REMOVAL ASSESSMENT REPORT

ABANDONED URANIUM MINE SITES
HAYSTACK NO.1, SECTION 24, AND BIBO TRESPASS

Navajo Nation, Baca/Haystack Chapter, McKinley County, New Mexico

EPA Contract No.: EP-S5-13-02
TDD No.: 0002/1302-T2-R9-14-07-0001
Document Control No.: 0009-08-AAFI

June 2015

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ABBREVIATIONS AND ACRONYMS

ATV	all-terrain vehicle
AUM	Abandoned Uranium Mine
bgs	below ground surface
BLM	Bureau of Land Management
cpm	counts per minute
DCGL	Derived Concentration Guidance Level
DOE	Department of Energy
EE/CA	Engineering Evaluation/Cost Analysis
EML	Environmental Measurements Laboratory
EPA	U.S. Environmental Protection Agency
FOSC	Federal On-Scene Coordinator
GPS	Global Positioning System
HASL	Health and Safety Laboratory
m^2	square meter
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
Navajo Nation	Navajo Nation Native American Reservation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NNEPA	Navajo Nation Environmental Protection Agency
NRC	Nuclear Regulatory Commission
pCi/g	picocuries per gram
PRG	preliminary remediation goal
PVC	polyvinyl chloride
R^2	coefficient of determination
Ra-226	Radium 226
Ra-226+d	Radium 226 and daughter progeny
RPD	relative percent difference
QA	quality assurance
QC	quality control
SAP	Sampling and Analysis Plan

SOP	Standard Operating Procedures
SSL	site screening level
START	Superfund Technical Assessment and Response Team
TDD	Technical Direction Document
TestAmerica	TestAmerica Laboratories, Inc.
U_3O_8	Triuranium octoxide
WESTON	Weston Solutions, Inc.

1. INTRODUCTION

In August 2014, the U.S. Environmental Protection Agency Region 9 Federal On-Scene Coordinator (FOSC) Randy Nattis tasked Weston Solutions, Inc.'s (WESTON) Superfund Technical Assessment and Response Team (START) to provide technical support for an EPA-funded removal assessment at the Haystack No. 1 Abandoned Uranium Mine (AUM) site, which incorporates the former Haystack No. 1, Section 24, and Bibo Trespass AUMs. The Haystack No. 1 AUM site (the site) is located in McKinley County, New Mexico, within the Baca/Haystack Chapter of the Navajo Nation Native American Reservation (Navajo Nation).

This removal assessment was initiated in response to regulatory concern over potential radioactive contamination at the site from historical uranium ore mining practices that may pose an "imminent and substantial endangerment to human health or the environment." During the most recent site screenings conducted in 2009 for each AUM, gamma radiation activity (gamma activity) counts were detected at maximum levels greater than 40 times the naturally-occurring background levels throughout the site. Based on these results, the Navajo Nation Environmental Protection Agency (NNEPA) requested assistance from EPA in performing a removal assessment at the site to determine the nature and extent of contamination for the purpose of mitigating any potential impacts to human health and/or the environment.

This report documents the results of field assessment actions conducted by START between August 10 and 20, 2014, to characterize site conditions and to determine whether previously detected elevated gamma activity at the site pose "imminent and substantial endangerment to human health or the environment." As appropriate, EPA will use data acquired during the removal assessment to evaluate the potential for a removal action at the site and identify alternatives to mitigate hazards that meet endangerment criteria.

2. SITE INFORMATION

2.1 SITE LOCATION AND DESCRIPTION

The removal assessment area is located atop the Haystack Butte, approximately 500 feet south of Haystack Mountain, within the Baca/Haystack Chapter of the Navajo Nation, approximately five miles east of Prewitt, McKinley County, New Mexico (Figure 1 in Appendix A).

The removal assessment area consists of three adjacently located AUMs, as well as adjoining areas where surface gamma activity was previously detected at levels greater than 25 times the reported naturally-occurring background level. The removal assessment area encompassed a total of approximately 174 acres, which included the three former AUMs with a total combined area of 118 acres. The removal assessment area is currently used for livestock grazing, and one residence is located within the boundary of the Haystack No.1 AUM. Approximately 10 other residences and a church are located within 0.25 mile of the removal assessment area. The removal assessment area topography is described as relatively flat, with an average slope ranging from 2-8%, and is bordered to the south by a cliff's edge. The removal assessment area drains northeast, into the Rio San Jose receiving basin.

In addition, a background site was also identified and assessed to determine naturally-occurring gamma activity levels within the regional vicinity of the removal assessment area.

The three adjacently located AUMs compromising the removal assessment area and the regional background site are described below, and are shown in Figure 2 in Appendix A.

2.1.1 Haystack No. 1 AUM

The Haystack No. 1 AUM encompasses approximately 69 acres, and comprises the eastern portion of the removal assessment area. The geographic coordinates for the approximate center of the AUM are 35.3457135782 North latitude and 107.943650564 West longitude.

The AUM is situated on both Indian Allotment and land privately owned by S. Farthree and McKingen, with the mineral rights owned by Newmont Mining Corporation. The former ore-mining operation extended throughout all 69 acres and included numerous pits ranging in size,

with a reported maximum depth of 60 feet below ground surface (bgs). The pits were reportedly reclaimed from 1990 to 1991 and are no longer present at the AUM. The AUM was screened in 2008 by WESTON for surface gamma activity, at which time elevated gamma activity was found throughout the site, including an area approximately 40 times above the reported naturally-occurring background level near the onsite residence.

2.1.2 Bibo Trespass AUM

The Bibo Trespass AUM encompasses approximately 22 acres, and comprises the northwestern portion of the removal assessment area. The geographic coordinates for the approximate center of the Bibo Trespass AUM are 35.3495228711 North latitude and 107.94863969 West longitude.

The AUM is located on federal land owned by the Bureau of Land Management (BLM), with the mineral rights also owned by BLM. The former ore-mining operation included one pit located in the southeast corner, which was an extension of a pit mined at the Haystack No.1 AUM. The pit was reportedly reclaimed from 1990 to 1991, and is no longer present at the AUM. The AUM was screened in 2008 by WESTON for surface gamma activity, at which time elevated gamma activity greater than five times the reported naturally-occurring background level was found along the dirt road transecting the AUM.

2.1.3 Section 24 AUM

The Section 24 AUM encompasses approximately 27 acres, and comprises the southwestern portion of the removal assessment area. The geographic coordinates for the approximate center of the Section 24 AUM are 35.3465449599 North latitude and 107.947928184 West longitude.

The AUM is located on Indian Allotment land, with Indian Allotment mineral rights. The former ore-mining operation included a 900 feet long by 300 feet wide area where the top 10 feet was stripped, and at least three pits were dug to a maximum depth of 15 to 20 feet bgs. Overburden limestone was reportedly piled throughout the workings, and a small mine dump was located in the center of the pits. The pits were reportedly reclaimed in 1990 and are no longer present at the AUM. The AUM was screened in 2008 by WESTON for surface gamma activity, at which time elevated gamma activity was found throughout the AUM, including areas that measured more than 25 times the naturally-occurring background level.

2.2 SITE HISTORY

The removal assessment area is comprised of three adjacently located former AUMs that were among 31 sections of land mined from the Todilto Limestone deposits in the Grants Uranium District of New Mexico. The Todilto Limestone deposits were one of few places in the world where commercially viable uranium was found within limestone formations. The Todilto deposits were mined from 1950 to 1981, and produced a total of approximately 3,300 tons of Triuranium octoxide (U_3O_8), a compound of uranium. The Haystack No.1 AUM, also known as "Haystack-Section 19 Open Pit Complex," was operational from 1951 to 1981 with a total U_3O_8 production volume of approximately 335 tons. The Bibo Trespass AUM, also known as "Section 13," was operational from 1951 to 1981 with a total U_3O_8 production volume of approximately 8.5 tons. The Section 24 AUM, also known as "Nan-a-bah Vandever" and "Glen and Edith," was operational from 1952 to 1957 with a total U_3O_8 production volume of approximately 58 tons.

In 1950, a Navajo sheepherder discovered uranium deposits in the limestone at the foot of Haystack Butte, at the current location of the Haystack No.1 AUM. The mineral rights at the discovery site were owned by Sante Fe Pacific Railroad who promptly began drilling, sampling, and test pitting in November of 1950. Sante Fe Pacific Railroad made the first shipments of U_3O_8 in 1951 to the Atomic Energy Commission buying station in Monticello, Utah.

In 1952, Sante Fe Pacific Railroad formed the Haystack Mining Development Company and began large scale exploration. By 1955, approximately 44%of the ore produced from the Todilto deposits came from the stockpiles at Haystack No.1.

The peak of the Todilto deposit mining was in 1959, when more than 293 tons of U_3O_8 was produced and sold to the local Anaconda Bluewater buying station, who announced they would no longer be accepting ore after May of 1959. Following the closure of the Anaconda-Bluewater station, the Haystack Mining Development Company sent ore to Homestake-New Mexico and Phillips Petroleum Company Mills. By 1981, declining prices of uranium eventually led to the closure of the Todilto deposit mines.

