	10/05/12	1,696,768.9	2,524,691.3	4665	134	1.63	0.17
028	10/05/12	1,696,768.0	2,524,611.3	4090	125	0.89	0.16
029	10/05/12	1,696,767.5	2,524,532.0	4311	129	1.17	0.17
030	10/05/12	1,696,767.7	2,524,450.9	4745	135	1.74	0.18
031	10/05/12	1,696,767.3	2,524,369.8	5047	139	2.13	0.18
032	10/05/12	1,696,767.1	2,524,290.6	4122	126	0.93	0.16
033	10/05/12	1,696,771.0	2,524,208.5	4997	139	2.07	0.18
034	10/05/12	1,696,839.8	2,524,248.8	3728	120	<0.60	-
035	10/05/12	1,696,836.7	2,524,332.0	3690	119	<0.60	-
036	10/05/12	1,696,828.1	2,524,409.9	4507	132	1.43	0.17

**Table 3: NECR EDRA Flat Area Interim Status Gamma Satic Survey Results Summary**

EDRA Static Survey Point ID	Survey Date	Point Coordinates (NAD83, State Plane, NM West, feet)		Gamma Radiation Level, 2x2 NaI Collimated detector SPA-3 #30 (EDRA Updated Correlation, pCi/g = 0.0013cpm-4.4308)			
		Northing	Easting	CPM	Uncertainty <sup>(1)</sup> CPM	Ra-226 (pCi/g)	Uncertainty (pCi/g)
037	10/05/12	1,696,839.0	2,524,490.5	4312	129	1.17	0.17
038	10/03/12	1,696,837.5	2,524,572.1	4368	130	1.25	0.17
039	10/03/12	1,696,838.1	2,524,652.0	4147	126	0.96	0.16
040	10/03/12	1,696,837.1	2,524,730.0	4203	127	1.03	0.17
041	10/03/12	1,696,837.5	2,524,812.0	4424	130	1.32	0.17
042	10/03/12	1,696,837.0	2,524,891.4	4553	132	1.49	0.17
043	10/05/12	1,696,838.6	2,524,971.7	4614	133	1.57	0.17
044	10/05/12	1,696,835.0	2,525,049.7	4661	134	1.63	0.17
045	10/05/12	1,696,839.5	2,525,132.2	4452	131	1.36	0.17
046	10/03/12	1,696,906.9	2,524,931.1	4326	129	1.19	0.17
047	10/03/12	1,696,908.9	2,524,850.7	4240	128	1.08	0.17
048	10/03/12	1,696,907.3	2,524,770.0	4067	125	0.86	0.16
049	10/03/12	1,696,907.5	2,524,690.7	4159	126	0.98	0.16
050	10/03/12	1,696,907.7	2,524,611.6	4579	133	1.52	0.17
051	10/05/12	1,696,907.1	2,524,531.2	4386	130	1.27	0.17
052	10/05/12	1,696,909.5	2,524,451.5	4506	132	1.43	0.17
053	10/05/12	1,696,906.9	2,524,290.4	4210	127	1.04	0.17
054	10/03/12	1,696,976.0	2,524,409.9	4775	135	1.78	0.18
055	10/03/12	1,696,972.7	2,524,489.8	4394	130	1.28	0.17
056	10/03/12	1,696,977.1	2,524,569.9	4506	132	1.43	0.17
057	10/03/12	1,696,977.4	2,524,651.2	4330	129	1.20	0.17
058	10/03/12	1,696,975.4	2,524,731.9	4493	131	1.41	0.17
059	10/03/12	1,696,976.2	2,524,810.5	4588	133	1.53	0.17
060	10/03/12	1,696,976.4	2,524,890.7	4335	129	1.20	0.17
061	10/03/12	1,696,976.3	2,524,970.3	4080	125	0.87	0.16
062	10/03/12	1,696,975.5	2,525,050.8	4131	126	0.94	0.16
063	10/02/12	1,697,046.8	2,525,250.5	4766	135	1.77	0.18
064	10/03/12	1,697,046.1	2,525,171.2	5066	140	2.16	0.18
065	10/03/12	1,697,046.2	2,525,090.0	4604	133	1.55	0.17
066	10/03/12	1,697,044.9	2,525,011.2	4573	133	1.51	0.17
067	10/03/12	1,697,046.9	2,524,933.8	4999	139	2.07	0.18
068	10/03/12	1,697,045.6	2,524,851.5	4996	139	2.06	0.18
069	10/03/12	1,697,046.0	2,524,770.7	4607	133	1.56	0.17
070	10/03/12	1,697,045.3	2,524,690.9	4496	131	1.41	0.17
071	10/03/12	1,697,047.4	2,524,611.6	4939	138	1.99	0.18
072	10/03/12	1,697,046.2	2,524,530.3	4472	131	1.38	0.17

**Table 3: NECR EDRA Flat Area Interim Status Gamma Satic Survey Results Summary**

EDRA Static Survey Point ID	Survey Date	Point Coordinates (NAD83, State Plane, NM West, feet)		Gamma Radiation Level, 2x2 NaI Collimated detector SPA-3 #30 (EDRA Updated Correlation, pCi/g = 0.0013cpm-4.4308)			
		Northing	Easting	CPM	Uncertainty <sup>(1)</sup> CPM	Ra-226 (pCi/g)	Uncertainty (pCi/g)
073	10/03/12	1,697,046.4	2,524,450.4	4599	133	1.55	0.17
074	10/03/12	1,697,045.3	2,524,371.5	4773	135	1.77	0.18
075	10/03/12	1,697,046.3	2,524,289.1	4176	127	1.00	0.16
076	10/03/12	1,697,113.1	2,524,251.0	4370	130	1.25	0.17
077	10/03/12	1,697,114.5	2,524,326.9	4698	134	1.68	0.17
078	10/03/12	1,697,114.7	2,524,410.8	4708	134	1.69	0.17
079	10/03/12	1,697,114.6	2,524,490.5	4587	133	1.53	0.17
080	10/03/12	1,697,115.2	2,524,570.4	4528	132	1.46	0.17
081	10/03/12	1,697,113.6	2,524,650.3	5220	142	2.36	0.18
082	10/03/12	1,697,114.1	2,524,731.1	5463	145	2.67	0.19
083	10/03/12	1,697,114.7	2,524,809.4	5095	140	2.19	0.18
084	10/03/12	1,697,115.6	2,524,889.0	5419	144	2.61	0.19
085	10/03/12	1,697,114.3	2,524,971.0	5372	144	2.55	0.19
086	10/03/12	1,697,112.2	2,525,046.9	5095	140	2.19	0.18
087	10/03/12	1,697,114.8	2,525,131.0	5046	139	2.13	0.18
088	10/02/12	1,697,111.7	2,525,212.2	4982	138	2.05	0.18
089	10/02/12	1,697,184.1	2,525,169.5	4405	130	1.30	0.17
090	10/02/12	1,697,183.9	2,525,090.6	4408	130	1.30	0.17
091	10/02/12	1,697,183.5	2,525,011.5	5184	141	2.31	0.18
092	10/02/12	1,697,184.4	2,524,930.3	4840	136	1.86	0.18
093	10/02/12	1,697,183.9	2,524,850.7	4788	136	1.79	0.18
094	10/02/12	1,697,183.3	2,524,769.9	4755	135	1.75	0.18
095	10/02/12	1,697,184.1	2,524,690.6	5043	139	2.13	0.18
096	10/02/12	1,697,183.8	2,524,610.9	4581	133	1.52	0.17
097	10/02/12	1,697,183.9	2,524,530.5	4628	133	1.59	0.17
098	10/02/12	1,697,183.3	2,524,450.3	4646	134	1.61	0.17
099	10/02/12	1,697,183.9	2,524,370.8	4984	138	2.05	0.18
100	10/02/12	1,697,183.7	2,524,290.6	4618	133	1.57	0.17
101	10/02/12	1,697,183.2	2,524,211.2	5000	139	2.07	0.18
102	10/02/12	1,697,183.6	2,524,131.3	5190	141	2.32	0.18
103	10/02/12	1,697,254.7	2,524,090.4	4619	133	1.57	0.17
104	10/02/12	1,697,253.7	2,524,169.9	4403	130	1.29	0.17
105	10/02/12	1,697,253.9	2,524,251.1	4389	130	1.27	0.17
106	10/02/12	1,697,252.7	2,524,330.5	4438	131	1.34	0.17
107	10/02/12	1,697,253.5	2,524,411.2	4865	137	1.89	0.18
108	10/02/12	1,697,253.2	2,524,490.3	4666	134	1.64	0.17



**Table 3: NECR EDRA Flat Area Interim Status Gamma Satic Survey Results Summary**

EDRA Static Survey Point ID	Survey Date	Point Coordinates (NAD83, State Plane, NM West, feet)		Gamma Radiation Level, 2x2 NaI Collimated detector SPA-3 #30 (EDRA Updated Correlation, pCi/g = 0.0013cpm-4.4308)			
		Northing	Easting	CPM	Uncertainty <sup>(1)</sup> CPM	Ra-226 (pCi/g)	Uncertainty (pCi/g)
109	10/02/12	1,697,256.0	2,524,571.1	5175	141	2.30	0.18
110	10/02/12	1,697,254.8	2,524,650.7	5211	141	2.34	0.18
111	10/02/12	1,697,252.1	2,524,730.0	5016	139	2.09	0.18
112	10/02/12	1,697,254.8	2,524,812.2	5073	140	2.16	0.18
113	09/28/12	1,697,252.6	2,524,891.1	4655	134	1.62	0.17
114	09/28/12	1,697,253.9	2,524,971.5	4175	127	1.00	0.16
115	09/28/12	1,697,254.6	2,525,052.2	4809	136	1.82	0.18
116	10/02/12	1,697,247.8	2,525,136.6	5137	140	2.25	0.18
117	09/28/12	1,697,320.5	2,525,009.0	4960	138	2.02	0.18
118	09/28/12	1,697,322.6	2,524,931.6	4910	137	1.95	0.18
119	09/28/12	1,697,322.8	2,524,850.0	4640	134	1.60	0.17
120	09/28/12	1,697,323.9	2,524,770.9	4729	135	1.72	0.18
121	09/28/12	1,697,323.2	2,524,690.6	4386	130	1.27	0.17
122	09/28/12	1,697,323.5	2,524,610.8	4454	131	1.36	0.17
123	09/28/12	1,697,323.2	2,524,531.3	4302	129	1.16	0.17
124	09/28/12	1,697,323.5	2,524,451.3	4366	130	1.25	0.17
125	09/28/12	1,697,323.1	2,524,370.8	4136	126	0.95	0.16
126	09/28/12	1,697,324.0	2,524,291.3	4150	126	0.96	0.16
127	09/28/12	1,697,322.6	2,524,212.7	4659	134	1.63	0.17
128	09/28/12	1,697,324.8	2,524,130.5	4214	127	1.05	0.17
129	09/28/12	1,697,394.1	2,524,090.2	4482	131	1.40	0.17
130	09/28/12	1,697,391.1	2,524,170.9	4254	128	1.10	0.17
131	09/28/12	1,697,392.5	2,524,250.9	4410	130	1.30	0.17
132	09/28/12	1,697,392.9	2,524,330.8	4773	135	1.77	0.18
133	09/28/12	1,697,390.9	2,524,411.4	4841	136	1.86	0.18
134	09/28/12	1,697,392.3	2,524,491.4	4280	128	1.13	0.17
135	09/28/12	1,697,390.4	2,524,571.8	4261	128	1.11	0.17
136	09/28/12	1,697,388.7	2,524,651.9	4505	132	1.43	0.17
137	09/28/12	1,697,391.6	2,524,730.7	5060	139	2.15	0.18
138	09/28/12	1,697,391.7	2,524,810.9	4961	138	2.02	0.18
139	09/28/12	1,697,391.7	2,524,892.0	4890	137	1.93	0.18
140	09/28/12	1,697,461.4	2,524,847.6	4705	134	1.69	0.17
141	09/28/12	1,697,460.4	2,524,770.1	5059	139	2.15	0.18
142	10/02/12	1,697,460.5	2,524,691.2	5243	142	2.39	0.18
143	09/28/12	1,697,462.0	2,524,370.8	4964	138	2.02	0.18
144	09/28/12	1,697,461.7	2,524,291.5	4941	138	1.99	0.18

**Table 3: NECR EDRA Flat Area Interim Status Gamma Satic Survey Results Summary**

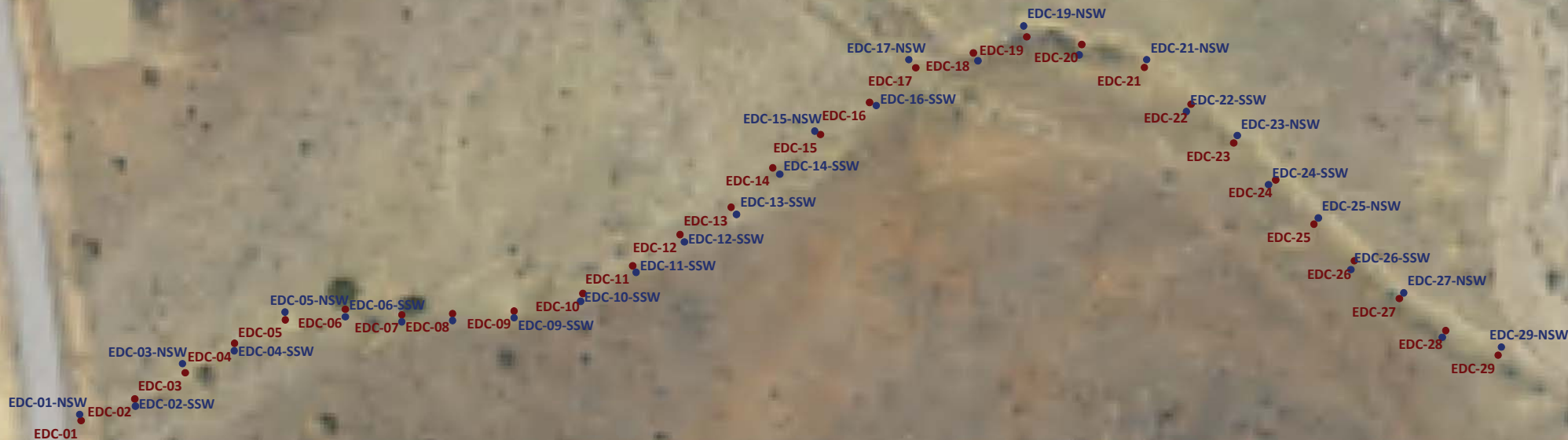
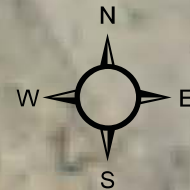
EDRA Static Survey Point ID	Survey Date	Point Coordinates (NAD83, State Plane, NM West, feet)		Gamma Radiation Level, 2x2 NaI Collimated detector SPA-3 #30 (EDRA Updated Correlation, pCi/g = 0.0013cpm-4.4308)			
		Northing	Easting	CPM	Uncertainty <sup>(1)</sup> CPM	Ra-226 (pCi/g)	Uncertainty (pCi/g)
145	09/28/12	1,697,463.9	2,524,210.6	4192	127	1.02	0.16
146	09/28/12	1,697,461.9	2,524,132.7	4376	130	1.26	0.17
147	10/02/12	1,697,529.5	2,524,088.6	4851	137	1.88	0.18
148	10/02/12	1,697,532.3	2,524,171.5	5151	141	2.27	0.18
149	10/02/12	1,697,530.4	2,524,251.2	5105	140	2.21	0.18
Z6-007	10/17/12	1,696,147.3	2,522,771.8	4757	135	1.75	0.18
Z6-008	10/17/12	1,696,143.6	2,522,852.4	4620	133	1.58	0.17
Z6-009	10/17/12	1,696,144.4	2,522,929.0	5503	145	2.72	0.19
Z6-010	10/17/12	1,696,143.8	2,523,012.3	5002	139	2.07	0.18
Z6-029	10/17/12	1,696,214.0	2,522,810.4	4758	135	1.75	0.18
Z6-030	10/17/12	1,696,213.1	2,522,892.0	4557	132	1.49	0.17
Z6-051	10/17/12	1,696,284.4	2,522,850.2	5104	140	2.20	0.18
Z6-072	10/18/12	1,696,352.7	2,522,814.3	5170	141	2.29	0.18
Z6-094	10/18/12	1,696,423.2	2,522,854.6	5062	139	2.15	0.18
Z6-114	10/18/12	1,696,474.3	2,522,891.4	5066	140	2.16	0.18

Note: (1) 95% CL uncertainty calculated for a single measurement as  $1.96\sigma$ , where  $\sigma$ , standard deviatio, is  $\sqrt{V}$  of the measurement (CPM)

**Mean**                **1.61**  
**Std Dev**            **0.48**  
**Max**                 **2.72**  
**Min**                 **0.35**  
**Median**            **1.58**

## **FIGURES**

**Figure 1**  
**Eastern Drainage Channel Field Soil Screening**  
**Sample Locations and Results**



**Note: Field Radation Soil Screening results <RAL at all locations**

**Legend**

- East Drainage Channel Bed Sample Location
- East Drainage Channel Sidewall Sample Location

**Figure 2**  
**EDRA Flat Area Interim Status Gamma**  
**Static Survey Points and Soil Sample Locations**

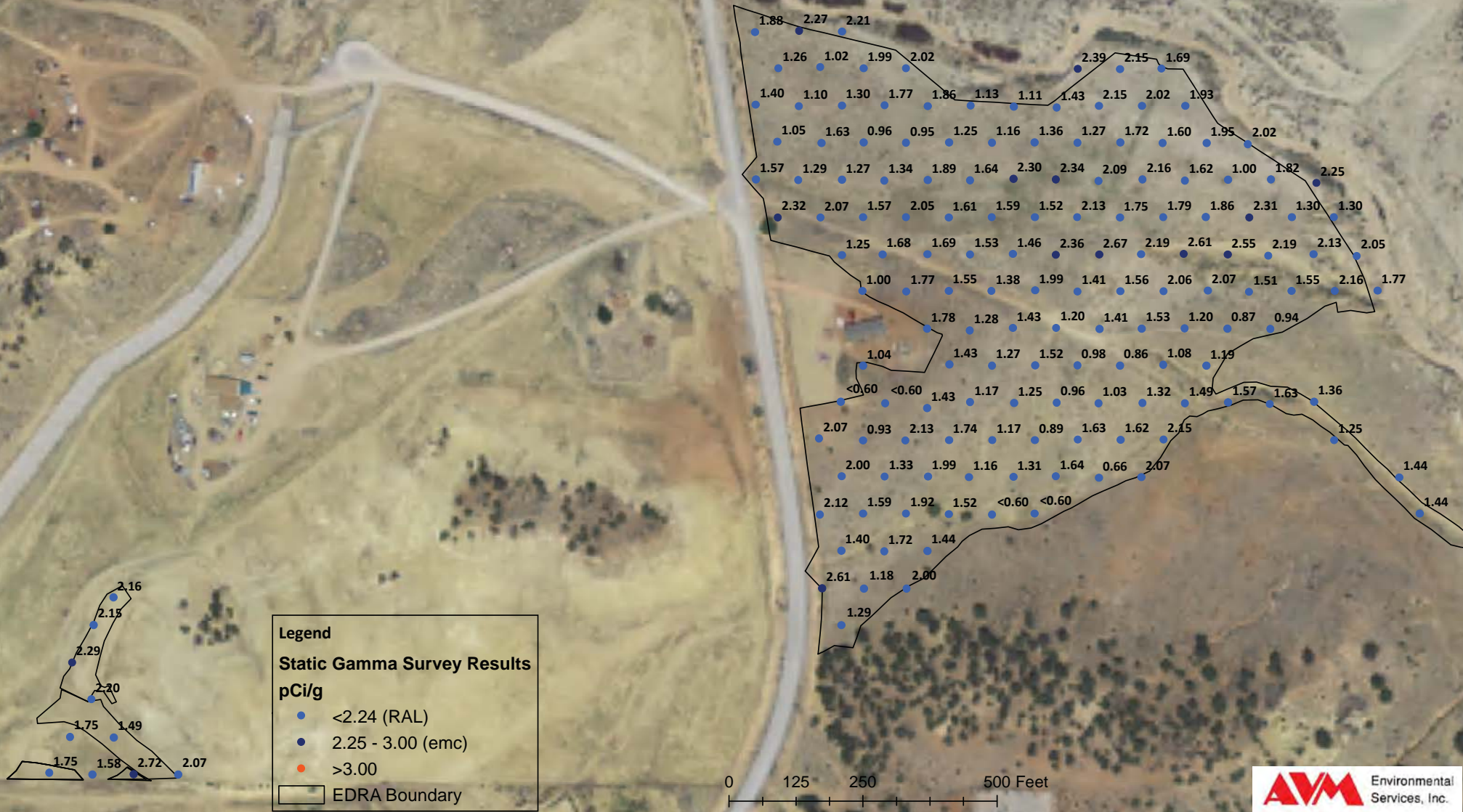


**Legend**

- Gamma Survey and Soil Sample Location
- Gamma Survey Locations
- EDRA Boundary

0 125 250 500 Feet

**Figure 3**  
**EDRA Flat Area Interim Status Survey Results Summary**



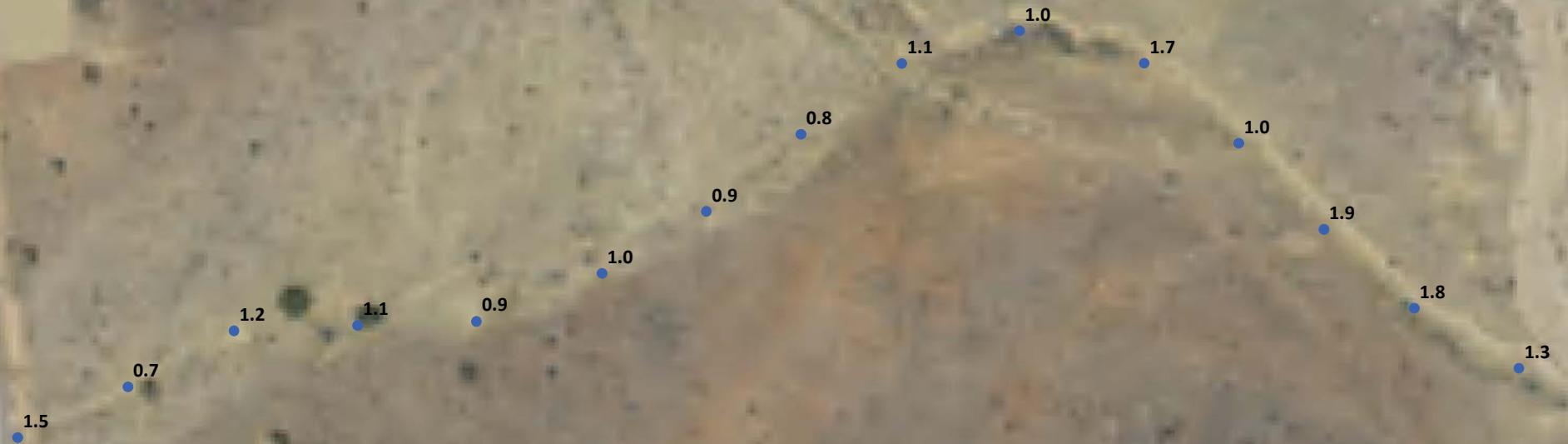
**Legend**

**Static Gamma Survey Results**  
**pCi/g**

- <2.24 (RAL)
- 2.25 - 3.00 (emc)
- >3.00
- EDRA Boundary

0 125 250 500 Feet

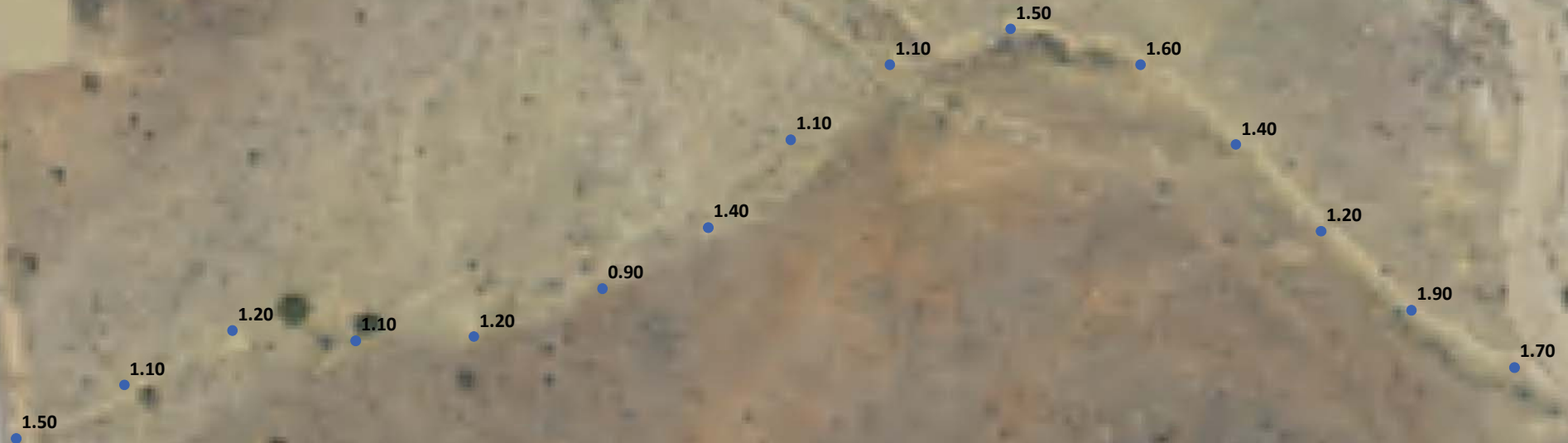
**Figure 4**  
**Eastern Drainage Channel Bed Final Status Survey Soil Sample Results**



**Legend**  
ED Channel Bed Sample  
Ra-226 pCi/g

- <2.24
- 2.25 - 3.00
- >3.00

Figure 5  
Eastern Drainage Channel Sidewall Final Status Survey Soil Sample Results



**Legend**  
ED Channel Sidewall Sample  
Ra-226 pCi/g

- <2.24
- 2.25 - 3.00
- >3.00



## **APPENDICES**

## **Appendix A**

### **Instrumentation Calibration and Function Checks**

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

Scaler/Ratemeter Ludlum 2221 #68782  
 Detector SPA-3 s# 408522-30

Source: U308 Ore in Can Strength: 1%

Scaler/Ratemeter Threshold set @ 10.0 mV, Window IN/OUT out, Window N/A mV

HV	Reading, CPM (Source)	Reading, CPM (Background)
500	<u>10235</u>	<u>351</u>
550	<u>26851</u>	<u>783</u>
600	<u>46821</u>	<u>1207</u>
650	<u>61797</u>	<u>1820</u>
700	<u>77939</u>	<u>2462</u>
750	<u>90434</u>	<u>2970</u>
800	<u>92553</u>	<u>3129</u>
850	<u>94061</u>	<u>3198</u>
900	<u>94078</u>	<u>3255</u>
950	<u>94821</u>	<u>3273</u>
1000	<u>95189</u>	<u>3301</u>
1050	<u>99066</u>	<u>3309</u>
1100	<u>107690</u>	<u>3370</u>
1150	<u>123655</u>	<u>3762</u>
1200	<u>163609</u>	<u>5494</u>
1250		<u>7399</u>
1300		
1350		
1400		

Background reading at designated function check location in office.

Count #	Bare Coll.	
	Reading (CPM)	
1	<u>7901</u>	<u>2882</u>
2	<u>7709</u>	<u>2865</u>
3	<u>7886</u>	<u>2965</u>
4	<u>7837</u>	<u>2856</u>
5	<u>7795</u>	<u>2904</u>
Average	<u>7826</u>	<u>2894</u>

FC Range 6260-9390 2315-3470  
 Count Readings with 1 percent U<sub>3</sub>O<sub>8</sub> can directly under collimated detector on designated function check location in office.

Count #	Reading (CPM)
1	<u>94670</u>
2	<u>94338</u>
3	<u>95110</u>
4	<u>94441</u>
5	<u>94248</u>
Average	<u>94561</u>

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

Input Sensitivity (THR), mV 100

Function Check with 1 percent U<sub>3</sub>O<sub>8</sub> ore in can. Can Directly under the detector.  
 Acceptable Function check range is: 75,650 to 113,470 CPM

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

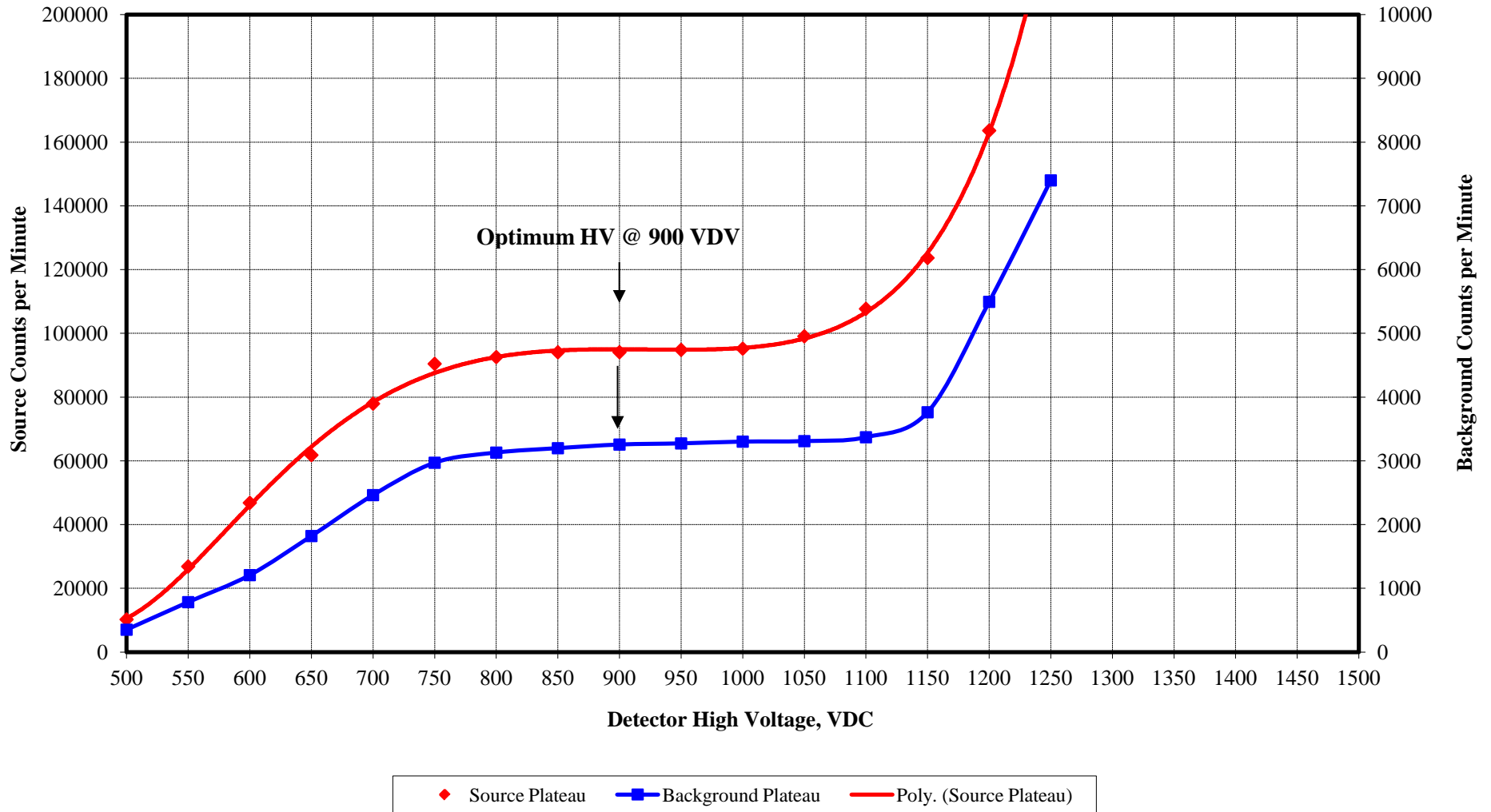
Bare (Uncollimated)		Collimated	
#1	<u>84754</u> cpm	#1	<u>48794</u> cpm
#2	<u>84562</u> cpm	#2	<u>49121</u> cpm
#3	<u>85362</u> cpm	#3	<u>48831</u> cpm
#4	<u>85102</u> cpm	#4	<u>49234</u> cpm
#5	<u>84962</u> cpm	#5	<u>49420</u> cpm
Average	<u>84948</u> cpm	Average	<u>49080</u> cpm
Eff (avg cpm/87.78 pCi/gm)	<u>967.8</u> cpm/pCi/gm	Eff	<u>559.1</u> cpm/pCi/gm

uR/hr @ 1.0'  
109  
Ludlum 19# 76248  
0.001283 uR/hr/cpm

Date 4-16-12

By [Signature]  
[Signature]

**Detector High Voltage Plateau**  
**SPA-3 #408522-30 with Ludlum 2221 #68782**  
**1% Uranium Ore in Sealed Can**  
**April 12, 2012**



## MDC Calculation

Detector: SPA-3, SR #408522-30 (2X2" NaI Scintillator), with Ludlum 2221, 04-16-2012

Unshielded 2x2 NaI Detector Background counts (cpm) = <b>7826</b>	Bare Detector efficiency (cpm/pCi/gm) for Ra-226 ( DOE Cal Pad GPL at Grants Site, 87.78 pCi/gm) = <b>967</b>
Shielded 2x2 NaI Detector Background counts (cpm) = <b>2894</b>	Collimated Detector efficiency (cpm/pCi/gm) for Ra-226 ( DOE Cal Pad GPL at Grants Site, 87.78 pCi/gm) = <b>559</b>

### 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	$L_D =$	414 cpm	MDC (LD/Eff)= <b>0.43 pCi/gm</b>
Collimated 2x2 NaI Detector	$L_D =$	253 cpm	MDC (LD/Eff)= <b>0.45 pCi/gm</b>

### 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 <sub>i</sub> is number background counts in the interval			
i is interval			
if b is in cpm, then b <sub>i</sub> 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=3, for 2 fps t=1.5, for 3 fps t=1			
<span style="border: 1px solid black; padding: 2px;"><b>scan rate</b></span> <b>3.0 ft/sec</b>			
Unshielded 2x2 NaI Detector	Background counts= 7826 cpm	b <sub>i</sub> = 130.4 counts	d' = <b>1.38</b> MDCR = 946 cpm
Shielded 2x2 NaI Detector	Background counts= 2894 cpm	b <sub>i</sub> = 48.2 counts	d' = <b>1.38</b> MDCR = 575 cpm
$MDCR_{surveyor} = MDCR / (p^{0.5})$ where p is a surveyor efficiency			
surveyor efficiency (p) unshielded	(active D) detector = 36	p = <b>0.5</b>	MDCR <sub>surveyor</sub> = 1337 cpm
surveyor efficiency (p) shielded	detector = 36	p = <b>0.5</b>	MDCR <sub>surveyor</sub> = 813 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=	<b>967</b> cpm/pCi/gm	Scan MDC =	<b>1.38 pCi/gm</b>
Collimated detector efficiency=	<b>559</b> cpm/pCi/gm	Scan MDC =	<b>1.45 pCi/gm</b>

**AVM Environmental Services Inc.**

**Scaler/Ratemeter Calibration Form**

Model : L2221

S/N: 68782

Reference Instrument/Source: Ludlum Pulser 500, S/N:114513

**HV Calibration**

HV Readout (2 points): Ref/Inst 600 / 602

Ref/Inst 1400 / 1403

**Ratemeter Calibration**

Instrument Threshold @ 100 (10 mV), WIN: Out, HV 900VDC; Pulser Threshold @ 200 (20mV)

Range/Mode	Calibration Point (Pulser Setting) cpm x multiplier	Target Cpm (± 5%)	As Found Reading	Left or Set Reading
Rate meter	40x1	38-42	40	40
	40x10	380-420	400	400
	40x100	3800-4200	4000	4000
	40x1k	38k-42k	40000	40000
	40x10k	380k-420k	400000	400000
Digital Ratemeter	40x1	38-42	40	40
	40x10	380-420	400	400
	40x100	3800-4200	3997	3997
	40x1k	38k-42k	39992	39992
	40x10k	380k-420k	399890	399890

**Threshold/Gain Calibration**

WIN OUT

Pulser Amplitude (mV)	Pulser CPM	L2221 Theshold (mv)	Target CPM	L2221 CPM Found	L2221 CPM Left or Set @
10.0	40000	100 (10 mV)	27K-33K	36750	30100
20.0	40000	200 (20 mV)	27K-33K	30900	30900
30.0	40000	300 (30 mV)	27K-33K	30850	30850
40.0	40000	400 (40 mV)	27K-33K	31200	31200
50.0	40000	500 (50 mV)	27K-33K	32000	32000

Note: Use R174 Gain Control on Power Supply Board to adjust L2221 CPM @75% for Threshold/Gain Calibration

**Window Cut-off Points Check**

L2221 Threshold set @100 (10.0 mv)

WIN @ 100 (10.0 mV)

✓

WIN @ 400 (10.0 mV)

✓

WIN @ 200 (20.0 mV)

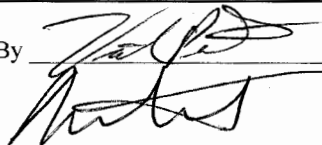
✓

WIN @ 500 (10.0 mV)

✓

Date 4-12-2012

Calibrated By





CERTIFICATE OF CALIBRATION

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

Model No. / Serial No. 500 / 114513

CUSTOMER AVM ENVIRONMENTAL SERVICES CUSTOMER PO 20120326A ORDER NO. 20197075/375510

Date 4-Apr-12 Cal Due Date 4-Apr-13 Cal. Interval 1 Year Procedure M500, Rev. 5

New Instrument Instrument Received [X] Within Tolerance Out of Tol. Requiring Repair Other-See Comments

T. 75 °F RH 24 % Alt 697.8 mm Hg Meter Zeroed [X] Mechanical Check

PULSE WIDTH table with columns: As Found, As Left, Acceptable Range (µs) ± 10%. Rows: NEG PULSE, POS PULSE.

PULSE AMPLITUDE table with columns: Reference Amplitude, As Found Amplitude Reading, As Left Amplitude Reading, Acceptable Range ± 10%. Rows: 1V, 100mV, 10mV, 1mV, 4V, 400mV, 40mV, 4mV.

PULSE FREQUENCY (PERIOD) table with columns: Reference Amplitude, As Found Amplitude Reading, As Left Amplitude Reading, Acceptable Range ± 10%. Rows: x 10K, x 1K, x 100, x 10, x 1, x 0.1.

Reference Voltage table with columns: Reference Voltage, As Found Voltage Reading, As Left Voltage Reading, Acceptable Range ± 5%. Rows: 500V, 2000V.

CPM Reading table with columns: CPM Reading, As Found cpm Reading, As Left cpm Reading, Acceptable Range ± 10%. Rows: MAX, MIN.

\* READING OF 0.99 IS ACCEPTABLE FOR INSTRUMENTS WITH A S/N 100000 AND BELOW AND MAIN BOARD = 5208-066

COMMENTS:

CAL'D W/ 39" CABLE.

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978.

Reference Instruments:

Frequency Counter Model 1856 D S/N 1856412450660063 Cal Date 18-Jan-12
Oscilloscope Model V 1560 S/N 9084101 Cal Date 18-Jan-12
Voltmeter Model Fluke 83 V S/N 94000441 Cal Date 10-Jan-12

Calibrated By: William Tinsley

Date 4-April-2012

Reviewed By: [Signature]

Date 5 APR 12

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



Designer and Manufacturer  
of  
Scientific and Industrial  
Instruments

# CERTIFICATE OF CALIBRATION

**LUDLUM 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. 20205140

Model Ludlum Measurements, Inc. Model 2241-2 Serial No. 2870 29

Model NA Model NA Serial No. NA

Cal. Date 22-Aug-12 Cal Due Date 22-Aug-13 Cal. Interval 1 Year Meterface digital

check mark  applies to applicable instr. and/or detector IAW mfg. spec. T. 74 °F RH 40 % Alt 703.8 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

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 Comments V Input Sens. Comment mV Det. Oper. NA V at NA mV Threshold Dial Ratio NA = NA mV

**COMMENTS:**

	Det.1 (cpm)	Det.2 (R/hr)
Deadtime Correction:	0µSec	0µSec
Calibration Constant:	100e-2	100e+9
Rateometer Alert:	50.0kcpm	50µR/hr
Rateometer Alarm:	20.0kcpm	20µR/hr
High Voltage:	900v	900v
Millivoltage:	35mv	35mv

Overload checked but not set.

FIRMWARE#: P-09-10

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*
Dig.rate	NA	NA	NA
Dig.rate			
NA			

\*Uncertainty within ± 10% C.F. within ± 20% Range(s) Calibrated Electronically

REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
800K cpm	NA	799 Kc/m	800K cpm	NA	79904 (0)
200K cpm		199 Kc/m	200K cpm		19990 (0)
80K cpm		79.9 Kc/m	80K cpm		7990 (0)
20K cpm		19.9 Kc/m	20K cpm		1999 (0)
8K cpm		7.99 Kc/m	8K cpm		800 (0)
2K cpm		1.99 Kc/m	2K cpm		200 (0)
800 cpm		799 c/m	800 cpm		80 (0)
200 cpm		199 c/m	200 cpm		20 (0)

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  Ra-226 S/N Y982  
 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 \_\_\_\_\_

500 S/N 38120  Oscilloscope S/N \_\_\_\_\_  Multimeter S/N 84260131

Calibrated By: Laura Otey Date 22-Aug-12

Reviewed By: Diana DeHone Date 22 Aug 12



Scaler/Ratemeter - 2" x 2" NaI Detector Function Check

~~San Mateo Uranium Mine Site~~  
AVM Environmental Services, NEA EDPA

Scaler/Ratemeter ID: Ludlum 2221 S# 68782

Function Check Source ID: 1% U<sub>3</sub>O<sub>8</sub> Ore in Sealed can 2315 Col. 3470 Col.

2" x 2" Detector ID: SPA-3 S# 408522-30

Acceptable background Count (cpm) Range (20%) 6260 Bare to 9390 Bare

Acceptable Source Count (cpm) Range (20%) 75650 to 113470

Date	Physical Check	Cal Due	Battery <sup>(1)</sup> Volts or OK	HV Volts	Threshold mV <sup>(2)</sup>	Window In or OUT <sup>(3)</sup>	C.C. <sup>(4)</sup>	BKG Counts cpm	Source Counts cpm	Within Acceptable Range Y or N	MDC pCi/gm	Tech
7-24-12	OK	4-12-13	5.9	900	100	out	N/A	7654B 2818C	96011	Y	<5	VP
7-30-12	OK	4-12-13	5.7	900	100	out	N/A	2677 Ed. 8052 Bare	94775	Y	<5	MJ
7-31-12	OK	4-12-13	5.7	900	100	out	N/A	83620 B 2980 C	95662	Y	<5	VP
8-1-12	OK	4-12-13	5.7	900	100	out	N/A	8420 B 2986 C	97426	Y	<5	VP
8-2-12	OK	4-12-13	5.6	900	100	out	N/A	2478 B 3082 C	94563	Y	<5	VP
8-6-12	OK	4-12-13	5.6	900	100	out	N/A	8330 B 2922 C	96784	Y	<5	VP
8-15-12	OK	4-12-13	6.2	900	100	out	N/A	8310 B 3046 C	95433	Y	<5	VP
8-16-12	OK	4-12-13	6.2	900	100	out	N/A	7673 B 2635 C	94054	Y	<5	M.J.
8-17-12	OK	4-12-13	6.1	900	100	out	N/A	7630 B 2651 C	94197	Y	<5	VP
8-20-12	OK	4-12-13	6.0	900	100	out	N/A	8062 B 2798 C	93977	Y	<5	VP
8-21-12	OK	4-12-13	5.9	900	100	out	N/A	7681 B 2658 C	94356	Y	<5	T.G.
8-22-12	OK	4-12-13	5.8	900	100	out	N/A	7576 B 2756 C	94051	Y	<5	T.G.
8-23-12	OK	4-12-13	5.8	900	100	out	N/A	7852 B 2791 C	93727	Y	<5	T.G.
8-24-12	OK	4-12-13	5.8	900	100	out	N/A	7616 B 2699 C	93416	Y	<5	T.G.
8-27-12	OK	4-12-13	5.7	900	100	out	N/A	8100 B 2835 C	93669	Y	<5	T.G.
8-28-12	OK	4-12-13	5.7	900	100	out	N/A	8053 B 2818 C	92863	Y	<5	T.G.
8-29-12	OK	4-12-13	5.7	900	100	out	N/A	8316 B 2901 C	93353	Y	<5	T.G.
8-30-12	OK	4-12-13	5.7	900	100	out	N/A	8341 B 2912 C	94525	Y	<5	T.G.

Note: (1) Battery Voltage for Ludlum 2221 must be >5.3 volts; (2) Threshold must be at 100 mV; (3) Window Position must be OUT; (4)

### Scaler/Ratemeter - 2" x 2" NaI Detector Function Check

~~San Mateo Uranium Mine Site~~  
AVM Environmental Services, NEEL GORDA

Scaler/Ratemeter ID: Ludlum 2221 S# 68782

Function Check Source ID: 1% U<sub>3</sub>O<sub>8</sub> Ore in Sealed can 2315 c 3470 c

2" x 2" Detector ID: SPA-3 S# 408522-30

Acceptable background Count (cpm) Range (20%) 6260 B to 9390 B

Acceptable Source Count (cpm) Range (20%) 75650 to 113470

Date	Physical Check	Cal Due	Battery <sup>(1)</sup> Volts or OK	HV Volts	Threshold mV <sup>(2)</sup>	Window In or OUT <sup>(3)</sup>	C.C. <sup>(4)</sup>	BKG Counts cpm	Source Counts cpm	Within Acceptable Range Y or N	MDC pCi/gm	Tech
8-31-12	OK	4-12-13	5.7	900	100	out	N/A	8300 B 2985 c	93440	Y	<5	T.G.
9-4-12	OK	4-12-13	5.6	900	100	out	N/A	7706 B 2814 c	95535	Y	<5	T.S.
9-5-12	OK	4-12-13	5.6	900	100	out	N/A	7701 B 2688 c	94285	Y	<5	T.S.
9-6-12	OK	4-12-13	5.6	900	100	out	N/A	8165 B 2603 c	94621	Y	<5	T.S.
9-7-12	OK	4-12-13	5.6	900	100	out	N/A	8887 B 2792 c	94206	Y	<5	T.S.

Note: (1) Battery Voltage for Ludlum 2221 must be >5.3 volts; (2) Threshold must be at 100 mV; (3) Window Position must be OUT; (4)

**AVM Environmental Services, Inc.**  
**Scaler/Ratemeter - 2" x 2" NaI Detector Function Check**

Function Check Source ID: 1% U<sub>3</sub>O<sub>8</sub> Ore in Sealed can

Acceptable background Count (cpm) Range (20%) 6260 to 9390 (Bare)

2" x 2" NaI Detector ID: SPA-3, # 408522-30

Acceptable background Count (cpm) Range (20%) 2315 to 3470 (collimated)

Acceptable Source Count (cpm) Range (20%) 75650 to 113470

Date	Scaler/Ratemeter	Physical Check	Cal Due	Battery <sup>(1)</sup> Volts or OK	HV Volts	THR mV <sup>(2)</sup>	Window In or OUT <sup>(3)</sup>	C.C. <sup>(4)</sup>	BKG Counts cpm	Source Counts cpm	Within Acceptable Range Y or N	MDC pCi/gm	Tech
9-10-12	L2241-2 #287029	✓	4-12-13	OK	900	10.0	—	0.001	7681 B 2642 C	94110	Y	2.5	NP
9-13-12	"	✓	"	OK	900	10.0	—	"	7851 B 2711 C	95225	Y	2.5	NP
9-14-12	"	✓	"	OK	900	10.0	—	"	7912 B 2808 C	93942	Y	2.5	NP
9-17-12	"	✓	"	OK	900	10.0	—	"	7808 B 2648 C	94051	Y	2.5	NP
9-18-12	"	✓	"	OK	900	10.0	—	"	7754 B 2774 C	92985	Y	2.5	NP
9-19-12	"	✓	"	OK	900	10.0	—	"	7816 B 2666 C	93664	Y	2.5	NP
9-20-12	"	✓	"	OK	900	10.0	—	"	7638 B 2709 C	94108	Y	2.5	NP
9-24-12	"	✓	"	OK	900	10.0	—	"	7846 B 2712 C	93885	Y	2.5	NP
9-25-12	"	✓	"	OK	900	10.0	—	"	7788 B 2816 C	93096	Y	2.5	NP
9-26-12	"	✓	"	OK	900	10.0	—	"	7879 B 2799 C	94308	Y	2.5	NP
9-27-12	"	✓	"	OK	900	10.0	—	"	7800 B 2750 C	93124	Y	2.5	NP
9-28-12	"	✓	"	OK	900	10.0	—	"	80.8 B 2856 C	96676	Y	2.5	NP
10-1-12	"	✓	"	OK	900	10.0	—	"	8182 B 2745 C	98214	Y	2.5	NP
10-2-12	"	✓	"	OK	900	10.0	—	"	8233 B 2620 C	97815	Y	2.5	NP
10-3-12	"	✓	"	OK	900	10.0	—	"	8211 B 2618 C	97894	Y	2.5	NP
10-4-12	"	✓	"	OK	900	10.0	—	"	8149 B 2586 C	97892	Y	2.5	NP
10-5-12	"	✓	"	OK	900	10.0	—	"	7915 B 2647 C	97692	Y	2.5	NP
10-8-12	"	✓	"	OK	900	10.0	—	"	7831 B 2796 C	94741	Y	2.5	NP

Note: (1) Battery Voltage for Ludlum 2221 must be >5.3 volts; (2) Threshold must be at 10.0 mV; (3) Window Position must be OUT; (4) CC on L2241-2 set at 0.001  
 Check HV and Threshold using Ludlum 500 pulser. For L2241-2

**AVM Environmental Services, Inc.**  
**Scaler/Ratemeter - 2" x 2" NaI Detector Function Check**

Function Check Source ID: 1% U<sub>3</sub>O<sub>8</sub> Ore in Sealed can

Acceptable background Count (cpm) Range (20%) 6260 to 9390 (Bare)

2" x 2" NaI Detector ID: SPA-3, 5# 408522-30

Acceptable background Count (cpm) Range (20%) 2315 to 3470 (collimated)

Acceptable Source Count (cpm) Range (20%) 75650 to 113470

Date	Scaler/Ratemeter	Physical Check	Cal Due	Battery <sup>(1)</sup> Volts or OK	HV Volts	THR mV <sup>(2)</sup>	Window In or OUT <sup>(3)</sup>	C.C. <sup>(4)</sup>	BKG Counts cpm	Source Counts cpm	Within Acceptable Range Y or N	MDC pCi/gm	Tech
10-9-12	L2241-2 #287029	OK	4-12-13	OK	900	10.0	-	0.001	8238B 2594C	97705	Y	<5	TQ.
10-10-12	"	OK	4-12-13	OK	900	10.0	-	0.001	8250B 2703C	97711	Y	<5	TQ.
10-11-12	"	OK	4-12-13	OK	900	10.0	-	0.001	8256B 2543C	97933	Y	<5	TQ.
10-12-12	"	OK	4-12-13	OK	900	10.0	-	0.001	8254B 2581C	98616	Y	<5	TQ.
10-15-12	"	DK	4-12-13	OK	900	10.0	-	0.001	8152B 2593C	97809	Y	<5	TQ.
10-16-12	"	OK	4-12-13	OK	900	10.0	-	0.001	8176B 2625C	97310	Y	<5	TQ.
10-17-12	"	OK	4-12-13	OK	900	10.0	-	0.001	8107B 2704C	97874	Y	<5	TQ.
10-18-12	"	OK	4-12-13	OK	900	10.0	-	0.001	8044B 2658C	98165	Y	<5	TQ.
10-22-12	"	OK	4-12-13	OK	900	10.0	-	0.001	8225B 2613C	97691	Y	<5	TQ.
10-23-12	"	OK	4-12-13	OK	900	10.0	-	0.001	7630B 2744C	96984	Y	<5	TQ.
10-24-12	"	OK	4-12-13	OK	900	10.0	-	0.001	8420B 2933C	96785	Y	<5	TQ.
10-25-12	"	OK	4-12-13	OK	900	10.0	-	0.001	8316B 2816C	97094	Y	<5	TQ.
10-26-12	"	DK	4-12-13	OK	900	16.0	-	0.001	2545C 7647B	97064	Y	<5	TQ.
10-29-12	"	OK	4-12-13	OK	900	10.0	-	0.001	3624C 7730B	97268	Y	<5	TQ.
10-30-12	"	OK	4-12-13	OK	900	10.0	-	0.001	2563C 7765B	97880	Y	<5	TQ.
11-2-12	"	OK	4-12-13	OK	900	10.0	-	0.001	2664C 7750B	97246	Y	<5	TQ.
11-3-12	"	OK	4-12-13	OK	900	10.0	-	0.001	2534C 7841B	97358	Y	<5	TQ.
11-5-12	"	OK	4-12-13	OK	900	10.0	-	0.001	2677C 7896B	97687	Y	<5	TQ.

Note: (1) Battery Voltage for Ludlum 2221 must be >5.3 volts; (2) Threshold must be at 10.0 mV; (3) Window Position must be OUT; (4) CC on L2241-2 set at 0.001  
 Check HV and Threshold using Ludlum 500 pulser.



# CERTIFICATE OF CALIBRATION

CUSTOMER UNC MINING & MILLING ORDER NO. 20199489/377877

Mfg. Ludlum Measurements, Inc. Model 2221 Serial No. 254769

Mfg. Ludlum Measurements, Inc. Model 44-10 Serial No. PR276626

Cal. Date 10-May-12 Cal Due Date 10-May-13 Cal. Interval 1 Year Meterface 202-159

Check mark  applies to applicable instr. and/or detector IAW mfg. spec. T. 72 °F RH 34 % Alt 694.8 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 Comments V Input Sens. Comment mV Det. Oper. Comments V at Comment mV Threshold 100 = 10 mV  
Dial Ratio

HV Readout (2 points) Ref./Inst. 500 / 500 V Ref./Inst. 2000 / 2002 V

## COMMENTS:

Peak settings	Gross Counts	Model 2221 currently set
High Voltage: 674V	1050V	for Gross Counts.
Threshold dial: 642	100(10mv)	High voltage set with detector
Window dial: 40	n/a	connected.
Window Position: "IN"	"OUT"	
Resolution for Cs137: ≈ 8.30%	n/a	Firmware:261010

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*
x1K	400kcpm	400	400
x1K	100kcpm	100	100
x100	40kcpm	400	400
x100	10kcpm	100	100
x10	4kcpm	400	400
x10	1kcpm	100	100
x1	400cpm	400	400
x1	100cpm	100	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*
Digital Readout 400kcpm	39986(0)	39986(0)		500kcpm	500kcpm	500kcpm
40kcpm	3998	3998		50kcpm	50	50
4kcpm	400	400		5kcpm	5	5
400cpm	40	40		500cpm	500cpm	500cpm
40cpm	4	4		50cpm	50	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  Ra-226 S/N Y982

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 190566  Oscilloscope S/N  Multimeter S/N 86250390

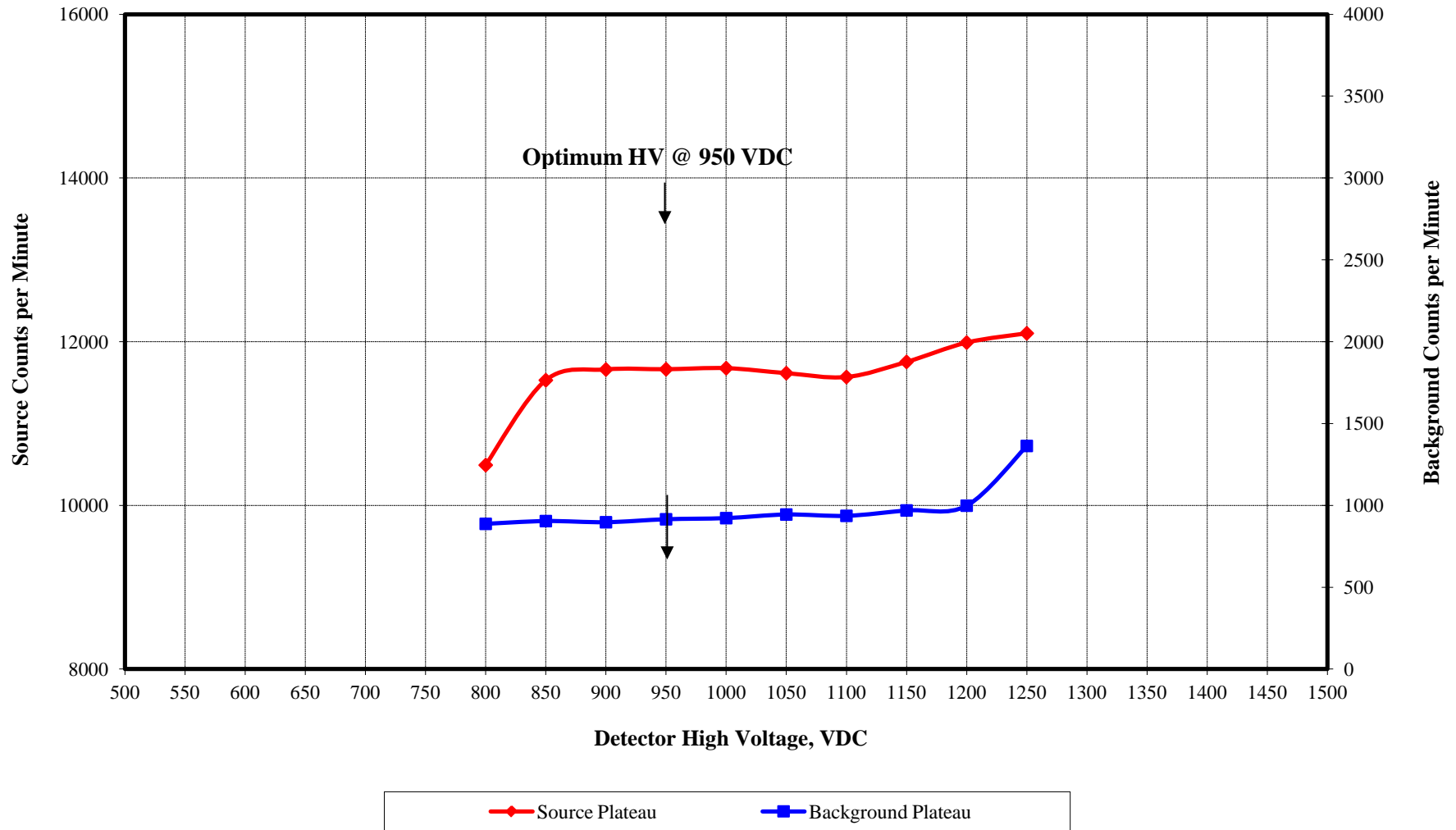
Calibrated By: [Signature] Date 10-MAY-12

Reviewed By: [Signature] Date 11 May 12

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



**Detector High Voltage Plateau**  
**L44-10 #PR276626 with Ludlum 2221 #254769 Am241 (0.79uCi)**  
**May 10, 2012**



**Scaler/Ratemeter - 2" x 2" NaI Detector Function Check  
UNC's NECR Mine Site**

Scaler/Ratemeter ID: Ludlum 2221 S/N 254769

Function Check Source ID: Cs-137 S/N 1524=1.55 uCi

2" x 2" Detector ID: Ludlum 44-10 S/N PR276626

Acceptable background Count (cpm) Range (20%) 5831 to 8747 (Bare)  
2050 to 3074 (collimated)  
 Acceptable Source Count (cpm) Range (20%) 57149 to 85723 (collimated)

Date	Physical Check	Cal Due	Battery <sup>(1)</sup> Volts or OK	HV Volts	Threshold mV <sup>(2)</sup>	Window In or OUT <sup>(3)</sup>	C.C. <sup>(4)</sup>	BKG Counts cpm	Source Counts cpm	Within Acceptable Range Y or N	MDC pCi/gm	Tech
8-23-12	OK	5-10-2013	6.1	950	100	OUT	NA	7289 (Bare) 2562 (Col.)	71436 (Col.)	Y		MC
8-30-12	OK	5-10-2013	6.1	950	100	OUT	NA	2373 (Col.)	71556 (Col.)	Y		MC
9-7-12	OK	5-10-2013	6.0	949	100	OUT	NA	2486 (Col.)	71088 (Col.)	Y		MC
9-10-12	OK	5-10-2013	6.0	949	100	OUT	NA	2345 (Col.)	70416 (Col.)	Y		MC
9-11-12	OK	5-10-2013	6.0	950	100	OUT	NA	2292 (Col.)	70899 (Col.)	Y		MC
9-12-12	OK	5-10-2013	5.9	950	100	OUT	NA	2346 (Col.)	70760 (Col.)	Y		MC
9-13-12	OK	5-10-2013	5.9	950	100	OUT	NA	2365 (Col.)	71379 (Col.)	Y		MC
9-14-12	OK	5-10-2013	5.9	950	100	OUT	NA	2272 (Col.)	70856 (Col.)	Y		MC
9-18-12	OK	5-10-2013	5.8	950	100	OUT	NA	2294 (Col.)	71324 (Col.)	Y		MC
9-21-12	OK	5-10-2013	5.9	949	100	OUT	NA	2401 (Col.)	71210 (Col.)	Y		MC
9-24-12	OK	5-10-2013	5.9	949	100	OUT	NA	2478 (Col.)	71091 (Col.)	Y		MC
9-25-12	OK	5-10-2013	5.8	949	100	OUT	NA	2462 (Col.)	71410 (Col.)	Y		MC
9-26-12	OK	5-10-2013	5.8	949	100	OUT	NA	2486 (Col.)	71142 (Col.)	Y		MC
9-27-12	OK	5-10-2013	5.8	950	100	OUT	NA	2500 (Col.)	70909 (Col.)	Y		MC
9-28-12	OK	5-10-2013	5.8	950	100	OUT	NA	2424 (Col.)	71016 (Col.)	Y		MC
10-1-12	OK	5-10-2013	5.8	950	100	OUT	NA	2505 (Col.)	71203 (Col.)	Y		MC
10-2-12	OK	5-10-2013	5.8	950	100	OUT	NA	2444 (Col.)	71427 (Col.)	Y		MC
10-3-12	OK	5-10-2013	5.8	950	100	OUT	NA	2416 (Col.)	71140 (Col.)	Y		MC

Note: (1) Battery Voltage for Ludlum 2221 must be >5.3 volts; (2) Threshold must be at 100 mV; (3) Window Position must be OUT; (4) C.C. for Eberline ESP scaler must be 1.0+00



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

SCA: L2221, SR #68782

Detector: Ludlum 44-20 (3x3 NaI Scintillator) # 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 632

Maximum CPM: 125K Background CPM: 23

HV Set @ 632 VDC

For Bi-214 609.2 KeV Peak (559 - 659 KeV ROI), Set Threshold @ 5.59 mV, Window @ 10.0 mV

Calibration Check w 1% U3O8 Ore Check Source: 19984 CPM

Background @ 5.59 mV The @ 10.0 mV Window in - 62 CPM

Date 10-2-12

Calibrated By [Signature]





# CERTIFICATE OF CALIBRATION

**LUDLUM 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 UNC MINING & MILLING ORDER NO. 20196869/375405

Mfg. Ludlum Measurements, Inc. Model 19 Serial No. 9180  
Mfg. \_\_\_\_\_ Model \_\_\_\_\_ Serial No. \_\_\_\_\_

Cal. Date 2-Apr-12 Cal Due Date 2-Apr-13 Cal. Interval 1 Year Meterface N/A

check mark  applies to applicable instr. and/or detector IAW mfg. spec. T. 74 °F RH 44 % Alt 688.8 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 700 V Input Sens. 41 mV Det. Oper. \_\_\_\_\_ V at \_\_\_\_\_ mV Threshold Dial Ratio \_\_\_\_\_ = \_\_\_\_\_ mV

HV Readout (2 points) Ref./Inst. 500 / \_\_\_\_\_ V Ref./Inst. 1500 / \_\_\_\_\_ 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	4100	4000
5000	1000 µR/hr	1000	1000
500	400 µR/hr = 75200 cpm	400	400
500	100 µR/hr	100	100
250	200 µR/hr = 36000 cpm	210	200
250	100 µR/hr	100	100
50	7520 cpm	42	40
50	1880 cpm	10	10
25	3600 cpm	22	20
25	900 cpm	5.5	5

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

50, 25 Range(s) Calibrated Electronically

REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout			Log Scale		

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  Ra-226 S/N Y982  
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 Ra226:Y982 ≈ 189.9µCi  
 m 500 S/N 63893  Oscilloscope S/N \_\_\_\_\_  Multimeter S/N 93870637

Calibrated By: Jeremy Thompson Date 2-Apr-12

Reviewed By: [Signature] Date 3-Apr-12

This certificate shall not be reproduced except in full, without the written approval of Ludlum Measurements, Inc.  
FORM C22A 10/24/2011 Page 1 of 1 Note: Checked w/UNC Cs137 source on 4-11-12 = 140-145 µR/hr

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

**AVM Environmental Services, Inc,  
Micro R Meter Function Check Form  
UNC's NECR Mine Site**

Micro R Meter: Ludlum 19, SR # 9180      Function Check Source ID: Cs 137,SR # 1524 =1.55 uCi

*Calibrated by Ludlum on 4-2-12*

Function Check @ Calibration 145 uR/HR *Established on 4-11-12*

Acceptable Function Check Reading Avg. (uR/hr) Range (20%) 116 to 174

Date	Physical Check	Cal Date	Battery (1) Volts or OK	BKG Reading Avg. uR/hr	Source Reading (2) Avg. uR/hr	Within Acceptable Range Y or N	Cal Due	Tech
8-30-12	OK	4-2-12	OK	7@UNC OFFC.	145	Y	4-2-13	MC
9-13-12	OK	4-2-12	OK	7@UNC OFFC.	145	Y	4-2-13	MC
9-21-12	OK	4-2-12	OK	7@UNC OFFC.	145	Y	4-2-13	MC
9-28-12	OK	4-2-12	OK	7@UNC OFFC.	145	Y	4-2-13	MC
10-4-12	OK	4-2-12	OK	7@UNC OFFC.	145	Y	4-2-13	MC
10-12-12	OK	4-2-12	OK	7@UNC OFFC.	145	Y	4-2-13	MC
10-18-12	OK	4-2-12	OK	7@UNC OFFC.	145	Y	4-2-13	MC
10-26-12	OK	4-2-12	OK	7@UNC OFFC.	145	Y	4-2-13	MC

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

# Calibration Certificate

**ThermoFisher**  
SCIENTIFIC

The world leader  
in serving science

Page 1 of 1

**Report Number** 00091355-221

**Instrument** SAC4

**Serial Number** 221

**Test Equipment** FLUKE 8060A S/N 6135154 Cal Due 27 Apr 13  
FLUKE 80K-40 S/N HVP-018 Cal Due 15 May 13

**Calibration Standards** MP-2 S/N 174 Cal Due: 10 May 13  
Pu-239 S/N 5743-06 Cal Due 23 Apr 13

### Environmental Conditions

**Temperature** 22°C    **Relative Humidity** 36%    **Barometric Pressure** 29.61 inHg

Time (In Minutes)	Calibration Point	Tolerance	Reading
.1	1K CPM	98 - 102 CPM	100 Counts
.2	1K CPM	198 - 202 CPM	200 Counts
.5	1K CPM	490 - 510 CPM	500 Counts
1	1K CPM	980 - 1020 CPM	1000 Counts
10	1K CPM	9975 - 10025 CPM	10003 Counts
1	19500 CPM (2π)	≥ 85% Efficiency	(*343) 17287 Counts (88.7%)
10	Background	≤ 3 Counts	2 Counts

(\*) Received readings out of specifications.

**Received condition**

- In tolerance  
 Out of tolerance

Calibration standards used have calibration traceable to N.I.S.T.

**Date:** 7-Sep-12

**Signature** \_\_\_\_\_

Richard E. Smith  
Electronic Technician

**P.O. Number:** 05190

**Checkout Procedure:** 10429076 May 92

*Other note:* Final recal./repair sheet & checked w/ VNC Th230/1310 = 9480 DPM on 9-18-12.  
10 cpm readings = 3794, 3858, 3860, 3967, 3961, 3913, 3869, 3804, 3892, 3924 = 3878.2  
EFF. = 40.9%    RF =  $\frac{SP}{\sqrt{Z}} = \frac{63.56}{62.28} = 1.02$ , ΔK within .65 - 1.21    Avg.

*Handwritten signature and date: 5-10-Sept-12*

## CERTIFICATE OF CONFORMANCE AND QUALITY ASSURANCE REPORT

The materials, items, supplies, equipment, instruments, systems or services comprising this order have passed all examinations, inspections, tests, and calibrations required by the ISO9001:2008 certified Quality Management System for Thermo Fisher Scientific, the relevant quality assurance procedures and Quality Systems Manual in effect at the time of shipment, and the applicable contract or purchase order.

The Quality Management System conforms to the requirements of:

- ISO9001:2008 Quality Management System Requirements
- ANSI/NCSL Z540.1-1994 Calibration Laboratories General Requirements
- ISO10012 Measurement Management Systems
- ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories
- 10CFR21 Reporting of Defects (as applicable)
- Other NRC Regulations as applicable

As these may apply to Commercial Grade Products and Services.



Quality Assurance Manager



# CERTIFICATE OF CALIBRATION

**LUDLUM MEASUREMENTS, INC.**

501 Oak Street  
325-235-5494  
Sweetwater, TX 79556, U.S.A.

231 Sam Rayburn Parkway  
865-270-8962  
Lenoir City, TN 37771, U.S.A.

CUSTOMER UNC MINING & MILLING ORDER NO. 20200857/378625

Mfg. Ludlum Measurements, Inc. Model 1000 Serial No. 8715

Mfg. Ludlum Measurements, Inc. Model 43-10 Serial No. PR 303624

Cal. Date 6-Jun-12 Cal Due Date 6-Jun-13 Cal. Interval 1 Year Meterface 202-014

check mark  applies to applicable instr. and/or detector IAW mfg. spec. T. 73 °F RH 36 % 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) \_\_\_\_\_ 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. 48 mV Det. Oper. 900 V at 48 mV Threshold Dial Ratio \_\_\_\_\_ = \_\_\_\_\_ mV

HV Readout (2 points) Ref./Inst. 500 / 505 V Ref./Inst. 2000 / 2003 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*
N/A			
N/A			

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

Range(s) Calibrated Electronically

REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout					
400kcpm	39986(0)	39986(0)			
40kcpm	3998	3998			
4kcpm	400	400			
400cpm	40	40			
40cpm	4	4			

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/NCCL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources:  059  280  720  734  781  1131  1616  1696  5105  5719CO  60646  70897  73410  E551  E552  G112  M565  S-394  S-1054  T-304  T879  T10081  T10082  Y982

Alpha S/N Pu239 SN:7053 24900dpm  Beta S/N \_\_\_\_\_  Other \_\_\_\_\_

m 500 S/N 190566  Oscilloscope S/N \_\_\_\_\_  Multimeter S/N 86250390

Calibrated By: [Signature] Date 6-Jun-12

Reviewed By: Donnie Miekos Date 6-Jun-12

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





**Appendix B**  
**NECR EDRA Updated Correlation Data**

**NECR EDRA Updated Gamma Radiation Level to Surface Soil Ra-226 Concentration Correlation Data**

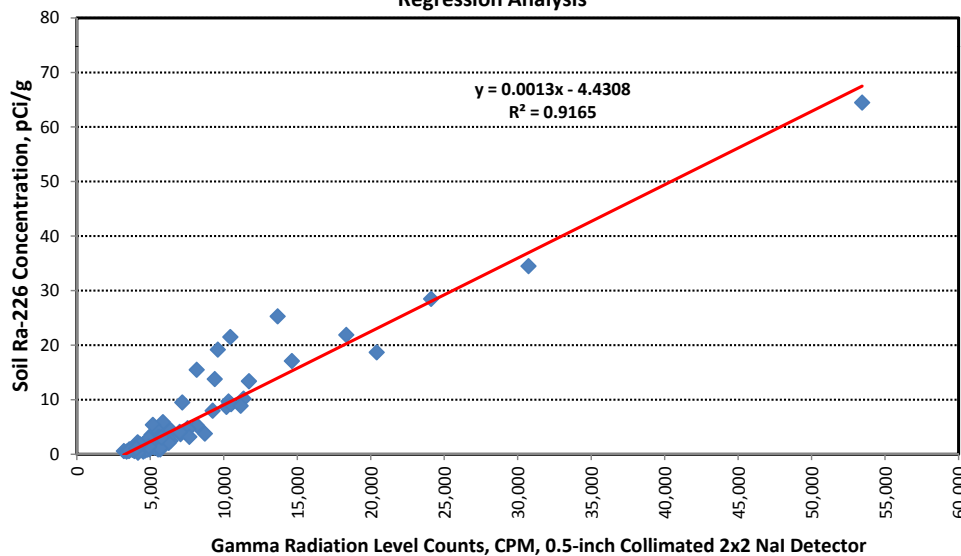
2012 Eastern Drainage RA Correlation Data		
Survey Point ID	Gamma Radiation Level (CPM)	Soil Sample Ra-226 Conc (pCi/g)
SSPT-011	4,575	1.4
SSPT-022	4,997	1.9
SSPT-033	4,997	1.5
SSPT-044	4,661	1.8
SSPT-055	4,394	1.6
SSPT-066	4,573	1.0
SSPT-074	4,773	1.5
SSPT-077	4,698	1.2
SSPT-088	4,982	1.5
SSPT-099	4,984	2.2
SSPT-110	5,211	1.4
SSPT-121	4,386	1.6
SSPT-132	4,773	2.0
SSPT-143	4,954	1.9
SSPT-030, Z-6	4,557	1.3

2011 East Drainage Area SRSE Correlation Data		
Survey Point ID	Gamma Radiation Level (CPM)	Soil Sample 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

2009 IRA Correlation Data		
Survey Point ID	Gamma Radiation Level (CPM)	Soil Sample 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

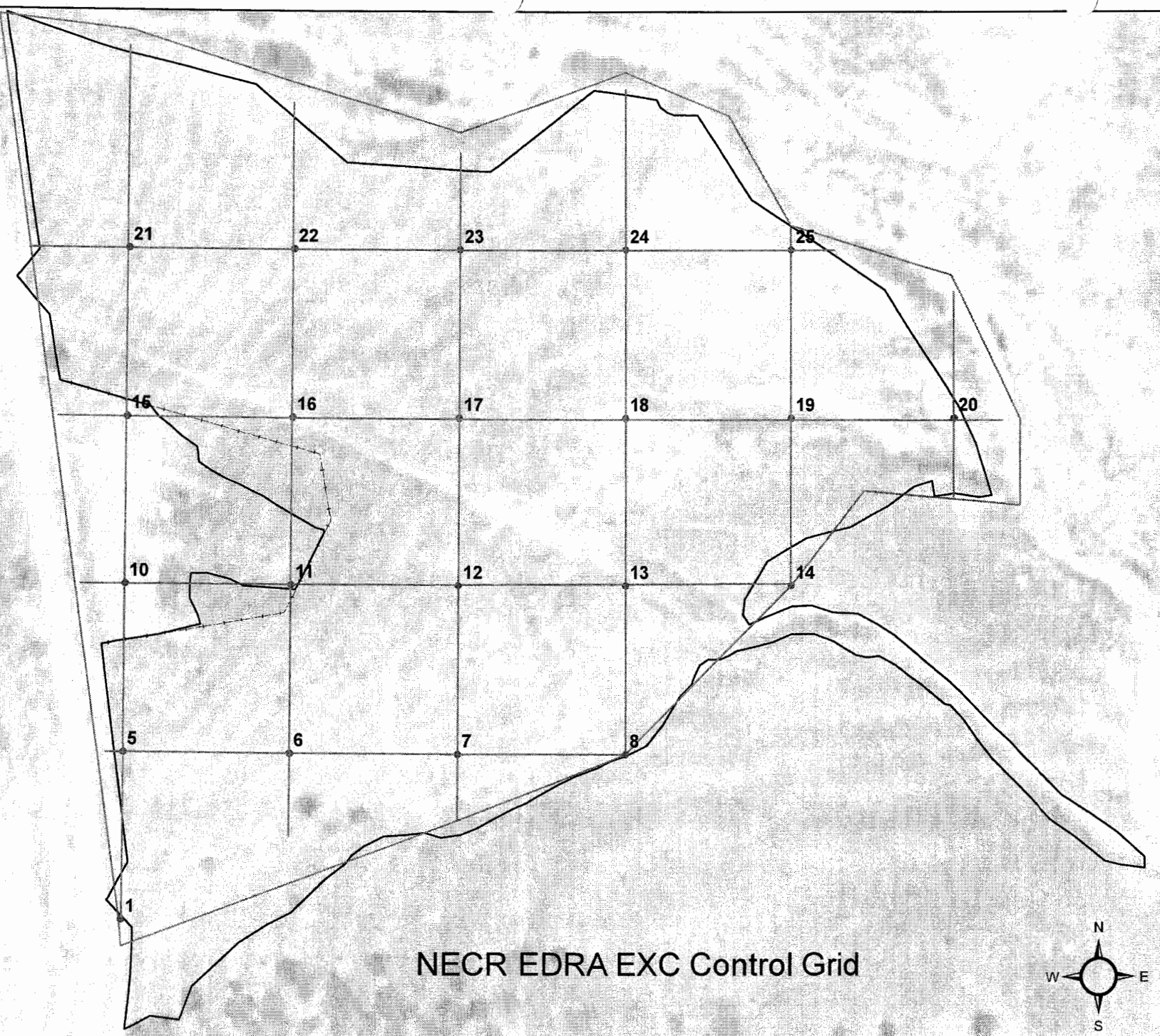
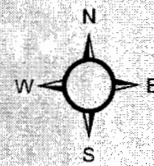
2008 SRSE Correlation Data		
Survey Point ID	Gamma Radiation Level (CPM)	Soil Sample Ra-226 Conc
home-014	10488	9.2
home-105	20401	18.7
home-112	5606	3.4
home-130	24105	28.5
home-146	8176	5.3
home-148	5697	2.5
home-149	4846	2.0
home-151	5169	5.4
home-153	5522	0.9
home-154	5186	2.5
home-155	4649	0.7
home-156	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

**NECR EDRA Updated Gamma Radiation Level to Soil Ra-226 Concentration Regression Analysis**



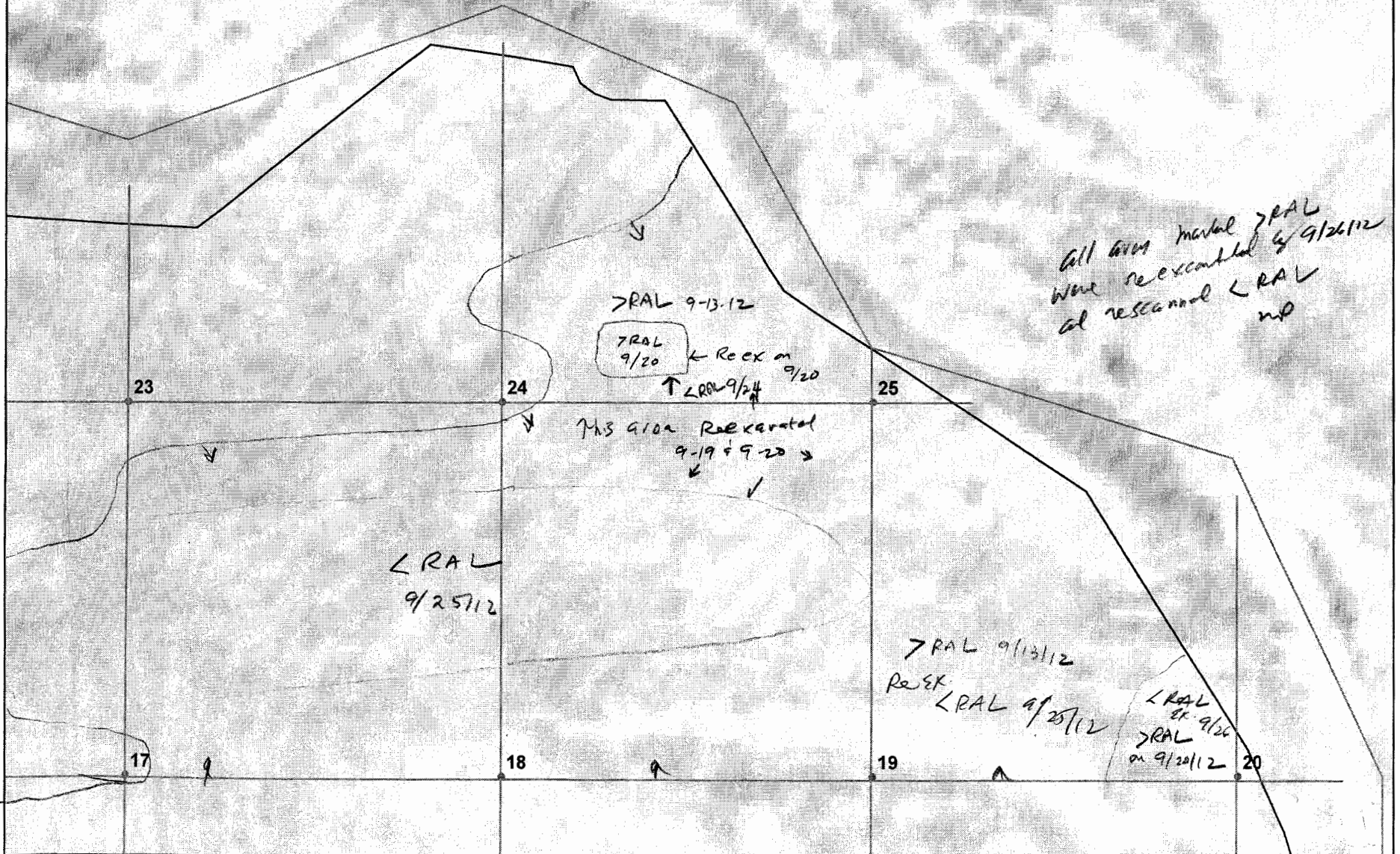
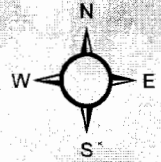
**Appendix C**  
**NECR EDRA Excavation Control Grid Forms**

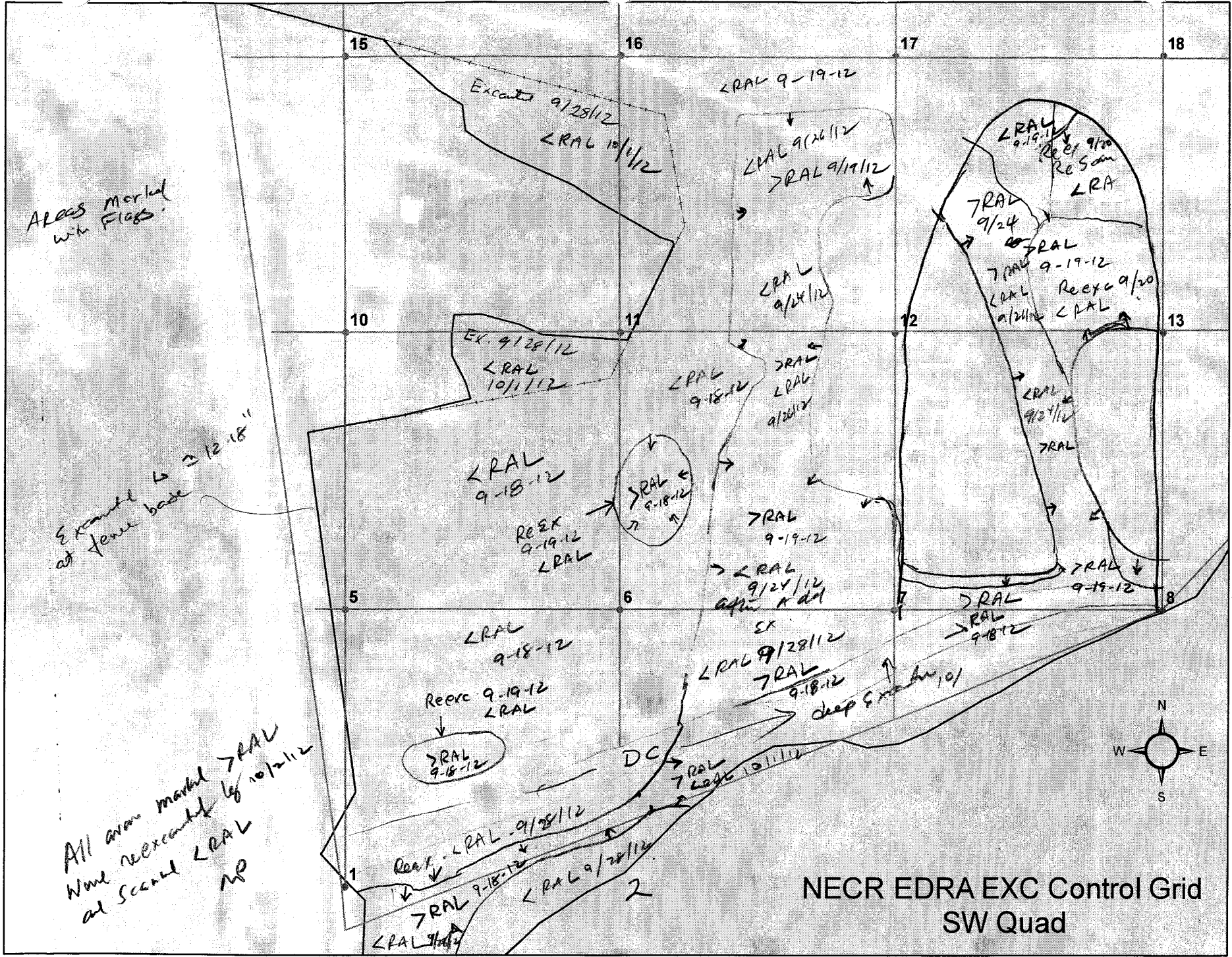
NECR EDRA EXC Control Grid



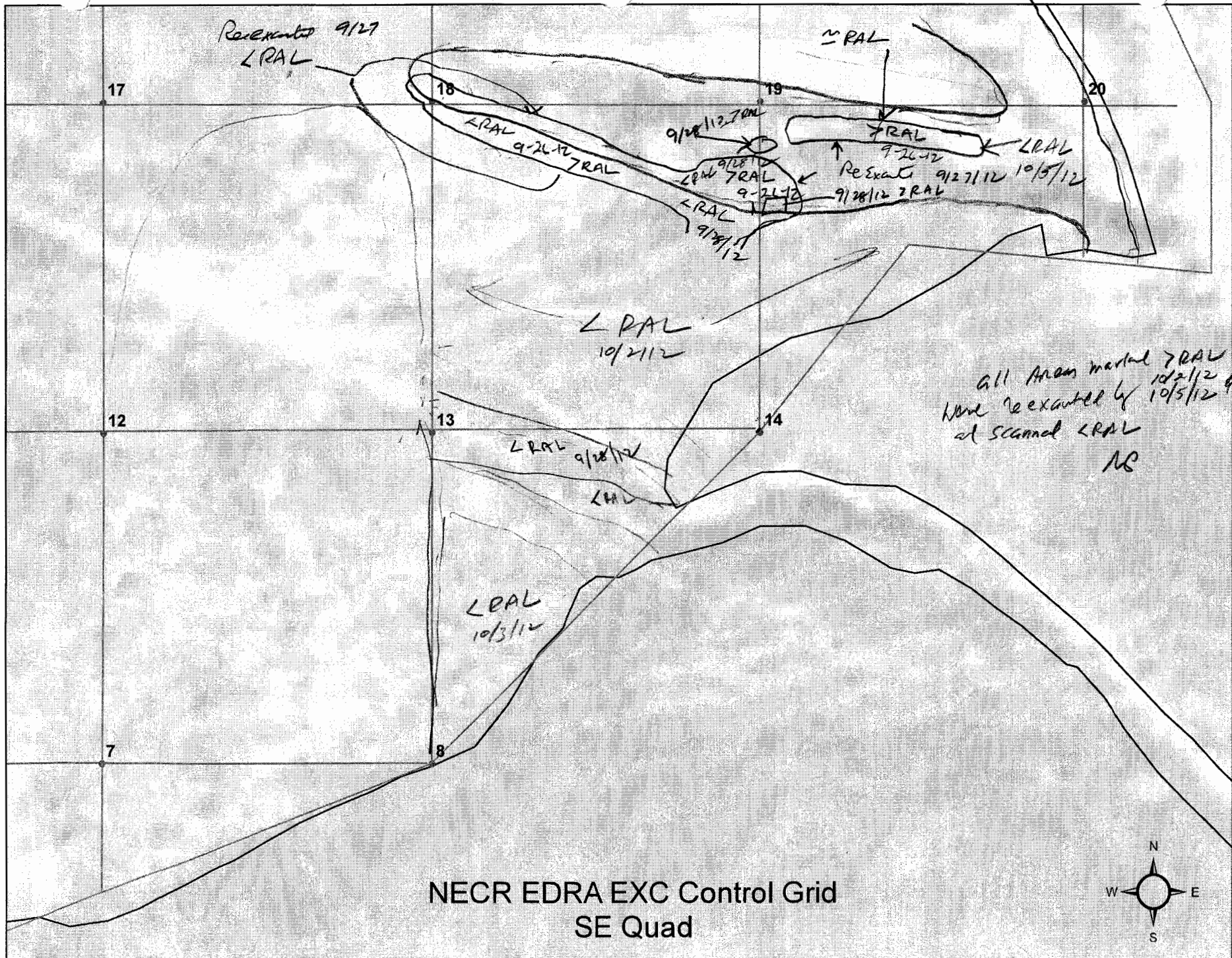


# NECR EDRA EXC Control Grid NE Quad





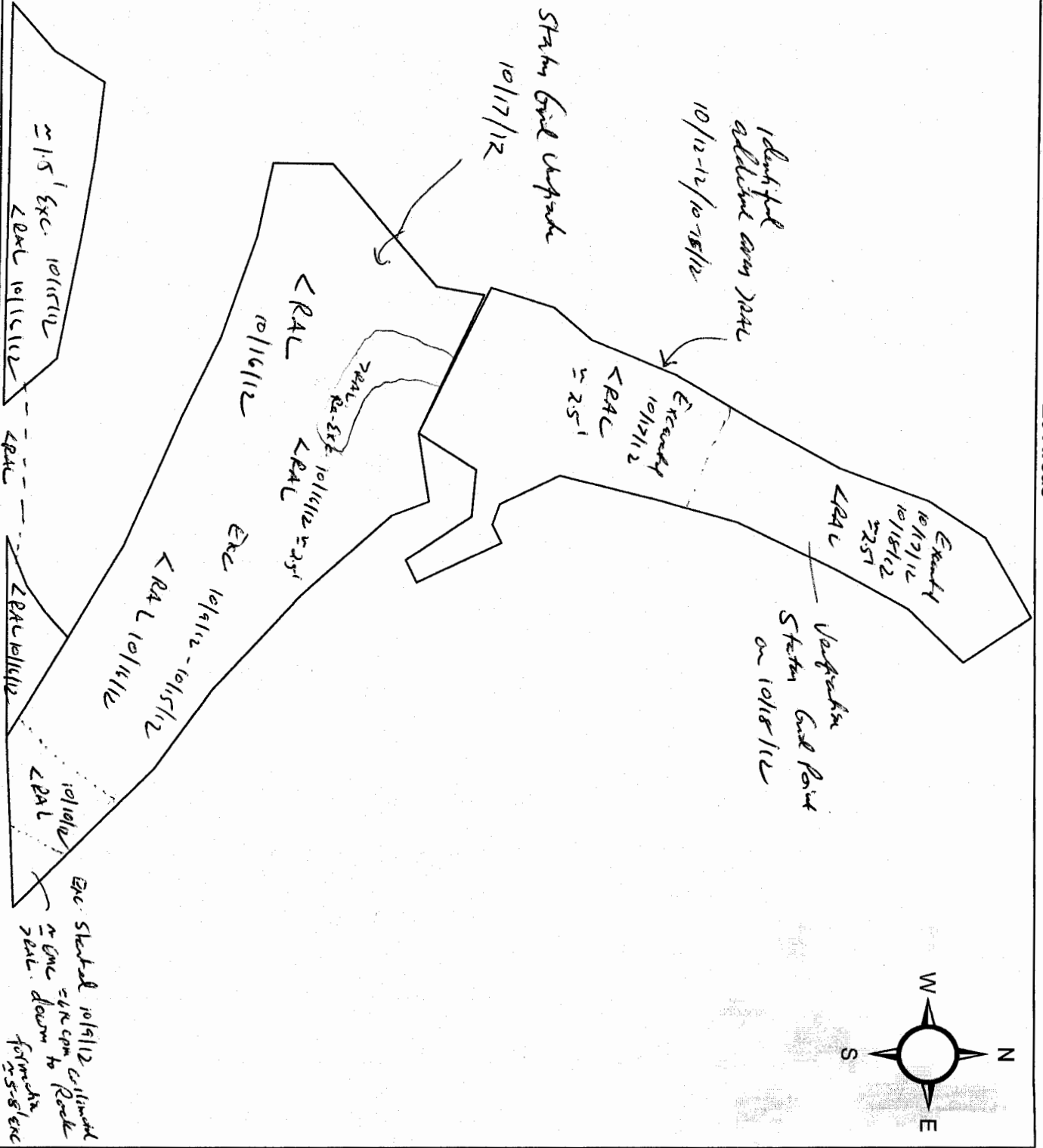
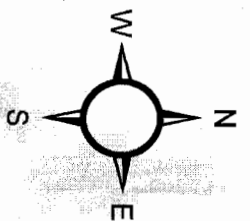
NECR EDRA EXC Control Grid  
SW Quad



NECR EDRA EXC Control Grid  
SE Quad



NECR EDRA EXC Control Grids  
Z6 Areas



**Appendix D**  
**Excavation Control Static Gamma Radiation Survey Field Forms**

**Gamma Radiation Survey @ NECR EDRA**

**Static Gamma Radiation Survey Field Form**

Instrumentation : Scaler/Ratemeter L2241-2, Detector SPA-3 # 408522-30  
 Instrument Calibration Date: 4-12-12, Instrument Daily Function Check Performed: Yes  
 2"x2" NaI Detector Collimated  Yes or  No.  
 Survey Area/Unit Description NECR EDRA Zone 2,

*RAL 16,600 cpm  
 BAC 15,700 cpm*

Survey Date/Time	Survey Point ID/Description	Survey Point Coordinate		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
9-26-12	2-27 6-18-3	259	947	13985	CPAL
	-4	173	931	14116	
	6-19-1	159	2525040	16011	
	2	152	150	15585	
	3	234	137	14096	
	4	250	030	14011	
	6-24-1	343	2524921	16102	
	-2	421	862	15212	
	-3	352	833	14998	
	6-23-1	343	753	13948	
	-2	446	750	15116	
	-3	402	656	16009	
	-4	341	644	15984	
	6-5-1	1694813	333	14008	
	-2	808	205	14369	
	-3	730	253	13985	
	-4	750	356	14122	
	6-1-1	657	352	15998	
	-2	642	226	14874	
	6-10-1	1697 050	362	13911	
	-2	089	275	14082	
	6-5-5	1696 877	370	15108	
	-6	873	292	16007	
	6-11-1	1697070	457	16108	
	6-11-2	050	549	15889	

Technician Signature [Signature], Reviewed by [Signature]

*Page 1*

**Gamma Radiation Survey @ NECR EDRA**

**Static Gamma Radiation Survey Field Form**

Instrumentation : Scaler/Ratemeter L2224 , Detector SPA3 1E30  
 Instrument Calibration Date: 4-12-12 , Instrument Daily Function Check Performed: yes  
 2"x2" NaI Detector Collimated \_\_\_\_\_ Yes or X No.  
 Survey Area/Unit Description NECR EDRA, Zone 2, 5, 3

Survey Date/Time	Survey Point ID/Description	Survey Point Coordinate		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
9-26-12	Z-2 G-11-3	1696955	2524524	15898	L RAL
	-4	953	449	14128	
	Z-2 G-12-1	1697048	633	15069	
	-2	035	761	14928	
	-3	1696932	751	14978	
	-4	945	663	14118	
9-27-12	Z-2 G-13-1	1697043	852	13967	
	-2	016	948	14189	
	-3	1696930	946	14718	
	-4	951	847	15911	
	G-14-1	1697016	2525043	15099	
	-2	6447	017	16011	
	G-6-1	1696871	2524461	15411	
	-2	1696741	440	16007	
	-3	716	568	15990	
	-4	857	547	16011	
9-28-12	Z-5 G-7-1	861	621	16902	L EMC
	-2	724	635	15988	L RAL
	-3	802	788	14192	
	-4	850	732	16114	
10-4-12	Z-2 G-8-1	859	835	15110	
10-4-12	G-3-1	1697262	2524163	14911	
	-2	201	138	16519	
	-3	142	163	15022	

Technician Signature [Signature] , Reviewed by [Signature]

**Gamma Radiation Survey @ NECR EDRA**

**Static Gamma Radiation Survey Field Form**

Instrumentation : Scaler/Ratemeter L2241-2 , Detector SPA-3 #30

Instrument Calibration Date: \_\_\_\_\_, Instrument Daily Function Check Performed: Yes

2"x2" NaI Detector Collimated  Yes or  No.