All three AUMs were reportedly reclaimed between 1990 and 1991 by Newmont Mining Corporation/Sante Fe Pacific Railroad under an EPA action. The reclamation included the backfilling of pits, removal of debris, and limited fencing and signage.

2.3 PREVIOUS INVESTIGATIONS

The EPA Region 9 began its AUM Project in 1994 to determine if the former uranium mining activities at the Navajo Nation posed a threat to human health or the environment. Over the course of this investigation, which lasted through January 2000, aerial radiation surveys were conducted over 1,194 square miles. In addition, over 200 water sources used for human consumption were identified and analyzed for radiation and related metal concentrations.

Based on EPA AUM Project data, a Site Screen Report was completed for each of the three AUMs in 2009 by WESTON: *Haystack No. 1 AUM Site Navajo AUM Eastern Region* (WESTON, 2009a), *Bibo Trespass AUM Site Navajo AUM Eastern Region* (WESTON, 2009b), and *Nan-a-bah Vandever AUM Site Navajo AUM Eastern Region* (WESTON, 2009c). Based on surface gamma activity levels collected in 2008, the following areas of concern were identified:

- Haystack No.1 AUM: Historical pits were located throughout the AUM, and elevated gamma activity levels were found across the site, including areas approximately 40 times the naturally-occurring background levels near the onsite residence. In addition to the site wide evidence of graded soil throughout the workings area, approximately 25 small test pits were located at the southeastern extent of the AUM, as well as immediately off-site. A fence runs the entire length of the northern and western boundaries, and radiological hazard signs are posted throughout the site;
- Bibo Trespass AUM: A historical pit was located in the southeast corner of the AUM, and elevated gamma activity levels were found highest along the dirt road transecting the site, more than five times the naturally-occurring background levels;
- Section 24 AUM: Historical workings were found in the northeast portion of the AUM, and elevated gamma activity and graded soil was found across the site, including levels measured at more than 25 times the naturally-occurring background levels. A fence runs the entire length of the northern and eastern boundaries, and radiological hazard signs are posted throughout the site;
- Offsite Delineation Areas (Elevated Gamma Levels): Elevated gamma activity levels along the AUM boundaries where the horizontal extent of contamination has not yet been determined, including the northern, eastern, and southern boundaries of the Haystack No.1 AUM, as well as limited portions of the Section 24 and Bibo Trespass AUM boundaries;

- Offsite Areas of Concern (Unknown Gamma Levels): Gamma activity levels have not been measured at some areas of specific concern near the AUMs, including along the bottom of the cliff area south of the site, and along the access roads and res idences northeast of the site.

3. FIELD ASSESSMENT

Field activities for this removal assessment were conducted from August 10 through 20, 2014, under the authority of FOSC Randy Nattis. WESTON START performed field assessment activities in accordance with the *Sampling and Analysis Plan (SAP), Removal Assessment of Haystack No. 1 Abandoned Uranium Mine, Including Haystack No. 1, Section 24, and Bibo Trespass, July 2014* (WESTON, 2014).

During the field assessment, a total of 15 surface soil samples from 0 to 6 inches bgs and 7 subsurface soil samples ranging from 6 inches bgs to 18 feet bgs were collected from the removal assessment area, and six surface soil samples ranging from 0 to 18 inches bgs and one subsurface soil sample (12 to 24 inches bgs) were collected from the regional background site. The field assessment activities are discussed in Sections 3.1 through 3.4. Photographs documenting the field assessment are provided in Appendix B.

The site-specific SAP (WESTON, 2014) described the sampling rationale, sampling methodology, analytical procedures, and scope of sampling to meet the following project objectives:

1. Determine the potential threat to human health or the environment from AUM waste (assessed as elevated gamma activity levels) at the site which exceed the proposed action level protective of human health;
2. Determine the lateral ground surface boundaries where elevated gamma radiation activity is present at the site;
3. Evaluate the vertical subsurface extent where elevated gamma radiation activity is present at the site; and
4. Determine the typical background levels for gamma radiation activity in areas surrounding the site.

3.1 REMOVAL ASSESSMENT FIELD ACTIVITIES

For the purposes of this removal assessment, the three adjacently located AUMs (Haystack No. 1, Bibo Trespass, and Section 24), adjoining elevated gamma activity areas, and surface water drainage pathways will be referenced herein as the removal assessment area, totaling an approximate area of 174 acres. All surface gamma activity scans, one-minute gamma activity

counts, and soil sampling conducted at the removal assessment area were performed according to the SAP (WESTON, 2014) unless otherwise noted.

3.3.1 Background Gamma Activity Measurements

A background gamma radiation survey unit measuring approximately 50 feet in radius was established prior to field scanning and sampling activities. The background area was identified using a paired Ludlum® Model 2241 meter and Ludlum Model 44 -20 (3 x 3) detector positioned six inches above the ground surface. The background area was located to the west of the Bibo Trespass AUM, at a similar elevation and geology as the site, in an undisturbed area with natural vegetation. One-minute static gam ma radiation counts were measured at six specific locations within the background area , whic h were used for comparison of soil sample concentrations collected in the assessment area. Figure 3 in Appendix A shows the results of the background screening and background laboratory samples. Table 1 in Appendix C summarizes the background samples collected and their corresponding one -minute gamma counts. The entire background area was also scanned on a daily basis by the surface gamma scanning units used to delineate the sitewide surface contamination. The mean gamma radiation measurements in the background surface soils were used to calculate the investigation level for gamma radiation at the site.

3.3.2 Surface Gamma Activity Measurements

An initial surface gamma acti vity scan was con ducted over the removal assessment area using EPA's VIPER software, linked to two all -terrain vehicles (ATVs), each mounted with two Trimble® Geo XT Global Positioning System (GPS) units, two Ludlum Model 2241 ratemeters, and two detector model 44 -20 units with 3 -inch x 3 -inch sodium iodide gamma s cintillators positioned six inches above the ground. The surface soil gamma radiation survey was conducted throughout the removal assessment area at approximately 5 -foot wide transects at a pace o f three feet per second. The transects extended laterally outside of the AUM areas as radiation measurements taken along the perimeter of the site exceeded the investigation level, until the contamination continued into the site boundaries of the other nea rby offsite AUM s, or the site topography was not suitable for continued scanning. The results of the surface scanning are shown on Figure 4 in Appendix A.

3.3.3 Subsurface Gamma Activity Measurements

Subsurface soil was scanned by attempting to advance boreholes to a subsurface depth of approximately 9.5 feet bgs, after which a Ludlum 44-62 (0.5 inch by 1 inch) detector paired with a Ludlum 2221 meter was placed within a thin-walled polyvinyl chloride (PVC) pipe with lead-shielded base and lowered into the borehole to collect static gamma measurements at one foot intervals. A total of 83 soil borings were distributed across the removal assessment area at depths ranging from 1.5 feet to 18 feet bgs, with total depths being dependent upon borehole refusal depths. The results from subsurface gamma screening are depicted on Figure 5 in Appendix A.

3.3.4 Surface Soil Sampling

A total of 15 surface soil samples were collected at the site and analyzed for Radium 226 (Ra-226) by EML HASL 300 4.5.2.3 method. Surface soil samples were co-located with one-minute static gamma radiation counts to establish a relationship between Ra-226 concentrations and gamma radiation measurements in counts per minute (cpm) in soil. Surface soil samples were collected from 0 to 6 inches bgs from locations with a wide range of gamma radiation measurement levels. Surface soil samples were collected from locations within the ranges of interest in each soil type and vegetation cover observed at the site. Before collecting surface soil samples, a one-minute surface gamma activity count was collected at each soil sampling location by placing a Ludlum 3x3 probe six inches above the soil surface during the measurement. Results for all surface samples are depicted on Figure 6 in Appendix A.

3.3.5 Subsurface Soil Sampling

A total of seven subsurface soil samples were collected using an EPA-supplied direct-push drill rig, with disposable acetate liner to collect soil cores. The subsurface sampling locations were collocated with selected surface sampling locations. The boreholes were advanced to depths ranging from 1.5 to 18 feet bgs, and the disposable sleeves were placed on a plastic-sheet lined table and labeled. Following the removal of the soil core, a Ludlum 44-62 detector (0.5 inch by 1 inch) paired with a Ludlum 2221 meter was placed in a thin-walled PVC pipe with a lead-shielded base and lowered into the borehole to collect static gamma measurements at one foot intervals. Soil sample depths were determined based on the gamma scanning measurements, and

the sample was collected directly from the core. Results for all subsurface samples are depicted on Figure 6 in Appendix A.

3.4 QUALITY ASSURANCE (QA)/ QUALITY CONTROL (QC) OF FIELD SAMPLING

Four QC field duplicate soil samples were collected at locations randomly selected in the field. According to the SAP, field duplicate samples were collected to determine a relative percent difference (RPD) between homogenized split duplicate soil samples collected as a double volume from one location. Field duplicate soil samples consisted of one sample aliquot collected as double volume, homogenized, and then split into two sample jars and assigned a unique sample ID for analysis of Ra-226.

Two laboratory QC soil samples and one laboratory QC water sample, referred to as matrix duplicates, were randomly selected for additional Ra-226 laboratory QC analyses.

Four QC equipment rinsate samples (EB-01 through EB-04) were collected from non-dedicated sampling instruments (e.g.., hand auger, trowel) used during the assessment to evaluate field decontamination procedures. In accordance with the SAP, equipment rinsate samples were collected following decontamination of the sampling equipment at a rate of once per day when non-dedicated sampling instruments were utilized. Rinsate samples were collected by pouring distilled water over the decontaminated sampling instrument and collecting the water into certified clean sample containers for analysis of Ra-226.

3.5 QA/QC OF FIELD GAMMA ACTIVITY MEASUREMENTS

The Ludlum 3x3 field screening instruments utilized during this removal assessment were evaluated to document that the equipment was within annual calibration and operating within daily QC parameters according to the SAP (WESTON, 2014). To minimize the potential for measurement variability, the Ludlum Model 2241 ratemeters were matched with the same Ludlum Model 44-20 detectors with 3-inch x 3-inch sodium iodide gamma scintillator throughout the assessment period. Prior to the assessment, the high voltage settings for the matched ratemeter-detector combinations were adjusted so that the detectors had similar gamma

radiation responses to a certified Ra-226 source. Data were collected within a voltage window on the matched ratemeter-detector that was specific to Ra-226.

Prior to performing any surface field measurements, a one-minute gamma activity count was performed for the matched ratemeter-detectors using a certified Ra-226 source. Immediately before or after the one-minute count was performed with the Ra-226 check source, an additional one-minute count was performed without a check source. A ±20% variation from this initial measurement value was set as the QC tolerance limit during subsequent daily QC checks.

Daily QC checks were performed at the end of each day of assessment activity. To minimize variance during each daily QC check, the check was performed with the Ra-226 source and ratemeter-detector combinations in the same location and orientation as those used during the initial calibration measurement described above. The ratemeter-detector combinations used during this removal assessment did not fail QC limits (i.e., within 20% of the initially measured values). Calibration sheets and annual calibration certificates are located in the project files.

4. PRESENTATION AND DIS CUSSION OF ANALYTICA L RE SULTS AND GAMMA ACTIVITY MEASUREMENTS

Soil samples and equipment rins ate blank samples collected during the August 2014 removal assessment to be analyzed for Ra -226 gamma spectroscopy (method HASL 300, 4.5.2.3) were submitted to TestAmerica Laboratories, Inc. (TestAmerica), located in Earth City, Missouri.

Gamma activity scans and one -minute surface gamma activity counts co nducted during the removal assessment were collected utilizing:

ATV Unit A-1:
- Ludlum 2241 ratemeter: S/N: 196687
- Ludlum 44-20 detector with 3-inch x 3-inch NaI gamma scintillator: S/N: PR262406

ATV Unit A-2:
- Ludlum 2241 ratemeter: S/N: 222196
- Ludlum 44-20 detector with 3-inch x 3-inch NaI gamma scintillator: S/N: PR213432

ATV Unit B-1:
- Ludlum 2241 ratemeter: S/N: 201097
- Ludlum 44-20 detector with 3-inch x 3-inch NaI gamma scintillator: S/N: PR269980

ATV Unit B-2:
- Ludlum 2241 ratemeter: S/N: 198223 (08/14 – 8/16); 198274 (8/17 – 8/20)
- Ludlum 44-20 detector with 3-inch x 3-inch NaI gamma scintillator: S/N: PR336004

Surface Sample Static Measurements:
- Ludlum 2221 ratemeter: S/N: RFW21430
- Ludlum 44-20 detector with 3-inch x 3-inch NaI gamma scintillator: S/N: PR298505

Subsurface Static Measurements
- Ludlum 2221 ratemeter: S/N: 399726
- Ludlum 44-62 detector with 3-inch x 3-inch NaI gamma scintillator: S/N: PR158625

All laboratory analyti cal results were provided by TestAmerica with Tier 2 data validation. A WESTON chemist then conducted data validation for all laboratory -generated data in general accordance with EPA *National Functional Guid elines for Inorganic Superfund Data Review* (EPA, 2014) modified as requires for the specific methods used . Tier 2 data validation included evaluation of criteria such as laboratory QA/QC summaries, holding times, and matrix -related recoveries. Data qualifiers were applied by START according to the guidance used (EPA, 2014).

All data were found to be acceptable for use as definitive data. A summary of analytical laboratory results and gamma activity measurements are presented in Appendix C. Laboratory Analytical Data Validation Reports are presented in Appendix D.

4.1 DERIVED CONCENTRATION GUIDANCE LEVEL (DCGL)

The DCGL was used to screen the risk to human health from Ra-226 concentrations in soil at the removal assessment area. The DCGL is defined by the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) as *a radionuclide -specific surface or volume residual radioactivity level that is related to a concentration dose or risk criterion* (MARSSIM, 2000). MARSSIM was composed under EPA, the Nuclear Regulatory Commission (NRC), and the Department of Energy (DOE) , the agencies responsible for the release of radioactive sites following cleanup; it is intended to provide a nationally consistent consensus approach for conducting radiation surveys and inve stigations at potentially contaminated sites for federal, state, and local agencies. DCGLs may be developed with EPA guidance using default modeling input parameters, such as the current EPA preliminary remediation goals (PRGs); or by using site-specific modeling parameters (e.g., exposure pathways, contamination zones, and land-use).

START used the EPA PRG Calculator to determine the DCGL at the Haystack No.1, Section 24, and Bibo Trespass AUMs. The PRG Calculator incorporates readily obtainable site data into simple, standardized equations to derive a site-specific site screening level (SSL) for Ra-226 based on various exposure pathways. The internet version of the PRG Calculator can be found at : http://epa- prgs.ornl.gov/cgi-bin/radionuclides/rprg_search. The potential pathways of exposure to radionuclides in soil at the site that were considered in the calculations were as follows:

- Direct ingestion of soil
- Inhalation of fugitive dusts
- External radiation exposure from photon-emitting radionuclides in soil

For some radionuclides, the ingestion of contaminated produce and drinking water constitute the most likely exposure pathways if these items are obtained from on-site sources. However, groundwater pathways were not considered because the nearby home sites are supplied with domestic water service by the Navajo Tribal Utility Authority, and produce ingestion pathways

were not considered because agriculture growth is not permitted near the site , and due to the arid climate, large gardens and fruit trees are uncommon in the vicinity.

The exposure pathways listed above represent the most likely exposure mechanisms for individuals residing near the AUMs . The external radiation exposure pathway is, for most radionuclides, the dominant mode of exposure and typically represents the most significant risk. The inhalation of fugitive dust pathway is included in the analysis; however, it is of significance for only a very few radionuclides.

For each pathway, radiotoxicity criteria are used to define an acceptable level of radionuclides in soil, based on an individual excess lifetime cancer risk range of 10^{-4} to 10^{-6}. The potential for additive effects has not been "built in" to the PRG Calculator. While the pathways included in the analysis are considered to represent expected pathways for the removal assessmentarea, SSLs are not calculated for a specific scenario (i.e., SSLs are not summed over a set of pathways). According to EPA guidance, setting a 10^{-6} risk level for individual radionuclides and pathways will generally lead to cumulative risks within the acceptable range of 10^{-4} to 10^{-6} for the combinations of radionuclides typically found at Superfund sites (EPA, 2000).

In calculating particulate emissions factors, the model uses climate data based on nine regional U. S. climatic zones. Climatic Zone 3, which includes the Haystack No. 1 AUM location, was selected for use in the model. Based on an assumed size of 112 acres for the impacted area at the site, an impacted area of 500,000 square meters (m^2) was selected in the model (area options were limited to 200,000 m^2 or 500,000 m^2).

Default values were used in all other cases. This included standard assumptions of a 26 year total exposure duration (6 years for children and 20 for adults), an Indoor Exposure Time Fraction of 0.683 (i.e., 68.3%), and an Outdoor Exposure Time Fraction of 7.3%. The time fractions are the estimated portions of time a resident spends indoors or outdoors in the contaminated area, respectively. For the non-residential areas, the standard assumption of 26 years was also applied ; however, the annual rate of exposure was reduced from 350 days to 180 days.

Based on the aforementioned input values and using a target excess cancer risk of 10^{-4}, the model calculated a residential scenario SSL for site of 1.38 picocuries per gram (pCi/g), and a non-residential (i.e. recreator) scenario SSL as 1.86 pCi/g.

The DCGLs were established by using the EPA excess risk level for Ra-226 and daughter progeny (Ra-226+d) for residential soils. To establish the site-specific DCGLs, the site-specific PRGs as described above at a 10^{-4} excess risk level for Ra-226+d were added to the average detected background soil concentration for Ra-226 of 0.352 pCi/g to produce the following DGCLs:

- A DCGL of 1.732 pCi/g was determined for a one-acre radius surrounding the residence located within the impacted area.
- A DCGL of 2.212 pCi/g was determined for the remaining site-wide impacted area.

4.2 REMOVAL ASSESSMENT AREA

Between August 10 and 20, 2014, START performed a surface gamma activity scan and collected surface and subsurface soil samples and co-located one-minute surface gamma activity counts at the removal assessment area. A summary of the Ra-226 analytical data for surface and subsurface soil samples and the co-located one-minute surface gamma activity counts is presented in the data summary tables in Appendix C.