Survey Area/Unit Description NECR EDRA Zone-6

Survey Date/Time	Survey Point ID/Description	Survey Point Coordinate		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
10-5-12	7-4-1	1697115	2524879	5009	<RAL
	2	119	973	5224	RAL-EMC
	3	111	2525017	5417	RAL-EMC
	4	087	063	5047	<RAL
	5	052	179	4998	↓
	6	027	240	5007	↓
10-17-12	2-6-1	1696264	2522844	4555	<RAL
	2	229	895	4753	<RAL
	3	186	876	5164	<EMC
	4	235	785	4076	<RAL
10-18-12	NECR 2-6-1	1696352	2522825	5055	"
	2	373	862	4772	"
	3	401	833	5422	<EMC
	4	421	864	5109	"
	5	458	882	4823	<RAL
	6	446	877	4955	"
	7	463	892	4954	"
	8	468	909	4789	"
	9	318	838	4916	"
	10	301	858	4995	"
	11	287	884	5012	"

Technician Signature [Signature] , Reviewed by [Signature]

**Appendix E**  
**NECR EDRA Soil Sample Log Forms**

NECR EDRA  
Soil Sample Log Form

Sample ID	Sample Date	Sample Description	Comments/Notes	Tech
EDC-01 @ 7.0'	10-2-12 @ 1317	East Drainage Channel Subsidence Sample from Excavation @ 7.0' depth N. 1696527.0 E. 2524195.0	Sent to Lab	no wq.
EDC-02 @ 6.1'	10-2-12 @ 1321	" 50' @ 6.1' depth N. 1696545.4 E. 2524241.5		no wq.
EDC-03 @ 7.5'	10-2-12 @ 1327	" 100' @ 7.5' depth N. 1696568.4 E. 2524285.2	Sent to Lab	no wq.
EDC-04 @ 5.5'	10-2-12 @ 1336	" 150' @ 5.5' depth N. 1696593.9 E. 2524328.0		no wq.
EDC-05 @ 5.0'	10-2-12 @ 1347	" 200' @ 5.0' depth N. 1696614.3 E. 2524372.0		no wq.
EDC-07 @ 5.0'	10-2-12 1354	" 300' @ 5.0' depth N. 1696618.6 E. 2524472.9	Sent to Lab	no wq.
EDC-08 @ 5.5'	10-2-12 1358	" 350' @ 5.5' depth N. 1696614.6 E. 2524516.8		no wq.
EDC-09 @ 5.5'	10-2-12 1402	" 400' @ 5.5' depth N. 1696621.9 E. 2524570.1	Sent to Lab	no wq.
EDC-10 @ 3.5'	10-2-12 1407	" 450' @ 3.5' depth N. 1696637.0 E. 2524629.5		no wq.
EDC-11 @ 2.8'	10-3-12 @ 0920	" 500' @ 2.8' depth N. 1696661.0 E. 2524672.6	Sent to Lab	no wq.
EDC-12 @ 2.8'	10-3-12 @ 0930	" 550' @ 2.8' depth N. 1696688.1 E. 2524713.8		no wq.
EDC-13 @ 3.8'	10-3-12 @ 0935	" 600' @ 3.8' depth N. 1696711.6 E. 2524757.9	Sent to Lab	no wq.

NECR EDRA  
Soil Sample Log Form

Sample ID	Sample Date	Sample Description	Comments/Notes	Tech
EDC-14 @ 4.0'	10-3-12 @ 0940	East Drainage Bed, 650' @ 4.0' depth Channel Exc. N 1696745.7 E 2524794.0	Bed Sample	MP M.G.
EDC-01-NSW @ 1100	10-3-12	" North Side Wall, 0 feet N 1696532.3 E 2524193.9	Wall Sample Sent to Lab 11-27-12	MP M.G.
EDC-02-SSW @ 1105	10-3-12	" South Side Wall 50 feet N 1696539.5 E 2524222.0	"	MP M.G.
EDC-03-NSW @ 1115	10-3-12	" North Side wall, 100' N 1696576.1 E 2524282.8	" Sent to Lab 11-27-12	MP M.G.
EDC-07-SSW @ 1127	10-3-12	" South Side wall, 300' N 1696612.6 E 2524472.9	Sent to Lab 11-27-12	MP M.G.
EDC-08-SSW @ 1135	10-3-12	" South Side wall, 350' N 1696613.7 E 2524516.8		MP M.G.
EDC-09-SSW @ 1145	10-3-12	" South side wall, 400' N 1696615.8 E 2524570.1	Sent to Lab 11-27-12	MP M.G.
EDC-10-SSW @ 1152	10-3-12	" South side wall, 450' N 1696630.4 E 2524627.6		MP M.G.
EDC-11-SSW @ 1200	10-3-12	" South side wall, 500' N 1696655.5 E 2524675.7	Sent to Lab 11-27-12	MP M.G.
EDC-12-SSW @ 1208	10-3-12	" South Side wall, 550' N 1696681.6 E 2524717.5		MP M.G.
EDC-13-SSW @ 1217	10-3-12	" South side wall, 600' N 1696705.4 E 2524762.4	Sent to Lab 11-27-12	MP M.G.
EDC-14-SSW @ 1225	10-3-12	" South Side wall, 650' N 1696740.1 E 2524800.0		MP M.G.



NECR EDRA  
Soil Sample Log Form

Sample ID	Sample Date	Sample Description	Comments/Notes	Tech
EDC-15 @ 3.0'	10-4-12 @ 1220	East Drainage Bed @ 700' @ 3.0' depth Channel Eoc. N 1696774.5 E 2524835.2	Sent to Lab	VP VP
EDC-16	10-4-12 @ 1230	" Bed, 750' @ 4.0' depth N 1696802.4 E 2524877.6		VP VP
EDC-15-NSW	10-4-12 @ 1310	" North side wall, 700' N 1696777.7 E 2524830.3	Sent to Lab	VP VP
EDC-16-SSW	10-4-12 @ 1317	" South Side wall, 750' N 1696799.7 E 2524883.6		VP VP
EDC-17 @ 7.0'	10-4-12 @ 1326	" Bed, 800' @ 7.0' depth N 1696832.2 E 2524917.6	Sent to Lab	VP VP
EDC-17-NSW	10-4-12 @ 1327	" North side wall, 800' N 1696839.4 E 2524911.8	Sent to Lab	VP VP
EDC-19 @ 3.9'	10-4-12 @ 1328	" Bed, 900' @ 3.9' N 1696859.2 E 2525013.9	Sent to Lab	VP VP
EDC-20 @ 3.5'	10-4-12 @ 1355	" Bed, 950' @ 3.5' N 1696852.5 E 2525061.3		VP VP
EDC-19-NSW	10-4-12 @ 1420	" North side wall, 900' N 1696868.7 E 2525011.1	Sent to Lab	VP VP
EDC-20-SSW	10-4-12 @ 1428	" South Side wall, 950' N 1696873.6 E 2525059.2		VP VP
EDC-18 @ 8.0'	10-4-12 @ 1449	" Bed, 850' @ 8.0' depth N 1696845.3 E 2524967.5		VP VP
EDC-21 @ 4.0'	10-4-12 @ 1541	" Bed, 1000' @ 4.0' depth N 1696532.5 E 2525115.9	Sent to Lab	VP VP

NECR EDRA  
Soil Sample Log Form

Sample ID	Sample Date	Sample Description	Comments/Notes	Tech
EDC-DS1	10-4-12 @ 1600	East Drainage Bed, 1000' @ 4.0' channel etc. QA/QC.	Field QA/QC of EDC-21 sent to Lab	MD JP
EDC-18-BSW M	10-4-12 @ 1610	" South North <sup>side</sup> side wall, 850' N 1696838.4 E 2524971.4		MD JP
EDC-21-NSW	10-4-12 @ 1626	" North side wall, 1000' N 1696839.4 E 2525117.7	Sent To Lab	MD JP
EDC-22 @ 2.5'	10-5-12 @ 1010	" Bed, 1050' @ 2.5' depth N 1696800.7 E 2525156.1		MD MJ
EDC-23 @ 2.8'	10-5-12 @ 1021	" Bed, 1100' @ 2.8' depth N 1696767.1 E 2525193.0	Sent To Lab	MD MJ
EDC-24 @ 2.5'	10-5-12 @ 1030	" Bed, 1150' @ 2.5' depth N 1696735.4 E 2525229.4		MD MJ
EDC-25 @ 4.0'	10-5-12 @ 1040	" Bed, 1200' @ 4.0' depth N 1696697.0 E 2525242.6		MD MJ
EDC-26 @ 3.0'	10-5-12 @ 1047	" Bed, 1250' @ 3.0' depth N 1696665.1 E 2525297.6		MD MJ
EDC-27 @ 3.0'	10-5-12 @ 1055	" Bed, 1300' @ 3.0' N 1696632.5 E 2525336.5		MD MJ
EDC-28 @ 2.5'	10-5-12 @ 1103	" Bed, 1350' @ 2.5' N 1696604.9 E 2525376.8		MD MJ
EDC-29 @ 2.5'	10-5-12 @ 1115	" Bed, 1400' @ 2.5' N 1696583.4 E 2525422.1	Sent To Lab	MD MJ
EDC-04 @ 6.5'	10-5-12 @ 1418	" Bed, Re Exc to 6.5' depth		MD MJ

NECR EDRA  
Soil Sample Log Form

Sample ID	Sample Date	Sample Description	Comments/Notes	Tech
EDC-05 @ 6.0'	10-5-12 @ 1435	East Drainage Channel Exc. Bed, 200' Re-exc to 6.0' N same	Sent To Lab	wp mf.
EDC-06 @ 4.5'	10-5-12 @ 1442	" Bed, 250' @ 4.5' N 1696623.2 E 2524423.9		wp M.G.
EDC-D52	10-5-12 @ 1450	" " "	Field QA/QC Dup of EDC-05 @ 4.5' 10-5-12 @ 1435	wp mf.
EDC-22-SSW	10-8-12 @ 0845	" South side wall, 1050' N 1696794.5 E 25251522		wp mf.
EDC-23-NSW	10-8-12 @ 0853	" North South side wall, 1100' N 1696773.6 E 2525196.1	Sent To Lab	wp mf.
EDC-24-SSW	10-8-12 @ 0900	" South side wall, 1150' N 1696731.8 E 2525223.3		wp mf.
EDC-29-NSW	10-8-12 @ 0912	" North side wall, 1400' N 1696590.7 E 2525424.9	Sent To Lab	wp mf.
EDC-04-SSW	10-8-12 @ 0930	" South side wall, 150' N 1696587.6 E 2524327.7		wp mf.
EDC-05-NSW	10-8-12 @ 0938	" North side wall, 200' N 1696621.0 E 2524371.6	Sent To Lab	wp mf.
EDC-06-SSW	10-8-12 @ 0945	" South side wall, 250' N 1696616.8 E 2524423.8		wp mf.
EDC-25- <del>SSW</del> @ 4.5'	10-8-12 @ 1040	" North side wall 1200' Bed, 1200' @ 4.5' depth Re-excavated to 4.5' depth	Sent To Lab	wp mf.
EDC-26 @ 4.0'	10-8-12 @ 1045	" Bed, 1250' @ 4.0' depth Re-excavated to 4.0' depth		wp mf.

NECR EDRA  
Soil Sample Log Form

Sample ID	Sample Date	Sample Description	Comments/Notes	Tech
EDC-27 @ 5.5'	10-8-12 @ 1050	East Drainage Bed, 1300' @ 5.5' Channel Re excavated to 5.5' Exc.		NO WQ.
EDC-28 @ 5.0'	10-8-12 @ 1057	" Bed, 1350' @ 5.0' Re excavated to 5.0'		NO WQ.
EDC-25-NSW	10-8-12 @ 1140	" North side wall, 1200' N 1694702.5 E 2525266.1	Sent to Lab	NO WQ.
EDC-26-SSW	10-8-12 @ 1150	" South side wall, 1250' N 1696657.6 E 2525294.3		NO WQ.
EDC-28-SSW	10-8-12 @ 1156	" South side wall, 1350' N 1696599.0 E 2525373.7		NO WQ.
EDC-27-NSW <sup>49</sup> @ 6.5'	10-8-12 @ 1254	" Bed, 1300', Re Exc. to 6.5' Re excavated to 6.5'	Sent to Lab	NO WQ.
EDC-27-NSW	10-8-12 @ 1320	" North side wall, 1300' N 1696637.7 E 2525340.3	Sent to Lab	NO WQ.
EDC-DS3	10-3-12 @ 1130	" South side wall 1300' QA/QC DUP	Field QA/QC DUP For EDC-07-SSW 10-3-12 @ 1127	NO WQ.
EDC-DS4	10-8-12 @ 0920	" North side wall, 1400' QA/QC DUP	Field QA/QC DUP for EDC-29-NSW 10-8-12 @ 0912	NO WQ.

NECR EDRA  
Soil Sample Log Form

Sample ID	Sample Date	Sample Description	Comments/Notes	Tech
SSPT-143	10-03-12 @ 1050	NECR EDRA Status Survey Cont. Surface soil sample @ Pt 143	N 2524371 E 1697462	W
SSPT-132	10-03-12 @ 1100	"	N 2524331 E 1697393 @ Pt 132	W
SSPT-099	10-03-12 @ 1109	"	N 2524371 E 1679184 @ Pt 099	W
SSPT-110	10-03-12 @ 1123	"	N 2524051 E 1697255 @ Pt 110	W
SSPT-121	10-03-12 @ 1130	"	N 2524691 E 1697323 @ Pt 121	W
SSPT-088	10-03-12 @ 1140	"	N 2524410 E 1674970 @ Pt 088	W
SSPT-066	10-03-12 @ 1147	"	N 2524971 E 1697114 @ Pt 066	W
SSPT-074	10-03-12 @ 1157	"	N 2524371 E 1697045 @ Pt 074	W
SSPT-077	10-03-12 @ 1209	"	N 2524327 E 1697115 @ Pt 077	W
SSPT-055	10-3-12 @ 1430	"	N 2524490 E 1696973 @ Pt 055	W
SSPT-DS1	10-3-12 @ 1445	"	N 2524490 E 1696973 @ —	Field QA/QC Dup of SSPT-055 W
SSPT-033	10-5-12 @ 1135	"	N 2524209 E 1696795 @ Pt 033	W

NECR EDRA  
Soil Sample Log Form

Sample ID	Sample Date	Sample Description	Comments/Notes	Tech
SSPT-022	10-5-12 @ 1143	NECR EDRA Status Survey Confirmatory Soil Sample N 2524810 E 1696699 @ pt 022		no
SSPT-011	10-5-12 @ 1150	" N 2524450 E 1696630 @ pt 011		no
SSPT-044	10-5-12 @ 1230	" N 2525050 E 1696835 @ pt 044		no
SSPT-052	10-5-12 @ 1245	" N 2525050 E 1696835 @ pt 044	Field CD/DC Dup of SSPT-044	no
SSPT-030 Z-6	10-17-12 @ 1122	" SSPT-030 Zone-6 N 2522892 E 1696213		no

NECR EDRA  
Soil Sample Log Form

Sample ID	Sample Date	Sample Description	Comments/Notes	Tech
SSPT-033R	12-4-12 @ 1026	NECR EDRA N 1696771.0 Status Survey E 2524208.5 Conf: Sample Site Soil - Re-Samples @ pt-033	Re Sample @ SSPT-033	up up
<p><i>Gama Rd @ SSPT-033R - 4787 cm (collimated detector). Area = 20' Radius for Pt Range from 4200-4900 cm</i></p>				

# Chain of Custody and Analytical Request Record

PLEASE PRINT (Provide as much information as possible.)

Company Name: <b>MWH</b>	Project Name, PWS, Permit, Etc. <b>NECR EDRA</b>	Sample Origin State: <b>NM</b>	EPA/State Compliance: Yes <input type="checkbox"/> No <input type="checkbox"/>
Report Mail Address: <b>P.O. Box 774018 Steamboat Springs, CO 80477</b>	Contact Name: <b>Toby Leeson</b> Phone/Fax: <b>970-871-4361</b> <b>970-871-9048</b>	Email: <b>Toby.Leeson@MWH.com</b>	Sampler: (Please Print) <b>Natier-Patel</b>
Invoice Address: <b>MWH, Bloomfield, CO</b>	Invoice Contact & Phone: <b>Toby Leeson 970-871-4361</b>	Purchase Order:	Quote/Bottle Order:

Special Report/Formats:

DW                       EDD/EDT (Electronic Data)

POTW/WWTP        **Format:** \_\_\_\_\_

State: \_\_\_\_\_     LEVEL IV

Other: \_\_\_\_\_      NELAC

**ANALYSIS REQUESTED**

Number of Containers: \_\_\_\_\_  
Sample Type:  A  W  S  V  B  O  DW  
 Air  Water  Soils  Sediment  
 Vegetation  Grossway  Other  
 DW - Drinking Water

**SEE ATTACHED**

Standard Turnaround (TAT): \_\_\_\_\_

**RUSH**

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

Comments:

Shipped by: \_\_\_\_\_

Center Temp: \_\_\_\_\_ °C

On Ice:  Y  N

Custody Seal:

On Site:  Y  N

On Center:  Y  N

Initial:  Y  N

Signature Match:  Y  N

LABORATORY USE ONLY

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	✓														
<b>SSPT-143</b>	<b>10-3-12</b>	<b>1050</b>	<b>S</b>	<input checked="" type="checkbox"/>														
<b>SSPT-132</b>	<b>"</b>	<b>1100</b>	<b>S</b>	<input checked="" type="checkbox"/>														
<b>SSPT-099</b>	<b>"</b>	<b>1109</b>	<b>S</b>	<input checked="" type="checkbox"/>														
<b>SSPT-110</b>	<b>"</b>	<b>1123</b>	<b>S</b>	<input checked="" type="checkbox"/>														
<b>SSPT-121</b>	<b>"</b>	<b>1130</b>	<b>S</b>	<input checked="" type="checkbox"/>														
<b>SSPT-088</b>	<b>"</b>	<b>1140</b>	<b>S</b>	<input checked="" type="checkbox"/>														
<b>SSPT-066</b>	<b>"</b>	<b>1147</b>	<b>S</b>	<input checked="" type="checkbox"/>														
<b>SSPT-074</b>	<b>"</b>	<b>1157</b>	<b>S</b>	<input checked="" type="checkbox"/>														
<b>SSPT-077</b>	<b>"</b>	<b>1209</b>	<b>S</b>	<input checked="" type="checkbox"/>														
<b>SSPT-055</b>	<b>"</b>	<b>1430</b>	<b>S</b>	<input checked="" type="checkbox"/>														

<b>Custody Record MUST be Signed</b>	Submitted by (print): <b>Natier Patel</b> Date/Time: <b>10-9-12 8:14 AM</b> Signature: <i>[Signature]</i>	Received by (print): _____      Date/Time: _____      Signature: _____
	Subcontracted to (print): _____      Date/Time: _____      Signature: _____	Received by (print): _____      Date/Time: _____      Signature: _____
	Sample Disposal: _____      Return to Client: _____      Lab Disposal: _____	Received by Laboratory: _____      Date/Time: _____      Signature: _____

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



# Chain of Custody and Analytical Request Record

PLEASE PRINT - Provide as much information as possible.

Company Name: <b>MWH</b>	Project Name, PWS, Permit, Etc. <b>NECR EDRA</b>	Sample Origin State: <b>NM</b>	EPA/State Compliance: Yes <input type="checkbox"/> No <input type="checkbox"/>
Report Mail Address: <b>P.O. Box 77408 Steamboat Springs, CO 80477</b>	Contact Name: <b>Toby Leason</b> Phone/Fax: <b>970-871-4361</b> <b>970-879-9048</b>	Email: <b>Toby-Leason@MWHglobal.com</b>	Sampler: (Please Print) <b>Natier Patel</b>
Invoice Address: <b>MWH Bloomfield, CO</b>	Invoice Contact & Phone: <b>Toby Leason 970-871-4361</b>	Purchase Order:	Quota/Bottle Order:

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

<input type="checkbox"/> DW	<input type="checkbox"/> A2LA
<input type="checkbox"/> GSA	<input type="checkbox"/> EDD/EDT (Electronic Data)
<input type="checkbox"/> POTW/WWTP	Format: _____
State: _____	<input type="checkbox"/> LEVEL IV
Other: _____	<input type="checkbox"/> NELAC

**ANALYSIS REQUESTED**

Number of Containers: \_\_\_\_\_  
Sample Type: **AW3V80**  
By: **Water Gels/Solids**  
Vegetation: \_\_\_\_\_  
Bioassay: \_\_\_\_\_

**SEE ATTACHED**

Normal Turnaround (TAT): \_\_\_\_\_

**R  
U  
S  
H**

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

Comments:

Shipped by: \_\_\_\_\_

Container Size: \_\_\_\_\_

Recept Temp: \_\_\_\_\_ °C

On Ice: Yes  No

Custody Seal: Y  N

Wet: Y  N

Signature: Y  N

Blank: Y  N

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	ANALYSIS REQUESTED
55PT-051	10-3-12	1445	S	SEE ATTACHED
55PT-033	10-5-12	1135	S	
55PT-022	"	1143	S	
55PT-011	"	1150	S	
55PT-044	"	1230	S	
55PT-052	"	1245	S	

<b>Custody Record MUST be Signed</b>	Submitted by (print): <b>Natier Patel</b> Date/Time: <b>10-4-12 1445</b> Signature: <i>[Signature]</i>	Received by (print): _____ Date/Time: _____ Signature: _____
	Submitted by (print): <b>Natier Patel</b> Date/Time: <b>10-4-12 1445</b> Signature: <i>[Signature]</i>	Received by (print): _____ Date/Time: _____ Signature: _____
	Sample Disposal: _____ Return to Client: _____ Lab Disposal: _____	Received by Laboratory: _____ Date/Time: _____ Signature: _____

LABORATORY USE ONLY

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

# Chain of Custody and Analytical Request Record

PLEASE PRINT (Provide as much information as possible.)

Company Name: <b>MWH</b>	Project Name, PWS, Permit, Etc. <b>NEIR EDRA</b>	Sample Origin State: <b>NM</b>	EPA/State Compliance Yes <input type="checkbox"/> No <input type="checkbox"/>
Report Mail Address: <b>PO Box 774018 Sloanburg Springs, CO 80417</b>	Contact Name: <b>Toby Larson</b> Phone/Fax: <b>970-871-4361</b> <b>970-871-9848</b>	Email: <b>Toby.Larson@energylab.com</b>	Sampler (Please Print) <b>Natwar Patel</b>
Invoice Address: <b>MWH Bloomfield, CO</b>	Invoice Contact & Phone: <b>Toby Larson 970-871-4361</b>	Purchase Order:	Quota/Bottle Order:

Special Report/Formats:

DW                       EDD/EDT (Electronic Data)  
 POTW/WWTP         Format: \_\_\_\_\_  
 State: \_\_\_\_\_     LEVEL IV  
 Other: \_\_\_\_\_      NELAC

ANALYSIS REQUESTED

Number of Containers: \_\_\_\_\_  
 Sample Type:  A  W  S  V  B  O  W  
 Air  Water  Soils  Sediments  
 Vegetation  Biomass  Other  
 DW - Drinking Water

SEE ATTACHED

Standard Turnaround (TAT)

**RUSH**

Contact ELI prior to RUSH sample submittal for changes and scheduling - See Instruction Page

Comments:

Shipped by \_\_\_\_\_

Order No. \_\_\_\_\_

Receipt Temp. \_\_\_\_\_ °C

On Ice Y N

Container Seal Y N

On Bottle Y N

On Cooler Y N

Initial Y N

Signature Y N

Batch Y N

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	ANALYSIS REQUESTED	STATUS
<sup>1</sup> EDC-01, 0', @ 70'	10-2-12	1317	S	✓	✓
<sup>2</sup> EDC-03, 100', @ 7.5'	"	1327	S	✓	✓
<sup>3</sup> EDC-07, 300', @ 50'	"	1354	S	✓	✓
<sup>4</sup> EDC-09, 400', @ 55'	"	1402	S	✓	✓
<sup>5</sup> EDC-11, 500', @ 24'	10-3-12	0930	S	✓	✓
<sup>6</sup> EDC-13, 600', @ 3.8'	"	0935	S	✓	✓
<sup>7</sup> EDC-15, 700', @ 3.0'	10-4-12	1220	S	✓	✓
<sup>8</sup> EDC-17, 800', @ 7.0'	"	1326	S	✓	✓
<sup>9</sup> EDC-19, 900', @ 3.9'	"	1328	S	✓	✓
<sup>10</sup> EDC-21, 1000', @ 40'	"	1541	S	✓	✓

<b>Custody Record MUST be Signed</b>	Requested by (print): <b>Natwar Patel</b> Date/Time: <b>10-9-12 1:10</b> Signature: <i>[Signature]</i>	Received by (print): _____      Date/Time: _____      Signature: _____
	Requested by (print): _____      Date/Time: _____      Signature: _____	Received by (print): _____      Date/Time: _____      Signature: _____
	Requested by Laboratory: _____      Date/Time: _____      Signature: _____	Received by Laboratory: _____      Date/Time: _____      Signature: _____

LABORATORY USE ONLY

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# Chain of Custody and Analytical Request Record

PLEASE PRINT (Provide as much information as possible.)

Company Name: <b>MWH</b>	Project Name, PWS, Permit, Etc.	Sample Origin State:	EPA/State Compliance Yes <input type="checkbox"/> No <input type="checkbox"/>
Report Mail Address: <b>P.O. Box 774018 Steamboat Springs CO 80477</b>	Contact Name: <b>Toby Leeson</b>	Phone/Fax: <b>970-871-4361</b>	Sampler: (Please Print) <b>Natver Patel</b>
Invoice Address: <b>MWH, Blomfield, CO</b>	Invoice Contact & Phone: <b>Toby Leeson, 970-871-4361</b>	Email: <b>Tleeson@MWH.com</b>	Quote/Bottle Order:
		Purchase Order:	

Special Report/Formats:

DW  
 POTW/WWTP  
 State: \_\_\_\_\_  
 Other: \_\_\_\_\_

EDD/EDT (Electronic Data) Format: \_\_\_\_\_  
 LEVEL IV  
 NELAC

ANALYSIS REQUESTED

SEE ATTACHED

Standard Turnaround (TAT)

**R  
U  
S  
H**

Number of Containers  
Sample Type: **AW 3 V B O DW**  
By Water Solids  
Vegetation Bioassay Other  
DW - Drinking Water

**Re-226, UVA 8041**

Contact ELI prior to RUSH sample submittal for charges and scheduling - See instruction Page

Comments:

Shipped by \_\_\_\_\_

Container Size \_\_\_\_\_

Sample Temp \_\_\_\_\_ °C

On Ice Y N

Quality Seal  
On Bottle Y N  
On Cooler Y N

Label Y N

Signature Y N

Batch \_\_\_\_\_

LABORATORY USE ONLY

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	
<sup>1</sup> EDC-051	10-4-12	1600	S	✓
<sup>2</sup> EDC-23, 110', @ 2'	10-5-12	1021	S	✓
<sup>3</sup> EDC-29, 140' @ 2.5'	"	1115	S	✓
<sup>4</sup> EDC-05, 300', @ 6'	"	1435	S	✓
<sup>5</sup> EDC-D52	"	1450	S	✓
<sup>6</sup> EDC-25, 120', @ 4.5'	10-8-12	1040	S	✓
<sup>7</sup> EDC-27, 140' @ 6.5'	"	1254	S	✓

<b>Custody Record MUST be Signed</b>	Subquipped to (print): <b>Natver Patel</b>	Date/Time: <b>10-9-12 @ 1400</b>	Signature: <i>[Signature]</i>	Received by (print):	Date/Time:	Signature:
	Subquipped to (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
	Sample Disposal: Return to Client	Lab Disposal:	Received by Laboratory:	Date/Time:	Signature:	

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PLEASE PRINT- Provide as much information as possible.

Company Name: <b>MWH</b>	Project Name, PWS, Permit, Etc. <b>NECR LDRA</b>	Sample Origin State: <b>NM</b>	EPA/State Compliance: Yes <input type="checkbox"/> No <input type="checkbox"/>
Report Mail Address: <b>Toby Leeson PO BOX 774018 Steamboat Springs, CO 80477</b>	Contact Name: <b>Toby Leeson,</b>	Phone/Fax: <b>970-871-4361</b>	Email: <b>Toby.Leeson@MWHglobal.com</b>
Invoice Address: <b>MWH, Breonfield, CO</b>	Invoice Contact & Phone: <b>Toby Leeson, 970-871-4361</b>	Purchase Order:	Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:				<b>ANALYSIS REQUESTED</b>										<b>R U S H</b>	Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page	Shipped by:																																																																																																																																			
<input type="checkbox"/> DW <input type="checkbox"/> A2LA <input type="checkbox"/> GSA <input type="checkbox"/> EDD/EDT (Electronic Data) <input type="checkbox"/> POTW/WWTP <b>Format:</b> _____ <input type="checkbox"/> State: _____ <input type="checkbox"/> LEVEL IV <input type="checkbox"/> Other: _____ <input type="checkbox"/> NELAC				<b>SEE ATTACHED</b> Normal Turnaround (TAT)	<b>LABORATORY USE ONLY</b>										Comments:	Receipt Temp _____ °C																																																																																																																																			
<table border="1"> <thead> <tr> <th>SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)</th> <th>Collection Date</th> <th>Collection Time</th> <th>MATRIX</th> <th>Number of Containers</th> <th>Sample Type: A W S V B O</th> <th>Air</th> <th>Water</th> <th>Soils/Solids</th> <th>Vegetation</th> <th>Bioassay</th> <th>Other</th> </tr> </thead> <tbody> <tr> <td>1 <b>SSPT-030 Z-6</b></td> <td><b>10-17-12</b></td> <td><b>1122</b></td> <td><b>S</b></td> <td><b>5</b></td> <td><b>✓</b></td> <td><b>RA-226</b></td> <td><b>EPA</b></td> <td><b>900-1</b></td> <td></td> <td></td> <td></td> </tr> <tr><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>8</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>9</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>10</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>															SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Number of Containers	Sample Type: A W S V B O	Air	Water	Soils/Solids	Vegetation	Bioassay	Other	1 <b>SSPT-030 Z-6</b>	<b>10-17-12</b>	<b>1122</b>	<b>S</b>	<b>5</b>	<b>✓</b>	<b>RA-226</b>	<b>EPA</b>	<b>900-1</b>				2												3												4												5												6												7												8												9												10												On Ice: Yes No
															SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Number of Containers	Sample Type: A W S V B O	Air	Water	Soils/Solids	Vegetation	Bioassay	Other																																																																																																																									
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Invoice:                      Date: 14Sep12  
 Customer: 37727                      Wgt: 5.00 LBS  
 Dept:                      COD:                      0.00  
 PO Number:                      DV:                      0.00  
 SHIPPING: 0.00  
 SPECIAL: 0.00  
 HANDLING: 0.00  
 TOTAL: 0.00

Svcs: GND PPD RMGR  
 TRCK: 369201362571782

<b>Custody Record MUST be Signed</b>	Relinquished by (print): <b>NATVER PATEL</b>	Date/Time: <b>10-23-12 @ 1400</b>	Signature: <i>[Signature]</i>	Received by (print):	Date/Time:	Signature:
	Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
	Sample Disposal: Return to Client: _____	Lab Disposal: _____	Received by Laboratory:	Date/Time:	Signature:	



# Chain of Custody and Analytical Request Record

PLEASE PRINT- Provide as much information as possible.

Company Name: <b>MWH</b>	Project Name, PWS, Permit, Etc. <b>NECR EDRA</b>	Sample Origin State: <b>NM</b>	EPA/State Compliance: Yes <input type="checkbox"/> No <input type="checkbox"/>
Report Mail Address: <b>PO Box 774018 Steamboat Springs, CO 80477</b>	Contact Name: <b>Toby Leeson, 970-871-4361 970-879-9048</b>	Phone/Fax: <b>970-871-4361 970-879-9048</b>	Email: <b>Toby.Leeson@mwhglobal.com</b>
Invoice Address: <b>MWH, Broomfield, CO</b>	Invoice Contact & Phone: <b>Toby Leeson, 970-871-4361</b>	Purchase Order:	Sampler: (Please Print) <b>Natver Patel</b>
Special Report/Formats – ELI must be notified prior to sample submittal for the following:		Quote/Bottle Order:	

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

Number of Containers Sample Type: A W S V B O Air Water Solids/Solids Vegetation Bioassay Other	<b>ANALYSIS REQUESTED</b>										<b>R U S H</b>	Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page  Comments:	Shipped by:
	<b>SEE ATTACHED</b> Normal Turnaround (TAT)												Cooler ID(s):
													Receipt Temp _____ °C
													On Ice: Yes <input type="checkbox"/> No <input type="checkbox"/>
													Custody Seal Y N
													Intact Y N
													Signature Match Y N

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX							
1 EDC-01-NSW	10-3-12	1100	S	✓						
2 EDC-03-NSW	"	1115	S	✓						
3 EDC-07-SSW	"	1127	S	✓						
4 EDC-053	"	1130	S	✓						
5 EDC-09-SSW	"	1145	S	✓						
6 EDC-11-SSW	"	1200	S	✓						
7 EDC-13-SSW	"	1217	S	✓						
8 EDC-15-NSW	10-4-12	1310	S	✓						
9 EDC-17-NSW	"	1327	S	✓						
10 EDC-19-NSW	"	1420	S	✓						

LABORATORY USE ONLY

<b>Custody Record MUST be Signed</b>	Relinquished by (print): <b>Natver Patel</b>	Date/Time: <b>11-27-12 01400</b>	Signature: <i>[Signature]</i>	Received by (print):	Date/Time:	Signature:
	Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
	Sample Disposal: _____	Return to Client: _____	Lab Disposal: _____	Received by Laboratory:	Date/Time:	Signature:

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# Chain of Custody and Analytical Request Record

PLEASE PRINT- Provide as much information as possible.

Company Name: <b>MWH</b>	Project Name, PWS, Permit, Etc. <b>NECR EDRA</b>	Sample Origin State: <b>NM</b>	EPA/State Compliance: Yes <input type="checkbox"/> No <input type="checkbox"/>
Report Mail Address: <b>PO Box 774018 Steamboat Springs, CO 80477</b>	Contact Name: <b>Toby Leeson</b> , Phone/Fax: <b>970-871-4361</b>	Email: <b>Toby.Leeson@mwhglobal.com</b>	Sampler: (Please Print) <b>Natver Patel</b>
Invoice Address: <b>MWH, Broomfield, CO</b>	Invoice Contact & Phone: <b>Toby Leeson 970-871-4361</b>	Purchase Order:	Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:				ANALYSIS REQUESTED	SEE ATTACHED	Normal Turnaround (TAT)	RUSH	Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page	Shipped by:
<input type="checkbox"/> DW <input type="checkbox"/> A2LA <input type="checkbox"/> GSA <input type="checkbox"/> EDD/EDT (Electronic Data) <input type="checkbox"/> POTW/WWTP <b>Format:</b> _____ <input type="checkbox"/> State: _____ <input type="checkbox"/> LEVEL IV <input type="checkbox"/> Other: _____ <input type="checkbox"/> NELAC								Number of Containers Sample Type: A W S V B O Air Water Soils/Solids Vegetation Bioassay Other	Comments:
SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Ra-226, EPA 901.1  LABORATORY USE ONLY					Custody Seal Y N
1 EDC-21-NSW	10-4-12	1626	S						Y N
2 EDC-23-NSW	10-8-12	0853	S						Y N
3 EDC-29-NSW	10-8-12	0912	S						Y N
4 EDC-054	11	0920	S						Y N
5 EDC-05-NSW	11	0938	S						Y N
6 EDC-25-NSW	11	1140	S						Y N
7 EDC-27-NSW	11	1320	S						Y N
8									
9									
10									

<b>Custody Record MUST be Signed</b>	Relinquished by (print): <b>NATVER PATEL</b> Date/Time: <b>11-27-12 @ 1400</b> Signature: <i>[Signature]</i>	Received by (print): _____      Date/Time: _____      Signature: _____
	Relinquished by (print): _____      Date/Time: _____      Signature: _____	Received by (print): _____      Date/Time: _____      Signature: _____
	Sample Disposal: Return to Client: _____      Lab Disposal: _____	Received by Laboratory: _____      Date/Time: _____      Signature: _____

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# Chain of Custody and Analytical Request Record

**PLEASE PRINT (Provide as much information as possible.)**

Company Name: <i>MWH</i>	Project Name, PWS, Permit, Etc. <i>NEIR EDRA</i>	Sample Origin State: <i>NM</i>	EPA/State Compliance: Yes <input type="checkbox"/> No <input type="checkbox"/>
Report Mail Address: <i>PO Box 774018 Steamboat Springs, CO 80477</i>	Contact Name: <i>Toby Leason</i>	Phone/Fax: <i>970-871-4361</i>	Email: <i>toby.leason@mwhglobal.com</i>
Invoice Address: <i>MWA Broomfield, CO</i>	Invoice Contact & Phone: <i>Toby Leason, 970-871-4361</i>	Purchase Order:	Quote/Bottle Order:

Special Report/Formats:

DW  
 POTW/WWTP  
 State: \_\_\_\_\_  
 Other: \_\_\_\_\_

EDD/EDT (Electronic Data)  
 Format: \_\_\_\_\_  
 LEVEL IV  
 NELAC

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

*Ro-226, EPA 9061*

**ANALYSIS REQUESTED**

SEE ATTACHED

Standard Turnaround (TAT)

**RUSH**

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

Comments:

Shipped by:

Cooler ID(s):

Receipt Temp \_\_\_\_\_ °C

On Ice: Y N

Custody Seal

On Bottle Y N

On Cooler Y N

Intact Y N

Signature Match Y N

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX															
<i>SSPT-033R</i>	<i>12-4-12</i>	<i>1026</i>	<i>S</i>	<i>✓</i>														

Ref: 37727  
Dep:

Date: 14Sep12  
Wgt: 5.00 LBS

SHIPPING: 0.00  
SPECIAL: 0.00  
HANDLING: 0.00  
TOTAL: 0.00

Svcs: PRIORITY OVERNIGHT  
TRCK: 4593 1687 2321

LABORATORY USE ONLY

<b>Custody Record MUST be Signed</b>	Relinquished by (print): <i>Natver Patel</i>	Date/Time: <i>1415</i>	Signature: <i>Natver Patel</i>	Received by (print):	Date/Time:	Signature:
	Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
	Sample Disposal: Return to Client: _____	Lab Disposal: _____	Received by Laboratory:	Date/Time:	Signature:	

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**Appendix F**  
**Field Soil Sample Gamma Radiation Screening Forms**



AVM Environmental Services, Inc.  
Field Soil Sample Gamma Radiation Screening Form  
NECR EDRA

Instrumentation : Scaler/Ratemeter L2221 # 68772 Detector L4420 # 295573  
Instrument Calibration Date: 4-12-12 Instrument Function Check Performed: Yes

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 EDRA East Drainage Channel Exc.

Date/Time	Soil Sample ID	609 (559-669) KeV Gamma Radiation Counts CPSM	Comments
10-2-12 @ 1255	Blank	290	
10-2-12 @ 1303	Ref Soil 2.0 pits	2103 2082	
10-2-12 @ 1320	EDC-01, 0' @ 7.0' depth 10-2-12 @ 1317	1330	2.0 pits to lab
10-2-12 @ 1327	EDC-02, 50' @ 6.1' d 10-2-12 @ 1321	1663	2.0 pits
10-2-12 @ 1335	EDC-03, 100' @ 7.5' d 10-2-12 @ 1327	1357	2.0 pits to lab
10-2-12 @ 1343	EDC-04, 150' @ 5.5' d 10-2-12 @ 1336	3033	> 2.0 pits
10-2-12 @ 1351	EDC-05, 200' @ 5.0' d 10-2-12 @ 1347	3945	> 2.0 pits
10-2-12 @ 1400	EDC-07, 300' @ 5.0' d 10-2-12 @ 1354	1696	2.0 pits To Lab
10-2-12 @ 1409	EDC-08, 350' @ 5.5' d 10-2-12 @ 1355	1662	2.0 pits
10-2-12 @ 1417	EDC-09, 400' @ 5.5' d 10-2-12 @ 1402	1487	2.0 pits To Lab
10-2-12 @ 1425	EDC-10, 450' @ 3.5' d 10-2-12 @ 1407	1895	2.0 pits

Technician Signature [Signature] Reviewed by [Signature]

AVM Environmental Services, Inc.  
Field Soil Sample Gamma Radiation Screening Form  
NECR EDRA

Instrumentation : Scaler/Ratemeter L2221 # 68792 Detector L44-20 # 295573

Instrument Calibration Date: 4-12-12 Instrument Function Check Performed: Yes

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 EDRA East Drainage Channel Excavation

Date/Time	Soil Sample ID	609 (559-669) Kev Gamma Radiation Counts CPSM	Comments
10-3-12 0930	Blank	310 299	
10-3-12 0936	Referon Soil 2.0 pCi/g	2126 2099	
10-3-12 0950	EDC-11, 500' @ 2.8' d 10-3-12 @ 0920	1887	L2.0 pCi/g To Lab
10-3-12 0957	EDC-12, 550' @ 2.8' d 10-3-12 @ 0930	1659	L2.0 pCi/g
10-3-12 1005	EDC-13, 600' @ 3.8' d 10-3-12 @ 0935	1685	L2.0 pCi/g To Lab
10-3-12 1013	EDC-14, 650' @ 4.0' d 10-3-12 @ 0940	1444	L2.0 pCi/g
10-3-12 11340	EDC-01-NSW, 0' North Side Wall 10-3-12 @ 1100	1405	L2.0 pCi/g To Lab
10-3-12 11349	EDC-02-SSW, South Side Wall 50' 10-3-12 @ 1105	1598	L2.0 pCi/g
10-3-12 11357	EDC-03-NSW, N Side Wall 100' 10-3-12 @ 1115	1488	L2.0 pCi/g To Lab
10-3-12 11409	EDC-07-SSW, S Side Wall, 300' 10-3-12 @ 1127	1665	L2.0 pCi/g To Lab
10-3-12 11420	EDC-08-SSW, S Side wall, 350' 10-3-12 @ 1135	1516	L2.0 pCi/g
10-3-12 11428	EDC-09-SSW, S side wall, 400' 10-3-12 @ 1145	1529	L2.0 pCi/g To Lab
10-3-12 11438	EDC-10-SSW, S Side wall, 450' 10-3-12 @ 1152	1908	L2.0 pCi/g
10-3-12 11446	EDC-11-SSW, S side wall, 500' 10-3-12 @ 1200	1919	L2.0 pCi/g To Lab
10-3-12 11456	EDC-12-SSW, S side wall, 550' 10-3-12 @ 1208	1758	L2.0 pCi/g
10-3-12 11507	EDC-13-SSW, S. Side wall, 600' 10-3-13 @ 1217	1601	L2.0 pCi/g To Lab
10-3-12 11515	EDC-14-SSW, S Side wall, 650' 10-3-12 @ 1225	1537	L2.0 pCi/g

Technician Signature

*[Handwritten Signature]*

Reviewed by

*[Handwritten Signature]*

AVM Environmental Services, Inc.  
Field Soil Sample Gamma Radiation Screening Form  
NECR EDRA

Instrumentation : Scaler/Ratemeter L2221 # C8792, Detector L44-20 # 295573

Instrument Calibration Date: 4-12-12, Instrument Function Check Performed: YES

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

Survey Area/Unit Description East Drainage Channel Excavation

Date/Time	Soil Sample ID	609 (559-669) Kev Gamma Radiation Counts CPSM	Comments
10-4-12 @ 1235	Blank	314 305	
10-4-12 @ 1241	Reference Soil 2.0 plits	2108 2093	
10-4-12 @ 1248	EDC-15, 700' @ 3.0' 10-4-12 @ 1230	1560	L 2.0 plits To Lab
10-4-12 @ 1255	EDC-16, 750' @ 4.0' 10-4-12 @ 1230	1400	L 2.0 plits
10-4-12 @ 1340	EDC-17, 800' @ 7.0' depth 10-4-12 @ 1326	1908	L 2.0 plits To Lab
10-4-12 @ 1349	EDC-19, 960' @ 3.9' 10-4-12 @ 1328	1854	L 2.0 plits To Lab
10-4-12 @ 1410	EDC-20, 950' @ 3.5' 10-4-12 @ 1355	1759	L 2.0 plits
10-4-12 @ 1459	EDC-18, 850' @ 8.0' depth 10-4-12 @ 1449	1408	L 2.0 plits
10-4-12 @ 1553	EDC-21, 1000' @ 4.0' 10-4-12 @ 1541	1637	L 2.0 plits To Lab.
10-5-12 @ 0841	Blank	291	
10-5-12 @ 0850	Reference Soil 2.0 plits	2218 2167	
10-5-12 @ 900	EDC-15-NSW, North side wall, 700' 10-4-12 @ 1310	1520	L 2.0 plits To Lab
10-5-12 @ 0910	EDC-16-SSW, South side wall, 750' 10-4-12 @ 1317	1391	L 2.0 plits
10-5-12 @ 0919	EDC-17-NSW, North side wall, 800' 10-4-12 @ 1327	1814	L 2.0 plits To Lab
10-5-12 @ 0930	EDC-19-NSW, North side wall, 900' 10-4-12 @ <del>1428</del> 1420	1796	L 2.0 plits To Lab
10-5-12 @ 0940	EDC-20-SSW, South side wall, 950' 10-4-12 @ 1428	1711	L 2.0 plits
10-5-12 @ 0949	EDC-18-SSW, South side wall, 850' 10-4-12 @ 1610	1405	L 2.0 plits
10-5-12 @ 0955	EDC-21-NSW, North side wall, 1000' 10-4-12 @ 1626	1578	L 2.0 plits To Lab.

Technician Signature

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Reviewed by

*[Handwritten Signature]*

AVM Environmental Services, Inc.  
Field Soil Sample Gamma Radiation Screening Form  
NECR EDRA

Instrumentation : Scaler/Ratemeter L2221 # 68742, Detector L2221-L4420 # 295573

Instrument Calibration Date: 4-12-12, Instrument Function Check Performed: Yes

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

Survey Area/Unit Description East Drainage Channel Excavation

Date/Time	Soil Sample ID	609 (559-669) Kev Gamma Radiation Counts CPSM	Comments
10-6-12 @0915	Blank	298 312	
10-6-12 @0926	Reference Soil 2.0 plits	2209 2152	
10-6-12 @0937	EDC-22, 1050' @ 2.5' d. 10-5-12 @ 1010	2102	≈ 2.0 plits
10-6-12 @0944	EDC-23, 1100' @ 2.8' d. 10-5-12 @ 1021	1752	< 2.0 plits To Lab
10-6-12 @0955	EDC-24, 1150' @ 2.5' d. 10-5-12 @ 1030	1801	< 2.0 plits
10-6-12 @1002	EDC-25, 1200' @ 4.0' d. 10-5-12 @ 1040	3573	> 2.0 plits To Lab
10-6-12 @1010	EDC-26, 1250' @ 3.0' d. 10-5-12 @ 1047	5318	> 2.0 plits
10-6-12 @1018	EDC-27, 1300' @ 3.0' d. 10-5-12 @ 1055	5863	> 2.0 plits <del>To Lab</del> <sup>NO</sup>
10-6-12 @1025	EDC-28, 1350' @ 2.5' d. 10-5-12 @ 1103	4271	> 2.0 plits
10-6-12 @1033	EDC-29, 1400' @ 2.5' d. 10-5-12 @ 1115	1881	< 2.0 plits To Lab
10-6-12 @1041	EDC-04, 150' Re-ex. to 65' 10-5-12 @ 1418	1701	< 2.0 plits
10-6-12 @1050	EDC-05, 200' Re-ex. to 60' 10-5-12 @ 1435	1503	< 2.0 plits To Lab
10-6-12 @1059	EDC-06, 250' @ 4.5' d. 10-5-12 @ 1442	1703	< 2.0 plits
10-8-12 @0942	Blank	307	
10-8-12 @0950	Reference Soil 2.0 plits	2502 <sup>up</sup> 2411	
10-8-12 @0958	EDC-22-SSW, South Side Wall, 1050' 10-8-12 @ 0845	1722	< 2.0 plits
10-8-12 @1006	EDC-23-NSW, North Side Wall, 1100' 10-8-12 @ 0853	1650	< 2.0 plits To Lab
10-8-12 @1015	EDC-24-SSW, South Side Wall, 1150' 10-8-12 @ 0900	1648	< 2.0 plits

Technician Signature [Signature]

Reviewed by [Signature]

**AVM Environmental Services, Inc.**  
**Field Soil Sample Gamma Radiation Screening Form**  
**NECR EDRA**

Instrumentation : Scaler/Ratemeter L2221 # 68792, Detector L44-20 # 295573

Instrument Calibration Date: 4-12-12, Instrument Function Check Performed: YES

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

Survey Area/Unit Description East Drainage Channel Excavation

Run Date/Time	Soil Sample ID	609 (559-669) Kev Gamma Radiation Counts CPSM	Comments
10-8-12 @ 1023	EDC-29-NSW, North Side Wall, 1400' 10-8-12 @ 0912	1701	< 2.0 pCi/g To Lab
10-8-12 @ 1105	EDC-25, 1200' @ 4.5'd 10-8-12 @ 1040	2103	< 2.0 pCi/g To Lab
10-8-12 @ 1112	EDC-26, 1250' @ 4.0'd 10-8-12 @ 1045	2389	< 2.0 pCi/g
10-8-12 @ 1120	EDC-27, 1300' @ 5.5'd 10-8-12 @ 1050	4171	> 2.0 pCi/g
10-8-12 @ 1128	EDC-28, 1350' @ 5.0'd 10-8-12 @ 1057	2105	< 2.0 pCi/g
10-8-12 @ 1211	EDC-25-NSW, North Side Wall, 1200' 10-8-12 @ 1140	1902	< 2.0 pCi/g To Lab
10-8-12 @ 1220	EDC-26-SSW, South Side Wall, 1250' 10-8-12 @ 1150	1890	< 2.0 pCi/g
10-8-12 1231	EDC-28-SSW, South Side Wall, 1300' 10-8-12 @ 1150	1909	< 2.0 pCi/g
10-8-12 @ 1240	EDC-04-SSW, South Side Wall, 150' 10-8-12 @ 0930	1560	< 2.0 pCi/g
10-8-12 @ 1248	EDC-05-NSW, North Side Wall, 200' 10-8-12 @ 0938	1448	< 2.0 pCi/g To Lab
10-8-12 @ 1255	EDC-06-SSW, South Side Wall, 250' 10-8-12 @ 0945	1662	< 2.0 pCi/g
10-8-12 @ 1304	EDC-27, 1300' Re-exc to 6.5'd 10-8-12 @ 1254	2107	< 2.0 pCi/g To Lab
10-8-12 @ 1330	EDC-27-NSW, North Side Wall, 1300' 10-8-12 @ 1320	2017	< 2.0 pCi/g To Lab
10-8-12 @ 1337	Reference Soil	2441	

Technician Signature

*[Handwritten Signature]*

Reviewed by

*[Handwritten Signature]*

**Appendix G**  
**80-ft Triangular Grid Status Static Gamma Radiation Survey Forms**

00-11 Triangular Grid Status Static Gamma Radiation Survey  
NECR EDRA

Instrumentation: Scaler/Ratemeter L2241-2 # 287029, Detector SPA-3, # 408522-30  
 Instrument Calibration Date: 4-12-12, Instrument Daily Function Check Performed: Yes  
 2"x2" NaI Detector Collimated  Yes or  No.

Survey Date/Time	Static Survey Point ID	Coordinates, NAD83, NM West, feet		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
10-5-12	1	1,696,423.4	2,524,250.6	4403	
10-5-12	2	1,696,492.7	2,524,370.6	4947	
10-5-12	3	1,696,492.7	2,524,290.6	4316	
10-5-12	4	1,696,492.7	2,524,210.6	5414	5' East of Drainage
10-5-12	5	1,696,562.0	2,524,250.6	4489	
10-5-12	6	1,696,562.0	2,524,330.6	4728	
10-5-12	7	1,696,562.0	2,524,410.6	4513	
10-5-12	8	1,696,631.3	2,525,330.6	4517	Slope of Drainage channel
10-5-12	9	1,696,631.3	2,524,610.6	3780	
10-5-12	10	1,696,631.3	2,524,530.6	3679	
10-5-12	11	1,696,631.3	2,524,450.6	4575	Soil Sample
10-5-12	12	1,696,631.3	2,524,370.6	4884	
10-5-12	13	1,696,631.3	2,524,290.6	4629	
10-5-12	14	1,696,631.3	2,524,210.6	5039	
10-5-12	15	1,696,700.5	2,524,250.6	4947	
10-5-12	16	1,696,700.5	2,524,330.6	4433	
10-5-12	17	1,696,700.5	2,524,410.6	4939	
10-5-12	18	1,696,700.5	2,524,490.6	4302	
10-5-12	19	1,696,700.5	2,524,570.6	4417	
10-5-12	20	1,696,700.5	2,524,650.6	4673	
10-5-12	21	1,696,700.5	2,524,730.6	3906	
10-5-12	22	1,696,700.5	2,524,810.6	4997	Soil Sample
10-5-12	23	1,696,700.5	2,525,290.6	4514	
10-5-12	24	1,696,769.8	2,525,170.6	4366	
10-5-12	25	1,696,769.8	2,524,850.6	5061	Ditch Bank - Took Sample 5' south
10-5-12	26	1,696,769.8	2,524,770.6	<del>3916</del> 4657	
10-5-12	27	1,696,769.8	2,524,690.6	4665	
10-5-12	28	1,696,769.8	2,524,610.6	4090	
10-5-12	29	1,696,769.8	2,524,530.6	4311	
10-5-12	30	1,696,769.8	2,524,450.6	4745	
10-5-12	31	1,696,769.8	2,524,370.6	5047	
10-5-12	32	1,696,769.8	2,524,290.6	4122	
10-5-12	33	1,696,769.8	2,524,210.6	4997	Soil Sample
10-5-12	34	1,696,839.1	2,524,250.6	3728	
10-5-12	35	1,696,839.1	2,524,330.6	3690	

**80-ft Triangular Grid Status Static Gamma Radiation Survey  
NECR EDRA**

Station: Scaler/Ratemeter L2241-2 # 287029, Detector SPA-3 # 408522-36  
 Instrument Calibration Date: 4-12-12, Instrument Daily Function Check Performed: Yes  
 NaI Detector Collimated  Yes or  No.

Survey Date/Time	Static Survey Point ID	Coordinates, NAD83, NM West, feet		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
10-5-12	36	1,696,839.1	2,524,410.6	4507	
10-5-12	37	1,696,839.1	2,524,490.6	4312	
10-3-12	38	1,696,839.1	2,524,570.6	4368	
10-3-12	39	1,696,839.1	2,524,650.6	4147	
10-3-12	40	1,696,839.1	2,524,730.6	4203	
10-3-12	41	1,696,839.1	2,524,810.6	4424	
10-3-12	42	1,696,839.1	2,524,890.6	4553	
10-5-12	43	1,696,839.1	2,524,970.6	4614	On Slope of Channel
10-5-12	44	1,696,839.1	2,525,050.6	4661	
10-5-12	45	1,696,839.1	2,525,130.6	4452	Soil Sample at RA/QC Dup DS2
10-3-12	46	1,696,908.4	2,524,930.6	4326	
10-3-12	47	1,696,908.4	2,524,850.6	4240	
10-3-12	48	1,696,908.4	2,524,770.6	4067	
10-3-12	49	1,696,908.4	2,524,690.6	4159	
10-3-12	50	1,696,908.4	2,524,610.6	4579	
10-5-12	51	1,696,908.4	2,524,530.6	4386	
10-5-12	52	1,696,908.4	2,524,450.6	4506	
10-5-12	53	1,696,908.4	2,524,290.6	4210	
10-3-12	54	1,696,977.7	2,524,410.6	4775	
10-3-12	55	1,696,977.7	2,524,490.6	<del>4394</del> 4394	Soil Sample at RA/QC Dup DS2
10-3-12	56	1,696,977.7	2,524,570.6	4506	
10-3-12	57	1,696,977.7	2,524,650.6	4330	
10-3-12	58	1,696,977.7	2,524,730.6	4493	
10-3-12	59	1,696,977.7	2,524,810.6	4588	
10-3-12	60	1,696,977.7	2,524,890.6	4335	
10-3-12	61	1,696,977.7	2,524,970.6	4080	
10-3-12	62	1,696,977.7	2,525,050.6	4131	
10-2-12	63	1,697,047.0	2,525,250.6	4766	
10-3-12	64	1,697,047.0	2,525,170.6	5066	
10-3-12	65	1,697,047.0	2,525,090.6	4604	5' S of Point. Arroyo Slope
10-3-12	66	1,697,047.0	2,525,010.6	4573	Soil Sample
10-3-12	67	1,697,047.0	2,524,930.6	4449	
10-3-12	68	1,697,047.0	2,524,850.6	4896	
10-3-12	69	1,697,047.0	2,524,770.6	4607	
10-3-12	70	1,697,047.0	2,524,690.6	4496	

Page 2



**80-ft Triangular Grid Status Static Gamma Radiation Survey  
NECR EDRA**

Instrumentation : Scaler/Ratemeter L2241-2 # 287024, Detector SPA-3 # 408522-30  
 Instrument Calibration Date: 9-12-12, Instrument Daily Function Check Performed: Y  
 2"x2" NaI Detector Collimated  Yes or  No.

Survey Date/Time	Static Survey Point ID	Coordinates, NAD83, NM West, feet		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
10-3-12	71	1,697,047.0	2,524,610.6	4939	
10-3-12	72	1,697,047.0	2,524,530.6	4472	
10-3-12	73	1,697,047.0	2,524,450.6	4599	
10-3-12	74	1,697,047.0	2,524,370.6	4773	Surface Sample
10-3-12	75	1,697,047.0	2,524,290.6	4176	
10-3-12	76	1,697,116.2	2,524,250.6	4370	
10-3-12	77	1,697,116.2	2,524,330.6	4698	Soil Sample
10-3-12	78	1,697,116.2	2,524,410.6	4708	
10-3-12	79	1,697,116.2	2,524,490.6	4587	
10-3-12	80	1,697,116.2	2,524,570.6	4528	
10-3-12	81	1,697,116.2	2,524,650.6	5220	1' S° From Point
10-3-12	82	1,697,116.2	2,524,730.6	5463	Point on Haul Road
10-3-12	83	1,697,116.2	2,524,810.6	5095	2' S° From the Point
10-3-12	84	1,697,116.2	2,524,890.6	5419	
10-3-12	85	1,697,116.2	2,524,970.6	5372	
10-3-12	86	1,697,116.2	2,525,050.6	5095	Arroyo Bank Slope
10-3-12	87	1,697,116.2	2,525,130.6	5046	
10-2-12	88	1,697,116.2	2,525,210.6	4982	Soil Sample
10-2-12	89	1,697,185.5	2,525,170.6	4405	
10-2-12	90	1,697,185.5	2,525,090.6	4408	
10-2-12	91	1,697,185.5	2,525,010.6	5184	
10-2-12	92	1,697,185.5	2,524,930.6	4840	
10-2-12	93	1,697,185.5	2,524,850.6	4788	
10-2-12	94	1,697,185.5	2,524,770.6	4755	
10-2-12	95	1,697,185.5	2,524,690.6	5043	
10-2-12	96	1,697,185.5	2,524,610.6	4581	
10-2-12	97	1,697,185.5	2,524,530.6	4628	
10-2-12	98	1,697,185.5	2,524,450.6	4646	
10-2-12	99	1,697,185.5	2,524,370.6	4984	Soil Sample
10-2-12	100	1,697,185.5	2,524,290.6	4618	
10-2-12	101	1,697,185.5	2,524,210.6	5000	
10-2-12	102	1,697,185.5	2,524,130.6	5190	
10-2-12	103	1,697,254.8	2,524,090.6	4619	
10-2-12	104	1,697,254.8	2,524,170.6	4403	
10-2-12	105	1,697,254.8	2,524,250.6	4389	

**80-ft Triangular Grid Status Static Gamma Radiation Survey  
NECR EDRA**

Instrumentation : Scaler/Ratemeter 12241-2 #287029 , Detector SPA-3 #30 (408522)

Instrument Calibration Date: 4-12-12 , Instrument Daily Function Check Performed: Yes

2"x2" NaI Detector Collimated  Yes or  No.

Survey Date/Time	Static Survey Point ID	Coordinates, NAD83, NM West, feet		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
10-2-12	106	1,697,254.8	2,524,330.6	4438	
10-2-12	107	1,697,254.8	2,524,410.6	4865	
10-2-12	108	1,697,254.8	2,524,490.6	4666	
10-2-12	109	1,697,254.8	2,524,570.6	5175	
10-2-12	110	1,697,254.8	2,524,650.6	5211	Soil Sample
10-2-12	111	1,697,254.8	2,524,730.6	5010	
10-2-12	112	1,697,254.8	2,524,810.6	5073	
9-28-12	113	1,697,254.8	2,524,890.6	4655	
"	114	1,697,254.8	2,524,970.6	4175	
"	115	1,697,254.8	2,525,050.6	4809	
10-2-12	116	1,697,254.8	2,525,130.6	5137	
9-28-12	117	1,697,324.1	2,525,010.6	4960	
"	118	1,697,324.1	2,524,930.6	4918	
"	119	1,697,324.1	2,524,850.6	4640	
"	120	1,697,324.1	2,524,770.6	4729	
"	121	1,697,324.1	2,524,690.6	4386	Soil Sample
"	122	1,697,324.1	2,524,610.6	4454	
"	123	1,697,324.1	2,524,530.6	4302	
"	124	1,697,324.1	2,524,450.6	4366	
"	125	1,697,324.1	2,524,370.6	4136	
"	126	1,697,324.1	2,524,290.6	4150	
"	127	1,697,324.1	2,524,210.6	4659	
"	128	1,697,324.1	2,524,130.6	4214	
"	129	1,697,393.4	2,524,090.6	4482	
"	130	1,697,393.4	2,524,170.6	4254	
"	131	1,697,393.4	2,524,250.6	4410	
"	132	1,697,393.4	2,524,330.6	4773	Soil Sample
"	133	1,697,393.4	2,524,410.6	4841	
"	134	1,697,393.4	2,524,490.6	4280	
"	135	1,697,393.4	2,524,570.6	4261	
"	136	1,697,393.4	2,524,650.6	4505	
"	137	1,697,393.4	2,524,730.6	5060	
"	138	1,697,393.4	2,524,810.6	4961	
"	139	1,697,393.4	2,524,890.6	4890	
"	140	1,697,462.6	2,524,850.6	4705	

**80-ft Triangular Grid Static Gamma Radiation Survey  
NECR EDRA**

Instrumentation : Scaler/Ratemeter L2241-2 # 287029, Detector SPA-3 #30 # 408522

Instrument Calibration Date: 4-12-12, Instrument Daily Function Check Performed: Yes

2"x2" NaI Detector Collimated  Yes or  No.

Survey Date/Time	Static Survey Point ID	Coordinates, NAD83, NM West, feet		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
9-28-12	141	1,697,462.6	2,524,770.6	5059	
"	142	1,697,462.6	2,524,690.6	5243	
9-28-12	143	1,697,462.6	2,524,370.6	4964	Soil Sample
"	144	1,697,462.6	2,524,290.6	4911	
"	145	1,697,462.6	2,524,210.6	4192	
"	146	1,697,462.6	2,524,130.6	4376	
"	147	1,697,531.9	2,524,090.6	4851	
"	148	1,697,531.9	2,524,170.6	5151	
10-2-12	149	1,697,531.9	2,524,250.6	5105	
10-17-12	Z6-007	1696171	2522772	4757	
"	Z6-008	1696144	2522852	4620	
"	Z6-009	1696144	2522929	5503	
"	Z6-010	1696144	2523012	5002	
"	Z6-029	1696214	2522810	4758	
"	Z6-030	1696213	2522892	4557	Soil Sample
"	Z6-051	1696284	2522850	5104	
10-18-12	Z6-072	1696353	2522814	5190	
"	Z6-094	1696423	2522855	5062	
"	Z6-114	1696474	2522891	5066	

Technician Signature Maria D'Amore, Reviewed by [Signature]



## Laboratory Data Consultants, Inc.

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

Phone 760.634.0437

Web [www.lab-data.com](http://www.lab-data.com)

Fax 760.634.0439

MWH Americas, Inc.  
10619 South Jordan Gateway, Suite 100  
Salt Lake City, Utah 84095  
ATTN: Ms. Elizabeth Van Pelt

January 17, 2013

SUBJECT: NECR EDRA, Data Validation

Dear Ms. Van Pelt,

Enclosed are the final validation reports for the fraction listed below. These SDGs were received on January 4, 2013. Attachment 1 is a summary of the samples that were reviewed for each analysis.

**LDC Project # 29016:**

<b><u>SDG #</u></b>	<b><u>Fraction</u></b>
C12100506 C12100524 C12101133 C12110989 C12120140	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:

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

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:** North East Church Rock, EDRA  
**Collection Date:** October 2 through October 8, 2012  
**LDC Report Date:** January 9, 2013  
**Matrix:** Soil  
**Parameters:** Radium-226  
**Validation Level:** EPA Level III  
**Laboratory:** Energy Laboratories  
**Sample Delivery Group (SDG):** C12100506

**Sample Identification**

EDC-01, 0' @ 7.0'  
EDC-03, 100', @ 7.5'  
EDC-07, 300', @ 5.0'  
EDC-09, 400', @ 5.5'  
EDC-11, 500', @ 2.8'  
EDC-13, 600', @ 3.8'  
EDC-15, 700', @ 3.0'  
EDC-17, 800', @ 7.0'  
EDC-19, 900', @ 3.9'  
EDC-21, 1000', @ 4.0'  
EDC-DS1  
EDC-23, 1100', @ 2.8'  
EDC-29, 1400', @ 2.5'  
EDC-05, 200', @ 6.0'  
EDC-DS2  
EDC-25, 1200', @ 4.5'  
EDC-27, 1300', @ 6.5'  
EDC-21, 1000', @ 4.0'DUP  
EDC-27, 1300', @ 6.5'DUP

## Introduction

This data review covers 19 soil samples listed on the cover sheet including dilutions and reanalysis as applicable. 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 isotope 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.
- NJ Presumptive evidence of presence of the compound at an estimated quantity.
- UJ Indicates the isotope 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 radionuclide of interest.

## **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 contained less than the minimum detectable activity (MDA).

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.

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

## **VI. Laboratory Control Samples**

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

## **VII. Chemical Recovery**

Chemical recovery analysis was not required by the method.

## **VIII. Minimum Detectable Activity**

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 EDC-21, 1000', @ 4.0' and EDC-DS1 and samples EDC-05, 200', @ 6.0' and EDC-DS2 were identified as field duplicates. No radium-226 was detected with the following exceptions:

Isotope	Activity (pCi/g)		RPD (Limits)
	EDC-21, 1000', @ 4.0'	EDC-DS1	
Radium-226	1.7	1.2	34 (≤30)

Isotope	Activity (pCi/g)		RPD (Limits)
	EDC-05, 200', @ 6.0'	EDC-DS2	
Radium-226	1.2	1.0	18 (≤30)

**North East Church Rock, EDRA  
Radium-226 - Data Qualification Summary - SDG C12100506**

No Sample Data Qualified in this SDG

**North East Church Rock, EDRA  
Radium-226 - Laboratory Blank Data Qualification Summary - SDG C12100506**

No Sample Data Qualified in this SDG

**North East Church Rock, EDRA  
Radium-226 - Field Blank Data Qualification Summary - SDG C12100506**

No Sample Data Qualified in this SDG

LDC #: 29016A29a

**VALIDATION COMPLETENESS WORKSHEET**

Date: 1-9-13

SDG #: C12100506

Level III

Page: 1 of 1

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: 10-2-12 through 10-8-12
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Blanks	A	
V.	Matrix Spike/(Matrix Spike) Duplicates	A	DUP
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 = 10+11, D = 14+15
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	EDC-01, 0' @ 7.0'	11	EDC-DS1	21		31	
2	EDC-03, 100', @ 7.5'	12	EDC-23, 1100', @ 2.8'	22		32	
3	EDC-07, 300', @ 5.0'	13	EDC-29, 1400', @ 2.5'	23		33	
4	EDC-09, 400', @ 5.5'	14	EDC-05, 200', @ 6.0'	24		34	
5	EDC-11, 500', @ 2.8'	15	EDC-DS2	25		35	
6	EDC-13, 600', @ 3.8'	16	EDC-25, 1200', @ 4.5'	26		36	
7	EDC-15, 700', @ 3.0'	17	EDC-27, 1300', @ 6.5'	27		37	
8	EDC-17, 800', @ 7.0'	18	EDC-21, 1000', @ 4.0'DUP	28		38	
9	EDC-19, 900', @ 3.9'	19	EDC-27, 1300', @ 6.5'DUP	29		39	
10	EDC-21, 1000', @ 4.0'	20		30	PBS	40	

Notes: \_\_\_\_\_  
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 \_\_\_\_\_

**VALIDATION FINDINGS WORKSHEET**  
**Field Duplicates**

Radiochemistry, Method 901.1

Isotope	Activity (pCi/g)		RPD ( $\leq 30$ )	
	10	11		
Ra-226	1.7	1.2	34	

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Isotope	Activity (pCi/g)		RPD ( $\leq 30$ )	
	14	15		
Ra-226	1.2	1.0	18	

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## Laboratory Data Consultants, Inc. Data Validation Report

**Project/Site Name:** North East Church Rock, EDRA  
**Collection Date:** October 3 through October 5, 2012  
**LDC Report Date:** January 9, 2013  
**Matrix:** Soil  
**Parameters:** Radium-226  
**Validation Level:** EPA Level III & IV  
**Laboratory:** Energy Laboratories  
**Sample Delivery Group (SDG):** C12100524

### Sample Identification

SSPT-143\*\*  
SSPT-132\*\*  
SSPT-099\*\*  
SSPT-110  
SSPT-121  
SSPT-088  
SSPT-066  
SSPT-074  
SSPT-077  
SSPT-055  
SSPT-DS1  
SSPT-033  
SSPT-022  
SSPT-011\*\*  
SSPT-044\*\*  
SSPT-DS2\*\*  
SSPT-055DUP  
SSPT-044DUP

\*\*Indicates sample underwent Level IV review

## Introduction

This data review covers 18 soil samples listed on the cover sheet including dilutions and reanalysis as applicable. 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 an EPA Level IV review. An EPA Level III review was performed on all of the other samples. Raw data were not evaluated for the samples reviewed by EPA Level III criteria since this review is based on QC data.

The following are definitions of the data qualifiers:

- U Indicates the isotope 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.
- NJ Presumptive evidence of presence of the compound at an estimated quantity.
- UJ Indicates the isotope 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 radionuclide of interest.

## **III. Continuing Calibration**

Continuing calibration and background determination was performed at the required frequencies.

## **IV. Blanks**

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

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.

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

## **VI. Laboratory Control Samples**

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

## **VII. Chemical Recovery**

Chemical recoveries were not required by the method.

## **IX. Sample Result Verification**

All sample result verifications were acceptable for samples on which an 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 SSPT-055 and SSPT-DS1 and samples SSPT-044\*\* and SSPT-DS2\*\* were identified as field duplicates. No radium-226 was detected with the following exceptions:

Isotope	Activity (pCi/g)		RPD (Limits)
	SSPT-055	SSPT-DS1	
Radium-226	1.6	1.5	6 ( $\leq 30$ )

Isotope	Activity (pCi/g)		RPD (Limits)
	SSPT-044**	SSPT-DS2**	
Radium-226	1.8	2.5	33 ( $\leq 30$ )



**North East Church Rock, EDRA  
Radium-226 - Data Qualification Summary - SDG C12100524**

No Sample Data Qualified in this SDG

**North East Church Rock, EDRA  
Radium-226 - Laboratory Blank Data Qualification Summary - SDG C12100524**

No Sample Data Qualified in this SDG

**North East Church Rock, EDRA  
Radium-226 - Field Blank Data Qualification Summary - SDG C12100524**

No Sample Data Qualified in this SDG

9MA

LDC #: 2901629 B 29a **VALIDATION COMPLETENESS WORKSHEET**

SDG #: C12100524

Level III/IV

Laboratory: ENERGY Laboratories

Date: 1-9-13

Page: 1 of 1

Reviewer: MG

2nd Reviewer: W

**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: 10-3-12 through 10-5-12
IIa.	Initial calibration	A	
IIb.	Calibration verification	A	
III.	Blanks	A	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	A	DUP
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	
VIII.	Field duplicates	SW	D=10+11, D=15+16
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	SSPT-143**	11	SSPT-DS1	21		31	
2	SSPT-132**	12	SSPT-033	22		32	
3	SSPT-099**	13	SSPT-022	23		33	
4	SSPT-110	14	SSPT-011**	24		34	
5	SSPT-121	15	SSPT-044**	25		35	
6	SSPT-088	16	SSPT-DS2**	26		36	
7	SSPT-066	17	SSPT-055DUP	27		37	
8	SSPT-074	18	SSPT-044DUP	28		38	
9	SSPT-077	19		29		39	
10	SSPT-055	20		30	PBS	40	

Notes: \_\_\_\_\_  
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LDC #: 29016B29a  
 SDG #:                     

**VALIDATION FINDINGS CHECKLIST**

Page: 1 of 2  
 Reviewer: MG  
 2nd Reviewer:                     

**Method: Radiochemistry(EPA Method 901.1 )**

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
All technical holding times were met.	✓			
<b>II. Calibration</b>				
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?	✓			
<b>III. Blanks</b>				
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.		✓		
<b>IV. Matrix spikes and Duplicates</b>				
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/DUR ( <u>Soil</u> 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) $\leq 1.42$ ?	✓			
<b>V. Laboratory control samples</b>				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	✓			
<b>VI. Sample Chemical/Carrier Recovery</b>				
Was a tracer/carrier added to each sample?		✓		
Were tracer/carrier recoveries within the QC limits?			✓	
<b>VII. Regional Quality Assurance and Quality Control</b>				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
<b>VIII. Sample Result Verification</b>				
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 #: 29016 B29a  
 SDG #:                     

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2  
 Reviewer: MG  
 2nd Reviewer:                     

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

Isotope	Activity (pCi/g)		RPD ( $\leq 30$ )	
	10	11		
Ra-226	1.6	1.5	6	

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Isotope	Activity (pCi/g)		RPD ( $\leq 30$ )	
	15	16		
Ra-226	1.8	2.5	33	

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LDC #: 29016 B29a  
 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	Reported	Acceptable (Y/N)
					%R or RPD	%R or RPD	
LCS	Laboratory control sample	Bi-214	2.575 (pci/g)	2.57 (pci/g)	100	100	Y
—	Matrix spike sample	—	—	—	—	—	—
18	Duplicate RPD	Ra-226	1.827 (pci/g)	1.886 (pci/g)	3.2	5.4	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 Data Consultants, Inc.  
Data Validation Report**

**Project/Site Name:** North East Church Rock, EDRA

**Collection Date:** October 17, 2012

**LDC Report Date:** January 9, 2013

**Matrix:** Soil

**Parameters:** Radium-226

**Validation Level:** EPA Level III

**Laboratory:** Energy Laboratories

**Sample Delivery Group (SDG):** C12101133

**Sample Identification**

SSPT-030 Z-6  
SSPT-030 Z-6DUP



## Introduction

This data review covers 2 soil samples listed on the cover sheet including dilutions and reanalysis as applicable. 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 isotope 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.
- NJ Presumptive evidence of presence of the compound at an estimated quantity.
- UJ Indicates the isotope 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 radionuclide of interest.

## **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 contained less than the minimum detectable activity (MDA).

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.

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

## **VI. Laboratory Control Samples**

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

## **VII. Chemical Recovery**

Chemical recovery analysis was not required by the method.

## **VIII. Minimum Detectable Activity**

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**

No field duplicates were identified in this SDG.

**North East Church Rock, EDRA  
Radium-226 - Data Qualification Summary - SDG C12101133**

No Sample Data Qualified in this SDG

**North East Church Rock, EDRA  
Radium-226 - Laboratory Blank Data Qualification Summary - SDG C12101133**

No Sample Data Qualified in this SDG

**North East Church Rock, EDRA  
Radium-226 - Field Blank Data Qualification Summary - SDG C12101133**

No Sample Data Qualified in this SDG

LDC #: 29016C29a

**VALIDATION COMPLETENESS WORKSHEET**

Date: 1-9-13

SDG #: C12101133

Level III

Page: 1 of 1

Laboratory: Energy Laboratories

Reviewer: MG

2nd Reviewer: *h***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: 10-17-12
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Blanks	A	
V.	Matrix Spike/(Matrix Spike) Duplicates	A	DUP
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	N	
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:

Soil

1	SSPT-030 Z-6	11		21		31	
2	SSPT-030 Z-6DUP	12		22		32	
3		13		23		33	
4		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: \_\_\_\_\_  
\_\_\_\_\_  
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## Laboratory Data Consultants, Inc. Data Validation Report

**Project/Site Name:** North East Church Rock, EDRA  
**Collection Date:** October 3 through October 8, 2012  
**LDC Report Date:** January 9, 2013  
**Matrix:** Soil  
**Parameters:** Radium-226  
**Validation Level:** EPA Level III  
**Laboratory:** Energy Laboratories  
**Sample Delivery Group (SDG):** C12100989

### Sample Identification

EDC-01-NSW  
EDC-03-NSW  
EDC-07-SSW  
EDC-DS3  
EDC-09-SSW  
EDC-11-SSW  
EDC-13-SSW  
EDC-15-NSW  
EDC-17-NSW  
EDC-19-NSW  
EDC-21-NSW  
EDC-23-NSW  
EDC-29-NSW  
EDC-DS4  
EDC-05-NSW  
EDC-25-NSW  
EDC-27-NSW  
EDC-19-NSWDUP  
EDC-27-NSWDUP

## Introduction

This data review covers 19 soil samples listed on the cover sheet including dilutions and reanalysis as applicable. 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 isotope 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.
- NJ Presumptive evidence of presence of the compound at an estimated quantity.
- UJ Indicates the isotope 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 radionuclide of interest.

## **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 contained less than the minimum detectable activity (MDA).

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.

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

## **VI. Laboratory Control Samples**

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

## **VII. Chemical Recovery**

Chemical recovery analysis was not required by the method.