4.2.1 Background Soil Sampling

Six surface soil samples and one subsurface soil sample were collected to identify the range and average of regional Ra-226 background concentrations and to provide a correlation factor between background surface gamma activity measurements and surface Ra-226 background concentrations. The regional background site for this removal assessment was selected based on guidelines set forth by the SAP (WESTON, 2014), and to meet background location selection criteria such as similar evaluation, similar geology, within an undisturbed area, and within an area not influenced by drainage or flooding. All background soil results are summarized in Table 1 in Appendix C and explained below.

Ra-226 concentrations in surface soil samples collected from the background site ranged from 0.264 to 0.425 pCi/g, with an average concentration of 0.352 pCi/g. In the six surface samples, all detected Ra-226 concentrations were below both DCGLs. Co-located one-minute surface gamma activity counts collected from these 11 soil sampling locations ranged from 13,633 cpm to 18,817 cpm and had an average of 17,271 cpm. The correlation between the detected Ra-226 surface concentrations and the one-minute surface gamma activity counts in co-located soil samples in the regional background area is discussed in Section 4.4.

4.2.2 Surface Soil Sampling and Gamma Activity Measurements

Fifteen surface soil samples were collected to identify whether concentrations of Ra-226 in surface soil exceeded the DCGL at the removal assessment area and to provide a correlation factor between surface gamma activity measurements and Ra-226 surface concentrations. All surface soil sampling results are summarized in Table 2 in Appendix C and explained below.

Ra-226 concentrations in 15 surface soil samples collected from the removal assessment area ranged from 0.423 to 26 pCi/g. Of these 15 surface samples, Ra-226 levels in six samples exceeded the site wide Ra-226 DCGL of 2.212 pCi/g. One of these samples was collected from the one-acre area surrounding the residence; its Ra-226 level of 1.99 exceeds the residential DCGL of 1.732 pCi/g. The average Ra-226 surface concentration detected in the sample set was 5.185 pCi/g, which significantly exceeds the DCGL. Co-located one-minute surface gamma activity counts collected using a Ludlum 44-20 (3 x 3) from these 15 soil sampling locations ranged from 21,472 cpm to 134,388 cpm and had an average of 46,989 cpm. The correlation between the detected Ra-226 surface concentrations and the one-minute surface gamma activity counts in co-located soil samples at the removal assessment area is discussed in Section 4.4.

4.2.3 Subsurface Soil Sampling

Seven subsurface soil samples were collected to evaluate the vertical extent of soil contamination and to estimate potential soil removal volumes at the removal assessment area. All subsurface soil results are summarized in Table 3 in Appendix C and explained below.

Ra-226 concentrations in subsurface soil samples ranged from 0.433 pCi/g at a depth of 17 to 18 feet bgs to 37.2 pCi/g at a depth of 0.5 to 1.5 feet bgs. Of these seven subsurface samples,

Ra-226 levels in five samples exceeded the site wide Ra-226 DCGL of 2.212 pCi/g. One of the samples was collected from within the one-acre area around the residence ; its Ra-226 level of 0.806 pCi/g does not exceed the residential DCGL of 1.732 pCi/g. The average Ra-226 surface concentration dete cted in the sample set was 12.026 pCi/g which significantly exceeds the DCGL. Co-located one-minute surface gamma activity counts collected using a Ludlum 44 -62 (0.5 x 1) from five subsurface soil sampling locations ranged from 1,234 cpm to 21,708 cpm and had an average of 11,104 cpm. Two sample depths (SS-03-B from 11 to 12 feet bgs and SS-06-B from 17 to 18 feet bgs) did not have co -located gamma measurements, due to the 9.5 foot length of the Ludlum 44-62 unit.

4.3 QA/QC RESULTS

Four field duplicates were collected to assess field precision. Field duplicates were collected and submitted for Ra -226. The sample results were evaluated by calculating the RPD between the field duplicate and parent sample results. An RPD of less than 50% for soil samples of Ra-226 is generally considered acceptable. All field duplicates were within this acceptance criteria.

To assess field decontamination procedures , equipment blanks were collected and submitted for Ra-226. The analytical results from all of the equipment blanks wer e non-detect, indicating that there wasn't cross contamination between samples.

4.4 CORRELATION BETWEEN SURFACE SOIL SAMPLIN G AND GAMMA ACTIVITY MEASUREMENTS

The detected Ra -226 surface concentrations and one-minute surface gamma activity counts in co-located soil samples in the removal assessment area were correlated to determine the gamma activity level equivalent to DCGL s of 1.732 and 2.212 pCi/g. Using linear regression analysis, the coefficient of determination (R^2) value between Ra -226 surface concentrations and one-minute surface gamma activity counts in corresponding samples was greater than 75 percent. The comparison of the Ra -226 surface soil concentrations and corresponding one -minute surface gamma activity counts is presented in Table 4 in Appendix C.

Although a correlation value was established between the detected Ra -226 surface concentration and one -minute surface gamma activity count in co -located soil samples, the actual R^2 value

used to evaluate the correlation between Ra -226 surface concentrati ons and the surface gamma activity scan for the purposes of this removal assessment is based on sample location data from where Ra-226 surface concentrations are < 20 pCi/g. A total of 14 of the 15 sampling locations from the removal assessment area were used to establish this R^2 value, the outlier SS -07-A was removed from the calculation . A summary of these data is included in Table 4 in Appendix C . The use of this more conservative R^2 value for correlating measurements collected during the surface gamma ac tivity scan and the surface Ra -226 concentrations is intended to more accurately represent Ra -226 concentrations near the proposed EPA DCGL s of 1.732 and 2.212 pCi/g to be protective of human health exposure risks. The R^2 value between Ra -226 surface concentrations < 20 pCi/g and one -minute surface gamma activity c ounts in corresponding samples was greater than 75 %. Therefore, gamma activity scanning data correlated to Ra-226 surface concentrations <20 pCi/g collected during this assessment meet EPA criterion for use as screening level data (R^2 = >70 percent) at the site.

5. CONCLUSIONS AND RECOMMENDATIONS

Per the EPA FOSC, for the purposes of data analysis, data collected from the site will be compared to site wide DCGL, except for one acre surrounding the on-site residence which will be compared to a more conservative residential DCGL.

Based on soil sampling data and gamma activity scan count rates, surface soil concentrations of Ra-226 appear to exceed the residential DCGL of 1.732 pCi/g over an estimated area of approximately 0.74 acres, or 32,200 square feet (ft^2), within one acre surrounding the on-site residence. A subsurface sample collected near the residence at a depth of 3.0 – 4.0 feet bgs was found to be below the DCGL, but a full vertical characterization of the contamination has not been performed. If any removal actions were to occur, a more detailed gamma scan should be performed, and additional surface and subsurface confirmation samples should be collected to properly define the removal area. The residential removal area is shown on Figure 7.

Based on soil sampling data and gamma activity scan count rates, surface soil concentrations of Ra-226 appear to exceed the site-wide DCGL of 2.212 pCi/g over an estimated area of approximately 107.4 acres, or 4,678,350 ft^2. Surface Ra-226 activity concentrations were above the action level in six of 15 soil samples. Elevated Ra-226 concentrations ranged from 1.99 pCi/g in sample SS-01-A to 37.2 pCi/g in sample SS-12-B. If any removal actions were to occur, a more detailed gamma scan should be performed, and additional surface and subsurface confirmation samples should be collected to properly define the removal area. The site wide removal area is shown on Figure 8.

Based on soil sampling and gamma activity scan count rates, surface soil concentrations of Ra-226 above the residential DCGL appear to be migrating off-site into the drainages to the northeast of the site, and to the west of the site. An elevated Ra-226 concentration of 3.76 pCi/g was identified in the western drainage, and elevated gamma scan concentrations were identified in both the western and eastern drainages. Off-site levated gamma scan concentrations were also identified throughout the test pit area east of Haystack No. 1, and at isolated locations southwest of Haystack No. 1, north of Haystack No.1 and Bibo Trespass, and west of Section 24. If any removal actions were to occur, a more detailed gamma scan should be performed, and additional

surface and subsurface confirmation samples should be collected to properly define the removal area. The offsite removal areas are shown on Figure 8.

The northern portion of the Bibo Trespass AUM, and portions of the Section 24 and Haystack No. 1 AUMs appear to have approximately one foot of clean cover material overlying impacted material. The vertical extent of the impacted material (i.e. material with gamma activity count rates greater than approximately two times the background count rate) in these areas was not defined. With the exception of the southern portion of Section 24, the southwestern portion of Haystack No. 1, and in two samples from the northernmost portion of Bibo Trespass, the vertical extent of elevated gamma activity was not defined in any area. Samples were impacted to the maximum depth explored (i.e. between 3 and 10 feet bgs) in most borings.