## **VIII. Minimum Detectable Activity**

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 EDC-07-SSW and EDC-DS3 and EDC-29-NSW and EDC-DS4 were identified as field duplicates. No radium-226 was detected with the following exceptions:

Isotope	Activity (pCi/g)		RPD (Limits)
	EDC-07-SSW	EDC-DS3	
Radium-226	1.1	1.3	17 (≤30)

Isotope	Activity (pCi/g)		RPD (Limits)
	EDC-29-NSW	EDC-DS4	
Radium-226	3.0	1.7	55 (≤30)

**North East Church Rock, EDRA  
Radium-226 - Data Qualification Summary - SDG C12100989**

No Sample Data Qualified in this SDG

**North East Church Rock, EDRA  
Radium-226 - Laboratory Blank Data Qualification Summary - SDG C12100989**

No Sample Data Qualified in this SDG

**North East Church Rock, EDRA  
Radium-226 - Field Blank Data Qualification Summary - SDG C12100989**

No Sample Data Qualified in this SDG

**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: 10-3-12 through 10-8-12
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Blanks	A	
V.	Matrix Spike/(Matrix Spike) Duplicates	A	DUP
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 = 3+4 , D = 13+14
XII	Field blanks	N	

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

Validated Samples:  
 all soil

1	EDC-01-NSW	11	EDC-21-NSW	21		31	
2	EDC-03-NSW	12	EDC-23-NSW	22		32	
3	EDC-07-SSW	13	EDC-29-NSW	23		33	
4	EDC-DS3	14	EDC-DS4	24		34	
5	EDC-09-SSW	15	EDC-05-NSW	25		35	
6	EDC-11-SSW	16	EDC-25-NSW	26		36	
7	EDC-13-SSW	17	EDC-27-NSW	27		37	
8	EDC-15-NSW	18	EDC-19-NSWDUP	28		38	
9	EDC-17-NSW	19	EDC-27-NSWDUP	29		39	
10	EDC-19-NSW	20		30	PBS	40	

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**VALIDATION FINDINGS WORKSHEET**  
**Field Duplicates**Radiochemistry, Method 901.1

Isotope	Activity (pCi/g)		RPD ( $\leq 30$ )	
	3	4		
Ra-226	1.1	1.3	17	

V:\FIELD DUPLICATES\FD\_inorganic\29016D29a.wpd

Isotope	Activity (pCi/g)		RPD ( $\leq 30$ )	
	13	14		
Ra-226	3.0	1.7	55	

V:\FIELD DUPLICATES\FD\_inorganic\29016D29a.wpd

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

**Project/Site Name:** North East Church Rock, EDRA

**Collection Date:** December 4, 2012

**LDC Report Date:** January 9, 2013

**Matrix:** Soil

**Parameters:** Radium-226

**Validation Level:** EPA Level III

**Laboratory:** Energy Laboratories

**Sample Delivery Group (SDG):** C12120140

**Sample Identification**

SSPT-033R  
SSPT-033RDUP

## Introduction

This data review covers 2 soil samples listed on the cover sheet including dilutions and reanalysis as applicable. 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 isotope 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.
- NJ Presumptive evidence of presence of the compound at an estimated quantity.
- UJ Indicates the isotope 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 radionuclide of interest.

## **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 contained less than the minimum detectable activity (MDA).

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.

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

## **VI. Laboratory Control Samples**

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

## **VII. Chemical Recovery**

Chemical recovery analysis was not required by the method.

## **VIII. Minimum Detectable Activity**

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**

No field duplicates were identified in this SDG.



**North East Church Rock, EDRA  
Radium-226 - Data Qualification Summary - SDG C12120140**

No Sample Data Qualified in this SDG

**North East Church Rock, EDRA  
Radium-226 - Laboratory Blank Data Qualification Summary - SDG C12120140**

No Sample Data Qualified in this SDG

**North East Church Rock, EDRA  
Radium-226 - Field Blank Data Qualification Summary - SDG C12120140**

No Sample Data Qualified in this SDG

LDC #: 29016E29a

**VALIDATION COMPLETENESS WORKSHEET**

Date: 1-9-13

SDG #: C12120140

Level III

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: 12-4-12
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Blanks	A	
V.	Matrix Spike/(Matrix Spike) Duplicates	A	DUP
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	N	
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:

Soil

1	SSPT-033R	11		21		31	
2	SSPT-033RDUP	12		22		32	
3		13		23		33	
4		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: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



# ANALYTICAL SUMMARY REPORT

November 29, 2012

Montgomery Watson Harza  
1475 Pine Grove Rd Ste 109  
Steamboat Springs, CO 80477

Workorder No.: C12100524                      Quote ID: C3869 - Level III and Level IV  
Project Name:   NECR EDRA

Energy Laboratories, Inc. Casper WY received the following 16 samples for Montgomery Watson Harza on 10/11/2012 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
C12100524-001	SSPT-143	10/03/12 10:50	10/11/12	Soil	Gamma Sample Preparation Gross Gamma
C12100524-002	SSPT-132	10/03/12 11:00	10/11/12	Soil	Same As Above
C12100524-003	SSPT-099	10/03/12 11:09	10/11/12	Soil	Same As Above
C12100524-004	SSPT-110	10/03/12 11:23	10/11/12	Soil	Same As Above
C12100524-005	SSPT-121	10/03/12 11:30	10/11/12	Soil	Same As Above
C12100524-006	SSPT-088	10/03/12 11:40	10/11/12	Soil	Same As Above
C12100524-007	SSPT-066	10/03/12 11:47	10/11/12	Soil	Same As Above
C12100524-008	SSPT-074	10/03/12 11:57	10/11/12	Soil	Same As Above
C12100524-009	SSPT-077	10/03/12 12:09	10/11/12	Soil	Same As Above
C12100524-010	SSPT-055	10/03/12 14:30	10/11/12	Soil	Same As Above
C12100524-011	SSPT-DS1	10/03/12 14:45	10/11/12	Soil	Same As Above
C12100524-012	SSPT-033	10/05/12 11:35	10/11/12	Soil	Same As Above
C12100524-013	SSPT-022	10/05/12 11:43	10/11/12	Soil	Same As Above
C12100524-014	SSPT-011	10/05/12 11:50	10/11/12	Soil	Same As Above
C12100524-015	SSPT-044	10/05/12 12:30	10/11/12	Soil	Same As Above
C12100524-016	SSPT-DS2	10/05/12 12:45	10/11/12	Soil	Same As Above

The results as reported relate only to the item(s) submitted for testing. The analyses presented in this report were performed at Energy Laboratories, Inc., 2393 Salt Creek Hwy., Casper, WY 82601, unless otherwise noted. Radiochemistry analyses were performed at Energy Laboratories, Inc., 2325 Kerzell Lane, Casper, WY 82601, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

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

Report Approved By:



**CLIENT:** Montgomery Watson Harza  
**Project:** NECR EDRA  
**Sample Delivery Group:** C12100524

**Report Date:** 11/29/12

## CASE NARRATIVE

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### COMMENTS

Included with the analysis reports are instrument data reports for all analysis associated with the instrument calibration, QC sample analysis, and sample analysis. All analytical data is within method QA/QC specifications except as noted on analyses and/or QC summary reports, or in this narrative. The analytical report identifies which QC batch ID and sequence QC is associated with each analysis result for a sample. The results of this Analytical Report relate only to the items submitted for analysis. Only the raw data associated with parameters listed on this report should be validated.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-143  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12100524-001  
**Collection Date:** 10/03/12 10:50  
**Date Received:** 10/11/12  
**Report Date:** 11/29/12

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.9	pCi/g-dry		0.3		E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 3		R167053
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 3		R167053

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-132  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12100524-002  
**Collection Date:** 10/03/12 11:00  
**Date Received:** 10/11/12  
**Report Date:** 11/29/12

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	2.0	pCi/g-dry		0.3		E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 4		R167053
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 4		R167053

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-099  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12100524-003  
**Collection Date:** 10/03/12 11:09  
**Date Received:** 10/11/12  
**Report Date:** 11/29/12

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	2.2	pCi/g-dry		0.3		E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 5		R167053
Radium 226 precision (±)	0.6	pCi/g-dry				E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 5		R167053

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-110  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12100524-004  
**Collection Date:** 10/03/12 11:23  
**Date Received:** 10/11/12  
**Report Date:** 11/29/12

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.4	pCi/g-dry		0.3		E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 6		R167053
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 6		R167053

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.





### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-121  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12100524-005  
**Collection Date:** 10/03/12 11:30  
**Date Received:** 10/11/12  
**Report Date:** 11/29/12

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.6	pCi/g-dry		0.3		E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 7		R167053
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 7		R167053

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-088  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12100524-006  
**Collection Date:** 10/03/12 11:40  
**Date Received:** 10/11/12  
**Report Date:** 11/29/12

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.5	pCi/g-dry		0.3		E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 8		R167053
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 8		R167053

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-066  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12100524-007  
**Collection Date:** 10/03/12 11:47  
**Date Received:** 10/11/12  
**Report Date:** 11/29/12

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.0	pCi/g-dry		0.3		E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 9		R167053
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 9		R167053

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-074  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12100524-008  
**Collection Date:** 10/03/12 11:57  
**Date Received:** 10/11/12  
**Report Date:** 11/29/12

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.5	pCi/g-dry		0.3		E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 10		R167053
Radium 226 precision (±)	0.4	pCi/g-dry				E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 10		R167053

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-077  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12100524-009  
**Collection Date:** 10/03/12 12:09  
**Date Received:** 10/11/12  
**Report Date:** 11/29/12

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.2	pCi/g-dry		0.3		E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 11		R167053
Radium 226 precision (±)	0.4	pCi/g-dry				E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 11		R167053

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-055  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12100524-010  
**Collection Date:** 10/03/12 14:30  
**Date Received:** 10/11/12  
**Report Date:** 11/29/12

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.6	pCi/g-dry		0.3		E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 12		R167053
Radium 226 precision (±)	0.4	pCi/g-dry				E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 12		R167053

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-DS1  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12100524-011  
**Collection Date:** 10/03/12 14:45  
**Date Received:** 10/11/12  
**Report Date:** 11/29/12

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.5	pCi/g-dry		0.3		E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 14		R167053
Radium 226 precision (±)	0.4	pCi/g-dry				E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 14		R167053

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-033  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12100524-012  
**Collection Date:** 10/05/12 11:35  
**Date Received:** 10/11/12  
**Report Date:** 11/29/12

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	6.2	pCi/g-dry		0.3		E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 15		R167053
Radium 226 precision (±)	0.7	pCi/g-dry				E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 15		R167053

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.





### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-022  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12100524-013  
**Collection Date:** 10/05/12 11:43  
**Date Received:** 10/11/12  
**Report Date:** 11/29/12

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.9	pCi/g-dry		0.3		E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 16		R167053
Radium 226 precision (±)	0.6	pCi/g-dry				E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 16		R167053

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-011  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12100524-014  
**Collection Date:** 10/05/12 11:50  
**Date Received:** 10/11/12  
**Report Date:** 11/29/12

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.4	pCi/g-dry		0.3		E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 17		R167053
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 17		R167053

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-044  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12100524-015  
**Collection Date:** 10/05/12 12:30  
**Date Received:** 10/11/12  
**Report Date:** 11/29/12

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.8	pCi/g-dry		0.3		E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 18		R167053
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 18		R167053

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-DS2  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12100524-016  
**Collection Date:** 10/05/12 12:45  
**Date Received:** 10/11/12  
**Report Date:** 11/29/12

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	2.5	pCi/g-dry		0.3		E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 20		R167053
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	11/06/12 08:15 / dpb	10/15/12 10:36		GAM-HPGE_121106A : 20		R167053

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



# QA/QC Summary Report

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza

**Report Date:** 11/29/12

**Project:** NECR EDRA

**Work Order:** C12100524

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: E901.1</b>										Batch: R167053
<b>Sample ID: LCS-R167053</b>										
		Laboratory Control Sample					Run: GAM-HPGE_121106A		11/06/12 08:15	
Bismuth 214		2.6	pCi/g-dry	0.3	100	70	130			
- The LCS sample uses Bi214 for Ra226.										
<b>Sample ID: MB-R167053</b>										
		Method Blank					Run: GAM-HPGE_121106A		11/06/12 08:15	
Radium 226		ND	pCi/g-dry							U
<b>Sample ID: C12100524-010ADUP</b>										
2		Sample Duplicate					Run: GAM-HPGE_121106A		11/06/12 08:15	
Radium 226		1.2	pCi/g-dry	0.3				29	20	R
Radium 226 precision (±)		0.5	pCi/g-dry							
- Duplicate RPD is outside of the acceptance range for this analysis; however, the RER of 1.2 is less than the limit of 2.0. This batch is approved.										
<b>Sample ID: C12100524-015ADUP</b>										
2		Sample Duplicate					Run: GAM-HPGE_121106A		11/06/12 08:15	
Radium 226		1.9	pCi/g-dry	0.3				5.4	20	
Radium 226 precision (±)		0.5	pCi/g-dry							

**Qualifiers:**

RL - Analyte reporting limit.  
R - RPD exceeds advisory limit.

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

# Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

## Workorder Receipt Checklist

Montgomery Watson Harza

C12100524

Login completed by: Kerri Schroeder

Date Received: 10/11/2012

Reviewed by: BL2000\swaldrop

Received by: km

Reviewed Date: 10/15/2012

Carrier NDA  
name:

Shipping container/cooler in good condition?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Not Present <input type="checkbox"/>
Custody seals intact on shipping container/cooler?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Not Present <input checked="" type="checkbox"/>
Custody seals intact on sample bottles?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Not Present <input checked="" type="checkbox"/>
Chain of custody present?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
Chain of custody signed when relinquished and received?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
Chain of custody agrees with sample labels?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
Samples in proper container/bottle?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
Sample containers intact?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
Sufficient sample volume for indicated test?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
Temp Blank received?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Not Applicable <input checked="" type="checkbox"/>
Container/Temp Blank temperature:	N/A °C		
Water - VOA vials have zero headspace?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	No VOA vials submitted <input checked="" type="checkbox"/>
Water - pH acceptable upon receipt?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Not Applicable <input checked="" type="checkbox"/>

Contact and Corrective Action Comments:

None



# Chain of Custody and Analytical Request Record

PLEASE PRINT (Provide as much information as possible.)

Company Name: <b>MWH</b>	Project Name, PWS, Permit, Etc. <b>NECR EDRA</b>	Sample Origin State: <b>NM</b>	EPA/State Compliance: Yes <input type="checkbox"/> No <input type="checkbox"/>
Report Mail Address: <b>P.O. Box 774018 Steamboat Springs, CO 80477</b>	Contact Name: <b>Toby Leeson</b>	Phone/Fax: <b>970-871-4361</b>	Email: <b>Toby.Leeson@MWHglobal.com</b>
Invoice Address: <b>MWH, Bloomfield, CO</b>	Invoice Contact & Phone: <b>Toby Leeson 970-871-4361</b>	Purchase Order:	Sampler: (Please Print) <b>Natver Patel</b>

Special Report/Formats:  <input type="checkbox"/> DW <input type="checkbox"/> EDD/EDT (Electronic Data) <input type="checkbox"/> POTW/WWTP <b>Format:</b> _____ <input type="checkbox"/> State: _____ <input type="checkbox"/> LEVEL IV <input type="checkbox"/> Other: _____ <input type="checkbox"/> NELAC	ANALYSIS REQUESTED Number of Containers: Sample Type: <input type="checkbox"/> AW <input type="checkbox"/> SV <input type="checkbox"/> BO <input type="checkbox"/> DW <input type="checkbox"/> Air <input type="checkbox"/> Water <input type="checkbox"/> Soils/Solids <input type="checkbox"/> Vegetation <input type="checkbox"/> Bioassay <input type="checkbox"/> Other <input type="checkbox"/> DW - Drinking Water <b>Ro-226, EPA 901.1</b>	<b>SEE ATTACHED</b> Standard Turnaround (TAT) <b>RUSH</b>	Contact ELI prior to <b>RUSH</b> sample submittal for charges and scheduling - See Instruction Page Comments:	Shipped by: <b>FEDEX - EX</b> Cooler ID(s): <b>35628</b> Receipt Temp: <b>9.2 °C</b> On Ice: Y <input checked="" type="checkbox"/> N <input type="checkbox"/> Custody Seal: On Bottle Y <input checked="" type="checkbox"/> On Cooler Y <input checked="" type="checkbox"/> Intact Y <input checked="" type="checkbox"/> Signature Match Y <input checked="" type="checkbox"/>																																																																																																																																																																																																																									
<table border="1"> <thead> <tr> <th>SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)</th> <th>Collection Date</th> <th>Collection Time</th> <th>MATRIX</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> </tr> </thead> <tbody> <tr><td>1 SSPT-143</td><td>10-3-12</td><td>1050</td><td>S</td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>2 SSPT-132</td><td>"</td><td>1100</td><td>S</td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>3 SSPT-099</td><td>"</td><td>1109</td><td>S</td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>4 SSPT-110</td><td>"</td><td>1123</td><td>S</td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>5 SSPT-121</td><td>"</td><td>1130</td><td>S</td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>6 SSPT-088</td><td>"</td><td>1140</td><td>S</td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>7 SSPT-064</td><td>"</td><td>1147</td><td>S</td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>8 SSPT-074</td><td>"</td><td>1157</td><td>S</td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>9 SSPT-077</td><td>"</td><td>1209</td><td>S</td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>10 SSPT-055</td><td>"</td><td>1430</td><td>S</td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)		Collection Date	Collection Time	MATRIX																	1 SSPT-143	10-3-12	1050	S	✓																2 SSPT-132	"	1100	S	✓																3 SSPT-099	"	1109	S	✓																4 SSPT-110	"	1123	S	✓																5 SSPT-121	"	1130	S	✓																6 SSPT-088	"	1140	S	✓																7 SSPT-064	"	1147	S	✓																8 SSPT-074	"	1157	S	✓																9 SSPT-077	"	1209	S	✓																10 SSPT-055	"	1430	S	✓															
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<b>Custody Record MUST be Signed</b>	Relinquished by (print): <b>NATVER PATEL</b>	Date/Time: <b>10/9/12 01:40</b>	Signature: <i>[Signature]</i>	Received by (print):	Date/Time:	Signature:
	Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
	Sample Disposal:    Return to Client:    Lab Disposal:	Received by Laboratory: <b>[Signature]</b>		Date/Time: <b>10/11/12 9:45</b>	Signature:	

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



# Chain of Custody and Analytical Request Record

PLEASE PRINT- Provide as much information as possible.

Company Name: <b>MWH</b>	Project Name, PWS, Permit, Etc. <b>NECR EDRA</b>	Sample Origin State: <b>NM</b>	EPA/State Compliance: Yes <input type="checkbox"/> No <input type="checkbox"/>
Report Mail Address: <b>P.O. Box 774018 Steamboat Springs, CO 80477</b>	Contact Name: <b>Toby Leeson</b>	Phone/Fax: <b>970-871-4361 970-879-9048</b>	Email: <b>Toby.Leeson@ mwh.global.com</b>
Invoice Address: <b>MWH Bloomfield, CO</b>	Invoice Contact & Phone: <b>Toby Leeson 970-871-4361</b>	Purchase Order:	Sampler: (Please Print) <b>Natver Patel</b>
Special Report/Formats – ELI must be notified prior to sample submittal for the following:	Invoice Contact & Phone:		Quote/Bottle Order:

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

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

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

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

Comments:

Shipped by:  
**Fedex-EX**

Cooler ID(s):  
**3868**

Receipt Temp  
**9.2 °C**

On Ice:  
Yes  No

Custody Seal Y  N   
 Intact Y  N   
 Signature Match Y  N

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	LABORATORY USE ONLY									
1 SSPT-051	10-3-12	1445	S	Ra-226, EPA 906.1 SEE ATTACHED Normal Turnaround (TAT)									
2 SSPT-033	10-5-12	1135	S										
3 SSPT-022	11	1143	S										
4 SSPT-011	11	1150	S										
5 SSPT-044	11	1230	S										
6 SSPT-052	11	1245	S										
7				C12100524									
8													
9													
10													

<b>Custody Record MUST be Signed</b>	Relinquished by (print): <b>NATVER PATEL</b>	Date/Time: <b>10-9-12 @ 1400</b>	Signature: <i>[Signature]</i>	Received by (print):	Date/Time:	Signature:
	Relinquished by (print): <b>NATVER PATEL</b>	Date/Time: <b>10-9-12 @ 1900</b>	Signature:	Received by (print):	Date/Time:	Signature:
	Sample Disposal: Return to Client: _____	Lab Disposal: _____	Received by Laboratory: <b>10-11-12 9:45</b>	Date/Time: <b>10/11/12 9:45</b>	Signature: <i>[Signature]</i>	Signature:

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**Level 4 Reporting Checklist**  
 Method# E901.1 Analyte/ Pa-226

- Initial calibration information  
(Calibration curve needs to bracket sample measurements)
- Continuing Calibration Information (CCI)  
(Calibration check every tenth sample)
- Bench-sheets  
(Sample run order should include duplicate, spike, method blank, reagent blank, and LCS every 20 samples)
- Calibration verification every 10 samples
- Serial dilution information
- Standard addition information (if performed)
- Documentation of Instrument Detection Limits (most recent IDL study)
- Photocopies of instrument run logs and/or lab notebook notes for the batch
- Photocopy of standard preparation notes
- Photocopy of standard source calibration certificate or chemical label noting manufacturer, stock and/or lot number
- Photocopies of method control charts for the following:
  - Laboratory Control Samples (LCS)
  - Matrix Spikes
  - Laboratory Duplicates
  - Method Blanks (MB)
- Analyst Case Narrative consisting of the following:
  - A statement documenting the analytes and the method used
  - Date of analysis
  - Any instrument adjustments or anomalies encountered during analysis
  - Typed name and signature of the analyst
- ICP needs:
  - Interference checks
  - Serial dilution information
  - ICP interelemental correction factors (IEC)
  - ICP linear ranges(LDR)
- no Screen Run performed?
- no Screen samples for dilution factor?

Please complete, attach and record documentation on next sheet and your numbered Log Book.

Level 4 Reporting

Date: 11-6-12

Time: 8:15

EPA Method Numbers and Analyte, please indicate on the attached tables.

Did you log sample from storage? Yes  No

Container size: Three inch steel can approx. 200g

Sample Preservation noted: none

Sample Numbers: C12100524, 1-16

Did you perform a screen of samples for concentrations and matrix interferences? Yes  No

Analyst case narrative: Ran sampler according to EPA method 901.1 using Datas Gamnavision software. Started batch on 11-6-12 and concluded the process on 11-7-12

Any instrument adjustments or anomalies encountered during analysis? None

**Level 4 Reporting (continued)**

Adjustments or anomalies (continued) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Analyst David L. Lida

Date 11-7-12

RS-86

2009 CAN

# CERTIFICATE OF CALIBRATION MULTINUCLIDE STANDARD SOURCE

Customer:	ENERGY LABORATORIES	Source No.:	1369-93-1
P.O. No.:	80311	Reference Date:	1-Jun-09 12:00 PST
Catalog No.:	EG-ML	Contained Radioactivity:	0.8669 $\mu$ Ci 32.08 kBq

**Physical Description:**

- |                              |   |
|------------------------------|---|
| A. Capsule type:             | Customer supplied can - 3" (76 mm) OD             |
| B. Nature of active deposit: | Multinuclide distributed in 1.5 g/cc epoxy matrix |
| C. Active diameter/volume:   | Approximately 124mL (186.0 grams)                 |
| D. Backing:                  | Steel   |
| E. Cover:                    | Steel   |

Gamma-Ray Energy (keV)	Nuclide	Half-life	Branching Ratio (%)	Activity ( $\mu$ Ci)	Gammas per second	Total Uncert
88	Cd-109	462.6 $\pm$ 0.7 days	3.63	0.2492	334.7	3.1 %
122	Co-57	271.79 $\pm$ 0.09 days	85.6	0.01081	342.4	3.1 %
159	Te-123m	119.7 $\pm$ 0.1 days	84.0	0.01236	384.1	3.1 %
320	Cr-51	27.706 $\pm$ 0.007 days	9.86	0.3056	1115	3.0 %
392	Sn-113	115.09 $\pm$ 0.04 days	64.9	0.04791	1150	3.0 %
514	Sr-85	64.849 $\pm$ 0.004 days	98.4	0.05830	2123	3.0 %
662	Cs-137	30.17 $\pm$ 0.16 years	85.1	0.04177	1315	3.0 %
898	Y-88	106.630 $\pm$ 0.025 days	94.0	0.09170	3189	3.0 %
1173	Co-60	5.272 $\pm$ 0.001 years	99.86	0.04926	1820	3.0 %
1333	Co-60	5.272 $\pm$ 0.001 years	99.98	0.04926	1822	3.0 %
1836	Y-88	106.630 $\pm$ 0.025 days	99.4	0.09170	3373	3.0 %

**Method of Calibration:**

This source was prepared from a weighed aliquot of solution whose concentrations in  $\mu$ Ci/g were determined by gamma spectrometry.

**Notes:**

- See reverse side for leak test(s) performed on this source.
- EZIP participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from IAEA-TECDOC-619, 1991.
- Overall uncertainty is calculated at the 99% confidence level.
- This source has a working life of 1 year.

*Daniel James Van Dalsen*  
Quality Control

*28-May-09*  
Date

EZIP Ref. No.: 1369-93

Calibration Description:

6/5/09 can calibration polynomial new standard  
 IPL #1369-93-1 new calibration perched

Energy Calibration Fit

$$\text{Energy} = -0.3919 + 0.243214 * \text{Channel} - 9.76725e-010 * \text{Channel} ** 2$$

$$\text{FWHM (keV)} = 2.7504 + 0.000971 * \text{Channel} - 2.70459e-008 * \text{Channel} ** 2$$

Energy/FWHM Table

Channel	Energy (keV)	Fit (keV)	Delta	FWHM	Fit	Delta
363.02	88.00	87.90	0.11%	0.74	0.75	-2.10%
502.91	122.00	121.92	0.06%	0.78	0.79	-0.93%
654.82	159.00	158.87	0.08%	0.81	0.82	-1.42%
1317.38	320.00	320.01	-0.00%	0.99	0.97	1.72%
1811.93	391.00	391.65	-0.17%	1.01	1.03	-2.39%
2114.79	514.00	513.95	0.01%	1.16	1.14	1.61%
2722.10	662.00	661.65	0.05%	1.31	1.26	3.65%
3694.22	898.00	898.08	-0.01%	1.50	1.45	2.99%
4825.86	1173.00	1173.30	-0.03%	1.67	1.66	1.09%
5480.66	1333.00	1332.55	0.03%	1.63	1.77	-8.16%
7657.24	1836.00	1836.12	-0.01%	2.12	2.08	2.12%

Efficiency Calibration Fit

Polynomial Uncertainty = 1.1491 %

Coefficients:

-0.345759 -5.963100 0.675305 -0.103447 0.008672 -0.000304

Efficiency Table

Energy	Efficiency	Fit	Delta
88.00	1.8030E-002	1.8033E-002	-0.02%
122.00	1.8069E-002	1.8041E-002	0.15%
159.00	1.5244E-002	1.5291E-002	-0.31%
320.00	8.6571E-003	8.7565E-003	1.14%
392.00	7.2997E-003	7.3136E-003	-0.19%
514.00	5.5726E-003	5.7472E-003	-3.13%
662.00	4.7604E-003	4.6095E-003	3.17%
898.00	3.5154E-003	3.5587E-003	-1.23%
1173.00	2.8900E-003	2.8429E-003	1.63%
1333.00	2.5087E-003	2.5490E-003	-1.61%
1836.00	1.9175E-003	1.9124E-003	0.27%

Calibration Certificate Table

Isotope	Energy	Pct	Half-life	Activity	GPS	Error	Date & Time
Cd-109	88.03	3.63	4.63E+002	9865.01	358.10	3.10%	5/1/2009 12:00:00
Co-57	122.07	85.60	2.72E+002	400.00	342.40	3.10%	6/1/2009 12:00:00
Te-123m	159.07	84.00	1.20E+002	457.26	384.10	3.00%	6/1/2009 12:00:00
Sn-113	391.69	64.90	1.15E+002	1771.96	1150.00	3.00%	6/1/2009 12:00:00
Y-88	898.02	94.00	1.07E+002	3392.55	3189.00	3.00%	6/1/2009 12:00:00
Co-60	1173.24	99.86	1.93E+003	1822.55	1820.00	3.00%	6/1/2009 12:00:00
Co-60	1333.00	99.98	1.93E+003	1822.36	1822.00	3.00%	6/1/2009 12:00:00
Y-88	1836.01	99.40	1.07E+002	3393.36	3373.00	3.00%	6/1/2009 12:00:00
Cr-51	320.00	9.86	2.77E+001	11308.32	1115.00	3.00%	6/1/2009 12:00:00
Sr-85	514.00	98.40	6.48E+001	2157.52	2123.00	3.00%	6/1/2009 12:00:00
Cs-137	661.66	85.10	1.10E+004	1545.24	1315.00	3.00%	6/1/2009 12:00:00
Cd-109	1836.27	3.63	4.63E+002	9220.39	334.70	3.10%	6/1/2009 12:00:00

Calibration Data from file: 1369.93.lccdeta1\_liperched.Clb  
 Energy Calibration Date: 10/16/2012 Time: 14:32:42  
 Efficiency Calibration Date: 6/5/2009 Time: 11:39:17

Calibration Description:  
 10/16/12 can calibration energy re-cal  
 IPL #1369-93-1 new calibration perched

Energy Calibration Fit

Energy = -0.2923 +0.243203\*Channel -4.95665e-009\*Channel\*\*2  
 FWHM (keV) = 2.5984 +0.001193\*Channel -6.59988e-008\*Channel\*\*2

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM	Fit	Delta
363.13	88.00	88.02	-0.02%	0.76	0.74	3.67%
503.23	122.06	122.09	-0.02%	0.74	0.77	-4.17%
2722.55	662.00	661.81	0.03%	1.31	1.30	0.35%
4826.55	1173.00	1173.43	-0.04%	1.65	1.66	-0.17%
5451.66	1333.00	1332.72	0.02%	1.74	1.74	0.07%

Efficiency Calibration Fit

Polynomial Uncertainty = 1.1491 %

Coefficients:

-0.345759 -5.963100 0.675305 -0.103447 0.008672 -0.000304

Efficiency Table

Energy	Efficiency	Fit	Delta
88.00	1.8030E-002	1.8033E-002	-0.02%
122.00	1.8069E-002	1.8041E-002	0.15%
159.00	1.5244E-002	1.5291E-002	-0.31%
320.00	8.8571E-003	8.7565E-003	1.14%
392.00	7.2997E-003	7.3136E-003	-0.19%
514.00	5.5726E-003	5.7472E-003	-3.13%
662.00	4.7604E-003	4.6095E-003	3.17%
898.00	3.5154E-003	3.5587E-003	-1.23%
1173.00	2.8900E-003	2.8429E-003	1.63%
1333.00	2.5087E-003	2.5490E-003	-1.61%
1836.00	1.9175E-003	1.9124E-003	0.27%

Calibration Certificate Table

Isotope	Energy	Pct	Half-life	Activity	GPS	Error	Date & Time
Cd-109	88.03	3.63	4.63E+002	9865.01	358.10	3.10%	5/1/2008 12:00:00
Ce-57	122.07	85.60	2.72E+002	400.00	342.40	3.10%	6/1/2009 12:00:00
Fe-123m	159.07	84.00	1.20E+002	457.26	384.10	3.00%	6/1/2009 12:00:00
Sn-113	391.69	64.90	1.15E+002	1771.96	1150.00	3.00%	6/1/2009 12:00:00
Y-88	898.02	94.00	1.07E+002	3392.55	3189.00	3.00%	6/1/2009 12:00:00
Co-60	1173.24	99.86	1.93E+003	1822.55	1820.00	3.00%	6/1/2009 12:00:00
Co-60	1333.00	99.98	1.93E+003	1822.36	1822.00	3.00%	6/1/2009 12:00:00
Y-88	1836.01	99.40	1.07E+002	3393.36	3373.00	3.00%	6/1/2009 12:00:00
Cr-51	320.00	9.86	2.77E+001	11308.32	1115.00	3.00%	6/1/2009 12:00:00
Sr-89	514.00	98.40	6.48E+001	2157.52	2123.00	3.00%	6/1/2009 12:00:00
Cs-137	661.66	85.10	1.10E+004	1545.24	1315.00	3.00%	6/1/2009 12:00:00
Ce-109	1836.27	3.63	4.63E+002	9220.39	334.70	3.10%	6/1/2009 12:00:00

D #: 3129  
Opened: \_\_\_\_\_  
Diluted Climax Sand Tailings-08826  
Expires: 5/6/2007  
Rec'd: 11/7/2006  
Energy Laboratories, Inc. 2393 Salt Creek Hwy /  
Casper WY 82602

DCS08826  
CAN  
LCS9

**U.S. ENVIRONMENTAL PROTECTION AGENCY**  
**ENVIRONMENTAL MONITORING AND SUPPORT LABORATORY-LAS VEGAS**  
**QUALITY ASSURANCE BRANCH**

Calibration Certificate  
DILUTED CLIMAX SAND TAILINGS

Description	Principal radionuclide	Thorium-230	Self-life	
	Initial activity		curies	
	Initial volume	10	ml in ampoule/bottle number	

Measurement: Activity of principal radionuclide

Activity per gram of this solution

35.3	pico curies	of	Thorium-230
			at 0400 hours PST on
			May 1, 1976

Activity of daughter radionuclide

The principal activity was accompanied at the quoted time by and 40 pico curies per gram of lead-210.

45.4	pico curies	per gram
of the daughter nuclide		
Radium-226		

Total mass of this solution	Total principal activity per gram at the quoted time
10 grams	35.3 pico curies

Method of measurement: Gravimetric dilution of analyzed Climax Sand Tailings. The thorium-230 was analyzed by alpha spectroscopy. Radium-226 was measured using radon emanation.

OC5 0.8821  
LC59

Random Errors

The repeatability of this standardization (dilutions, source preparations, counting statistics, mass determinations, etc.) was such that the certified value of the radioactive concentration of the principle activity had a standard error ( $\sigma$ ) not greater than

$\pm 4\%$

(The 99.7% confidence limits are given by  $\pm 3\sigma$ .)  
Due to limited results, the error estimate is based on the measurements of the undiluted sand tailings.

The total systematic error (sum of estimated maximum residual systematic errors due to dispensing, counting losses, counting corrections, known uncertainty of standard) of the certified radioactive concentration of the principle activity has been estimated not to exceed

$\pm 3\% (\delta)$  or  $- 3\% (\delta')$

The overall limits of error calculated on the basis of  $+(3\sigma + \delta)$  or  $-(3\sigma + \delta')$  are

$\pm 15\%$  or  $- 15\%$

of the quoted radioactive concentration.

The effective standard deviation is defined as 1/6th of the range between the overall limits

$+(3\sigma + \delta)$  and  $-(3\sigma + \delta')$  and is therefore  $\pm 5\%$

Decay Schemes

This standardization is based on the following assumptions of the principle nuclide, its daughter nuclides and impurities (no allowance for error in these assumptions or the assumption of quoted half-life have been included in the statement of accuracy above).

See attachment.

Chemical Composition of Solution

Carrier content per gram of solution:

Other components:

Preservative:

Remarks  
45.4  $\mu\text{Ci/g Ra-226}$   
 $\times 10 \text{ grams total}$   

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454  $\mu\text{Ci total activity}$   
 $\div 173.33 \text{ grams of blank leadate sand}$   

---

2.6  $\mu\text{Ci/gram Ra-226}$   
Date Certificate Prepared April 18, 1977

Approval Signature Joe H. Ziegler

Note:

Total mass of can is 183.33 grams  
w/v with OC5 10 grams inclusive.  
DJT-27-11



DRT 2

# PREP BATCH REPORT

Technician: Jason Salazar  
Prep Batch 35398 Prep Code: PRP-GAMMA Batch Units: G

Prep Start Date: 10/15/2012 10:36:53  
Prep End Date: 10/15/2012 10:41:00

Sample ID	Matrix	pH	Initial Samp Amt	Sol Added	Sol Recov	Fin Vol (mL)	Factor	Balance	PrepStart	PrepEnd
C12100524-001A - D & G	Soil		153.77	0	0	153.77	1	Sartorius CP3202	10/15/2012	10/15/2012
C12100524-002A	Soil		164.18	0	0	164.18	1	Sartorius CP3202	10/15/2012	10/15/2012
C12100524-003A	Soil		174.42	0	0	174.42	1	Sartorius CP3202	10/15/2012	10/15/2012
C12100524-004A	Soil		180.12	0	0	180.12	1	Sartorius CP3202	10/15/2012	10/15/2012
C12100524-005A	Soil		188.08	0	0	188.08	1	Sartorius CP3202	10/15/2012	10/15/2012
C12100524-006A	Soil		158.04	0	0	158.04	1	Sartorius CP3202	10/15/2012	10/15/2012
C12100524-007A	Soil		166.89	0	0	166.89	1	Sartorius CP3202	10/15/2012	10/15/2012
C12100524-008A	Soil		183.51	0	0	183.51	1	Sartorius CP3202	10/15/2012	10/15/2012
C12100524-009A	Soil		161.92	0	0	161.92	1	Sartorius CP3202	10/15/2012	10/15/2012
C12100524-010A	Soil	DUP	181.22	0	0	181.22	1	Sartorius CP3202	10/15/2012	10/15/2012
C12100524-011A	Soil		183.99	0	0	183.99	1	Sartorius CP3202	10/15/2012	10/15/2012
C12100524-012A	Soil		171.46	0	0	171.46	1	Sartorius CP3202	10/15/2012	10/15/2012
C12100524-013A	Soil		184.02	0	0	184.02	1	Sartorius CP3202	10/15/2012	10/15/2012
C12100524-014A	Soil		176.17	0	0	176.17	1	Sartorius CP3202	10/15/2012	10/15/2012
C12100524-015A	Soil	DUP	180.46	0	0	180.46	1	Sartorius CP3202	10/15/2012	10/15/2012
C12100524-016A	Soil		175.84	0	0	175.84	1	Sartorius CP3202	10/15/2012	10/15/2012

Started 11-6-12 @ 8:15 DB

QA/QC 11/19/12 R.S.

Count on or after 11-5-12  
Hp Co (12a226)

121106A  
8:15  
DB  
11-12-12  
DB  
calcd

Spk ID	Spike Name	SampType	AmtAdd
RW	PREP BATCH OK	All	10/15/2012

Energy Laboratories, Inc.  
Alpha Spectroscopy / Gamma Spectroscopy  
Instrument / Maintenance Run Log

Instruments: EGG Ortec Octete PC Alpha Spectroscopy System and EGG Ortec High Purity Germanium Detector

Date	Det. No.	Count Time Min.	Isotope	Batch ID	Associated Samples	Data File Number	Instrument ID		Int	Comments Maintenance Log
							Alpha Spec	Gamma Spec		
10-23-12	1-17, 2-23	240	Th	1721		Th-1721	✓			
10-23-12	1-16	240	Th	1720		Th-1720	✓			
10-23-12	1-19, 2-23	180	Th	1724		Th-1724	✓			
10-23-12	1-4	240	Th	1720		Th-1720	✓			
10-24-12	1-17	240	Th	1722		Th-1722	✓			
10-24-12	1-14	720	Th	1723		Th-1723	✓			
10-26-12	1-10	240	ISO U	547		ISO U-547	✓			
10-26-12	1-19, 2-22	240	Th	1725		Th-1725	✓			
10-29-12	1-19, 2-24	5	N/A	Pulser	Canberra	15399-15421	✓			
10-29-12	1-16	5	N/A	Pulser	Ortec	2012.10.29.001	✓			
11-1-12	1-19, 2-1	240	Th	1727		Th-1727	✓			
11-1-12	1-10	240	ISO U	548		ISO U-548	✓			
11-1-12	1-16	240	ISO U	549		ISO U-549	✓			
11-1-12	1, 2	10, 30, 60, 120	PCK	BKG	C12100323, 1	C12100732	✓			
11-2-12	1-10	240	Th	1729	Ortec	Th-1729	✓			
11-2-12	1-12	240	Th	1730	Canberra	Th-1730	✓			
11-2-12	1, 2	120			C12100323, C12101141	PCK, BKG	✓			
11-2-12	1-16	1000	BKG		BKG Calib	2012.11.02.001	✓			
11-2-12	1-19, 2-24	1000	BKG		BKG Calib		✓			
11-5-12	1, 2		PCK	BKG	10, 30, 60, 120	C12101141	✓			
11-5-12	1-16	5	N/A	Pulser		15597-15619	✓			
11-5-12	1-19, 2-24	5	N/A	Pulser		2012.11.05.001	✓			
11-5-12	1-16	5	Th-230	EFF CHECK	Ortec EFF Check		✓			

Energy Laboratories, Inc.  
Alpha Spectroscopy / Gamma Spectroscopy  
Instrument / Maintenance Run Log

Instruments: EGG Ortec Octete PC Alpha Spectroscopy System and EGG Ortec High Purity Germanium Detector

Date	Det. No.	Count Time Min.	Isotope	Batch ID	Associated Samples	Data File Number	Instrument ID		Int	Comments Maintenance Log
							Alpha Spec	Gamma Spec		
11-5-12	1-20 <sup>19</sup>	5	Th230	Th230	Effck Nov 2012 Cambria Effck	Th230 Effck Nov 2012				
11-5-12	21-2A	5	Th230	1 2		Th230 Effck Nov 2012				
11-5-12	1 2	10,30	60	PCK BKG	C12100506, C12100524					
11-5-12	11	480	Th	1726	added count time to Seq #11 (min)	Th-1726				
11-6-12	1-19, 2A	240	Th	1732		Th-1732				
11-6-12	1-12	120	Po210	469		Po210-469				
11-6-12	1-15	240	Th	1731		Th-1731				
11-7-12	1, 2	10,30	60	PCK BKG	C12100524					
11-8-12	1, 2	10,30	60, 120	PCK BKG	C12100609, C12100687					
11-8-12	1-6	240	Th	1734		Th-1734				
11-8-12	1-18	240	Th	1733		Th-1733				
11-9-12	1, 2	10,30	60	PCK BKG	DET2 C12100609, DET1 1000 min BKG NOV					
11-12-12	1-16	5	Pulser	N/A	Pulser ck Ortec	2012.11.12				
11-12-12	1-2A	5	Pulser	N/A	Pulser ck Cambria	15816-15838				
11-12-12	1, 2	10,30	60	PCK, BKG	C12100609					
11-12-12	1-18 <sup>19</sup>	240	U	550		U-550				
11-12-12	1-16	240	U	551		U-551				
11-12-12	1-19	240	U	552		U-552				
11-12-12	1-5	240	U	550		U-550				

ACTIVITY DECAY CORRECTIONS  
LCS CANS 6 - 10, gbkg

Input Analyte	LCS #	Input Half life Years	Calc Half life Days	Calc Half life Hours	Input Original pCi	Calc Original uCi	Calc Corrected pCi	Calc Corrected nCi	Calc Corrected uCi	Calc Corrected Bq	Input Reference Date	Input Current Date	Calc DPM	Input Measured pCi	Calc Percent Recovery	LCS #	
IPL-6	6	1600	5.84E+05	14025600	47.4	4.74E-05	46.88	0.05	4.69E-05	1.735	4/1/1987	9/7/2012	104.08	43.1	0.92	6	DET1
IPL-6	6	1600	5.84E+05	14025600	47.4	4.74E-05	46.88	0.05	4.69E-05	1.735	4/1/1987	9/7/2012	104.08	41.4	0.88	6	DET2
IPL-7	7	1600	5.84E+05	14025600	8.72	8.72E-06	8.66	0.01	8.66E-06	0.320	2/1/1997	9/21/2012	19.23	8.0	0.93	7	DET1
IPL-7	7	1600	5.84E+05	14025600	8.72	8.72E-06	8.66	0.01	8.66E-06	0.320	2/1/1997	9/7/2012	19.23	8.0	0.93	7	DET2
IPL-8	8	1600	5.84E+05	14025600	23.93	2.39E-05	23.77	0.02	2.38E-05	0.879	2/1/1997	9/7/2012	52.77	26.3	1.11	8	DET1
IPL-8	8	1600	5.84E+05	14025600	23.93	2.39E-05	23.77	0.02	2.38E-05	0.879	2/1/1997	9/7/2012	52.77	21.4	0.90	8	DET2
DCS08826	9	1600	5.84E+05	14025600	2.6	2.60E-06	2.57	0.00	2.57E-06	0.095	9/13/1989	11/8/2012	5.71	2.5	0.97	9	DET1
DCS08826	9	1600	5.84E+05	14025600	2.6	2.60E-06	2.57	0.00	2.57E-06	0.095	9/13/1989	11/7/2012	5.71	2.6	1.00	9	DET2

110712dcs088261csdet2

ORTEC g v - i ( 143) wan32 G53W2.06 07-NOV-2012 15:54:55 Page 1  
Energy Laboratory Spectrum name: 110712dcs088261csdet2.An1

Sample description  
110712dcs088261csdet2

Spectrum Filename: C:\User\110712dcs088261csdet2.An1

Acquisition information

Start time: 07-Nov-2012 14:52:06  
Live time: 3600  
Real time: 3603  
Dead time: 0.07 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccdet2\_11perched.c1b  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 50.000%  
Peak search sensitivity: 3  
Sample Size: 1.8333E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8333E+02) =  
1.4728E-01  
Detection limit method: LLD - ORTEC method (US-NRC)  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	13-Sep-1989 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1327

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count Activity pci/g	Time Corrected Activity pci/g	Uncertainty Counting pci/g	1 Sigma Total pci/g
Ra-228	1.0716E+00	1.7464E+01	4.7107E+00	4.7155E+00
Ra-226 <	6.6105E+00	6.6772E+00		
Bi-214	2.5748E+00 ✓	2.6007E+00	2.7998E-01	2.8176E-01
Pb-214	2.4466E+00	2.4713E+00	2.1746E-01	2.1953E-01
Ir-192 B<	1.69E-01 >12	Halfives		
Sb-124 B<	8.13E-02 >12	Halfives		
Sc-46 <	5.35E-01 >12	Halfives		
Pb-210	No in-range peaks			
Th-228 <	2.15E+00 >12	Halfives		
Th-230 <	3.4182E+01	3.4190E+01		
Cs-137 <	6.3320E-02	1.0792E-01		
Co-60 B<	8.5390E-02	1.7933E+00		
Am-241 <	2.4012E-01	2.4920E-01		
K-40	5.9164E+00	5.9164E+00	1.3626E+00	1.3645E+00
U-235	2.8351E-01	2.8351E-01	7.7018E-02	7.7095E-02
Th-234 B<	2.0829E+00	2.0829E+00		
Cs-134 <	7.6699E-02	1.8398E+02		
Pb-212 A	1.9390E-01	1.9390E-01	9.6786E-02	9.6817E-02
Ra-224 <	4.99E+00 >12	Halfives		
I-131 A	1.5748E-01 >12	Halfives	6.9403E-02	6.9429E-02
Mn-54 #A	1.4806E-01 >12	Halfives	5.3487E-02	5.3517E-02
Tl-208 H	3.7122E-01 >12	Halfives	8.3258E-02	8.3381E-02
Bi-212 <	1.78E+00 >12	Halfives		
Ra-223 <	5.27E-01 >12	Halfives		
Pa-234 <	4.68E-01 >12	Halfives		
Eu-154 <	2.3207E-01	1.4375E+00		

Eu-152 < 7.0080E-01 2.3358E+00  
 Na-22 < 5.2962E-04 2.5383E-01

Zn-65 < 1.28E-01 >12 Halflives  
 Ba-133 < 1.4577E-01 6.7210E-01  
 Ru-103 B< 3.10E-01 >12 Halflives  
 Be-7 B< 3.34E-01 >12 Halflives  
 I-125 No in-range peaks  
 Tl-201 #A 6.7306E-01 >12 Halflives 3.3616E-01 3.3640E-01  
 Pa-234 B< 4.66E+00 >12 Halflives

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

S U M M A R Y

-----  
 Total Activity ( 48.8 to 1990.5 keV) 1.2486851E+01 pCi/g  
 Total Decayed Activity ( 48.8 to 1990.5 keV) 2.8929718E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1115.52 % Zn-65      1120.51 % Sc-46      1173.00 % Co-60      1274.50 Na-22  
 1274.54 % Eu-154      1333.00 % Co-60      1408.00 & Eu-152

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
                     Dave Blaida

Reviewed by: \_\_\_\_\_  
                     Supervisor

Laboratory: Energy Laboratory

110712blankdet2

ORTEC g v - i ( 143) wan32 G53W2.06 07-NOV-2012 14:51:14 Page 1  
Energy Laboratory Spectrum name: 110712blankdet2.An1

Sample description  
110712blankdet2

Spectrum Filename: C:\User\110712blankdet2.An1

Acquisition information

Start time: 07-Nov-2012 13:48:50  
Live time: 3597  
Real time: 3600  
Dead time: 0.07 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 2  
Sample Size: 1.0000E+00  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.0000E+00) =  
2.7000E+01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000



Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	30-Apr-1999 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0609

-----  
 \*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*  
 Nuclide Time of Count Time Corrected Uncertainty 2 Sigma  
 Activity Activity Counting Total  
 pci/l pci/l pci/l pci/l

Ra-228	<	1.3424E+02	6.8547E+02		
Ra-226	<	6.9579E+02	6.9988E+02		
Bi-214	B<	8.2341E+01	8.2824E+01		
Pb-214	<	8.5699E+01	8.6203E+01		
Ir-192	B<	2.98E+01	>12 Halflives		
Sb-124	B<	3.15E+01	>12 Halflives		
Sc-46	<	4.09E+01	>12 Halflives		
Pb-210	No in-range peaks				
Th-228	<	1.3408E+03	1.8158E+05		
Th-230	<	2.8913E+03	2.8917E+03		
Cs-137	<	2.9629E+01	4.0456E+01		
Co-60	B<	3.1501E+01	1.8654E+02		
Am-241	<	3.3474E+01	3.4208E+01		
K-40	<	9.7989E+02	9.7989E+02		
U-235	<	4.5001E+01	4.5001E+01		
Th-234	B<	7.0246E+02	7.0246E+02		
Cs-134	<	3.1127E+01	2.9358E+03		
Pb-212	<	5.5113E+01	5.5113E+01		
Ra-224	<	5.59E+02	>12 Halflives		
I-131	B<	2.17E+01	>12 Halflives		
Mn-54	<	2.08E+01	>12 Halflives		
Tl-208	<	3.86E+01	>12 Halflives		
Bi-212	<	2.53E+02	>12 Halflives		
Ra-223	<	1.50E+02	>12 Halflives		
Pa-234	<	5.50E+01	>12 Halflives		
Eu-154	<	5.3874E+01	1.5634E+02		

Eu-152 < 1.6746E+02 3.3835E+02  
 Na-22 < 2.2480E+01 8.2755E+02

110712blankdet2

Zn-65 < 5.63E+01 >12 Halflives  
 Ba-133 < 3.3474E+01 8.1749E+01  
 Ru-103 B< 3.53E+01 >12 Halflives  
 Be-7 B< 1.52E+02 >12 Halflives  
 I-125 No in-range peaks  
 Tl-201 B< 1.62E+02 >12 Halflives  
 Pa-234 B< 5.54E+02 >12 Halflives

- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

S U M M A R Y

Total Activity ( 48.8 to 1990.5 keV) 0.0000000E+00 pCi/l  
 Total Decayed Activity ( 48.8 to 1990.5 keV) 0.0000000E+00 pCi/l

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 911.07 % Ra-228    969.10 % Ra-228    1115.52 % Zn-65    1120.28 % Bi-214  
 1120.51 % Sc-46    1173.00 % Co-60    1274.50    Na-22    1274.54 % Eu-154  
 1333.00 & Co-60    1408.00 % Eu-152    1460.80 % K-40

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

C12100524.1

ORTEC g v - i (2191) wan32 G53W2.06 06-NOV-2012 10:13:31 Page 1  
Energy Laboratory Spectrum name: C12100524.1.An1

Sample description  
C12100524.1

Spectrum Filename: C:\User\C12100524.1.An1

Acquisition information

Start time: 06-Nov-2012 09:01:09  
Live time: 3597  
Real time: 3600  
Dead time: 0.08 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.C1b  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.5377E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.5377E+02) =  
1.7559E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	15-Oct-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0747

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma	MDA
	Activity	Activity	Counting	Total	pCi/g
	pCi/g	pCi/g	pCi/g	pCi/g	
Ra-228 A	7.9119E-01	7.9693E-01	3.3498E-01	3.3554E-01	
Ra-226 A	9.0466E-02	9.0468E-02	3.1648E+00	3.1648E+00	
Bi-214 C	1.8756E+00	1.8757E+00	4.9818E-01	5.0026E-01	
Pb-214	1.3972E+00	1.3973E+00	4.1266E-01	4.1405E-01	
Ir-192 #B	1.0130E-01	1.2433E-01	1.9806E-01	1.9808E-01	
Sb-124 #B	3.8357E-02	4.9344E-02	1.2792E-01	1.2792E-01	
Sc-46 A	2.4498E-01	2.9355E-01	2.4971E-01	2.4982E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	-1.2752E+00	-1.3033E+00	1.8053E+04	1.8053E+04	
Th-230 #A	-3.4470E-01	-3.4470E-01	2.6614E+04	2.6614E+04	
Cs-137 #A	-4.8816E-02	-4.8883E-02	-9.4218E-01	-9.4218E-01	
Co-60 #B	-9.2463E-02	-9.3194E-02	3.1856E+02	3.1856E+02	
Am-241 #A	1.1223E-01	1.1224E-01	1.7055E-01	1.7057E-01	
K-40	2.0781E+01	2.0781E+01	4.2717E+00	4.3015E+00	
U-235 A	1.6988E-01	1.6988E-01	1.6107E-01	1.6112E-01	
Th-234 #B	4.0995E+00	4.0995E+00	3.9805E+00	3.9823E+00	
Cs-134 #A	-8.9403E-02	-9.1221E-02	-6.4684E-01	-6.4685E-01	
Pb-212	1.5227E+00	1.5227E+00	3.0905E-01	3.1139E-01	
Ra-224 A	1.5977E+00	1.0535E+02	1.9978E+02	1.9980E+02	
I-131 #B	1.5044E-01	9.9179E-01	9.6443E-01	9.6473E-01	
Mn-54 #A	1.2861E-01	1.3500E-01	1.2614E-01	1.2619E-01	
Tl-208 H	4.2312E-01	>12 Halflives	3.0141E-01	3.0159E-01	
Bi-212 #	5.7915E+00	>12 Halflives	2.1100E+00	2.1147E+00	
Ra-223 #A	3.3819E-01	1.2744E+00	3.3154E+00	3.3156E+00	
Pa-234 #A	1.5419E-01	>12 Halflives	2.9757E-01	2.9760E-01	
Eu-154 #A	8.1290E-04	8.1675E-04	1.0747E-01	1.0747E-01	

Eu-152 #A	5.1470E-01	5.1630E-01	5.4295E-01	5.4310E-01
Na-22 #A	0.0000E+00	0.0000E+00	2.1414E+02	2.1414E+02

C12100524.1					
Zn-65	A	8.9047E-02	9.4747E-02	2.2335E-01	2.2336E-01
Ba-133	A	3.0778E-02	3.0900E-02	1.7145E-01	1.7145E-01
Ru-103	#B	1.5686E-02	2.3060E-02	1.2780E-01	1.2780E-01
Be-7	#F	2.2202E+00	2.9492E+00	1.9795E+00	1.9826E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	1.0699E+00	1.5581E+02	1.6207E+02	1.6217E+02
Pa-234	#F	7.2685E+00	>12 Halflives	3.5569E+00	3.5670E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----  
 Total Activity ( 48.8 to 1990.5 keV) 2.5576126E+01 pCi/g  
 Total Decayed Activity ( 48.8 to 1990.5 keV) 2.5576210E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

c12100524.2

ORTEC g v - i (2191) wan32 G53W2.06 06-NOV-2012 11:22:59 Page 1  
Energy Laboratory Spectrum name: C12100524.2.An1

Sample description  
c12100524.2

Spectrum Filename: C:\User\C12100524.2.An1

Acquisition information

Start time: 06-Nov-2012 10:14:37  
Live time: 3585  
Real time: 3600  
Dead time: 0.43 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.C1b  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.6418E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.6418E+02) =  
1.6445E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	15-Oct-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1417

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma	MDA
	Activity	Activity	Counting	Total	pci/g
	pci/g	pci/g	pci/g	pci/g	
Ra-228 A	9.6882E-01	9.7586E-01	5.0448E-01	5.0503E-01	
Ra-226 A	1.4455E+00	1.4455E+00	3.1732E+00	3.1734E+00	
Bi-214	2.0464E+00 ✓	2.0464E+00	5.4803E-01 ✓	5.5028E-01	
Pb-214	1.8543E+00	1.8544E+00	5.2776E-01	5.2969E-01	
Ir-192 B	1.6580E-01	2.0359E-01	1.8169E-01	1.8176E-01	
Sb-124 #B	3.6075E-02	4.6436E-02	1.5078E-01	1.5079E-01	
Sc-46 A	1.3019E-01	1.5606E-01	1.6144E-01	1.6148E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	2.8295E+00	2.8918E+00	5.0618E+00	5.0623E+00	
Th-230 #A	5.6214E+00	5.6214E+00	1.8854E+01	1.8855E+01	
Cs-137 #A	-3.2493E-02	-3.2538E-02	-2.8089E-01	-2.8089E-01	
Co-60 #B	7.5375E-02	7.5972E-02	3.9631E-02	3.9674E-02	
Am-241 #A	1.9060E-02	1.9062E-02	1.0648E-01	1.0648E-01	
K-40	2.2465E+01	2.2465E+01	4.2003E+00	4.2357E+00	
U-235 A	1.5895E-01	1.5895E-01	1.7840E-01	1.7845E-01	
Th-234 #B	1.3873E+00	1.3873E+00	4.0375E+00	4.0377E+00	
Cs-134 #A	-5.9902E-02	-6.1123E-02	-2.9341E-01	-2.9342E-01	
Pb-212	1.3872E+00	1.3872E+00	2.8386E-01	2.8597E-01	
Ra-224 A	1.6554E+00	1.1022E+02	1.8454E+02	1.8456E+02	
I-131 #B	-2.0631E-02	-1.3661E-01	1.1569E+03	1.1569E+03	
Mn-54 #A	9.5523E-03	1.0028E-02	5.6923E-02	5.6924E-02	
Tl-208 H	6.4253E-01	>12 Halflives	2.7256E-01	2.7301E-01	
Bi-212	2.9191E+00	>12 Halflives	2.0948E+00	2.0960E+00	
Ra-223 #A	-2.0099E-01	-7.5972E-01	4.2007E+03	4.2007E+03	
Pa-234 A	4.5338E-02	>12 Halflives	2.7132E-01	2.7132E-01	
Eu-154 #A	-7.0076E-02	-7.0408E-02	1.0845E+03	1.0845E+03	

Eu-152 #A	4.8555E-01	4.8707E-01	5.1034E-01	5.1048E-01
Na-22 #A	1.6994E-02	1.7268E-02	6.2261E-02	6.2263E-02

C12100524.2

Zn-65	A	3.0416E-01	3.2367E-01	2.9205E-01	2.9216E-01
Ba-133	A	-2.0444E-02	-2.0525E-02	3.9405E+02	3.9405E+02
Ru-103	#B	-1.7070E-02	-2.5118E-02	2.4165E+02	2.4165E+02
Be-7	#B	-3.6728E-01	-4.8821E-01	2.2974E+03	2.2974E+03
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	-9.7390E-02	-1.4348E+01	1.5175E+05	1.5175E+05
Pa-234	F	5.9658E+00	>12 Halfives	2.4392E+00	2.4491E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----

Total Activity ( 48.8 to 1990.5 keV) 2.7752728E+01 pCi/g  
 Total Decayed Activity ( 48.8 to 1990.5 keV) 2.7752829E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
                   Dave Blaida

Reviewed by: \_\_\_\_\_  
                   Supervisor

Laboratory: Energy Laboratory



C12100524.3

ORTEC g v - i (2191) wan32 G53W2.06 06-NOV-2012 12:29:48 Page 1  
Energy Laboratory Spectrum name: C12100524.3.An1

Sample description  
C12100524.3

Spectrum Filename: C:\User\C12100524.3.An1

Acquisition information

Start time: 06-Nov-2012 11:24:06  
Live time: 3597  
Real time: 3600  
Dead time: 0.08 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.7442E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.7442E+02) =  
1.5480E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	15-Oct-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0967

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*****	SUMMARY OF NUCLIDES IN SAMPLE				*****
	Time of Count	Time Corrected	Uncertainty	2 Sigma	
Nuclide	Activity	Activity	Counting	Total	MDA
	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g

---

Ra-228	1.7408E+00	1.7534E+00	5.1475E-01	5.1651E-01	
Ra-226 #A	0.0000E+00	0.0000E+00	1.0726E+04	1.0726E+04	
Bi-214 #C	2.2256E+00 ✓	2.2257E+00	5.5606E-01 ✓	5.5869E-01	
Pb-214	1.7738E+00	1.7739E+00	3.8502E-01	3.8743E-01	
Ir-192 #B	-2.2434E-02	-2.7560E-02	1.8419E+02	1.8419E+02	
Sb-124 #B	-6.0585E-03	-7.8029E-03	1.8337E+02	1.8337E+02	
Sc-46	4.1674E-01	4.9978E-01	2.1918E-01	2.1952E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	6.1244E-01	6.2596E-01	5.1750E+00	5.1750E+00	
Th-230 #A	3.1461E+01	3.1461E+01	2.9082E+01	2.9091E+01	
Cs-137 #A	1.0000E-01	1.0014E-01	1.5728E-01	1.5729E-01	
Co-60 #B	-8.1516E-02	-8.2164E-02	3.0124E+02	3.0124E+02	
Am-241 A	1.1901E-01	1.1902E-01	1.8057E-01	1.8059E-01	
K-40	1.7211E+01	1.7211E+01	3.6926E+00	3.7163E+00	
U-235 #	3.3352E-01	3.3352E-01	2.0565E-01	2.0581E-01	
Th-234 F	7.2678E+00	7.2678E+00	4.3100E+00	4.3151E+00	
Cs-134 #A	-9.3145E-02	-9.5048E-02	-4.3596E-01	-4.3597E-01	
Pb-212	1.3288E+00	1.3288E+00	2.8428E-01	2.8622E-01	
Ra-224 A	7.6172E-01	5.1190E+01	1.8726E+02	1.8726E+02	
I-131 #F	2.3026E-01	1.5311E+00	1.6354E+00	1.6358E+00	
Mn-54 #A	-2.9303E-02	-3.0766E-02	-2.1884E-01	-2.1884E-01	
Tl-208 #H	6.6617E-01	>12 Halflives	2.2498E-01	2.2556E-01	
Bi-212 #	2.4993E+00	>12 Halflives	2.1414E+00	2.1422E+00	
Ra-223	1.1917E+00	4.5175E+00	3.1766E+00	3.1785E+00	
Pa-234 #A	5.1299E-01	>12 Halflives	4.7435E-01	4.7451E-01	
Eu-154 #A	9.5446E-02	9.5900E-02	1.3553E-01	1.3555E-01	

Eu-152 #A	-3.0602E-01	-3.0698E-01	-2.8280E+00	-2.8280E+00
Na-22 #A	0.0000E+00	0.0000E+00	2.5730E+02	2.5730E+02

C12100524.3

Zn-65	A	1.7212E-01	1.8319E-01	2.4052E-01	2.4057E-01
Ba-133	A	1.0080E-01	1.0120E-01	1.4332E-01	1.4334E-01
Ru-103	#B	-1.6068E-02	-2.3663E-02	2.1208E+02	2.1208E+02
Be-7	#B	4.8549E-01	6.4574E-01	1.1507E+00	1.1510E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	9.0408E-01	1.3467E+02	1.8245E+02	1.8252E+02
Pa-234	#F	6.7927E+00	>12 Halfives	2.8370E+00	2.8481E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

S U M M A R Y

Total Activity ( 48.8 to 1990.5 keV) 2.2539284E+01 pCi/g  
Total Decayed Activity ( 48.8 to 1990.5 keV) 2.2539389E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
1120.28 - Bi-214 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

Analyzed by: \_\_\_\_\_  
Dave Blaida

Reviewed by: \_\_\_\_\_  
Supervisor

Laboratory: Energy Laboratory

C12100524.4

ORTEC g v - i (2191) wan32 G53W2.06 06-NOV-2012 13:38:17 Page 1  
Energy Laboratory Spectrum name: C12100524.4.An1

Sample description  
C12100524.4

Spectrum Filename: C:\User\C12100524.4.An1

Acquisition information

Start time: 06-Nov-2012 12:30:47  
Live time: 3597  
Real time: 3600  
Dead time: 0.08 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.8012E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8012E+02) =  
1.4990E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

0

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	15-Oct-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1017

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*****	SUMMARY OF NUCLIDES IN SAMPLE				*****
	Time of Count	Time Corrected	Uncertainty	2 Sigma	
Nuclide	Activity	Activity	Counting	Total	MDA
	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g

---

Ra-228 #	1.5608E+00	1.5722E+00	6.6573E-01	6.6683E-01	
Ra-226 #A	0.0000E+00	0.0000E+00	1.0614E+04	1.0614E+04	
Bi-214 #C	1.4388E+00	1.4388E+00	4.5756E-01	4.5889E-01	
Pb-214	1.3820E+00	1.3821E+00	3.5597E-01	3.5755E-01	
Ir-192 #B	-9.9468E-03	-1.2225E-02	-1.2462E-01	-1.2462E-01	
Sb-124 #B	7.0040E-03	9.0254E-03	8.7762E-02	8.7762E-02	
Sc-46	3.0610E-01	3.6723E-01	2.0554E-01	2.0573E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	2.0933E+00	2.1396E+00	4.7750E+00	4.7752E+00	
Th-230 #A	2.1599E+00	2.1599E+00	1.6055E+01	1.6055E+01	
Cs-137 #A	1.9589E-02	1.9616E-02	1.0643E-01	1.0643E-01	
Co-60 #B	-7.8936E-02	-7.9565E-02	2.7197E+02	2.7197E+02	
Am-241 #A	4.0901E-02	4.0905E-02	2.0172E-01	2.0173E-01	
K-40	1.7382E+01	1.7382E+01	3.6232E+00	3.6478E+00	
U-235	3.1845E-01	3.1845E-01	1.7532E-01	1.7549E-01	
Th-234 F	6.0664E+00	6.0664E+00	4.0280E+00	4.0318E+00	
Cs-134 #A	-9.1739E-02	-9.3617E-02	-4.5762E-01	-4.5762E-01	
Pb-212	9.8542E-01	9.8542E-01	2.5596E-01	2.5714E-01	
Ra-224 #A	-1.7224E-02	-1.1678E+00	-2.2158E+02	-2.2158E+02	
I-131 B	8.4338E-02	5.6304E-01	9.0051E-01	9.0061E-01	
Mn-54 #	1.9188E-01	2.0148E-01	1.4784E-01	1.4792E-01	
Tl-208 H	4.8737E-01	>12 Halfives	1.8096E-01	1.8135E-01	
Bi-212 #A	-4.4823E-01	>12 Halfives	-9.5594E+00	-9.5594E+00	
Ra-223 #A	9.7300E-01	3.6990E+00	3.3516E+00	3.3528E+00	
Pa-234 #A	2.3212E-01	>12 Halfives	3.6395E-01	3.6400E-01	
Eu-154 #A	-6.3875E-02	-6.4179E-02	4.0204E+02	4.0204E+02	

Eu-152 #A -1.5714E-01 -1.5764E-01 -5.4961E-01 -5.4962E-01  
 Na-22 #A 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

C12100524.4

Zn-65	A	1.6497E-01	1.7560E-01	2.1662E-01	2.1666E-01
Ba-133	A	3.9987E-02	4.0146E-02	1.4383E-01	1.4383E-01
Ru-103	#F	1.5608E-01	2.3004E-01	1.6001E-01	1.6024E-01
Be-7	#B	6.7664E-02	9.0052E-02	6.4448E-01	6.4449E-01
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#F	1.3120E+00	1.9750E+02	1.5103E+02	1.5122E+02
Pa-234	F	4.5156E+00	>12 Halflives	2.4485E+00	2.4541E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

S U M M A R Y

-----  
Total Activity ( 48.8 to 1990.5 keV) 2.1188549E+01 pCi/g  
Total Decayed Activity ( 48.8 to 1990.5 keV) 2.1188623E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
1120.28 - Bi-214 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
Analyzed by: \_\_\_\_\_  
Dave Blaida

Reviewed by: \_\_\_\_\_  
Supervisor

Laboratory: Energy Laboratory

C12100524.5

ORTEC g v - i (2191) wan32 G53W2.06 06-NOV-2012 14:42:30 Page 1  
Energy Laboratory Spectrum name: C12100524.5.An1

Sample description  
C12100524.5

Spectrum Filename: C:\User\C12100524.5.An1

Acquisition information

Start time: 06-Nov-2012 13:39:14  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.c1b  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.8808E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8808E+02) =  
1.4356E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	15-Oct-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1952

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*****	SUMMARY OF NUCLIDES IN SAMPLE				*****
	Time of Count	Time Corrected	Uncertainty	2 Sigma	
Nuclide	Activity	Activity	Counting	Total	MDA
	pci/g	pci/g	pci/g	pci/g	pci/g

---

Ra-228	1.4975E+00	1.5084E+00	4.6177E-01	4.6322E-01	
Ra-226 A	9.1311E-01	9.1314E-01	2.4720E+00	2.4721E+00	
Bi-214	1.5502E+00	1.5503E+00	4.5228E-01	4.5385E-01	
Pb-214	5.9118E-01	5.9120E-01	2.9527E-01	2.9562E-01	
Ir-192 #B	4.4037E-02	5.4146E-02	1.1355E-01	1.1356E-01	
Sb-124 #B	8.1676E-02	1.0530E-01	1.5044E-01	1.5046E-01	
Sc-46 A	1.4468E-01	1.7364E-01	6.2448E-02	6.2590E-02	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	3.9126E+00	3.9994E+00	4.7526E+00	4.7535E+00	
Th-230 #A	7.5509E+00	7.5509E+00	1.2907E+01	1.2908E+01	
Cs-137 #A	8.2508E-02	8.2623E-02	1.5027E-01	1.5029E-01	
Co-60 B	-7.5596E-02	-7.6199E-02	2.6049E+02	2.6049E+02	
Am-241 #A	3.9160E-02	3.9164E-02	1.1707E-01	1.1708E-01	
K-40	1.6813E+01	1.6813E+01	3.6619E+00	3.6846E+00	
U-235 A	3.5474E-02	3.5474E-02	1.4364E-01	1.4364E-01	
Th-234 B	2.2213E+00	2.2213E+00	2.7732E+00	2.7739E+00	
Cs-134 #A	-4.2101E-02	-4.2965E-02	-2.4289E-01	-2.4289E-01	
Pb-212	1.2094E+00	1.2094E+00	2.4812E-01	2.4996E-01	
Ra-224 A	6.6212E-01	4.5303E+01	1.7143E+02	1.7143E+02	
I-131 #B	-1.8009E-02	-1.2072E-01	9.8181E+02	9.8181E+02	
Mn-54 #A	5.2729E-02	5.5372E-02	7.2996E-02	7.3009E-02	
Tl-208 #H	5.1310E-01	>12 Halflives	2.4019E-01	2.4052E-01	
Bi-212 A	1.6306E+00	>12 Halflives	2.1010E+00	2.1014E+00	
Ra-223 #	1.4739E+00	5.6193E+00	4.1239E+00	4.1262E+00	
Pa-234 #A	4.9059E-02	>12 Halflives	3.0883E-01	3.0883E-01	
Eu-154 #A	-4.8374E-03	-4.8605E-03	-2.5359E-02	-2.5360E-02	

Eu-152 #A	-3.6304E-02	-3.6419E-02	-3.5826E-01	-3.5826E-01
Na-22 #A	0.0000E+00	0.0000E+00	1.0975E+02	1.0975E+02



C12100524.5					
Zn-65	A	7.8702E-02	8.3786E-02	2.1585E-01	2.1586E-01
Ba-133	A	3.5090E-02	3.5230E-02	1.0373E-01	1.0373E-01
Ru-103	#B	5.6380E-02	8.3168E-02	1.4870E-01	1.4874E-01
Be-7	B	6.1865E-01	8.2386E-01	1.2716E+00	1.2720E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	4.3840E-01	6.6712E+01	1.2836E+02	1.2839E+02
Pa-234	B	2.4393E+00	>12 Halflives	1.9704E+00	1.9724E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----

Total Activity ( 48.8 to 1990.5 keV) 1.9717720E+01 pCi/g  
 Total Decayed Activity ( 48.8 to 1990.5 keV) 1.9746725E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1173.00 & Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- p - Peakbackground subtraction

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Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

C12100524.6

ORTEC g v - i (2191) wan32 G53W2.06 06-NOV-2012 15:49:53 Page 1  
Energy Laboratory Spectrum name: C12100524.6.An1

Sample description  
C12100524.6

Spectrum Filename: C:\User\C12100524.6.An1

Acquisition information

Start time: 06-Nov-2012 14:43:45  
Live time: 3597  
Real time: 3600  
Dead time: 0.08 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample size: 1.5804E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.5804E+02) =  
1.7084E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	15-Oct-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1117

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***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****					
Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228	1.8953E+00	1.9092E+00	7.4311E-01	7.4456E-01	
Ra-226 A	1.2795E+00	1.2795E+00	3.0413E+00	3.0415E+00	
Bi-214 C	1.5328E+00	1.5329E+00	5.2255E-01	5.2388E-01	
Pb-214	1.0958E+00	1.0958E+00	4.2049E-01	4.2133E-01	
Ir-192 #B	-1.4692E-02	-1.8072E-02	-3.2190E-01	-3.2190E-01	
Sb-124 #B	1.3023E-01	1.6799E-01	1.8583E-01	1.8588E-01	
Sc-46 A	1.1485E-01	1.3789E-01	2.2000E-01	2.2002E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	2.1135E+00	2.1605E+00	5.2179E+00	5.2181E+00	
Th-230 #A	1.0853E+01	1.0853E+01	1.5340E+01	1.5342E+01	
Cs-137 #A	8.0006E-02	8.0118E-02	1.4324E-01	1.4325E-01	
Co-60 #B	-8.9965E-02	-9.0684E-02	3.0998E+02	3.0998E+02	
Am-241 #A	1.2846E-01	1.2847E-01	2.9834E-01	2.9836E-01	
K-40	1.7769E+01	1.7769E+01	3.9925E+00	4.0159E+00	
U-235 A	6.4239E-02	6.4239E-02	1.7272E-01	1.7273E-01	
Th-234 #B	1.2746E+00	1.2746E+00	3.7085E+00	3.7087E+00	
Cs-134 #A	-1.0807E-01	-1.1029E-01	3.4508E+02	3.4508E+02	
Pb-212	1.4267E+00	1.4267E+00	2.9373E-01	2.9589E-01	
Ra-224 A	2.3071E+00	1.5922E+02	1.9974E+02	1.9977E+02	
I-131 F	2.2675E-01	1.5259E+00	1.5866E+00	1.5870E+00	
Mn-54 #A	-3.2340E-02	-3.3965E-02	-3.9227E-01	-3.9227E-01	
Tl-208 H	6.9372E-01	>12 Halflives	2.0831E-01	2.0899E-01	
Bi-212	3.3467E+00	>12 Halflives	1.8556E+00	1.8574E+00	
Ra-223 #A	8.0416E-01	3.0743E+00	3.5130E+00	3.5138E+00	
Pa-234 #A	-4.0855E-02	>12 Halflives	5.3938E+02	5.3938E+02	
Eu-154 #A	-7.2799E-02	-7.3147E-02	2.8032E+03	2.8032E+03	

Eu-152 #A	5.6879E-01	5.7059E-01	5.4563E-01	5.4581E-01
Na-22 #A	6.3771E-02	6.4808E-02	7.2759E-02	7.2776E-02

C12100524.6					
Zn-65	#A	-5.4932E-02	-5.8487E-02	-3.1221E+00	-3.1221E+00
Ba-133	A	8.6383E-02	8.6729E-02	1.4023E-01	1.4024E-01
Ru-103	#B	5.7685E-02	8.5160E-02	1.6519E-01	1.6522E-01
Be-7	#B	7.0779E-01	9.4311E-01	1.8775E+00	1.8779E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	1.2920E+00	1.9862E+02	2.0101E+02	2.0115E+02
Pa-234	#F	4.0194E+00	>12 Halfives	3.0839E+00	3.0875E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----  
 Total Activity ( 48.8 to 1990.5 keV) 2.1824165E+01 pCi/g  
 Total Decayed Activity ( 48.8 to 1990.5 keV) 2.1824234E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 969.10 - Ra-228 1120.28 - Bi-214 1173.00 & Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

c12100524.7

ORTEC g v - i (2191) wan32 G53W2.06 06-NOV-2012 20:27:25 Page 1  
Energy Laboratory Spectrum name: C12100524.7.An1

Sample description  
c12100524.7

Spectrum Filename: C:\User\C12100524.7.An1

Acquisition information

Start time: 06-Nov-2012 15:51:10  
Live time: 3597  
Real time: 3600  
Dead time: 0.08 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample size: 1.6689E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.6689E+02) =  
1.6178E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	15-Oct-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1015

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma	MDA
	Activity	Activity	Counting	Total	pCi/g
	pCi/g	pCi/g	pCi/g	pCi/g	
Ra-228	1.2800E+00	1.2894E+00	5.6472E-01	5.6559E-01	
Ra-226 A	5.2256E-01	5.2257E-01	3.4652E+00	3.4652E+00	
Bi-214 F	1.0143E+00	1.0143E+00	4.7544E-01	4.7608E-01	
Pb-214	6.4724E-01	6.4725E-01	3.1423E-01	3.1463E-01	
Ir-192 #B	1.6275E-02	2.0029E-02	9.8543E-02	9.8544E-02	
Sb-124 #B	3.4184E-02	4.4120E-02	8.6964E-02	8.6971E-02	
Sc-46 A	1.2688E-01	1.5239E-01	2.3194E-01	2.3197E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	4.4152E+00	4.5135E+00	5.9374E+00	5.9383E+00	
Th-230 A	1.5309E+01	1.5309E+01	1.5471E+01	1.5475E+01	
Cs-137 #A	9.3011E-02	9.3141E-02	1.5025E-01	1.5027E-01	
Co-60 #B	-2.1090E-02	-2.1259E-02	-9.5825E-02	-9.5826E-02	
Am-241 A	9.7025E-02	9.7034E-02	1.9334E-01	1.9336E-01	
K-40	2.0307E+01	2.0307E+01	4.0112E+00	4.0415E+00	
U-235 A	2.9846E-01	2.9846E-01	1.8703E-01	1.8717E-01	
Th-234 #	1.0201E+01	1.0201E+01	3.7906E+00	3.8020E+00	
Cs-134 #A	-9.2357E-02	-9.4260E-02	-1.7323E+00	-1.7323E+00	
Pb-212	1.1634E+00	1.1634E+00	2.7402E-01	2.7556E-01	
Ra-224 A	9.6470E-01	6.7175E+01	1.8105E+02	1.8106E+02	
I-131 #F	2.2427E-01	1.5153E+00	1.2656E+00	1.2661E+00	
Mn-54 #A	-2.6196E-02	-2.7515E-02	-3.8601E-01	-3.8601E-01	
Tl-208 #H	6.2812E-01	>12 Halflives	2.6309E-01	2.6353E-01	
Bi-212 #	1.8380E+00	>12 Halflives	1.2658E+00	1.2666E+00	
Ra-223 #A	1.0162E+00	3.8959E+00	3.3928E+00	3.3941E+00	
Pa-234 #A	4.3670E-01	>12 Halflives	3.9929E-01	3.9943E-01	
Eu-154 #A	1.5755E-01	1.5830E-01	3.2905E-01	3.2907E-01	

Eu-152 #A	8.7933E-02	8.8211E-02	3.8752E-01	3.8753E-01
Na-22 #A	0.0000E+00	0.0000E+00	5.3269E+02	5.3269E+02

C12100524.7

Zn-65	#A	-6.2151E-02	-6.6182E-02	6.0215E+02	6.0215E+02
Ba-133	A	5.7762E-02	5.7994E-02	1.4086E-01	1.4087E-01
Ru-103	#B	2.5612E-02	3.7842E-02	1.1124E-01	1.1125E-01
Be-7	#B	-3.3417E-01	-4.4554E-01	-4.9936E+00	-4.9936E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	B	7.9734E-01	1.2389E+02	1.1679E+02	1.1688E+02
Pa-234	F	8.5277E+00	>12 Halflives	3.5297E+00	3.5437E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Halflife limit exceeded

S U M M A R Y

-----  
 Total Activity ( 48.8 to 1990.5 keV) 3.1671150E+01 pCi/g  
 Total Decayed Activity ( 48.8 to 1990.5 keV) 3.1671150E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 969.10 - Ra-228 1120.28 - Bi-214 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at Fw25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

c12100524.8

ORTEC g v - i (2191) wan32 G53W2.06 06-NOV-2012 21:33:46 Page 1  
Energy Laboratory Spectrum name: C12100524.8.An1

Sample description  
c12100524.8

Spectrum Filename: C:\User\C12100524.8.An1

Acquisition information

Start time: 06-Nov-2012 20:30:32  
Live time: 3586  
Real time: 3600  
Dead time: 0.38 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.C1b  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.8351E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8351E+02) =  
1.4713E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□



Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	15-Oct-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1078

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma	MDA
	Activity	Activity	Counting	Total	pci/g
	pci/g	pci/g	pci/g	pci/g	
Ra-228	1.8563E+00	1.8701E+00	5.9355E-01	5.9529E-01	
Ra-226 A	1.3289E+00	1.3289E+00	2.8513E+00	2.8514E+00	
Bi-214 C	1.5007E+00	1.5008E+00	4.3852E-01	4.4003E-01	
Pb-214	1.2090E+00	1.2091E+00	3.6358E-01	3.6476E-01	
Ir-192 #B	2.2158E-02	2.7317E-02	9.4382E-02	9.4384E-02	
Sb-124 #B	1.7164E-01	2.2203E-01	2.2113E-01	2.2119E-01	
Sc-46	3.7299E-01	4.4872E-01	2.0727E-01	2.0756E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	4.1274E+00	4.2201E+00	5.3062E+00	5.3071E+00	
Th-230 A	1.7912E+01	1.7912E+01	1.5175E+01	1.5181E+01	
Cs-137 #A	1.0597E-01	1.0612E-01	1.2517E-01	1.2520E-01	
Co-60 #B	-9.2568E-03	-9.3316E-03	-1.0681E-01	-1.0681E-01	
Am-241 #A	-1.2906E-02	-1.2908E-02	-6.6072E-01	-6.6072E-01	
K-40	1.9495E+01	1.9495E+01	3.7189E+00	3.7491E+00	
U-235 A	5.7856E-02	5.7856E-02	1.6027E-01	1.6027E-01	
Th-234 #B	3.1848E+00	3.1848E+00	3.2685E+00	3.2697E+00	
Cs-134 #A	-4.7542E-02	-4.8530E-02	-4.3536E-01	-4.3537E-01	
Pb-212	1.1474E+00	1.1474E+00	2.5348E-01	2.5510E-01	
Ra-224 A	1.9976E+00	1.4437E+02	1.8003E+02	1.8007E+02	
I-131 #F	1.5886E-01	1.0914E+00	1.0199E+00	1.0203E+00	
Mn-54 #A	1.1762E-01	1.2360E-01	1.2943E-01	1.2947E-01	
Tl-208 #H	6.7123E-01	>12 Halflives	1.6986E-01	1.7065E-01	
Bi-212 #	4.3326E+00	>12 Halflives	2.1320E+00	2.1346E+00	
Ra-223 #A	1.0475E+00	4.0636E+00	3.9445E+00	3.9457E+00	
Pa-234 #A	2.4174E-02	>12 Halflives	2.0371E-01	2.0371E-01	
Eu-154 A	1.2406E-01	1.2466E-01	1.2796E-01	1.2799E-01	

Eu-152 #A	-4.4700E-01	-4.4843E-01	1.5188E+03	1.5188E+03
Na-22 #A	0.0000E+00	0.0000E+00	2.1185E+02	2.1185E+02

C12100524.8

Zn-65	A	2.5890E-01	2.7585E-01	2.5674E-01	2.5683E-01
Ba-133	A	7.5416E-02	7.5721E-02	1.3817E-01	1.3818E-01
Ru-103	B	1.0077E-01	1.4940E-01	1.6696E-01	1.6706E-01
Be-7	#B	1.5015E-01	2.0070E-01	1.3613E+00	1.3613E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	3.8377E-01	6.2324E+01	1.1766E+02	1.1769E+02
Pa-234	#B	3.6960E+00	>12 Halflives	3.0649E+00	3.0680E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

S U M M A R Y

Total Activity ( 48.8 to 1990.5 keV) 2.5208561E+01 pCi/g  
 Total Decayed Activity ( 48.8 to 1990.5 keV) 2.5222378E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 969.10 - Ra-228 1120.28 - Bi-214 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

c12100524.9

ORTEC g v - i (2191) wan32 G53W2.06 06-NOV-2012 22:40:29 Page 1  
Energy Laboratory Spectrum name: C12100524.9.An1

Sample description  
C12100524.9

Spectrum Filename: C:\User\C12100524.9.An1

Acquisition information

Start time: 06-Nov-2012 21:37:22  
Live time: 3591  
Real time: 3600  
Dead time: 0.25 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.6192E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.6192E+02) =  
1.6675E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections Status Comments  
 Decay correct to date: YES 15-Oct-2012 12:00:00  
 Decay during acquisition: YES  
 Decay during collection: NO  
 True coincidence correction: NO  
 Peaked background correction: YES 020711bkg1000mindet2.Pbc  
 07-Feb-2011 12:45:23  
 Absorption (Internal): NO  
 Geometry correction: NO  
 Random summing: YES slope 1.0000E+00  
 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1103

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228 #	1.8914E+00	1.9054E+00	5.7080E-01	5.7268E-01	
Ra-226 A	3.8545E-01	3.8546E-01	3.0971E+00	3.0972E+00	
Bi-214 C	1.2009E+00	1.2009E+00	4.0976E-01	4.1080E-01	
Pb-214	9.1600E-01	9.1602E-01	3.6653E-01	3.6721E-01	
Ir-192 #B	6.6060E-02	8.1478E-02	1.5035E-01	1.5037E-01	
Sb-124 #B	-2.9407E-03	-3.8059E-03	-6.5982E-02	-6.5982E-02	
Sc-46	4.1619E-01	5.0088E-01	2.0770E-01	2.0806E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	3.4676E+00	3.5457E+00	5.6451E+00	5.6456E+00	
Th-230 #A	1.4713E+01	1.4713E+01	2.4245E+01	2.4247E+01	
Cs-137 #A	-4.1891E-02	-4.1951E-02	-2.9718E-01	-2.9719E-01	
Co-60 #B	4.4959E-02	4.5323E-02	5.9980E-02	5.9990E-02	
Am-241 #A	-1.4635E-02	-1.4636E-02	-4.9877E-01	-4.9877E-01	
K-40	1.9744E+01	1.9744E+01	4.3492E+00	4.3756E+00	
U-235 A	1.8011E-01	1.8011E-01	1.6788E-01	1.6794E-01	
Th-234 B	2.8029E-01	2.8029E-01	2.8460E+00	2.8460E+00	
Cs-134 #A	-2.1312E-02	-2.1756E-02	-2.9085E-01	-2.9085E-01	
Pb-212	1.2195E+00	1.2195E+00	2.7971E-01	2.8137E-01	
Ra-224 A	1.9357E+00	1.4114E+02	2.0556E+02	2.0558E+02	
I-131 #B	-2.0919E-02	-1.4430E-01	1.0682E+03	1.0682E+03	
Mn-54 #A	1.1936E-01	1.2544E-01	1.3996E-01	1.3999E-01	
Tl-208 H	6.7037E-01	>12 Halflives	2.4447E-01	2.4501E-01	
Bi-212 #	4.8553E+00	>12 Halflives	2.3650E+00	2.3680E+00	
Ra-223 #A	8.7424E-01	3.4010E+00	3.5727E+00	3.5737E+00	
Pa-234 #A	1.0196E-01	>12 Halflives	3.7131E-01	3.7132E-01	
Eu-154 #A	4.3222E-02	4.3432E-02	6.8957E-02	6.8965E-02	