Based on relatively low Ra-226 activity concentrations in surface soils collected in areas with relatively high surface gamma activity scan rates (e.g. samples SS-09-A at 0.827 pCi/g, SS-12-A at 0.42 pCi/g and ED-01-A at 0.88 pCi/g), it appears that the cap may be too thin to provide adequate shielding from elevated gamma activity and possibly radon. It is unclear whether the original cap was designed and/or constructed too thin, or if erosive forces have thinned the cap since it was installed. It is recommended to use standard industry practices in accordance with DOE guidance for calculating the thickness of the cap required to shield receptors from radon emanation and elevated gamma activity. The calculation should include a factor of safety to account for soil loss due to erosion for the design life of the cap. The soil cap in the northern portion of the Bibo Trespass Mine appears to be effective at reducing surface gamma activity count rates to less than twice background.

Based on the nature of the ore body (i.e. a relatively shallow hard rock surface ore body), mining techniques used at the assessment area (open pit mining), and the available data generated as part of this assessment work, it is unlikely that excavation and off-site disposal of the waste would be the most efficacious method of reducing risks to humans and the environment from past mine operations. Even after removing large volumes of contaminated material (calculated at 1.86 million cubic yards for a 115-acre area with an average depth of 10 feet), it is unlikely the residual surface activity concentrations would be below the proposed action level. It is likely that some form of consolidation, soil/rock capping, and limited institutional controls would be the

most cost effective method of permanently reducing near term and long term risks at the site. Institutional controls, such as providing permanent alternative housing at an off -site location, may be warranted for the re sidents living in the northwestern portion of the Haystack No. 1 AUM. Soil data for samples collected from this area suggest surface and subsurface soil concentrations in this area are between two and five times the background level. Use of a computer mode ling software such as DOE's Resrad program may be warranted to further evaluate risks to residents living on and near the site.

5.1 TIME CRITICAL REMOVAL ACTION

A time-critical removal action may be necessary to mitigate exposure to contamination migrating off-site of the AUM boundaries , and within a one acre buffer area surrounding the on -site residence. Based on soil sampling and gamma activity scan count rates, surface soil concentrations of Ra -226 above the residential DCGL appear to be migrating off -site or into areas of concern at the locations described in the table below:

Time Critical Removal Areas of Concern

Area of Concern	Description	Depth (ft bgs)	Area (acres)	Area (ft^2)	Volume (yd^3)
Northeastern Drainage	Extending approximately 0.35 miles northeast of Haystack No.1 AUM, crossing a culvert beneath Red Mountain Road	Surface	2.6	111,400	2,061
Western Drainage	Extending approximately 0.2 miles west of Bibo Tresspass AUM, continuing down a steep ravine to the foot of the mesa below	Surface	1.2	53,450	989
On-Site Residence	Within a one-acre buffer of the on-site residential homesite	Surface	0.74	32,200	596
Haystack No.1 / Bibo Trespass Unfenced Area	Located within the boundaries of Haystack No. 1 and Bibo Trespass AUMs, immediately west of the on-site residential homesite, north of the fence line limiting access to Haystack No.1 and Section 24 AUMs	Surface	0.86	37,500	694
Test Pit Area	Throughout the test pit area located on the southeastern finger immediately east of Haystack No.1 AUM, above the intersection of County Road 23 and Red Mountain Road	2	3.2	140,000	10,360
Isolated Locations - North	Includes three small isolated elevated locations within 100 feet the northern boundaries of Haystack No. 1 and Bibo Tresspass AUMs, approximately 250 ft south of the residences north of the site	Surface	0.21	9,000	167
Isolated Locations - East	Includes nine small isolated elevated locations within 500 feet the western boundary of Haystack No. 1 AUM	2	0.64	28,000	2,072
Isolated Locations - South	o Includes three small isolated elevated locations within 200 feet the southern boundary of Haystack No. 1 AUM, approximately 600 ft northeast of the church at the foot of the mesa	Surface	0.32	14,000	259
Isolated Locations - West	Includes five small isolated elevated locations within 250 feet the western boundary of Section 24 AUM, less than 150 ft from the edge of the mesa at the northern most location	Surface	0.33	14,250	264

In order to protect the health of local residents, it is recommended tha t an estimated volume of 17,462 yd^3 of contaminated soil and residual contaminated mine waste be removed from the above areas of concern. Under the direction of EPA, a surgical assessment will be conducted to define the full lateral and vertical extent of the removal area , and gamma spectrometry measurements will be collected to confirm that the removal objectives have been met.

In order to expedite the removal and address the immediate health threat, the removed soil can be transported to within the fenced area located within the boundaries of Haystack No.1 AUM. The removed soil will be temporarily stockpiled and stabilized in a remote location within the AUM, until a full removal action can take place at a later date.

Residents living within the remova l area, and along the removal transportation routes, may need to be relocated for the duration of the time-critical removal action.

The remainder of the site does not appear to present an immediate threat to public health. A removal action addressing th e entire site would be very complex. Complexities of the site include the extremely large area, site ownership, and regulatory jurisdictions. Each of the AUMs is currently owned by different entities including Navajo Nation, U.S. BLM, and a private owner. START recommends performing an Engineering Evaluation/Cost Analysis (EE/CA) to further pursue the viability of a potential removal action. The EE/CA could help identify areas of the site in need of remediation, potential strategies for mitigating risk to t he onsite receptors, and associated costs. During this assessment, other potential regulatory agencies including: EPA Region 6, EPA Region 9, the State of New Mexico, the New Mexico Environmental Department, and NNEPA should be included in discussions of possible next steps for the site.

5.2 NATIONAL OIL AND HAZ ARDOUS SUBSTANCES PO LLUTION CONTINGENCY PLAN

The following factors listed in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) §300.415(b)(2) are present throughout the removal assessment area, and may be used by EPA in determining the appropriateness of a removal action:

(i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants

The removal ass essment area is currently used for livestock grazing, and one residence is located within the boundary of the Haystack No.1 AUM. Approximately 10 other residences and a church are located within 0.25 miles of the removal assessment area. Elevated levels of Ra-226 above the DCGL were documented in surface and subsurface soils throughout the removal assessment area.

(ii) Actual or potential contamination of drinking water supplies or sensitive ecosystems

The potential impact to drinking water or sensitive e cosystems was not addressed during the removal assessment.

(iii) Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release

No drums, barrels, tanks, or other bulk stor age containers were observed in the removal assessment area.

(iv) High levels of hazardous substances or pollutants or contaminants in soils largely at or nea r the surface, that may migrate

Elevated levels of Ra-226 above the DCGL were documented in surf ace soils throughout the removal assessment area. Elevated gamma activity significantly above the regional background levels was observed in drainages impacted by site soils and runoff.

(v) Weather conditions that may cause hazardous substances or polluta nts or contami nants to migrate or be released

High winds, seasonal thunderstorms, and heavy rainfall events may freque nt the removal assessment area, and can lead to the off-site migration of contaminated soils.

(vi) Threat of fire or explosion

No fire or explosion hazards were observed in the removal assessment area.

(vii) The availability of other appropriate federal or state response mechanisms to respond to the release

The removal assessment area is located within the boundaries of the Navajo Nati on, which fall under the jurisdiction of EPA Region 9.

(viii) Other situations or factors that may pose threats to public health or welfare of the United States or the environment.

No other factors that may pose a threat to public health and welfare were addressed in this removal assessment.

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WESTON. 2009b. *Site Screen Report for Bibo Trespass AUM Site Navajo AUM Eastern Region.*

WESTON. 2009c. *Site Screen Report for Nan-a-bah Vandever AUM Site Navajo AUM Eastern Region.*

WESTON. 2014. *Sampling and Analysis Plan (SAP), Removal Assessment of Haystack No. 1 Abandoned Uranium Mine, Including Haystack No. 1, Section 24, and Bibo Trespass.*

APPENDIX A
FIGURES

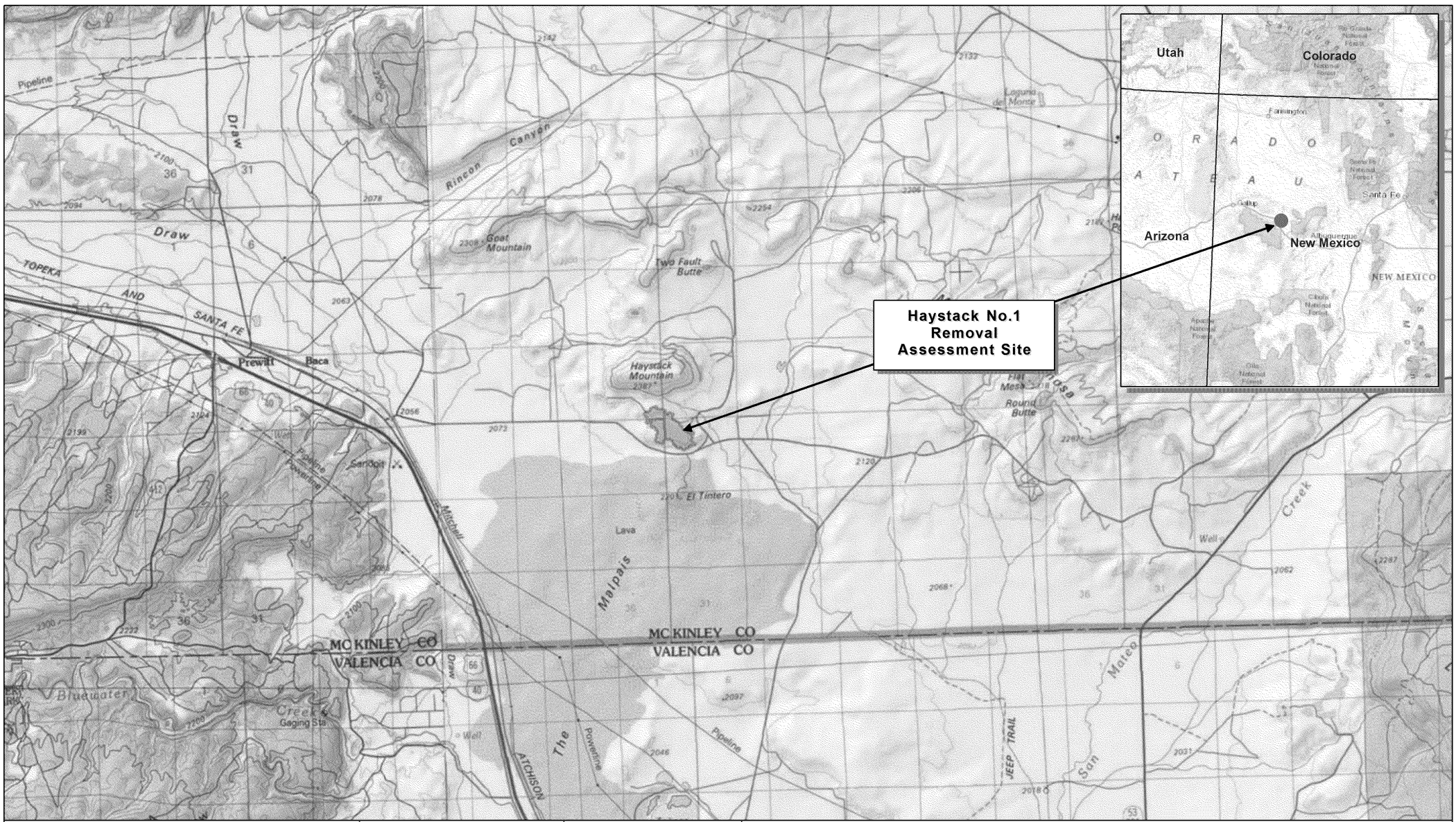

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FIGURE #1
SITE LOCATION
Haystack No. 1 Removal Assessment
Baca/Haystack Chapter, Navajo Nation, NM

Contract: EP-S5-13-02; **TDD:** 0002/1302-T2-R9-14-07-0001

Document Control Numberr: 0009-08-AAFI

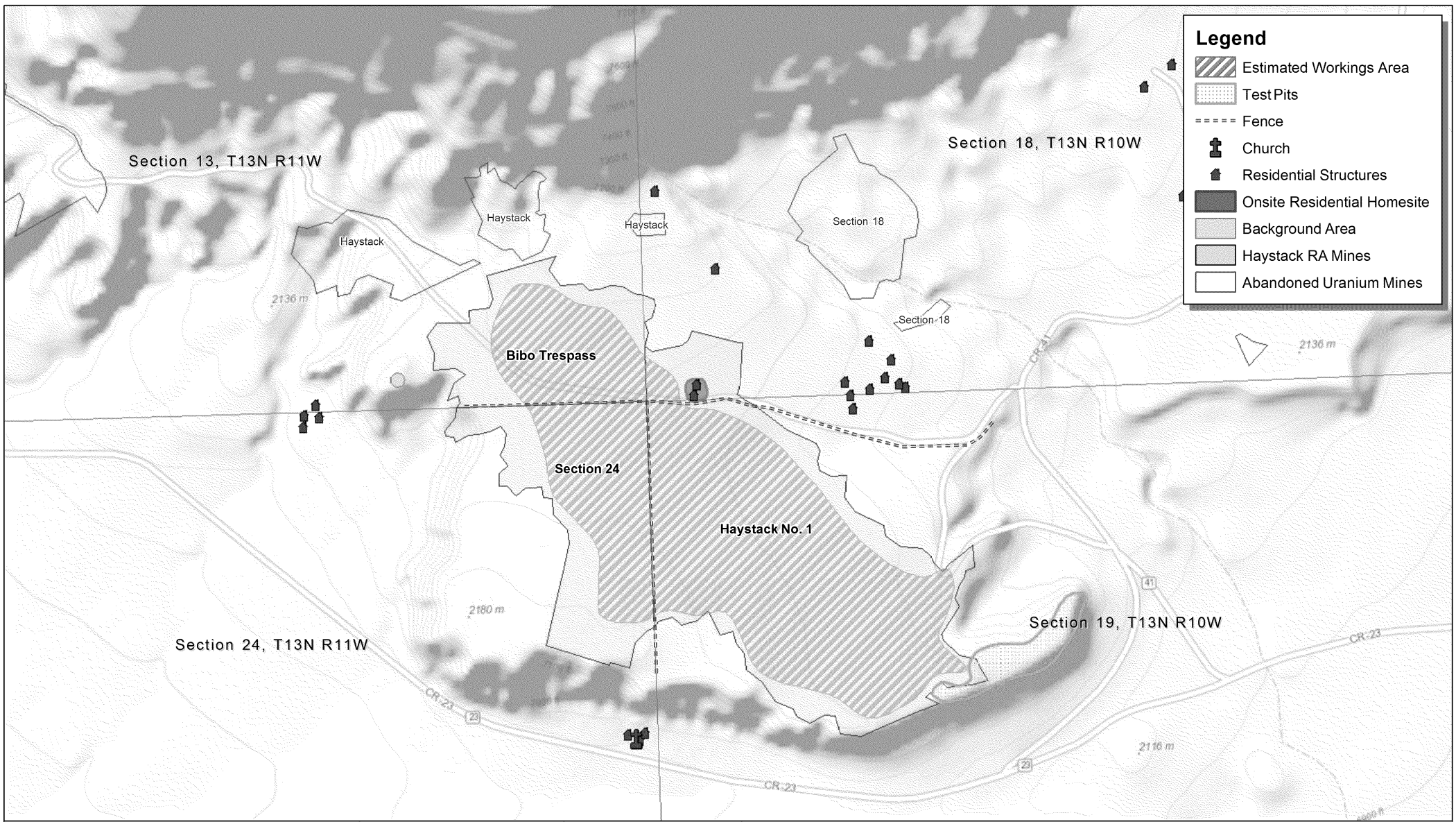

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FIGURE #2
SITE LAYOUT
Haystack No. 1 Removal Assessment
Baca/Haystack Chapter, Navajo Nation, NM

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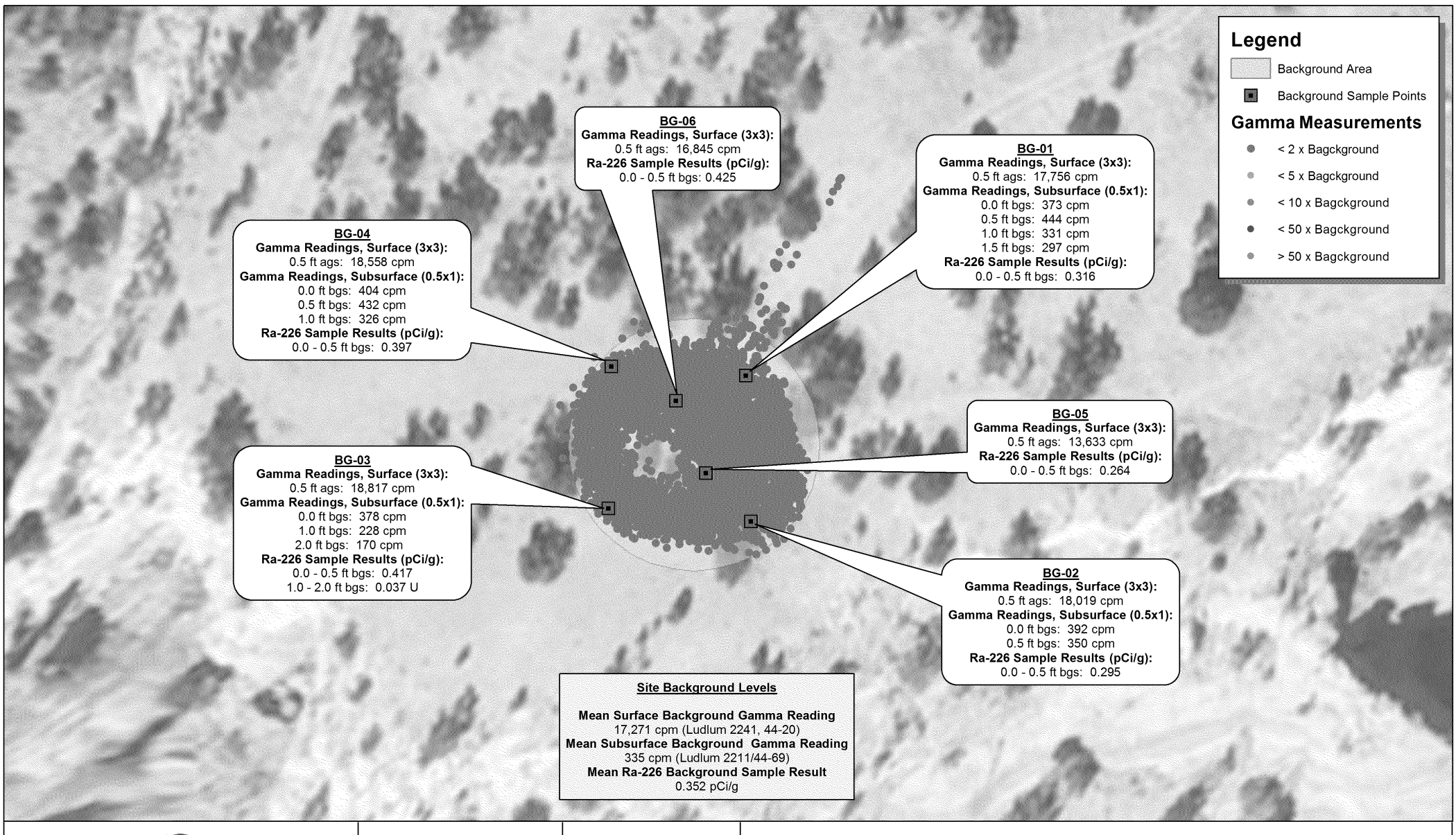