Eu-152 #A -4.4013E-01 -4.4154E-01 -5.5380E+00 -5.5380E+00  
 Na-22 #A 0.0000E+00 0.0000E+00 1.8033E+02 1.8033E+02

C12100524.9

Zn-65	A	2.2703E-01	2.4192E-01	2.6066E-01	2.6072E-01
Ba-133	A	1.3903E-01	1.3960E-01	1.3358E-01	1.3362E-01
Ru-103	#B	1.0343E-02	1.5347E-02	1.3189E-01	1.3189E-01
Be-7	#B	-2.9766E-01	-3.9811E-01	-4.7422E+00	-4.7422E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	8.1495E-01	1.3375E+02	2.2975E+02	2.2980E+02
Pa-234	#B	1.5788E+00	>12 Halflives	2.6256E+00	2.6263E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----

Total Activity ( 48.8 to 1990.5 keV) 2.3080244E+01 pCi/g  
 Total Decayed Activity ( 48.8 to 1990.5 keV) 2.3080301E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

c12100524.10

ORTEC g v - i (2191) wan32 G53W2.06 06-NOV-2012 23:48:59 Page 1  
Energy Laboratory Spectrum name: C12100524.10.An1

Sample description  
c12100524.10

Spectrum Filename: c:\User\c12100524.10.An1

Acquisition information

Start time: 06-Nov-2012 22:42:59  
Live time: 3588  
Real time: 3600  
Dead time: 0.33 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.8122E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8122E+02) =  
1.4899E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	15-Oct-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	slope 1.0000E+00 Net factor 1.0000E+00

Energy calibration  
 Normalized diff: 0.0896

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\*\*\*\*\* SUMMARY OF NUCLIDES IN SAMPLE \*\*\*\*\*

Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228 #	1.8780E+00	1.8920E+00	6.9631E-01	6.9783E-01	
Ra-226 A	1.0622E+00	1.0623E+00	2.6451E+00	2.6452E+00	
Bi-214 #C	1.6010E+00	1.6010E+00	3.9756E-01	3.9947E-01	
Pb-214	1.1977E+00	1.1978E+00	3.4503E-01	3.4626E-01	
Ir-192 #B	1.0310E-01	1.2722E-01	1.4728E-01	1.4731E-01	
Sb-124 #F	2.4961E-01	3.2323E-01	1.9096E-01	1.9112E-01	
Sc-46	3.2853E-01	3.9553E-01	1.6511E-01	1.6539E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	5.6984E+00	5.8269E+00	5.5080E+00	5.5096E+00	
Th-230 #A	1.7071E+01	1.7071E+01	2.4046E+01	2.4049E+01	
Cs-137 #A	-3.8747E-02	-3.8802E-02	-4.8730E-01	-4.8730E-01	
Co-60 #B	8.4468E-02	8.5153E-02	7.6215E-02	7.6244E-02	
Am-241 #A	8.9631E-02	8.9639E-02	1.9645E-01	1.9646E-01	
K-40	1.7823E+01	1.7823E+01	3.6418E+00	3.6675E+00	
U-235 A	9.3872E-02	9.3872E-02	1.5618E-01	1.5619E-01	
Th-234 #B	2.7724E+00	2.7724E+00	3.3315E+00	3.3325E+00	
Cs-134 A	9.0084E-02	9.1964E-02	1.2387E-01	1.2389E-01	
Pb-212	1.1970E+00	1.1970E+00	2.6457E-01	2.6626E-01	
Ra-224 A	1.3973E+00	1.0277E+02	1.9257E+02	1.9258E+02	
I-131 B	1.3424E-01	9.2966E-01	1.1243E+00	1.1246E+00	
Mn-54 #A	1.7220E-01	1.8099E-01	1.5852E-01	1.5858E-01	
Tl-208 #H	4.7628E-01	>12 Halflives	2.0428E-01	2.0460E-01	
Bi-212 #	3.3991E+00	>12 Halflives	1.8767E+00	1.8785E+00	
Ra-223 #A	1.4710E-01	5.7382E-01	2.5108E+00	2.5109E+00	
Pa-234 #A	9.7886E-02	>12 Halflives	2.2800E-01	2.2802E-01	
Eu-154	6.1211E-01	6.1508E-01	2.9629E-01	2.9666E-01	

Eu-152 A	2.8505E-01	2.8596E-01	2.4894E-01	2.4904E-01
Na-22 #A	0.0000E+00	0.0000E+00	7.8714E+02	7.8714E+02

C12100524.10

Zn-65	A	1.4439E-01	1.5388E-01	1.8125E-01	1.8129E-01
Ba-133	A	9.1620E-02	9.1992E-02	1.4726E-01	1.4728E-01
Ru-103	#B	-1.3404E-02	-1.9905E-02	-2.9006E-01	-2.9006E-01
Be-7	#B	-3.5781E-01	-4.7884E-01	-1.1456E+01	-1.1456E+01
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	5.8511E-01	9.7032E+01	1.3897E+02	1.3902E+02
Pa-234	B	2.4830E+00	>12 Halflives	2.2392E+00	2.2411E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----

Total Activity ( 48.8 to 1990.5 keV) 2.3697134E+01 pCi/g  
 Total Decayed Activity ( 48.8 to 1990.5 keV) 2.3711172E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 969.10 & Ra-228 1120.28 - Bi-214

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

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Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory



C12100524.10dup

ORTEC g v - i (2191) wan32 G53W2.06 07-NOV-2012 01:07:01 Page 1  
Energy Laboratory Spectrum name: C12100524.10dup.An1

Sample description  
C12100524.10dup

Spectrum Filename: C:\User\C12100524.10dup.An1

Acquisition information

Start time: 06-Nov-2012 23:52:04  
Live time: 3588  
Real time: 3600  
Dead time: 0.34 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample size: 1.8122E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8122E+02) =  
1.4899E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	15-Oct-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0680

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\*\*\*\*\* SUMMARY OF NUCLIDES IN SAMPLE \*\*\*\*\*

Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma	MDA
	Activity	Activity	Counting	Total	pCi/g
	pCi/g	pCi/g	pCi/g	pCi/g	
Ra-228	2.2688E+00	2.2857E+00	5.9475E-01	5.9735E-01	
Ra-226 A	1.7348E+00	1.7348E+00	2.8094E+00	2.8097E+00	
Bi-214 C	1.2089E+00	1.2089E+00	4.5921E-01	4.6015E-01	
Pb-214	1.1327E+00	1.1327E+00	3.3858E-01	3.3969E-01	
Ir-192 B	6.4970E-02	8.0204E-02	1.7476E-01	1.7477E-01	
Sb-124 #B	6.4718E-02	8.3851E-02	1.0792E-01	1.0794E-01	
Sc-46 A	1.9372E-01	2.3332E-01	1.8473E-01	1.8482E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	3.4382E+00	3.5159E+00	4.9312E+00	4.9319E+00	
Th-230 #A	1.3893E+01	1.3893E+01	1.9882E+01	1.9884E+01	
Cs-137 #A	3.0273E-02	3.0316E-02	9.6582E-02	9.6585E-02	
Co-60 #B	5.2046E-02	5.2469E-02	6.3542E-02	6.3554E-02	
Am-241 #A	-1.3071E-02	-1.3073E-02	-3.6382E-01	-3.6382E-01	
K-40	1.8064E+01	1.8064E+01	3.6577E+00	3.6840E+00	
U-235 A	5.9695E-02	5.9695E-02	1.6365E-01	1.6366E-01	
Th-234 #F	6.0338E+00	6.0338E+00	4.1144E+00	4.1181E+00	
Cs-134 #A	-7.4275E-02	-7.5829E-02	-9.8576E-01	-9.8576E-01	
Pb-212	1.1632E+00	1.1632E+00	2.5717E-01	2.5881E-01	
Ra-224 A	2.8279E+00	2.0992E+02	1.8429E+02	1.8436E+02	
I-131 #F	1.9217E-01	1.3363E+00	1.2267E+00	1.2271E+00	
Mn-54	1.3405E-01	1.4090E-01	9.4367E-02	9.4429E-02	
Tl-208 H	5.1261E-01	>12 Halfives	2.1808E-01	2.1844E-01	
Bi-212 #A	1.8129E+00	>12 Halfives	1.9329E+00	1.9334E+00	
Ra-223 A	6.7624E-01	2.6456E+00	2.4726E+00	2.4735E+00	
Pa-234 #A	1.9471E-01	>12 Halfives	3.5997E-01	3.6000E-01	
Eu-154 #A	1.6174E-01	1.6252E-01	1.7108E-01	1.7113E-01	

Eu-152 #A -1.4390E-01 -1.4436E-01 -7.1351E-01 -7.1352E-01  
 Na-22 #A 0.0000E+00 0.0000E+00 3.5203E+02 3.5203E+02

c12100524.10dup					
Zn-65	A	1.3036E-01	1.3895E-01	1.7845E-01	1.7848E-01
Ba-133	A	7.5459E-02	7.5766E-02	1.4253E-01	1.4254E-01
Ru-103	#B	1.5448E-02	2.2959E-02	6.6261E-02	6.6267E-02
Be-7	#B	1.0209E+00	1.3670E+00	1.5426E+00	1.5435E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	B	4.1872E-01	7.0201E+01	1.4060E+02	1.4062E+02
Pa-234	B	3.5250E+00	>12 Halflives	2.9538E+00	2.9566E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Halflife limit exceeded

----- S U M M A R Y -----

Total Activity ( 48.8 to 1990.5 keV) 2.3838102E+01 pCi/g  
 Total Decayed Activity ( 48.8 to 1990.5 keV) 2.3855072E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 969.10 & Ra-228 1120.28 - Bi-214

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
                   Dave Blaida

Reviewed by: \_\_\_\_\_  
                   Supervisor

Laboratory: Energy Laboratory

C12100524.11

ORTEC g v - i (2191) wan32 G53W2.06 07-NOV-2012 03:13:30 Page 1  
Energy Laboratory Spectrum name: C12100524.11.An1

Sample description  
C12100524.11

Spectrum Filename: C:\User\C12100524.11.An1

Acquisition information

Start time: 07-Nov-2012 01:09:33  
Live time: 3590  
Real time: 3600  
Dead time: 0.29 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.8399E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8399E+02) =  
1.4675E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	15-Oct-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1387

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma	MDA
	Activity	Activity	Counting	Total	pCi/g
	pCi/g	pCi/g	pCi/g	pCi/g	
Ra-228	1.4511E+00	1.4619E+00	5.2874E-01	5.2994E-01	
Ra-226 A	2.6305E+00	2.6306E+00	2.6494E+00	2.6502E+00	
Bi-214 #C	1.4908E+00	1.4908E+00	4.1200E-01	4.1359E-01	
Pb-214	9.0201E-01	9.0203E-01	3.2645E-01	3.2719E-01	
Ir-192 #B	5.2392E-02	6.4710E-02	1.1251E-01	1.1252E-01	
Sb-124 #F	2.3628E-01	3.0632E-01	2.4471E-01	2.4482E-01	
Sc-46	2.8503E-01	3.4345E-01	1.9268E-01	1.9286E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	2.8277E+00	2.8918E+00	5.0037E+00	5.0041E+00	
Th-230 #A	-2.8808E-01	-2.8808E-01	4.1180E+04	4.1180E+04	
Cs-137 #A	8.8701E-03	8.8828E-03	8.9130E-02	8.9130E-02	
Co-60 #B	-5.3967E-02	-5.4407E-02	-1.8712E-01	-1.8712E-01	
Am-241 #A	1.8355E-01	1.8357E-01	2.1141E-01	2.1145E-01	
K-40	1.9653E+01	1.9653E+01	3.7208E+00	3.7514E+00	
U-235 A	9.0426E-02	9.0426E-02	1.6033E-01	1.6035E-01	
Th-234 #B	4.5085E+00	4.5085E+00	3.7413E+00	3.7436E+00	
Cs-134 A	1.5217E-01	1.5536E-01	1.3907E-01	1.3912E-01	
Pb-212	1.0266E+00	1.0266E+00	2.5846E-01	2.5973E-01	
Ra-224 A	3.1212E-01	2.3409E+01	1.9596E+02	1.9596E+02	
I-131 F	2.9656E-01	2.0718E+00	1.4626E+00	1.4634E+00	
Mn-54 #A	3.7995E-02	3.9943E-02	9.1874E-02	9.1879E-02	
Tl-208 #H	4.6649E-01	>12 Halfives	2.7527E-01	2.7550E-01	
Bi-212	2.4176E+00	>12 Halfives	1.4533E+00	1.4545E+00	
Ra-223 #	1.7845E+00	7.0043E+00	4.1079E+00	4.1114E+00	
Pa-234 #A	1.8508E-01	>12 Halfives	3.3114E-01	3.3117E-01	
Eu-154 #A	-6.2531E-02	-6.2836E-02	4.8262E+02	4.8262E+02	

Eu-152 #A	5.0502E-02	5.0664E-02	6.9866E-02	6.9877E-02
Na-22 #A	0.0000E+00	0.0000E+00	1.0152E+02	1.0152E+02



C12100524.12

ORTEC g v - i (2191) wan32 G53W2.06 07-NOV-2012 08:01:25 Page 1  
Energy Laboratory Spectrum name: C12100524.12.An1

Sample description  
C12100524.12

Spectrum Filename: C:\User\C12100524.12.An1

Acquisition information

Start time: 07-Nov-2012 03:15:58  
Live time: 3597  
Real time: 3600  
Dead time: 0.09 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.7146E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.7146E+02 ) =  
1.5747E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	15-Oct-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0677

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma	MDA
	Activity	Activity	Counting	Total	pCi/g
	pCi/g	pCi/g	pCi/g	pCi/g	
Ra-228	1.5407E+00	1.5523E+00	6.8542E-01	6.8646E-01	
Ra-226 A	1.2844E+00	1.2845E+00	4.2540E+00	4.2541E+00	
Bi-214	6.2287E+00 ✓	6.2289E+00	6.8665E-01 ✓	7.0317E-01	
Pb-214	7.0038E+00	7.0040E+00	6.6399E-01	6.8550E-01	
Ir-192 #B	9.3180E-02	1.1518E-01	1.8485E-01	1.8487E-01	
Sb-124 #B	3.4404E-02	4.4648E-02	1.0233E-01	1.0233E-01	
Sc-46 A	9.9026E-02	1.1941E-01	3.8281E-01	3.8282E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	5.4115E+00	5.5346E+00	6.6533E+00	6.6546E+00	
Th-230 A	2.6162E+01	2.6162E+01	2.9529E+01	2.9535E+01	
Cs-137 A	2.4586E-01	2.4621E-01	2.2386E-01	2.2394E-01	
Co-60 #B	9.6120E-03	9.6907E-03	1.6651E-02	1.6653E-02	
Am-241 #A	1.3883E-01	1.3884E-01	2.6516E-01	2.6518E-01	
K-40	2.0522E+01	2.0522E+01	3.9528E+00	3.9842E+00	
U-235	6.5203E-01	6.5203E-01	2.2307E-01	2.2363E-01	
Th-234 F	6.5925E+00	6.5925E+00	5.0110E+00	5.0146E+00	
Cs-134 #A	2.6711E-02	2.7274E-02	1.2070E-01	1.2070E-01	
Pb-212	1.0752E+00	1.0752E+00	2.8929E-01	2.9054E-01	
Ra-224 A	5.0463E+00	3.8489E+02	2.9809E+02	2.9823E+02	
I-131 #F	1.9296E-01	1.3583E+00	1.3841E+00	1.3845E+00	
Mn-54 #A	-1.9748E-02	-2.0764E-02	-2.2082E-01	-2.2082E-01	
Tl-208 #H	4.9422E-01	>12 Halfives	2.6591E-01	2.6618E-01	
Bi-212 #A	2.2226E-01	>12 Halfives	1.8626E+00	1.8626E+00	
Ra-223 #A	1.0719E+00	4.2296E+00	4.0024E+00	4.0037E+00	
Pa-234 #A	2.4740E-01	>12 Halfives	4.1859E-01	4.1863E-01	
Eu-154 #A	6.3607E-02	6.3919E-02	1.6610E-01	1.6610E-01	

Eu-152 #A -4.6238E-02 -4.6387E-02 -1.5562E-01 -1.5562E-01  
 Na-22 #A 0.0000E+00 0.0000E+00 2.6187E+02 2.6187E+02



C12100524.12

Zn-65	A	1.6869E-01	1.7987E-01	2.0060E-01	2.0065E-01
Ba-133	A	7.6613E-02	7.6928E-02	1.0989E-01	1.0991E-01
Ru-103	#B	1.3682E-01	2.0386E-01	2.2754E-01	2.2767E-01
Be-7	#B	-3.1645E-01	-4.2453E-01	-6.4359E+00	-6.4359E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	1.4382E+00	2.4903E+02	2.1610E+02	2.1630E+02
Pa-234	#F	6.6497E+00	>12 Halfives	3.7458E+00	3.7539E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----

Total Activity ( 48.8 to 1990.5 keV) 3.5482098E+01 pCi/g  
 Total Decayed Activity ( 48.8 to 1990.5 keV) 3.5482452E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

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Analyzed by: \_\_\_\_\_  
                   Dave Blaida

Reviewed by: \_\_\_\_\_  
                   Supervisor

Laboratory: Energy Laboratory

C12100524.13

ORTEC g v - i (2191) wan32 G53W2.06 07-NOV-2012 09:20:28 Page 1  
Energy Laboratory Spectrum name: C12100524.13.An1

Sample description  
c12100524.13

Spectrum Filename: C:\User\C12100524.13.An1

Acquisition information

Start time: 07-Nov-2012 08:02:35  
Live time: 3597  
Real time: 3600  
Dead time: 0.08 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.C1b  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.8402E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8402E+02) =  
1.4672E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	15-Oct-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1122

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma	MDA
	Activity	Activity	Counting	Total	pCi/g
	pCi/g	pCi/g	pCi/g	pCi/g	
Ra-228	1.7087E+00	1.7217E+00	6.3198E-01	6.3336E-01	
Ra-226 A	1.3060E+00	1.3061E+00	2.9199E+00	2.9201E+00	
Bi-214 C	1.9460E+00 ✓	1.9460E+00	5.8714E-01 ✓	5.8905E-01	
Pb-214	1.9989E+00	1.9989E+00	3.7719E-01	3.8031E-01	
Ir-192 #B	1.4013E-01	1.7354E-01	1.7083E-01	1.7088E-01	
Sb-124 #F	2.4622E-01	3.2027E-01	1.8443E-01	1.8459E-01	
Sc-46	5.5407E-01	6.6921E-01	3.1681E-01	3.1723E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	2.3206E+00	2.3739E+00	5.6522E+00	5.6525E+00	
Th-230 #A	-1.2789E-01	-1.2789E-01	-8.4923E+00	-8.4923E+00	
Cs-137 #	3.3986E-01	3.4035E-01	1.8217E-01	1.8236E-01	
Co-60 #B	6.3992E-03	6.4520E-03	2.3498E-02	2.3498E-02	
Am-241 #A	1.4092E-01	1.4093E-01	1.8881E-01	1.8884E-01	
K-40	1.8768E+01	1.8768E+01	3.6603E+00	3.6887E+00	
U-235 A	1.9321E-01	1.9321E-01	1.6107E-01	1.6113E-01	
Th-234 B	1.7671E+00	1.7671E+00	1.7682E+00	1.7690E+00	
Cs-134 #A	-7.4706E-02	-7.6293E-02	-5.7168E-01	-5.7168E-01	
Pb-212	1.2493E+00	1.2493E+00	2.6503E-01	2.6686E-01	
Ra-224 A	2.3500E+00	1.8620E+02	2.2822E+02	2.2827E+02	
I-131 #F	1.3084E-01	9.3695E-01	1.0296E+00	1.0298E+00	
Mn-54 #A	3.4612E-04	3.6410E-04	6.3246E-02	6.3246E-02	
Tl-208 #H	4.2838E-01	>12 Halfives	1.5559E-01	1.5594E-01	
Bi-212 #A	-3.2642E-01	>12 Halfives	-5.1618E+00	-5.1618E+00	
Ra-223 #	9.6395E-01	3.8500E+00	3.0738E+00	3.0752E+00	
Pa-234 #A	4.2721E-01	>12 Halfives	4.5587E-01	4.5599E-01	
Eu-154 #A	5.0261E-02	5.0510E-02	1.1876E-01	1.1877E-01	

Eu-152 #A 4.3011E-01 4.3151E-01 4.5377E-01 4.5389E-01  
 Na-22 #A 0.0000E+00 0.0000E+00 4.2805E+02 4.2805E+02

C12100524.13

Zn-65	#A	-5.6365E-02	-6.0136E-02	7.3336E+02	7.3336E+02
Ba-133	A	5.9904E-02	6.0152E-02	1.2087E-01	1.2087E-01
Ru-103	#B	3.9421E-02	5.8942E-02	1.1508E-01	1.1510E-01
Be-7	#B	-2.2099E-01	-2.9724E-01	-3.1972E+00	-3.1972E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	1.8436E-01	3.3402E+01	8.6936E+01	8.6945E+01
Pa-234	#B	0.0000E+00	>12 Halflives	1.2398E+04	1.2398E+04

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Halflife limit exceeded

S U M M A R Y

-----  
Total Activity ( 48.8 to 1990.5 keV) 2.5671137E+01 pCi/g  
Total Decayed Activity ( 48.8 to 1990.5 keV) 2.5684170E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
1120.28 - Bi-214

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
Analyzed by: \_\_\_\_\_  
Dave Blaida

Reviewed by: \_\_\_\_\_  
Supervisor

Laboratory: Energy Laboratory

sc12100524.14

ORTEC g v - i (2191) wan32 G53W2.06 07-NOV-2012 10:27:19 Page 1  
Energy Laboratory Spectrum name: sc12100524.14.An1

Sample description  
c12100524.14

Spectrum Filename: C:\User\sc12100524.14.An1

Acquisition information

Start time: 07-Nov-2012 09:22:35  
Live time: 3597  
Real time: 3600  
Dead time: 0.08 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.7617E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.7617E+02) =  
1.5326E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	15-Oct-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1711

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228	1.6576E+00	1.6701E+00	5.1976E-01	5.2135E-01	
Ra-226 #A	0.0000E+00	0.0000E+00	1.4279E+04	1.4279E+04	
Bi-214 #C	1.3774E+00	1.3775E+00	5.3057E-01	5.3163E-01	
Pb-214	8.2450E-01	8.2452E-01	3.0787E-01	3.0852E-01	
Ir-192 #B	3.6492E-02	4.5215E-02	1.2611E-01	1.2611E-01	
Sb-124 #B	1.1134E-01	1.4492E-01	2.0070E-01	2.0073E-01	
Sc-46	2.3063E-01	2.7868E-01	1.5817E-01	1.5832E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	5.6719E+00	5.8024E+00	6.0332E+00	6.0347E+00	
Th-230 #A	6.2230E+00	6.2230E+00	1.1748E+01	1.1749E+01	
Cs-137 #A	1.2624E-01	1.2642E-01	1.3204E-01	1.3208E-01	
Co-60 #B	4.5665E-02	4.6043E-02	3.8365E-02	3.8382E-02	
Am-241 #A	3.8150E-03	3.8154E-03	1.0784E-01	1.0784E-01	
K-40	1.5330E+01	1.5330E+01	3.5398E+00	3.5594E+00	
U-235	6.5615E-01	6.5615E-01	3.1070E-01	3.1111E-01	
Th-234 #	2.6912E+01	2.6912E+01	5.6126E+00	5.6661E+00	
Cs-134 #A	-9.6948E-02	-9.9012E-02	3.0978E+02	3.0978E+02	
Pb-212	1.0216E+00	1.0216E+00	2.4905E-01	2.5036E-01	
Ra-224 A	1.5625E+00	1.2513E+02	1.9246E+02	1.9248E+02	
I-131 F	2.2104E-01	1.5905E+00	1.1004E+00	1.1010E+00	
Mn-54	2.3955E-01	2.5201E-01	1.4992E-01	1.5005E-01	
Tl-208 H	5.0203E-01	>12 Halfives	1.9715E-01	1.9752E-01	
Bi-212	2.8264E+00	>12 Halfives	2.0596E+00	2.0607E+00	
Ra-223 A	6.8121E-01	2.7299E+00	3.9910E+00	3.9915E+00	
Pa-234 #A	2.0822E-01	>12 Halfives	3.3638E-01	3.3642E-01	
Eu-154 #A	-6.5307E-02	-6.5630E-02	9.9226E+02	9.9226E+02	

Eu-152 #A -3.8430E-01 -3.8556E-01 -4.3792E+00 -4.3792E+00  
 Na-22 #A 7.1018E-02 7.2214E-02 5.8963E-02 5.8989E-02

sc12100524.14

Zn-65	A	2.2789E-01	2.4318E-01	2.1639E-01	2.1647E-01
Ba-133	A	8.1594E-02	8.1932E-02	1.1037E-01	1.1039E-01
Ru-103	#B	1.1095E-01	1.6605E-01	1.9731E-01	1.9741E-01
Be-7	#B	-7.6541E-02	-1.0302E-01	-1.2530E+00	-1.2530E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#F	1.1901E+00	2.1836E+02	1.6438E+02	1.6459E+02
Pa-234		1.6517E+01	>12 Halfives	3.9002E+00	3.9477E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----

Total Activity ( 48.8 to 1990.5 keV) 4.5465172E+01 pCi/g  
 Total Decayed Activity ( 48.8 to 1990.5 keV) 4.5465233E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----

Analyzed by: \_\_\_\_\_  
                   Dave Blaida

Reviewed by: \_\_\_\_\_  
                   Supervisor

Laboratory: Energy Laboratory

c12100524.15

ORTEC g v - i (2191) wan32 G53W2.06 07-NOV-2012 11:30:10 Page 1  
Energy Laboratory Spectrum name: C12100524.15.An1

Sample description  
c12100524.15

Spectrum Filename: C:\User\C12100524.15.An1

Acquisition information

Start time: 07-Nov-2012 10:28:04  
Live time: 3597  
Real time: 3600  
Dead time: 0.08 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.8046E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8046E+02) =  
1.4962E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000



Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections Status Comments  
 Decay correct to date: YES 15-Oct-2012 12:00:00  
 Decay during acquisition: YES  
 Decay during collection: NO  
 True coincidence correction: NO  
 Peaked background correction: YES 020711bkg1000mindet2.Pbc  
 07-Feb-2011 12:45:23  
 Absorption (Internal): NO  
 Geometry correction: NO  
 Random summing: YES Slope 1.0000E+00  
 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.2837

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*  
 Time of Count Time Corrected Uncertainty 2 Sigma  
 Nuclide Activity Activity Counting Total MDA  
 pci/g pci/g pci/g pci/g pci/g

Ra-228		1.5404E+00	1.5521E+00	4.5589E-01	4.5745E-01	
Ra-226	A	1.5073E+00	1.5074E+00	2.6240E+00	2.6242E+00	
Bi-214	C	1.8267E+00 ✓	1.8268E+00	4.5471E-01 ✓	4.5688E-01	
Pb-214		1.4007E+00	1.4007E+00	3.9137E-01	3.9285E-01	
Ir-192	#B	2.6808E-02	3.3230E-02	1.0135E-01	1.0135E-01	
Sb-124	F	1.8042E-01	2.3495E-01	1.8704E-01	1.8713E-01	
Sc-46	A	2.1645E-01	2.6164E-01	2.0462E-01	2.0472E-01	
Pb-210	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228	A	1.1160E+00	1.1418E+00	4.2374E+00	4.2375E+00	
Th-230	#A	4.1155E+00	4.1155E+00	1.2420E+01	1.2420E+01	
Cs-137		2.4953E-01	2.4989E-01	1.9969E-01	1.9978E-01	
Co-60	#B	2.7925E-02	2.8157E-02	7.1732E-02	7.1735E-02	
Am-241	#A	2.4804E-02	2.4807E-02	1.2500E-01	1.2500E-01	
K-40	#	1.6038E+01	1.6038E+01	3.5289E+00	3.5504E+00	
U-235	A	1.3204E-02	1.3204E-02	1.4626E-01	1.4626E-01	
Th-234	#F	6.1936E+00	6.1936E+00	3.9677E+00	3.9717E+00	
Cs-134	#A	4.8448E-02	4.9481E-02	1.1327E-01	1.1328E-01	
Pb-212		1.1911E+00	1.1911E+00	2.7361E-01	2.7522E-01	
Ra-224	A	2.3464E+00	1.8955E+02	2.3002E+02	2.3006E+02	
I-131	F	2.9270E-01	2.1144E+00	1.9420E+00	1.9427E+00	
Mn-54	#A	1.5875E-01	1.6703E-01	1.6517E-01	1.6522E-01	
Tl-208	H	6.9471E-01	>12 Halflives	2.1054E-01	2.1122E-01	
Bi-212	#	2.8737E+00	>12 Halflives	1.9240E+00	1.9252E+00	
Ra-223	#A	2.9111E-02	1.1698E-01	2.0002E+00	2.0002E+00	
Pa-234	A	2.4936E-02	>12 Halflives	2.9479E-01	2.9479E-01	
Eu-154	#	5.8073E-01	5.8361E-01	2.8965E-01	2.9000E-01	

Eu-152 #A 6.1722E-01 6.1924E-01 5.0690E-01 5.0712E-01  
 Na-22 #A 0.0000E+00 0.0000E+00 5.1766E+02 5.1766E+02

C12100524.15

Zn-65	#A	-2.7523E-02	-2.9372E-02	-6.3293E-01	-6.3293E-01
Ba-133	A	4.2858E-02	4.3036E-02	1.1201E-01	1.1201E-01
Ru-103	#B	9.0768E-02	1.3596E-01	1.3571E-01	1.3581E-01
Be-7	#B	-3.3415E-01	-4.5002E-01	2.2018E+03	2.2018E+03
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	4.0397E-01	7.4894E+01	1.2769E+02	1.2772E+02
Pa-234	B	3.3778E-01	>12 Halflives	2.3126E+00	2.3127E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Halflife limit exceeded

S U M M A R Y

Total Activity ( 48.8 to 1990.5 keV) 2.0457003E+01 pCi/g  
 Total Decayed Activity ( 48.8 to 1990.5 keV) 2.0457090E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

c12100524.15dup

ORTEC g v - i (2191) wan32 G53W2.06 07-NOV-2012 16:02:21 Page 1  
Energy Laboratory Spectrum name: c12100524.15dup.An1

Sample description  
c12100524.15dup

Spectrum Filename: C:\User\c12100524.15dup.An1

Acquisition information

Start time: 07-Nov-2012 11:32:32  
Live time: 3597  
Real time: 3600  
Dead time: 0.08 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.c1b  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.8046E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8046E+02) =  
1.4962E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections Status Comments  
 Decay correct to date: YES 15-oct-2012 12:00:00  
 Decay during acquisition: YES  
 Decay during collection: NO  
 True coincidence correction: NO  
 Peaked background correction: YES 020711bkg1000mindet2.Pbc  
 07-Feb-2011 12:45:23  
 Absorption (Internal): NO  
 Geometry correction: NO  
 Random summing: YES Slope 1.0000E+00  
 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1544

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count Activity pci/g	Time Corrected Activity pci/g	Uncertainty Counting pci/g	2 Sigma Total pci/g	MDA pci/g
Ra-228	1.7686E+00	1.7821E+00	5.6892E-01	5.7057E-01	
Ra-226 A	1.2612E+00	1.2613E+00	2.7153E+00	2.7155E+00	
Bi-214 #C	1.8861E+00 ✓	1.8862E+00 ✓	4.9944E-01 ✓	5.0154E-01	
Pb-214	2.0048E+00	2.0048E+00	3.7506E-01	3.7822E-01	
Ir-192 #B	8.1912E-02	1.0158E-01	1.7621E-01	1.7623E-01	
Sb-124 #B	7.9791E-02	1.0396E-01	1.5152E-01	1.5154E-01	
Sc-46	3.4641E-01	4.1890E-01	1.8451E-01	1.8479E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	6.0598E+00	6.1998E+00	6.0410E+00	6.0427E+00	
Th-230 #A	1.9466E+01	1.9466E+01	2.3377E+01	2.3381E+01	
Cs-137	4.2367E-01	4.2429E-01	1.8058E-01	1.8088E-01	
Co-60 #B	-7.8788E-02	-7.9442E-02	2.7155E+02	2.7155E+02	
Am-241 #A	3.2394E-02	3.2397E-02	1.6422E-01	1.6422E-01	
K-40	2.0570E+01	2.0570E+01	3.8229E+00	3.8555E+00	
U-235 A	3.1398E-02	3.1398E-02	1.5327E-01	1.5327E-01	
Th-234 #B	1.8549E+00	1.8549E+00	3.8444E+00	3.8448E+00	
Cs-134 #	2.5155E-01	2.5692E-01	1.8194E-01	1.8205E-01	
Pb-212	1.0174E+00	1.0174E+00	2.6234E-01	2.6357E-01	
Ra-224 A	3.5425E-01	2.8863E+01	2.2512E+02	2.2512E+02	
I-131 #B	4.9472E-02	3.5876E-01	7.3906E-01	7.3911E-01	
Mn-54 #A	1.0277E-01	1.0814E-01	1.2080E-01	1.2083E-01	
Tl-208 #H	6.8019E-01	>12 Halflives	2.7065E-01	2.7115E-01	
Bi-212	2.5588E+00	>12 Halflives	1.8913E+00	1.8924E+00	
Ra-223 #A	-9.6498E-02	-3.8883E-01	-6.1433E+00	-6.1433E+00	
Pa-234 #A	1.2805E-01	>12 Halflives	3.5161E-01	3.5163E-01	
Eu-154 #A	1.5624E-02	1.5702E-02	4.2474E-02	4.2476E-02	

Eu-152 #A -9.5224E-02 -9.5536E-02 -1.7524E-01 -1.7526E-01  
 Na-22 #A 1.5407E-02 1.5667E-02 5.6489E-02 5.6490E-02

c12100524.15dup

Zn-65	A	1.7814E-01	1.9013E-01	1.9559E-01	1.9564E-01
Ba-133	A	5.7502E-02	5.7741E-02	1.4192E-01	1.4193E-01
Ru-103	#B	6.7033E-02	1.0048E-01	1.3754E-01	1.3759E-01
Be-7	#B	1.2224E+00	1.6473E+00	2.0072E+00	2.0082E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	-7.3448E-02	-1.3756E+01	-4.4146E+02	-4.4146E+02
Pa-234	F	3.6963E+00	>12 Halflives	2.2650E+00	2.2691E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Halflife limit exceeded

----- S U M M A R Y -----

Total Activity ( 48.8 to 1990.5 keV) 2.5477959E+01 pCi/g  
 Total Decayed Activity ( 48.8 to 1990.5 keV) 2.5478065E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

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Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

c12100524.16

ORTEC g v - i (2191) wan32 G53W2.06 07-NOV-2012 17:05:54 Page 1  
Energy Laboratory Spectrum name: C12100524.16.An1

Sample description  
c12100524.16

Spectrum Filename: C:\User\C12100524.16.An1

Acquisition information

Start time: 07-Nov-2012 15:58:11  
Live time: 3597  
Real time: 3600  
Dead time: 0.08 %  
Detector ID: 1

Detector system  
Det 2

Calibration

Filename: 1369.93.1ccd2\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 det2 New standard perched

Energy Calibration

Created: 16-Oct-2012 14:41:07  
Zero offset: -0.142 keV  
Gain: 0.245 keV/channel  
Quadratic: -4.513E-08 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:52:48  
Type: Polynomial  
Uncertainty: 0.662 %  
Coefficients: -0.298905 -5.705226 0.676697  
-0.107108 0.009115 -0.000318

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.82keV )  
Stop channel: 8144 ( 1990.47keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.7584E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.7584E+02) =  
1.5355E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	15-Oct-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	020711bkg1000mindet2.Pbc 07-Feb-2011 12:45:23
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1141

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228	2.4592E+00	2.4780E+00	6.7055E-01	6.7326E-01	
Ra-226 #A	0.0000E+00	0.0000E+00	1.4935E+04	1.4935E+04	
Bi-214 C	2.5078E+00	2.5078E+00	5.0339E-01	5.0707E-01	
Pb-214	2.0011E+00	2.0011E+00	4.2205E-01	4.2485E-01	
Ir-192 B	8.1802E-02	1.0162E-01	1.2799E-01	1.2802E-01	
Sb-124 #B	1.3902E-01	1.8152E-01	1.6690E-01	1.6696E-01	
Sc-46 A	2.6029E-01	3.1524E-01	2.1413E-01	2.1427E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	-1.1152E+00	-1.1412E+00	1.2644E+04	1.2644E+04	
Th-230 #A	2.9667E+00	2.9667E+00	1.5667E+01	1.5667E+01	
Cs-137 #	4.6209E-01	4.6277E-01	1.9961E-01	1.9992E-01	
Co-60 #B	-6.7102E-03	-6.7664E-03	-1.2534E-02	-1.2535E-02	
Am-241 A	2.2882E-01	2.2884E-01	2.3390E-01	2.3396E-01	
K-40	2.0845E+01	2.0845E+01	4.0685E+00	4.0999E+00	
U-235 A	2.9086E-01	2.9086E-01	2.7062E-01	2.7071E-01	
Th-234 B	2.0102E+00	2.0102E+00	2.8219E+00	2.8225E+00	
Cs-134 #A	-5.2916E-02	-5.4056E-02	-4.1662E-01	-4.1662E-01	
Pb-212	1.0530E+00	1.0530E+00	2.5224E-01	2.5361E-01	
Ra-224 A	5.4384E-01	4.5903E+01	2.3852E+02	2.3852E+02	
I-131 #F	2.5619E-01	1.8876E+00	1.5355E+00	1.5362E+00	
Mn-54 A	1.7133E-01	1.8036E-01	1.5545E-01	1.5551E-01	
Tl-208 #H	5.7878E-01	>12 Halfives	2.4637E-01	2.4677E-01	
Bi-212 #	3.4047E+00	>12 Halfives	1.7637E+00	1.7656E+00	
Ra-223 #A	1.7491E-01	7.1270E-01	3.1763E+00	3.1763E+00	
Pa-234 A	3.0641E-01	>12 Halfives	3.4313E-01	3.4321E-01	
Eu-154 #A	9.5000E-02	9.5476E-02	1.1932E-01	1.1934E-01	

Eu-152 #A 6.3346E-01 6.3555E-01 5.2024E-01 5.2047E-01  
 Na-22 #A 0.0000E+00 0.0000E+00 4.5087E+02 4.5087E+02

C12100524.16

Zn-65	A	2.2532E-01	2.4062E-01	2.2863E-01	2.2871E-01
Ba-133	A	6.7276E-02	6.7558E-02	1.4353E-01	1.4354E-01
Ru-103	#B	-8.5241E-03	-1.2819E-02	-3.3946E-01	-3.3946E-01
Be-7	#B	1.7793E-02	2.4035E-02	9.2695E-01	9.2695E-01
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	1.1905E-01	2.3255E+01	8.9771E+01	8.9775E+01
Pa-234	#B	3.8775E+00	>12 Halflives	3.2124E+00	3.2156E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

S U M M A R Y

-----  
 Total Activity ( 48.8 to 1990.5 keV) 2.8866154E+01 pCi/g  
 Total Decayed Activity ( 48.8 to 1990.5 keV) 2.8885151E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory





# ANALYTICAL SUMMARY REPORT

January 02, 2013

Montgomery Watson Harza  
1475 Pine Grove Rd Ste 109  
Steamboat Springs, CO 80477

Workorder No.: C12101133                      Quote ID: C3667 - San Mateo Mine  
Project Name:   NECR EDRA

Energy Laboratories, Inc. Casper WY received the following 1 sample for Montgomery Watson Harza on 10/26/2012 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
C12101133-001	SSPT-030 Z-6	10/17/12 11:22	10/26/12	Soil	Gamma Sample Preparation Gross Gamma

The results as reported relate only to the item(s) submitted for testing. The analyses presented in this report were performed at Energy Laboratories, Inc., 2393 Salt Creek Hwy., Casper, WY 82601, unless otherwise noted. Radiochemistry analyses were performed at Energy Laboratories, Inc., 2325 Kerzell Lane, Casper, WY 82601, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

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

Report Approved By:

**CLIENT:** Montgomery Watson Harza  
**Project:** NECR EDRA  
**Sample Delivery Group:** C12101133

**Revised Date:** 01/02/13

**Report Date:** 11/15/12

## CASE NARRATIVE

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### REVISED/SUPPLEMENTAL REPORT

The attached analytical report has been revised from a previously submitted report due to the the inclusion of Level III raw data as originally requested. In addition, the Radium 226 has been reanalyzed by Method 901.1 as originally requested by the client.

### COMMENTS

Included with the analysis reports are instrument data reports for all analysis associated with the instrument calibration, QC sample analysis, and sample analysis. All analytical data is within method QA/QC specifications except as noted on analyses and/or QC summary reports, or in this narrative. The analytical report identifies which QC batch ID and sequence QC is associated with each analysis result for a sample. The results of this Analytical Report relate only to the items submitted for analysis. Only the raw data associated with parameters listed on this report should be validated.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-030 Z-6  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12101133-001  
**Collection Date:** 10/17/12 11:22  
**Date Received:** 10/26/12  
**Report Date:** 11/15/12      **Revised Date:** 01/02/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.3	pCi/g-dry		0.3		E901.1	12/07/12 08:25 / dpb	10/30/12 09:20		GAM-HPGE_121207A : 29		R168127
Radium 226 precision (±)	0.6	pCi/g-dry				E901.1	12/07/12 08:25 / dpb	10/30/12 09:20		GAM-HPGE_121207A : 29		R168127

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



# QA/QC Summary Report

Prepared by Casper, WY Branch

Revised Date: 01/02/13

Report Date: 11/15/12

Work Order: C12101133

Client: Montgomery Watson Harza

Project: NECR EDRA

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: E901.1</b>										
Batch: R168127										
<b>Sample ID: LCS-R168127</b>	Laboratory Control Sample									
Bismuth 214		2.5	pCi/g-dry	0.3	98	70	130			12/07/12 08:25
- The LCS sample uses Bi214 for Ra226.										
<b>Sample ID: MB-R168127</b>	2	Method Blank								12/07/12 08:25
Radium 226		ND	pCi/g-dry							U
Radium 226 precision (±)		ND	pCi/g-dry							
<b>Sample ID: C12101133-001ADUP</b>	2	Sample Duplicate								12/07/12 08:25
Radium 226		1.2	pCi/g-dry	0.3				8.0	20	
Radium 226 precision (±)		0.4	pCi/g-dry							

**Qualifiers:**

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

U - Not detected at minimum detectable concentration

# Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

## Workorder Receipt Checklist

Montgomery Watson Harza

C12101133

Login completed by: Timothy I. Houghteling

Date Received: 10/26/2012

Reviewed by: BL2000\kmiller

Received by: dw

Reviewed Date: 10/30/2012

Carrier FedEx  
name:

- |   |   |                             |  |
|---|---|-----------------------------|--|
| Shipping container/cooler in good condition?  | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> | Not Present <input type="checkbox"/>                       |
| Custody seals intact on shipping container/cooler?  | Yes <input type="checkbox"/>            | No <input type="checkbox"/> | Not Present <input checked="" type="checkbox"/>            |
| Custody seals intact on sample bottles?   | Yes <input type="checkbox"/>            | No <input type="checkbox"/> | Not Present <input checked="" type="checkbox"/>            |
| Chain of custody present?   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |  |
| Chain of custody signed when relinquished and received?   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |  |
| Chain of custody agrees with sample labels?   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |  |
| Samples in proper container/bottle?   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |  |
| Sample containers intact?   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |  |
| Sufficient sample volume for indicated test?  | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |  |
| All samples received within holding time?<br>(Exclude analyses that are considered field parameters<br>such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.) | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |  |
| Temp Blank received?  | Yes <input type="checkbox"/>            | No <input type="checkbox"/> | Not Applicable <input checked="" type="checkbox"/>         |
| Container/Temp Blank temperature:   | 7.6°C                                   |                             |  |
| Water - VOA vials have zero headspace?  | Yes <input type="checkbox"/>            | No <input type="checkbox"/> | No VOA vials submitted <input checked="" type="checkbox"/> |
| Water - pH acceptable upon receipt?   | Yes <input type="checkbox"/>            | No <input type="checkbox"/> | Not Applicable <input checked="" type="checkbox"/>         |

Contact and Corrective Action Comments:

None



**Radiochemistry**  
**Level 4 Reporting Checklist**

Method #: E901.1 Analyte: Pa-226

- Energy Labs Batch ID: \_\_\_\_\_
- Omega Data Entry Batch ID: 35798, 35803
- Instrument ID: DET1
- Instrument background check
- Instrument efficiency/calibration check
- Bench-sheets (Sample run order should include MS, MSD, MB, RB, STD, and LCS every 20 samples)
- Photocopy of instrument run log
- Photocopy of standard preparation notes
- Photocopy of standard source calibration certificate noting manufacturer, stock and/or lot number
- Photocopy of method control charts for the following:  
(provided by QA Dept.)
  - Laboratory Control Standard (LCS)
  - Matrix Spikes (MS) and Matrix Spike Duplicates (MSD)
  - Method Blank (MB)
- Analyst Case Narrative consisting of the following:
  - A statement documenting the analytes and the method used
  - Date of analysis
  - Any instrument adjustment or anomalies encountered during analysis
  - Printed name and signature of analyst

Did you log sample from storage? Yes  No

Container size: 3 inch <sup>Steel</sup> Can Sample Preservation noted: None

Sample Numbers: C12110623, 1-24 ; C12101133-001

**Analyst Case Narrative**

Method #: E901.1 Analyte: Pa-226 Date/time of analysis: 12-7-12 8:25

*Any problems or anomalies encountered during analysis?*

No  Yes  (please explain below)

Analyst case narrative: RAN SAMPLES ACCORDING TO  
EPA METHOD 901.1 USING GAMMAVISION  
SOFTWARE

*Any instrument adjustments or anomalies encountered during analysis?*

No  Yes  (please explain below)

Analyst case narrative: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Analyst: DAVID BLAIDA  
Please print

Signature: David Blaida



# PREP BATCH REPORT

Prep Batch 35798    Prep Code: PRP-GAMMA

Technician: David Mikesell  
Batch Units: G

Prep Start Date: 11/16/2012 12:45:23  
Prep End Date: 11/16/2012 13:13:00

Sample ID	Matrix	pH	Initial Samp Amt	Sol Added	Sol Recov	Fin Vol (mL)	Factor	Balance	PrepStart	PrepEnd
C12110623-001A - D & G	Soil		202.81	0	0	202.81	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-002A	Soil		206.28	0	0	206.28	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-003A	Soil		195.43	0	0	195.43	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-004A	Soil		198.05	0	0	198.05	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-005A	Soil		206.71	0	0	206.71	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-006A	Soil		210.33	0	0	210.33	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-007A	Soil		208.25	0	0	208.25	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-008A	Soil		186.97	0	0	186.97	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-009A	Soil		210.44	0	0	210.44	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-010A	Soil	DUP	196.91	0	0	196.91	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-011A	Soil		208.26	0	0	208.26	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-012A	Soil		203.48	0	0	203.48	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-013A	Soil		208.27	0	0	208.27	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-014A	Soil		188.9	0	0	188.9	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-015A	Soil		200.86	0	0	200.86	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-016A	Soil		209.78	0	0	209.78	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-017A	Soil		209.02	0	0	209.02	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-018A	Soil		196.63	0	0	196.63	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-019A	Soil		188.08	0	0	188.08	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-020A	Soil	DUP	202.44	0	0	202.44	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-021A	Soil		186.82	0	0	186.82	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-022A	Soil		184.63	0	0	184.63	1	Sartorius CP3202	11/16/2012	11/16/2012

*Counted after 12/7/12*

*HP Co. 12/26*

*Started 12-7-12 @ 8:25 DB  
GEGG+PGE  
12/20/12  
8:25*

*(12)  
12-22-12  
DB  
cule*

*QA/QC  
12/13/12  
R.S.*

Spk ID	Spike Name	SampType	AmtAdd
RW	PREP BATCH OK	All	10/29/2012

# PREP BATCH REPORT

Prep Batch 35798

Prep Code: PRP-GAMMA

Technician: David Mikesell

Batch Units: G

Prep Start Date: 11/16/2012 12:45:23

Prep End Date: 11/16/2012 13:13:00

Sample ID	Matrix	pH	Initial Samp Amt	Sol Added	Sol Recov	Fin Vol (mL)	Factor	Balance	PrepStart	PrepEnd
C12110623-023A	Soil		183.56	0	0	183.56	1	Sartorius CP3202	11/16/2012	11/16/2012
C12110623-024A	Soil		203.54	0	0	203.54	1	Sartorius CP3202	11/16/2012	11/16/2012

Spk ID	Spike Name	SampType	AmtAdd
RW	PREP BATCH OK	All	10/29/2012

RAD

# PREP BATCH REPORT

Prep Batch 35803    Prep Code: PRP-GAMMA

Technician: Rich White  
Batch Units: G

Prep Start Date: 11/19/2012 9:06:12  
Prep End Date: 11/19/2012 9:08:00

Sample ID	Matrix	pH	Initial Samp Amt	Sol Added	Sol Recov	Fin Vol (mL)	Factor	Balance	PrepStart	PrepEnd
C12101133-001A D&G	Soil		186.57	0	0	186.57	1	Sartorius	11/19/2012	11/19/2012

Started  
12-11-12  
5:11 AM

Count on or  
after 12-10-12  
HpGe Ra-226

HPGE  
121207A  
8:25

R  
12-12-12  
DB

calc'd

Spk ID	Spike Name	SampType	AmtAdd
RW	PREP BATCH OK	All	11/19/2012

Instruments: EGG Ortec Octete PC Alpha Spectroscopy System and EGG Ortec High Purity Germanium Detector

Date	Det. No.	Count Time Min.	Isotope	Batch ID	Associated Samples	Data File Number	Instrument ID		Int	Comments Maintenance Log
							Alpha Spec	Gamma Spec		
11-29-12	1-5	240	Th	1740		Th-1740	✓			
11-29-12	6-14	240	Th	1740		Th-1741	✓			
11-30-12	1-5, 1-19, 2-23	240	Th	1743		Th-1743	✓			
12-3-12	1, 2	10, 30	PCIK, BKG							
12-3-12	1-24	5	N/A	Pulser		16218-16241	✓			
12-3-12	1-16	5	N/A	Pulser		2012.12.03.001 MCB 1-16	✓			
12-3-12	1-16	5	N/A	EFF CK	Monthly Eff CK Dec 0	2012.12.03.001 MCB 1-16	✓			
12-3-12	1-5, 7, 19, 23	5	N/A	EFF CK	" "		✓			
12-3-12	1, 2	1000	Extended by 1000 min December 2012							
12-3-12	1-24	1000	160 Th	Bkg Check		16267-16290	✓			
12-3-12	1-16	1000	L			2012.12.03.001 MCB 1-16	✓			
12-5-12	15-24	5	N/A	EFF CK			✓			
12-5-12	1	10, 30, 120	PCIK	BKG	C12110669					
12-5-12	1-5, 7, 19, 21	240	Th	1744		Th-1744	✓			
12-5-12	1-5, 7, 19, 21, 24	240	U	558		1500-558	✓			
12-6-12	1-2	240	L		11748 11748		✓			
12-6-12	13-19, 23	240	Th	1745		Th-1745	✓			
12-6-12	1-7	240	U	557		1500-557	✓			
12-6-12	9-14	240	Th	1746		Th-1746	✓			
12-6-12	1, 2	10, 30, 120	PCIK	BKG	ON DET 2 C12120045, 1-3					
12-7-12	1, 2	PCIK, BKG			C12120045, 1-3 C12110623, 1-24					
12-10-12	1, 2	PCIK, BKG			C12110623, 1-					
12-10-12	1-24	5	N/A	Pulser		16431-16454	✓			





ECKERT & ZIEGLER

Valencia, California 91355

Isotope Products

Tel 661-309-1010

Fax 661-257-8303

2009 CAN

# CERTIFICATE OF CALIBRATION MULTINUCLIDE STANDARD SOURCE

Customer: ENERGY LABORATORIES  
P.O. No.: 80311  
Catalog No.: EG-ML

Source No.: 1369-93-1  
Reference Date: 1-Jun-09 12:00 PST  
Contained Radioactivity: 0.8669  $\mu$ Ci 32.08 kBq

### Physical Description:

- A. Capsule type: Customer supplied can - 3" (76 mm) OD
- B. Nature of active deposit: Multinuclide distributed in 1.5 g/cc epoxy matrix
- C. Active diameter/volume: Approximately 124mL (186.0 grams)
- D. Backing: Steel
- E. Cover: Steel

Gamma-Ray Energy (keV)	Nuclide	Half-life	Branching Ratio (%)	Activity ( $\mu$ Ci)	Gammas per second	Total Uncert
88	Cd-109	462.6 $\pm$ 0.7 days	3.63	0.2492	334.7	3.1 %
122	Co-57	271.79 $\pm$ 0.09 days	85.6	0.01081	342.4	3.1 %
159	Te-123m	119.7 $\pm$ 0.1 days	84.0	0.01236	384.1	3.1 %
320	Cr-51	27.706 $\pm$ 0.007 days	9.86	0.3056	1115	3.0 %
392	Sn-113	115.09 $\pm$ 0.04 days	64.9	0.04791	1150	3.0 %
514	Sr-85	64.849 $\pm$ 0.004 days	98.4	0.05830	2123	3.0 %
662	Cs-137	30.17 $\pm$ 0.16 years	85.1	0.04177	1315	3.0 %
898	Y-88	106.630 $\pm$ 0.025 days	94.0	0.09170	3189	3.0 %
1173	Co-60	5.272 $\pm$ 0.001 years	99.86	0.04926	1820	3.0 %
1333	Co-60	5.272 $\pm$ 0.001 years	99.98	0.04926	1822	3.0 %
1836	Y-88	106.630 $\pm$ 0.025 days	99.4	0.09170	3373	3.0 %

### Method of Calibration:

This source was prepared from a weighed aliquot of solution whose concentrations in  $\mu$ Ci/g were determined by gamma spectrometry.

### Notes:

- See reverse side for leak test(s) performed on this source.
- EZIP participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from IAEA-TECDOC-619, 1991.
- Overall uncertainty is calculated at the 99% confidence level.
- This source has a working life of 1 year.

*Daniel James Van Dolen*  
Quality Control

28-May-09  
Date

EZIP Ref. No.: 1369-93

ISO 9001 CERTIFIED

Medical Imaging Laboratory

Industrial Gauging Laboratory

RS-82

#: 3129

Opened: \_\_\_\_\_  
Diluted Climax Sand Tailings-08826  
Expires: 5/6/2007  
Rec'd: 11/7/2006  
Energy Laboratories, Inc 2393 Salt Creek Hwy  
Casper WY 82602

DCS 08826  
CAN  
LCS 9

**U.S. ENVIRONMENTAL PROTECTION AGENCY**  
**ENVIRONMENTAL MONITORING AND SUPPORT LABORATORY-LAS VEGAS**  
**QUALITY ASSURANCE BRANCH**

Calibration Certificate  
DILUTED CLIMAX SAND TAILINGS

Description	Principal radionuclide	Thorium-230	Net-317s	
	Net activity		curies	
	Net volume	10	g	net in ampule/bottle number

**Measurement**

**Activity of principal radionuclide**

Activity per gram of this solution

35.3 pico curies or Thorium-230  
at 0600 hours PST on May 1, 1976

**Activity of daughter radionuclide**

The principal activity was accompanied at the quoted time by and 40 pico curies per gram of lead-210.

45.4 pico curies per gram

of the daughter nuclide Radium-226

Total mass of this solution

Total principal activity per gram at the quoted time

10 grams      35.3 pico curies

Method of measurement: Gravimetric dilution of analyzed Climax Sand Tailings. The thorium-230 was analyzed by alpha spectroscopy. Radium-226 was measured using radon emanation.

REV. 1-17-66

OC5 0.8821  
1.659

Random Errors

The repeatability of this standardization (dilutions, source preparations, counting statistics, mass determinations, etc.) was such that the certified value of the radioactive concentration of the principle activity had a standard error ( $\sigma$ ) not greater than

4%

(The 99.7% confidence limits are given by  $\pm 3\sigma$ .)  
Due to limited results, the error estimate is based on the measurements of the undiluted sand tailings.

The total systematic error (sum of estimated maximum residual systematic errors due to dispensing, counting losses, counting corrections, known uncertainty of standard) of the certified radioactive concentration of the principle activity has been estimated not to exceed

+ 3% ( $\delta$ ) or - 3% ( $\delta'$ )

The overall limits of error calculated on the basis of  $+(3\sigma + \delta)$  or  $-(3\sigma + \delta')$  are

+ 15% or - 15%

of the quoted radioactive concentration.

The effective standard deviation is defined as 1/6th of the range between the overall limits  $+(3\sigma + \delta)$  and  $-(3\sigma + \delta')$  and is therefore

5%

Decay Schemes

This standardization is based on the following assumptions of the principle nuclide, its daughter nuclides and impurities (no allowance for error in these assumptions or the assumption of quoted half-life have been included in the statement of accuracy above).

See attachment.

Chemical Composition of Solution

Carrier content per gram of solution:

Other components:

Preservative:

Remarks

45.4  $\mu\text{Ci/g}$  Ra-226  
 $\times 10$  grams total  
454  $\mu\text{Ci}$  total activity  
 $\div 173.33$  grams of blank leadate sand  
2.6  $\mu\text{Ci/g}$  Ra-226  
Date Certificate Prepared April 18, 1977

Approval Signature

*Joe H. Ziegler*

Note:

Total mass of can is 183.33 grams  
 $\sqrt{v}$  with OC5 10 gram inclusive.

OB 7-27-11



Calibration Data from file: 1369.93.1ccdet1\_lperched.Clb  
 Energy Calibration Date: 6/5/2009 Time: 11:22:16  
 Efficiency Calibration Date: 6/5/2009 Time: 11:39:17

Calibration Description:  
 6/5/09 can calibration polynomial new standard  
 IPL #1369-93-1 new calibration perched

Energy Calibration Fit  
 Energy =  $-0.3919 + 0.243214 * \text{Channel} - 9.76725e-010 * \text{Channel}^2$   
 FWHM (keV) =  $2.7504 + 0.000971 * \text{Channel} - 2.70459e-008 * \text{Channel}^2$

Channel	Energy(keV)	Fit(keV)	Delta	FWHM	Fit	Delta
363.02	88.00	87.90	0.11%	0.74	0.75	-2.10%
502.91	122.00	121.92	0.06%	0.78	0.79	-0.93%
654.82	159.00	158.87	0.08%	0.81	0.82	-1.42%
1317.38	320.00	320.01	-0.00%	0.99	0.97	1.72%
1611.93	391.00	391.65	-0.17%	1.01	1.03	-2.39%
2114.79	514.00	513.95	0.01%	1.16	1.14	1.61%
2722.10	662.00	661.65	0.05%	1.31	1.26	3.65%
3694.22	898.00	898.08	-0.01%	1.50	1.45	2.99%
4825.86	1173.00	1173.30	-0.03%	1.67	1.66	1.09%
5480.66	1333.00	1332.55	0.03%	1.63	1.77	-8.16%
7551.24	1836.00	1836.12	-0.01%	2.12	2.08	2.12%

Efficiency Calibration Fit  
 Polynomial Uncertainty = 1.1491 %  
 Coefficients:  
 $-0.345759 -5.963100 0.675305 -0.103447 0.008672 -0.000304$

Energy	Efficiency	Fit	Delta
88.00	1.8030E-002	1.8033E-002	-0.02%
122.00	1.8069E-002	1.8041E-002	0.15%
159.00	1.5244E-002	1.5291E-002	-0.31%
320.00	8.8571E-003	8.7565E-003	1.14%
392.00	7.2997E-003	7.3136E-003	-0.19%
514.00	5.5726E-003	5.7472E-003	-3.13%
662.00	4.7604E-003	4.6095E-003	3.17%
898.00	3.5154E-003	3.5587E-003	-1.23%
1173.00	2.8900E-003	2.8429E-003	1.63%
1333.00	2.5087E-003	2.5490E-003	-1.61%
1836.00	1.9175E-003	1.9124E-003	0.27%

Isotope	Energy	Pct	Halflife	Activity	GPS	Error	Date & Time
Cd-109	88.03	3.63	4.63E+002	9865.01	358.10	3.10%	5/1/2008 12:00:00
Co-57	122.07	85.60	2.72E+002	400.00	342.40	3.10%	6/1/2009 12:00:00
Te-123m	159.07	84.00	1.20E+002	457.26	384.10	3.00%	6/1/2009 12:00:00
Sn-113	391.69	64.90	1.15E+002	1771.96	1150.00	3.00%	6/1/2009 12:00:00
Y-88	898.02	94.00	1.07E+002	3392.55	3189.00	3.00%	6/1/2009 12:00:00
Co-60	1173.24	99.86	1.93E+003	1822.55	1820.00	3.00%	6/1/2009 12:00:00
Co-60	1333.00	99.98	1.93E+003	1822.36	1822.00	3.00%	6/1/2009 12:00:00
Y-88	1836.01	99.40	1.07E+002	3393.36	3373.00	3.00%	6/1/2009 12:00:00
Cr-51	320.00	9.86	2.77E+001	11308.32	1115.00	3.00%	6/1/2009 12:00:00
Sr-85	514.00	98.40	6.48E+001	2157.52	2123.00	3.00%	6/1/2009 12:00:00
Cs-137	661.66	85.10	1.10E+004	1545.24	1315.00	3.00%	6/1/2009 12:00:00
Cd-109	1836.27	3.63	4.63E+002	9220.39	334.70	3.10%	6/1/2009 12:00:00

Calibration Data from file: 1369.93.lccd1\_1lperched.Clb  
 Energy Calibration Date: 10/16/2012 Time: 14:32:42  
 Efficiency Calibration Date: 6/5/2009 Time: 11:39:17

Calibration Description:  
 10/16/12 can calibration energy re-cal  
 IPL #1369-93-1 new calibration perched

Energy Calibration Fit  
 Energy = -0.2923 +0.243203\*Channel -4.95665e-009\*Channel\*\*2  
 FWHM (keV) = 2.5984 +0.001193\*Channel -6.59988e-008\*Channel\*\*2

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM	Fit	Delta
363.13	88.00	88.02	-0.02%	0.76	0.74	3.67%
503.23	122.06	122.09	-0.02%	0.74	0.77	-4.17%
2722.55	662.00	661.81	0.03%	1.31	1.30	0.35%
4826.55	1173.00	1173.43	-0.04%	1.65	1.66	-0.17%
5481.66	1333.00	1332.72	0.02%	1.74	1.74	0.07%

Efficiency Calibration Fit  
 Polynomial Uncertainty = 1.1491 %  
 Coefficients:  
 -0.345759 -5.963100 0.675305 -0.103447 0.008672 -0.000304

Efficiency Table

Energy	Efficiency	Fit	Delta
88.00	1.8030E-002	1.8033E-002	-0.02%
122.00	1.8069E-002	1.8041E-002	0.15%
159.00	1.5244E-002	1.5291E-002	-0.31%
320.00	8.8571E-003	8.7565E-003	1.14%
392.00	7.2997E-003	7.3136E-003	-0.19%
514.00	5.5726E-003	5.7472E-003	-3.13%
662.00	4.7604E-003	4.6095E-003	3.17%
898.00	3.5154E-003	3.5587E-003	-1.23%
1173.00	2.8900E-003	2.8429E-003	1.63%
1333.00	2.5087E-003	2.5490E-003	-1.61%
1836.00	1.9175E-003	1.9124E-003	0.27%

Calibration Certificate Table

Isotope	Energy	Pct	Half-life	Activity	GPS	Error	Date & Time
Cd-109	88.03	3.63	4.63E+002	9865.01	358.10	3.10%	5/1/2008 12:00:00
Co-57	122.07	85.60	2.72E+002	400.00	342.40	3.10%	6/1/2009 12:00:00
Te-123m	159.07	84.00	1.20E+002	457.26	384.10	3.00%	6/1/2009 12:00:00
Sn-113	391.69	64.90	1.15E+002	1771.96	1150.00	3.00%	6/1/2009 12:00:00
Y-88	898.02	94.00	1.07E+002	3392.55	3189.00	3.00%	6/1/2009 12:00:00
Co-60	1173.24	99.86	1.93E+003	1822.55	1820.00	3.00%	6/1/2009 12:00:00
Co-60	1333.00	99.98	1.93E+003	1822.36	1822.00	3.00%	6/1/2009 12:00:00
Y-88	1836.01	99.40	1.07E+002	3393.36	3373.00	3.00%	6/1/2009 12:00:00
Cr-51	320.00	9.86	2.77E+001	11308.32	1115.00	3.00%	6/1/2009 12:00:00
Sr-85	514.00	98.40	6.48E+001	2157.52	2123.00	3.00%	6/1/2009 12:00:00
Cs-137	661.66	85.10	1.10E+004	1545.24	1315.00	3.00%	6/1/2009 12:00:00
Cd-109	1836.27	3.63	4.63E+002	9220.39	334.70	3.10%	6/1/2009 12:00:00

ACTIVITY DECAY CORRECTIONS  
LCS CANS 6 - 10, gbkg

Input Analyte	LCS #	Input Half life Years	Calc Half life Days	Calc Half life Hours	Input Original pCi	Calc Original uCi	Calc Corrected pCi	Calc Corrected nCi	Calc Corrected uCi	Calc Corrected Bq	Input Reference Date	Input Current Date	Calc DPM	Input Measured pCi	Calc Percent Recovery	LCS #	
IPL-6	6	1600	5.84E+05	14025600	47.4	4.74E-05	46.88	0.05	4.69E-05	1.734	4/1/1987	11/13/2012	104.07	43.1	0.92	6	DET1
IPL-6	6	1600	5.84E+05	14025600	47.4	4.74E-05	46.88	0.05	4.69E-05	1.734	4/1/1987	11/13/2012	104.07	41.4	0.88	6	DET2
IPL-7	7	1600	5.84E+05	14025600	8.72	8.72E-06	8.66	0.01	8.66E-06	0.320	2/1/1997	11/13/2012	19.23	8.0	0.93	7	DET1
IPL-7	7	1600	5.84E+05	14025600	8.72	8.72E-06	8.66	0.01	8.66E-06	0.320	2/1/1997	11/13/2012	19.23	8.2	0.94	7	DET2
IPL-8	8	1600	5.84E+05	14025600	23.93	2.39E-05	23.77	0.02	2.38E-05	0.879	2/1/1997	11/13/2012	52.76	26.3	1.11	8	DET1
IPL-8	8	1600	5.84E+05	14025600	23.93	2.39E-05	23.77	0.02	2.38E-05	0.879	2/1/1997	11/13/2012	52.76	21.4	0.90	8	DET2
DCS08826	9	1600	5.84E+05	14025600	2.6	2.60E-06	2.57	0.00	2.57E-06	0.095	9/13/1989	12/11/2012	5.71	2.5	0.98	9	DET1
DCS08826	9	1600	5.84E+05	14025600	2.6	2.60E-06	2.57	0.00	2.57E-06	0.095	9/13/1989	11/15/2012	5.71	2.4	0.94	9	DET2

121112dcs088261csdet1

ORTEC g v - i (2191) wan32 G53W2.06 11-DEC-2012 08:41:13 Page 1  
Energy Laboratory Spectrum name: 121112dcs088261csdet1.An1

Sample description  
121112dcs088261csdet1

Spectrum Filename: C:\User\121112dcs088261csdet1.An1

Acquisition information

Start time: 11-Dec-2012 07:25:00  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd1\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 2  
Sample size: 1.8333E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8333E+02) =  
1.4728E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	13-Sep-1989 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

 Energy Calibration  
 Normalized diff: 0.1380

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***** SUMMARY OF NUCLIDES IN SAMPLE *****					
Nuclide	Time of Count	Time Corrected	Uncertainty	1 Sigma	MDA
	Activity	Activity	Counting	Total	pci/g
	pci/g	pci/g	pci/g	pci/g	
Ra-228	A	5.1165E-01	8.4312E+00	3.8888E+00	3.8904E+00
Ra-226	A	3.9758E+00	4.0160E+00	1.3323E+00	1.3334E+00
Bi-214	C	2.5278E+00	2.5534E+00	2.9370E-01	2.9566E-01
Pb-214		2.7404E+00	2.7681E+00	2.2617E-01	2.2915E-01
Ir-192	F	1.4157E-01	>12 Halflives	5.9198E-02	5.9228E-02
Sb-124	#B	6.9721E-02	>12 Halflives	4.8223E-02	4.8232E-02
Sc-46		5.7784E-01	>12 Halflives	1.0934E-01	1.0961E-01
Pb-210	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Th-228	#A	6.5459E+00	>12 Halflives	3.1381E+00	3.1391E+00
Th-230	#A	4.2661E+00	4.2670E+00	5.5479E+00	5.5481E+00
Cs-137	#A	2.7680E-02	4.7275E-02	5.2768E-02	5.2772E-02
Co-60	#B	-3.0821E-02	-6.5516E-01	2.0841E+03	2.0841E+03
Am-241	#A	-1.8185E-02	-1.8876E-02	1.4121E+02	1.4121E+02
K-40	#A	-9.0632E-01	-9.0632E-01	2.3290E+03	2.3290E+03
U-235	#A	-1.5078E-02	-1.5078E-02	-9.8702E-02	-9.8702E-02
Th-234	F	7.6109E+00	7.6109E+00	1.7030E+00	1.7065E+00
Cs-134	#A	-3.2099E-02	-7.9422E+01	2.8568E+05	2.8568E+05
Pb-212	A	2.1685E-01	2.1685E-01	8.8710E-02	8.8759E-02
Ra-224	A	3.1535E-01	>12 Halflives	1.2529E+00	1.2530E+00
I-131	#B	-1.9755E-02	>12 Halflives	7.5624E+01	7.5624E+01
Mn-54	#A	-4.6927E-02	>12 Halflives	-2.7694E-01	-2.7694E-01
Tl-208	#A	-2.6702E-02	>12 Halflives	-1.5261E-01	-1.5261E-01
Bi-212	#A	-1.5711E-02	>12 Halflives	-4.3250E-01	-4.3250E-01
Ra-223	A	4.4683E-02	>12 Halflives	2.7752E-01	2.7752E-01
Pa-234	#A	1.0846E-01	>12 Halflives	1.0387E-01	1.0388E-01
Eu-154	#A	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

□

Eu-152	#	8.6464E-01	2.8958E+00	9.3918E-01	9.3997E-01
Na-22	#A	-2.0006E-02	-9.8268E+00	3.8248E+04	3.8248E+04

121112dcs088261csdet1

Zn-65	A	2.0053E-01	>12 Halflives	1.2564E-01	1.2567E-01
Ba-133	A	5.4736E-02	2.5391E-01	1.8191E-01	1.8194E-01
Ru-103	#B	4.6685E-02	>12 Halflives	2.3141E-02	2.3160E-02
Be-7	#B	0.0000E+00	>12 Halflives	9.3664E+02	9.3664E+02
I-125	#	0.0000E+00	>12 Halflives	0.0000E+00	0.0000E+00
Tl-201	#B	6.5066E-02	>12 Halflives	1.1422E-01	1.1423E-01
Pa-234	#B	0.0000E+00	>12 Halflives	6.6614E+03	6.6614E+03

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

S U M M A R Y

Total Activity ( 48.3 to 1980.0 keV) 5.2682428E+00 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 5.3215609E+00 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214 1173.00 - Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

121112blankdet1

ORTEC g v - i ( 143) wan32 G53W2.06 11-DEC-2012 09:44:57 Page 1  
Energy Laboratory Spectrum name: 121112blankdet1.An1

Sample description  
121112blankdet1

Spectrum Filename: C:\User\121112blankdet1.An1

Acquisition information

Start time: 11-Dec-2012 08:42:34  
Live time: 3598  
Real time: 3600  
Dead time: 0.05 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd1\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.0000E+00  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.0000E+00) =  
2.7000E+01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	30-Apr-1999 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 1.0000

\*\*\*\*\* SUMMARY OF NUCLIDES IN SAMPLE \*\*\*\*\*

Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma
	Activity	Activity	Counting	Total
	pci/l	pci/l	pci/l	pci/l
Ra-228	< 1.3213E+02	6.8224E+02		
Ra-226	< 6.8468E+02	6.8874E+02		
Bi-214	B< 8.1738E+01	8.2222E+01		
Pb-214	< 7.7202E+01	7.7658E+01		
Ir-192	B< 9.53E+00	>12 Halflives		
Sb-124	B< 2.62E+01	>12 Halflives		
Sc-46	< 4.24E+01	>12 Halflives		
Pb-210	No in-range peaks			
Th-228	< 1.1741E+03	1.6444E+05		
Th-230	< 2.3414E+03	2.3417E+03		
Cs-137	< 2.1476E+01	2.9386E+01		
Co-60	B< 2.6987E+01	1.6177E+02		
Am-241	< 3.7646E+01	3.8477E+01		
K-40	< 4.0860E+02	4.0860E+02		
U-235	< 3.8937E+01	3.8937E+01		
Th-234	# 1.1826E+03	1.1826E+03	3.8619E+02	3.8770E+02
Cs-134	< 2.5869E+01	2.5169E+03		
Pb-212	< 5.0269E+01	5.0269E+01		
Ra-224	< 4.90E+02	>12 Halflives		
I-131	B< 1.80E+01	>12 Halflives		
Mn-54	< 2.86E+01	>12 Halflives		
Tl-208	< 3.19E+01	>12 Halflives		
Bi-212	< 2.27E+02	>12 Halflives		
Ra-223	< 7.75E+01	>12 Halflives		
Pa-234	< 6.21E+01	>12 Halflives		
Eu-154	< 5.8808E+01	1.7190E+02		

Eu-152 < 2.0941E+02 4.2515E+02  
 Na-22 < 2.2849E+01 8.6216E+02





C12101133.1

ORTEC g v - i (2191) wan32 G53W2.06 11-DEC-2012 06:11:58 Page 1  
Energy Laboratory Spectrum name: C12101133.1.An1

Sample description  
C12101133.1

Spectrum Filename: C:\User\C12101133.1.An1

Acquisition information

Start time: 11-Dec-2012 05:10:37  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd1\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample size: 1.8657E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8657E+02 ) =  
1.4472E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	19-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0422

\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228	1.4872E+00	1.4979E+00	4.3885E-01	4.4066E-01	
Ra-226 #A	0.0000E+00	0.0000E+00	1.0952E+04	1.0952E+04	
Bi-214 F	1.3431E+00	1.3432E+00	6.1002E-01	6.1107E-01	
Pb-214	9.1068E-01	9.1070E-01	3.3636E-01	3.3724E-01	
Ir-192 #B	9.1519E-03	1.1216E-02	5.0158E-02	5.0159E-02	
Sb-124 #B	0.0000E+00	0.0000E+00	9.3036E+01	9.3036E+01	
Sc-46 A	1.5312E-01	1.8324E-01	1.7471E-01	1.7478E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	6.2171E+00	6.3527E+00	5.8062E+00	5.8081E+00	
Th-230 #A	4.1920E+00	4.1920E+00	1.2389E+01	1.2390E+01	
Cs-137 #A	1.3536E-02	1.3555E-02	6.1567E-02	6.1568E-02	
Co-60 #B	-2.2394E-02	-2.2570E-02	-1.1872E-01	-1.1872E-01	
Am-241 #A	2.3666E-01	2.3669E-01	1.9907E-01	1.9914E-01	
K-40 #	1.6197E+01	1.6197E+01	3.3038E+00	3.3318E+00	
U-235 A	1.7562E-01	1.7562E-01	1.6469E-01	1.6476E-01	
Th-234 #	1.0926E+01	1.0926E+01	2.9731E+00	2.9898E+00	
Cs-134 #A	6.4094E-02	6.5388E-02	9.6031E-02	9.6046E-02	
Pb-212	1.1940E+00	1.1940E+00	2.6635E-01	2.6833E-01	
Ra-224 A	1.9170E+00	1.2259E+02	1.4962E+02	1.4965E+02	
I-131 #F	1.3526E-01	8.7947E-01	8.0391E-01	8.0425E-01	
Mn-54 #A	-4.2568E-02	-4.4667E-02	-3.2748E-01	-3.2748E-01	
Tl-208 #H	5.9123E-01	>12 Halflives	2.4473E-01	2.4523E-01	
Bi-212 #A	1.3509E+00	>12 Halflives	1.0792E+00	1.0798E+00	
Ra-223 #A	-4.3414E-02	-1.6201E-01	-2.9623E+00	-2.9623E+00	
Pa-234 A	2.2241E-01	>12 Halflives	3.0124E-01	3.0129E-01	
Eu-154 #A	0.0000E+00	0.0000E+00	3.7871E+02	3.7871E+02	

Eu-152 #A	3.7234E-01	3.7349E-01	3.9091E-01	3.9103E-01
Na-22 #A	-1.9658E-02	-1.9972E-02	2.0743E+02	2.0743E+02

C12101133.1

Zn-65	A	3.0296E-01	3.2220E-01	2.5023E-01	2.5037E-01
Ba-133	A	6.0364E-02	6.0601E-02	9.4591E-02	9.4605E-02
Ru-103	#B	5.2427E-02	7.6857E-02	1.2393E-01	1.2397E-01
Be-7	#B	3.1833E-02	4.2198E-02	2.0238E-01	2.0238E-01
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	B	4.3842E-01	6.1561E+01	1.0955E+02	1.0957E+02
Pa-234	B	3.5653E+00	>12 Halfives	2.5707E+00	2.5740E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

S U M M A R Y

-----  
 Total Activity ( 48.3 to 1980.0 keV) 2.9227444E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 2.9227467E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

c12101133.1dup

ORTEC g v - i (2191) wan32 G53W2.06 11-DEC-2012 07:22:55 Page 1  
Energy Laboratory Spectrum name: C12101133.1dup.An1

Sample description  
c12101133.1dup

Spectrum Filename: C:\User\C12101133.1dup.An1

Acquisition information

Start time: 11-Dec-2012 06:14:17  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd1\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.8657E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8657E+02 ) =  
1.4472E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	19-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1156

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma	MDA
	Activity	Activity	Counting	Total	pc/g
	pc/g	pc/g	pc/g	pc/g	
Ra-228 #	1.7840E+00	1.7968E+00	6.0890E-01	6.1077E-01	
Ra-226 A	2.8140E+00	2.8141E+00	2.8038E+00	2.8048E+00	
Bi-214 C	1.2203E+00	1.2203E+00	3.5538E-01	3.5687E-01	
Pb-214	1.3461E+00	1.3461E+00	3.4575E-01	3.4760E-01	
Ir-192 #B	2.1964E-02	2.6929E-02	8.6563E-02	8.6566E-02	
Sb-124 #B	0.0000E+00	0.0000E+00	1.6123E+02	1.6123E+02	
Sc-46 A	1.5056E-01	1.8024E-01	1.6278E-01	1.6285E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	2.1293E+00	2.1758E+00	5.6783E+00	5.6785E+00	
Th-230 #A	7.7851E+00	7.7851E+00	1.3075E+01	1.3076E+01	
Cs-137 #A	-1.2082E-02	-1.2098E-02	-9.7268E-02	-9.7268E-02	
Co-60 #F	1.7489E-01	1.7626E-01	1.1471E-01	1.1480E-01	
Am-241 A	9.3876E-02	9.3885E-02	2.0629E-01	2.0630E-01	
K-40	1.9071E+01	1.9071E+01	3.5708E+00	3.6068E+00	
U-235 A	8.2545E-02	8.2545E-02	1.6194E-01	1.6195E-01	
Th-234 #F	9.4804E+00	9.4804E+00	4.1310E+00	4.1400E+00	
Cs-134 #A	1.7168E-01	1.7516E-01	1.4327E-01	1.4335E-01	
Pb-212	8.9647E-01	8.9647E-01	2.4370E-01	2.4492E-01	
Ra-224 A	1.0116E+00	6.5242E+01	1.3927E+02	1.3928E+02	
I-131 F	1.7072E-01	1.1143E+00	9.8669E-01	9.8713E-01	
Mn-54 #A	-4.6112E-02	-4.8391E-02	-4.4939E-01	-4.4939E-01	
Tl-208 H	6.0051E-01	>12 Halflives	1.6401E-01	1.6479E-01	
Bi-212 #	2.3111E+00	>12 Halflives	1.6874E+00	1.6886E+00	
Ra-223	1.2227E+00	4.5753E+00	3.6840E+00	3.6860E+00	
Pa-234 #A	2.2240E-01	>12 Halflives	2.9675E-01	2.9681E-01	
Eu-154 #A	8.5541E-02	8.5944E-02	1.2154E-01	1.2156E-01	

Eu-152 #A	3.9153E-01	3.9275E-01	2.6885E-01	2.6905E-01
Na-22 #A	-1.9658E-02	-1.9973E-02	2.7503E+02	2.7503E+02

c12101133.1dup					
Zn-65	A	2.1806E-01	2.3194E-01	2.0145E-01	2.0155E-01
Ba-133	A	4.1786E-02	4.1951E-02	8.8417E-02	8.8424E-02
Ru-103	#B	1.5728E-02	2.3075E-02	7.9934E-02	7.9939E-02
Be-7	#B	0.0000E+00	0.0000E+00	1.4884E+03	1.4884E+03
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	3.6992E-01	5.2467E+01	8.6059E+01	8.6084E+01
Pa-234	F	4.0027E+00	>12 Halflives	2.2773E+00	2.2821E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Halflife limit exceeded

----- S U M M A R Y -----

Total Activity ( 48.3 to 1980.0 keV) 2.4317823E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 2.4330748E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214 1173.00 - Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
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- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
                   Dave Blaida

Reviewed by: \_\_\_\_\_  
                   Supervisor

Laboratory: Energy Laboratory

# ANALYTICAL SUMMARY REPORT

January 03, 2013

Montgomery Watson Harza  
1475 Pine Grove Rd Ste 109  
Steamboat Springs, CO 80477

Workorder No.: C12110989                      Quote ID: C3898 - NECR

Project Name:   NECR EDRA

Energy Laboratories, Inc. Casper WY received the following 17 samples for Montgomery Watson Harza on 11/28/2012 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
C12110989-001	EDC-01-NSW	10/03/12 11:00	11/28/12	Soil	Gamma Sample Preparation Gross Gamma
C12110989-002	EDC-03-NSW	10/03/12 11:15	11/28/12	Soil	Same As Above
C12110989-003	EDC-07-SSW	10/03/12 11:27	11/28/12	Soil	Same As Above
C12110989-004	EDC-DS3	10/03/12 11:30	11/28/12	Soil	Same As Above
C12110989-005	EDC-09-SSW	10/03/12 11:45	11/28/12	Soil	Same As Above
C12110989-006	EDC-11-SSW	10/03/12 12:00	11/28/12	Soil	Same As Above
C12110989-007	EDC-13-SSW	10/03/12 12:17	11/28/12	Soil	Same As Above
C12110989-008	EDC-15-NSW	10/04/12 13:10	11/28/12	Soil	Same As Above
C12110989-009	EDC-17-NSW	10/04/12 13:27	11/28/12	Soil	Same As Above
C12110989-010	EDC-19-NSW	10/04/12 14:20	11/28/12	Soil	Same As Above
C12110989-011	EDC-21-NSW	10/04/12 16:26	11/28/12	Soil	Same As Above
C12110989-012	EDC-23-NSW	10/08/12 8:53	11/28/12	Soil	Same As Above
C12110989-013	EDC-29-NSW	10/08/12 9:12	11/28/12	Soil	Same As Above
C12110989-014	EDC-DS4	10/08/12 9:20	11/28/12	Soil	Same As Above
C12110989-015	EDC-05-NSW	10/08/12 9:38	11/28/12	Soil	Same As Above
C12110989-016	EDC-25-NSW	10/08/12 11:40	11/28/12	Soil	Same As Above
C12110989-017	EDC-27-NSW	10/08/12 13:20	11/28/12	Soil	Same As Above

The results as reported relate only to the item(s) submitted for testing. The analyses presented in this report were performed at Energy Laboratories, Inc., 2393 Salt Creek Hwy., Casper, WY 82601, unless otherwise noted. Radiochemistry analyses were performed at Energy Laboratories, Inc., 2325 Kerzell Lane, Casper, WY 82601, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

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

Report Approved By:





**CLIENT:** Montgomery Watson Harza  
**Project:** NECR EDRA  
**Sample Delivery Group:** C12110989

**Report Date:** 01/03/13

## CASE NARRATIVE

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### COMMENTS

Included with the analysis reports are instrument data reports for all analysis associated with the instrument calibration, QC sample analysis, and sample analysis. All analytical data is within method QA/QC specifications except as noted on analyses and/or QC summary reports, or in this narrative. The analytical report identifies which QC batch ID and sequence QC is associated with each analysis result for a sample. The results of this Analytical Report relate only to the items submitted for analysis. Only the raw data associated with parameters listed on this report should be validated.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-01-NSW  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-001  
**Collection Date:** 10/03/12 11:00  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.1	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 3		R168402
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 3		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-03-NSW  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-002  
**Collection Date:** 10/03/12 11:15  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.1	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 4		R168402
Radium 226 precision (±)	0.4	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 4		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-07-SSW  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-003  
**Collection Date:** 10/03/12 11:27  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.1	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 5		R168402
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 5		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-DS3  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-004  
**Collection Date:** 10/03/12 11:30  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.3	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 6		R168402
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 6		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-09-SSW  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-005  
**Collection Date:** 10/03/12 11:45  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.2	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 7		R168402
Radium 226 precision (±)	0.4	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 7		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-11-SSW  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-006  
**Collection Date:** 10/03/12 12:00  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	0.9	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 8		R168402
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 8		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-13-SSW  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-007  
**Collection Date:** 10/03/12 12:17  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.4	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 9		R168402
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 9		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.





### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-15-NSW  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-008  
**Collection Date:** 10/04/12 13:10  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.1	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 10		R168402
Radium 226 precision (±)	0.4	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 10		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-17-NSW  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-009  
**Collection Date:** 10/04/12 13:27  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.1	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 11		R168402
Radium 226 precision (±)	0.4	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 11		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-19-NSW  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-010  
**Collection Date:** 10/04/12 14:20  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.5	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 12		R168402
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 12		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-21-NSW  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-011  
**Collection Date:** 10/04/12 16:26  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.6	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 14		R168402
Radium 226 precision (±)	0.6	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 14		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-23-NSW  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-012  
**Collection Date:** 10/08/12 08:53  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.4	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 15		R168402
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 15		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-29-NSW  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-013  
**Collection Date:** 10/08/12 09:12  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	3.0	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 16		R168402
Radium 226 precision (±)	0.6	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 16		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-DS4  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-014  
**Collection Date:** 10/08/12 09:20  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.7	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 17		R168402
Radium 226 precision (±)	0.6	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 17		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-05-NSW  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-015  
**Collection Date:** 10/08/12 09:38  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.2	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 18		R168402
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 18		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.





### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-25-NSW  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-016  
**Collection Date:** 10/08/12 11:40  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.2	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 19		R168402
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 19		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** EDC-27-NSW  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12110989-017  
**Collection Date:** 10/08/12 13:20  
**Date Received:** 11/28/12  
**Report Date:** 01/03/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.9	pCi/g-dry		0.3		E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 20		R168402
Radium 226 precision (±)	0.6	pCi/g-dry				E901.1	12/18/12 08:00 / dpb	11/29/12 10:50		GAM-HPGE_121218B : 20		R168402

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



# QA/QC Summary Report

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza

**Report Date:** 01/03/13

**Project:** NECR EDRA

**Work Order:** C12110989

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: E901.1</b>										Batch: R168402
<b>Sample ID: LCS-R168402</b>		Laboratory Control Sample					Run: GAM-HPGE_121218B		12/18/12 08:00	
Bismuth 214		3.0	pCi/g-dry	0.3	118	70	130			
- The LCS sample uses Bi214 for Ra226.										
<b>Sample ID: MB-R168402</b>		2 Method Blank					Run: GAM-HPGE_121218B		12/18/12 08:00	
Radium 226		ND	pCi/g-dry							U
Radium 226 precision (±)		ND	pCi/g-dry							
<b>Sample ID: C12110989-010ADUP</b>		2 Sample Duplicate					Run: GAM-HPGE_121218B		12/18/12 08:00	
Radium 226		1.5	pCi/g-dry	0.3				0.0	20	
Radium 226 precision (±)		0.5	pCi/g-dry							
<b>Sample ID: C12110989-017ADUP</b>		2 Sample Duplicate					Run: GAM-HPGE_121218B		12/18/12 08:00	
Radium 226		1.7	pCi/g-dry	0.3				11	20	
Radium 226 precision (±)		0.5	pCi/g-dry							

**Qualifiers:**

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

U - Not detected at minimum detectable concentration

# Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

## Workorder Receipt Checklist

Montgomery Watson Harza

C12110989

Login completed by: Debra Williams

Date Received: 11/28/2012

Reviewed by: BL2000\kmiller

Received by: th

Reviewed Date: 11/28/2012

Carrier FedEx  
name:

- |   |   |  |  |
|---|---|--|--|
| Shipping container/cooler in good condition?  | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/>            | Not Present <input type="checkbox"/>                       |
| Custody seals intact on shipping container/cooler?  | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/>            | Not Present <input type="checkbox"/>                       |
| Custody seals intact on sample bottles?   | Yes <input type="checkbox"/>            | No <input type="checkbox"/>            | Not Present <input checked="" type="checkbox"/>            |
| Chain of custody present?   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/>            |  |
| Chain of custody signed when relinquished and received?   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/>            |  |
| Chain of custody agrees with sample labels?   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/>            |  |
| Samples in proper container/bottle?   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/>            |  |
| Sample containers intact?   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/>            |  |
| Sufficient sample volume for indicated test?  | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/>            |  |
| All samples received within holding time?<br>(Exclude analyses that are considered field parameters<br>such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.) | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/>            |  |
| Temp Blank received?  | Yes <input type="checkbox"/>            | No <input checked="" type="checkbox"/> | Not Applicable <input type="checkbox"/>                    |
| Container/Temp Blank temperature:   | 13.1 °C No Ice                          |  |  |
| Water - VOA vials have zero headspace?  | Yes <input type="checkbox"/>            | No <input type="checkbox"/>            | No VOA vials submitted <input checked="" type="checkbox"/> |
| Water - pH acceptable upon receipt?   | Yes <input type="checkbox"/>            | No <input type="checkbox"/>            | Not Applicable <input checked="" type="checkbox"/>         |

Contact and Corrective Action Comments:

None

# Chain of Custody and Analytical Request Record

PLEASE PRINT- Provide as much information as possible.

Company Name: <b>MWH</b>	Project Name, PWS, Permit, Etc. <b>NECR EDRA</b>	Sample Origin State: <b>NM</b>	EPA/State Compliance: Yes <input type="checkbox"/> No <input type="checkbox"/>
Report Mail Address: <b>PO Box 774018 Steamboat Springs, CO 80477</b>	Contact Name: <b>Toby Leeson</b> Phone/Fax: <b>970-871-4361 970-879-9048</b>	Email: <b>Toby.Leeson@mwhglobal.com</b>	Sampler: (Please Print) <b>Natver Patel</b>
Invoice Address: <b>MWH, Broomfield, CO</b>	Invoice Contact & Phone: <b>Toby Leeson, 970-871-4361</b>	Purchase Order:	Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:  <input type="checkbox"/> DW <input type="checkbox"/> A2LA <input type="checkbox"/> GSA <input checked="" type="checkbox"/> EDD/EDT (Electronic Data) <input type="checkbox"/> POTW/WWTP <b>Format:</b> _____ <input type="checkbox"/> State: _____ <input type="checkbox"/> LEVEL IV <input type="checkbox"/> Other: _____ <input type="checkbox"/> NELAC	ANALYSIS REQUESTED  SEE ATTACHED  Normal Turnaround (TAT)	<b>R U S H</b>	Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page  Comments:	Shipped by: <b>Fedex-Ex</b> Cooler ID(s): <b>2496</b> Receipt Temp: <b>13.1 °C</b> On Ice: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Custody Seal Intact: <b>Y</b> N Signature Match: <b>Y</b> N
---	---	----------------------------	---	---

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Number of Containers Sample Type: A W S V B O <input type="checkbox"/> Air <input type="checkbox"/> Water <input type="checkbox"/> Soils/Solids <input type="checkbox"/> Vegetation <input type="checkbox"/> Bioassay <input type="checkbox"/> Other	ANALYSIS REQUESTED	SEE ATTACHED	Normal Turnaround (TAT)	RUSH	LABORATORY USE ONLY
<sup>1</sup> EDC-01-NSW	10-3-12	1100	S	✓					
<sup>2</sup> EDC-03-NSW	"	1115	S	✓					
<sup>3</sup> EDC-07-SSW	"	1127	S	✓					
<sup>4</sup> EDC-053	"	1130	S	✓					
<sup>5</sup> EDC-09-SSW	"	1145	S	✓					
<sup>6</sup> EDC-11-SSW	"	1200	S	✓					
<sup>7</sup> EDC-13-SSW	"	1217	S	✓					
<sup>8</sup> EDC-15-NSW	10-4-12	1310	S	✓					
<sup>9</sup> EDC-17-NSW	"	1327	S	✓					
<sup>10</sup> EDC-19-NSW	"	1420	S	✓					

<b>Custody Record MUST be Signed</b>	Relinquished by (print): <b>Natver Patel</b>	Date/Time: <b>11-27-12 @ 1400</b>	Signature: <i>[Signature]</i>	Received by (print):	Date/Time:	Signature:
	Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
	Sample Disposal: _____	Return to Client: _____	Lab Disposal: _____	Received by Laboratory:	Date/Time: <b>11/28/12/945</b>	Signature: <i>[Signature]</i>

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



# Chain of Custody and Analytical Request Record

PLEASE PRINT- Provide as much information as possible.

Company Name: <b>MWH</b>	Project Name, PWS, Permit, Etc. <b>NEAR EDRA</b>	Sample Origin State: <b>NM</b>	EPA/State Compliance: Yes <input type="checkbox"/> No <input type="checkbox"/>
Report Mail Address: <b>PO Box 774018 Steamboat Springs, CO 80477</b>	Contact Name: <b>Toby Leeson</b>	Phone/Fax: <b>970-871-4361</b>	Email: <b>Toby.Leeson@mwhglobal.com</b>
Invoice Address: <b>MWH, Broomfield, CO</b>	Invoice Contact & Phone: <b>Toby Leeson 970-871-4361</b>	Purchase Order:	Sampler: (Please Print) <b>Natver Patel</b>
Special Report/Formats – ELI must be notified prior to sample submittal for the following:	Invoice Contact & Phone:	Purchase Order:	Quote/Bottle Order:

- Special Report/Formats – ELI must be notified prior to sample submittal for the following:
- DW
  - GSA
  - POTW/WWTP
  - State: \_\_\_\_\_
  - Other: \_\_\_\_\_
  - A2LA
  - EDD/EDT (Electronic Data)
  - LEVEL IV
  - NELAC
- Format: \_\_\_\_\_

Number of Containers Sample Type: A W S V B O Air Water Soils/Solids Vegetation Bioassay Other	<b>ANALYSIS REQUESTED</b>												SEE ATTACHED Normal Turnaround (TAT)	<b>RUSH</b>	Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page	Shipped by: <b>Fedex-EX</b>
	Ra-226, EPA 901.1														Receipt Temp <b>13.1 °C</b>	Receipt Temp <b>13.1 °C</b>
Comments:													On Ice: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Custody Seal Intact Y N		
													Signature Match Y N			

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	ANALYSIS REQUESTED												SEE ATTACHED Normal Turnaround (TAT)	RUSH	Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page	Shipped by: Cooler ID(e): Receipt Temp On Ice: Custody Seal Intact Signature Match
1 EDC-21-NSW	10-4-12	1626	S	Ra-226, EPA 901.1												SEE ATTACHED	RUSH		Fedex-EX 2496 13.1 °C No
2 EDC-23-NSW	10-8-12	0853	S	Ra-226, EPA 901.1												SEE ATTACHED	RUSH		Y N Y N Y N
3 EDC-29-NSW	10-8-12	0912	S	Ra-226, EPA 901.1												SEE ATTACHED	RUSH		
4 EDC-DS4	11	0920	S	Ra-226, EPA 901.1												SEE ATTACHED	RUSH		
5 EDC-05-NSW	11	0938	S	Ra-226, EPA 901.1												SEE ATTACHED	RUSH		
6 EDC-25-NSW	11	1140	S	Ra-226, EPA 901.1												SEE ATTACHED	RUSH		
7 EDC-27-NSW	11	1320	S	Ra-226, EPA 901.1												SEE ATTACHED	RUSH		
8				Ra-226, EPA 901.1												SEE ATTACHED	RUSH		
9				Ra-226, EPA 901.1												SEE ATTACHED	RUSH		
10				Ra-226, EPA 901.1												SEE ATTACHED	RUSH		

LABORATORY USE ONLY  
2110989

<b>Custody Record MUST be Signed</b>	Relinquished by (print): <b>NATVER PATEL</b>	Date/Time: <b>11-27-12 01400</b>	Signature: <i>[Signature]</i>	Received by (print):	Date/Time:	Signature:
	Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
	Sample Disposal:	Return to Client:	Lab Disposal:	Received by Laboratory:	Date/Time: <b>11/28/12/945</b>	Signature: <i>[Signature]</i>

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

**Radiochemistry**  
**Level 4 Reporting Checklist**

Method #: E901.1      Analyte: PA226

- Energy Labs Batch ID: \_\_\_\_\_
- Omega Data Entry Batch ID: R168402
- Instrument ID: DET 1
- Instrument background check
- Instrument efficiency/calibration check
- Bench-sheets (Sample run order should include MS, MSD, MB, RB, STD, and LCS every 20 samples)
- Photocopy of instrument run log
- Photocopy of standard preparation notes
- Photocopy of standard source calibration certificate noting manufacturer, stock and/or lot number
- Photocopy of method control charts for the following:  
(provided by QA Dept.)
  - Laboratory Control Standard (LCS)
  - Matrix Spikes (MS) and Matrix Spike Duplicates (MSD)
  - Method Blank (MB)
- Analyst Case Narrative consisting of the following:
  - A statement documenting the analytes and the method used
  - Date of analysis
  - Any instrument adjustment or anomalies encountered during analysis
  - Printed name and signature of analyst

Did you log sample from storage? Yes  No

Container size: 3 inch <sup>Steel</sup> Can Sample Preservation noted: none

Sample Numbers: C12110989, 1-17

### Analyst Case Narrative

Method #: E901.1 Analyte: PA226 Date/time of analysis: 12-18-12 @ 8:00

Any problems or anomalies encountered during analysis?

No  Yes  (please explain below)

Analyst case narrative: RAN SAMPLES ACCORDING TO  
EPA 901.1 METHOD UTILIZING ORTEC GAMMA-  
VISION SOFTWARE.

Any instrument adjustments or anomalies encountered during analysis?

No  Yes  (please explain below)

Analyst case narrative: \_\_\_\_\_

Analyst: DAVID BLAIDA

Please print

Signature: David Blaida



# DET 1

## PREP BATCH REPORT

Prep Batch **35887**    Prep Code: **PRP-GAMMA**    Technician: **Jason Salazar**  
Batch Units: **G**

Prep Start Date: **11/29/2012 10:50:03**  
Prep End Date: **11/29/2012 10:59:00**

Sample ID	Matrix	pH	Initial Samp Amt	Sol Added	Sol Recov	Fin Vol (mL)	Factor	Balance	PrepStart	PrepEnd
C12110989-001A D&G	Soil		172.64	0	0	172.64	1	Sartorius CP3202	11/29/2012	11/29/2012
C12110989-002A	Soil		177.95	0	0	177.95	1	Sartorius CP3202	11/29/2012	11/29/2012
C12110989-003A	Soil		181.46	0	0	181.46	1	Sartorius CP3202	11/29/2012	11/29/2012
C12110989-004A	Soil		179.92	0	0	179.92	1	Sartorius CP3202	11/29/2012	11/29/2012
C12110989-005A	Soil		186.77	0	0	186.77	1	Sartorius CP3202	11/29/2012	11/29/2012
C12110989-006A	Soil		185.94	0	0	185.94	1	Sartorius CP3202	11/29/2012	11/29/2012
C12110989-007A	Soil		184.17	0	0	184.17	1	Sartorius CP3202	11/29/2012	11/29/2012
C12110989-008A	Soil		191.93	0	0	191.93	1	Sartorius CP3202	11/29/2012	11/29/2012
C12110989-009A	Soil		179.63	0	0	179.63	1	Sartorius CP3202	11/29/2012	11/29/2012
C12110989-010A <i>DUP</i>	Soil		177.31	0	0	177.31	1	Sartorius CP3202	11/29/2012	11/29/2012
C12110989-011A	Soil		168.79	0	0	168.79	1	Sartorius CP3202	11/29/2012	11/29/2012
C12110989-012A	Soil		177.15	0	0	177.15	1	Sartorius CP3202	11/29/2012	11/29/2012
C12110989-013A	Soil		169.87	0	0	169.87	1	Sartorius CP3202	11/29/2012	11/29/2012
C12110989-014A	Soil		176.68	0	0	176.68	1	Sartorius CP3202	11/29/2012	11/29/2012
C12110989-015A	Soil		184.22	0	0	184.22	1	Sartorius CP3202	11/29/2012	11/29/2012
C12110989-016A	Soil		190.56	0	0	190.56	1	Sartorius CP3202	11/29/2012	11/29/2012
C12110989-017A <i>DUP</i>	Soil		161.95	0	0	161.95	1	Sartorius CP3202	11/29/2012	11/29/2012

*Started 12-18-12  
@ 8:00 DID  
HPGe Ra-226*

*QA/AC  
12/18/12  
R.S.*

*JEGG  
12/21/12  
8:00*

*(P)  
12-20-12  
DID  
catch*

*Count on on  
after 12-18-12  
DB HPGe Ra-226  
LCS  
BKG*

Energy Laboratories, Inc.  
Alpha Spectroscopy / Gamma Spectroscopy  
Instrument / Maintenance Run Log

Instruments: EGG Ortec Octete PC Alpha Spectroscopy System and EGG Ortec High Purity Germanium Detector

Date	Det. No.	Count Time Min.	Isotope	Batch ID	Associated Samples	Data File Number	Instrument ID		Int	Comments Maintenance Log
							Alpha Spec	Gamma Spec		
12-17-12	1-16	5	N/A	Pulsar	Pulsar CK Ortec	2012.12.17.001	✓			
12-17-12	1-17	240	Th	1757		Th-1757	✓			
12-17-12	1-16	90	Po210	475		Po210-475	✓			
12-17-12	1-9	90	↓	↓		↓	✓			
12-17-12	10-11	90	Po210	477	recount of 342 dup	Po210-477	✓			
12-17-12	1-13	240	Th	1756		Th-1756	✓			
12-17-12	1-13	240	U	559	recount for MDC (du)	150 U-559	✓			
12-18-12	1, 2	10, 30, 60	PCK, BKG	C12110989, 1-17	12120573, 1-?	→	✓			DET 2
12-18-12	1-12	240	Th	1759		Th-1759	✓			
12-18-12	1-16	240	Th	1753		Th-1753	✓			
12-18-12	1, 2	10, 30, 60	PCK, BKG	C12110989, 1-17		→	✓			DET 1
12-18-12	1-16	120	Po210	476		Po210-476	✓			
12-18-12	1-8	90	↓	↓		↓	✓			
12-19-12	1, 2	10, 30, 60	PCK, BKG	C12126573, 1-?	C12110989, 1-17	→	✓			
12-19-12	5, 7	120	Po210	476		Po210-476	✓			
12-20-12	1	10, 30, 60	PCK, BKG	C12110989, 1-17		→	✓			



ECKERT & Ziegler

Valencia, California 91355

Isotope Products

Tel 661-309-1010

Fax 661-257-8303

2009 CAN

# CERTIFICATE OF CALIBRATION MULTINUCLIDE STANDARD SOURCE

Customer: ENERGY LABORATORIES Source No.: 1369-93-1  
 P.O. No.: 80311 Reference Date: 1-Jun-09 12:00 PST  
 Catalog No.: EG-ML Contained Radioactivity: 0.8669  $\mu$ Ci 32.08 kBq

### Physical Description:

A. Capsule type: Customer supplied can - 3" (76 mm) OD  
 B. Nature of active deposit: Multinuclide distributed in 1.5 g/cc epoxy matrix  
 C. Active diameter/volume: Approximately 124mL (186.0 grams)  
 D. Backing: Steel  
 E. Cover: Steel

Gamma-Ray Energy (keV)	Nuclide	Half-life	Branching Ratio (%)	Activity ( $\mu$ Ci)	Gammas per second	Total Uncert
88	Cd-109	462.6 $\pm$ 0.7 days	3.63	0.2492	334.7	3.1 %
122	Co-57	271.79 $\pm$ 0.09 days	85.6	0.01081	342.4	3.1 %
159	Te-123m	119.7 $\pm$ 0.1 days	84.0	0.01236	384.1	3.1 %
320	Cr-51	27.706 $\pm$ 0.007 days	9.86	0.3058	1115	3.0 %
392	Sn-113	115.09 $\pm$ 0.04 days	64.9	0.04791	1150	3.0 %
514	Sr-85	64.849 $\pm$ 0.004 days	98.4	0.05830	2123	3.0 %
662	Cs-137	30.17 $\pm$ 0.16 years	85.1	0.04177	1315	3.0 %
898	Y-88	106.630 $\pm$ 0.025 days	94.0	0.09170	3189	3.0 %
1173	Co-60	5.272 $\pm$ 0.001 years	99.86	0.04926	1820	3.0 %
1333	Co-60	5.272 $\pm$ 0.001 years	99.98	0.04926	1822	3.0 %
1836	Y-88	106.630 $\pm$ 0.025 days	99.4	0.09170	3373	3.0 %

### Method of Calibration:

This source was prepared from a weighed aliquot of solution whose concentrations in  $\mu$ Ci/g were determined by gamma spectrometry.

### Notes:

- See reverse side for leak test(s) performed on this source.
- EZIP participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from IAEA-TECDOC-619, 1991.
- Overall uncertainty is calculated at the 99% confidence level.
- This source has a working life of 1 year.

*Daniel James Van Dolen*  
Quality Control

*28-May-09*  
Date

EZIP Ref. No.: 1369-93

ISO 9001 CERTIFIED

Medical Imaging Laboratory

Industrial Gauging Laboratory

RS-82

08826

DCS 08826

CAN

LCS 9

#: 3129

Opened: \_\_\_\_\_  
Diluted Climax Sand Tailings-08826  
Expires: 5/8/2007  
Rec'd: 11/7/2006  
Energy Laboratories, Inc. 2393 Salt Creek Hwy (Casper WY 82602-

U.S. ENVIRONMENTAL PROTECTION AGENCY  
ENVIRONMENTAL MONITORING AND SUPPORT LABORATORY-LAS VEGAS  
QUALITY ASSURANCE BRANCH

Calibration Certificate  
DILUTED CLIMAX SAND TAILINGS

Description	Principal radionuclide	Thorium-230	Mil-11%	
	Net activity		curies	
	Net volume	10	g	net in capsule/bottle number

Measurement

Activity of principal radionuclide

Activity per gram of this solution

35.3 pico curies of Thorium-230  
at 0400 hours PST on May 1, 1976

Activity of daughter radionuclide

The principal activity was accompanied at the quoted time by and 40 pico curies per gram of lead-210.

45.4 pico curies per gram

of the daughter nuclide Radium-226

Total mass of this solution

10 grams

Total principal activity per gram at the quoted time

35.3 pico curies

Method of measurement: Gravimetric dilution of analyzed Climax Sand Tailings. The thorium-230 was analyzed by alpha spectroscopy. Radium-226 was measured using radon emanation.

7826  
00508821  
1059

Random Errors

The repeatability of this standardization (dilutions, source preparations, counting statistics, mass determinations, etc.) was such that the certified value of the radioactive concentration of the principle activity had a standard error ( $\sigma$ ) not greater than

$\pm 4\%$

(The 99.7% confidence limits are given by  $\pm 3\sigma$ .)  
Due to limited results, the error estimate is based on the measurements of the undiluted sand tailings.

The total systematic error (sum of estimated maximum residual systematic errors due to dispensing, counting losses, counting corrections, known uncertainty of standard) of the certified radioactive concentration of the principle activity has been estimated not to exceed

$\pm 3\% (\sigma)$  or  $- 3\% (\sigma')$

The overall limits of error calculated on the basis of  $+(3\sigma + \sigma)$  or  $-(3\sigma + \sigma')$  are

$\pm 15\%$  or  $- 15\%$

of the quoted radioactive concentration.

The effective standard deviation is defined as 1/6th of the range between the overall limits  $+(3\sigma + \sigma)$  and  $-(3\sigma + \sigma')$  and is therefore

$5\%$

Decay Schemes

This standardization is based on the following assumptions of the principle nuclide, its daughter nuclides and impurities (no allowance for error in these assumptions or the assumption of quoted half-life have been included in the statement of accuracy above).

See attachment.

Chemical Composition of Solution

Carrier content per gram of solution:

Other components:

Preservative:

Remarks  
 $45.4 \mu\text{Ci/g Ra-226}$   
 $\times 10 \text{ grams total}$   
 $454 \mu\text{Ci total activity}$   
 $\div 173.33 \text{ grams of blank leadate sand}$   
 $2.6 \mu\text{Ci/gram Ra-226}$   
Date Certificate Prepared April 18, 1977

Approval Signature

*Joe H. Ziegler*

Note:

Total mass of can is 183.33 grams  
w/ with 6CS 10 gram inclusive.

08-27-11

Calibration Data from file: 1369.93.lccd1\_1perched.C1b  
 Energy Calibration Date: 6/5/2009 Time: 11:22:16  
 Efficiency Calibration Date: 6/5/2009 Time: 11:39:17

Calibration Description:  
 6/5/09 can calibration polynomial new standard  
 IPL #1369-93-1 new calibration perched

Energy Calibration Fit  
 Energy =  $-0.3919 + 0.243214 * \text{Channel} - 9.76725e-010 * \text{Channel}^2$   
 FWHM (keV) =  $2.7504 + 0.000971 * \text{Channel} - 2.70459e-008 * \text{Channel}^2$

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM	Fit	Delta
363.02	88.00	87.90	0.11%	0.74	0.75	-2.10%
502.91	122.00	121.92	0.06%	0.78	0.79	-0.93%
654.82	159.00	158.87	0.08%	0.81	0.82	-1.42%
1317.38	320.00	320.01	-0.00%	0.99	0.97	1.72%
1611.93	391.00	391.65	-0.17%	1.01	1.03	-2.39%
2114.79	514.00	513.95	0.01%	1.16	1.14	1.61%
2722.10	662.00	661.65	0.05%	1.31	1.26	3.65%
3694.22	898.00	898.08	-0.01%	1.50	1.45	2.99%
4825.86	1173.00	1173.30	-0.03%	1.67	1.66	1.09%
5480.66	1333.00	1332.55	0.03%	1.63	1.77	-8.16%
7551.24	1836.00	1836.12	-0.01%	2.12	2.08	2.12%

Efficiency Calibration Fit  
 Polynomial Uncertainty = 1.1491 %  
 Coefficients:  
 -0.345759 -5.963100 0.675305 -0.103447 0.008672 -0.000304

Efficiency Table

Energy	Efficiency	Fit	Delta
88.00	1.8030E-002	1.8033E-002	-0.02%
122.00	1.8069E-002	1.8041E-002	0.15%
159.00	1.5244E-002	1.5291E-002	-0.31%
320.00	8.8571E-003	8.7565E-003	1.14%
392.00	7.2997E-003	7.3136E-003	-0.19%
514.00	5.5726E-003	5.7472E-003	-3.13%
662.00	4.7604E-003	4.6095E-003	3.17%
898.00	3.5154E-003	3.5587E-003	-1.23%
1173.00	2.8900E-003	2.8429E-003	1.63%
1333.00	2.5087E-003	2.5490E-003	-1.61%
1836.00	1.9175E-003	1.9124E-003	0.27%

Calibration Certificate Table

Isotope	Energy	Pct	Halflife	Activity	GPS	Error	Date & Time
Cd-109	88.03	3.63	4.63E+002	9865.01	358.10	3.10%	5/1/2008 12:00:00
Co-57	122.07	85.60	2.72E+002	400.00	342.40	3.10%	6/1/2009 12:00:00
Te-123m	159.07	84.00	1.20E+002	457.26	384.10	3.00%	6/1/2009 12:00:00
Sn-113	391.69	64.90	1.15E+002	1771.96	1150.00	3.00%	6/1/2009 12:00:00
Y-88	898.02	94.00	1.07E+002	3392.55	3189.00	3.00%	6/1/2009 12:00:00
Co-60	1173.24	99.86	1.93E+003	1822.55	1820.00	3.00%	6/1/2009 12:00:00
Co-60	1333.00	99.98	1.93E+003	1822.36	1822.00	3.00%	6/1/2009 12:00:00
Y-88	1836.01	99.40	1.07E+002	3393.36	3373.00	3.00%	6/1/2009 12:00:00
Cr-51	320.00	9.86	2.77E+001	11308.32	1115.00	3.00%	6/1/2009 12:00:00
Sr-85	514.00	98.40	6.48E+001	2157.52	2123.00	3.00%	6/1/2009 12:00:00
Cs-137	661.66	85.10	1.10E+004	1545.24	1315.00	3.00%	6/1/2009 12:00:00
Cd-109	1836.27	3.63	4.63E+002	9220.39	334.70	3.10%	6/1/2009 12:00:00

Calibration Data from file: 1369.93.lccdeta1\_1lperched.C1b  
 Energy Calibration Date: 10/16/2012 Time: 14:32:42  
 Efficiency Calibration Date: 6/5/2009 Time: 11:39:17

Calibration Description:  
 10/16/12 can calibration energy re-cal  
 IPL #1369-93-1 new calibration perched

Energy Calibration Fit  
 Energy =  $-0.2923 + 0.243203 * \text{Channel} - 4.95665e-009 * \text{Channel}^2$   
 FWHM (keV) =  $2.5984 + 0.001193 * \text{Channel} - 6.59988e-008 * \text{Channel}^2$

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM	Fit	Delta
363.13	88.00	88.02	-0.02%	0.76	0.74	3.67%
503.23	122.06	122.09	-0.02%	0.74	0.77	-4.17%
2722.55	662.00	661.81	0.03%	1.31	1.30	0.35%
4826.55	1173.00	1173.43	-0.04%	1.65	1.66	-0.17%
5481.66	1333.00	1332.72	0.02%	1.74	1.74	0.07%

Efficiency Calibration Fit  
 Polynomial Uncertainty = 1.1491 %  
 Coefficients:  
 $-0.345759 - 5.963100 \text{ Energy} + 0.675305 \text{ Energy}^2 - 0.103447 \text{ Energy}^3 + 0.008672 \text{ Energy}^4 - 0.000304 \text{ Energy}^5$

Efficiency Table

Energy	Efficiency	Fit	Delta
88.00	1.8030E-002	1.8033E-002	-0.02%
122.00	1.8069E-002	1.8041E-002	0.15%
159.00	1.5244E-002	1.5291E-002	-0.31%
320.00	8.8571E-003	8.7565E-003	1.14%
392.00	7.2997E-003	7.3136E-003	-0.19%
514.00	5.5726E-003	5.7472E-003	-3.13%
662.00	4.7604E-003	4.6095E-003	3.17%
898.00	3.5154E-003	3.5587E-003	-1.23%
1173.00	2.8900E-003	2.8429E-003	1.63%
1333.00	2.5087E-003	2.5490E-003	-1.61%
1836.00	1.9175E-003	1.9124E-003	0.27%

Calibration Certificate Table

Isotope	Energy	Pct	Halflife	Activity	GPS	Error	Date & Time
Cd-109	88.03	3.63	4.63E+002	9865.01	358.10	3.10%	5/1/2008 12:00:00
Co-57	122.07	85.60	2.72E+002	400.00	342.40	3.10%	6/1/2009 12:00:00
Te-123m	159.07	84.00	1.20E+002	457.26	384.10	3.00%	6/1/2009 12:00:00
Sn-113	391.69	64.90	1.15E+002	1771.96	1150.00	3.00%	6/1/2009 12:00:00
Y-88	898.02	94.00	1.07E+002	3392.55	3189.00	3.00%	6/1/2009 12:00:00
Co-60	1173.24	99.86	1.93E+003	1822.55	1820.00	3.00%	6/1/2009 12:00:00
Co-60	1333.00	99.98	1.93E+003	1822.36	1822.00	3.00%	6/1/2009 12:00:00
Y-88	1836.01	99.40	1.07E+002	3393.36	3373.00	3.00%	6/1/2009 12:00:00
Cr-51	320.00	9.86	2.77E+001	11308.32	1115.00	3.00%	6/1/2009 12:00:00
Sr-85	514.00	98.40	6.48E+001	2157.52	2123.00	3.00%	6/1/2009 12:00:00
Cs-137	661.66	85.10	1.10E+004	1545.24	1315.00	3.00%	6/1/2009 12:00:00
Cd-109	1836.27	3.63	4.63E+002	9220.39	334.70	3.10%	6/1/2009 12:00:00

ACTIVITY DECAY CORRECTIONS  
LCS CANS 6 - 10, gbkg

Input Analyte	LCS #	Input Half life Years	Calc Half life Days	Calc Half life Hours	Input Original pCi	Calc Original uCi	Calc Corrected pCi	Calc Corrected nCi	Calc Corrected uCi	Calc Corrected Bq	Input Reference Date	Input Current Date	Calc DPM	Input Measured pCi	Calc Percent Recovery	LCS #	
IPL-6	6	1600	5.84E+05	14025600	47.4	4.74E-05	46.87	0.05	4.69E-05	1.734	4/1/1987	12/19/2012	104.06	43.10	0.92	6	DET1
IPL-6	6	1600	5.84E+05	14025600	47.4	4.74E-05	46.87	0.05	4.69E-05	1.734	4/1/1987	12/19/2012	104.06	41.40	0.88	6	DET2
IPL-7	7	1600	5.84E+05	14025600	8.72	8.72E-06	8.66	0.01	8.66E-06	0.320	2/1/1997	12/19/2012	19.23	8.04	0.93	7	DET1
IPL-7	7	1600	5.84E+05	14025600	8.72	8.72E-06	8.66	0.01	8.66E-06	0.320	2/1/1997	12/19/2012	19.23	8.18	0.94	7	DET2
IPL-8	8	1600	5.84E+05	14025600	23.93	2.39E-05	23.77	0.02	2.38E-05	0.879	2/1/1997	12/19/2012	52.76	26.30	1.11	8	DET1
IPL-8	8	1600	5.84E+05	14025600	23.93	2.39E-05	23.77	0.02	2.38E-05	0.879	2/1/1997	12/19/2012	52.76	21.40	0.90	8	DET2
DCS08826	9	1600	5.84E+05	14025600	2.6	2.60E-06	2.57 ✓	0.00	2.57E-06	0.095	9/13/1989	12/19/2012	5.71	3.03 ✓	1.18 ✓	9	DET1



121912dcs088261csdet1

ORTEC g v - i (2191) wan32 G53W2.06 20-DEC-2012 01:23:56 Page 1  
Energy Laboratory Spectrum name: 121912dcs088261csdet1.An1

Sample description  
121912dcs088261csdet1

Spectrum Filename: C:\User\121912dcs088261csdet1.An1

Acquisition information

Start time: 20-Dec-2012 00:07:44  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccdet1\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 2  
Sample size: 1.8333E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8333E+02) =  
1.4728E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

0

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	13-Sep-1989 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1810

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***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****					
Nuclide	Time of Count	Time Corrected	Uncertainty	1 Sigma	MDA
	Activity	Activity	Counting	Total	pCi/g
	pCi/g	pCi/g	pCi/g	pCi/g	
Ra-228 #A	3.7415E-01	6.1831E+00	3.6774E+00	3.6783E+00	
Ra-226 A	4.4391E+00	4.4841E+00	1.5109E+00	1.5121E+00	
Bi-214	3.0398E+00	3.0706E+00	3.2511E-01	3.2767E-01	
Pb-214	2.0306E+00	2.0512E+00	2.4419E-01	2.4571E-01	
Ir-192 #B	6.9853E-02	>12 Halflives	4.3015E-02	4.3025E-02	
Sb-124 #B	0.0000E+00	>12 Halflives	3.6867E+01	3.6867E+01	
Sc-46 A	1.4364E-02	>12 Halflives	1.1995E-01	1.1995E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	4.7794E-01	>12 Halflives	2.3478E+00	2.3478E+00	
Th-230 #A	2.4378E+00	2.4383E+00	4.1939E+00	4.1939E+00	
Cs-137 #A	3.4632E-02	5.9182E-02	3.9848E-02	3.9856E-02	
Co-60 #B	-2.5467E-02	-5.4305E-01	-1.4425E+00	-1.4426E+00	
Am-241 A	1.4978E-02	1.5547E-02	5.8932E-02	5.8932E-02	
K-40	4.7818E+00	4.7818E+00	9.6147E-01	9.6358E-01	
U-235 A	1.1478E-01	1.1478E-01	8.6483E-02	8.6497E-02	
Th-234	8.3183E+00	8.3183E+00	1.3757E+00	1.3809E+00	
Cs-134	1.9905E-01	4.9647E+02	1.3226E+02	1.3243E+02	
Pb-212 A	1.5713E-01	1.5713E-01	9.7731E-02	9.7755E-02	
Ra-224 #A	-1.9991E-01	>12 Halflives	3.4409E+03	3.4409E+03	
I-131 #F	2.8177E-01	>12 Halflives	5.8752E-02	5.8872E-02	
Mn-54 #A	-5.0534E-02	>12 Halflives	-1.8404E-01	-1.8404E-01	
Tl-208 #A	1.4811E-01	>12 Halflives	7.2583E-02	7.2609E-02	
Bi-212 #A	7.7351E-01	>12 Halflives	4.5098E-01	4.5110E-01	
Ra-223 #A	1.6317E-01	>12 Halflives	2.2646E-01	2.2647E-01	
Pa-234 A	2.2024E-01	>12 Halflives	1.7449E-01	1.7452E-01	
Eu-154 #A	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	

Eu-152	#A	3.7893E-01	1.2706E+00	6.6493E-01	6.6515E-01
Na-22	#A	-2.0006E-02	-9.8894E+00	3.8491E+04	3.8491E+04
Zn-65	A	4.8199E-02	>12 Halflives	9.7851E-02	9.7853E-02
Ba-133	#A	2.6983E-02	1.2537E-01	1.1849E-01	1.1851E-01
Ru-103	#B	8.5367E-02	>12 Halflives	3.9524E-02	3.9559E-02
Be-7	#B	3.3476E-01	>12 Halflives	4.0707E-01	4.0712E-01
I-125	#	0.0000E+00	>12 Halflives	0.0000E+00	0.0000E+00
Tl-201	B	2.3703E-01	>12 Halflives	2.9214E-01	2.9217E-01
Pa-234	F	4.3238E+00	>12 Halflives	1.5051E+00	1.5072E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Halflife limit exceeded

S U M M A R Y

-----  
 Total Activity ( 48.3 to 1980.0 keV) 1.3388710E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 1.3440079E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 969.10 & Ra-228 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

122012blankdet1

ORTEC g v - i ( 143) wan32 G53W2.06 20-DEC-2012 09:56:46 Page 1  
Energy Laboratory Spectrum name: 122012blankdet1.An1

Sample description  
122012blankdet1

Spectrum Filename: C:\User\122012blankdet1.An1

Acquisition information

Start time: 20-Dec-2012 08:55:45  
Live time: 3598  
Real time: 3600  
Dead time: 0.04 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd1\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample size: 1.0000E+00  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.0000E+00) =  
2.7000E+01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	30-Apr-1999 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 1.0000

\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma
	Activity	Activity	Counting	Total
	pCi/l	pCi/l	pCi/l	pCi/l
Ra-228	<	1.3592E+02	7.0391E+02	
Ra-226	<	6.5920E+02	6.6310E+02	
Bi-214	B<	8.0661E+01	8.1139E+01	
Pb-214	<	8.0197E+01	8.0672E+01	
Ir-192	B<	1.74E+01	>12 Halflives	
Sb-124	B<	2.68E+01	>12 Halflives	
Sc-46	<	4.79E+01	>12 Halflives	
Pb-210	No in-range peaks			
Th-228	<	1.3259E+03	1.8737E+05	
Th-230	<	1.7284E+03	1.7287E+03	
Cs-137	<	1.9761E+01	2.7055E+01	
Co-60	B<	2.6986E+01	1.6228E+02	
Am-241	<	3.0592E+01	3.1269E+01	
K-40	<	4.0859E+02	4.0859E+02	
U-235	<	3.9038E+01	3.9038E+01	
Th-234	B<	5.7988E+02	5.7988E+02	
Cs-134	<	2.6755E+01	2.6249E+03	
Pb-212	<	5.3210E+01	5.3210E+01	
Ra-224	<	5.36E+02	>12 Halflives	
I-131	B<	1.72E+01	>12 Halflives	
Mn-54	<	2.67E+01	>12 Halflives	
Tl-208	<	3.63E+01	>12 Halflives	
Bi-212	<	3.01E+02	>12 Halflives	
Ra-223	<	9.06E+01	>12 Halflives	
Pa-234	<	5.61E+01	>12 Halflives	
Eu-154	<	5.8803E+01	1.7222E+02	

Eu-152 < 1.1964E+02 2.4321E+02  
 Na-22 < 2.2848E+01 8.6780E+02

122012blankdet1

Zn-65 < 6.46E+01 >12 Halflives  
 Ba-133 < 2.5818E+01 6.3540E+01  
 Ru-103 B< 1.40E+01 >12 Halflives  
 Be-7 B< 1.92E+02 >12 Halflives  
 I-125 No in-range peaks  
 Tl-201 B< 1.05E+02 >12 Halflives  
 Pa-234 B< 5.42E+02 >12 Halflives

- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

S U M M A R Y

-----  
 Total Activity ( 48.3 to 1980.0 keV) 0.0000000E+00 pCi/l  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 0.0000000E+00 pCi/l

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*

911.07 % Ra-228	969.10 % Ra-228	1115.52 % Zn-65	1120.28 % Bi-214
1120.51 % Sc-46	1173.00 ? Co-60	1274.50 ? Na-22	1274.54 ? Eu-154
1333.00 ? Co-60	1408.00 ? Eu-152	1460.80 % K-40	

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

Analyzed by: \_\_\_\_\_  
Dave Blaida

Reviewed by: \_\_\_\_\_  
Supervisor

Laboratory: Energy Laboratory

C12110989.1

ORTEC g v - i (2191) wan32 G53W2.06 18-DEC-2012 10:31:03 Page 1  
Energy Laboratory Spectrum name: C12110989.1.An1

Sample description  
C12110989.1

Spectrum Filename: C:\User\C12110989.1.An1

Acquisition information

Start time: 18-Dec-2012 08:43:15  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd11perched.C1b  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.7264E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.7264E+02) =  
1.5639E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0434

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma	MDA
	Activity	Activity	Counting	Total	pci/g
	pci/g	pci/g	pci/g	pci/g	
Ra-228 A	1.2644E-01	1.2723E-01	8.7481E-02	8.7547E-02	
Ra-226 A	1.2382E+00	1.2383E+00	3.0051E+00	3.0053E+00	
Bi-214 F	1.0600E+00	1.0601E+00	5.4985E-01	5.5058E-01	
Pb-214	1.1285E+00	1.1286E+00	3.8793E-01	3.8909E-01	
Ir-192 B	9.0990E-02	1.0857E-01	1.0681E-01	1.0685E-01	
Sb-124 #F	3.3761E-01	4.1951E-01	2.3984E-01	2.4010E-01	
Sc-46 A	1.2001E-01	1.4027E-01	1.1295E-01	1.1302E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #	9.8740E+00	1.0061E+01	7.3214E+00	7.3251E+00	
Th-230 #A	0.0000E+00	0.0000E+00	2.7942E+04	2.7942E+04	
Cs-137 A	1.4751E-01	1.4769E-01	1.2738E-01	1.2744E-01	
Co-60 #B	-9.1844E-03	-9.2469E-03	-7.9602E-02	-7.9602E-02	
Am-241 #A	-2.1547E-02	-2.1549E-02	-5.9088E-01	-5.9088E-01	
K-40	1.7158E+01	1.7158E+01	3.5368E+00	3.5662E+00	
U-235 A	1.4341E-01	1.4341E-01	1.6388E-01	1.6392E-01	
Th-234	1.5098E+01	1.5098E+01	3.7602E+00	3.7853E+00	
Cs-134 #A	1.4032E-01	1.4278E-01	1.2401E-01	1.2407E-01	
Pb-212	1.3252E+00	1.3252E+00	2.8362E-01	2.8591E-01	
Ra-224 A	1.8785E+00	6.9572E+01	8.4570E+01	8.4590E+01	
I-131 #F	1.5208E-01	7.7328E-01	6.6554E-01	6.6586E-01	
Mn-54 #A	1.9146E-01	1.9964E-01	2.1698E-01	2.1705E-01	
Tl-208 H	5.0848E-01	>12 Halfives	2.4783E-01	2.4820E-01	
Bi-212 #A	3.0258E-01	>12 Halfives	9.6111E-01	9.6115E-01	
Ra-223 #A	-9.9343E-02	-3.1184E-01	3.5713E+03	3.5713E+03	
Pa-234 #A	3.3531E-01	>12 Halfives	3.4580E-01	3.4591E-01	
Eu-154 #A	0.0000E+00	0.0000E+00	4.0902E+02	4.0902E+02	

Eu-152 A -1.1341E-01 -1.1371E-01 8.7254E+02 8.7254E+02  
 Na-22 #A -2.1244E-02 -2.1539E-02 2.2371E+02 2.2371E+02



C12110989.1

Zn-65	A	2.8459E-02	3.0023E-02	1.8876E-01	1.8876E-01
Ba-133	#A	-1.8444E-02	-1.8507E-02	1.6137E+02	1.6137E+02
Ru-103	#B	2.6912E-02	3.7519E-02	1.4898E-01	1.4899E-01
Be-7	#B	1.2384E+00	1.5820E+00	1.7984E+00	1.7994E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	2.2702E-01	1.6650E+01	4.4320E+01	4.4324E+01
Pa-234	B	1.8487E+00	>12 Halflives	3.0478E+00	3.0486E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

S U M M A R Y

-----  
 Total Activity ( 48.3 to 1980.0 keV) 3.4709419E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 3.4709450E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 969.10 + Ra-228

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
                   Dave Blaida

Reviewed by: \_\_\_\_\_  
                   Supervisor

Laboratory: Energy Laboratory

C12110989.2

ORTEC g v - i (2191) wan32 G53W2.06 18-DEC-2012 11:49:25 Page 1  
Energy Laboratory Spectrum name: C12110989.2.An1

Sample description  
C12110989.2

Spectrum Filename: C:\User\C12110989.2.An1

Acquisition information

Start time: 18-Dec-2012 10:33:49  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd11perched.clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample size: 1.7795E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.7795E+02) =  
1.5173E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1349

-----

\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228	1.5491E+00	1.5588E+00	5.5164E-01	5.5321E-01	
Ra-226 #A	0.0000E+00	0.0000E+00	1.0786E+04	1.0786E+04	
Bi-214	1.0770E+00	1.0770E+00	3.6433E-01	3.6545E-01	
Pb-214	1.3476E+00	1.3477E+00	4.1765E-01	4.1919E-01	
Ir-192 #B	5.2773E-02	6.3015E-02	1.2040E-01	1.2042E-01	
Sb-124 #B	2.2985E-02	2.8586E-02	7.2880E-02	7.2884E-02	
Sc-46 #A	0.0000E+00	0.0000E+00	6.3561E+02	6.3561E+02	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	5.5193E+00	5.6241E+00	6.3045E+00	6.3059E+00	
Th-230 #A	6.2787E-01	6.2787E-01	1.1475E+01	1.1475E+01	
Cs-137 #A	9.6558E-02	9.6673E-02	1.2254E-01	1.2256E-01	
Co-60 #B	-6.9318E-03	-6.9792E-03	-1.1899E-01	-1.1899E-01	
Am-241 #A	-1.1141E-02	-1.1142E-02	-3.8905E-01	-3.8905E-01	
K-40 #A	2.3828E-01	2.3828E-01	3.8618E+00	3.8618E+00	
U-235	3.0782E-01	3.0782E-01	1.7446E-01	1.7465E-01	
Th-234 B	3.3845E+00	3.3845E+00	3.2780E+00	3.2794E+00	
Cs-134 #A	9.2266E-02	9.3888E-02	1.0203E-01	1.0206E-01	
Pb-212	1.0648E+00	1.0648E+00	2.5834E-01	2.5996E-01	
Ra-224 A	2.8440E+00	1.0689E+02	8.8536E+01	8.8582E+01	
I-131 #B	1.1275E-01	5.7710E-01	9.8491E-01	9.8503E-01	
Mn-54 #A	4.4549E-02	4.6459E-02	8.6303E-02	8.6312E-02	
Tl-208 H	5.8093E-01	>12 Halflives	1.8573E-01	1.8637E-01	
Bi-212 #	2.7908E+00	>12 Halflives	2.2177E+00	2.2190E+00	
Ra-223 #	1.3583E+00	4.2836E+00	2.9343E+00	2.9365E+00	
Pa-234 #A	2.2480E-01	>12 Halflives	3.0128E-01	3.0134E-01	
Eu-154 #A	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	

Eu-152 #A	7.5623E-03	7.5827E-03	2.6290E-02	2.6291E-02
Na-22 #A	-2.0610E-02	-2.0897E-02	1.6267E+02	1.6267E+02

C12110989.2					
Zn-65	A	4.1380E-02	4.3664E-02	2.1515E-01	2.1516E-01
Ba-133	#A	1.3095E-01	1.3140E-01	1.1875E-01	1.1880E-01
Ru-103	#B	0.0000E+00	0.0000E+00	1.0144E+02	1.0144E+02
Be-7	#B	0.0000E+00	0.0000E+00	1.3029E+03	1.3029E+03
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	9.0973E-02	6.7898E+00	2.7579E+01	2.7581E+01
Pa-234	#B	0.0000E+00	>12 Halflives	1.5359E+04	1.5359E+04

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Halflife limit exceeded

----- S U M M A R Y -----  
Total Activity ( 48.3 to 1980.0 keV) 3.4893920E+00 pCi/g  
Total Decayed Activity ( 48.3 to 1980.0 keV) 3.4894462E+00 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
1120.28 + Bi-214      1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
Analyzed by: \_\_\_\_\_  
                  Dave Blaida

Reviewed by: \_\_\_\_\_  
                  Supervisor

Laboratory: Energy Laboratory

C12110989.3

ORTEC g v - i (2191) wan32 G53W2.06 18-DEC-2012 13:05:10 Page 1  
Energy Laboratory Spectrum name: C12110989.3.An1

Sample description  
C12110989.3

Spectrum Filename: C:\User\C12110989.3.An1

Acquisition information

Start time: 18-Dec-2012 11:50:12  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample size: 1.8146E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8146E+02) =  
1.4879E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1754

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228	1.9138E+00	1.9258E+00	7.4286E-01	7.4463E-01	
Ra-226 A	2.7561E+00	2.7562E+00	2.7915E+00	2.7925E+00	
Bi-214 F	1.0653E+00	1.0653E+00	5.0879E-01	5.0958E-01	
Pb-214	1.5202E+00	1.5202E+00	4.5107E-01	4.5289E-01	
Ir-192 #B	9.5978E-02	1.1466E-01	1.2582E-01	1.2586E-01	
Sb-124 #B	2.1132E-02	2.6297E-02	1.3915E-01	1.3915E-01	
Sc-46 A	1.5981E-01	1.8699E-01	2.0866E-01	2.0872E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	3.5797E+00	3.6479E+00	6.0869E+00	6.0875E+00	
Th-230 #A	7.3887E+00	7.3887E+00	1.7063E+01	1.7064E+01	
Cs-137	3.6862E-01	3.6906E-01	1.7762E-01	1.7790E-01	
Co-60 #B	8.2452E-02	8.3017E-02	8.6455E-02	8.6483E-02	
Am-241 #A	1.7737E-01	1.7739E-01	1.8381E-01	1.8385E-01	
K-40	1.5832E+01	1.5832E+01	3.3165E+00	3.3432E+00	
U-235 A	7.2982E-02	7.2982E-02	1.7100E-01	1.7101E-01	
Th-234 #	1.0891E+01	1.0891E+01	3.5191E+00	3.5331E+00	
Cs-134 #	2.0930E-01	2.1299E-01	1.6362E-01	1.6371E-01	
Pb-212	1.0341E+00	1.0341E+00	2.5719E-01	2.5873E-01	
Ra-224 A	1.8231E+00	6.9222E+01	9.1775E+01	9.1794E+01	
I-131 #B	4.5049E-02	2.3164E-01	4.4336E-01	4.4340E-01	
Mn-54 #A	-5.8343E-02	-6.0851E-02	2.5296E+02	2.5296E+02	
Tl-208 H	5.6969E-01	>12 Halflives	2.4600E-01	2.4647E-01	
Bi-212 #	1.8826E+00	>12 Halflives	1.5121E+00	1.5129E+00	
Ra-223 #A	7.5341E-01	2.3837E+00	1.8645E+00	1.8656E+00	
Pa-234 A	1.3627E-01	>12 Halflives	2.2142E-01	2.2145E-01	
Eu-154 #A	8.7951E-02	8.8312E-02	1.2489E-01	1.2491E-01	

Eu-152 #A	-1.0790E-01	-1.0819E-01	8.3014E+02	8.3014E+02
Na-22 #A	-2.0212E-02	-2.0494E-02	2.8221E+02	2.8221E+02

c12110989.3

Zn-65	A	3.0638E-01	3.2333E-01	3.1532E-01	3.1544E-01
Ba-133	A	9.4222E-02	9.4546E-02	1.1571E-01	1.1574E-01
Ru-103	#B	1.5363E-01	2.1467E-01	1.9914E-01	1.9932E-01
Be-7	#B	5.5640E-01	7.1196E-01	8.7448E-01	8.7493E-01
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	2.4417E-01	1.8445E+01	4.9922E+01	4.9927E+01
Pa-234	F	6.0119E+00	>12 Halflives	2.6793E+00	2.6885E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

S U M M A R Y

-----  
Total Activity ( 48.3 to 1980.0 keV) 2.9276890E+01 pCi/g  
Total Decayed Activity ( 48.3 to 1980.0 keV) 2.9276924E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
969.10 - Ra-228      1173.00 - Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
Analyzed by: \_\_\_\_\_  
                                Dave Blaida

Reviewed by: \_\_\_\_\_  
                                Supervisor

Laboratory: Energy Laboratory

C12110989.4

ORTEC g v - i (2191) wan32 G53W2.06 18-DEC-2012 14:44:20 Page 1  
Energy Laboratory Spectrum name: C12110989.4.An1

Sample description  
C12110989.4

Spectrum Filename: C:\User\C12110989.4.An1

Acquisition information

Start time: 18-Dec-2012 13:06:45  
Live time: 3598  
Real time: 3600  
Dead time: 0.05 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd11perched.C1b  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample size: 1.7992E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.7992E+02) =  
1.5007E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).

Half lives decay limit: 12.000

□



Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0734

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***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****					
Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma	MDA
	Activity	Activity	Counting	Total	pCi/g
	pCi/g	pCi/g	pCi/g	pCi/g	
Ra-228	1.3390E+00	1.3475E+00	5.5432E-01	5.5548E-01	
Ra-226 A	1.2197E+00	1.2198E+00	2.8307E+00	2.8308E+00	
Bi-214 F	1.3348E+00	1.3349E+00	5.4030E-01	5.4147E-01	
Pb-214	1.2430E+00	1.2430E+00	4.9418E-01	4.9529E-01	
Ir-192 #B	2.8470E-03	3.4028E-03	1.8325E-02	1.8325E-02	
Sb-124 #B	0.0000E+00	0.0000E+00	2.0920E+02	2.0920E+02	
Sc-46 #A	0.0000E+00	0.0000E+00	6.4034E+02	6.4034E+02	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	3.3552E+00	3.4193E+00	6.9393E+00	6.9398E+00	
Th-230 #A	0.0000E+00	0.0000E+00	2.5670E+04	2.5670E+04	
Cs-137 #	2.7259E-01	2.7292E-01	1.8248E-01	1.8262E-01	
Co-60 #B	4.6106E-02	4.6423E-02	4.2575E-02	4.2593E-02	
Am-241 #A	1.6494E-01	1.6495E-01	2.6442E-01	2.6445E-01	
K-40	1.5498E+01	1.5498E+01	3.5929E+00	3.6165E+00	
U-235 A	1.2336E-01	1.2336E-01	1.4123E-01	1.4127E-01	
Th-234 #	1.3578E+01	1.3578E+01	3.6706E+00	3.6915E+00	
Cs-134 #A	-2.0312E-02	-2.0671E-02	-2.4130E-01	-2.4130E-01	
Pb-212	1.0318E+00	1.0318E+00	2.4812E-01	2.4971E-01	
Ra-224 A	1.6984E+00	6.5147E+01	9.4488E+01	9.4504E+01	
I-131 #B	1.2127E-01	6.2644E-01	7.4918E-01	7.4936E-01	
Mn-54 #A	-5.5167E-02	-5.7546E-02	-5.1990E-01	-5.1990E-01	
Tl-208 H	3.2743E-01	>12 Halflives	1.5970E-01	1.5994E-01	
Bi-212 #	3.6601E+00	>12 Halflives	1.9630E+00	1.9655E+00	
Ra-223	7.3971E-01	2.3479E+00	1.7096E+00	1.7107E+00	
Pa-234 #A	1.5607E-01	>12 Halflives	2.5745E-01	2.5748E-01	
Eu-154 A	0.0000E+00	0.0000E+00	3.9249E+02	3.9249E+02	

Eu-152 #A 1.3863E-01 1.3901E-01 2.8651E-01 2.8654E-01  
 Na-22 #A -2.0385E-02 -2.0670E-02 2.1468E+02 2.1468E+02

C12110989.4

Zn-65	A	2.1447E-01	2.2638E-01	2.6816E-01	2.6823E-01
Ba-133	#A	6.1859E-02	6.2072E-02	6.4024E-02	6.4045E-02
Ru-103	#F	1.9707E-01	2.7563E-01	2.1657E-01	2.1684E-01
Be-7	#B	4.9513E-01	6.3400E-01	8.6621E-01	8.6656E-01
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	1.1839E-01	9.0522E+00	2.8280E+01	2.8282E+01
Pa-234	#F	6.8051E+00	>12 Halflives	3.0776E+00	3.0879E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

S U M M A R Y

-----  
 Total Activity ( 48.3 to 1980.0 keV) 3.0107819E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 3.0107819E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
                   Dave Blaida

Reviewed by: \_\_\_\_\_  
                   Supervisor

Laboratory: Energy Laboratory

c12110989.5

ORTEC g v - i (2191) wan32 G53W2.06 18-DEC-2012 15:50:36 Page 1  
Energy Laboratory Spectrum name: C12110989.5.An1

Sample description  
c12110989.5

Spectrum Filename: C:\User\C12110989.5.An1

Acquisition information

Start time: 18-Dec-2012 14:48:01  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.8677E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8677E+02) =  
1.4456E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
Min. step backg. energy 0.000

Corrections Status Comments  
Decay correct to date: YES 29-Nov-2012 12:00:00  
Decay during acquisition: YES  
Decay during collection: NO  
True coincidence correction: NO  
Peaked background correction: YES 011108bkg1000mindet1.Pbc  
15-Jan-2008 17:02:27  
Absorption (Internal): NO  
Geometry correction: NO  
Random summing: YES slope 1.0000E+00  
Net factor 1.0000E+00

Energy Calibration  
Normalized diff: 0.1828

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma	MDA
	Activity	Activity	Counting	Total	pCi/g
	pCi/g	pCi/g	pCi/g	pCi/g	
Ra-228	1.1737E+00	1.1811E+00	6.5189E-01	6.5265E-01	
Ra-226 A	2.6708E+00	2.6709E+00	2.5987E+00	2.5996E+00	
Bi-214 C	1.2365E+00	1.2365E+00	4.1092E-01	4.1224E-01	
Pb-214	1.3018E+00	1.3018E+00	3.7944E-01	3.8102E-01	
Ir-192 #B	3.6569E-03	4.3737E-03	3.4929E-02	3.4929E-02	
Sb-124 F	2.7648E-01	3.4456E-01	2.2350E-01	2.2369E-01	
Sc-46 A	3.1022E-02	3.6334E-02	4.0791E-02	4.0803E-02	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	4.8903E+00	4.9841E+00	6.3391E+00	6.3401E+00	
Th-230 #A	0.0000E+00	0.0000E+00	2.5828E+04	2.5828E+04	
Cs-137 #A	1.3294E-01	1.3310E-01	1.2203E-01	1.2208E-01	
Co-60 #B	-2.2370E-02	-2.2525E-02	-1.1848E-01	-1.1848E-01	
Am-241 #A	3.7963E-02	3.7967E-02	1.1570E-01	1.1570E-01	
K-40	1.5355E+01	1.5355E+01	3.5436E+00	3.5671E+00	
U-235 A	4.3521E-02	4.3521E-02	1.4278E-01	1.4279E-01	
Th-234	8.5798E+00	8.5798E+00	2.6295E+00	2.6412E+00	
Cs-134 #A	-3.1508E-02	-3.2067E-02	2.0431E+02	2.0431E+02	
Pb-212	9.8568E-01	9.8568E-01	2.2974E-01	2.3131E-01	
Ra-224 A	1.4649E+00	5.6951E+01	8.3577E+01	8.3591E+01	
I-131 #B	-1.9392E-02	-1.0078E-01	7.1483E+02	7.1483E+02	
Mn-54 #A	-3.8982E-02	-4.0669E-02	-6.8570E-01	-6.8570E-01	
Tl-208 #H	4.2364E-01	>12 Halfives	1.9720E-01	1.9752E-01	
Bi-212 #A	1.3126E+00	>12 Halfives	1.2224E+00	1.2229E+00	
Ra-223	1.1875E+00	3.7854E+00	2.9928E+00	2.9945E+00	
Pa-234 #A	1.4693E-02	>12 Halfives	1.4140E-01	1.4140E-01	
Eu-154 A	8.0456E-02	8.0788E-02	9.9917E-02	9.9940E-02	

Eu-152 #A 4.6640E-01 4.6767E-01 2.8135E-01 2.8163E-01  
Na-22 #A -1.4530E-02 -1.4735E-02 -8.3283E-02 -8.3283E-02

C12110989.5

Zn-65	A	3.6617E-02	3.8657E-02	2.2080E-01	2.2080E-01
Ba-133	A	2.4968E-02	2.5054E-02	1.1313E-01	1.1314E-01
Ru-103	#B	0.0000E+00	0.0000E+00	1.3711E+02	1.3711E+02
Be-7	#B	1.0600E-01	1.3585E-01	7.8933E-01	7.8935E-01
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	B	3.7409E-01	2.9065E+01	3.7053E+01	3.7071E+01
Pa-234	#B	0.0000E+00	>12 Halflives	1.3106E+04	1.3106E+04

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

S U M M A R Y

-----  
 Total Activity ( 48.3 to 1980.0 keV) 2.7459026E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 2.7459084E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 969.10 - Ra-228 1120.28 - Bi-214 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

c12110989.6

ORTEC g v - i (2191) wan32 G53W2.06 18-DEC-2012 16:53:35 Page 1  
Energy Laboratory Spectrum name: C12110989.6.An1

Sample description  
c12110989.6

Spectrum Filename: C:\User\C12110989.6.An1

Acquisition information

Start time: 18-Dec-2012 15:51:41  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.8594E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8594E+02 ) =  
1.4521E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1040

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228	1.1790E+00	1.1865E+00	4.6089E-01	4.6197E-01	
Ra-226 A	1.8794E+00	1.8795E+00	2.4405E+00	2.4410E+00	
Bi-214 F	8.5459E-01	8.5461E-01	5.0141E-01	5.0193E-01	
Pb-214	1.0302E+00	1.0302E+00	3.6017E-01	3.6121E-01	
Ir-192 #B	1.7447E-02	2.0876E-02	7.3378E-02	7.3380E-02	
Sb-124 #B	4.1245E-03	5.1426E-03	2.7694E-02	2.7694E-02	
Sc-46 A	2.1039E-01	2.4651E-01	1.8275E-01	1.8287E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	1.6431E+00	1.6746E+00	5.3089E+00	5.3090E+00	
Th-230 #A	2.0029E+00	2.0029E+00	8.8674E+00	8.8675E+00	
Cs-137	3.4260E-01	3.4301E-01	1.2180E-01	1.2214E-01	
Co-60 #B	6.5626E-03	6.6080E-03	1.1375E-01	1.1375E-01	
Am-241 #A	-1.7930E-02	-1.7931E-02	2.6261E+02	2.6261E+02	
K-40	1.2886E+01	1.2886E+01	2.9719E+00	2.9916E+00	
U-235 A	2.9523E-02	2.9523E-02	1.4115E-01	1.4115E-01	
Th-234 B	1.1548E+00	1.1548E+00	2.8216E+00	2.8218E+00	
Cs-134 #A	8.2303E-02	8.3767E-02	8.8878E-02	8.8906E-02	
Pb-212	1.0846E+00	1.0846E+00	2.2906E-01	2.3095E-01	
Ra-224 A	1.6179E+00	6.3433E+01	8.1025E+01	8.1042E+01	
I-131 #B	1.0085E-01	5.2614E-01	8.6265E-01	8.6277E-01	
Mn-54 #A	-3.5600E-02	-3.7145E-02	-1.3655E-01	-1.3655E-01	
Tl-208 #H	6.0254E-01	>12 Halfives	2.2973E-01	2.3029E-01	
Bi-212	2.5783E+00	>12 Halfives	1.4041E+00	1.4058E+00	
Ra-223 A	7.0117E-01	2.2411E+00	1.8914E+00	1.8923E+00	
Pa-234 #A	2.1113E-01	>12 Halfives	3.0700E-01	3.0705E-01	
Eu-154 #A	0.0000E+00	0.0000E+00	1.9530E+03	1.9530E+03	

Eu-152 #A	3.6941E-01	3.7042E-01	2.4964E-01	2.4984E-01
Na-22 #A	9.5688E-02	9.7036E-02	1.2581E-01	1.2584E-01

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Zn-65	A	1.3760E-01	1.4528E-01	2.2354E-01	2.2357E-01
Ba-133	#A	1.3506E-01	1.3553E-01	1.1341E-01	1.1346E-01
Ru-103	#B	1.1310E-01	1.5851E-01	1.9352E-01	1.9362E-01
Be-7	#B	4.2587E-02	5.4613E-02	2.7246E-01	2.7247E-01
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	1.2372E-01	9.7100E+00	4.5926E+01	4.5927E+01
Pa-234	F	5.5025E+00	>12 Halfives	2.4818E+00	2.4902E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----

Total Activity ( 48.3 to 1980.0 keV) 1.4313614E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 1.4314028E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----

Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory



C12110989.7

ORTEC g v - i (2191) wan32 G53W2.06 18-DEC-2012 21:06:48 Page 1  
Energy Laboratory Spectrum name: C12110989.7.An1

Sample description  
C12110989.7

Spectrum Filename: C:\User\C12110989.7.An1

Acquisition information

Start time: 18-Dec-2012 16:55:14  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd1\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample size: 1.8417E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8417E+02) =  
1.4660E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1057

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228 #A	-4.1997E-03	-4.2264E-03	-2.8581E-03	-2.8603E-03	
Ra-226 A	2.3584E+00	2.3585E+00	2.6338E+00	2.6345E+00	
Bi-214 C	1.4080E+00	1.4081E+00	5.1216E-01	5.1353E-01	
Pb-214	1.2571E+00	1.2571E+00	4.1343E-01	4.1478E-01	
Ir-192 #B	9.2711E-02	1.1098E-01	1.2942E-01	1.2945E-01	
Sb-124 #F	2.4707E-01	3.0822E-01	2.2961E-01	2.2976E-01	
Sc-46 A	2.7197E-01	3.1878E-01	2.3818E-01	2.3833E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	2.8732E+00	2.9285E+00	5.8973E+00	5.8977E+00	
Th-230 #A	9.7066E+00	9.7066E+00	1.5601E+01	1.5603E+01	
Cs-137 #	2.0056E-01	2.0081E-01	9.5255E-02	9.5405E-02	
Co-60 #B	5.7869E-02	5.8271E-02	5.8825E-02	5.8846E-02	
Am-241 A	4.4788E-02	4.4791E-02	1.2642E-01	1.2642E-01	
K-40	1.4466E+01	1.4466E+01	3.1536E+00	3.1770E+00	
U-235 A	9.6460E-02	9.6460E-02	1.3989E-01	1.3991E-01	
Th-234	9.9701E+00	9.9701E+00	3.2284E+00	3.2412E+00	
Cs-134 #	3.1117E-01	3.1672E-01	1.8246E-01	1.8265E-01	
Pb-212	1.0500E+00	1.0500E+00	2.4609E-01	2.4775E-01	
Ra-224 A	3.8043E-01	1.5042E+01	8.9847E+01	8.9848E+01	
I-131 #F	1.4640E-01	7.6666E-01	5.4823E-01	5.4861E-01	
Mn-54 #A	3.9454E-02	4.1170E-02	1.2913E-01	1.2913E-01	
Tl-208 H	4.2962E-01	>12 Halfives	1.6508E-01	1.6547E-01	
Bi-212 #A	2.8364E-01	>12 Halfives	7.0187E-01	7.0191E-01	
Ra-223 #	1.1207E+00	3.5917E+00	2.5796E+00	2.5814E+00	
Pa-234 #	4.4380E-01	>12 Halfives	2.9334E-01	2.9358E-01	
Eu-154 #A	0.0000E+00	0.0000E+00	2.3042E+03	2.3042E+03	

Eu-152 A	1.4870E-01	1.4911E-01	2.1891E-01	2.1895E-01
Na-22 #A	7.8483E-02	7.9591E-02	1.0345E-01	1.0347E-01

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Zn-65	A	1.4204E-01	1.4999E-01	2.3897E-01	2.3900E-01
Ba-133	#A	9.4014E-02	9.4340E-02	9.7126E-02	9.7159E-02
Ru-103	#F	1.3809E-01	1.9367E-01	1.3966E-01	1.3986E-01
Be-7	#B	1.2899E-01	1.6551E-01	5.7334E-01	5.7338E-01
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#F	8.0499E-01	6.3815E+01	4.5525E+01	4.5594E+01
Pa-234	B	6.0005E-01	>12 Halflives	2.4604E+00	2.4605E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----  
 Total Activity ( 48.3 to 1980.0 keV) 2.8151522E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 2.8151581E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 969.10 + Ra-228 1120.28 - Bi-214

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

C12110989.8

ORTEC g v - i (2191) wan32 G53W2.06 18-DEC-2012 22:12:03 Page 1  
Energy Laboratory Spectrum name: C12110989.8.An1

Sample description  
C12110989.8

Spectrum Filename: C:\User\C12110989.8.An1

#### Acquisition information

Start time: 18-Dec-2012 21:09:33  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

#### Calibration

Filename: 1369.93.1ccd11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

#### Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

#### Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

#### Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

#### Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.9193E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.9193E+02) =  
1.4068E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0941

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***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****					
Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma	MDA
	Activity	Activity	Counting	Total	pCi/g
	pCi/g	pCi/g	pCi/g	pCi/g	
Ra-228	1.3774E+00	1.3862E+00	4.9505E-01	4.9643E-01	
Ra-226 A	2.1930E+00	2.1930E+00	3.3257E+00	3.3262E+00	
Bi-214 C	1.1066E+00	1.1066E+00	3.7258E-01	3.7374E-01	
Pb-214	1.1129E+00	1.1129E+00	4.0356E-01	4.0465E-01	
Ir-192 #B	9.7859E-03	1.1733E-02	6.7496E-02	6.7497E-02	
Sb-124 #F	2.1577E-01	2.6972E-01	2.1301E-01	2.1313E-01	
Sc-46	2.9071E-01	3.4124E-01	1.7025E-01	1.7049E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	9.0465E-01	9.2224E-01	6.4619E+00	6.4620E+00	
Th-230 #A	6.2095E+00	6.2095E+00	1.3630E+01	1.3631E+01	
Cs-137 #	4.2820E-01	4.2872E-01	2.0766E-01	2.0797E-01	
Co-60 #B	1.2398E-01	1.2485E-01	9.7710E-02	9.7767E-02	
Am-241 #A	2.0850E-02	2.0852E-02	9.1485E-02	9.1486E-02	
K-40	1.3882E+01	1.3882E+01	3.0261E+00	3.0486E+00	
U-235	4.3484E-01	4.3484E-01	1.7527E-01	1.7566E-01	
Th-234 #	1.8566E+01	1.8566E+01	3.6583E+00	3.6974E+00	
Cs-134 #A	-3.0661E-02	-3.1213E-02	1.9887E+02	1.9887E+02	
Pb-212	1.0928E+00	1.0928E+00	2.3874E-01	2.4059E-01	
Ra-224 A	1.2872E+00	5.2645E+01	8.5424E+01	8.5435E+01	
I-131 #B	-1.8870E-02	-1.0034E-01	8.2079E+02	8.2079E+02	
Mn-54 #A	-3.4825E-03	-3.6354E-03	-1.0485E-01	-1.0485E-01	
Tl-208 H	6.3790E-01	>12 Halfives	2.1206E-01	2.1274E-01	
Bi-212	3.1978E+00	>12 Halfives	1.7054E+00	1.7075E+00	
Ra-223 #A	-8.9358E-02	-2.8946E-01	2.8165E+03	2.8165E+03	
Pa-234 #A	2.5696E-01	>12 Halfives	3.6828E-01	3.6834E-01	
Eu-154 #A	0.0000E+00	0.0000E+00	1.6772E+03	1.6772E+03	

Eu-152 #A -1.0201E-01 -1.0229E-01 7.8490E+02 7.8490E+02  
 Na-22 # 1.4488E-01 1.4695E-01 1.0030E-01 1.0038E-01

C12110989.8					
Zn-65	A	4.2831E-02	4.5251E-02	1.9843E-01	1.9844E-01
Ba-133	#A	-1.6591E-02	-1.6649E-02	1.7758E+02	1.7758E+02
Ru-103	#B	-2.5482E-03	-3.5851E-03	-3.2508E-02	-3.2509E-02
Be-7	#B	9.9021E-01	1.2735E+00	1.3175E+00	1.3184E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	6.1263E-01	5.0559E+01	6.0227E+01	6.0260E+01
Pa-234		8.6313E+00	>12 Halflives	2.9388E+00	2.9561E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Halflife limit exceeded

----- S U M M A R Y -----  
 Total Activity ( 48.3 to 1980.0 keV) 3.5760269E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 3.5760319E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214 1173.00 - Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

C12110989.9

ORTEC g v - i (2191) wan32 G53W2.06 18-DEC-2012 23:20:02 Page 1  
Energy Laboratory Spectrum name: C12110989.9.An1

Sample description  
C12110989.9

Spectrum Filename: C:\User\C12110989.9.An1

Acquisition information

Start time: 18-Dec-2012 22:14:36  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.7963E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.7963E+02) =  
1.5031E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1059

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*****	SUMMARY OF NUCLIDES IN SAMPLE				*****
	Time of Count	Time Corrected	Uncertainty	2 Sigma	
Nuclide	Activity	Activity	Counting	Total	MDA
	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g

---

Ra-228	1.3962E+00	1.4052E+00	5.9698E-01	5.9815E-01	
Ra-226 A	3.4633E+00	3.4634E+00	2.7207E+00	2.7222E+00	
Bi-214 F	1.0606E+00	1.0606E+00	4.1420E-01	4.1516E-01	
Pb-214	1.1681E+00	1.1681E+00	3.7634E-01	3.7762E-01	
Ir-192 #B	2.7565E-02	3.3065E-02	8.4003E-02	8.4007E-02	
Sb-124 #B	5.1232E-02	6.4074E-02	1.4486E-01	1.4487E-01	
Sc-46 A	9.9886E-03	1.1729E-02	2.8193E-02	2.8195E-02	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	1.0623E+00	1.0830E+00	6.6160E+00	6.6161E+00	
Th-230 #A	3.1099E-01	3.1099E-01	3.4770E+00	3.4770E+00	
Cs-137 #A	-1.7870E-02	-1.7892E-02	2.2380E+02	2.2380E+02	
Co-60 #B	-2.3259E-02	-2.3423E-02	-1.2321E-01	-1.2321E-01	
Am-241 #A	9.1054E-02	9.1061E-02	1.5095E-01	1.5097E-01	
K-40	1.9808E+01	1.9808E+01	3.7088E+00	3.7461E+00	
U-235 #A	-3.9419E-02	-3.9419E-02	-2.5808E-01	-2.5808E-01	
Th-234 #F	9.4856E+00	9.4856E+00	4.1481E+00	4.1572E+00	
Cs-134 #A	-3.2761E-02	-3.3352E-02	2.1250E+02	2.1250E+02	
Pb-212	1.1218E+00	1.1218E+00	2.4594E-01	2.4783E-01	
Ra-224 A	1.2876E+00	5.3123E+01	8.8275E+01	8.8286E+01	
I-131 #B	2.9034E-02	1.5498E-01	5.1904E-01	5.1906E-01	
Mn-54 #A	1.6560E-01	1.7289E-01	1.6177E-01	1.6184E-01	
Tl-208 H	5.0155E-01	>12 Halfives	1.8936E-01	1.8983E-01	
Bi-212 #	2.8989E+00	>12 Halfives	1.9602E+00	1.9618E+00	
Ra-223 #A	2.6730E-01	8.6823E-01	2.0410E+00	2.0411E+00	
Pa-234 #A	1.3765E-01	>12 Halfives	2.0157E-01	2.0161E-01	
Eu-154 A	0.0000E+00	0.0000E+00	2.0387E+03	2.0387E+03	

Eu-152 #A	3.8672E-01	3.8779E-01	4.0587E-01	4.0600E-01
Na-22 #A	-1.5108E-02	-1.5324E-02	-8.6613E-02	-8.6614E-02



C12110989.9					
Zn-65	A	1.3112E-01	1.3855E-01	2.6226E-01	2.6229E-01
Ba-133	A	-1.7727E-02	-1.7789E-02	1.8974E+02	1.8974E+02
Ru-103	#B	6.1259E-02	8.6255E-02	1.6942E-01	1.6945E-01
Be-7	#B	-2.2042E-02	-2.8363E-02	-1.3766E-01	-1.3766E-01
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	2.1819E-01	1.8193E+01	4.3870E+01	4.3876E+01
Pa-234	#F	7.4860E+00	>12 Halflives	3.1454E+00	3.1576E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----  
 Total Activity ( 48.3 to 1980.0 keV) 2.2097548E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 2.2097574E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 969.10 - Ra-228 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

C12110989.10

ORTEC g v - i (2191) wan32 G53W2.06 19-DEC-2012 00:24:27 Page 1  
Energy Laboratory Spectrum name: C12110989.10.An1

Sample description  
C12110989.10

Spectrum Filename: C:\User\C12110989.10.An1

#### Acquisition information

Start time: 18-Dec-2012 23:22:23  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

#### Calibration

Filename: 1369.93.1ccd1\_11perched.clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

#### Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

#### Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

#### Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

#### Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.7731E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.7731E+02) =  
1.5228E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0651

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\*\*\*\*\* SUMMARY OF NUCLIDES IN SAMPLE \*\*\*\*\*

Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228 #	1.9288E+00	1.9412E+00	6.3494E-01	6.3704E-01	
Ra-226 #A	0.0000E+00	0.0000E+00	1.2096E+04	1.2096E+04	
Bi-214	1.5241E+00	1.5241E+00	5.1246E-01	5.1406E-01	
Pb-214	1.4454E+00	1.4455E+00	4.1577E-01	4.1754E-01	
Ir-192 B	1.2422E-01	1.4907E-01	1.3885E-01	1.3890E-01	
Sb-124 #F	1.9896E-01	2.4897E-01	1.9724E-01	1.9735E-01	
Sc-46 #A	0.0000E+00	0.0000E+00	4.1946E+02	4.1946E+02	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	2.4345E+00	2.4821E+00	6.1572E+00	6.1574E+00	
Th-230 #A	0.0000E+00	0.0000E+00	2.5449E+04	2.5449E+04	
Cs-137 #A	9.6906E-02	9.7025E-02	1.0380E-01	1.0383E-01	
Co-60 #B	5.1167E-02	5.1527E-02	7.4790E-02	7.4803E-02	
Am-241 #A	4.4343E-02	4.4346E-02	1.7459E-01	1.7459E-01	
K-40 #	1.7210E+01	1.7210E+01	3.4925E+00	3.5224E+00	
U-235 A	1.0457E-01	1.0457E-01	1.9289E-01	1.9291E-01	
Th-234 #	1.2052E+01	1.2052E+01	3.4494E+00	3.4669E+00	
Cs-134 #A	1.2933E-02	1.3167E-02	7.5642E-02	7.5643E-02	
Pb-212	1.2060E+00	1.2060E+00	2.5801E-01	2.6010E-01	
Ra-224 A	2.1856E+00	9.0987E+01	9.8066E+01	9.8096E+01	
I-131 F	2.7962E-01	1.4987E+00	6.7022E-01	6.7141E-01	
Mn-54 #	2.2930E-01	2.3942E-01	1.4595E-01	1.4609E-01	
Tl-208 H	6.4327E-01	>12 Halflives	1.9673E-01	1.9747E-01	
Bi-212 #	2.2375E+00	>12 Halflives	1.5119E+00	1.5131E+00	
Ra-223 #A	-8.6518E-02	-2.8183E-01	-8.9293E+00	-8.9293E+00	
Pa-234 #A	2.8084E-02	>12 Halflives	2.4025E-01	2.4026E-01	
Eu-154 #A	1.8002E-01	1.8077E-01	1.8077E-01	1.8084E-01	

Eu-152 #A	1.0916E-01	1.0946E-01	1.7245E-01	1.7248E-01
Na-22 #A	-2.0685E-02	-2.0981E-02	4.5565E+02	4.5565E+02

C12110989.10

Zn-65	A	3.0714E-01	3.2458E-01	2.5069E-01	2.5084E-01
Ba-133	A	5.4069E-02	5.4259E-02	8.4959E-02	8.4971E-02
Ru-103	#B	5.3786E-02	7.5796E-02	9.8256E-02	9.8301E-02
Be-7	#B	0.0000E+00	0.0000E+00	1.5204E+03	1.5204E+03
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	1.4416E-02	1.2150E+00	9.3324E+00	9.3325E+00
Pa-234	F	4.2314E+00	>12 Halflives	2.6573E+00	2.6619E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Halflife limit exceeded

S U M M A R Y

-----  
 Total Activity ( 48.3 to 1980.0 keV) 3.3438297E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 3.3438366E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214 1173.00 - Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

ORTEC g v - i (2191) wan32 G53W2.06 19-DEC-2012 01:33:33 Page 1  
 Energy Laboratory Spectrum name: C12110989.10DUP.An1

Sample description  
 C12110989.10DUP

Spectrum Filename: C:\User\C12110989.10DUP.An1

#### Acquisition information

Start time: 19-Dec-2012 00:26:39  
 Live time: 3598  
 Real time: 3600  
 Dead time: 0.06 %  
 Detector ID: 2

Detector system  
 Det 1

#### Calibration

Filename: 1369.93.1ccd11perched.Clb  
 10/16/12 can calibration energy re-cal  
 IPL #1369-93-1 new calibration perched

##### Energy Calibration

Created: 16-Oct-2012 14:32:42  
 Zero offset: -0.292 keV  
 Gain: 0.243 keV/channel  
 Quadratic: -4.957E-09 keV/channel<sup>2</sup>

##### Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
 Type: Polynomial  
 Uncertainty: 1.149 %  
 Coefficients: -0.345759 -5.963100 0.675305  
 -0.103447 0.008672 -0.000304

#### Library Files

Main analysis library: Norman.lib  
 Library Match Width: 0.500

#### Analysis parameters

Analysis engine: wan32 G53W2.06  
 Start channel: 200 ( 48.35keV )  
 Stop channel: 8144 ( 1980.03keV )  
 Peak rejection level: 20.000%  
 Peak search sensitivity: 3  
 Sample Size: 1.7731E+02  
 Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.7731E+02) =  
 1.5228E-01  
 Detection limit method: Nureg 4.16  
 Random error: 1.0000000E+00  
 Systematic error: 1.0000000E+00  
 Fraction Limit: 0.000%  
 Background width: best method (based on spectrum).  
 Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0996

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma	MDA
	Activity	Activity	Counting	Total	pCi/g
	pCi/g	pCi/g	pCi/g	pCi/g	
Ra-228 #A	1.0527E+00	1.0596E+00	5.3807E-01	5.3881E-01	
Ra-226 A	2.5349E+00	2.5349E+00	2.7433E+00	2.7441E+00	
Bi-214	1.5282E+00	1.5283E+00	5.4683E-01	5.4834E-01	
Pb-214	1.3490E+00	1.3490E+00	4.4636E-01	4.4780E-01	
Ir-192 #F	1.7334E-01	2.0810E-01	1.8819E-01	1.8827E-01	
Sb-124 #B	0.0000E+00	0.0000E+00	1.3499E+02	1.3499E+02	
Sc-46 A	7.5505E-02	8.8729E-02	2.1486E-01	2.1487E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	1.2056E+00	1.2292E+00	5.7778E+00	5.7779E+00	
Th-230 A	1.1973E+01	1.1973E+01	1.5891E+01	1.5894E+01	
Cs-137 #A	2.4606E-01	2.4636E-01	2.1939E-01	2.1949E-01	
Co-60 #B	6.7774E-02	6.8252E-02	8.1930E-02	8.1951E-02	
Am-241 #	2.5229E-01	2.5231E-01	2.4902E-01	2.4909E-01	
K-40	1.5866E+01	1.5866E+01	3.3607E+00	3.3871E+00	
U-235 A	2.4487E-02	2.4487E-02	1.6606E-01	1.6606E-01	
Th-234	8.5120E+00	8.5120E+00	2.7474E+00	2.7584E+00	
Cs-134 #A	1.5969E-01	1.6258E-01	1.7033E-01	1.7039E-01	
Pb-212	1.0445E+00	1.0445E+00	2.6731E-01	2.6882E-01	
Ra-224 #A	-1.0160E-01	-4.2660E+00	-2.9567E+02	-2.9567E+02	
I-131 #F	2.0777E-01	1.1179E+00	7.1919E-01	7.1981E-01	
Mn-54 #A	-5.2250E-02	-5.4560E-02	-5.8324E-01	-5.8324E-01	
Tl-208 H	4.5927E-01	>12 Halflives	2.1982E-01	2.2016E-01	
Bi-212 #A	1.9655E+00	>12 Halflives	1.6973E+00	1.6981E+00	
Ra-223 #A	1.9933E-01	6.5108E-01	1.6593E+00	1.6593E+00	
Pa-234 #A	1.3375E-02	>12 Halflives	1.0772E-01	1.0773E-01	
Eu-154 #A	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	

Eu-152 A	2.2875E-01	2.2939E-01	1.4588E-01	1.4601E-01
Na-22 #A	-2.0685E-02	-2.0982E-02	1.6333E+02	1.6333E+02

C12110989.10DUP

Zn-65	A	3.2071E-01	3.3897E-01	3.2178E-01	3.2191E-01
Ba-133	A	1.2367E-01	1.2410E-01	1.4064E-01	1.4068E-01
Ru-103	#B	1.1585E-01	1.6338E-01	1.4261E-01	1.4276E-01
Be-7	F	1.6078E+00	2.0714E+00	1.1120E+00	1.1150E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	7.2080E-02	6.1370E+00	2.1819E+01	2.1820E+01
Pa-234	#B	0.0000E+00	>12 Halflives	1.4447E+04	1.4447E+04

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

S U M M A R Y

-----  
 Total Activity ( 48.3 to 1980.0 keV) 2.8299860E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 2.8299925E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1173.00 - Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at Fw25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
                   Dave Blaida

Reviewed by: \_\_\_\_\_  
                   Supervisor

Laboratory: Energy Laboratory

C12110989.11

ORTEC g v - i (2191) wan32 G53W2.06 19-DEC-2012 08:02:40 Page 1  
Energy Laboratory Spectrum name: C12110989.11.An1

Sample description  
C12110989.11

Spectrum Filename: C:\User\C12110989.11.An1

Acquisition information

Start time: 19-Dec-2012 01:36:03  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd1\_11perched.clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample size: 1.6879E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.6879E+02) =  
1.5996E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□



Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0790

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228 #	1.5196E+00	1.5295E+00	5.3622E-01	5.3776E-01	
Ra-226 A	2.7335E+00	2.7336E+00	3.0572E+00	3.0581E+00	
Bi-214 C	1.5622E+00	1.5623E+00	6.1919E-01	6.2058E-01	
Pb-214	1.5975E+00	1.5975E+00	4.3118E-01	4.3328E-01	
Ir-192 B	9.1044E-02	1.0935E-01	1.2822E-01	1.2825E-01	
Sb-124 #B	6.3611E-02	7.9684E-02	1.0433E-01	1.0435E-01	
Sc-46 A	2.7099E-01	3.1858E-01	1.6411E-01	1.6432E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	2.5575E+00	2.6077E+00	5.0112E+00	5.0116E+00	
Th-230 #A	9.2673E+00	9.2673E+00	1.6429E+01	1.6430E+01	
Cs-137 #A	1.7165E-01	1.7186E-01	1.4839E-01	1.4846E-01	
Co-60 #B	5.3751E-02	5.4131E-02	7.8569E-02	7.8583E-02	
Am-241 #A	-3.0882E-04	-3.0885E-04	-1.2235E-01	-1.2235E-01	
K-40	1.8962E+01	1.8962E+01	3.7528E+00	3.7866E+00	
U-235 A	1.2717E-01	1.2717E-01	1.7738E-01	1.7742E-01	
Th-234	1.2518E+01	1.2518E+01	3.2265E+00	3.2467E+00	
Cs-134 #A	-8.4367E-03	-8.5901E-03	-1.6496E-01	-1.6496E-01	
Pb-212	1.1523E+00	1.1523E+00	2.8291E-01	2.8465E-01	
Ra-224 A	9.0452E-01	3.8330E+01	1.0407E+02	1.0407E+02	
I-131 #B	1.3178E-01	7.1197E-01	8.9682E-01	8.9702E-01	
Mn-54 #A	3.5215E-02	3.6776E-02	1.0621E-01	1.0622E-01	
Tl-208 #H	5.2693E-01	>12 Halfives	2.5233E-01	2.5272E-01	
Bi-212 #A	-1.7063E-02	>12 Halfives	-7.3444E-01	-7.3444E-01	
Ra-223 #A	9.3330E-01	3.0574E+00	2.7754E+00	2.7766E+00	
Pa-234 #A	7.4281E-03	>12 Halfives	1.8321E-01	1.8321E-01	
Eu-154 #A	0.0000E+00	0.0000E+00	4.1841E+02	4.1841E+02	

Eu-152 #A	1.7026E-02	1.7074E-02	6.4566E-02	6.4567E-02
Na-22 #A	-2.1729E-02	-2.2042E-02	2.2892E+02	2.2892E+02

C12110989.11					
Zn-65	A	1.9787E-01	2.0916E-01	2.7940E-01	2.7945E-01
Ba-133	#A	5.9302E-02	5.9512E-02	8.9696E-02	8.9710E-02
Ru-103	#B	2.6078E-02	3.6809E-02	1.6092E-01	1.6092E-01
Be-7	#B	1.4075E-01	1.8144E-01	7.6979E-01	7.6982E-01
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	1.0096E-01	8.6906E+00	4.2219E+01	4.2220E+01
Pa-234		6.8139E+00	>12 Halfives	2.5588E+00	2.5712E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----

Total Activity ( 48.3 to 1980.0 keV) 3.5792305E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 3.5792381E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214 1173.00 - Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
                   Dave Blaida