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FIGURE #3
BACKGROUND SAMPLE RESULTS
Haystack No. 1 Removal Assessment
Baca/Haystack Chapter, Navajo Nation, NM

Contract: EP-S5-13-02; **TDD:** 0002/1302-T2-R9-14-07-0001

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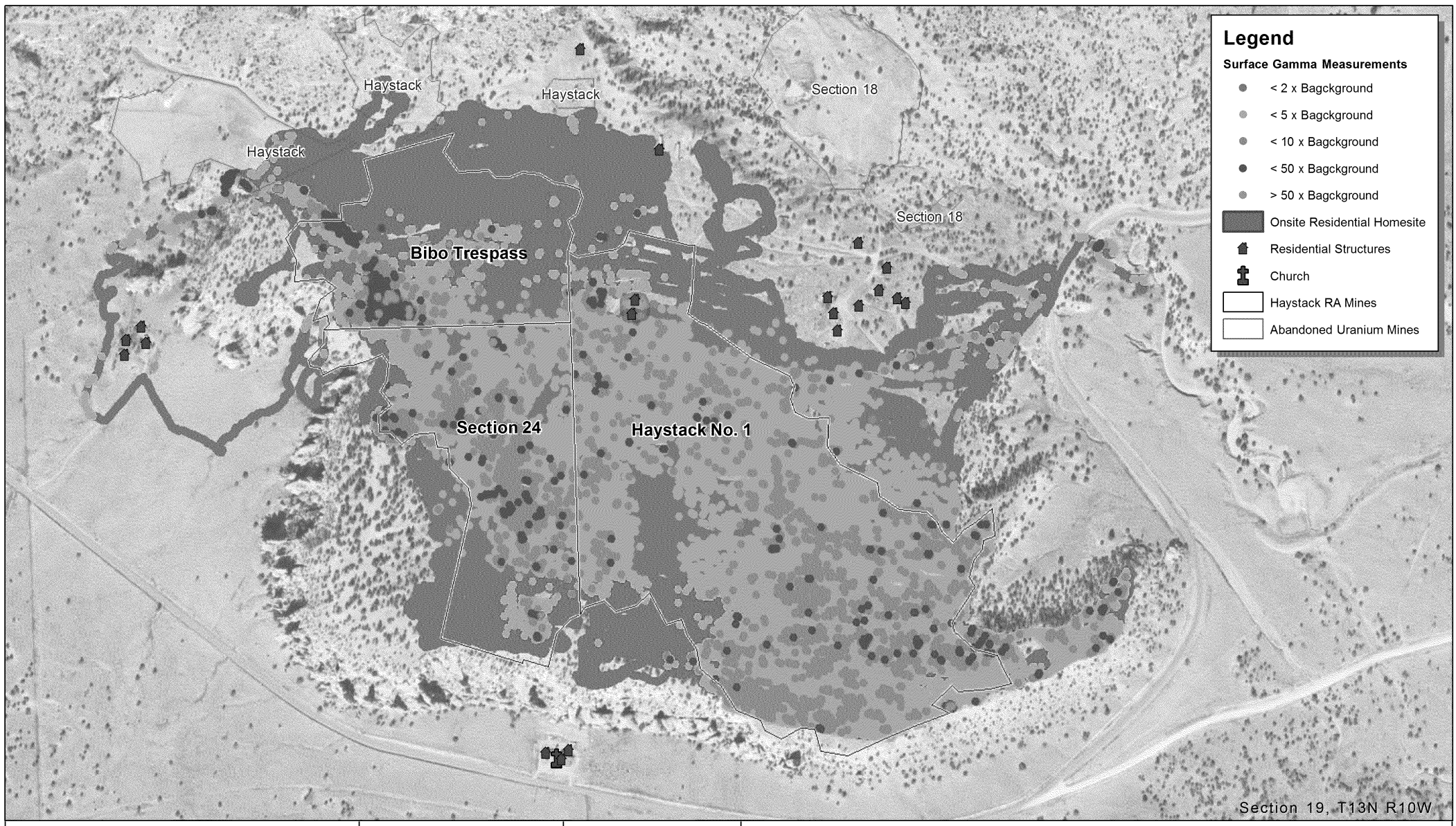

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FIGURE #4
SURFACE GAMMA RADIATION
Haystack No. 1 Removal Assessment
Baca/Haystack Chapter, Navajo Nation, NM

Contract: EP-S5-13-02; **TDD:** 0002/1302-T2-R9-14-07-0001

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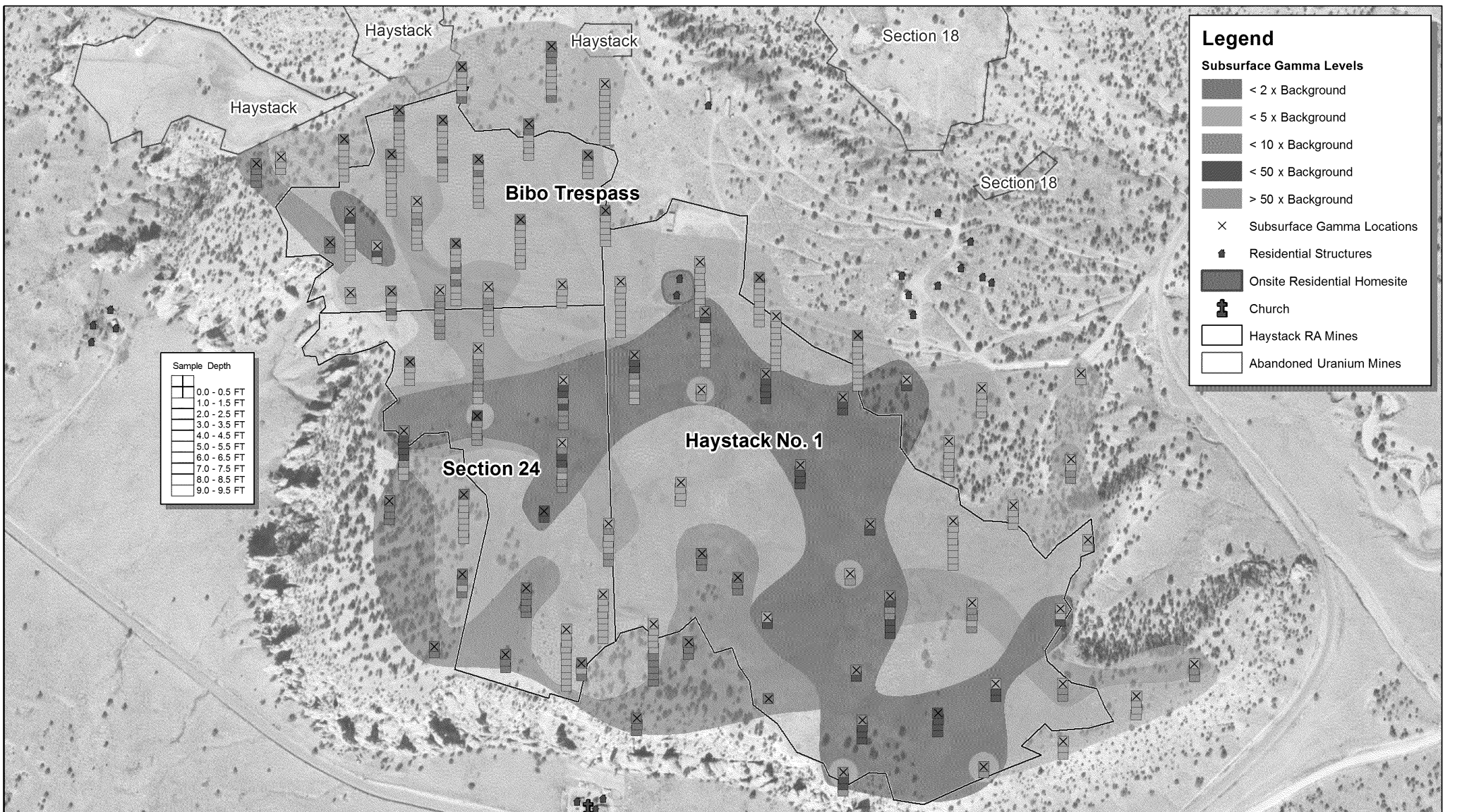