Reviewed by: \_\_\_\_\_  
                   Supervisor

Laboratory: Energy Laboratory

C12110989.12

ORTEC g v - i (2191) wan32 G53W2.06 19-DEC-2012 09:04:43 Page 1  
Energy Laboratory Spectrum name: C12110989.12.An1

Sample description  
C12110989.12

Spectrum Filename: C:\User\C12110989.12.An1

Acquisition information

Start time: 19-Dec-2012 08:03:51  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd1\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.7715E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.7715E+02) =  
1.5241E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0880

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228 #	1.6707E+00	1.6816E+00	5.3347E-01	5.3534E-01	
Ra-226 A	1.5684E+00	1.5684E+00	3.0059E+00	3.0062E+00	
Bi-214	1.3592E+00	1.3592E+00	4.7942E-01	4.8079E-01	
Pb-214	1.3025E+00	1.3026E+00	4.0855E-01	4.1002E-01	
Ir-192 #B	0.0000E+00	0.0000E+00	1.6237E+02	1.6237E+02	
Sb-124 #B	0.0000E+00	0.0000E+00	1.3560E+02	1.3560E+02	
Sc-46 #A	0.0000E+00	0.0000E+00	6.4323E+02	6.4323E+02	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	4.4438E+00	4.5323E+00	6.4235E+00	6.4244E+00	
Th-230 #A	2.1129E+01	2.1129E+01	1.9382E+01	1.9388E+01	
Cs-137 #A	1.5995E-01	1.6015E-01	1.6775E-01	1.6780E-01	
Co-60 #B	7.1061E-02	7.1570E-02	7.4533E-02	7.4557E-02	
Am-241 #A	3.3488E-02	3.3490E-02	1.7804E-01	1.7804E-01	
K-40	2.0422E+01	2.0422E+01	3.7908E+00	3.8296E+00	
U-235 A	2.4324E-01	2.4324E-01	1.4860E-01	1.4874E-01	
Th-234 B	4.9057E+00	4.9057E+00	3.6859E+00	3.6886E+00	
Cs-134 #A	1.4305E-01	1.4568E-01	1.5669E-01	1.5674E-01	
Pb-212	1.0172E+00	1.0172E+00	2.6181E-01	2.6328E-01	
Ra-224 A	6.5820E-01	2.9367E+01	1.0794E+02	1.0794E+02	
I-131 #B	9.1045E-02	5.0344E-01	8.1966E-01	8.1977E-01	
Mn-54 #A	-4.8564E-02	-5.0747E-02	-3.5796E-01	-3.5796E-01	
Tl-208 H	6.6180E-01	>12 Halfives	2.4350E-01	2.4414E-01	
Bi-212	2.6674E+00	>12 Halfives	1.6168E+00	1.6183E+00	
Ra-223 #A	2.0974E-01	6.9839E-01	2.5824E+00	2.5824E+00	
Pa-234 #A	-1.8162E-02	>12 Halfives	4.2262E+02	4.2262E+02	
Eu-154 #	5.8560E-01	5.8811E-01	3.2623E-01	3.2660E-01	

Eu-152 #A 4.1042E-01 4.1158E-01 2.2631E-01 2.2657E-01  
 Na-22 #A -2.0704E-02 -2.1005E-02 4.8645E+02 4.8645E+02

C12110989.12

Zn-65	A	2.7599E-01	2.9197E-01	2.2994E-01	2.3007E-01
Ba-133	A	6.5474E-02	6.5710E-02	7.6108E-02	7.6128E-02
Ru-103	#B	8.2825E-03	1.1746E-02	5.5096E-02	5.5098E-02
Be-7	#F	2.7827E+00	3.5999E+00	1.7869E+00	1.7924E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	1.1544E-01	1.0565E+01	2.4777E+01	2.4781E+01
Pa-234	B	3.4129E+00	>12 Halflives	2.8823E+00	2.8851E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----

Total Activity ( 48.3 to 1980.0 keV) 2.5771662E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 2.5782698E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 + Bi-214

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----

Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

C12110989.13

ORTEC g v - i (2191) wan32 G53W2.06 19-DEC-2012 11:40:46 Page 1  
Energy Laboratory Spectrum name: C12110989.13.An1

Sample description  
C12110989.13

Spectrum Filename: C:\User\C12110989.13.An1

Acquisition information

Start time: 19-Dec-2012 10:34:18  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd1\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample size: 1.6987E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.6987E+02) =  
1.5895E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0604

-----

*****	SUMMARY OF NUCLIDES IN SAMPLE				*****
	Time of Count	Time Corrected	Uncertainty	2 Sigma	
Nuclide	Activity	Activity	Counting	Total	MDA
	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g

---

Ra-228	A	4.9389E-01	4.9715E-01	3.0610E-01	3.0639E-01	
Ra-226	A	2.6329E+00	2.6329E+00	2.9345E+00	2.9354E+00	
Bi-214		2.9595E+00	2.9596E+00	5.8998E-01	5.9522E-01	
Pb-214		2.5504E+00	2.5505E+00	4.9255E-01	4.9722E-01	
Ir-192	#B	4.8249E-02	5.8154E-02	1.1386E-01	1.1387E-01	
Sb-124	#B	1.8059E-02	2.2720E-02	6.6886E-02	6.6889E-02	
Sc-46	#A	0.0000E+00	0.0000E+00	8.6053E+02	8.6053E+02	
Pb-210	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228	#A	6.1196E+00	6.2421E+00	7.6587E+00	7.6601E+00	
Th-230	A	1.4470E+01	1.4470E+01	2.3606E+01	2.3608E+01	
Cs-137	#A	-1.8897E-02	-1.8921E-02	2.7520E+02	2.7520E+02	
Co-60	#B	7.0745E-02	7.1255E-02	8.5534E-02	8.5555E-02	
Am-241	#A	1.3606E-01	1.3608E-01	1.9510E-01	1.9512E-01	
K-40	#	1.7263E+01	1.7263E+01	3.5774E+00	3.6068E+00	
U-235	A	1.3361E-01	1.3361E-01	1.6571E-01	1.6575E-01	
Th-234	#	1.1695E+01	1.1695E+01	3.4140E+00	3.4307E+00	
Cs-134	#A	-1.2759E-02	-1.2996E-02	-1.5021E-01	-1.5021E-01	
Pb-212		1.2402E+00	1.2402E+00	2.9046E-01	2.9242E-01	
Ra-224	A	1.3765E+00	6.2656E+01	1.3411E+02	1.3412E+02	
I-131	#B	1.9325E-02	1.0783E-01	4.5015E-01	4.5016E-01	
Mn-54	#A	-6.2323E-02	-6.5140E-02	2.7078E+02	2.7078E+02	
Tl-208	H	4.7090E-01	>12 Halfives	2.6100E-01	2.6131E-01	
Bi-212	#A	5.3061E-01	>12 Halfives	1.9883E+00	1.9883E+00	
Ra-223	#A	2.2406E-01	7.5081E-01	2.2355E+00	2.2356E+00	
Pa-234	#A	4.5485E-01	>12 Halfives	4.5476E-01	4.5492E-01	
Eu-154	#A	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	

Eu-152	#A	2.3596E-01	2.3663E-01	2.9479E-01	2.9486E-01
Na-22	#A	-2.1591E-02	-2.1907E-02	1.7053E+02	1.7053E+02

C12110989.13

Zn-65	A	1.5951E-01	1.6879E-01	2.4284E-01	2.4288E-01
Ba-133	A	8.7394E-02	8.7709E-02	1.2063E-01	1.2065E-01
Ru-103	#B	2.0154E-02	2.8636E-02	9.3643E-02	9.3650E-02
Be-7	#B	0.0000E+00	0.0000E+00	7.9831E+02	7.9831E+02
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	4.4642E-01	4.1842E+01	4.4729E+01	4.4759E+01
Pa-234	F	4.7594E+00	>12 Halflives	2.7430E+00	2.7486E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Halflife limit exceeded

S U M M A R Y

-----  
 Total Activity ( 48.3 to 1980.0 keV) 3.5708511E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 3.5708641E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 + Bi-214 1173.00 & Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory



C12110989.14

ORTEC g v - i (2191) wan32 G53W2.06 19-DEC-2012 12:49:38 Page 1  
Energy Laboratory Spectrum name: C12110989.14.An1

Sample description  
C12110989.14

Spectrum Filename: C:\User\C12110989.14.An1

Acquisition information

Start time: 19-Dec-2012 11:49:27  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd1\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.7668E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.7668E+02) =  
1.5282E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0799

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228	1.8296E+00	1.8417E+00	5.6391E-01	5.6604E-01	
Ra-226	4.3628E+00	4.3629E+00	2.8020E+00	2.8045E+00	
Bi-214 C	1.6963E+00	1.6964E+00	5.6965E-01	5.7144E-01	
Pb-214	1.7365E+00	1.7365E+00	3.7145E-01	3.7432E-01	
Ir-192 #B	5.7986E-03	6.9924E-03	2.9112E-02	2.9112E-02	
Sb-124 #B	3.3279E-02	4.1893E-02	7.4032E-02	7.4040E-02	
Sc-46 A	2.7193E-01	3.2081E-01	2.4244E-01	2.4259E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	4.9749E+00	5.0747E+00	7.1640E+00	7.1650E+00	
Th-230 #A	6.6401E+00	6.6401E+00	1.4098E+01	1.4099E+01	
Cs-137	2.4694E-01	2.4725E-01	1.6372E-01	1.6385E-01	
Co-60 #B	-2.6425E-02	-2.6616E-02	-1.4140E-01	-1.4141E-01	
Am-241 #A	1.3909E-02	1.3910E-02	1.2231E-01	1.2231E-01	
K-40	1.8958E+01	1.8958E+01	3.6637E+00	3.6983E+00	
U-235 #A	-1.8237E-02	-1.8237E-02	-2.1100E-01	-2.1100E-01	
Th-234 #	1.1714E+01	1.1714E+01	3.7284E+00	3.7437E+00	
Cs-134 #A	-2.0684E-02	-2.1068E-02	-2.2896E-01	-2.2896E-01	
Pb-212	1.2040E+00	1.2040E+00	2.7019E-01	2.7217E-01	
Ra-224 A	6.5983E-01	3.0337E+01	1.2171E+02	1.2171E+02	
I-131 #F	2.6797E-01	1.5019E+00	1.0896E+00	1.0904E+00	
Mn-54 #A	-1.1268E-02	-1.1778E-02	-1.1158E-01	-1.1159E-01	
Tl-208 #H	6.4394E-01	>12 Halflives	2.1866E-01	2.1933E-01	
Bi-212 #A	1.0069E-01	>12 Halflives	9.6472E-01	9.6472E-01	
Ra-223 #A	-9.7071E-02	-3.2631E-01	2.6009E+03	2.6009E+03	
Pa-234 #A	-1.8210E-02	>12 Halflives	3.9330E+02	3.9330E+02	
Eu-154 #A	4.6838E-02	4.7041E-02	1.4876E-01	1.4876E-01	

Eu-152 #A	2.6103E-01	2.6177E-01	2.3612E-01	2.3622E-01
Na-22 #A	-2.0759E-02	-2.1064E-02	4.2970E+02	4.2970E+02

C12110989.14					
Zn-65	A	3.8206E-01	4.0434E-01	2.9971E-01	2.9990E-01
Ba-133	#A	1.5076E-01	1.5131E-01	1.3224E-01	1.3230E-01
Ru-103	#B	9.2733E-02	1.3188E-01	1.1525E-01	1.1536E-01
Be-7	#B	6.7230E-02	8.7151E-02	4.8262E-01	4.8263E-01
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	1.2539E-01	1.1893E+01	2.9445E+01	2.9449E+01
Pa-234	B	3.3748E+00	>12 Halflives	2.8926E+00	2.8953E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----  
 Total Activity ( 48.3 to 1980.0 keV) 3.5309334E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 3.5309414E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

C12110989.15

ORTEC g v - i (2191) wan32 G53W2.06 19-DEC-2012 14:31:39 Page 1  
Energy Laboratory Spectrum name: C12110989.15.An1

Sample description  
C12110989.15

Spectrum Filename: C:\User\C12110989.15.An1

Acquisition information

Start time: 19-Dec-2012 12:50:33  
Live time: 3598  
Real time: 3600  
Dead time: 0.05 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd1\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.8422E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8422E+02) =  
1.4656E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1138

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***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****					
Nuclide	Time of Count Activity pci/g	Time Corrected Activity pci/g	Uncertainty Counting pci/g	2 Sigma Total pci/g	MDA pci/g
Ra-228	1.1090E+00	1.1164E+00	4.9910E-01	4.9999E-01	
Ra-226 A	2.5334E+00	2.5335E+00	2.3859E+00	2.3869E+00	
Bi-214 #F	1.2358E+00	1.2359E+00	4.9790E-01	4.9899E-01	
Pb-214	1.4179E+00	1.4180E+00	3.6758E-01	3.6952E-01	
Ir-192 B	1.0844E-01	1.3082E-01	1.5776E-01	1.5780E-01	
Sb-124 #B	8.3259E-03	1.0486E-02	6.6870E-02	6.6871E-02	
Sc-46	2.9632E-01	3.4971E-01	1.7974E-01	1.7998E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #	8.6930E+00	8.8677E+00	5.5740E+00	5.5777E+00	
Th-230 #A	3.6389E+00	3.6389E+00	1.6424E+01	1.6424E+01	
Cs-137 #A	8.9810E-02	8.9924E-02	9.4601E-02	9.4631E-02	
Co-60 #B	-3.0672E-02	-3.0894E-02	1.9655E+02	1.9655E+02	
Am-241 #A	8.0402E-02	8.0409E-02	1.4885E-01	1.4886E-01	
K-40	1.7212E+01	1.7212E+01	3.4231E+00	3.4537E+00	
U-235 #A	-9.6089E-02	-9.6089E-02	-4.7235E-01	-4.7236E-01	
Th-234	1.0502E+01	1.0502E+01	3.3641E+00	3.3778E+00	
Cs-134 A	1.7791E-01	1.8122E-01	1.6768E-01	1.6775E-01	
Pb-212	1.0802E+00	1.0802E+00	2.3964E-01	2.4144E-01	
Ra-224 A	5.2805E-01	2.4476E+01	9.3531E+01	9.3534E+01	
I-131 #B	3.7255E-02	2.0957E-01	3.4134E-01	3.4138E-01	
Mn-54 #A	-1.7987E-02	-1.8803E-02	-1.1202E-01	-1.1202E-01	
Tl-208 #H	5.7682E-01	>12 Halflives	2.5333E-01	2.5380E-01	
Bi-212 #A	6.2015E-01	>12 Halflives	7.6828E-01	7.6845E-01	
Ra-223 #A	5.1607E-03	1.7393E-02	1.7144E+00	1.7144E+00	
Pa-234 #A	2.3737E-01	>12 Halflives	2.5951E-01	2.5959E-01	
Eu-154 A	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	

Eu-152 #A	4.5764E-01	4.5895E-01	4.2750E-01	4.2768E-01
Na-22 #A	-1.9909E-02	-2.0202E-02	1.5726E+02	1.5726E+02

C12110989.15					
Zn-65	#A	-1.3048E-02	-1.3811E-02	-6.3551E-01	-6.3551E-01
Ba-133	#A	-1.7285E-02	-1.7348E-02	1.9979E+02	1.9979E+02
Ru-103	#B	0.0000E+00	0.0000E+00	1.4128E+02	1.4128E+02
Be-7	#B	2.5791E-01	3.3451E-01	7.9629E-01	7.9639E-01
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	8.1863E-01	7.8399E+01	8.6647E+01	8.6702E+01
Pa-234	B	7.3401E-02	>12 Halfives	2.8296E+00	2.8296E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----

Total Activity ( 48.3 to 1980.0 keV) 3.0211824E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 3.0211859E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214      1173.00 - Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----

Analyzed by: \_\_\_\_\_  
                     Dave Blaida

Reviewed by: \_\_\_\_\_  
                     Supervisor

Laboratory: Energy Laboratory

C12110989.16

ORTEC g v - i (2191) wan32 G53W2.06 19-DEC-2012 16:04:08 Page 1  
Energy Laboratory Spectrum name: C12110989.16.An1

sample description  
C12110989.16

Spectrum Filename: C:\User\C12110989.16.An1

#### Acquisition information

Start time: 19-Dec-2012 14:33:16  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

#### Calibration

Filename: 1369.93.1ccd11perched.C1b  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

#### Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

#### Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

#### Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

#### Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.9056E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.9056E+02 ) =  
1.4169E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0710

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*****	SUMMARY OF NUCLIDES IN SAMPLE				*****
	Time of Count	Time Corrected	Uncertainty	2 Sigma	
Nuclide	Activity	Activity	Counting	Total	MDA
	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g

---

Ra-228	1.3865E+00	1.3958E+00	7.0943E-01	7.1040E-01	
Ra-226 A	1.0271E+00	1.0272E+00	2.1608E+00	2.1610E+00	
Bi-214 F	1.1776E+00	1.1776E+00	4.8013E-01	4.8115E-01	
Pb-214	8.5957E-01	8.5959E-01	3.4584E-01	3.4660E-01	
Ir-192 #B	1.7921E-03	2.1634E-03	1.6633E-02	1.6633E-02	
Sb-124 #B	1.7708E-01	2.2321E-01	2.3416E-01	2.3424E-01	
Sc-46 A	2.0554E-01	2.4271E-01	1.7968E-01	1.7979E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	1.7237E+00	1.7585E+00	5.1355E+00	5.1357E+00	
Th-230 #A	3.5180E+00	3.5180E+00	1.1609E+01	1.1609E+01	
Cs-137 #A	2.8302E-02	2.8338E-02	7.9733E-02	7.9737E-02	
Co-60 #B	-2.4500E-02	-2.4678E-02	-1.3111E-01	-1.3111E-01	
Am-241 #A	1.0812E-01	1.0813E-01	1.7877E-01	1.7879E-01	
K-40	1.9923E+01	1.9923E+01	3.6063E+00	3.6451E+00	
U-235 #A	-1.2145E-02	-1.2145E-02	-1.4801E-01	-1.4801E-01	
Th-234 #	9.6632E+00	9.6632E+00	3.2276E+00	3.2397E+00	
Cs-134 #A	1.0372E-01	1.0566E-01	1.0731E-01	1.0734E-01	
Pb-212	1.1595E+00	1.1595E+00	2.5271E-01	2.5468E-01	
Ra-224 A	3.4602E-01	1.6259E+01	9.9061E+01	9.9062E+01	
I-131 #F	1.3985E-01	7.9155E-01	4.5700E-01	4.5749E-01	
Mn-54 #A	-3.4737E-02	-3.6320E-02	-2.6703E-01	-2.6703E-01	
Tl-208 #H	5.9401E-01	>12 Halflives	2.0373E-01	2.0434E-01	
Bi-212 #	3.5282E+00	>12 Halflives	1.9002E+00	1.9025E+00	
Ra-223 #A	5.9870E-01	2.0265E+00	2.4809E+00	2.4814E+00	
Pa-234 #A	1.2390E-01	>12 Halflives	2.5560E-01	2.5562E-01	
Eu-154 #A	0.0000E+00	0.0000E+00	3.7066E+02	3.7066E+02	

Eu-152 #A	1.5262E-01	1.5306E-01	2.2838E-01	2.2841E-01
Na-22 #A	-1.9247E-02	-1.9531E-02	2.0285E+02	2.0285E+02



C12110989.16

Zn-65	A	1.1429E-01	1.2100E-01	2.3730E-01	2.3732E-01
Ba-133	#A	9.0363E-02	9.0692E-02	1.6574E-01	1.6576E-01
Ru-103	#F	1.4886E-01	2.1212E-01	1.6776E-01	1.6797E-01
Be-7	#B	1.0597E+00	1.3757E+00	1.1232E+00	1.1245E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	B	4.4266E-01	4.3087E+01	6.6183E+01	6.6204E+01
Pa-234		6.3909E+00	>12 Halflives	2.1321E+00	2.1452E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Halflife limit exceeded

----- S U M M A R Y -----

Total Activity ( 48.3 to 1980.0 keV) 3.0745642E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 3.0745642E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1120.28 - Bi-214 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

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Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

C12110989.17

ORTEC g v - i (2191) wan32 G53W2.06 19-DEC-2012 22:52:55 Page 1  
Energy Laboratory Spectrum name: C12110989.17.An1

Sample description  
C12110989.17

Spectrum Filename: C:\User\C12110989.17.An1

Acquisition information

Start time: 19-Dec-2012 21:45:10  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd1\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.6195E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.6195E+02) =  
1.6672E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.1277

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\*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*

Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228	1.9830E+00	1.9964E+00	6.8430E-01	6.8636E-01	
Ra-226 #A	4.0622E+00	4.0623E+00	3.4330E+00	3.4348E+00	
Bi-214 #C	1.8911E+00	1.8911E+00	5.5496E-01	5.5724E-01	
Pb-214	1.4944E+00	1.4944E+00	4.0277E-01	4.0473E-01	
Ir-192 #F	1.6975E-01	2.0549E-01	1.3796E-01	1.3807E-01	
Sb-124 #B	2.3678E-02	2.9949E-02	1.2847E-01	1.2847E-01	
Sc-46	2.9147E-01	3.4504E-01	1.8719E-01	1.8742E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	2.1344E+00	2.1781E+00	7.3381E+00	7.3383E+00	
Th-230 #A	0.0000E+00	0.0000E+00	2.9787E+04	2.9787E+04	
Cs-137 #A	3.5269E-02	3.5314E-02	1.8244E-01	1.8244E-01	
Co-60 #B	-2.8829E-02	-2.9041E-02	-1.5429E-01	-1.5429E-01	
Am-241 #A	4.8549E-02	4.8554E-02	1.7133E-01	1.7133E-01	
K-40 #	1.9947E+01	1.9947E+01	3.9286E+00	3.9643E+00	
U-235 #A	1.4652E-01	1.4652E-01	1.9147E-01	1.9151E-01	
Th-234	1.6687E+01	1.6687E+01	4.8358E+00	4.8597E+00	
Cs-134 #A	-2.7156E-02	-2.7671E-02	-3.0952E-01	-3.0952E-01	
Pb-212	1.4190E+00	1.4190E+00	2.7709E-01	2.7978E-01	
Ra-224 #A	9.6220E-01	4.7886E+01	1.2467E+02	1.2468E+02	
I-131 #F	3.6352E-01	2.1114E+00	1.1823E+00	1.1836E+00	
Mn-54 #A	-5.7205E-02	-5.9852E-02	-6.1357E-01	-6.1357E-01	
Tl-208 #H	7.3460E-01	>12 Halflives	2.6664E-01	2.6735E-01	
Bi-212 #	4.4492E+00	>12 Halflives	1.5315E+00	1.5361E+00	
Ra-223 #A	5.3680E-01	1.8503E+00	2.5097E+00	2.5101E+00	
Pa-234 #A	1.8950E-01	>12 Halflives	2.9460E-01	2.9464E-01	
Eu-154 #A	3.5188E-02	3.5343E-02	5.8847E-02	5.8854E-02	

Eu-152 #A -1.2090E-01 -1.2125E-01 9.3033E+02 9.3033E+02  
 Na-22 #A -2.2647E-02 -2.2987E-02 7.0781E+02 7.0781E+02

C12110989.17

Zn-65	A	1.5463E-01	1.6384E-01	2.4143E-01	2.4147E-01
Ba-133	#A	1.1655E-01	1.1698E-01	1.0336E-01	1.0340E-01
Ru-103	#B	3.6239E-02	5.1914E-02	1.5393E-01	1.5394E-01
Be-7	#B	0.0000E+00	0.0000E+00	1.6849E+03	1.6849E+03
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	3.1567E-02	3.2898E+00	3.8925E+01	3.8926E+01
Pa-234	B	7.1477E-01	>12 Halflives	2.9346E+00	2.9347E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Halflife limit exceeded

S U M M A R Y

-----  
Total Activity ( 48.3 to 1980.0 keV) 4.1438152E+01 pCi/g  
Total Decayed Activity ( 48.3 to 1980.0 keV) 4.1438232E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
1120.28 - Bi-214 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
Analyzed by: \_\_\_\_\_  
Dave Blaida

Reviewed by: \_\_\_\_\_  
Supervisor

Laboratory: Energy Laboratory

c12110989.17dup

ORTEC g v - i (2191) wan32 G53W2.06 19-DEC-2012 23:57:35 Page 1  
Energy Laboratory Spectrum name: C12110989.17dup.An1

Sample description  
c12110989.17dup

Spectrum Filename: C:\User\C12110989.17dup.An1

Acquisition information

Start time: 19-Dec-2012 22:55:08  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system

Det 1

Calibration

Filename: 1369.93.1ccd11perched.clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample size: 1.6195E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.6195E+02) =  
1.6672E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	29-Nov-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0926

\*\*\*\*\* SUMMARY OF NUCLIDES IN SAMPLE \*\*\*\*\*

Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228	2.3981E+00	2.4144E+00	8.6638E-01	8.6877E-01	
Ra-226 A	2.2912E+00	2.2913E+00	3.3723E+00	3.3728E+00	
Bi-214	1.7177E+00	1.7177E+00	5.3592E-01	5.3787E-01	
Pb-214	1.4101E+00	1.4102E+00	4.6369E-01	4.6521E-01	
Ir-192 #B	1.8978E-02	2.2985E-02	9.7515E-02	9.7517E-02	
Sb-124 #B	4.7355E-03	5.9931E-03	1.3401E-02	1.3402E-02	
Sc-46 A	3.2917E-02	3.8983E-02	1.3277E-01	1.3278E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	1.1784E+00	1.2026E+00	5.1000E+00	5.1001E+00	
Th-230 #A	2.5297E+00	2.5297E+00	1.1865E+01	1.1865E+01	
Cs-137 #	2.0251E-01	2.0277E-01	1.1983E-01	1.1995E-01	
Co-60 #B	3.7839E-02	3.8119E-02	7.3266E-02	7.3274E-02	
Am-241 #A	8.7025E-04	8.7033E-04	8.6227E-02	8.6227E-02	
K-40	1.4796E+01	1.4796E+01	3.4122E+00	3.4349E+00	
U-235 A	1.2495E-01	1.2495E-01	1.8539E-01	1.8542E-01	
Th-234	1.6468E+01	1.6468E+01	3.5362E+00	3.5680E+00	
Cs-134 #A	-2.2565E-02	-2.2994E-02	-2.4009E-01	-2.4009E-01	
Pb-212	1.5106E+00	1.5106E+00	2.9166E-01	2.9455E-01	
Ra-224 A	1.5483E+00	7.7773E+01	1.2056E+02	1.2058E+02	
I-131 B	1.0027E-01	5.8484E-01	8.9112E-01	8.9125E-01	
Mn-54 #A	-5.9247E-02	-6.1995E-02	-4.3248E-01	-4.3248E-01	
Tl-208 #H	5.3671E-01	>12 Halflives	2.1080E-01	2.1128E-01	
Bi-212 #A	2.3748E-01	>12 Halflives	1.2242E+00	1.2242E+00	
Ra-223 #A	1.7051E-02	5.8950E-02	1.0091E+00	1.0091E+00	
Pa-234 #A	6.7560E-02	>12 Halflives	2.8410E-01	2.8410E-01	
Eu-154 #A	0.0000E+00	0.0000E+00	2.4022E+03	2.4022E+03	

Eu-152 #	1.0704E+00	1.0736E+00	6.6276E-01	6.6338E-01
Na-22 #	2.0704E-01	2.1016E-01	1.2932E-01	1.2945E-01

c12110989.17dup

Zn-65	#A	-1.1911E-02	-1.2622E-02	-2.7533E-01	-2.7533E-01
Ba-133	#A	4.7700E-02	4.7877E-02	9.1101E-02	9.1110E-02
Ru-103	B	1.1778E-01	1.6887E-01	1.4465E-01	1.4480E-01
Be-7	#B	4.4007E-01	5.7390E-01	1.0213E+00	1.0215E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	5.8399E-01	6.1539E+01	9.0427E+01	9.0459E+01
Pa-234		8.0308E+00	>12 Halflives	3.0485E+00	3.0629E+00

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- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----

Total Activity ( 48.3 to 1980.0 keV) 3.6890530E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 3.6906818E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 969.10 - Ra-228 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
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- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

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Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory



# ANALYTICAL SUMMARY REPORT

January 04, 2013

Montgomery Watson Harza  
1475 Pine Grove Rd Ste 109  
Steamboat Springs, CO 80477

Workorder No.: C12120140                      Quote ID: C3898 - NECR  
Project Name:   NECR EDRA

Energy Laboratories, Inc. Casper WY received the following 1 sample for Montgomery Watson Harza on 12/5/2012 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
C12120140-001	SSPT-033R	12/04/12 10:26	12/05/12	Soil	Gamma Sample Preparation Gross Gamma

The results as reported relate only to the item(s) submitted for testing. The analyses presented in this report were performed at Energy Laboratories, Inc., 2393 Salt Creek Hwy., Casper, WY 82601, unless otherwise noted. Radiochemistry analyses were performed at Energy Laboratories, Inc., 2325 Kerzell Lane, Casper, WY 82601, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

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

Report Approved By:





**CLIENT:** Montgomery Watson Harza  
**Project:** NECR EDRA  
**Sample Delivery Group:** C12120140

**Report Date:** 01/04/13

## CASE NARRATIVE

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### COMMENTS

Included with the analysis reports are instrument data reports for all analysis associated with the instrument calibration, QC sample analysis, and sample analysis. All analytical data is within method QA/QC specifications except as noted on analyses and/or QC summary reports, or in this narrative. The analytical report identifies which QC batch ID and sequence QC is associated with each analysis result for a sample. The results of this Analytical Report relate only to the items submitted for analysis. Only the raw data associated with parameters listed on this report should be validated.



### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza  
**Client Sample ID:** SSPT-033R  
**Project:** NECR EDRA  
**Matrix:** Soil

**Lab ID:** C12120140-001  
**Collection Date:** 12/04/12 10:26  
**Date Received:** 12/05/12  
**Report Date:** 01/04/13

Analyses	Result	Units	QUAL	RL	MCL	Method	Analysis Date / By	Prep Date	Prep Method	RunID	Run Order	BatchID
<b>RADIONUCLIDES - GAMMA</b>												
Radium 226	1.5	pCi/g-dry		0.3		E901.1	12/26/12 08:55 / dpb	12/07/12 08:19		GAM-HPGE_121226A : 3		R168583
Radium 226 precision (±)	0.5	pCi/g-dry				E901.1	12/26/12 08:55 / dpb	12/07/12 08:19		GAM-HPGE_121226A : 3		R168583

**Report Definitions:** RL - Analyte reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.



# QA/QC Summary Report

Prepared by Casper, WY Branch

**Client:** Montgomery Watson Harza

**Report Date:** 01/04/13

**Project:** NECR EDRA

**Work Order:** C12120140

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: E901.1</b>										
Batch: R168583										
<b>Sample ID: LCS-R168583</b>	Laboratory Control Sample					Run: GAM-HPGE_121226A		12/26/12 08:55		
Bismuth 214		2.9	pCi/g-dry	0.3	112	70	130			
- The LCS sample uses Bi214 for Ra226.										
<b>Sample ID: MB-R168583</b>	2	Method Blank				Run: GAM-HPGE_121226A		12/26/12 08:55		
Radium 226		ND	pCi/g-dry							U
Radium 226 precision (±)		ND	pCi/g-dry							
<b>Sample ID: C12120140-001ADUP</b>	2	Sample Duplicate				Run: GAM-HPGE_121226A		12/26/12 08:55		
Radium 226		1.0	pCi/g-dry	0.3				40	20	R
Radium 226 precision (±)		0.4	pCi/g-dry							
- Duplicate RPD is outside of the acceptance range for this analysis; however, the RER of 1.5 is less than the limit of 2.0. This batch is approved.										

**Qualifiers:**

RL - Analyte reporting limit.  
R - RPD exceeds advisory limit.

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

# Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

## Workorder Receipt Checklist

Montgomery Watson Harza

C12120140

Login completed by: Corinne Wagner

Date Received: 12/5/2012

Reviewed by: Corinne Wagner

Received by: tj

Reviewed Date: 12/11/2012

Carrier FedEx  
name:

- |   |   |                             |  |
|---|---|-----------------------------|--|
| Shipping container/cooler in good condition?  | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> | Not Present <input type="checkbox"/>                       |
| Custody seals intact on shipping container/cooler?  | Yes <input type="checkbox"/>            | No <input type="checkbox"/> | Not Present <input checked="" type="checkbox"/>            |
| Custody seals intact on sample bottles?   | Yes <input type="checkbox"/>            | No <input type="checkbox"/> | Not Present <input checked="" type="checkbox"/>            |
| Chain of custody present?   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |  |
| Chain of custody signed when relinquished and received?   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |  |
| Chain of custody agrees with sample labels?   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |  |
| Samples in proper container/bottle?   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |  |
| Sample containers intact?   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |  |
| Sufficient sample volume for indicated test?  | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |  |
| All samples received within holding time?<br>(Exclude analyses that are considered field parameters<br>such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.) | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |  |
| Temp Blank received?  | Yes <input type="checkbox"/>            | No <input type="checkbox"/> | Not Applicable <input checked="" type="checkbox"/>         |
| Container/Temp Blank temperature:   | 18.0°C                                  |                             |  |
| Water - VOA vials have zero headspace?  | Yes <input type="checkbox"/>            | No <input type="checkbox"/> | No VOA vials submitted <input checked="" type="checkbox"/> |
| Water - pH acceptable upon receipt?   | Yes <input type="checkbox"/>            | No <input type="checkbox"/> | Not Applicable <input checked="" type="checkbox"/>         |

Contact and Corrective Action Comments:

None



# Chain of Custody and Analytical Request Record

PLEASE PRINT (Provide as much information as possible.)

Company Name: <b>MWH</b>		Project Name, PWS, Permit, Etc. <b>NECR EDRA</b>		Sample Origin State: <b>NM</b>		EPA/State Compliance: Yes <input type="checkbox"/> No <input type="checkbox"/>		
Report Mail Address: <b>PO Box 774018 Steamboat Springs, CO 80477</b>		Contact Name: <b>Toby Leeson, 970-871-4361</b>		Phone/Fax: <b>970-871-4361</b>		Email: <b>Toby.Leeson@MWHglobal.com</b>		
Invoice Address: <b>MWH, Broomfield, CO</b>		Invoice Contact & Phone: <b>Toby Leeson, 970-871-4361</b>		Purchase Order:		Quote/Bottle Order:		
Special Report/Formats:  <input type="checkbox"/> DW <input type="checkbox"/> POTW/WWTP <input type="checkbox"/> State: _____ <input type="checkbox"/> Other: _____		<input checked="" type="checkbox"/> EDD/EDT (Electronic Data) Format: _____ <input type="checkbox"/> LEVEL IV <input type="checkbox"/> NELAC		Number of Containers Sample Type: <input type="checkbox"/> A <input type="checkbox"/> W <input type="checkbox"/> S <input type="checkbox"/> V <input type="checkbox"/> B <input type="checkbox"/> O <input type="checkbox"/> DW <input type="checkbox"/> Air Water <input type="checkbox"/> Soils/Solids <input type="checkbox"/> Vegetation <input type="checkbox"/> Bioassay <input type="checkbox"/> Other <input type="checkbox"/> DW - Drinking Water		<b>ANALYSIS REQUESTED</b> SEE ATTACHED Standard Turnaround (TAT)		
SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)		Collection Date	Collection Time	MATRIX	R U S H I Standard Turnaround (TAT)	Contact ELI prior to RUSH sample submittal for charges and scheduling - See Instruction Page Shipped by: <b>Jedex-Expres</b> Cooler ID(s): <b>2479</b> Receipt Temp: <b>18.0</b> °C On Ice: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Custody Seal On Bottle: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N On Cooler: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Intact: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Signature Match: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N		
1 <b>5SPT-033R</b>		<b>12-4-12</b>	<b>1026</b>	<b>S</b>		Comments: LABORATORY USE ONLY <b>2120140</b>		
2								
3								
4								
5								
6								
7								
8								
9								
10								
<b>Custody Record MUST be Signed</b>		Relinquished by (print): <b>Natvar Patel</b>		Date/Time: <b>12:15</b>		Signature: <i>[Signature]</i>		
		Relinquished by (print):		Date/Time:		Signature:		
		Sample Disposal: Return to Client: _____		Lab Disposal: _____		Received by Laboratory: <b>12-5-12</b>		Date/Time: <b>10:15</b>
						Signature: <i>[Signature]</i>		

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

**Radiochemistry**  
**Level 4 Reporting Checklist**

Method #: E901, 1 Analyte: 12A226

- Energy Labs Batch ID: \_\_\_\_\_
- Omega Data Entry Batch ID: 768583
- Instrument ID: DET1
- Instrument background check
- Instrument efficiency/calibration check
- Bench-sheets (Sample run order should include MS, MSD, MB, RB, STD, and LCS every 20 samples)
- Photocopy of instrument run log
- Photocopy of standard preparation notes
- Photocopy of standard source calibration certificate noting manufacturer, stock and/or lot number
- Photocopy of method control charts for the following:  
(provided by QA Dept.)
  - Laboratory Control Standard (LCS)
  - Matrix Spikes (MS) and Matrix Spike Duplicates (MSD)
  - Method Blank (MB)
- Analyst Case Narrative consisting of the following:
  - A statement documenting the analytes and the method used
  - Date of analysis
  - Any instrument adjustment or anomalies encountered during analysis
  - Printed name and signature of analyst

Did you log sample from storage? Yes  No

Container size: 3 inch STEEL CAN Sample Preservation noted: NONE

Sample Numbers: C12120140-1

**Analyst Case Narrative**

Method # E901.1 Analyte: RA226 Date/time of analysis: 12-26-12 @ 8:55

*Any problems or anomalies encountered during analysis?*

No  Yes  (please explain below)

Analyst case narrative: RAW SAMPLES ACCORDING TO EPA 901.1  
METHODOLOGY USING ORTEC GAMMAVISION  
SOFTWARE

*Any instrument adjustments or anomalies encountered during analysis?*

No  Yes  (please explain below)

Analyst case narrative: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Analyst: DAVID BLAIDA  
Please print

Signature: David Blaida

# PREP BATCH REPORT

Prep Batch **35951**    Prep Code: **PRP-GAMMA**    Technician: **Rich White**  
 Batch Units: **G**

Prep Start Date: **12/7/2012 08:19:27**  
 Prep End Date: **12/7/2012 08:21:00**

Sample ID	Matrix	pH	Initial Samp Amt	Sol Added	Sol Recov	Fin Vol (mL)	Factor	Balance	PrepStart	PrepEnd
C12120140-001A D&G	Soil <i>Dug</i>		189.09	0	0	189.09	1	Sartorius	12/7/2012	12/7/2012

*Started 12-26-12*  
*@ 8:55 DTB*

*LCS*  
*BKG*

*1 tp Ge - 12226*  
*L4*

*GEGG*  
~~*122612A*~~ *121226A*  
*8:55*

*QA/QC*  
*12/28/12*  
*R.S.*

*(12)*  
*12-26-12*  
*DTB*  
*calcd*



Energy Laboratories, Inc.  
Alpha Spectroscopy / Gamma Spectroscopy  
Instrument / Maintenance Run Log

Instruments: EGG Ortec Octete PC Alpha Spectroscopy System and EGG Ortec High Purity Germanium Detector

Date	Det. No.	Count Time Min.	Isotope	Batch ID	Associated Samples	Data File Number	Instrument ID		Int	Comments Maintenance Log
							Alpha Spec	Gamma Spec		
12-17-12	1-16	5	N/A	Pulser	Pulser	2012.12.17.007	✓			
12-17-12	1-17	240	Th	1757		Th-1757	✓			
12-17-12	1-16	90	Po210	475		Po210-475	✓			
12-17-12	1-9	90	↓	↓		↓	✓			
12-17-12	10-11	90	Po210	477	recount of 3A2 & dup	Po210-477	✓			
12-17-12	1-13	240	Th	1756		Th-1756	✓			
12-17-12	1-13	240	U	559	recount for MDC (DU)	ISO U-559	✓			
12-18-12	1, 2	10, 30, 60	PCK, BKG		C12120573, 1-7	→				DET 2
12-18-12	1-12	240	Th	1759		Th-1759	✓			
12-18-12	1-6	240	Th	1753		Th-1753	✓			
12-18	1, 2	10, 30, 60	PCK, BKG		C12110989, 1-17	→				DET 1
12-18-12	1-16	120	Po210	476		Po210-476	✓			
12-18-12	1-8	90	↓	↓		↓	✓			
12-19-12	1, 2	10, 30, 60	PCK, BKG		C12120573, 1-7 C12110989, 1-17	→				
12-19-12	5, 7	120	Po210	476		Po210-476	✓			
12-20-12	1	10, 30, 60	PCK, BKG		C12110989, 1-17	→				
12-26-12	1, 2	10, 30, 60	PCK, BKG		<del>C12110989</del> 1 C121201401-1 DB 12-26-12	→				DET 1



ECKERT & ZIEGLER

Valencia, California 91355

Isotope Products

Tel 661-309-1010

Fax 661-257-8303

2009 CAN

# CERTIFICATE OF CALIBRATION MULTINUCLIDE STANDARD SOURCE

Customer: ENERGY LABORATORIES  
P.O. No.: 80311  
Catalog No.: EG-ML

Source No.: 1369-93-1  
Reference Date: 1-Jun-09 12:00 PST  
Contained Radioactivity: 0.8669  $\mu$ Ci 32.08 kBq

### Physical Description:

A. Capsule type:	Customer supplied can - 3" (76 mm) OD
B. Nature of active deposit:	Multinuclide distributed in 1.5 g/cc epoxy matrix
C. Active diameter/volume:	Approximately 124mL (186.0 grams)
D. Backing:	Steel
E. Cover:	Steel

Gamma-Ray Energy (keV)	Nuclide	Half-life	Branching Ratio (%)	Activity ( $\mu$ Ci)	Gammas per second	Total Uncert
88	Cd-109	462.6 $\pm$ 0.7 days	3.63	0.2492	334.7	3.1 %
122	Co-57	271.79 $\pm$ 0.09 days	85.6	0.01081	342.4	3.1 %
159	Te-123m	119.7 $\pm$ 0.1 days	84.0	0.01236	384.1	3.1 %
320	Cr-51	27.706 $\pm$ 0.007 days	9.86	0.3058	1115	3.0 %
392	Sn-113	115.09 $\pm$ 0.04 days	64.9	0.04791	1150	3.0 %
514	Sr-85	64.849 $\pm$ 0.004 days	98.4	0.05830	2123	3.0 %
662	Cs-137	30.17 $\pm$ 0.16 years	85.1	0.04177	1315	3.0 %
898	Y-88	106.630 $\pm$ 0.025 days	94.0	0.09170	3189	3.0 %
1173	Co-60	5.272 $\pm$ 0.001 years	99.86	0.04926	1820	3.0 %
1333	Co-60	5.272 $\pm$ 0.001 years	99.98	0.04926	1822	3.0 %
1836	Y-88	106.630 $\pm$ 0.025 days	99.4	0.09170	3373	3.0 %

### Method of Calibration:

This source was prepared from a weighed aliquot of solution whose concentrations in  $\mu$ Ci/g were determined by gamma spectrometry.

### Notes:

- See reverse side for leak test(s) performed on this source.
- EZIP participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from IAEA-TECDOC-619, 1991.
- Overall uncertainty is calculated at the 99% confidence level.
- This source has a working life of 1 year.

*Daniel James Van Dellen*  
Quality Control

*28-May-09*  
Date

EZIP Ref. No.: 1369-93

ISO 9001 CERTIFIED

Medical Imaging Laboratory

Industrial Gauging Laboratory

RS-82

408826

DCS08826

CAN

LC59

#: 3129

Opened:

Diluted Climax Sand Tailings-08826

Expires: 5/6/2007

Rec'd: 11/7/2006

Energy Laboratories, Inc. 2393 Salt Creek Hwy  
Casper WY 82602

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
ENVIRONMENTAL MONITORING AND SUPPORT LABORATORY-LAS VEGAS  
QUALITY ASSURANCE BRANCH**

Calibration Certificate

DILUTED CLIMAX SAND TAILINGS

Description	Principal radionuclide	Thorium-230	Half-life	
	Initial activity		curies	
	Initial volume	10	g	in ampoule/bottle number

Measurement

Activity of principal radionuclide

Activity per gram of this solution

35.3 pico curies of Thorium-230  
at 0600 hours PST on May 1, 1976

Activity of daughter radionuclide

The principal activity was accompanied at the quoted time by and 40 pico curies per gram of lead-210.

45.4 pico curies per gram of the daughter nuclide Radium-226

Total mass of this solution

10 grams

Total principal activity per gram at the quoted time

35.3 pico curies

Method of measurement: Gravimetric dilution of analyzed Climax Sand Tailings. The thorium-230 was analyzed by alpha spectroscopy. Radium-226 was measured using radon emanation.

00508821  
LC59

Random Errors

The repeatability of this standardization (dilutions, source preparations, counting statistics, mass determinations, etc.) was such that the certified value of the radioactive concentration of the principle activity had a standard error ( $\sigma$ ) not greater than

$\pm 4\%$

(The 99.7% confidence limits are given by  $\pm 3\sigma$ .)  
Due to limited results, the error estimate is based on the measurements of the undiluted sand tailings.

The total systematic error (sum of estimated maximum residual systematic errors due to dispensing, counting losses, counting corrections, known uncertainty of standard) of the certified radioactive concentration of the principle activity has been estimated not to exceed

$\pm 3\% (\delta)$  or  $\pm 3\% (\delta')$

The overall limits of error calculated on the basis of  $\pm (3\sigma + \delta)$  or  $\pm (3\sigma + \delta')$  are

$\pm 15\%$  or  $\pm 15\%$

of the quoted radioactive concentration.

The effective standard deviation is defined as 1/6th of the range between the overall limits

$\pm (3\sigma + \delta)$  and  $\pm (3\sigma + \delta')$  and is therefore  $\pm 5\%$

Decay Schemes

This standardization is based on the following assumptions of the principle nuclide, its daughter nuclides and impurities (no allowance for error in these assumptions or the assumption of quoted half-life have been included in the statement of accuracy above).

See attachment.

Chemical Composition of Solution

Carrier content per gram of solution:

Other components:

Preservative:

Remarks

45.4  $\mu\text{Ci/g}$  Ra-226  
 $\times 10$  grams total  

---

454  $\mu\text{Ci}$  total activity  
 $\div 173.33$  grams of blank leadate sand  

---

2.6  $\mu\text{Ci/gram}$  Ra-226  
Date Certificate Prepared April 18, 1977

Approval Signature

*[Signature]*

Note:

Total mass of can is 183.33 grams  
w/ with 005 10 grams inclusive.  
DB T-27-11

Calibration Data from file: 1369.93.lccdet1\_lperched.C1b  
 Energy Calibration Date: 6/5/2009 Time: 11:22:16  
 Efficiency Calibration Date: 6/5/2009 Time: 11:39:17

Calibration Description:

6/5/09 can calibration polynomial new standard  
 IPL #1369-93-1 new calibration perched

Energy Calibration Fit

Energy =  $-0.3919 + 0.243214 * \text{Channel} - 9.76725e-010 * \text{Channel}^2$   
 FWHM (keV) =  $2.7504 + 0.000971 * \text{Channel} - 2.70459e-008 * \text{Channel}^2$

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM	Fit	Delta
363.02	88.00	87.90	0.11%	0.74	0.75	-2.10%
502.91	122.00	121.92	0.06%	0.78	0.79	-0.93%
654.82	159.00	158.87	0.08%	0.81	0.82	-1.42%
1317.38	320.00	320.01	-0.00%	0.99	0.97	1.72%
1611.93	391.00	391.65	-0.17%	1.01	1.03	-2.39%
2114.79	514.00	513.95	0.01%	1.16	1.14	1.61%
2722.10	662.00	661.65	0.05%	1.31	1.26	3.65%
3694.22	898.00	898.08	-0.01%	1.50	1.45	2.99%
4825.86	1173.00	1173.30	-0.03%	1.67	1.66	1.09%
5480.66	1333.00	1332.55	0.03%	1.63	1.77	-8.16%
7551.24	1836.00	1836.12	-0.01%	2.12	2.08	2.12%

Efficiency Calibration Fit

Polynomial Uncertainty = 1.1491 %

Coefficients:

-0.345759 -5.963100 0.675305 -0.103447 0.008672 -0.000304

Efficiency Table

Energy	Efficiency	Fit	Delta
88.00	1.8030E-002	1.8033E-002	-0.02%
122.00	1.8069E-002	1.8041E-002	0.15%
159.00	1.5244E-002	1.5291E-002	-0.31%
320.00	8.8571E-003	8.7565E-003	1.14%
392.00	7.2997E-003	7.3136E-003	-0.19%
514.00	5.5726E-003	5.7472E-003	-3.13%
662.00	4.7604E-003	4.6095E-003	3.17%
898.00	3.5154E-003	3.5587E-003	-1.23%
1173.00	2.8900E-003	2.8429E-003	1.63%
1333.00	2.5087E-003	2.5490E-003	-1.61%
1836.00	1.9175E-003	1.9124E-003	0.27%

Calibration Certificate Table

Isotope	Energy	Pct	Halflife	Activity	GPS	Error	Date & Time
Cd-109	88.03	3.63	4.63E+002	9865.01	358.10	3.10%	5/1/2008 12:00:00
Co-57	122.07	85.60	2.72E+002	400.00	342.40	3.10%	6/1/2009 12:00:00
Te-123m	159.07	84.00	1.20E+002	457.26	384.10	3.00%	6/1/2009 12:00:00
Sn-113	391.69	64.90	1.15E+002	1771.96	1150.00	3.00%	6/1/2009 12:00:00
Y-88	898.02	94.00	1.07E+002	3392.55	3189.00	3.00%	6/1/2009 12:00:00
Co-60	1173.24	99.86	1.93E+003	1822.55	1820.00	3.00%	6/1/2009 12:00:00
Co-60	1333.00	99.98	1.93E+003	1822.36	1822.00	3.00%	6/1/2009 12:00:00
Y-88	1836.01	99.40	1.07E+002	3393.36	3373.00	3.00%	6/1/2009 12:00:00
Cr-51	320.00	9.86	2.77E+001	11308.32	1115.00	3.00%	6/1/2009 12:00:00
Sr-85	514.00	98.40	6.48E+001	2157.52	2123.00	3.00%	6/1/2009 12:00:00
Cs-137	661.66	85.10	1.10E+004	1545.24	1315.00	3.00%	6/1/2009 12:00:00
Cd-109	1836.27	3.63	4.63E+002	9220.39	334.70	3.10%	6/1/2009 12:00:00

Calibration Data from file: 1369.93.lccdett1\_1lperched.Clb  
 Energy Calibration Date: 10/16/2012 Time: 14:32:42  
 Efficiency Calibration Date: 6/5/2009 Time: 11:39:17

Calibration Description:  
 10/16/12 can calibration energy re-cal  
 IPL #1369-93-1 new calibration perched

Energy Calibration Fit  
 Energy =  $-0.2923 + 0.243203 \cdot \text{Channel} - 4.95665e-009 \cdot \text{Channel}^2$   
 FWHM (keV) =  $2.5984 + 0.001193 \cdot \text{Channel} - 6.59988e-008 \cdot \text{Channel}^2$

Channel	Energy(keV)	Fit(keV)	Delta	FWHM	Fit	Delta
363.13	88.00	88.02	-0.02%	0.76	0.74	3.67%
503.23	122.06	122.09	-0.02%	0.74	0.77	-4.17%
2722.55	662.00	661.81	0.03%	1.31	1.30	0.35%
4826.55	1173.00	1173.43	-0.04%	1.65	1.66	-0.17%
5481.66	1333.00	1332.72	0.02%	1.74	1.74	0.07%

Efficiency Calibration Fit  
 Polynomial Uncertainty = 1.1491 %  
 Coefficients:  
 $-0.345759 -5.963100 0.675305 -0.103447 0.008672 -0.000304$

Energy	Efficiency	Fit	Delta
88.00	1.8030E-002	1.8033E-002	-0.02%
122.00	1.8069E-002	1.8041E-002	0.15%
159.00	1.5244E-002	1.5291E-002	-0.31%
320.00	8.8571E-003	8.7565E-003	1.14%
392.00	7.2997E-003	7.3136E-003	-0.19%
514.00	5.5726E-003	5.7472E-003	-3.13%
662.00	4.7604E-003	4.6095E-003	3.17%
898.00	3.5154E-003	3.5587E-003	-1.23%
1173.00	2.8900E-003	2.8429E-003	1.63%
1333.00	2.5087E-003	2.5490E-003	-1.61%
1836.00	1.9175E-003	1.9124E-003	0.27%

Isotope	Energy	Pct	Half-life	Activity	GPS	Error	Date & Time
Cd-109	88.03	3.63	4.63E+002	9865.01	358.10	3.10%	5/1/2008 12:00:00
Co-57	122.07	85.60	2.72E+002	400.00	342.40	3.10%	6/1/2009 12:00:00
Te-123m	159.07	84.00	1.20E+002	457.26	384.10	3.00%	6/1/2009 12:00:00
Sn-113	391.69	64.90	1.15E+002	1771.96	1150.00	3.00%	6/1/2009 12:00:00
Y-88	898.02	94.00	1.07E+002	3392.55	3189.00	3.00%	6/1/2009 12:00:00
Co-60	1173.24	99.86	1.93E+003	1822.55	1820.00	3.00%	6/1/2009 12:00:00
Co-60	1333.00	99.98	1.93E+003	1822.36	1822.00	3.00%	6/1/2009 12:00:00
Y-88	1836.01	99.40	1.07E+002	3393.36	3373.00	3.00%	6/1/2009 12:00:00
Cr-51	320.00	9.86	2.77E+001	11308.32	1115.00	3.00%	6/1/2009 12:00:00
Sr-85	514.00	98.40	6.48E+001	2157.52	2123.00	3.00%	6/1/2009 12:00:00
Cs-137	661.66	85.10	1.10E+004	1545.24	1315.00	3.00%	6/1/2009 12:00:00
Cd-109	1836.27	3.63	4.63E+002	9220.39	334.70	3.10%	6/1/2009 12:00:00

ACTIVITY DECAY CORRECTIONS  
 LCS CANS 6 - 10, gbkg

Input Analyte	LCS #	Input Half life Years	Calc Half life Days	Calc Half life Hours	Input Original pCi	Calc Original uCi	Calc Corrected pCi	Calc Corrected nCi	Calc Corrected uCi	Calc Corrected Bq	Input Reference Date	Input Current Date	Calc DPM	Input Measured pCi	Calc Percent Recovery	LCS #	
IPL-6	6	1600	5.84E+05	14025600	47.4	4.74E-05	46.87	0.05	4.69E-05	1.734	4/1/1987	12/19/2012	104.06	43.10	0.92	6	DET1
IPL-6	6	1600	5.84E+05	14025600	47.4	4.74E-05	46.87	0.05	4.69E-05	1.734	4/1/1987	12/19/2012	104.06	41.40	0.88	6	DET2
IPL-7	7	1600	5.84E+05	14025600	8.72	8.72E-06	8.66	0.01	8.66E-06	0.320	2/1/1997	12/19/2012	19.23	8.04	0.93	7	DET1
IPL-7	7	1600	5.84E+05	14025600	8.72	8.72E-06	8.66	0.01	8.66E-06	0.320	2/1/1997	12/19/2012	19.23	8.18	0.94	7	DET2
IPL-8	8	1600	5.84E+05	14025600	23.93	2.39E-05	23.77	0.02	2.38E-05	0.879	2/1/1997	12/19/2012	52.76	26.30	1.11	8	DET1
IPL-8	8	1600	5.84E+05	14025600	23.93	2.39E-05	23.77	0.02	2.38E-05	0.879	2/1/1997	12/19/2012	52.76	21.40	0.90	8	DET2
DCS08826	9	1600	5.84E+05	14025600	2.6	2.60E-06	2.57✓	0.00	2.57E-06	0.095	9/13/1989	12/26/2012	5.71	2.87✓	1.12✓	9	DET1

122612dcs088261csdet1

ORTEC g v - i (2191) wan32 G53W2.06 26-DEC-2012 13:07:53 Page 1  
Energy Laboratory Spectrum name: 122612dcs088261csdet1.An1

Sample description  
122612dcs088261csdet1

Spectrum Filename: C:\User\122612dcs088261csdet1.An1

Acquisition information

Start time: 26-Dec-2012 11:56:36  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccdet1\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 2  
Sample Size: 1.8333E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8333E+02) =  
1.4728E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□



Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	13-Sep-1989 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 1.0000

-----

*****	SUMMARY OF NUCLIDES IN SAMPLE				*****
	Time of Count	Time Corrected	Uncertainty	1 Sigma	
Nuclide	Activity	Activity	Counting	Total	MDA
	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g

---

Ra-228 #A	-2.1430E-01	-3.5491E+00	-6.3649E+00	-6.3651E+00	
Ra-226 A	1.2960E+00	1.3091E+00	1.3413E+00	1.3414E+00	
Bi-214 #C	2.8761E+00 ✓	2.9053E+00	3.1263E-01	3.1501E-01	
Pb-214	2.6223E+00	2.6489E+00	2.2823E-01	2.3094E-01	
Ir-192 #B	2.9804E-02	>12 Halfives	3.0918E-02	3.0920E-02	
Sb-124 #F	3.7649E-01	>12 Halfives	8.5731E-02	8.5877E-02	
Sc-46	4.6727E-01	>12 Halfives	1.0206E-01	1.0225E-01	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	4.2313E+00	>12 Halfives	2.8952E+00	2.8956E+00	
Th-230 #A	2.3362E+00	2.3367E+00	6.0148E+00	6.0148E+00	
Cs-137 #A	-1.7509E-02	-2.9933E-02	1.0179E+02	1.0179E+02	
Co-60 #B	1.7364E-02	3.7114E-01	5.9461E-01	5.9463E-01	
Am-241 #A	3.8675E-02	4.0147E-02	5.9024E-02	5.9026E-02	
K-40 #	3.4816E+00	3.4816E+00	8.4446E-01	8.4573E-01	
U-235 A	7.0680E-03	7.0680E-03	7.5370E-02	7.5370E-02	
Th-234 #	8.0636E+00	8.0636E+00	1.4722E+00	1.4768E+00	
Cs-134 #A	-2.3989E-02	-6.0190E+01	-2.3920E+02	-2.3920E+02	
Pb-212 A	1.7799E-01	1.7799E-01	9.5469E-02	9.5500E-02	
Ra-224 A	2.8099E-01	>12 Halfives	1.2403E+00	1.2403E+00	
I-131 #B	-1.9755E-02	>12 Halfives	7.0063E+01	7.0063E+01	
Mn-54 #A	-3.9714E-02	>12 Halfives	-1.2782E-01	-1.2782E-01	
Tl-208 #H	2.2843E-01	>12 Halfives	7.5644E-02	7.5705E-02	
Bi-212 #A	5.4801E-01	>12 Halfives	4.9573E-01	4.9579E-01	
Ra-223 #A	5.2850E-01	>12 Halfives	4.1576E-01	4.1582E-01	
Pa-234 A	2.1617E-01	>12 Halfives	1.4886E-01	1.4889E-01	
Eu-154 A	0.0000E+00	0.0000E+00	3.2514E+03	3.2514E+03	

Eu-152	9.4559E-01	3.1737E+00	9.7965E-01	9.8056E-01
Na-22 #A	4.7628E-02	2.3656E+01	2.2967E+01	2.2969E+01

122612dcs088261csdet1

Zn-65	A	9.2877E-02	>12	Halfives	9.1431E-02	9.1440E-02
Ba-133	#A	7.2314E-03		3.3637E-02	1.6581E-01	1.6581E-01
Ru-103	#B	5.2020E-02	>12	Halfives	4.0215E-02	4.0228E-02
Be-7	#B	6.4791E-02	>12	Halfives	1.7142E-01	1.7143E-01
I-125	#	0.0000E+00	>12	Halfives	0.0000E+00	0.0000E+00
Tl-201	#B	2.9280E-01	>12	Halfives	2.8472E-01	2.8478E-01
Pa-234	#F	5.3404E+00	>12	Halfives	1.3891E+00	1.3926E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

S U M M A R Y

-----  
 Total Activity ( 48.3 to 1980.0 keV) 1.3562037E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 1.3617786E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 969.10 + Ra-228 1120.28 - Bi-214 1173.00 + Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----  
 Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

122612blankdet1

ORTEC g v - i ( 143) wan32 G53W2.06 26-DEC-2012 14:13:32 Page 1  
Energy Laboratory Spectrum name: 122612blankdet1.An1

Sample description  
122612blankdet1

Spectrum Filename: C:\User\122612blankdet1.An1

Acquisition information

Start time: 26-Dec-2012 13:08:49  
Live time: 3598  
Real time: 3600  
Dead time: 0.05 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.iccdet1\_11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.0000E+00  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.0000E+00) =  
2.7000E+01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	30-Apr-1999 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 1.0000

-----  
 \*\*\*\*\* S U M M A R Y O F N U C L I D E S I N S A M P L E \*\*\*\*\*  
 Nuclide Time of Count Time Corrected Uncertainty 2 Sigma  
 Activity Activity Counting Total  
 pci/l pci/l pci/l pci/l

Ra-228	<	1.3498E+02	7.0050E+02		
Ra-226	<	6.9945E+02	7.0360E+02		
Bi-214	B<	1.0102E+02	1.0162E+02		
Pb-214	<	8.1882E+01	8.2368E+01		
Ir-192	B<	1.57E+01	>12 Halflives		
Sb-124	B<	3.68E+01	>12 Halflives		
Sc-46	<	3.59E+01	>12 Halflives		
Pb-210	No in-range peaks				
Th-228	<	1.2395E+03	1.7624E+05		
Th-230	<	2.3743E+03	2.3746E+03		
Cs-137	<	2.3392E+01	3.2039E+01		
Co-60	B<	2.9319E+01	1.7671E+02		
Am-241	<	3.5012E+01	3.5787E+01		
K-40	<	4.2764E+02	4.2764E+02		
U-235	<	4.2573E+01	4.2573E+01		
Th-234	B<	5.2313E+02	5.2313E+02		
Cs-134	<	3.1441E+01	3.1021E+03		
Pb-212	<	5.0848E+01	5.0848E+01		
Ra-224	<	4.49E+02	>12 Halflives		
I-131	B<	2.67E+01	>12 Halflives		
Mn-54	<	2.86E+01	>12 Halflives		
Tl-208	<	4.84E+01	>12 Halflives		
Bi-212	<	3.01E+02	>12 Halflives		
Ra-223	<	8.70E+01	>12 Halflives		
Pa-234	<	5.84E+01	>12 Halflives		
Eu-154	<	5.8806E+01	1.7246E+02		

Eu-152	<	1.1965E+02	2.4343E+02		
Na-22	<	3.8395E+01	1.4649E+03		

122612blankdet1

Zn-65 < 4.92E+01 >12 Halflives  
 Ba-133 < 2.7605E+01 6.8014E+01  
 Ru-103 B< 2.16E+01 >12 Halflives  
 Be-7 B< 1.56E+02 >12 Halflives  
 I-125 No in-range peaks  
 Tl-201 B< 1.41E+02 >12 Halflives  
 Pa-234 B< 4.72E+02 >12 Halflives

- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

S U M M A R Y

Total Activity ( 48.3 to 1980.0 keV) 0.0000000E+00 pci/l  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 0.0000000E+00 pci/l

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 911.07 % Ra-228      969.10 % Ra-228      1115.52 % Zn-65      1120.28 % Bi-214  
 1120.51 ! Sc-46      1173.00 & Co-60      1274.50 Na-22      1274.54 & Eu-154  
 1333.00 % Co-60      1408.00 % Eu-152      1460.80 % K-40

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory

C12120140.1

ORTEC g v - i (2191) wan32 G53W2.06 26-DEC-2012 10:46:28 Page 1  
Energy Laboratory Spectrum name: C12120140.1.An1

Sample description  
C12120140.1

Spectrum Filename: C:\User\C12120140.1.An1

Acquisition information

Start time: 26-Dec-2012 09:42:39  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd11perched.Clb  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.8909E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8909E+02) =  
1.4279E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	07-Dec-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0607

-----

***** SUMMARY OF NUCLIDES IN SAMPLE *****					
Nuclide	Time of Count Activity pCi/g	Time Corrected Activity pCi/g	Uncertainty Counting pCi/g	2 Sigma Total pCi/g	MDA pCi/g
Ra-228	9.7118E-01	9.7726E-01	4.6564E-01	4.6637E-01	
Ra-226 A	1.4316E+00	1.4316E+00	2.8185E+00	2.8187E+00	
Bi-214	1.5356E+00	1.5357E+00	4.5878E-01	4.6060E-01	
Pb-214	1.2825E+00	1.2825E+00	3.8098E-01	3.8251E-01	
Ir-192 #B	5.4180E-03	6.4673E-03	4.2899E-02	4.2899E-02	
Sb-124 #B	1.3790E-01	1.7143E-01	1.9778E-01	1.9783E-01	
Sc-46 #A	0.0000E+00	0.0000E+00	5.6505E+02	5.6505E+02	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 A	2.6771E+00	2.7279E+00	6.5021E+00	6.5024E+00	
Th-230 #A	3.1514E+00	3.1514E+00	1.0066E+01	1.0066E+01	
Cs-137 #A	1.1952E-01	1.1966E-01	1.1819E-01	1.1824E-01	
Co-60 #B	-2.9882E-02	-3.0086E-02	1.9141E+02	1.9141E+02	
Am-241 A	9.8751E-02	9.8760E-02	1.6954E-01	1.6956E-01	
K-40	1.4300E+01	1.4300E+01	3.4918E+00	3.5125E+00	
U-235 A	1.5644E-01	1.5644E-01	1.5164E-01	1.5170E-01	
Th-234 #	1.1384E+01	1.1384E+01	3.0374E+00	3.0551E+00	
Cs-134 #A	6.7173E-02	6.8352E-02	1.6534E-01	1.6535E-01	
Pb-212	1.1749E+00	1.1749E+00	2.3964E-01	2.4177E-01	
Ra-224 A	1.7676E+00	6.5987E+01	7.7656E+01	7.7676E+01	
I-131 #B	1.7570E-02	8.9657E-02	2.7391E-01	2.7392E-01	
Mn-54 #	1.7481E-01	1.8229E-01	1.0262E-01	1.0274E-01	
Tl-208 H	7.0398E-01	>12 Halflives	1.9423E-01	1.9513E-01	
Bi-212 #A	1.5151E+00	>12 Halflives	1.5613E+00	1.5618E+00	
Ra-223 #A	2.5393E-01	7.9910E-01	1.5896E+00	1.5897E+00	
Pa-234 #A	1.8791E-01	>12 Halflives	3.5037E-01	3.5040E-01	
Eu-154 #A	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	

Eu-152 #	8.3830E-01	8.4056E-01	5.4524E-01	5.4570E-01
Na-22 #A	-1.9396E-02	-1.9666E-02	1.5308E+02	1.5308E+02

C12120140.1

Zn-65	A	4.2760E-02	4.5115E-02	1.6782E-01	1.6782E-01
Ba-133		3.0134E-01	3.0237E-01	2.3393E-01	2.3407E-01
Ru-103	#B	1.0087E-01	1.4073E-01	1.2055E-01	1.2067E-01
Be-7	F	1.3820E+00	1.7663E+00	1.2123E+00	1.2143E+00
I-125	#	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tl-201	#B	7.6603E-01	5.6712E+01	4.6032E+01	4.6086E+01
Pa-234	B	3.4848E+00	>12 Halflives	2.4301E+00	2.4335E+00

- # - All peaks for activity calculation had bad shape.
- \* - Activity omitted from total
- & - Activity omitted from total and all peaks had bad shape.
- < - MDA value printed.
- A - Activity printed, but activity < MDA.
- B - Activity < MDA and failed test.
- C - Area < Critical level.
- F - Failed fraction or key line test.
- H - Half-life limit exceeded

----- S U M M A R Y -----

Total Activity ( 48.3 to 1980.0 keV) 2.9677322E+01 pCi/g  
 Total Decayed Activity ( 48.3 to 1980.0 keV) 2.9677387E+01 pCi/g

\*\*\*\*\* S U M M A R Y O F D I S C A R D E D P E A K S \*\*\*\*\*  
 1173.00 & Co-60

- ! - Peak is part of a multiplet and this area went negative during deconvolution.
- ? - Peak is too narrow.
- @ - Peak is too wide at FW25M, but ok at FWHM.
- % - Peak fails sensitivity test.
- \$ - Peak identified, but first peak of this nuclide failed one or more qualification tests.
- + - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
- = - Peak outside analysis energy range.
- & - Calculated peak centroid is not close enough to the library energy centroid for positive identification.
- P - Peakbackground subtraction

-----

Analyzed by: \_\_\_\_\_  
 Dave Blaida

Reviewed by: \_\_\_\_\_  
 Supervisor

Laboratory: Energy Laboratory



C12120140.1dup

ORTEC g v - i (2191) wan32 G53W2.06 26-DEC-2012 11:54:03 Page 1  
Energy Laboratory Spectrum name: C12120140.1dup.An1

Sample description  
C12120140.1dup

Spectrum Filename: C:\User\C12120140.1dup.An1

Acquisition information

Start time: 26-Dec-2012 10:48:18  
Live time: 3598  
Real time: 3600  
Dead time: 0.06 %  
Detector ID: 2

Detector system  
Det 1

Calibration

Filename: 1369.93.1ccd1\_11perched.C1b  
10/16/12 can calibration energy re-cal  
IPL #1369-93-1 new calibration perched

Energy Calibration

Created: 16-Oct-2012 14:32:42  
Zero offset: -0.292 keV  
Gain: 0.243 keV/channel  
Quadratic: -4.957E-09 keV/channel<sup>2</sup>

Efficiency Calibration

Created: 05-Jun-2009 11:39:17  
Type: Polynomial  
Uncertainty: 1.149 %  
Coefficients: -0.345759 -5.963100 0.675305  
-0.103447 0.008672 -0.000304

Library Files

Main analysis library: Norman.lib  
Library Match Width: 0.500

Analysis parameters

Analysis engine: wan32 G53W2.06  
Start channel: 200 ( 48.35keV )  
Stop channel: 8144 ( 1980.03keV )  
Peak rejection level: 20.000%  
Peak search sensitivity: 3  
Sample Size: 1.8909E+02  
Activity scaling factor: 2.7000E+01/( 1.0000E+00\* 1.8909E+02) =  
1.4279E-01  
Detection limit method: Nureg 4.16  
Random error: 1.0000000E+00  
Systematic error: 1.0000000E+00  
Fraction Limit: 0.000%  
Background width: best method (based on spectrum).  
Half lives decay limit: 12.000

□

Activity range factor: 2.000  
 Min. step backg. energy 0.000

Corrections	Status	Comments
Decay correct to date:	YES	07-Dec-2012 12:00:00
Decay during acquisition:	YES	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	011108bkg1000mindet1.Pbc 15-Jan-2008 17:02:27
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	YES	Slope 1.0000E+00 Net factor 1.0000E+00

Energy Calibration  
 Normalized diff: 0.0365

-----

***** SUMMARY OF NUCLIDES IN SAMPLE *****					
Nuclide	Time of Count	Time Corrected	Uncertainty	2 Sigma	MDA
	Activity	Activity	Counting	Total	pCi/g
	pCi/g	pCi/g	pCi/g	pCi/g	
Ra-228	1.8230E+00	1.8344E+00	7.0072E-01	7.0242E-01	
Ra-226 A	3.4200E+00	3.4201E+00	2.4847E+00	2.4864E+00	
Bi-214 F	9.6447E-01	9.6450E-01	4.0559E-01	4.0641E-01	
Pb-214	1.3131E+00	1.3132E+00	3.9875E-01	4.0028E-01	
Ir-192 F	1.6615E-01	1.9841E-01	1.3503E-01	1.3513E-01	
Sb-124 #B	2.9743E-02	3.6995E-02	1.5441E-01	1.5442E-01	
Sc-46 #A	0.0000E+00	0.0000E+00	4.2300E+02	4.2300E+02	
Pb-210 #	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	
Th-228 #A	3.3746E+00	3.4388E+00	6.0252E+00	6.0257E+00	
Th-230 #A	3.9392E+00	3.9392E+00	1.0366E+01	1.0367E+01	
Cs-137 #	2.8634E-01	2.8668E-01	2.2178E-01	2.2191E-01	
Co-60 #B	-2.9882E-02	-3.0086E-02	1.9141E+02	1.9141E+02	
Am-241 #A	1.2938E-01	1.2939E-01	1.8500E-01	1.8502E-01	
K-40 #	1.8029E+01	1.8029E+01	3.4521E+00	3.4853E+00	
U-235 #A	-3.1429E-02	-3.1429E-02	-2.2503E-01	-2.2504E-01	
Th-234 B	2.9610E+00	2.9610E+00	2.8980E+00	2.8992E+00	
Cs-134 #A	-1.3429E-02	-1.3665E-02	-1.3850E-01	-1.3850E-01	
Pb-212	1.1890E+00	1.1890E+00	2.3129E-01	2.3354E-01	
Ra-224 A	2.1241E+00	7.9989E+01	8.2954E+01	8.2981E+01	
I-131 #B	-1.9154E-02	-9.8124E-02	7.5124E+02	7.5124E+02	
Mn-54 #	2.1327E-01	2.2242E-01	1.5282E-01	1.5294E-01	
Tl-208 H	5.2380E-01	>12 Halflives	2.0079E-01	2.0127E-01	
Bi-212 #A	-1.5232E-02	>12 Halflives	-1.0079E+00	-1.0079E+00	
Ra-223 A	3.7838E-01	1.1940E+00	1.6949E+00	1.6952E+00	
Pa-234 #A	2.6082E-01	>12 Halflives	2.3813E-01	2.3823E-01	
Eu-154 A	2.9541E-01	2.9662E-01	2.2422E-01	2.2436E-01	

Eu-152 #A	4.7077E-02	4.7204E-02	1.4592E-01	1.4592E-01
Na-22 #A	-1.9396E-02	-1.9666E-02	5.6540E+02	5.6540E+02



**APPENDIX D**  
**RIPRAP QUALITY AND GRADATION DATA**



Client: Native Sun Materials  
 PO Box 1007  
 Colorado City, AZ 87323-

Report Date: September 20, 2011

Attn: Ernie Jessop  
 Project Name: General Rock Products Misc. Testing 2010  
 Gallup, NM

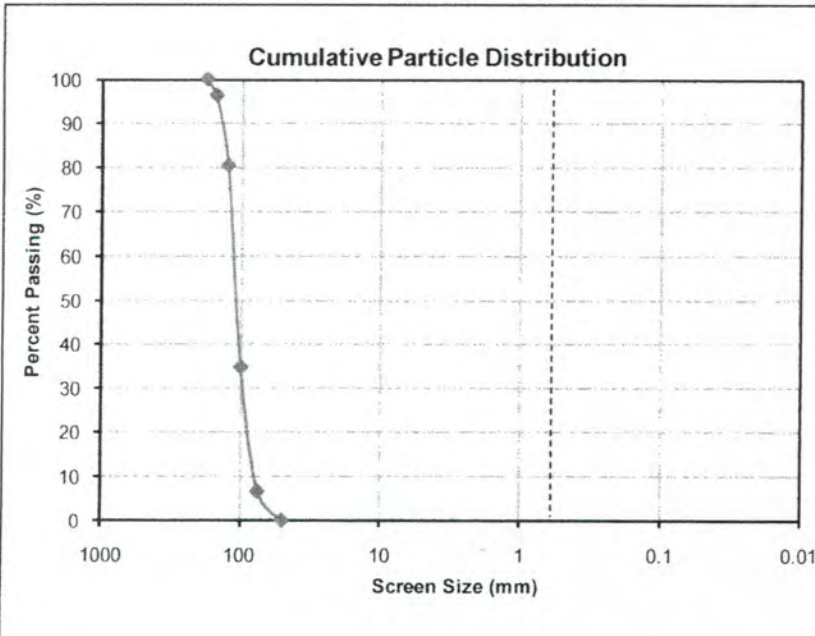
Project #: 10-519-00165  
 Work Order #: 22  
 Lab #: G4904

Sampled By: Client  
 Date Sampled: 9/14/2011  
 Visual Description of Grey Rip-Rap  
 Material:  
 Sample Source: Thoreau Pit

Project Manager: Lee Lommler

SOILS / AGGREGATES

Sieve Analysis ASTM D5519



Sieve Size	Passing
7in.	100.0%
6in.	96.2% *
5in.	80.3%
4in.	34.7%
3in.	6.6%
2in.	0.0%

CC: 1.033                      CU: 1.457                      C<sub>mu</sub>: 1.381  
 D10: 78.921                  D20: 87.419                  D30: 96.832  
 D50: 109.493                D60: 114.980                D70: 120.742

Reviewed By: *[Signature]*  
 jo

**Distribution:** Client:  File:  Supplier:  Other: Addressee (1)  
 Email: Ernie Jessop (email) (1)



**APPENDIX E**  
**FINAL REVEGETATION PLAN AND SEED CERTIFICATES**

**United Nuclear Corporation (UNC)**

**2012 Eastern Drainage  
Revegetation Plan**

**NORTHEAST CHURCH ROCK MINE**

**NOVEMBER, 2012**



5586 Overhill Dr.  
Fort Collins, Colorado 80526  
(970) 223-0775  
[www.cedarcreekassociatesinc.com](http://www.cedarcreekassociatesinc.com)



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---

# United Nuclear Corporation (UNC)

## Northeast Church Rock Mine

### **EASTERN DRAINAGE REVEGETATION PLAN**

---

#### **1.0 BACKGROUND**

Following completion of the Eastern Drainage Removal Action (EDRA) at Northeast Church Rock (NECR) Mine and placement of removed material at the NECR-1 temporary stockpile, the work area will be prepared for revegetation and seeded. Final revegetation of the NECR-1, Eastern Drainage, and borrow areas will be conducted following implementation of the EDRA and completion of a site status survey, in accordance with the Eastern Drainage Removal Action Work Plan (MWH, 2012).

Objectives of the EDRA revegetation effort are attainment of erosional stability and the preclusion of off-site transport of generated sediments from the mine permit area as well as return of the pre-disturbance land uses. The principal means to obtain erosional stability will be use of stability-enhancing metrics and the construction of a stable physical landscape that can then support the establishment and persistence of a reasonable herbaceous ground cover (that also provides enhanced protection against erosion). Once such a condition is achieved, natural processes will facilitate advancement along the successional continuum and eventually to a condition that fully supports the interim revegetation effort. If adequate growth media, precipitation, and other related factors are not at issue, such progression will occur in a relatively short period of time, perhaps as few as 3 to 5 years.

#### **1.1 Growth Medium Characteristics**

Soils around uranium mines in McKinley County, NM typically exhibit textures that range from clay loam to sandy loam, have a near neutral pH, and exhibit low organic matter. Therefore, to improve potential for revegetation success, sterile organic mulch (sterile cow manure) will be applied to the Eastern Drainage area to increase organic content and improve agronomic properties of the surface soils.

Once the Eastern Drainage area has been graded to final contour, remaining sub-soil will be prepared for subsequent revegetation activities. The Eastern Drainage area will receive four tons per acre of sterile organic manure as an amendment. The incorporation of sterile organic manure will improve nutrient availability, nutrient cycling, and soil moisture retention (Brady and Weil, 1999). Sterile material is necessary because seeds of noxious or weedy species can pass through cattle intact. If the

manure is sterilized (composted) prior to application, weed seeds are rendered infertile. Mulch will be spread uniformly across the area immediately prior to discing and seeding discussed below. Additions to NECR-1 will largely be composed of native growth media removed from the Eastern Drainage area as well as additional C-horizon material where contamination has been identified deeper in the soil profile. It will be capped with a layer of uncontaminated material from the designated borrow area. NECR-1 will also receive sterile organic manure at a rate of four tons per acre. The borrow areas will not receive sterile organic manure.

## **1.2 Surface Material Preparation**

Once the project area has been regraded to final configuration and NECR-1 has been capped with the previously described native surface soil components, areas of steeper slopes (>3:1) will be deep ripped, where possible, with a single or double-toothed chisel plow pulled by a D8 or equivalent dozer. Deep ripping will occur along the contour to create contour ridges to help preclude erosion. Ripping will occur at nominal intervals of 4 feet (but no more than 6 feet) between the ripper teeth. On flatter slopes between 3:1 and 5:1 ripping will again occur on the contour, but the depth will be reduced and the interval between "rip lines" will be increased to 10 or 12 feet. Flat areas (< 5:1 slopes) will not be ripped unless haulage traffic has compacted the growth media, or it is naturally compacted. In such compacted circumstances, ripping will follow the procedures for steep slopes.

Following deep ripping, the upper 3 to 6 inches of remaining growth media will be prepared for seeding through fragmentation into a fine-grained unconsolidated material by use of a heavy disc or heavy harrow. This process oxygenates the growth media and opens up inter-grain pore spaces facilitating moisture retention. If the surface is extraordinarily hard, multiple passes may be necessary to gain adequate depth. Final passes will be oriented parallel to the contour to preclude creation of preferential erosion pathways.

It is best that seeding occur immediately following this deep discing / harrowing step. If seeding cannot occur immediately following this step, then a light harrowing immediately in advance of seeding will occur to break up any crusting that may have developed during the interim. This final harrowing will occur along the contour, should use low-ground pressure equipment, and is necessary to maximize opportunities for "seed to soil" contact.

## **1.3 Seeding**

The final restoration step for the EDRA will be planting of the designated seed mixes for Eastern Drainage and NECR-1 (Tables 1 and 2). Seeding of the Primary Mix (Table 1) will be used on all areas of

the Eastern Drainage Removal Action, including restored areas on NECR-1 and associated borrow areas. The Supplemental Mix will be used on all restored areas east of Red Water Pond Road. Planting will take place in late October or November as soon as possible after surface preparation is completed. As indicated on the seed mix tables, distribution of seed is best accomplished by a mix of two planting techniques. In this regard, seed designated for broadcasting will be applied first, to be followed by seed designated for drilling. This can be best accomplished by placing a cyclone spreader on the front of the equipment (tractor) that pulls the seed drill. The cyclone should be adjusted to spread seed the approximate width of the drill. The action of the seed drill then acts as a harrow to lightly cover the broadcast seed thereby eliminating the need for the final step - harrowing. If, broadcasting occurs in any other manner or timing, the area just seeded should be lightly harrowed before drilling of grass seed. Harrowing must be very light so as not to overly bury distributed seed (the majority of seed should be covered no deeper than 2 to 3 mm). A very short length of chain-link fencing dragged over the broadcast area is often used for such light harrowing. Drilling of grass seed is best accomplished by setting depth bands on a seed drill to place seed 5 to 8 mm below the surface. Furthermore, an experienced seed applicator will be used so as to obtain proper distribution of the indicated amount of seed on a per acre basis.

#### **1.4 Mulching**

Areas exhibiting flatter slopes (<3:1) shall not be mulched unless deemed necessary by site management personnel. Steeper areas (within the limitations of safe equipment operation) shall receive 2 tons per acre of certified weed-free straw mulch that will be "crimped-into" the surface by use of a standard agricultural disc with the coulters set parallel to the direction of travel. If such "crimping" cannot be accomplished in the manner indicated due to slope angle, contour furrowing, or similar reclamation metric, an alternate procedure will be used to "affix" the straw. The first alternate measure that may be used would involve a small dozer (e.g., D6 or equivalent) operating up and down the slope. In this manner the grousers will crimp the straw into the soil surface in much the same manner as coulters on a disk. A second alternate procedure would involve application of 2 tons per acre of wood fiber mulch applied hydraulically (hydromulching) from the top of the structure and/or from the base.

#### **1.5 Amendments**

As indicated on Table 1, the seed mixes are comprised entirely of native species that should be adapted to low-fertility soils and to the climactic regime of the project area. Because weedy annuals typically take greater advantage of inorganic fertilizers that will then result in significant problematic circumstances, no inorganic fertilizers will be used. However, because a borrow source of topsoil will not be used in the Eastern Drainage area, 4 tons per acre of a sterile organic manure (cow manure) shall be

applied for the reasons indicated in Section 1.1. This material shall be applied prior to seedbed preparation, and therefore, will be incorporated into the soil profile with disking activities.

Furthermore, because seed mixes are comprised of species adapted to the climactic conditions of the project area, no irrigation will be used in this revegetation project. Irrigation would cause an artificial climactic regime that would overly encourage the wrong species versus the desired ones (e.g, annual weeds). Also, under the influence of irrigation, the adapted plants that do come up would develop above ground biomass at the expense of below ground biomass. Thus once the irrigation stops, those plants would have essentially become "accustomed" to artificial circumstances and likely would die during a normally tolerated drought. Over approximately the last 20 years, practical applications of arid land restoration science have abandoned the use of irrigation. Where currently used in modern restoration, irrigation typically has one of several finitely specific purposes, none of which are applicable to the EDRA environs.

## **1.6 Woody Species**

It has been recommended that all tree specimens be left in place during the removal action. However, logistics of such a procedure are often difficult and it is likely that some trees will be lost and/or damaged during the removal action. As a precautionary strategy, all individual trees in the vicinity of the EDRA were located with GPS coordinates and recorded by species during the site survey in August 2012 (Cedar Creek ERDA Baseline Report).

## **1.7 Fencing**

Existing fencing around the perimeter of the Eastern Drainage area is adequate to exclude grazing livestock from revegetated areas. The existing fencing includes 48" of net wire, overlain with two strands of barbed wire spaced 6-8 inches apart. Allotment permittees will be notified that grazing of the restored area will not be permitted until approved by a qualified revegetation specialist (biologist or ecologist).

Table 1									
NECR - Final Primary Seed Mix*									
For NECR-1, Eastern Drainage, and Borrow Areas - (Livestock Grazing Land Use)									
Primary Mix				Recommendations				This entire mix can be drill seeded	
No.	Obs. On Site	Common Name	Scientific Nomenclature	PLS / lb.**	Recommnd . PLS lbs/ac	PLS / ft²	% of Seeds in Mix	Preferred Method of Seeding	Comment (Based on Site-specific Findings or Professional Judgment)
1	XX	Western wheatgrass	<i>Agropyron smithii</i>	110,000	1.00	2.5	2.0%	Drill	NRCS indicated climax species
2	XX	Sand Dropseed	<i>Sporobolus cryptandrus</i>	5,298,000	0.50	60.8	47.9%	B-cast/Harrow	NRCS indicated climax species
3	XX	Blue Grama	<i>Bouteloua gracilis</i>	825,000	0.50	9.5	7.5%	Drill	Stong component of native community
4	XX	Galleta	<i>Hillaria jamesii</i>	159,000	0.50	1.8	1.4%	Drill	Stong component of native community
5		Thickspike Wheatgrass	<i>Agropyron dasystachyum</i>	154,000	0.50	1.8	1.4%	Drill	Fair performer - Offers diversity
6	XX	Indian Ricegrass	<i>Oryzopsis hymenoides</i>	141,000	0.75	2.4	1.9%	Drill	Should do well in areas of sandy texture
7	XX	Sideoats Grama	<i>Bouteloua curtipendula</i>	191,000	0.75	3.3	2.6%	Drill	Good performer - Offers diversity
8	XX	Bottlebrush Squirreltail	<i>Sitanion hystrix</i>	192,000	0.25	1.1	0.9%	Drill	Fair performer - Offers diversity
<b>Subtotal</b>				<b>4.75</b>	<b>83.2</b>	<b>65.5%</b>			
9	XX	Desert Globemallow	<i>Sphaeralcea ambigua</i>	500,000	0.75	8.6	6.8%	B-cast/Harrow	Sufficient performer for diversity
10		Palmer Penstemon	<i>Penstemon palmeri</i>	610,000	0.50	7.0	5.5%	B-cast/Harrow	Good performer - Offers diversity
11	XX	Rocky Mountain Penstemon	<i>Penstemon strictus</i>	592,000	0.25	3.4	2.7%	B-cast/Harrow	Fair performer - Offers diversity
12		Lewis Flax	<i>Linum lewisii</i>	293,000	1.00	6.7	5.3%	B-cast/Harrow	Good performer - Offers diversity
<b>Subtotal</b>				<b>2.50</b>	<b>25.7</b>	<b>20.3%</b>			
13	XX	Fourwing Saltbush	<i>Atriplex canescens</i>	52,000	0.75	0.9	0.7%	Drill	NRCS indicated climax species - good forage value
14	XX	Wyoming Big Sagebrush	<i>Artemisia tridentata wyo.</i>	2,500,000	0.25	14.3	11.3%	B-cast/Harrow	Occasional performer - Offers diversity
15	XX	Cliffrose	<i>Purshia mexicana</i>	64,600	1.00	1.5	1.2%	B-cast/Harrow	Fair performer - Offers diversity
16		Winterfat	<i>Ceratoides lanata</i>	56,700	1.00	1.3	1.0%	B-cast/Harrow	Good performer - good forage value
<b>Subtotal</b>				<b>3.00</b>	<b>18.0</b>	<b>14.2%</b>			
<b>Total</b>				<b>10.25</b>	<b>127.0</b>				

\* The 10.25 lb/ac mix is designed for drill seeding of grasses. When broadcast and harrow methods are used for grasses, the rate should be increased 1.5 times. When hydroseeding methods are to be used, the rate should be doubled (2X). \*\* PLS = Pure Live Seed.

Table 2									
NECR - Final Supplemental Seed Mix*									
For Areas East of Red Water Pond Road - (Livestock Grazing Land Use)									
Supplemental Mix				Recommendations				This entire mix can be drill seeded	
No.	Obs. On Site	Common Name	Scientific Nomenclature	PLS / lb.**	Recommnd . PLS lbs/ac	PLS / ft²	% of Seeds in Mix	Preferred Method of Seeding	Comment (Based on Site-specific Findings or Professional Judgment)
1		Alkali Sacaton	<i>Sporobolus airoides</i>	1,758,000	0.25	10.1	28.6%	B-cast/Harrow	NRCS indicated climax species
2	XX	Blue Grama	<i>Bouteloua gracilis</i>	825,000	0.50	9.5	26.8%	Drill	Stong component of native community
<b>Subtotal</b>				<b>0.75</b>	<b>19.6</b>	<b>55.4%</b>			
3	XX	Scarlet Globemallow	<i>Sphaeralcea coccinea</i>	500,000	0.25	2.9	8.1%	B-cast/Harrow	Sufficient performer for diversity
4		Rocky Mtn. Bee Plant	<i>Cleome serrulata</i>	65,900	1.50	2.3	6.4%	B-cast/Harrow	Good performer - Offers diversity
5		Upright Prairie Coneflower	<i>Ratibida columnifera</i>	737,104	0.25	4.2	12.0%	B-cast/Harrow	Fair performer - Offers diversity
<b>Subtotal</b>				<b>2.00</b>	<b>9.4</b>	<b>26.5%</b>			
6	XX	Fourwing Saltbush	<i>Atriplex canescens</i>	52,000	1.50	1.8	5.1%	Drill	NRCS indicated climax species - good forage value
7	XX	Rubber Rabbitbrush	<i>Chrysothamnus naseousus</i>	400,000	0.50	4.6	13.0%	B-cast/Harrow	NRCS indicated climax species
<b>Subtotal</b>				<b>2.00</b>	<b>6.4</b>	<b>18.1%</b>			
<b>Total</b>				<b>4.75</b>	<b>35.3</b>				

\* The 4.75 lb/ac mix is designed for drill seeding of grasses. When broadcast and harrow methods are used for grasses, the rate should be increased 1.5 times. When hydroseeding methods are to be used, the rate should be doubled (2X). \*\* PLS = Pure Live Seed.

## 2.0 REVEGETATION MONITORING AND SUCCESS EVALUATIONS

### 2.1 Revegetation Monitoring Schedule

Based on Cedar Creek's previous experience, especially with restoration that may be subject to livestock grazing impacts, a vegetation monitoring program is necessary to maximize the potential for eventual success. In this regard, a qualified revegetation specialist will review the revegetated areas on an annual basis (during the peak growing season in September or shortly thereafter) to catch developing problems early in the process. The annual site visits will be as follows:

Year 1 – Qualitative and semi-quantitative evaluations (managerial info. only).

Year 2 – Qualitative and quantitative evaluations (managerial info. only).

Year 3 – Qualitative and quantitative evaluations (managerial info. only).

Year 4 – Qualitative and quantitative evaluations (managerial info. only).

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Year 5 – Qualitative and quantitative evaluations (final success evaluation).

As indicated, the final effort during year 5 would be an evaluation for success determination. Year 5 information will be collected in such a manner as to provide defensible verification that success has been achieved. If it is determined that vegetation needs additional time to mature, monitoring will continue once every 2 years, thereafter, until success evaluations are positive. Other than first year efforts, annual monitoring would be a combination of both qualitative and quantitative efforts to facilitate tracking and progress toward revegetation success standards.

To facilitate additional views of the revegetation for visual evaluation, a program of quarterly photographic monitoring will be initiated to coincide with the Erosion and Sedimentation Surveys prescribed as part of the post removal site controls in the NECR Eastern Drainage Removal Action Construction Work Plan (MWH, 2012). This quarterly monitoring will be implemented over the first five years, or until the Erosion and Sedimentation Surveys are completed, whichever occurs first.

Once per year, results from site-specific surveys and photo-documentation will be compiled into a brief report for submittal to the EPA.

## **2.2 Revegetation Monitoring Procedures**

### **2.2.1 Physical and Biotic Attributes / Emergent Plant Density**

During the first growing season following seeding each restored unit will be subjected to a relatively brief one-time evaluation to document plant establishment as well as other restoration considerations. This evaluation consists of a qualified observer traversing the subject area and evaluating vegetation establishment and related physical and biotic conditions. Approximately 1 hour of qualitative review time per 20 acres will be expended. During the traverses, the observer will note, among other items: 1) areas of poor seedling emergence, 2) pervasively weak or stressed seedlings, 3) indicators of soil fertility problems (e.g. certain anthocyanine colorations), 4) noxious weeds or invasive plant infestation, 5) evidence of unintended livestock grazing, 6) excessive erosion and type, 7) "pockets" of the aforementioned, and 8) any other similar revegetation / restoration related problems.

In addition to the physical and biotic attributes evaluation, the surveying observer will collect semi-quantitative samples to document the emergent density of seeded species. In this regard, a total of 20 samples will be collected from each restored unit. Each sample will consist of a cluster of five 1.0 ft<sup>2</sup> quadrats distributed in an unbiased manner (total of 100 quadrats). The number of emergent plants rooted within the perimeter of each quadrat will be recorded accordingly into one of five classes: perennial grass, perennial forb, shrub/tree, annual grass, or annual forb. This procedure typically takes only a few minutes per sample point (5 quadrats) yet yields valuable information on the success of the seeding effort. Efforts that result in an average of fewer than 1 perennial emergent per 1.0 ft<sup>2</sup> should be considered to be poor and a possible candidate for remediation. Efforts with 1 – 2 perennial emergents per 1.0 ft<sup>2</sup> are considered to be fair, 2 - 3 perennial emergents per 1.0 ft<sup>2</sup> are considered good, and 3 - 5 perennial emergents per 1.0 ft<sup>2</sup> are considered to be very good. Finally, greater than 5 perennial emergents per 1.0 ft<sup>2</sup> are considered to be excellent.

The results of the qualitative, and semi-quantitative emergent density survey will form an initial basis for recommendations for future needs of the restored unit. It is most probable that a recommendation to proceed to Year 2 monitoring will be made. Other possible recommendations may include:

1. Allow additional time for seed to emerge and re-evaluate using Year 1 Protocols. The amount of additional time may be one or two years.
2. Retreat all or parts of a unit by resoiling, reseeding, fertilizing, or weed control efforts.



An important concept that must be taken into account is that precipitation is not always favorable for restoration efforts in any given year or environment, just as occurs for agricultural practices. Also, species selected, growth form, depredation by granivores, and mold or fungus may impact emergence. Therefore, as indicated above, a second growing season is occasionally necessary to achieve the desired seedling emergence. If however, after two growing seasons emergence is still unsatisfactory, reseeding may be necessary to replenish the seed bank. If such mitigation occurs, the area should be monitored again the following growing season using Year 1 protocols.

### **2.2.2 Photo Monitoring Points**

As indicated above, photo monitoring will occur annually for the first five years during revegetation monitoring. Permanent photo-points (marked with a stake or rock cairn and GPS coordinates) will be established on the Eastern Drainage. At each point, four photos will be exposed, one each in a cardinal compass direction (N-E-S-W) using a photo board to indicate photo-point and direction visible in each frame. Photos will be exposed in "portrait" orientation (as opposed to landscape) with the horizon at the very top of each photo. In this manner, all vegetation from very close to very far away will be observable.

### **2.2.3 Qualitative and Quantitative Vegetation Monitoring**

During years 2, 3, and 4, monitoring will involve brief qualitative and quantitative evaluations of each of the two restored units. Qualitative monitoring will consist of a repeat of those observations of physical and biotic attributes discussed in Section 2.2.1 above. Quantitative monitoring will involve collection of ground cover data, by species, within each revegetated unit to be evaluated and in the reference area to provide comparison parameters. A total of 20 transects shall be established in an unbiased manner within each of the revegetated areas and another 20 in the reference area established in 2012. Species diversity (composition) information will be calculated from ground cover data. Sampling for ground cover will be accomplished utilizing the point-intercept procedure using modern instrumentation (e.g. lasers or optics) along transects of 100 intercepts each.

Sampling procedures will closely approximate those presented in the "NE Church Rock Mine, Vegetation Evaluations Contributory to Development of Final Reclamation Considerations" (Cedar Creek Associates, Inc., 2012) work plan previously submitted to EPA. The first step of the vegetation sampling protocol will be to obtain samples of the ground cover from each revegetated unit to be evaluated. Ground cover will also be obtained from the reference area. Sampling will occur during the peak biomass period of the year (late summer ~ September) and sampling locations will be determined utilizing a

visually-based systematic method. This systematic procedure also provides proportionate representation from across each restored unit for such characteristics as aspect and slope.

Ground Cover Determination. Ground cover at each sampling site will be determined utilizing the point-intercept methodology (Bonham 1989) as illustrated in the Work Plan. This methodology has been utilized for range studies for over eighty (80) years and will occur as follows: First, a transect of 10 meters length will be extended from the starting point of each sample site toward the direction of the next site to be sampled. Then, at each one-meter interval along the transect, a "laser point bar" or "optical point bar" will be situated vertically above the ground surface, and a set of 10 readings recorded as to hits on vegetation (by species), litter, rock (>2mm), or bare soil. Hits will be determined at each meter interval as follows. When a laser point bar is used, a battery of 10 tightly focused specialized lasers situated along the bar at 10 centimeter intervals will be activated and the variable intercepted by each of the narrow (0.5mm) focused beams will be recorded. If an optical point bar is used, intercepts will be recorded based on the item intercepted by fine crosshairs situated within each of 10 optical scopes located at 10-centimeter intervals. In either situation, a total of 100 intercepts per transect will be recorded resulting in 1 percent cover per intercept. This methodology and instrumentation facilitates the collection of the most unbiased, repeatable, precise, and cost-effective ground cover data possible.

Because data are for managerial information in Years 2, 3, and 4, sample adequacy calculations will only be calculated for informational purposes. Only in Year 5 (or thereafter as necessary) would collection of an adequate sample be necessary.

Depending on the results of data analyses and interpretation of observations, appropriate management recommendations will be generated for the target units in each of Years 2, 3, and 4. For most efforts on a reasonable path to growth and development, it is anticipated that a recommendation to proceed to the next year of monitoring or success evaluation will be forthcoming. Other possible recommendations include:

1. Allow additional time for the establishing community to mature and then re-evaluate using monitoring protocols.
2. Retreat all or parts of a unit by reseeding, fertilizing, weed control efforts, etc. and continue monitoring using Section 2.2.3 protocols as necessary.

Advancement to success evaluation would be based on both age of the restoration (at least 5 years of age) and the estimated amount of expressed vegetation in the target restoration unit(s) in comparison to the success criterion based on reference area data. When it is determined the amount of vegetation

cover is approaching and will likely exceed the success threshold the following year, or presently exceeds the success criterion, then the following program will commence.

### **2.3 Revegetation Success Criteria**

A determination of revegetation success will take into account the following three factors:

- Comparison will be to an established reference area representative of the adjacent vegetation community and/or desirable ecological conditions (for the variables of ground cover and diversity);
- Plant species present in the approved (and planted) seed mixes; and
- The post-mining land use (livestock grazing with coincidental wildlife habitat) has been established and the vegetation is capable of being grazed at proper grazing intensity.

When utilizing reference areas (that are late seral by definition) for determinations of revegetation success, certain allowances must be made when comparing them to early seral revegetated communities; otherwise comparisons would be scientifically invalid. Furthermore, precedent has been set in this regard in both the coal and hard-rock industry's restoration regulatory mandates. These allowances are a modest reduction in the amount of ground cover and diversity from late-seral values.

Revegetation success in revegetated units planted primarily as grassland or shrub steppe (targeting livestock grazing land uses with coincidental wildlife habitats) will concentrate on two performance standards (1) vegetative ground cover, and 2) diversity. Therefore, revegetation efforts will be considered successful when the following criteria have been met following at least five years of growth and development.

#### **1. Vegetative Ground Cover Criterion**

The total vegetative ground cover (exclusive of listed noxious species) below breast height (1.25 meters) in the target revegetated unit equals or exceeds 75 percent of the reference area's perennial vegetative ground cover (exclusive of listed noxious species) below breast height (1.25 meters), with 90 percent statistical confidence.

#### **2. Species Diversity Standard:**

Diversity, as indicated by the number of "important species" (exclusive of listed noxious weeds) in each revegetated unit equals or exceeds 50% of the "important species" found in the reference area. An important species is defined as any desired taxon that equals or exceeds 1% absolute ground cover.

Revegetation success comparisons for NECR-1 will be made against the Piñon-Juniper Reference Area established during the original removal action. Whereas, the Eastern Drainage removal area will be compared with the Eastern Drainage Reference Area established in 2012.

#### **2.4 Revegetation Testing for Success Determination**

Following field evaluations during Year 5 (or thereafter) using the protocols detailed above, the collected parameters (for ground cover) for the reference area will be compared with the target revegetated units' values to provide an indication of revegetation success. This testing will involve the commonly accepted statistical student's "t-test" of the means for ground cover from each of the areas at the level of significance of  $\alpha = 0.1$  with 90% confidence. Diversity testing will be a direct mathematical comparison. In both cases, testing will be against criteria developed from reference area data as indicated in the preceding section (2.3).

Sampling Adequacy. Sampling adequacy will not be necessary for managerial level monitoring data collected prior to Year 5. However, data collection for success evaluation will continue within each discrete sampling unit (revegetated unit or reference area) until a statistically adequate sample has been obtained. One exception is possible - if reverse-null hypothesis testing is employed. In this case, use of parameters from an adequate sampling effort is not a statistical requirement.

Adequacy of sampling in Year 5 will be achieved when, for each discrete unit, the number of samples actually collected ( $n$ ) provides a level of precision within 10% of the true mean ( $\mu$ ) with 90% confidence ( $n_{\min}$ ), i.e., when  $n_{\min} \leq n$ . And  $n_{\min}$  is calculated as follows:

$$n_{\min} = (t^2 s^2) / (0.1 \bar{x})^2$$

where:  $n$  = the number of actual samples collected with a minimum of 20 in each unit;

$t$  = the one-tailed value from the  $t$  distribution for 90% confidence with  $n-1$  degrees of freedom;

$s^2$  = the variance of the estimate as calculated from the initial samples;

$\bar{x}$  = the mean of the estimate as calculated from the initial samples.

As indicated above, this formula provides an estimate of the sample mean to within 10% of the true population mean ( $\mu$ ) with 90% confidence. Calculations of the mean and variance will be based on "total vegetation ground cover" exclusive of litter. Furthermore, a minimum sample size of twenty (20) samples will be collected from each discrete revegetated unit or the reference area in Year 5. If the

initial 20 samples do not provide an adequate estimate of the mean (e.g., the inequality above is false), additional samples will be collected until the inequality is satisfied. However, in no case will more than 40 ground cover transects be collected in any given sampling unit.

As indicated above, ground cover will be assessed using a classical “t” test comparison of the means and diversity will be assessed using a straight-forward mathematical comparison. With regard to the ground cover evaluation, the decision rule will be:

If  $t_c \leq t$  for  $t_{(a=0.1, n_{ra}+n_{rv}-2 \text{ d.f.})}$  the test can be considered successful.

For the diversity evaluation, if the number of “important” species of the restored area is equal to or greater than 0.5 times the number of “important” species of the reference area, then the test can be considered successful. On occasion, a classical “t” test comparison may be inappropriate. In such circumstances, a “reverse null” “t” test will be performed.

For the reverse null procedure, collection of an “adequate” sample (where  $n_{\min} \leq n$ ) is not necessary as it is in the operator’s best interest to sample until a “tight” estimate of the mean is obtained (i.e., sampling should continue until the variance is more “narrowly” defined). Typically, a sample size of 30 or greater provides such an estimate (due to the Central Limit Theorem). In the “classical” hypothesis test, rejection of  $H_0$  means failure as the hypothesis being tested is that the target area variable is greater than or equal to 75% of the reference area or standard. However, in the reverse null test, rejection of  $H_0$  means success as the hypothesis being tested is that the target area variable is less than or equal to 75% of the reference area or standard. Therefore, once a sample has been collected from both the target area of interest and the reference area, the means and variances ( $\bar{x}$  and  $s^2$ ) of those samples will be utilized for testing success or failure as follows:

For two-sample testing (with a reference area) for equal variances (usual case), the following test would be performed (rv = revegetated unit, ra = reference area):

$$t_c = \frac{\bar{x}_{rv} - 0.75\bar{x}_{ra}}{\sqrt{s_p^2 \left( \frac{1}{n_{rv}} + \frac{1}{n_{ra}} \right)}} \quad \text{Where the pooled variance } s_p^2 =$$

$$s_p^2 = \frac{[(n_{ra} - 1)0.5625s_{ra}^2 + (n_{rv} - 1)s_{rv}^2]}{(n_{ra} + n_{rv}) - 2}$$

**Then if  $t_c \geq t$  for  $t_{(a=0.1, n_{ra}+n_{rv}-2 \text{ d.f.})}$  the test is successful.**

For two-sample testing (with a reference area) for unequal variances (infrequent case), the following test would be performed

$$t_c = \frac{\bar{x}_{rv} - 0.75\bar{x}_{ra}}{\sqrt{w_{rv} - w_{ra}}} \quad \text{Where } w_{ra} = \frac{0.5625s_{ra}^2}{n_{ra}} \quad \text{and } w_{rv} = \frac{s_{rv}^2}{n_{rv}}$$

and the degrees of freedom are approximated by :

$$\frac{(w_{ra} + w_{rv})^2}{\frac{w_{ra}^2}{n_{ra} - 1} + \frac{w_{rv}^2}{n_{rv} - 1}}$$

Then if  $t_c \geq t$  for  $t$  ( $\alpha=0.1$ , approx. d.f.) the test is successful.

## **2.5 Contingency Plan and Conditions for Final Relinquishment**

If at any time before, during, or after Year 5 for a revegetated unit, monitoring indicates significant potential for failure to meet any of the foregoing revegetation performance standards, the applicant will document such findings in a report to the appropriate agencies within 90 days of problem identification. The report will describe the area of concern, the perceived problem, and the probable causes. Within 60 days of submission of the report, the applicant will submit a corrective action plan, with an implementation schedule, to the EPA for review and approval. Following EPA approval, the corrective action plan will be implemented by the applicant.

If a revegetated unit continues to fail to meet a performance standard following another 5 years after the applicant's substantial compliance with the Revegetation Plan and after application of any appropriate corrective action procedures as described above, the applicant may request a revision of the performance standard for any revegetated unit(s) on the grounds that either:

- (a) a revised performance standard is appropriate as the permit area will be restored to a condition that allows for re-establishment of a self-sustaining ecosystem appropriate for the life zone of the surrounding areas; or
- (b) the applicant qualifies for a waiver in that the unit will meet all applicable federal and state laws, regulations and standards for air, surface water and ground water protection and will not pose a current or future hazard to public health or safety; or

(c) the applicant qualifies for a variance as the standard imposes undue economic burden, and the variance will not result in a significant threat to human health, safety, or the environment.

To the contrary, if it is determined that any failure to achieve a performance standard is due to human or livestock-related damage to restoration as a result of actions by outside parties, or their livestock, in the form of compromised exclusionary fencing or other human-related detrimental actions, then it will be assumed that standards would have been achieved and liabilities will be released.

### 3.0 LITERATURE CITED

Bonham, Charles D. 1989. *Measurements for Terrestrial Vegetation*. John Wiley & Sons. 338 pp. New York, NY.

Brady, N.C. and R.R. Weil. 1999. *The Nature and Properties of Soils*. 12th ed. Prentice-Hall, Inc. Upper Saddle River, NJ.

Cedar Creek Associates, Inc. NE Church Rock Mine, Vegetation Evaluations Contributory to Development of Final Reclamation Considerations. August 2005.

MWH, Global. Removal Action Construction Work Plan - Eastern Drainage Area - Northeast Church Rock Mine. July 2012.



From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

7 of 11

Mix Name: Broadcast Mix 1-15437  
Mix # 111112 Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
40.04	ROCKY MOUNTAIN BEEPLANT	VNS	84 -72	CO
13.21	RUBBER RABBITRUSH	VNS	95 -72	UT
7.47	YELLOW PRAIRIE CONEFLOWER	Stillwater	84 + 0 = 84	WA
7.13	SCARLET GLOBEMALLOW	VNS	88 -72	UT
8.47	ALKALI SACATON	VNS	97 -72	NM

0.04	Other Crop	Date Tested	23-MAY-12
25.58	Inert Matter	% Hard Seed	0.00
0.00	Weed Seed	Noxious Weed	None

Net Weight 5.50 Lbs PLS 7.97 Lbs Bulk

Coverage: 2 Acres

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Ship To  
Siler Seeding  
BRANDON - 775-777-5570  
Hold at Dock  
Gallup, NM

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

11 of 11

Mix Name: Broadcast Mix 1-15437  
Mix # 111112 Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
40.04	ROCKY MOUNTAIN BEEPLANT	VNS	84 -72	CO
13.21	RUBBER RABBITRUSH	VNS	95 -72	UT
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8.47	ALKALI SACATON	VNS	97 -72	NM

0.04	Other Crop	Date Tested	23-MAY-12
25.58	Inert Matter	% Hard Seed	0.00
0.00	Weed Seed	Noxious Weed	None

Net Weight 5.50 Lbs PLS 7.97 Lbs Bulk

Coverage: 2 Acres

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Ship To  
Siler Seeding  
BRANDON - 775-777-5570  
Hold at Dock  
Gallup, NM

8 of 11

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: Broadcast Mix 1-15437  
Mix # 111112 Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
40.04	ROCKY MOUNTAIN BEEPLANT	VNS	84 -72	CO
13.21	RUBBER RABBITRUSH	VNS	95 -72	UT
7.47	YELLOW PRAIRIE CONEFLOWER	Stillwater	84 + 0 = 84	WA
7.13	SCARLET GLOBEMALLOW	VNS	88 -72	UT
8.47	ALKALI SACATON	VNS	97 -72	NM

0.04	Other Crop	Date Tested	23-MAY-12
25.58	Inert Matter	% Hard Seed	0.00
0.00	Weed Seed	Noxious Weed	None

Net Weight 5.50 Lbs PLS 7.97 Lbs Bulk

Coverage: 2 Acres

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Ship To  
Siler Seeding  
BRANDON - 775-777-5570  
Hold at Dock  
Gallup, NM

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

6 of 11

Mix Name: Broadcast Mix 1-15437

Mix # 111112 Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
40.04	ROCKY MOUNTAIN BEEPLANT	VNS	94 -TZ	CO
13.21	RUBBER RABBITBRUSH	VNS	95 -TZ	UT
7.47	YELLOW PRAIRIE CONEFLOWER	Stillwater	84 + 0 = 84	WA
7.13	SCARLET GLOBEMALLOW	VNS	88 -TZ	UT
6.47	ALKALI SACATON	VNS	97 -TZ	NM

0.04 Other Crop Date Tested 23-MAY-12  
25.55 Inert Matter % Hard Seed 0.00  
0.08 Weed Seed Non-pus Weed None

Net Weight: 5.50 Lbs PLS 7.97 Lbs Bulk

Coverage: 2 Acres

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Ship To  
Sister Seeding  
BRANDON - 775-777-5570  
Hold at Dock  
Gallup, NM

225-0604707  
EXLA  
225-0604707  
EXLA  
225-0604707  
EXLA

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

10 of 11

Mix Name: Broadcast Mix 1-15437

Mix # 111112 Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
40.04	ROCKY MOUNTAIN BEEPLANT	VNS	94 -TZ	CO
13.21	RUBBER RABBITBRUSH	VNS	95 -TZ	UT
7.47	YELLOW PRAIRIE CONEFLOWER	Stillwater	84 + 0 = 84	WA
7.13	SCARLET GLOBEMALLOW	VNS	88 -TZ	UT
6.47	ALKALI SACATON	VNS	97 -TZ	NM

0.04 Other Crop Date Tested 23-MAY-12  
25.55 Inert Matter % Hard Seed 0.00  
0.08 Weed Seed Non-pus Weed None

Net Weight: 5.50 Lbs PLS 7.97 Lbs Bulk

Coverage: 2 Acres

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Ship To  
Sister Seeding  
BRANDON - 775-777-5570  
Hold at Dock  
Gallup, NM

225-0604707  
EXLA  
225-0604707  
EXLA  
225-0604707  
EXLA

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: Broadcast Mix 1-15437  
Mix # 111112 Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
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13.21	RUBBER RABBITBRUSH	VNS	95 -TZ	UT
7.47	YELLOW PRAIRIE CONEFLOWER	Stillwater	84 + 0 = 84	WA
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6.47	ALKALI SACATON	VNS	97 -TZ	NM

0.04 Other Crop Date Tested 23-MAY-12  
25.55 Inert Matter % Hard Seed 0.00  
0.08 Weed Seed Non-pus Weed None

Net Weight: 5.50 Lbs PLS 7.97 Lbs Bulk

Coverage: 2 Acres

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Ship To  
Sister Seeding  
BRANDON - 775-777-5570  
Hold at Dock  
Gallup, NM

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: Broadcast Mix 1-15437  
Mix # 111112 Church Rock Mine - add

Mix Name: Broadcast Mix 1-15437  
Mix # 111112 Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
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7.13	SCARLET GLOBEMALLOW	VNS	88 -T2	UT
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0.04 Other Crop Date Tested: 23-MAY-12  
25.58 Inert Matter % Hard Seed: 0.00  
0.08 Weed Seed Noxious Weed: None

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0.08 Weed Seed Noxious Weed: None

Net Weight: 5.50 Lbs PLS 7.97 Lbs Bulk

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Coverage: 2 Acres

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Ship To:  
Slater Seeding  
BRANDON - 775-777-5570  
Hold at Dock

Ship To:  
Slater Seeding  
BRANDON - 775-777-5570  
Hold at Dock  
Gallup, NM

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: Broadcast Mix 1-15437  
Mix # 111112 Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
40.04	ROCKY MOUNTAIN BEEPLANT	VNS	94 -T2	CO
13.21	RUBBER RABBIT BRUSH	VNS	95 -T2	UT
7.47	YELLOW PRAIRIE CONEFLOWER	Stillwater	84 + 0 = 84	WA
7.13	SCARLET GLOBEMALLOW	VNS	88 -T2	UT
8.47	ALKALI SACATON	VNS	97 -T2	NM

0.04 Other Crop Date Tested: 23-MAY-12  
25.58 Inert Matter % Hard Seed: 0.00  
0.08 Weed Seed Noxious Weed: None

Net Weight: 5.50 Lbs PLS 7.97 Lbs Bulk

Coverage: 2 Acres

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Ship To:  
Slater Seeding  
BRANDON - 775-777-5570  
Hold at Dock  
Gallup, NM

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: Broadcast Mix

1-15437

Mix # 111112

Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
40.04	ROCKY MOUNTAIN BEEPLANT	VNS	94 -TZ	CO
13.21	RUBBER RABBITBRUSH	VNS	95 -TZ	UT
7.47	YELLOW PRAIRIE CONEFLOWER	Stillwater	84 + D + 84	WA
7.13	SCARLET GLOBEMALLOW	VNS	98 -TZ	UT
6.47	ALKALI SACATON	VNS	97 -TZ	NM

0.04 Other Crop Date Tested 23-MAY-12  
25.58 Inert Matter % Hard Seed 0.00  
0.08 Weed Seed Noxious Weed None

Net Weight 5.50 Lbs PLS 7.97 Lbs Bulk

Coverage: 2 Acres

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Hold at Dock  
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Ship To  
Slater Seeding  
BRANDON - 775-777-5570  
Hold at Dock  
Gallup, NM

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

13 of 14

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

100

Mix Name: broadcast

1-15110

Mix Name: broadcast

1-151

Mix # 110369

Church Rock Mine

Mix # 110369

Church Rock Min

% Pure	Common Name	Variety	G + D or H	Origin
13.93	WINTERWIT	VNS	81 -7Z	NM
12.94	MEXICAN CLIFFROSE	VNS	90 -7Z	UT
11.51	LEWIS BLUE FLAX	Appar	99 -7Z	WA
9.80	DESERT GLOBEMALLOW	VNS	98	CA
5.94	PALMER PENSTEMON	VNS	95 -7Z	NV
5.76	SAND DROPSEED	VNS	98 -7Z	CO
4.80	ROCKY MOUNTAIN PENSTEMON	VNS	45 + 13 + 55	OR
2.95	WYOMING BIG SAGEBRUSH	VNS	95 -7Z	ID

0.02 Other Crop Date Tested 10-MAY-12  
11.99 Inert Matter % Hard Seed 0.00  
0.02 Weed Seed  
Noxious Weed: None

Net Weight: 15.73 Lbs PLS 20.59 Lbs Bulk  
Rice Hulls 6.00 Lbs Bulk

Coverage: 2 Acres

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0.02 Weed Seed  
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Ship To  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location in  
Gallup

Ship To  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location in  
Gallup

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043  
Mix Name: broadcast  
Mix # 110369

1-15110  
Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
13.93	WINTERWIT	VNS	81 -7Z	NM
12.94	MEXICAN CLIFFROSE	VNS	90 -7Z	UT
11.51	LEWIS BLUE FLAX	Appar	99 -7Z	WA
9.80	DESERT GLOBEMALLOW	VNS	98	CA
5.94	PALMER PENSTEMON	VNS	95 -7Z	NV
5.76	SAND DROPSEED	VNS	98 -7Z	CO
4.80	ROCKY MOUNTAIN PENSTEMON	VNS	45 + 13 + 55	OR
2.95	WYOMING BIG SAGEBRUSH	VNS	95 -7Z	ID

0.02 Other Crop Date Tested 10-MAY-12  
11.99 Inert Matter % Hard Seed 0.00  
0.02 Weed Seed  
Noxious Weed: None

Net Weight: 15.73 Lbs PLS 20.59 Lbs Bulk  
Rice Hulls 6.00 Lbs Bulk

Coverage: 2 Acres

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Ship To  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location in  
Gallup  
Call Up Nki 87501

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

7 of 14

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

90

Mix Name: broadcast

1-15110

Mix Name: broadcast

1-151

Mix # 110369

Church Rock Mine

Mix # 110369

Church Rock Mine

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5.94	PALMER PENSTEMON	VNS	95-7Z	NV
3.76	SAND DROPSEED	VNS	98-7Z	CO
4.80	ROCKY MOUNTAIN PENSTEMON	VNS	45 + 13 + 58	OR
2.95	WYOMING BIG SAGEBRUSH	VNS	95-7Z	ID

0.02 Other Crop Date Tested 10-MAY-12

11.99 Inert Matter % Hard Seed 0.00

0.02 Weed Seed

Noxious Weed: None

Net Weight 15.75 Lbs PLS 20.59 Lbs Bulk  
Rice Hulls 8.00 Lbs Bulk

Coverage: 2 Acres

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Ship To  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location in

Ship To  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location in

8 of 14

1-15110

Church Rock Mine

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0.02 Weed Seed

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Ship To  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location in

Gallup, NM 87301

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

3 of 14

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

12 of 14

Mix Name: broadcast

1-15110

Mix # 110369

Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
13.93	WINTERPAT	VNS	91 -7Z	NM
12.54	MEXICAN CLIFFROSE	VNS	90 -7Z	UT
11.51	LEWIS BLUE FLAX	Appar	98 -7Z	WA
8.60	DESERT GLOBEMALLOW	VNS	98	CA
5.94	PALMER PENSTEMON	VNS	95 -7Z	NV
5.78	SAND DROPSOED	VNS	96 -7Z	CO
4.80	ROCKY MOUNTAIN PENSTEMON	VNS	45 + 13 = 58	OR
2.95	WYOMING BIG SAGEBRUSH	VNS	95 -7Z	ID

0.02 Other Crop Date Tested 10-MAY-12  
11.39 Inert Matter % Hard Seed 0.00  
0.02 Weed Seed

Noxious Weed: None

Net Weight: 15.73 Lbs PLS 20.50 Lbs Bulk  
Rice Hulls 6.00 Lbs Bulk

Coverage: 2 Acres

Mix Name: broadcast

1-15110

Mix # 110369

Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
13.93	WINTERPAT	VNS	91 -7Z	NM
12.54	MEXICAN CLIFFROSE	VNS	90 -7Z	UT
11.51	LEWIS BLUE FLAX	Appar	98 -7Z	WA
8.60	DESERT GLOBEMALLOW	VNS	98	CA
5.94	PALMER PENSTEMON	VNS	95 -7Z	NV
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4.80	ROCKY MOUNTAIN PENSTEMON	VNS	45 + 13 = 58	OR
2.95	WYOMING BIG SAGEBRUSH	VNS	95 -7Z	ID

0.02 Other Crop Date Tested 10-MAY-12  
11.39 Inert Matter % Hard Seed 0.00  
0.02 Weed Seed

Noxious Weed: None

Net Weight: 15.73 Lbs PLS 20.50 Lbs Bulk  
Rice Hulls 6.00 Lbs Bulk

Coverage: 2 Acres

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Ship To  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location In  
Gallup

Ship To  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location In  
Gallup

2 of 14

1-15110  
Church Rock Mine  
Mix Name: broadcast  
Mix # 110369

% Pure	Common Name	Variety	G + D or H	Origin
13.93	WINTERPAT	VNS	91 -7Z	NM
12.54	MEXICAN CLIFFROSE	VNS	90 -7Z	UT
11.51	LEWIS BLUE FLAX	Appar	98 -7Z	WA
8.60	DESERT GLOBEMALLOW	VNS	98	CA
5.94	PALMER PENSTEMON	VNS	95 -7Z	NV
5.78	SAND DROPSOED	VNS	96 -7Z	CO
4.80	ROCKY MOUNTAIN PENSTEMON	VNS	45 + 13 = 58	OR
2.95	WYOMING BIG SAGEBRUSH	VNS	95 -7Z	ID

0.02 Other Crop Date Tested 10-MAY-12  
11.39 Inert Matter % Hard Seed 0.00  
0.02 Weed Seed

Noxious Weed: None

Net Weight: 15.73 Lbs PLS 20.50 Lbs Bulk  
Rice Hulls 6.00 Lbs Bulk

Coverage: 2 Acres

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Ship To  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location In  
Gallup  
Gallup, NM 87301

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

5 of 14

Mix Name: broadcast  
Mix # 110369

1-15110  
Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
13.93	WINTERPAT	VNS	81 -TZ	NM
12.64	MEXICAN CLIFFROSE	VNS	90 -TZ	UT
11.51	LEWIS BLUE FLAX	Appar	98 -TZ	WA
9.60	DESERT GLOBEMALLOW	VNS	98	CA
9.54	PALMER PENSTEMON	VNS	95 -TZ	NV
9.76	SAND DROPSOED	VNS	98 -TZ	CO
4.80	ROCKY MOUNTAIN PENSTEMON	VNS	45 + 13 + 58	OR
2.95	WYOMING BIG SAGEBRUSH	VNS	95 -TZ	ID

0.02 Other Crop Date Tested 10-MAY-12  
11.39 Inert Matter % Hard Seed 0.00  
0.02 Weed Seed Noxious Weed None

Net Weight 5.73 Lbs PLS 20.59 Lbs Bulk  
Rice Hulls 6.00 Lbs Bulk

Coverage: 2 Acres

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Ship To  
Slater Seeding  
BRANDON - 775-777-5670 775-777-5570

1-15110  
Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
13.93	WINTERPAT	VNS	81 -TZ	NM
12.64	MEXICAN CLIFFROSE	VNS	90 -TZ	UT
11.51	LEWIS BLUE FLAX	Appar	98 -TZ	WA
9.60	DESERT GLOBEMALLOW	VNS	98	CA
9.54	PALMER PENSTEMON	VNS	95 -TZ	NV
9.76	SAND DROPSOED	VNS	98 -TZ	CO
4.80	ROCKY MOUNTAIN PENSTEMON	VNS	45 + 13 + 58	OR
2.95	WYOMING BIG SAGEBRUSH	VNS	95 -TZ	ID

0.02 Other Crop Date Tested 10-MAY-12  
11.39 Inert Matter % Hard Seed 0.00  
0.02 Weed Seed Noxious Weed None

Net Weight 5.73 Lbs PLS 20.59 Lbs Bulk  
Rice Hulls 6.00 Lbs Bulk

Coverage: 2 Acres

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Ship To  
Slater Seeding  
BRANDON - 775-777-5670 775-777-5570  
Call For Weeding Literature in  
Gallup  
Gallup, NM 87301

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

6 of 14

Mix Name: broadcast  
Mix # 110369

1-15110  
Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
13.93	WINTERPAT	VNS	81 -TZ	NM
12.64	MEXICAN CLIFFROSE	VNS	90 -TZ	UT
11.51	LEWIS BLUE FLAX	Appar	98 -TZ	WA
9.60	DESERT GLOBEMALLOW	VNS	98	CA
9.54	PALMER PENSTEMON	VNS	95 -TZ	NV
9.76	SAND DROPSOED	VNS	98 -TZ	CO
4.80	ROCKY MOUNTAIN PENSTEMON	VNS	45 + 13 + 58	OR
2.95	WYOMING BIG SAGEBRUSH	VNS	95 -TZ	ID

0.02 Other Crop Date Tested 10-MAY-12  
11.39 Inert Matter % Hard Seed 0.00  
0.02 Weed Seed Noxious Weed None

Net Weight 5.73 Lbs PLS 20.59 Lbs Bulk  
Rice Hulls 6.00 Lbs Bulk

Coverage: 2 Acres

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From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

1 of 14

Mix Name: broadcast  
Mix # 110369

1-15110  
Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
18.93	WINTERPAT	VNS	81 -TZ	NM
12.54	MEXICAN CLIFFROSE	VNS	90 -TZ	UT
11.51	LEWIS BLUE FLAX	Appar	98 -TZ	WA
8.60	DESERT GLOBEMALLOW	VNS	98	CA
5.94	PALMER PENSTEMON	VNS	95 -TZ	NV
5.76	SAND DROPSEED	VNS	98 -TZ	CO
4.80	ROCKY MOUNTAIN PENSTEMON	VNS	45 + 13 + 55	OR
2.95	WYOMING BIG SAGEBRUSH	VNS	95 -TZ	ID

0.02 Other Crop Date Tested 10-MAY-12  
11.39 Inert Matter % Hard Seed 0.00  
0.02 Weed Seed Noxious Weed None

Net Weight 15.75 Lbs PLS 20.59 Lbs Bulk

Rice Hulls 8.00 Lbs Bulk

Coverage: 2 Acres

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Ship To  
Slater Seeding  
BRANDON - 775-777-6570 775-777-6570  
Call For Meeting Location in  
Gallup  
Gallup NM 87301

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

14 of

Mix Name: broadcast  
Mix # 110369

1-151  
Church Rock Min

% Pure	Common Name	Variety	G + D or H	Origin
18.93	WINTERPAT	VNS	81 -TZ	NM
12.54	MEXICAN CLIFFROSE	VNS	90 -TZ	UT
11.51	LEWIS BLUE FLAX	Appar	98 -TZ	WA
8.60	DESERT GLOBEMALLOW	VNS	98	CA
5.94	PALMER PENSTEMON	VNS	95 -TZ	NV
5.76	SAND DROPSEED	VNS	98 -TZ	CO
4.80	ROCKY MOUNTAIN PENSTEMON	VNS	45 + 13 + 55	OR
2.95	WYOMING BIG SAGEBRUSH	VNS	95 -TZ	ID

0.02 Other Crop Date Tested 10-MAY-12  
11.39 Inert Matter % Hard Seed 0.00  
0.02 Weed Seed Noxious Weed None

Net Weight 15.75 Lbs PLS 20.59 Lbs Bulk

Rice Hulls 8.00 Lbs Bulk

Coverage: 2 Acres

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Ship To  
Slater Seeding  
BRANDON - 775-777-6570 775-777-6570  
Call For Meeting Location in  
Gallup  
Gallup NM 87301

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: Drill Mix 1-15437

Mix # 111113 Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
73.37	FOURWING SALT BUSH	VNS	69 -TZ	NM
19.18	BLUE GRAMA	Bird's Eye	88 -TZ	WY

0.00 Other Crop Date Tested: 17-JAN-12  
 7.45 Inert Matter % Hard Seed: 0.00  
 0.00 Weed Seed Noxious Weed: None

Net Weight: 4.00 Lbs PLS 5.93 Lbs Bulk

Coverage: 2 Acres

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Ship To:  
Slaters Seeding  
BRANDON - 775-777-5570  
Hold at Dock  
Gallup, NM

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: Drill Mix 1-15437

Mix # 111113 Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
73.37	FOURWING SALT BUSH	VNS	69 -TZ	NM
19.18	BLUE GRAMA	Bird's Eye	88 -TZ	WY

0.00 Other Crop Date Tested: 17-JAN-12  
 7.45 Inert Matter % Hard Seed: 0.00  
 0.00 Weed Seed Noxious Weed: None

Net Weight: 4.00 Lbs PLS 5.93 Lbs Bulk

Coverage: 2 Acres

NOTICE TO BUYER LIMITATIONS OF WARRANTIES AND REMEDIES

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Slaters Seeding  
BRANDON - 775-777-5570  
Hold at Dock  
Gallup, NM

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: Drill Mix 1-15437  
Church Rock Mine - add  
Mix # 111113

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19.18	BLUE GRAMA	Bird's Eye	88 -TZ	WY

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Slaters Seeding  
BRANDON - 775-777-5570  
Hold at Dock  
Gallup, NM

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: Drill Mix 1-15437

Mix Name: Drill Mix

1-15437

Mix # 111113 Church Rock Mine - add

Mix # 111113

Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
73.37	FOURRING SALTBUSSH	VNS	69 -TZ	NM
19.18	BLUE GRAMA	Bird's Eye	88 -TZ	WY

0.00 Other Crop Date Tested 17-JAN-12  
 7.45 Inert Matter % Hard Seed 0.00  
 0.00 Weed Seed Noxious Weed None

Net Weight: 4.00 Lbs PLS 5.93 Lbs Bulk  
 Coverage: 2 Acres

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19.18	BLUE GRAMA	Bird's Eye	88 -TZ	WY

0.00 Other Crop Date Tested 17-JAN-12  
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Ship To  
 State Seeding  
 BRANDON - 775-777-5570  
 Hold at Dock  
 Gallup, NM

Ship To  
 State Seeding  
 BRANDON - 775-777-5570  
 Hold at Dock  
 Gallup, NM

From: Granite Seed - Lehi  
 1697 W 2100 N  
 Lehi, UT 84043

Mix Name: Drill Mix 1-15437  
 Mix # 111113 Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
73.37	FOURRING SALTBUSSH	VNS	69 -TZ	NM
19.18	BLUE GRAMA	Bird's Eye	88 -TZ	WY

0.00 Other Crop Date Tested 17-JAN-12  
 7.45 Inert Matter % Hard Seed 0.00  
 0.00 Weed Seed Noxious Weed None

Net Weight: 4.00 Lbs PLS 5.93 Lbs Bulk  
 Coverage: 2 Acres

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Ship To  
 State Seeding  
 BRANDON - 775-777-5570  
 Hold at Dock  
 Gallup, NM

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 8404

7 of 11

Mix Name: Drill Mix 1-15437

Mix # 111113 Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
73.37	FOURWING SALTBU	VNS	89-TZ	NM
19.18	BLUE GRAMA	Bird's Eye	88-TZ	WY

0.00 Other Crop Date Tested 17-JAN-12  
 7.45 Inert Matter % Hard Seed 0.00  
 0.00 Weed Seed

Noxious Weed None

Net Weight 4.00 Lbs PLS 5.93 Lbs Bulk

Coverage: 2 Acres

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From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: Drill Mix  
MIX # 111113

1-15437  
Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
73.37	FOURWING SALTBU	VNS	89-TZ	NM
19.18	BLUE GRAMA	Bird's Eye	88-TZ	WY

0.00 Other Crop Date Tested 17-JAN-12  
 7.45 Inert Matter % Hard Seed 0.00  
 0.00 Weed Seed

Noxious Weed None

Net Weight 4.00 Lbs PLS 5.93 Lbs Bulk

Coverage: 2 Acres

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Ship To  
State Seeding  
BRANDON - 715-777-5570  
HOLD at Dock  
Gallop, WI

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

8 of 11

Mix Name: Drill Mix 1-15437

Mix # 111113 Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
73.37	FOURWING SALTBU	VNS	89-TZ	NM
19.18	BLUE GRAMA	Bird's Eye	88-TZ	WY

0.00 Other Crop Date Tested 17-JAN-12  
 7.45 Inert Matter % Hard Seed 0.00  
 0.00 Weed Seed

Noxious Weed None

Net Weight 4.00 Lbs PLS 5.93 Lbs Bulk

Coverage: 2 Acres

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From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

10 of 11

Mix Name: Drill Mix

1-15437

Mix # 111113

Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
73.37	FOURWING SALTBUSSH	VNS	69 -TZ	NM
19.18	BLUE GRAMA	Bird's Eye	88 -TZ	WY

0.00 Other Crop Date Tested 17-JAN-12

7.45 Inert Matter % Hard Seed 0.00

0.00 Weed Seed Noxious Weed None

Net Weight 4.00 Lbs PLS 5.93 Lbs Bulk

Coverage: 2 Acres

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Ship To  
Slater Seeding  
BRANDON - 775-777-5570  
Hold at Dock  
Gallup, NM

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

11 of 11

Mix Name: Drill Mix

1-15437

Mix # 111113

Church Rock Mine - add

% Pure	Common Name	Variety	G + D or H	Origin
73.37	FOURWING SALTBUSSH	VNS	69 -TZ	NM
19.18	BLUE GRAMA	Bird's Eye	88 -TZ	WY

0.00 Other Crop Date Tested 17-JAN-12

7.45 Inert Matter % Hard Seed 0.00

0.00 Weed Seed Noxious Weed None

Net Weight 4.00 Lbs PLS 5.93 Lbs Bulk

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Ship To  
Slater Seeding  
BRANDON - 775-777-5570  
Hold at Dock  
Gallup, NM

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: drill

1-15110

Mix # 110370

Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
19.41	WESTERN WHEATGRASS	Amba	95 -TZ	WA
13.81	INDIAN RICEGRASS	Rimrock	89 -TZ	MT
13.36	SIDECATS GRAMA	Vaughn	92 -TZ	NM
12.94	FOURWING SALT BUSH	High Elev	95 -TZ	WY
9.50	THICKSPIKE WHEATGRASS	Ontana	85 -12 = 97	OR
6.98	BLUE GRAMA	Bird's Eye	88 -TZ	WY
6.44	JAMES' GALLET	Viva	90 - 5.5 = 95.5	TX
3.53	BOTTLEBRUSH SQUIRRELTAIL	VNS	87 -TZ	WA

0.17 Other Crop Date Tested: 01-DEC-11  
13.70 Inert Matter % Hard Seed: 0.00  
0.15 Weed Seed  
Noxious Weed: crabgrass, large, banyardgrass, downy brome

Net Weight: 13.00 Lbs PLS 16.27 Lbs Bulk

Coverage: 2 Acres

**NOTICE TO BUYER LIMITATIONS OF WARRANTIES AND REMEDIES**

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From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: drill

1-15110

Mix # 110370

Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
19.41	WESTERN WHEATGRASS	Amba	95 -TZ	WA
13.81	INDIAN RICEGRASS	Rimrock	89 -TZ	MT
13.36	SIDECATS GRAMA	Vaughn	92 -TZ	NM
12.94	FOURWING SALT BUSH	High Elev	95 -TZ	WY
9.50	THICKSPIKE WHEATGRASS	Ontana	85 -12 = 97	OR
6.98	BLUE GRAMA	Bird's Eye	88 -TZ	WY
6.44	JAMES' GALLET	Viva	90 - 5.5 = 95.5	TX
3.53	BOTTLEBRUSH SQUIRRELTAIL	VNS	87 -TZ	WA

0.17 Other Crop Date Tested: 01-DEC-11  
13.70 Inert Matter % Hard Seed: 0.00  
0.15 Weed Seed  
Noxious Weed: crabgrass, large, banyardgrass, downy brome

Net Weight: 13.00 Lbs PLS 16.27 Lbs Bulk

Coverage: 2 Acres

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Ship To:  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570

Ship To:  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570

1-15110  
Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
19.41	WESTERN WHEATGRASS	Amba	95 -TZ	WA
13.81	INDIAN RICEGRASS	Rimrock	89 -TZ	MT
13.36	SIDECATS GRAMA	Vaughn	92 -TZ	NM
12.94	FOURWING SALT BUSH	High Elev	95 -TZ	WY
9.50	THICKSPIKE WHEATGRASS	Ontana	85 -12 = 97	OR
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6.44	JAMES' GALLET	Viva	90 - 5.5 = 95.5	TX
3.53	BOTTLEBRUSH SQUIRRELTAIL	VNS	87 -TZ	WA

0.17 Other Crop Date Tested: 01-DEC-11  
13.70 Inert Matter % Hard Seed: 0.00  
0.15 Weed Seed  
Noxious Weed: crabgrass, large, banyardgrass, downy brome  
Net Weight: 13.00 Lbs PLS 16.27 Lbs Bulk  
Coverage: 2 Acres

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Ship To:  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location in  
Callup: NW 87301

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: drill  
Mix # 110370

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: drill

Mix # 110370

1-15110

Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
19.41	WESTERN WHEATGRASS	Amba	95 -TZ	WA
13.81	INDIAN RICEGRASS	Rimrock	89 -TZ	MT
13.36	SIDE-OATS GRAMA	Vaughn	92 -TZ	NM
12.94	FOURWING SALT BUSH	High Elev	95 -TZ	WY
9.50	THICKSPIKE WHEATGRASS	Citana	85 -12 = 97	OR
6.98	BLUE GRAMA	Bird's Eye	88 -TZ	WY
6.44	JAMES' GALLETA	Viva	90 -5.5 = 95.5	TX
3.53	BOTTLEBRUSH SQUIRRELTAIL	VNS	87 -TZ	WA

0.17 Other Crop Date Tested 01-DEC-11  
13.70 Inert Matter % Hard Seed 0.00  
0.15 Weed Seed

Noxious Weed crabgrass, large, barnyardgrass, downy brome

Net Weight 13.00 Lbs PLS 16.27 Lbs Bulk

Coverage: 2 Acres

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Ship To:  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location in  
California

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: drill

Mix # 110370

1-15110

Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
19.41	WESTERN WHEATGRASS	Amba	95 -TZ	WA
13.81	INDIAN RICEGRASS	Rimrock	89 -TZ	MT
13.36	SIDE-OATS GRAMA	Vaughn	92 -TZ	NM
12.94	FOURWING SALT BUSH	High Elev	95 -TZ	WY
9.50	THICKSPIKE WHEATGRASS	Citana	85 -12 = 97	OR
6.98	BLUE GRAMA	Bird's Eye	88 -TZ	WY
6.44	JAMES' GALLETA	Viva	90 -5.5 = 95.5	TX
3.53	BOTTLEBRUSH SQUIRRELTAIL	VNS	87 -TZ	WA

0.17 Other Crop Date Tested 01-DEC-11  
13.70 Inert Matter % Hard Seed 0.00  
0.15 Weed Seed

Noxious Weed crabgrass, large, barnyardgrass, downy brome

Net Weight 13.00 Lbs PLS 16.27 Lbs Bulk

Coverage: 2 Acres

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Ship To:  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location in  
California

1-15110  
Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
19.41	WESTERN WHEATGRASS	Amba	95 -TZ	WA
13.81	INDIAN RICEGRASS	Rimrock	89 -TZ	MT
13.36	SIDE-OATS GRAMA	Vaughn	92 -TZ	NM
12.94	FOURWING SALT BUSH	High Elev	95 -TZ	WY
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6.44	JAMES' GALLETA	Viva	90 -5.5 = 95.5	TX
3.53	BOTTLEBRUSH SQUIRRELTAIL	VNS	87 -TZ	WA

0.17 Other Crop

Date Tested 01-DEC-11

13.70 Inert Matter

% Hard Seed 0.00

0.15 Weed Seed

Noxious Weed crabgrass, large, barnyardgrass, downy brome

Net Weight 13.00 Lbs PLS 16.27 Lbs Bulk

Coverage: 2 Acres

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Ship To:  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location in  
California  
Call/ub. NW. 87301

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: drill 1-15110  
Mix # 110370 Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
19.41	WESTERN WHEATGRASS	Amba	95 -TZ	WA
13.81	INDIAN RICEGRASS	Rimrock	89 -TZ	MT
13.36	SIDCOATS GRAMA	Vaughn	92 -TZ	NM
12.94	FOURMING SALTBUUSH	High Elev	95 -TZ	WY
9.50	THICKSPIKE WHEATGRASS	Critana	85 - 12 = 97	OR
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6.44	JAMES' GALLETÀ	Viva	90 - 5.5 = 95.5	TX
3.53	BOTTLEBRUSH SQUIRRELTAIL	VNS	87 -TZ	WA

0.17 Other Crop Date Tested 01-DEC-11  
13.70 Inert Matter % Hard Seed 0.00  
0.15 Weed Seed

Noxious Weed crabgrass, large, barmygrass, downy brome

Net Weight 13.00 Lbs PLS 16.27 Lbs Bulk

Coverage: 2 Acres

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Ship To:  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location In  
Gallup

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: drill 1-15110  
Mix # 110370 Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
19.41	WESTERN WHEATGRASS	Amba	95 -TZ	WA
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13.36	SIDCOATS GRAMA	Vaughn	92 -TZ	NM
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3.53	BOTTLEBRUSH SQUIRRELTAIL	VNS	87 -TZ	WA

0.17 Other Crop Date Tested 01-DEC-11  
13.70 Inert Matter % Hard Seed 0.00  
0.15 Weed Seed

Noxious Weed crabgrass, large, barmygrass, downy brome

Net Weight 13.00 Lbs PLS 16.27 Lbs Bulk

Coverage: 2 Acres

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Ship To:  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location In  
Gallup

1-15110  
Church Rock Mine

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: drill  
Mix # 110370

% Pure	Common Name	Variety	G + D or H	Origin
19.41	WESTERN WHEATGRASS	Amba	95 -TZ	WA
13.81	INDIAN RICEGRASS	Rimrock	89 -TZ	MT
13.36	SIDCOATS GRAMA	Vaughn	92 -TZ	NM
12.94	FOURMING SALTBUUSH	High Elev	95 -TZ	WY
9.50	THICKSPIKE WHEATGRASS	Critana	85 - 12 = 97	OR
6.98	BLUE GRAMA	Bird's Eye	88 -TZ	WY
6.44	JAMES' GALLETÀ	Viva	90 - 5.5 = 95.5	TX
3.53	BOTTLEBRUSH SQUIRRELTAIL	VNS	87 -TZ	WA

0.17 Other Crop Date Tested 01-DEC-11  
13.70 Inert Matter % Hard Seed 0.00  
0.15 Weed Seed

Noxious Weed crabgrass, large, barmygrass, downy brome

Net Weight 13.00 Lbs PLS 16.27 Lbs Bulk

Coverage: 2 Acres

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Ship To:  
Slater Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location In  
Gallup, NM 87301



From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: drill 1-15110

Mix # 110370 Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
13.81	WESTERN WHEATGRASS	Amba	95 -TZ	WA
13.81	INDIAN RICEGRASS	Rimrock	89 -TZ	MT
13.36	SIDECATS GRAMA	Vaughn	92 -TZ	NM
12.94	FOURWING SALTBUUSH	High Elev	95 -TZ	WY
9.50	THICKSPIKE WHEATGRASS	Ontana	85 - 12 = 97	OR
6.98	BLUE GRAMA	Bird's Eye	88 -TZ	WY
6.44	JAMES' GALLETA	Viva	90 - 5.5 = 95.5	TX
3.53	BOTTLEBRUSH SQUIRRELTAIL	VNS	87 -TZ	WA

0.17 Other Crop Date Tested 01-DEC-11  
13.70 Inert Matter % Hard Seed 0.00  
0.15 Weed Seed  
Noxious Weed crabg ass, large, bamyardgrass downy brome

Net Weight: 13.00 Lbs PLS 16.27 Lbs Bulk

Coverage: 2 Acres

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Ship To:  
Sister Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location in  
Gallup

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: drill 1-15110

Mix # 110370 Church Rock Mine

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3.53	BOTTLEBRUSH SQUIRRELTAIL	VNS	87 -TZ	WA

0.17 Other Crop Date Tested 01-DEC-11  
13.70 Inert Matter % Hard Seed 0.00  
0.15 Weed Seed  
Noxious Weed crabg ass, large, bamyardgrass downy brome

Net Weight: 13.00 Lbs PLS 16.27 Lbs Bulk

Coverage: 2 Acres

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Ship To:  
Sister Seeding  
BRANDON - 775-777-5570 775-777-5570  
Call For Meeting Location in  
Gallup

1-15110  
Church Rock Mine

Mix Name: drill  
Mix # 110370

% Pure	Common Name	Variety	G + D or H	Origin
13.81	WESTERN WHEATGRASS	Amba	95 -TZ	WA
13.81	INDIAN RICEGRASS	Rimrock	89 -TZ	MT
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0.17 Other Crop Date Tested 01-DEC-11  
13.70 Inert Matter % Hard Seed 0.00  
0.15 Weed Seed  
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Net Weight: 13.00 Lbs PLS 16.27 Lbs Bulk

Coverage: 2 Acres

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Ship To:  
Sister Seeding  
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Call For Meeting Location in  
Gallup  
Gallup, NM 87301

From: Granite Seed - Lehi  
1697 W 2100 N  
Lehi, UT 84043

Mix Name: drill

1-15110

Mix # 110370

Church Rock Mine

% Pure	Common Name	Variety	G + D or H	Origin
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0.17 Other Crop Date Tested 01-DEC-11

15.70 Inert Matter % Hard Seed 0.00

0.15 Weed Seed Noxious Weed crabgrass, large, balfyardgrass, downy, broms

Net Weight 13.00 Lbs PLS 16.27 Lbs Bulk

Coverage: 2 Acres

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1-15110

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15.70 Inert Matter % Hard Seed 0.00

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Net Weight 13.00 Lbs PLS 16.27 Lbs Bulk

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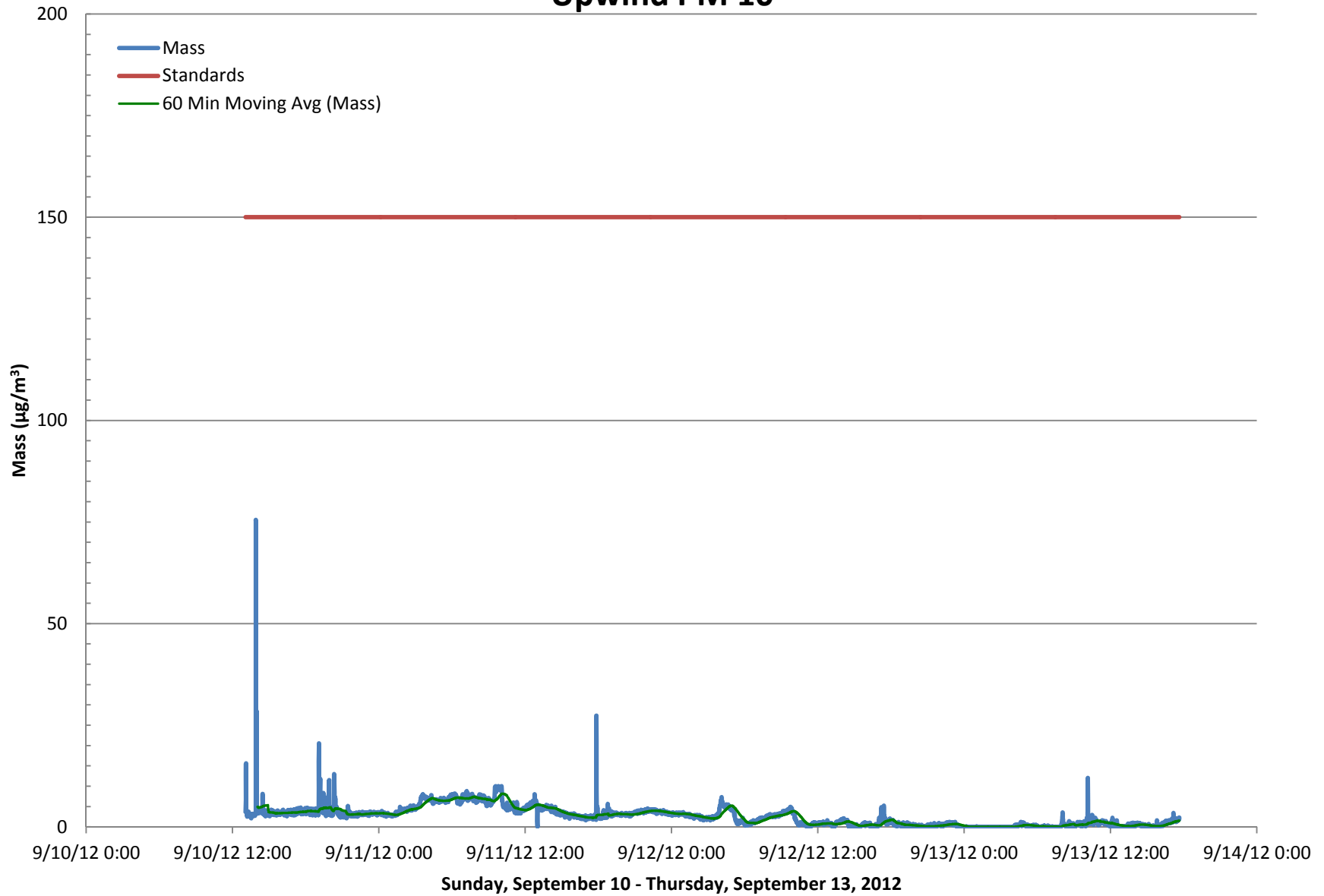
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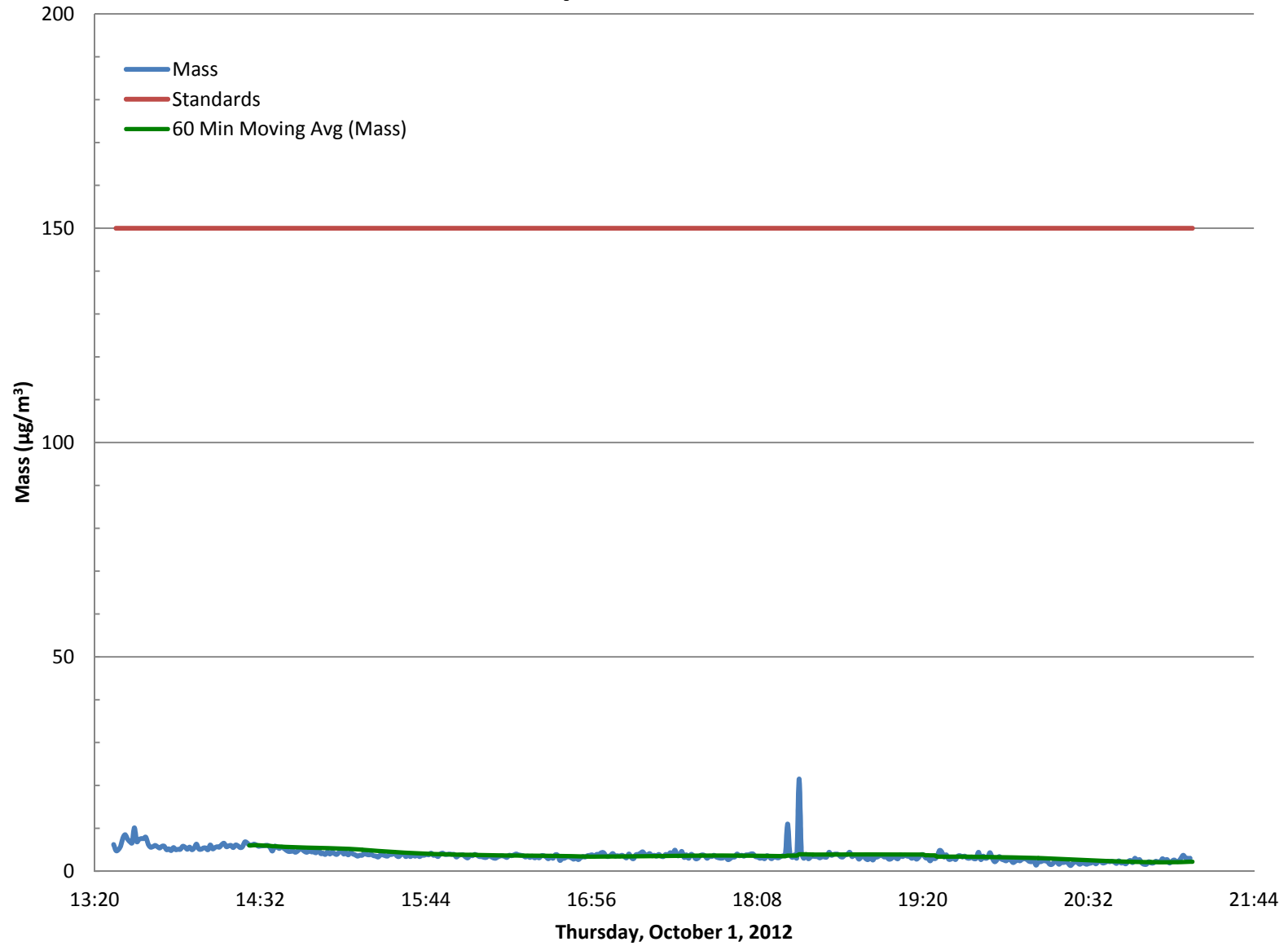
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BRANDON - 775-777-5570 775-777-5570  
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**APPENDIX F**  
**ENVIRONMENTAL MONITORING DATA**

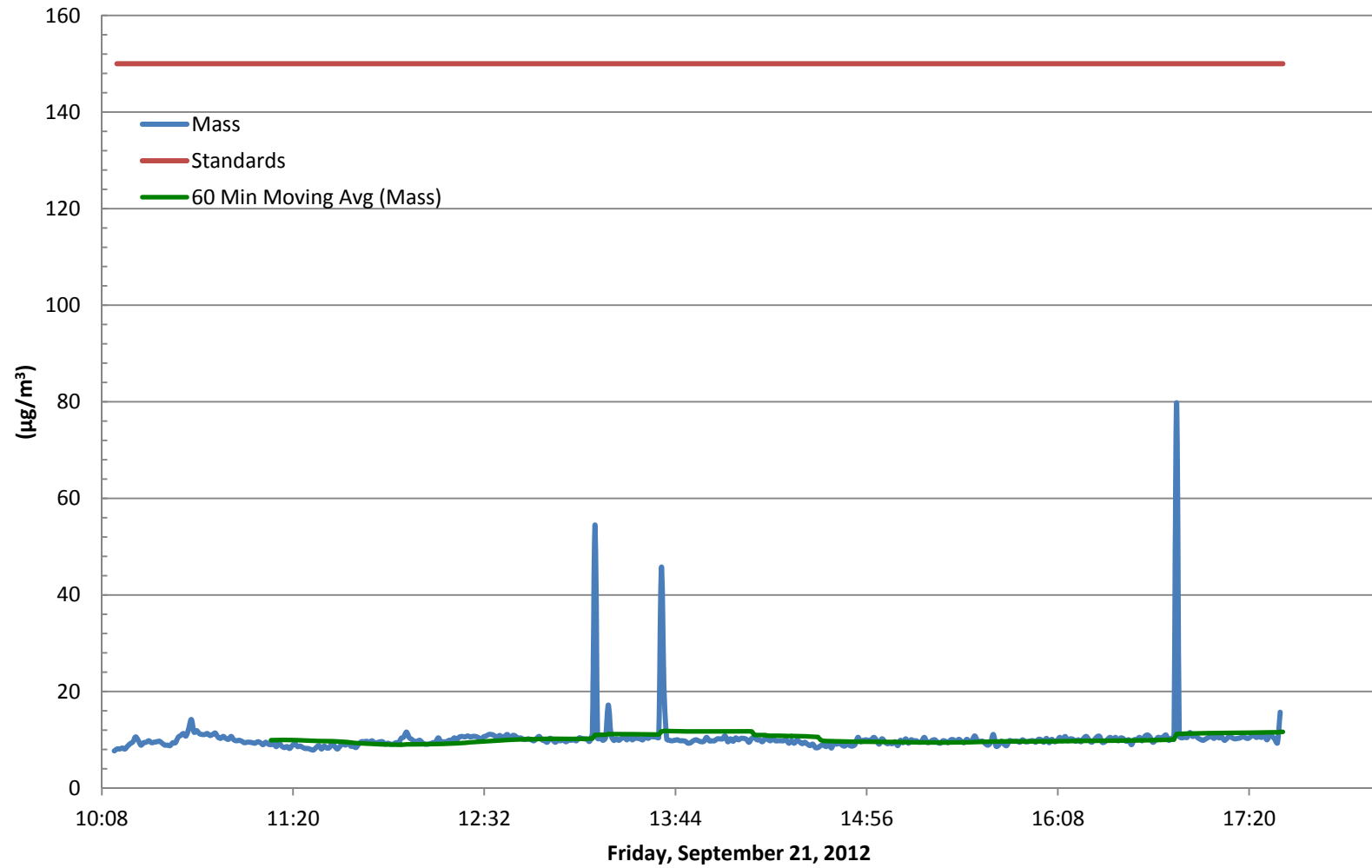
# Airborne Dust Monitoring Upwind PM 10



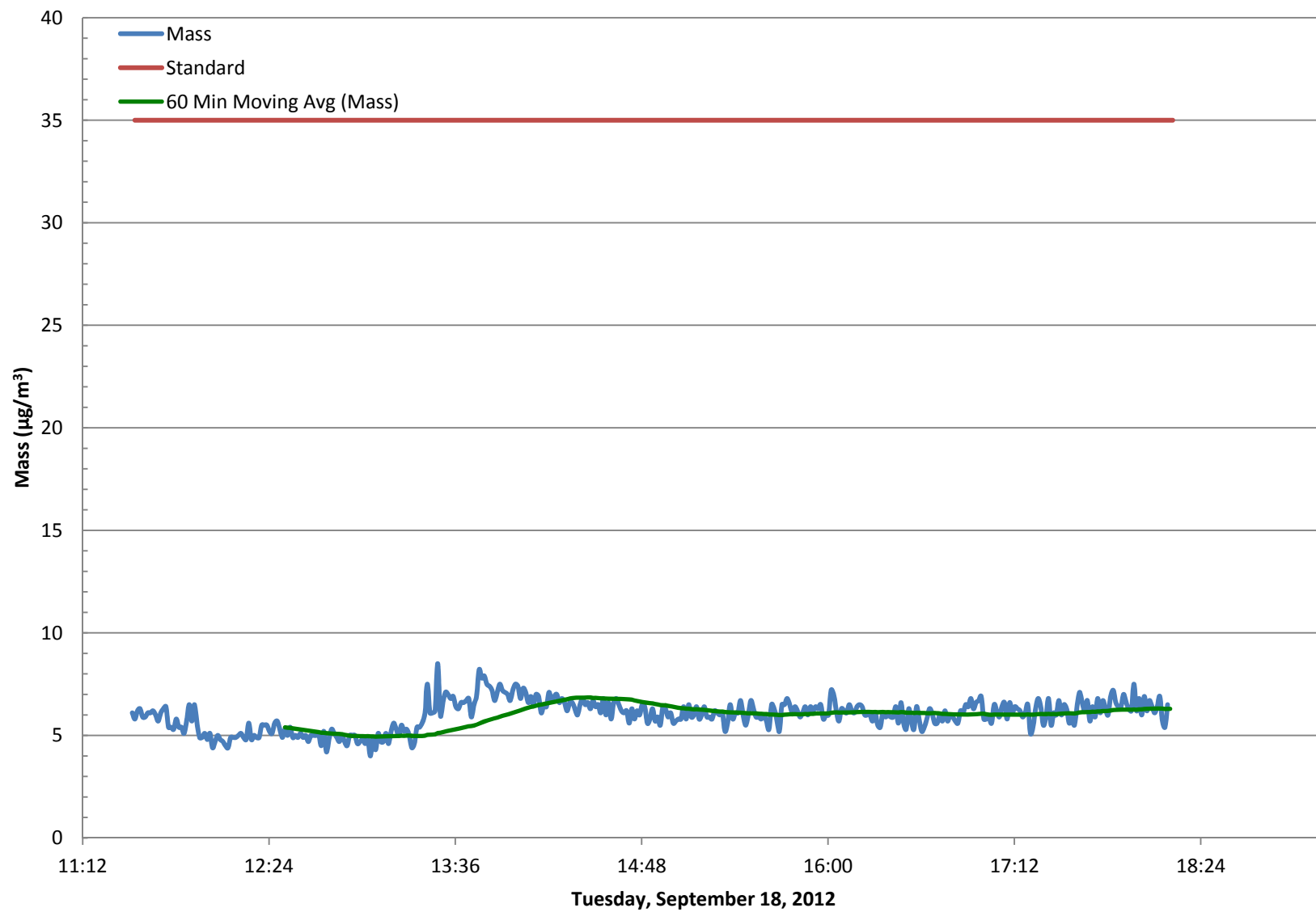
# Airborne Dust Monitoring Upwind PM 10



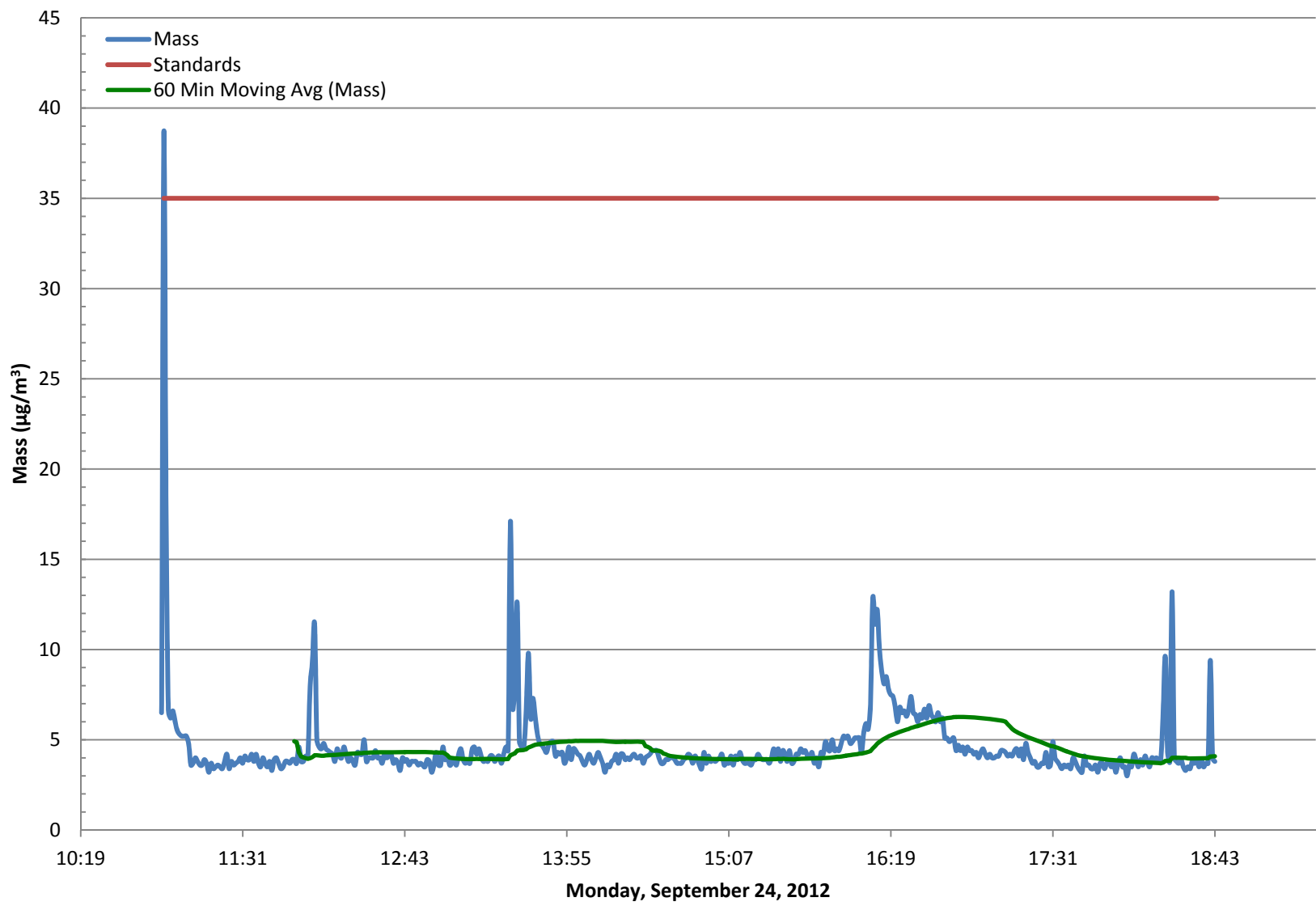
# Airborne Dust Monitoring Upwind PM 10



# Airborne Dust Monitoring Upwind PM 2.5

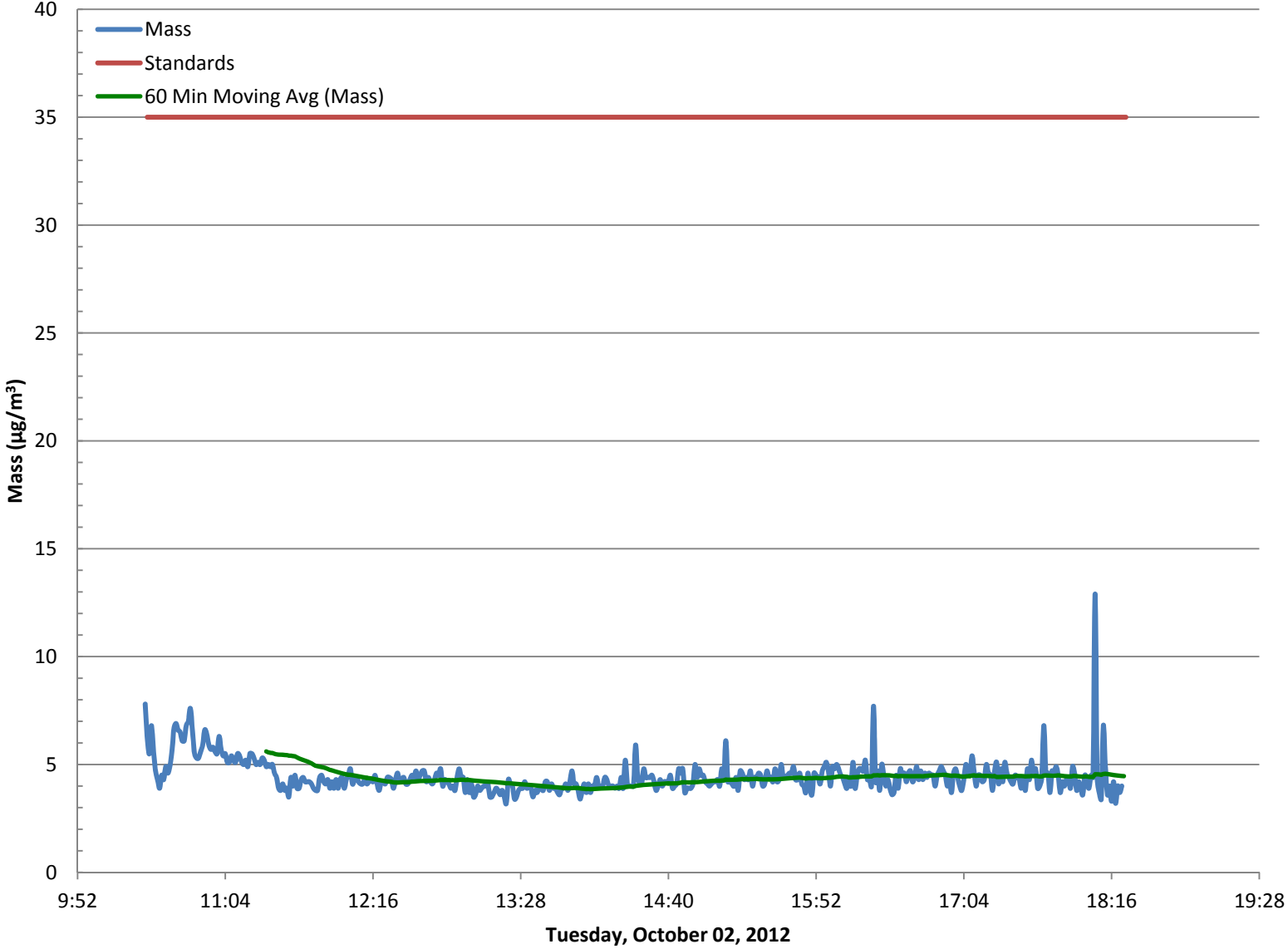


# Airborne Dust Monitoring Upwind PM 2.5

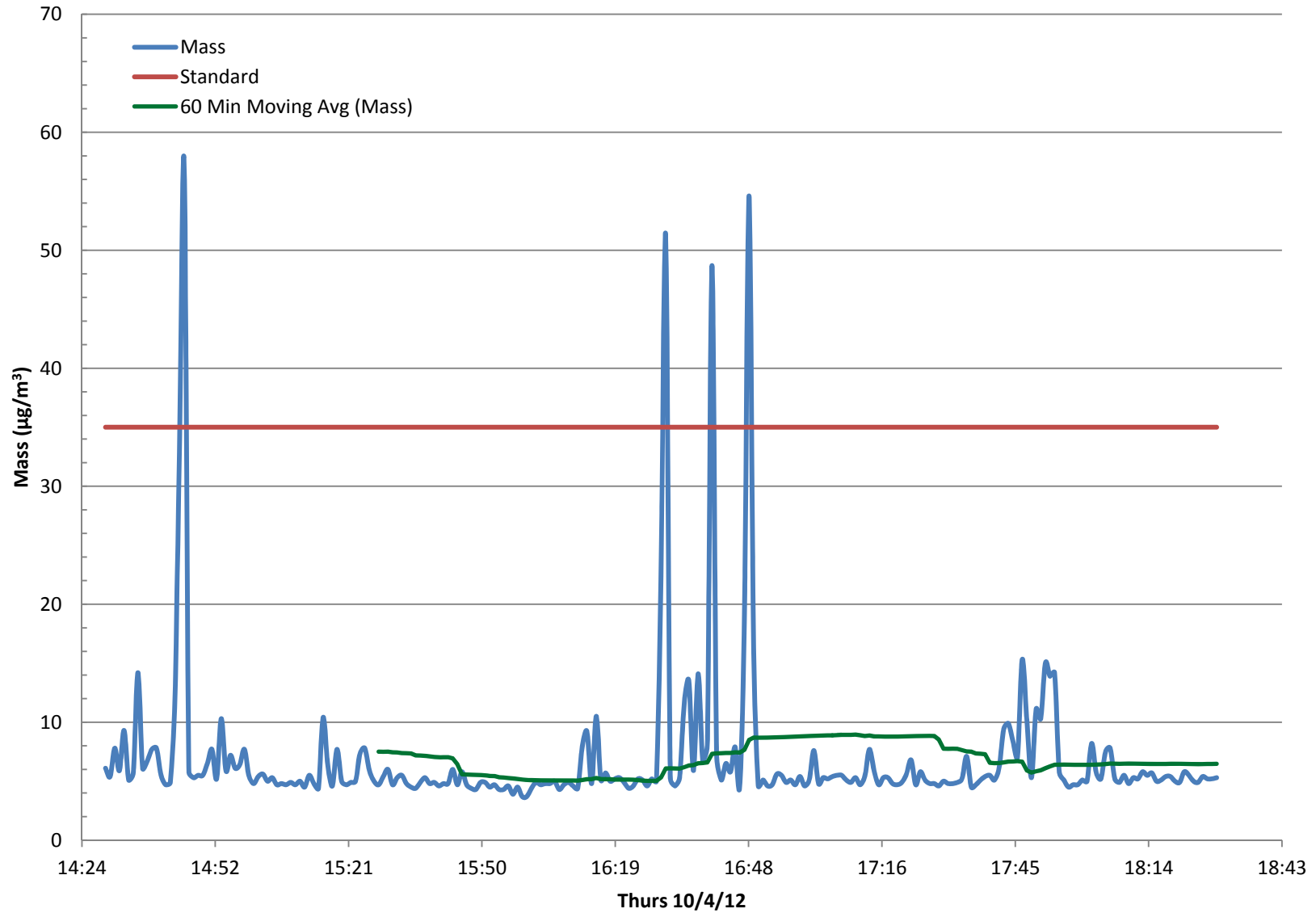




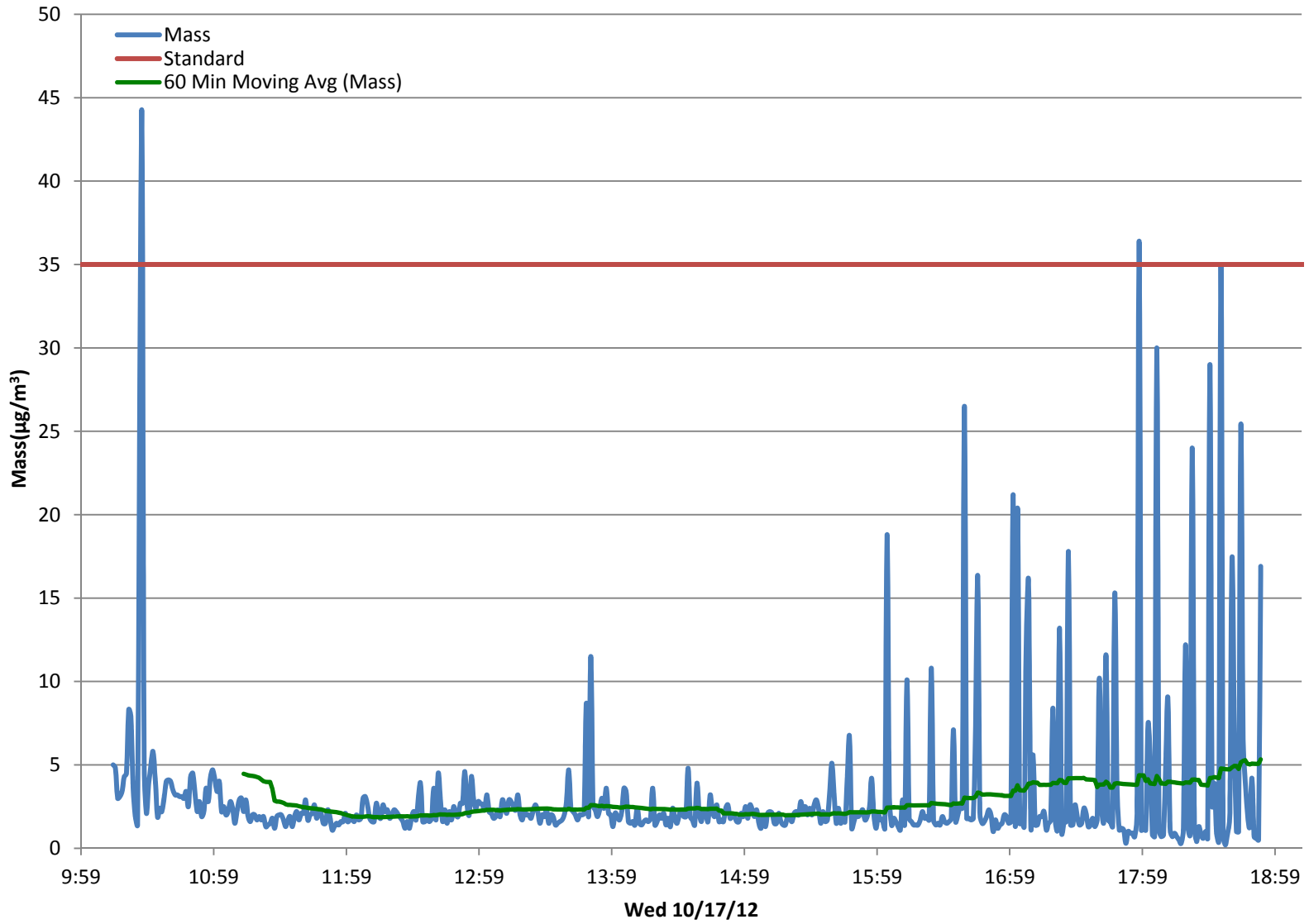
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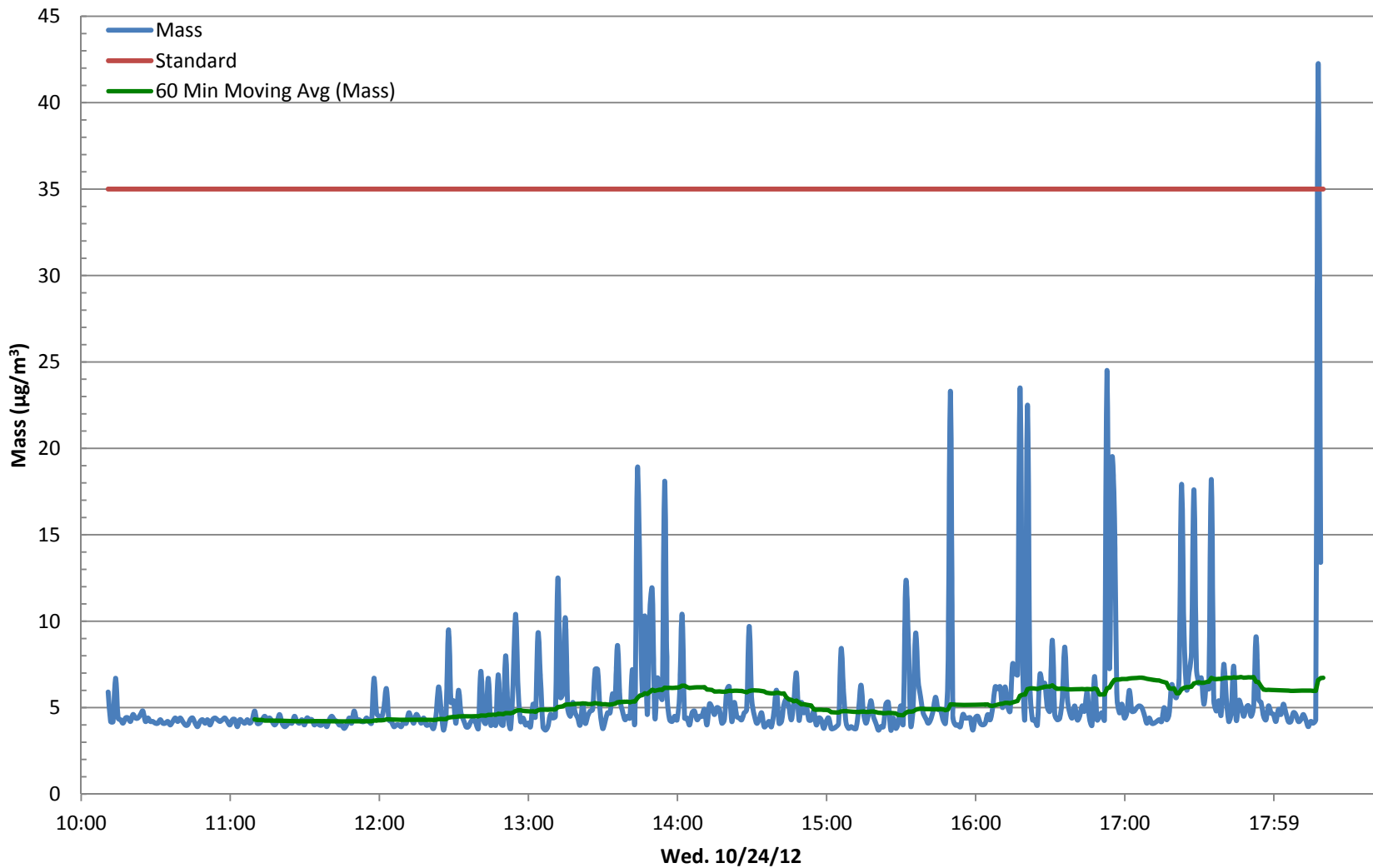
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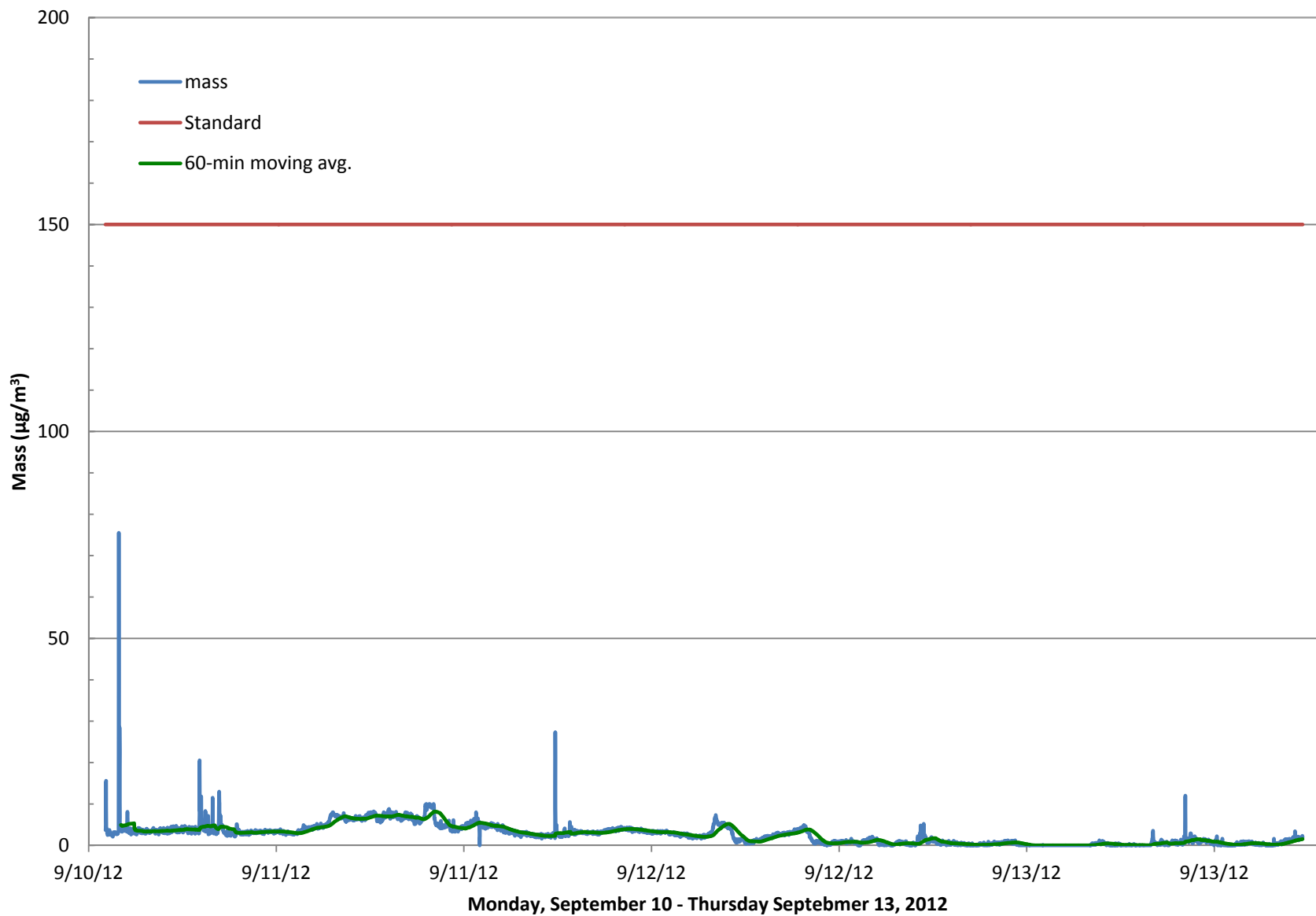
# Airborne Dust Monitoring Bus Stop PM 2.5



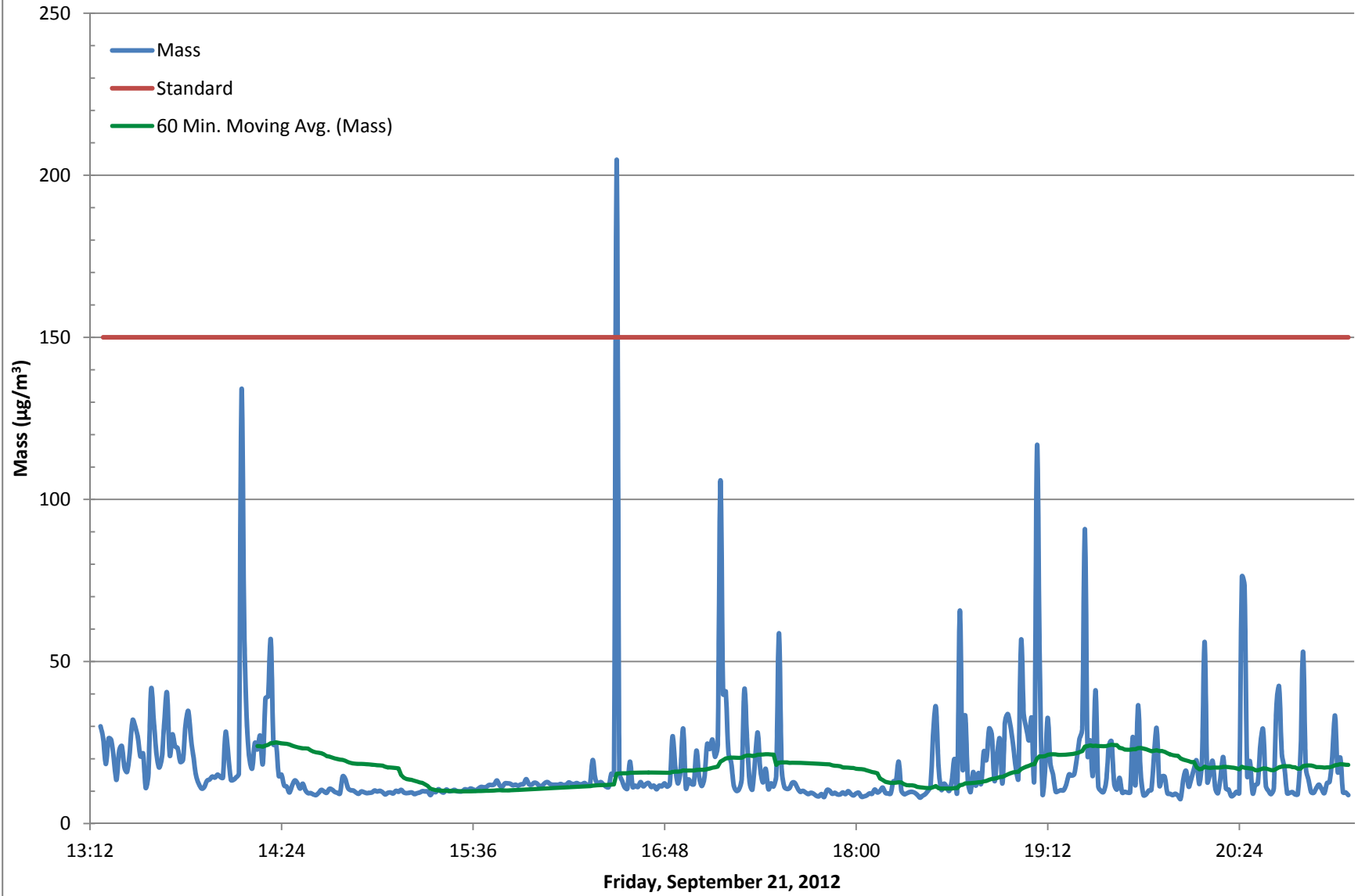
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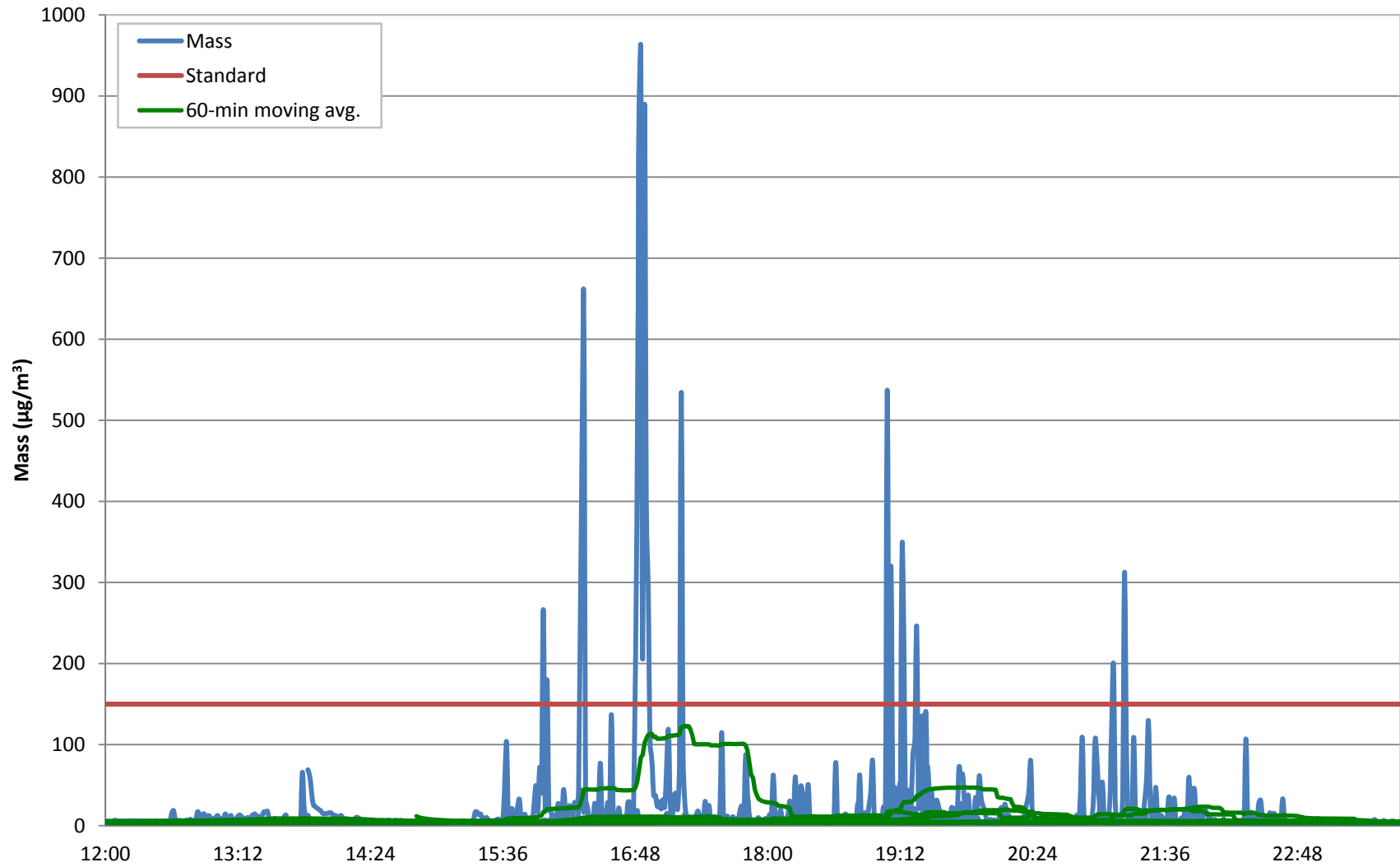
# Airborne Dust Monitoring Downwind PM10



# Airborne Dust Monitoring Downwind PM 10

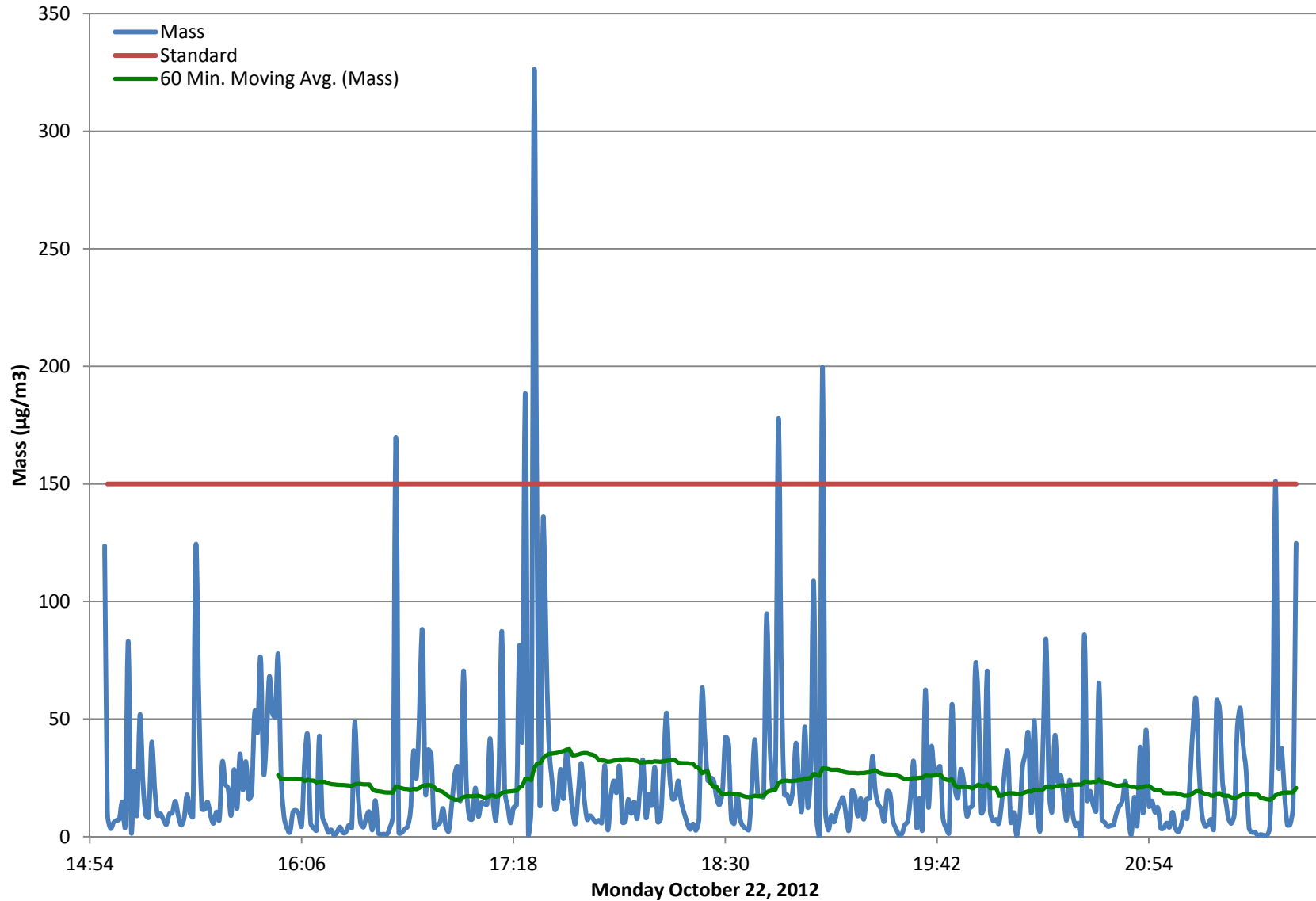


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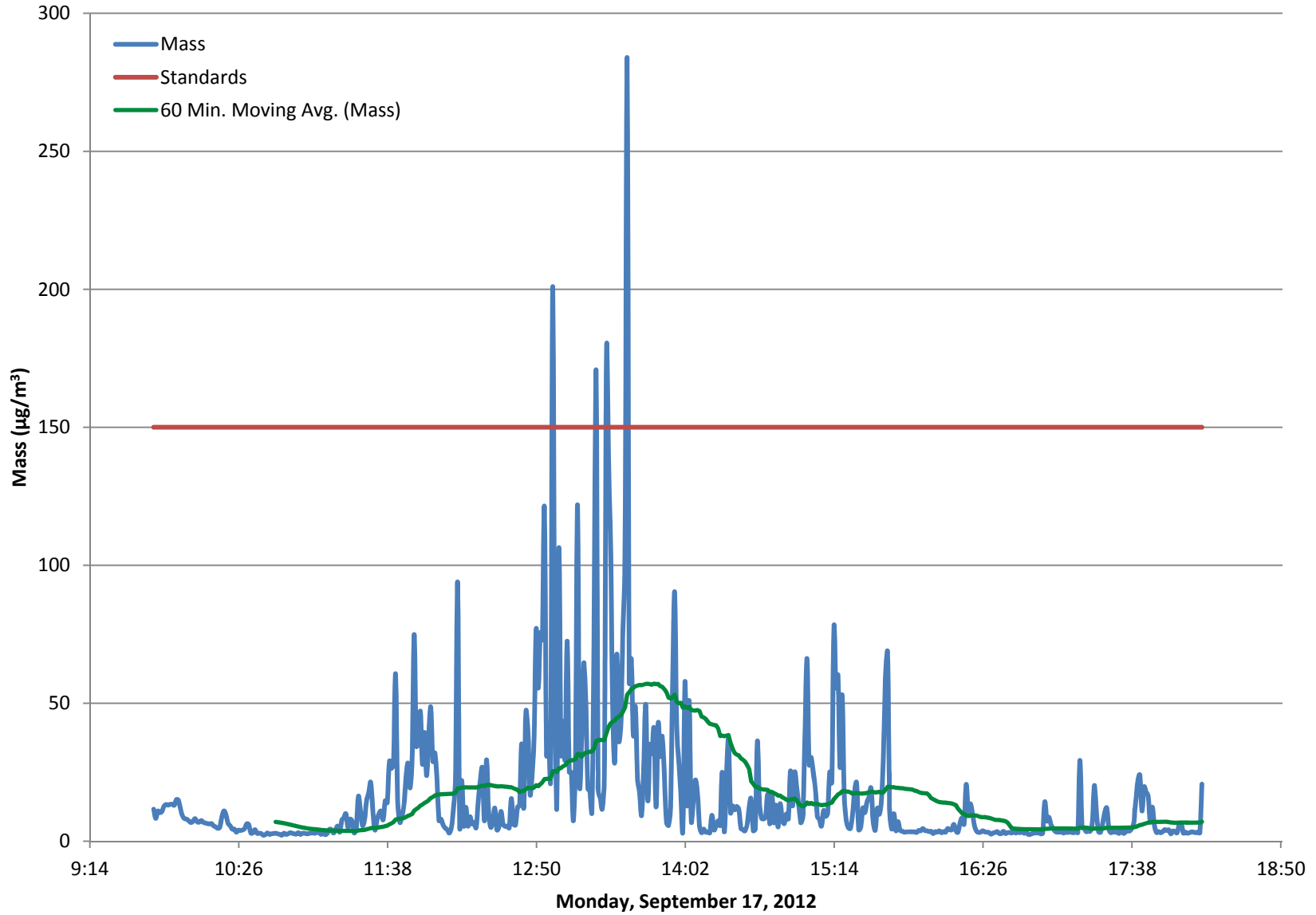
Monday, September 24 - Thursday, September 27, 2012

# Airborne Dust Monitoring Downwind PM 10

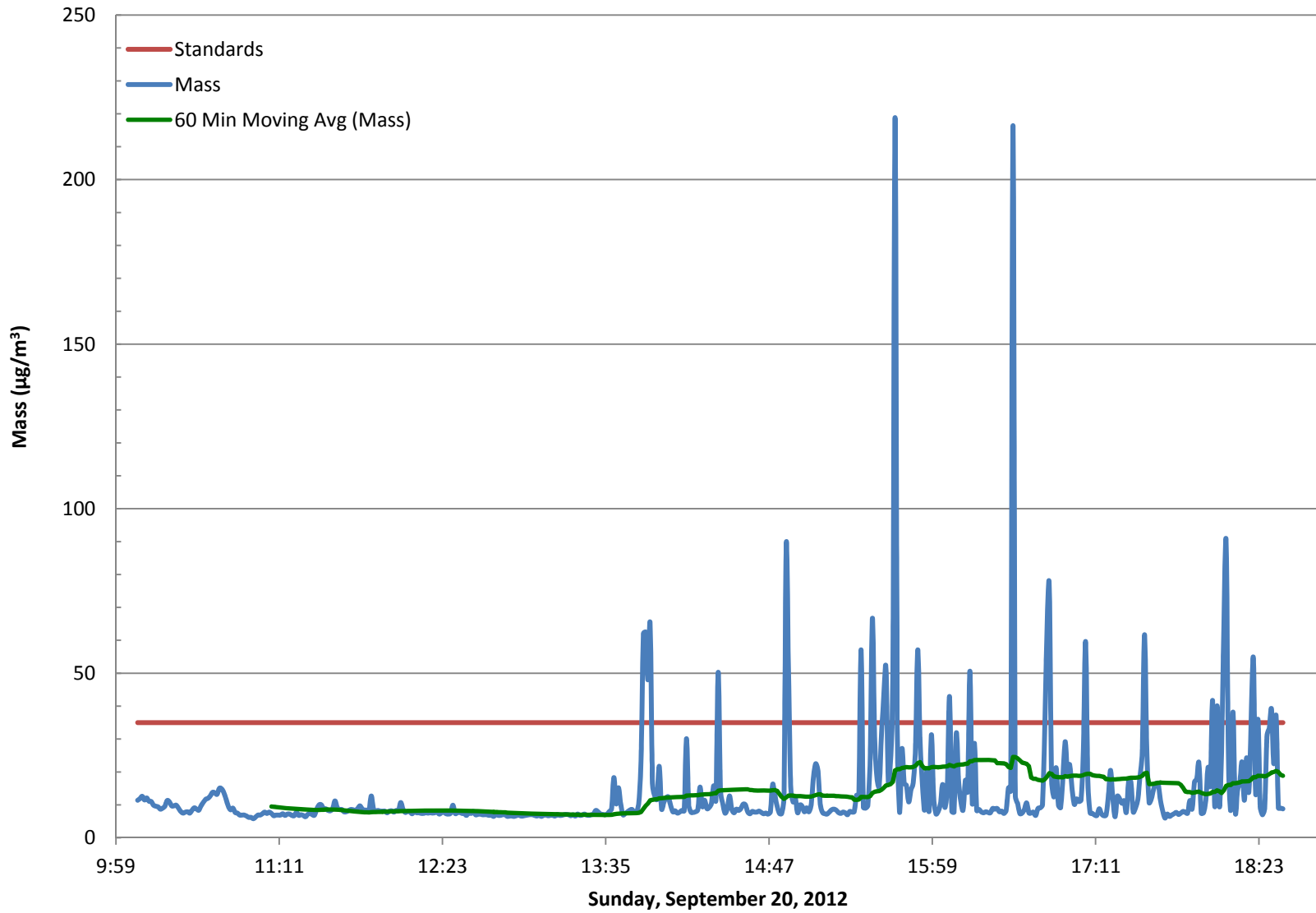




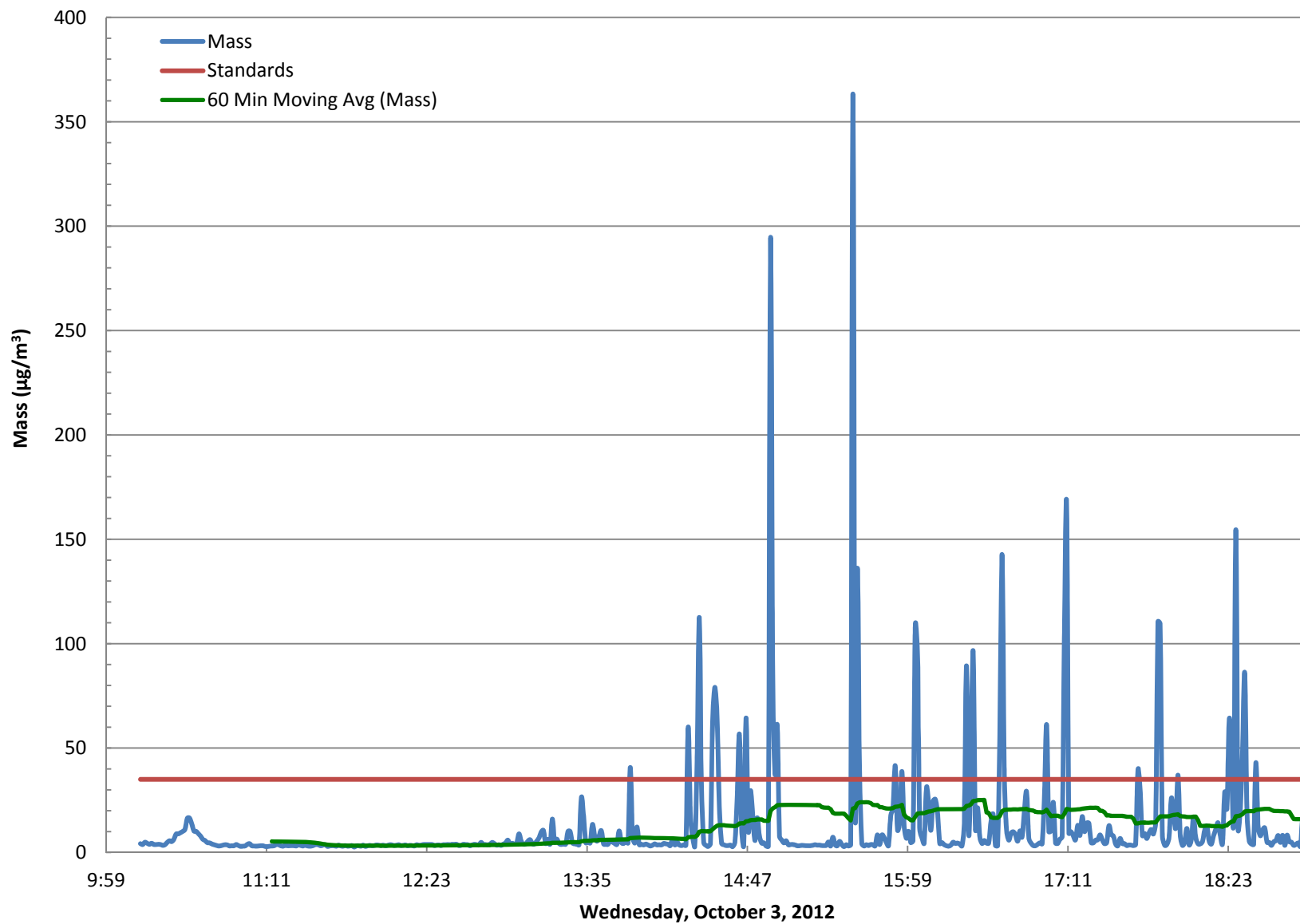
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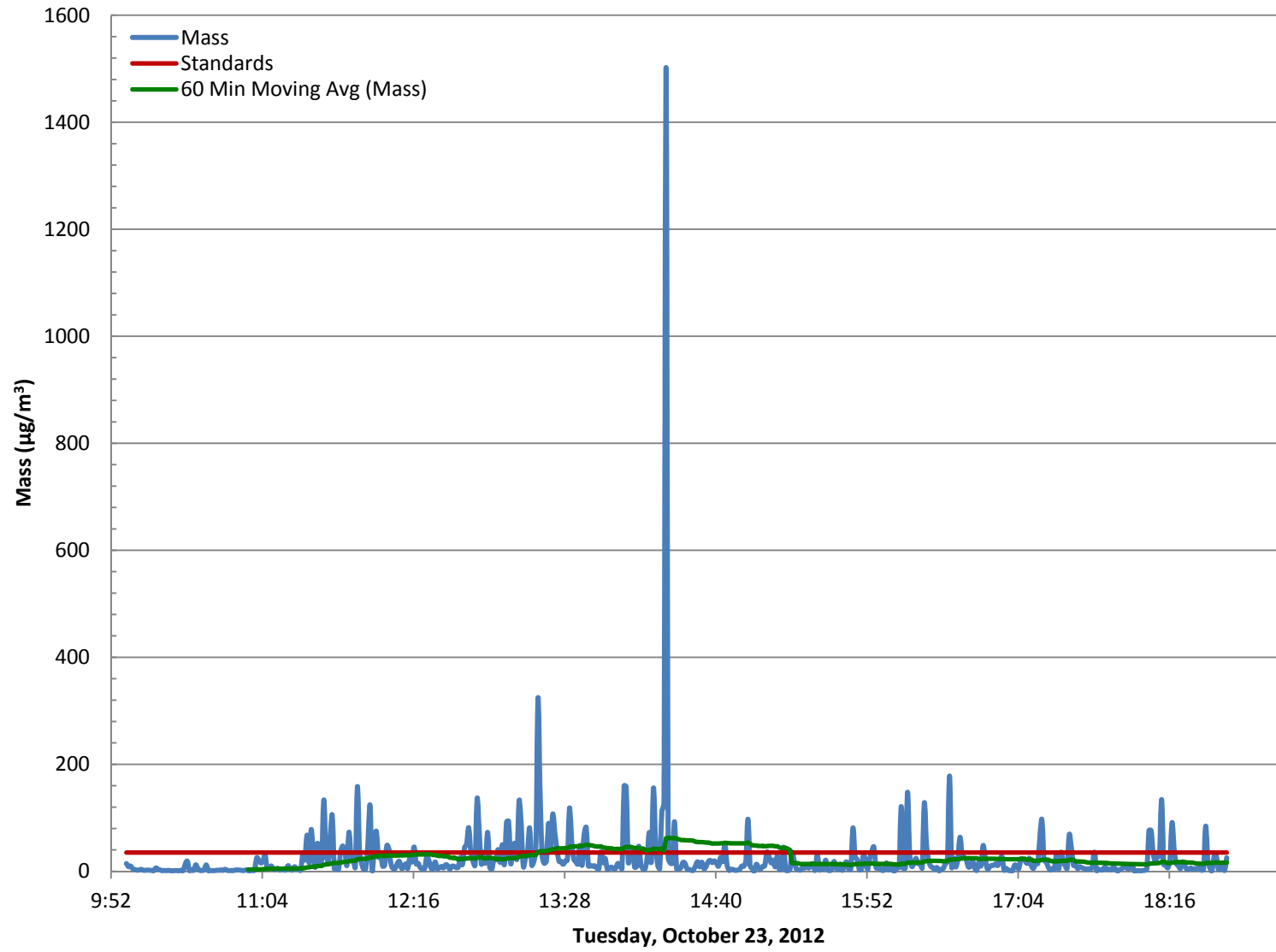
# Airborne Dust Monitoring Downwind PM 2.5



# Airborne Dust Monitoring Downwind PM 2.5



# Airborne Dust Monitoring Downwind PM 2.5



Perimeter Air Monitoring Results for Potential Exposure to General Public											
Perimeter Air Station <sup>(5)</sup>	Sample Date	Sample ID	Airborne Particulate Activity (uCi/ml) <sup>(1)</sup>				DAC (uCi/ml) 10CFR20, AppB				Comments
			Gross Alpha	U-nat	Ra-226	Th-230	Gross Alpha <sup>(4)</sup>	U-nat	Ra-226	Th-230	
				% of DAC <sup>(3)</sup>							
			Gross Alpha	U-nat	Ra-226	Th-230	Gross Alpha	U-nat	Ra-226	Th-230	
NECR-D1	8/30/2012	NECREDRA-D1 (Scool Bus Stop Area)	5.7E-15	2.8E-15	1.4E-15	1.4E-15	0.0%	0.0%	0.0%	1.0%	Baseline Sampling, downwind and upwind essentially the same
NECR-D2	8/30/2012	NECREDRA-D2 (EDA Downwind nearest Residence)	1.0E-15	5.2E-16	2.6E-16	2.6E-16	-0.2%	-0.2%	-0.1%	-4.8%	
NECR-U1	8/30/2012	NECREDRA-U1 (Upwind)	4.8E-15	2.4E-15	1.2E-15	1.2E-15	-	-	-	-	
NECR-D1	8/31/2012	NECREDRA-D1 (Scool Bus Stop Area)	7.3E-15	3.6E-15	1.8E-15	1.8E-15	0.1%	0.1%	0.0%	1.3%	Baseline Sampling, downwind and upwind essentially the same
NECR-D2	8/31/2012	NECREDRA-D2 (EDA Downwind nearest Residence)	5.1E-15	2.5E-15	1.3E-15	1.3E-15	-0.1%	-0.1%	0.0%	-1.5%	
NECR-U1	8/31/2012	NECREDRA-U1 (Upwind)	6.2E-15	3.1E-15	1.6E-15	1.6E-15	-	-	-	-	
NECR-D1	9/10/2012	NECREDRA-D1 (Scool Bus Stop Area)	1.2E-14	6.1E-15	3.0E-15	3.0E-15	0.0%	0.0%	0.0%	-0.4%	Perimeter air concentrations less than DACs
NECR-D2	9/10/2012	NECREDRA-D2 (EDA Downwind nearest Residence)	2.9E-14	1.5E-14	7.3E-15	7.3E-15	0.9%	0.9%	0.5%	20.9%	
NECR-U1	9/10/2012	NECREDRA-U1 (Upwind)	1.2E-14	6.2E-15	3.1E-15	3.1E-15	-	-	-	-	
NECR-D1	9/11/2012	NECREDRA-D1 (Scool Bus Stop Area)	-3.7E-15	-1.8E-15	-9.2E-16	-9.2E-16	-0.2%	-0.2%	-0.1%	-4.6%	Perimeter air concentrations less than DACs
NECR-D2	9/11/2012	NECREDRA-D2 (EDA Downwind (North Perimeter))	1.5E-14	7.5E-15	3.7E-15	3.7E-15	0.8%	0.8%	0.4%	18.6%	
NECR-U1	9/11/2012	NECREDRA-U1 (Upwind)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	-	-	-	-	
NECR-D1	9/12/2012	NECREDRA-D1 (Scool Bus Stop Area)	-6.0E-15	-3.0E-15	-1.5E-15	-1.5E-15	-0.3%	-0.3%	-0.2%	-7.5%	Perimeter air concentrations less than DACs
NECR-D2	9/12/2012	NECREDRA-D2 (EDA Downwind (North Perimeter))	-1.1E-15	-5.4E-16	-2.7E-16	-2.7E-16	-0.1%	-0.1%	0.0%	-1.3%	
NECR-U1	9/12/2012	NECREDRA-U1 (Upwind)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	-	-	-	-	
NECR-D1	9/13/2012	NECREDRA-D1 (Scool Bus Stop Area)	6.3E-15	3.2E-15	1.6E-15	1.6E-15	0.3%	0.3%	0.1%	6.7%	Perimeter air concentrations less than DACs
NECR-D2	9/13/2012	NECREDRA-D2 (EDA Downwind (North Perimeter))	1.5E-14	7.5E-15	3.8E-15	3.8E-15	0.8%	0.8%	0.4%	17.6%	
NECR-U1	9/13/2012	NECREDRA-U1 (Upwind)	9.1E-16	4.6E-16	2.3E-16	2.3E-16	-	-	-	-	
NECR-D1	9/14/2012	NECREDRA-D1 (Scool Bus Stop Area)	2.2E-15	1.1E-15	5.5E-16	5.5E-16	-0.2%	-0.2%	-0.1%	-5.5%	Perimeter air concentrations less than DACs
NECR-D2	9/14/2012	NECREDRA-D2 (EDA Downwind (North Perimeter))	4.4E-15	2.2E-15	1.1E-15	1.1E-15	-0.1%	-0.1%	-0.1%	-2.8%	
NECR-U1	9/14/2012	NECREDRA-U1 (Upwind)	6.6E-15	3.3E-15	1.7E-15	1.7E-15	-	-	-	-	
NECR-D1	9/17/2012	NECREDRA-D1 (Scool Bus Stop Area)	6.1E-15	3.0E-15	1.5E-15	1.5E-15	0.2%	0.2%	0.1%	3.6%	The downwind air sampling station was about 15 feet from the soil excavation in Zone 2. The air sampling station was put there to power the dust monitor from the generator used for air monitoring station. When noticed, the air sampling station was relocated to North
NECR-D2	9/17/2012	NECREDRA-D2 (EDA Downwind, near excavation in Zone 2)	9.8E-14	4.9E-14	2.5E-14	2.5E-14	5.3%	5.3%	2.6%	119.2%	
NECR-U1	9/17/2012	NECREDRA-U1 (Upwind)	3.2E-15	1.6E-15	7.9E-16	7.9E-16	-	-	-	-	
NECR-D1	9/19/2012	NECREDRA-D1 (Scool Bus Stop Area)	1.9E-15	9.6E-16	4.8E-16	4.8E-16	-0.1%	-0.1%	-0.1%	-2.5%	Perimeter air concentrations less than DACs,

Perimeter Air Monitoring Results for Potential Exposure to General Public											
Perimeter Air Station <sup>(5)</sup>	Sample Date	Sample ID	Airborne Particulate Activity (uCi/ml) <sup>(1)</sup>				DAC (uCi/ml) 10CFR20, AppB				Comments
			Gross Alpha	U-nat	Ra-226	Th-230	Gross Alpha <sup>(4)</sup>	U-nat	Ra-226	Th-230	
% of DAC <sup>(3)</sup>				Gross Alpha	U-nat	Ra-226	Th-230				
NECR-D2	9/19/2012	NECREDRA-D2 (EDA Downwind (North Perimeter))	2.8E-14	1.4E-14	6.9E-15	6.9E-15	1.3%	1.3%	0.7%	29.7%	Excavation activities close to sampling station, strong winds
NECR-U1	9/19/2012	NECREDRA-U1 (Upwind)	3.9E-15	2.0E-15	9.8E-16	9.8E-16	-	-	-	-	
NECR-D1	9/21/2012	NECREDRA-D1 (Scool Bus Stop Area)	2.9E-15	1.5E-15	7.4E-16	7.4E-16	0.3%	0.3%	0.1%	6.2%	Perimeter air concentrations less than DACs, Excavation activities close to sampling station, strong winds
NECR-D2	9/21/2012	NECREDRA-D2 (EDA Downwind (North Perimeter))	2.8E-14	1.4E-14	7.0E-15	7.0E-15	1.7%	1.7%	0.8%	37.3%	
NECR-U1	9/21/2012	NECREDRA-U1 (Upwind)	-2.0E-15	-9.9E-16	-4.9E-16	-4.9E-16	-	-	-	-	
NECR-D1	9/24/2012	NECREDRA-D1 (Scool Bus Stop Area)	6.9E-15	3.4E-15	1.7E-15	1.7E-15	-0.2%	-0.2%	-0.1%	-3.9%	Perimeter air concentrations less than DACs, Excavation activities close to sampling station, strong winds
NECR-D2	9/24/2012	NECREDRA-D2 (EDA Downwind (North Perimeter))	1.8E-14	8.8E-15	4.4E-15	4.4E-15	0.4%	0.4%	0.2%	9.5%	
NECR-U1	9/24/2012	NECREDRA-U1 (Upwind)	1.0E-14	5.0E-15	2.5E-15	2.5E-15	-	-	-	-	
NECR-D1	9/26/2012	NECREDRA-D1 (Scool Bus Stop Area)	-4.1E-15	-2.1E-15	-1.0E-15	-1.0E-15	-0.2%	-0.2%	-0.1%	-5.1%	Perimeter air concentrations less than DACs
NECR-D2	9/26/2012	NECREDRA-D2 (EDA Downwind (North Perimeter))	6.4E-15	3.2E-15	1.6E-15	1.6E-15	0.4%	0.4%	0.2%	8.0%	
NECR-U1	9/26/2012	NECREDRA-U1 (Upwind)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	-	-	-	-	
NECR-D1	10/2/2012	NECREDRA-D1 (Scool Bus Stop Area)	-1.0E-14	-5.0E-15	-2.5E-15	-2.5E-15	-0.1%	-0.1%	-0.1%	-2.4%	Perimeter air concentrations less than DACs
NECR-D2	10/2/2012	NECREDRA-D2 (EDA Downwind (North Perimeter))	1.1E-14	5.7E-15	2.9E-15	2.9E-15	1.1%	1.1%	0.5%	24.4%	
NECR-U1	10/2/2012	NECREDRA-U1 (Upwind)	-8.1E-15	-4.1E-15	-2.0E-15	-2.0E-15	-	-	-	-	
NECR-D1	10/4/2012	NECREDRA-D1 (Scool Bus Stop Area)	-5.1E-15	-2.5E-15	-1.3E-15	-1.3E-15	-0.5%	-0.5%	-0.3%	-11.5%	Perimeter air concentrations less than DACs
NECR-D2	10/4/2012	NECREDRA-D2 (EDA Downwind (North Perimeter))	1.7E-14	8.5E-15	4.3E-15	4.3E-15	0.7%	0.7%	0.4%	16.2%	
NECR-U1	10/4/2012	NECREDRA-U1 (Upwind)	4.1E-15	2.1E-15	1.0E-15	1.0E-15	-	-	-	-	
NECR-D1	10/9/2012	NECREDRA-D1 (Scool Bus Stop Area)	7.1E-15	3.6E-15	1.8E-15	1.8E-15	0.7%	0.7%	0.3%	15.3%	Perimeter air concentrations less than DACs
NECR-D2	10/9/2012	NECREDRA-D2 (EDA Downwind (North Perimeter))	8.5E-15	4.3E-15	2.1E-15	2.1E-15	0.8%	0.8%	0.4%	17.1%	
NECR-U1	10/9/2012	NECREDRA-U1 (Upwind)	-5.1E-15	-2.6E-15	-1.3E-15	-1.3E-15	-	-	-	-	
NECR-D1	10/11/2012	NECREDRA-D1 (Scool Bus Stop Area)	1.2E-14	6.1E-15	3.0E-15	3.0E-15	0.0%	0.0%	0.0%	-0.4%	Perimeter air concentrations less than DACs
NECR-D2	10/11/2012	NECREDRA-D2 (EDA Downwind (North Perimeter))	8.4E-15	4.2E-15	2.1E-15	2.1E-15	-0.2%	-0.2%	-0.1%	-5.0%	
NECR-U1	10/11/2012	NECREDRA-U1 (Upwind)	1.2E-14	6.2E-15	3.1E-15	3.1E-15	-	-	-	-	
NECR-D1	10/16/2012	NECREDRA-D1 (Scool Bus Stop Area)	1.2E-14	6.1E-15	3.0E-15	3.0E-15	0.5%	0.5%	0.2%	10.4%	Perimeter air concentrations less than DACs
NECR-D2	10/16/2012	NECREDRA-D2 (EDA Downwind (North Perimeter))	9.7E-16	4.9E-16	2.4E-16	2.4E-16	-0.2%	-0.2%	-0.1%	-3.6%	
NECR-U1	10/16/2012	NECREDRA-U1 (Upwind)	3.8E-15	1.9E-15	9.6E-16	9.6E-16	-	-	-	-	

Perimeter Air Monitoring Results for Potential Exposure to General Public											
Perimeter Air Station <sup>(5)</sup>	Sample Date	Sample ID	Airborne Particulate Activity (uCi/ml) <sup>(1)</sup>				DAC (uCi/ml) 10CFR20, AppB				Comments
			Gross Alpha	U-nat	Ra-226	Th-230	Gross Alpha <sup>(4)</sup>	U-nat	Ra-226	Th-230	
% of DAC <sup>(3)</sup>				Gross Alpha	U-nat	Ra-226	Th-230				
NECR-D1	10/18/2012	NECREDRA-D1 (Scool Bus Stop Area)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.1%	0.1%	0.1%	2.4%	Perimeter air concentrations less than DACs
NECR-D2	10/18/2012	NECREDRA-D2 (EDA Downwind (North Perimeter))	4.9E-15	2.4E-15	1.2E-15	1.2E-15	0.4%	0.4%	0.2%	8.5%	
NECR-U1	10/18/2012	NECREDRA-U1 (Upwind)	-1.9E-15	-9.5E-16	-4.8E-16	-4.8E-16	-	-	-	-	
NECR-D1	10/23/2012	NECREDRA-D1 (Scool Bus Stop Area)	-2.1E-15	-1.0E-15	-5.2E-16	-5.2E-16	-0.5%	-0.5%	-0.2%	-10.5%	Perimeter air concentrations less than DACs
NECR-D2	10/23/2012	NECREDRA-D2 (EDA Downwind (North Perimeter))	2.0E-14	1.0E-14	5.1E-15	5.1E-15	0.8%	0.8%	0.4%	17.7%	
NECR-U1	10/23/2012	NECREDRA-U1 (Upwind)	6.3E-15	3.2E-15	1.6E-15	1.6E-15	-	-	-	-	
NECR-D1	11/1/2012	NECREDRA-D1 (Scool Bus Stop Area)	7.1E-15	3.6E-15	1.8E-15	1.8E-15	0.3%	0.3%	0.1%	6.3%	Perimeter air concentrations less than DACs
NECR-D2	11/1/2012	NECREDRA-D2 (EDA Downwind (North Perimeter))	1.6E-14	8.0E-15	4.0E-15	4.0E-15	0.8%	0.8%	0.4%	17.4%	
NECR-U1	11/1/2012	NECREDRA-U1 (Upwind)	2.1E-15	1.0E-15	5.2E-16	5.2E-16	-	-	-	-	
NECR-D1	Mean	D1 Baseline	6.5E-15	3.2E-15	1.6E-15	1.6E-15	0.1%	0.1%	0.0%	1.2%	Baseline Sampling, downwind and upwind essentially the same
NECR-D2	Mean	D2 Baseline	3.0E-15	1.5E-15	7.6E-16	7.6E-16	-0.1%	-0.1%	-0.1%	-3.1%	
NECR-D1	Mean	NECREDRA-D1 (Scool Bus Stop Area)	2.6E-15	1.3E-15	6.4E-16	6.4E-16	0.0%	0.0%	0.0%	-0.2%	Mean School Bus Stop air concentrations similar to upwind
	Max		1.2E-14	6.1E-15	3.0E-15	3.0E-15	1%	1%	0%	15%	
NECR-D2	Mean	NECREDRA-D2 (EDA Downwind (North Perimeter))	1.8E-14	9.1E-15	4.6E-15	4.6E-15	0.9%	0.9%	0.4%	19.4%	Mean Perimeter air concentrations less than 25% of DACs
	Max		9.8E-14	4.9E-14	2.5E-14	2.5E-14	5%	5%	3%	119%	
NECR-U1	Mean	NECREDRA-U1 (Upwind) Project Mean	2.7E-15	1.4E-15	6.8E-16	6.8E-16	-	-	-	-	

**Notes:**  
(1) U-nat, Ra-226 and Th-230 activity calculated from measured gross alpha activity @ faction of 0.5 for U-nat, 0.25 for Ra-226 and 0.25 for Th-230 of gross alpha activity  
(2) DACs from 10CFR20, Appendix B, Table 2 for control and assessment of dose to the public  
(3) Net % of DACs for downwind, i.e subtracting upwind concentration from downwind  
(4) Calculated DAC for gross alpha activity by summing U-nat, Ra-226 and Th-230 DACs for control measures, not a regulatory DAC.  
(5) Location coordinates (NAD1983, NMWest feet): NECR Downwind 1 (Scool Bus Stop) are N1697450, E2523355; NECR Downwind 2 (East Drainage Area North Perimeter) N 1697480, E2524830; NECR Upwind 1 are N1694745, E2520038

Perimeter Air Particulate Sample Calculation																					
Air Particulate Sample Information			Air Sampling Data				Sample Counting Data						Ais Sample Results								
Sample ID	Sample Location ID	Sample Date	Average Sample Flow Rate (lpm)	Sample Duration (Mins)	Sample Flow Calibration Correction	Sample Volume (ml)	Sample Count Date & Time	BKG Counts	BKG Count Time (Mins)	Eff (cpm/dpm)	Sample Gross Alpha Counts	Sample Count Time (Mins)	Air Sample Activity			Isotopic Activity (Based on secular equilibrium in ore)			% of DACs		
													Gross Alpha Activity uCi/ml	Estimated Uncertainty 95% uCi/ml	MDC uCi/ml	U-nat uCi/ml	Ra-226 uCi/ml	Th-230 uCi/ml	U-nat	Ra-226	Th-230
NECR-D1	Down wind 1	8/30/2012	53.0	491	0.7732	2.01E+07	9/6/12	17	60	0.395	23	60	5.7E-15	1.2E-14	3.0E-14	2.8E-15	1.4E-15	1.4E-15	0%	0%	7%
NECR-D2	Down wind 2	8/30/2012	48.5	491	0.7721	1.84E+07	9/6/12	17	60	0.395	18	60	1.0E-15	1.2E-14	3.3E-14	5.2E-16	2.6E-16	2.6E-16	0%	0%	1%
NECR-U1	Upwind 1	8/30/2012	49.5	507	0.7821	1.96E+07	9/6/12	17	60	0.395	22	60	4.8E-15	1.2E-14	3.1E-14	2.4E-15	1.2E-15	1.2E-15	0%	0%	6%
NECR-D1	Down wind 1	8/31/2012	48.5	489	0.7721	1.83E+07	9/6/12	17	60	0.395	24	60	7.3E-15	1.3E-14	3.3E-14	3.6E-15	1.8E-15	1.8E-15	0%	0%	9%
NECR-D2	Down wind 2	8/31/2012	49.0	491	0.7821	1.88E+07	9/6/12	17	60	0.395	22	60	5.1E-15	1.2E-14	3.2E-14	2.5E-15	1.3E-15	1.3E-15	0%	0%	6%
NECR-U1	Upwind 1	8/31/2012	50.0	491	0.7454	1.83E+07	9/6/12	17	60	0.395	23	60	6.2E-15	1.3E-14	3.3E-14	3.1E-15	1.6E-15	1.6E-15	0%	0%	8%
NECR-D1	Down wind 1	9/10/2012	50.0	480	0.7821	1.88E+07	9/18/12	13	60	0.396	25	60	1.2E-14	1.2E-14	2.8E-14	6.1E-15	3.0E-15	3.0E-15	1%	0%	15%
NECR-D2	Down wind 2	9/10/2012	49.0	481	0.7454	1.76E+07	9/18/12	13	60	0.396	40	60	2.9E-14	1.5E-14	3.0E-14	1.5E-14	7.3E-15	7.3E-15	2%	1%	36%
NECR-U1	Upwind 1	9/10/2012	49.5	480	0.7721	1.83E+07	9/18/12	13	60	0.396	25	60	1.2E-14	1.2E-14	2.9E-14	6.2E-15	3.1E-15	3.1E-15	1%	0%	16%
NECR-D1	Down wind 1	9/11/2012	50.0	530	0.7821	2.07E+07	9/20/12	17	60	0.393	13	60	-3.7E-15	9.9E-15	2.9E-14	-1.8E-15	-9.2E-16	-9.2E-16	0%	0%	-5%
NECR-D2	Down wind 2	9/11/2012	49.0	526	0.7454	1.92E+07	9/20/12	17	60	0.393	32	60	1.5E-14	1.4E-14	3.1E-14	7.5E-15	3.7E-15	3.7E-15	1%	0%	19%
NECR-U1	Upwind 1	9/11/2012	50.0	522	0.7721	2.02E+07	9/20/12	17	60	0.393	17	60	0.0E+00	1.1E-14	3.0E-14	0.0E+00	0.0E+00	0.0E+00	0%	0%	0%
NECR-D1	Down wind 1	9/12/2012	50.0	488	0.7821	1.91E+07	9/20/12	17	60	0.396	11	60	-6.0E-15	1.0E-14	3.1E-14	-3.0E-15	-1.5E-15	-1.5E-15	0%	0%	-7%
NECR-D2	Down wind 2	9/12/2012	49.0	482	0.7454	1.76E+07	9/20/12	17	60	0.396	16	60	-1.1E-15	1.2E-14	3.4E-14	-5.4E-16	-2.7E-16	-2.7E-16	0%	0%	-1%
NECR-U1	Upwind 1	9/12/2012	49.5	489	0.7721	1.87E+07	9/20/12	17	60	0.396	17	60	0.0E+00	1.2E-14	3.2E-14	0.0E+00	0.0E+00	0.0E+00	0%	0%	0%
NECR-D1	Down wind 1	9/13/2012	50.0	539	0.7821	2.11E+07	9/21/12	8	60	0.395	15	60	6.3E-15	8.5E-15	2.0E-14	3.2E-15	1.6E-15	1.6E-15	0%	0%	8%
NECR-D2	Down wind 2	9/13/2012	49.0	520	0.7454	1.90E+07	9/21/12	8	60	0.395	23	60	1.5E-14	1.1E-14	2.2E-14	7.5E-15	3.8E-15	3.8E-15	1%	0%	19%
NECR-U1	Upwind 1	9/13/2012	50.0	539	0.7721	2.08E+07	9/21/12	8	60	0.395	9	60	9.1E-16	7.4E-15	2.0E-14	4.6E-16	2.3E-16	2.3E-16	0%	0%	1%
NECR-D1	Down wind 1	9/14/2012	50.0	450	0.7821	1.76E+07	9/21/12	13	60	0.386	15	60	2.2E-15	1.1E-14	3.1E-14	1.1E-15	5.5E-16	5.5E-16	0%	0%	3%
NECR-D2	Down wind 2	9/14/2012	49.5	480	0.7454	1.77E+07	9/21/12	13	60	0.386	17	60	4.4E-15	1.2E-14	3.0E-14	2.2E-15	1.1E-15	1.1E-15	0%	0%	5%
NECR-U1	Upwind 1	9/14/2012	49.5	460	0.7721	1.76E+07	9/21/12	13	60	0.386	19	60	6.6E-15	1.2E-14	3.1E-14	3.3E-15	1.7E-15	1.7E-15	0%	0%	8%
NECR-D1	Down wind 1	9/17/2012	50.0	475	0.7821	1.86E+07	9/24/12	15	60	0.400	21	60	6.1E-15	1.2E-14	3.0E-14	3.0E-15	1.5E-15	1.5E-15	0%	0%	8%
NECR-D2	Down wind 2	9/17/2012	49.5	485	0.7454	1.79E+07	9/24/12	15	60	0.400	109	60	9.8E-14	2.3E-14	3.1E-14	4.9E-14	2.5E-14	2.5E-14	5%	3%	123%
NECR-U1	Upwind 1	9/17/2012	49.5	466	0.7721	1.78E+07	9/24/12	15	60	0.400	18	60	3.2E-15	1.2E-14	3.1E-14	1.6E-15	7.9E-16	7.9E-16	0%	0%	4%
NECR-D1	Down wind 1	9/19/2012	50.0	502	0.7821	1.96E+07	9/26/12	16	60	0.400	18	60	1.9E-15	1.1E-14	2.9E-14	9.6E-16	4.8E-16	4.8E-16	0%	0%	2%
NECR-D2	Down wind 2	9/19/2012	49.5	495	0.7454	1.83E+07	9/26/12	16	60	0.400	43	60	2.8E-14	1.5E-14	3.1E-14	1.4E-14	6.9E-15	6.9E-15	2%	1%	35%
NECR-U1	Upwind 1	9/19/2012	49.5	500	0.7721	1.91E+07	9/26/12	16	60	0.400	20	60	3.9E-15	1.2E-14	3.0E-14	2.0E-15	9.8E-16	9.8E-16	0%	0%	5%
NECR-D1	Down wind 1	9/21/2012	49.5	480	0.7821	1.86E+07	9/24/12	15	60	0.411	18	60	2.9E-15	1.1E-14	2.9E-14	1.5E-15	7.4E-16	7.4E-16	0%	0%	4%
NECR-D2	Down wind 2	9/21/2012	49.5	480	0.7454	1.77E+07	9/24/12	15	60	0.411	42	60	2.8E-14	1.5E-14	3.1E-14	1.4E-14	7.0E-15	7.0E-15	2%	1%	35%
NECR-U1	Upwind 1	9/21/2012	49.5	483	0.7721	1.85E+07	9/24/12	15	60	0.411	13	60	-2.0E-15	1.0E-14	2.9E-14	-9.9E-16	-4.9E-16	-4.9E-16	0%	0%	-2%
NECR-D1	Down wind 1	9/24/2012	49.5	486	0.7821	1.88E+07	10/1/12	15	60	0.405	22	60	6.9E-15	1.2E-14	2.9E-14	3.4E-15	1.7E-15	1.7E-15	0%	0%	9%
NECR-D2	Down wind 2	9/24/2012	49.5	485	0.7454	1.79E+07	10/1/12	15	60	0.405	32	60	1.8E-14	1.4E-14	3.1E-14	8.8E-15	4.4E-15	4.4E-15	1%	0%	22%
NECR-U1	Upwind 1	9/24/2012	49.5	485	0.7721	1.85E+07	10/1/12	15	60	0.405	25	60	1.0E-14	1.2E-14	3.0E-14	5.0E-15	2.5E-15	2.5E-15	1%	0%	13%
NECR-D1	Down wind 1	9/26/2012	49.5	480	0.7821	1.86E+07	10/3/12	16	60	0.393	12	60	-4.1E-15	1.1E-14	3.1E-14	-2.1E-15	-1.0E-15	-1.0E-15	0%	0%	-5%
NECR-D2	Down wind 2	9/26/2012	49.5	485	0.7454	1.79E+07	10/3/12	16	60	0.393	22	60	6.4E-15	1.3E-14	3.3E-14	3.2E-15	1.6E-15	1.6E-15	0%	0%	8%



**Perimeter Air Particulate Sample Calculation**

Air Particulate Sample Information			Air Sampling Data				Sample Counting Data						Ais Sample Results								
Sample ID	Sample Location ID	Sample Date	Average Sample Flow Rate (lpm)	Sample Duration (Mins)	Sample Flow Calibration Correction	Sample Volume (ml)	Sample Count Date & Time	BKG Counts	BKG Count Time (Mins)	Eff (cpm/dpm)	Sample Gross Alpha Counts	Sample Count Time (Mins)	Air Sample Activity			Isotopic Activity (Based on secular equilibrium in ore)			% of DACs		
													Gross Alpha Activity uCi/ml	Estimated Uncertainty 95% uCi/ml	MDC uCi/ml	U-nat uCi/ml	Ra-226 uCi/ml	Th-230 uCi/ml	U-nat	Ra-226	Th-230
NECR-U1	Upwind 1	9/26/2012	49.5	480	0.7721	1.83E+07	10/3/12	16	60	0.393	16	60	0.0E+00	1.2E-14	3.2E-14	0.0E+00	0.0E+00	0.0E+00	0%	0%	0%
NECR-D1	Down wind 1	10/2/2012	49.5	485	0.7821	1.88E+07	10/9/12	15	60	0.400	5	60	-1.0E-14	8.8E-15	3.0E-14	-5.0E-15	-2.5E-15	-2.5E-15	-1%	0%	-12%
NECR-D2	Down wind 2	10/2/2012	49.5	490	0.7454	1.81E+07	10/9/12	15	60	0.400	26	60	1.1E-14	1.3E-14	3.1E-14	5.7E-15	2.9E-15	2.9E-15	1%	0%	14%
NECR-U1	Upwind 1	10/2/2012	49.5	485	0.7721	1.85E+07	10/9/12	15	60	0.400	7	60	-8.1E-15	9.3E-15	3.0E-14	-4.1E-15	-2.0E-15	-2.0E-15	0%	0%	-10%
NECR-D1	Down wind 1	10/4/2012	49.5	480	0.7821	1.86E+07	10/12/12	12	60	0.397	7	60	-5.1E-15	8.7E-15	2.7E-14	-2.5E-15	-1.3E-15	-1.3E-15	0%	0%	-6%
NECR-D2	Down wind 2	10/4/2012	49.5	480	0.7454	1.77E+07	10/12/12	12	60	0.397	28	60	1.7E-14	1.3E-14	2.8E-14	8.5E-15	4.3E-15	4.3E-15	1%	0%	21%
NECR-U1	Upwind 1	10/4/2012	49.5	480	0.7721	1.83E+07	10/12/12	12	60	0.397	16	60	4.1E-15	1.1E-14	2.7E-14	2.1E-15	1.0E-15	1.0E-15	0%	0%	5%
NECR-D1	Down wind 1	10/9/2012	49.5	480	0.7821	1.86E+07	10/16/12	14	60	0.398	21	60	7.1E-15	1.2E-14	2.9E-14	3.6E-15	1.8E-15	1.8E-15	0%	0%	9%
NECR-D2	Down wind 2	10/9/2012	49.5	480	0.7454	1.77E+07	10/16/12	14	60	0.398	22	60	8.5E-15	1.3E-14	3.1E-14	4.3E-15	2.1E-15	2.1E-15	0%	0%	11%
NECR-U1	Upwind 1	10/9/2012	49.5	480	0.7721	1.83E+07	10/16/12	14	60	0.398	9	60	-5.1E-15	9.7E-15	2.9E-14	-2.6E-15	-1.3E-15	-1.3E-15	0%	0%	-6%
NECR-D1	Down wind 1	10/11/2012	49.5	490	0.7821	1.90E+07	10/18/12	13	60	0.392	25	60	1.2E-14	1.2E-14	2.8E-14	6.1E-15	3.0E-15	3.0E-15	1%	0%	15%
NECR-D2	Down wind 2	10/11/2012	49.5	495	0.7454	1.83E+07	10/18/12	13	60	0.392	21	60	8.4E-15	1.2E-14	2.9E-14	4.2E-15	2.1E-15	2.1E-15	0%	0%	10%
NECR-U1	Upwind 1	10/11/2012	49.5	485	0.7721	1.85E+07	10/18/12	13	60	0.392	25	60	1.2E-14	1.2E-14	2.9E-14	6.2E-15	3.1E-15	3.1E-15	1%	0%	15%
NECR-D1	Down wind 1	10/16/2012	49.5	525	0.7821	2.03E+07	10/23/12	15	60	0.394	28	60	1.2E-14	1.2E-14	2.8E-14	6.1E-15	3.0E-15	3.0E-15	1%	0%	15%
NECR-D2	Down wind 2	10/16/2012	49.5	530	0.7454	1.96E+07	10/23/12	15	60	0.394	16	60	9.7E-16	1.1E-14	2.9E-14	4.9E-16	2.4E-16	2.4E-16	0%	0%	1%
NECR-U1	Upwind 1	10/16/2012	49.5	520	0.7721	1.99E+07	10/23/12	15	60	0.394	19	60	3.8E-15	1.1E-14	2.8E-14	1.9E-15	9.6E-16	9.6E-16	0%	0%	5%
NECR-D1	Down wind 1	10/18/2012	49.5	540	0.7821	2.09E+07	10/25/12	11	60	0.386	11	60	0.0E+00	8.6E-15	2.4E-14	0.0E+00	0.0E+00	0.0E+00	0%	0%	0%
NECR-D2	Down wind 2	10/18/2012	49.5	540	0.7454	1.99E+07	10/25/12	11	60	0.386	16	60	4.9E-15	9.9E-15	2.5E-14	2.4E-15	1.2E-15	1.2E-15	0%	0%	6%
NECR-U1	Upwind 1	10/18/2012	49.5	535	0.7721	2.04E+07	10/25/12	11	60	0.386	9	60	-1.9E-15	8.3E-15	2.4E-14	-9.5E-16	-4.8E-16	-4.8E-16	0%	0%	-2%
NECR-D1	Down wind 1	10/23/2012	49.5	483	0.7821	1.87E+07	10/30/12	16	60	0.389	14	60	-2.1E-15	1.1E-14	3.2E-14	-1.0E-15	-5.2E-16	-5.2E-16	0%	0%	-3%
NECR-D2	Down wind 2	10/23/2012	49.5	485	0.7454	1.79E+07	10/30/12	16	60	0.389	35	60	2.0E-14	1.5E-14	3.3E-14	1.0E-14	5.1E-15	5.1E-15	1%	1%	26%
NECR-U1	Upwind 1	10/23/2012	49.5	480	0.7721	1.83E+07	10/30/12	16	60	0.389	22	60	6.3E-15	1.3E-14	3.2E-14	3.2E-15	1.6E-15	1.6E-15	0%	0%	8%
NECR-D1	Down wind 1	11/1/2012	49.5	485	0.7821	1.88E+07	11/8/12	14	60	0.394	21	60	7.1E-15	1.2E-14	2.9E-14	3.6E-15	1.8E-15	1.8E-15	0%	0%	9%
NECR-D2	Down wind 2	11/1/2012	49.5	485	0.7454	1.79E+07	11/8/12	14	60	0.394	29	60	1.6E-14	1.4E-14	3.1E-14	8.0E-15	4.0E-15	4.0E-15	1%	0%	20%
NECR-U1	Upwind 1	11/1/2012	49.5	480	0.7721	1.83E+07	11/8/12	14	60	0.394	16	60	2.1E-15	1.1E-14	3.0E-14	1.0E-15	5.2E-16	5.2E-16	0%	0%	3%

**Formulas:**

Air Gross Alpha Activity, uCi/ml =  $\frac{(Gross\ cpm - BKG\ cpm) \times (FA)}{2.22E+6\ (dpm/uCi) \times Eff\ (cpm/dpm) \times Air\ Sample\ Volume\ (ml)}$

+/- (95%), uCi/ml =  $\frac{1.96 \times [(Gross\ Counts/gross\ Count\ t) + (BKG\ Counts/BKG\ Count\ t)]^{0.5}}{2.22E+6\ (dpm/uCi) \times Eff\ (cpm/dpm) \times Air\ Sample\ Volume\ (ml)}$

Gross Alpha, uCi/ml =  $\frac{(3+4.66) \times (FA) \times [(BKG\ Counts)^{0.5}/BKG\ Count\ t]}{2.22E+6\ (dpm/uCi) \times Eff\ (cpm/dpm) \times Air\ Sample\ Volume\ (ml)}$

# Radon Monitoring Report

MWH AMERICAS  
 ATTN: LELAND FUHRIG  
 PO BOX 774018  
 STIMBOAT SPRINGS, CO 80477

## LANDAUER

Landauer, Inc. 2 Science Road Glenwood, Illinois 60425-1586  
 Telephone: (800) 528-8327 Facsimile: (708) 755-7048

Acct. No. 0410390

Detector Number	Detector Type	Starting Date	Ending Date	Field Data / Comments	Exposure pCi/l-days	Avg. Radon Conc. pCi/l	
4847319	DRNF	30-AUG-12	08-NOV-12	OUTDOOR RADON NECR-UI UPWIND SW PRTION NEAR MINE STE	107.8 ±7.7	1.5 ±0.11	
4847320	DRNF	30-AUG-12	08-NOV-12	OUTDOOR RADON NECR-D1 DWNWIND NEAR SCHOOL BUS STOP	115.9 ±8.1	1.7 ±0.12	
4847321	DRNF	30-AUG-12	08-NOV-12	OUTDOOR RADON NECR-D2 DOWNWIND INSIDE WRK PRJCT AREA	148.3 ±9.5	2.1 ±0.14	

①                      ②                      ③                      ④                      ⑤                      ⑥                      ⑦                      ⑧

RESULTS RELATED ONLY TO MONITORS  
 AS RECEIVED BY LANDAUER.

Q.C. Release	Process No.	Report Date	Date Received
LMR	A22561	05-DEC-12	26-NOV-12

MHW GLOBAL HEADQUARTERS  
 ATTN LELAND FUHRIG  
 SUITE 200  
 380 INTERLOKEN CRESCENT  
 BLOOMFIELD, CO 80021

Report Date (YYYY-MM-DD)	2012-12-03
Page	1 of 1
Dosimeter Received	2012-11-27
QC Release	LCA
Analytical Work Order	1233110529

**LANDAUER**<sup>®</sup>  
 Landauer, Inc., 2 Science Road  
 Glenwood, Illinois 60425-1586  
 www.landauer.com  
 Telephone: (708) 755-7000  
 Facsimile: (708) 755-7016  
 Customer Service: (800) 323-8830  
 Technical: (800) 438-3241

## Environmental Dosimetry Report

Account : 703377    Subaccount : 1416548    Series: X9

Location ID Number	Dosimeter Type	Identifier (Client Supplied)	Exposure (Ambient Dose mrem)		Net Cumulative Totals (mrem)			Inception Date (YYYY-MM)	Serial Number
			Gross	Net	Quarter to Date	Year to Date	Permanent		
Monitoring Period:			2012-07-15 to	2012-10-14	Q3	2012			
00000	V03NH	Deploy Control						2012-07	EX00010521B
00000	V03NH	Deploy Control						2012-07	EX000124071
00000	V03NH	Deploy Control						2012-07	EX00012888J
	V03NH	Control Dose Used	21.3						
00017	V03NH	AREA MONITOR 1 Unused; Unused				-1.3	-1.3	2012-07	EX00063177P
00018	V03NH	AREA MONITOR 2 Unused; Unused				1.6	1.6	2012-07	EX000190618
00019	V03NH	AREA MONITOR 3 Unused; Unused				2.3	2.3	2012-07	EX00008576Q
Monitoring Period:			2012-10-15 to	2013-01-14	Q4	2012			
00000	V03NH	Deploy Control						2012-07	EX000137701
00000	V03NH	Deploy Control						2012-07	EX00021575V
00000	V03NH	Deploy Control						2012-07	EX000234432
	V03NH	Control Dose Used	23.8						
00017	V03NH	AREA MONITOR 1	22.5	-1.3	-1.3	-1.3	-1.3	2012-07	EX00015120G
00018	V03NH	AREA MONITOR 2	25.4	1.6	1.6	1.6	1.6	2012-07	EX00008993M
00019	V03NH	AREA MONITOR 3	26.1	2.3	2.3	2.3	2.3	2012-07	EX00041815R

## General Information

The Environmental dosimeter is for both indoor and outdoor use, and is designed to withstand extremes of temperature, humidity, precipitation, and other environmental conditions. InLight dosimeters are built on an assembly of a case component with copper and plastic filters along with a four-positioned aluminum oxide detector slide component. Both the case and slide are uniquely bar coded with serial numbers for chain of custody and sensitivity identification. The InLight dosimeter is sealed within a heavy-duty vinyl tamper resistant pouch that has multiple slots to permit several methods of attachment for easy deployment.

### Technical Specifications

- Fully meets ANSI N545-1977, NRC Regulatory Guide 4.13, and HPS Draft Standard N13.29 for environmental dosimetry.
- Minimum Detectable Dose - nominally 0.1 mrem (1  $\mu$ Sv), reporting to tenths of a millirem ambient dose equivalent.
- Detection Capabilities:
  - Photons (x and gamma rays) with energies above 15 keV nominally: 0.1 mrem to 1000 rem (1  $\mu$ Sv to 10 Sv).
  - Beta particles with energies greater than approximately 500 keV average energy: 20 mrem to 1000 rem (200  $\mu$ Sv to 10 Sv).

### Control Dosimeter

A minimum of two control dosimeters are provided per shipment. The first is for field deployment/retrieval used to measure exposure during shipment and placement/collection. The second is for transit used to measure exposure during shipment only. Both control dosimeters assigned to a shipment should accompany that shipment both from and to Landauer. Do not use the control dosimeters for any other purpose. Store dosimeters away from radiation when not in use along with the control dosimeter(s) of the same use date.

Dosimetry reports show gross and net dosage. Gross dosage includes the dosage to the controls. Landauer's background subtraction protocol is:

1. Subtract the deployment/retrieval control; or if not returned to Landauer
2. Subtract the transit control.

## Dosimetry Report Information

### Location ID Number

Unique number assigned by Landauer.

### Dosimeter Type

Dosimeter Type	Analytical Sensitivity	Minimum Detectable Dose Level (mrem)
V03NH	High	0.1
V03NN	Standard	5.0
V06NH	High	0.1
V06NN	Standard	5.0

### Identifier

Location name supplied by customer.

### Exposure Ambient Dose (mrem)

Gross: Gross exposure before control subtraction.

Net: Net exposure after control subtraction.

### Net Cumulative Totals (mrem)

Quarter to Date, Year to Date, and Permanent are accumulated net ambient exposure.

### Inception Date

The date Landauer began keeping dosimeter records for a given dosimeter for a monitoring location on the current account.

### Serial Number

Dosimeter serial number.

### U.S. Patents

6,316,782; 6,127,685; 5,892,234

Landauer, Inc.  
2 Science Road  
Glenwood, Illinois 60425-1586  
www.landauer.com  
Telephone: (708) 755-7000  
Facsimile: (708) 755-7016  
Customer Service: (800) 323-8830  
Technical: (800) 438-3241

# Radiation Survey @ NECR EDRA

## Scan Gamma Radiation Exposure Rate Survey Field Form

Instrumentation : Ludlum 19 S/N 9180

Instrument Calibration Date: 4-2-12, Instrument Daily Function Check Performed: yes

Survey Area/Unit Description SW and N. of NECR mine Site

Survey Date/Time	Survey Area-Transect ID/Description	Exposure Rate uR/hr	Comments/Notes
8-30-12 0914	NECR-U1 (Upwind and SW portion of NECR mine site)	Avg. uR/hr = 15	Readings taken at air monitoring stations.
8-30-12 0941	NECR-D1 (Downwind nearby school bus stop area)	Avg. uR/hr. = 11	"
8-30-12 0954	NECR-D2 (Downwind nearby work and residential area)	Avg. uR/hr. = 23	"
9-13-12 1705	NECR-U1 (Upwind and SW portion of NECR mine site)	Avg. uR/hr. = 15 uR/hr.	Readings taken at air monitoring stations.
9-13-12 1654	NECR-D1 (Downwind nearby school bus stop area.)	Avg. uR/hr. = 11 uR/hr.	"
9-13-12 1630	NECR-D2 (Downwind and location moved to E. portion of work area)	Avg. uR/hr. = 65 uR/hr.	"

Technician Signature \_\_\_\_\_, Reviewed by \_\_\_\_\_

# Radiation Survey @ NECR EDRA

## Scan Gamma Radiation Exposure Rate Survey Field Form

Instrumentation : Ludlum 19 S/N 9180

Instrument Calibration Date: 4-2-12, Instrument Daily Function Check Performed: YES

Survey Area/Unit Description SW and N. of NECR MINE SITE

Survey Date/Time	Survey Area-Transect ID/Description	Exposure Rate uR/hr	Comments/Notes
9-21-12 1115	NECR-U1 (Upwind and SW portion of NECR mine site)	Avg. uR/hr = 14	Readings taken @ air and radon monitoring stations.
9-21-12 1127	NECR-D1 (Downwind nearby school bus stop area)	Avg. uR/hr = 11	"
9-21-12 0954	NECR-D2 (Downwind and location moved to NE portion of work area)	Avg. uR/hr = 12	"
9-28-12 1000	NECR-U1 (Upwind and SW portion of NECR MINE SITE)	Avg. uR/hr. = 13	Readings taken at air and radon monitoring stations.
9-28-12 1020	NECR-D1 (Downwind nearby school bus stop area)	Avg. uR/hr = 11	"
9-28-12 1035	NECR-D2 (Downwind and location moved to NE corner perimeter of work area)	Avg. uR/hr. = 15	"

Technician Signature Mal Chidley J., Reviewed by \_\_\_\_\_

# Radiation Survey @ NECR EDRA

## Scan Gamma Radiation Exposure Rate Survey Field Form

Instrumentation : Ludlum 19 S/H 9180

Instrument Calibration Date: 4-2-12, Instrument Daily Function Check Performed: YES

Survey Area/Unit Description SW and N. of NECR MINE SITE

Survey Date/Time	Survey Area-Transect ID/Description	Exposure Rate uR/hr	Comments/Notes
10-4-12 1007	NECR-U1 (Upwind and SW portion of NECR MINE SITE).	Avg. uR/hr = 14	Readings taken at air, radon and env. gamma dosimetry monitoring stations,
10-4-12 1022	NECR-D1 (Downwind nearby school bus stop area)	Avg. uR/hr = 11	As above
10-4-12 1030	NECR-D2 (Downwind and NE corner perimeter of work area)	Avg. uR/hr = 15	As above
10-12-12 1100	NECR-U1 (Upwind and SW portion of NECR MINE SITE).	Avg. uR/hr = 15	Readings taken at air, radon and env. gamma dosimetry monitoring stations.
10-12-12 1050	NECR-D1 (Downwind nearby school bus stop area).	Avg. uR/hr = 13	As above
10-12-12 1056	NECR-D2 (Downwind and NE corner perimeter of work area).	Avg. uR/hr = 15	As above

Technician Signature Max Chockley, Reviewed by \_\_\_\_\_

# Radiation Survey @ NECR EDPA

## Scan Gamma Radiation Exposure Rate Survey Field Form

Instrumentation : Ludlum 19 S/N 9180

Instrument Calibration Date: 4-2-12 , Instrument Daily Function Check Performed: YES

Survey Area/Unit Description SW 2nd N of NECR MINE SITE

Survey Date/Time	Survey Area-Transect ID/Description	Exposure Rate uR/hr	Comments/Notes
10-18-12 1441	NECR-U1 (Upwind 2nd SW portion of NECR MINE SITE).	Avg. uR/hr = 13	Reading taken at air, radon and env. gamma dosimetry monitoring stations.
10-18-12 1423	NECR-D1 (Downwind nearby school bus stop area).	Avg. uR/hr = 11	As above
10-18-12 1431	NECR-D2 (Downwind and NE corner perimeter of work area).	Avg. uR/hr = 13	As above
10-26-12 1109	NECR-U1 (Upwind 3rd SW portion of NECR-MINE SITE).	Avg. uR/hr = 13	As above
10-26-12 1035	NECR-D1 (Downwind nearby school bus stop area).	Avg. uR/hr = 11	As above
10-26-12 1048	NECR-D2 (Downwind and NE corner perimeter of work area).	Avg. uR/hr = 14	As above

Technician Signature Map Chodley J. , Reviewed by \_\_\_\_\_



<b>AMEC Construction Zone Dust Monitoring Results</b>		
<b>Date</b>	<b>Maximum Daily Value (ug/m<sup>3</sup>)</b>	<b>Average Daily Value (ug/m<sup>3</sup>)</b>
9/7/2012	308.7	16.3
9/10/2012	352.4	17.6
9/11/2012	179.7	12.5
9/12/2012	10.7	1.9
9/13/2012	117.9	8.0
9/14/2012	21.9	6.1
9/17/2012	234.0	11.5
9/18/2012	397.1	20.8
9/19/2012	417.9	41.8
9/20/2012	1117.6	39.1
9/21/2012	305.5	20.3
9/24/2012	637.8	19.6
9/25/2012	182.3	8.9
9/26/2012	72.0	7.1
9/27/2012	204.4	13.6
9/28/2012	299.6	13.3
10/1/2012	1446.9	23.9
10/2/2012	323.8	6.6
10/3/2012	669.7	12.4
10/4/2012	279.7	20.5
10/5/2012	134.1	11.2
10/9/2012	112.7	8.0
10/10/2012	103.1	8.0
10/11/2012	138.5	6.9
10/12/2012	29.0	3.8
10/15/2012	117.2	11.2
10/16/2012	61.6	8.5
10/17/2012	119.3	6.4
10/19/2012	809.8	12.2
10/22/2012	224.6	9.2
10/23/2012	548.5	14.2
10/24/2012	230.1	5.6
10/25/2012	1737.5	17.5

**Notes:**  
Dataram Serial # 3408 D061

**APPENDIX G**  
**RESULTS OF INTERIM AND FINAL STATUS SURVEYS**

From File: J:\United Nuclear Corporation\10501302 NECR Removal Actions\Data Repository\10 - EDRA Data>Status Survey Stats\gamma+background.xls.wst

<b>Summary Statistics for Raw Full Data Sets</b>											
<b>Variable</b>	<b>NumObs</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Median</b>	<b>Variance</b>	<b>SD</b>	<b>MAD/0.675</b>	<b>Skewness</b>	<b>Kurtosis</b>	<b>CV</b>
Ra-226 (Background area)	25	0.6	1.3	1.0	1.0	0.0	0.2	0.1	-0.585	0.139	0.176
Ra-226 (Zone 6 gamma static)	10	1.5	2.7	2.0	2.1	0.1	0.4	0.4	0.313	-0.0919	0.185
Ra-226 (Zones 2-5 gamma static)	149	0.4	2.7	1.6	1.6	0.2	0.5	0.5	-0.0712	-0.236	0.3
Ra-226 (2009 IRA Area)	359	0.6	2.8	1.6	1.5	0.2	0.5	0.4	0.364	-0.129	0.284
<b>Percentiles for Raw Full Data Sets</b>											
<b>Variable</b>	<b>NumObs</b>	<b>5%ile</b>	<b>10%ile</b>	<b>20%ile</b>	<b>25%ile(Q1)</b>	<b>50%ile(Q2)</b>	<b>75%ile(Q3)</b>	<b>80%ile</b>	<b>90%ile</b>	<b>95%ile</b>	<b>99%ile</b>
Ra-226 (Background area)	25	0.7	0.8	0.9	1.0	1.0	1.2	1.2	1.3	1.3	1.3
Ra-226 (Zone 6 gamma static)	10	1.5	1.6	1.7	1.8	2.1	2.2	2.2	2.3	2.5	2.7
Ra-226 (Zones 2-5 gamma static)	149	0.9	1.0	1.2	1.3	1.6	2.0	2.1	2.2	2.3	2.6
Ra-226 (2009 IRA Area)	359	0.877	1.033	1.26	1.323	1.537	1.912	2.028	2.235	2.41	2.729

## Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

### User Selected Options

From File	gamma+background.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	1.14
Selected Null Hypothesis	Site or AOC Mean/Median $\geq$ Background Mean/Median Plus Substantial Difference, S (Form 2)
Alternative Hypothesis	Site or AOC Mean/Median Less Than Background Mean/Median Plus Substantial Difference, S

Area of Concern Data: Ra-226 (zones 2-5 gamma static)

Background Data: Ra-226 (background area)

### Raw Statistics

	Site	Background
Number of Valid Observations	149	25
Number of Distinct Observations	139	8
Minimum	0.352	0.6
Maximum	2.671	1.3
Mean	1.584	1.036
Median	1.558	1
SD	0.475	0.182
SE of Mean	0.0389	0.0365

### Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC  $\geq$  Mean/Median of Background + 1.14

Site Rank Sum W-Stat	11662
WMW Test U-Stat	-5.899
WMW Critical Value (0.050)	-1.645
P-Value	1.82E-09

### Conclusion with Alpha = 0.05

Reject H0, Conclude Site < Background + 1.14

P-Value < alpha (0.05)

## Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

### User Selected Options

From File	Combined_IRA_Resurvey.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	1.14
Selected Null Hypothesis	Site or AOC Mean/Median $\geq$ Background Mean/Median Plus Substantial Difference, S (Form 2)
Alternative Hypothesis	Site or AOC Mean/Median Less Than Background Mean/Median Plus Substantial Difference, S

Area of Concern Data: Ra-226 in pCi/g (2009 IRA Area)

Background Data: Ra-226 in pCi/g (Background Reference Area)

### Raw Statistics

	Site	Background
Number of Valid Observations	359	25
Number of Distinct Observations	299	8
Minimum	0.61	0.6
Maximum	2.842	1.3
Mean	1.603	1.036
Median	1.537	1
SD	0.455	0.182
SE of Mean	0.024	0.0365

### Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC  $\geq$  Mean/Median of Background + 1.14

Site Rank Sum W-Stat	65857
WMW Test U-Stat	-6.057
WMW Critical Value (0.050)	-1.645
P-Value	6.95E-10

### Conclusion with Alpha = 0.05

Reject H0, Conclude Site < Background + 1.14

P-Value < alpha (0.05)