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FIGURE #5
SUBSURFACE GAMMA RADIATION
Haystack No. 1 Removal Assessment
Baca/Haystack Chapter, Navajo Nation, NM

Contract: EP-S5-13-02; **TDD:** 0002/1302-T2-R9-14-07-0001 **Document Control Numberr:** 0009-08-AAFI

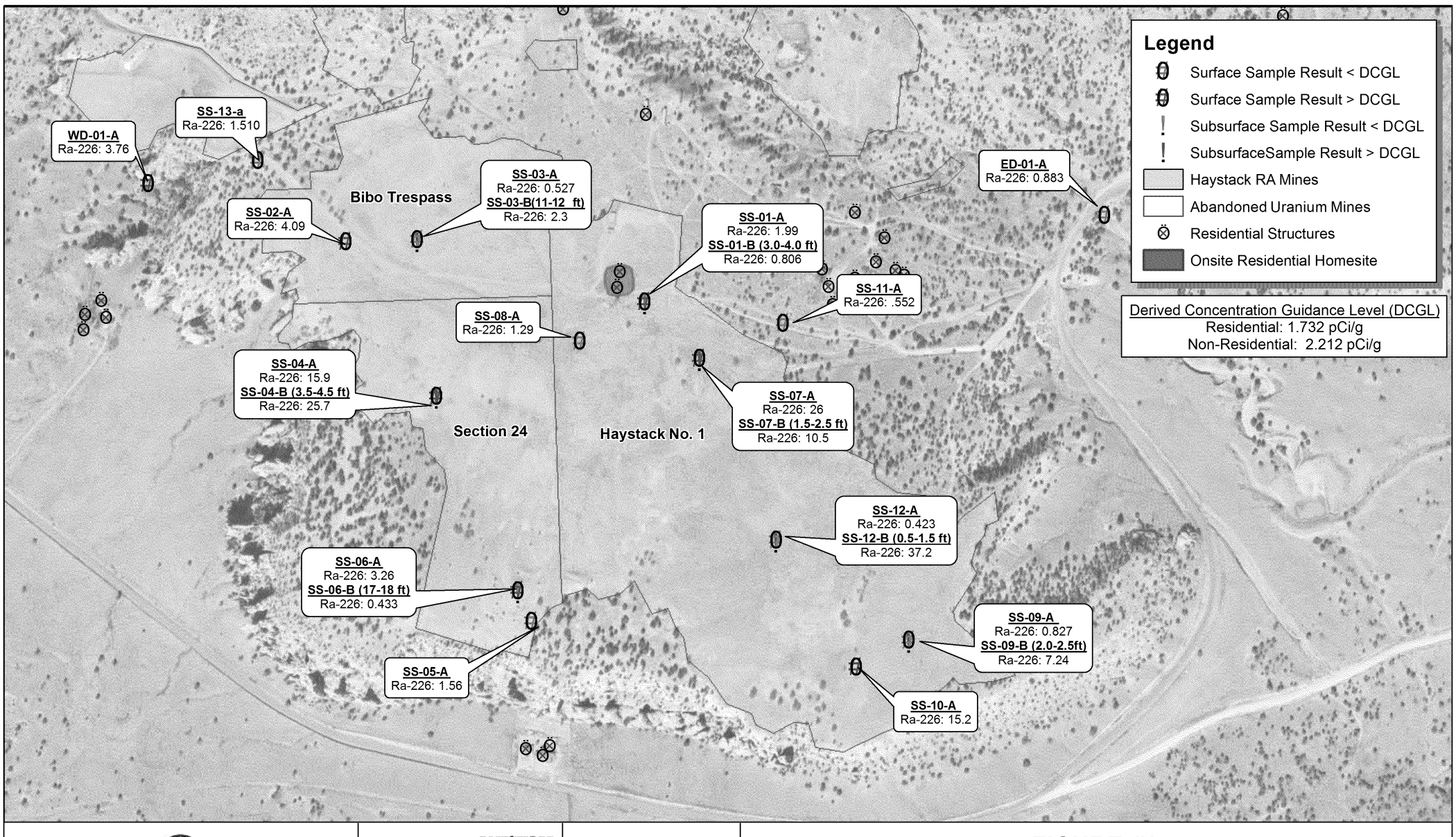

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FIGURE #6
SAMPLE RESULTS
Haystack No. 1 Removal Assessment
Baca/Haystack Chapter, Navajo Nation, NM

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FIGURE #7
RESIDENTIAL REMOVAL AREA
Haystack No. 1 Removal Assessment
Baca/Haystack Chapter, Navajo Nation, NM

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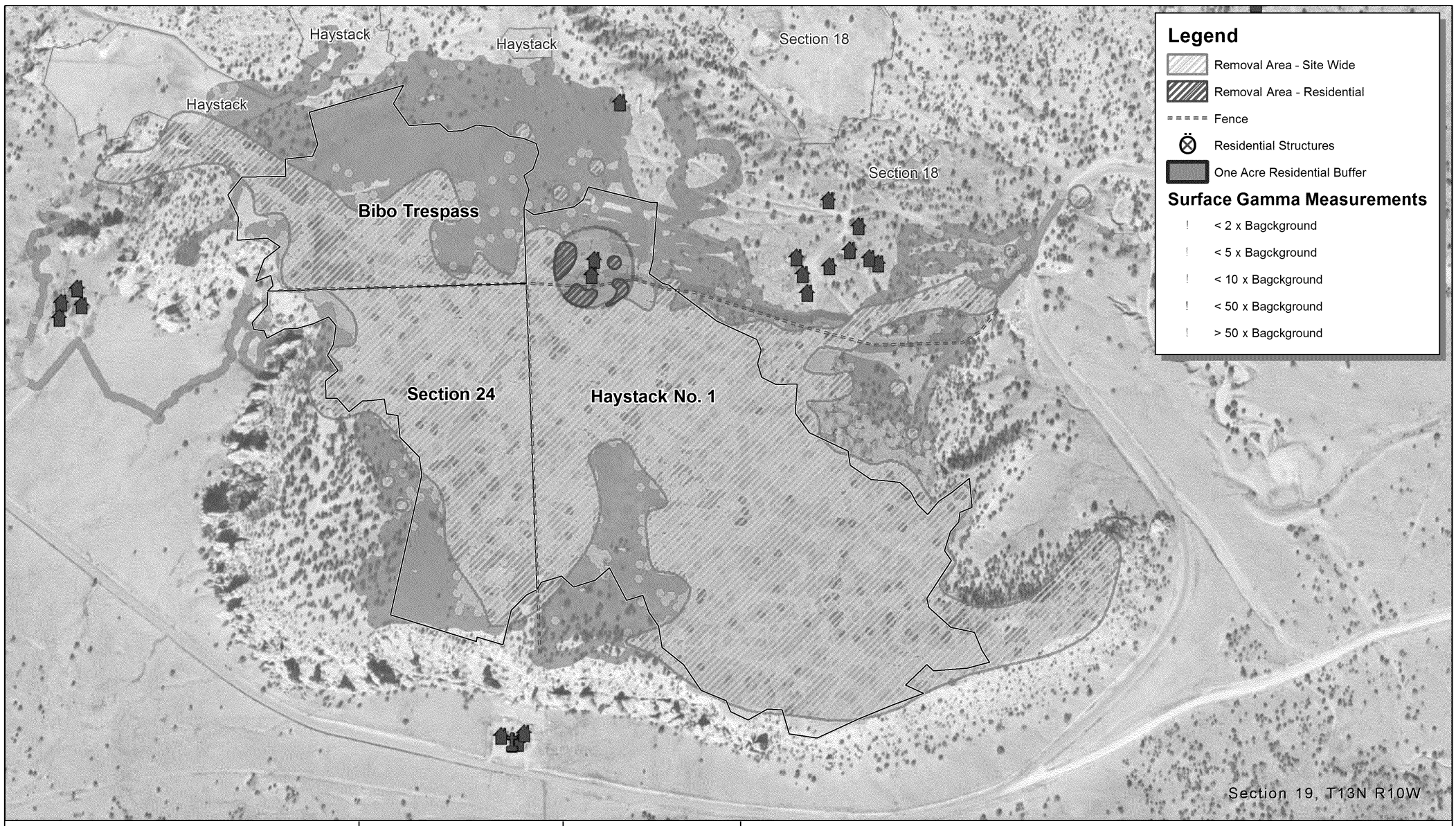

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FIGURE #8
SITE WIDE REMOVAL AREA
Haystack No. 1 Removal Assessment
Baca/Haystack Chapter, Navajo Nation, NM

Contract: EP-S5-13-02; **TDD:** 0002/1302-T2-R9-14-07-0001

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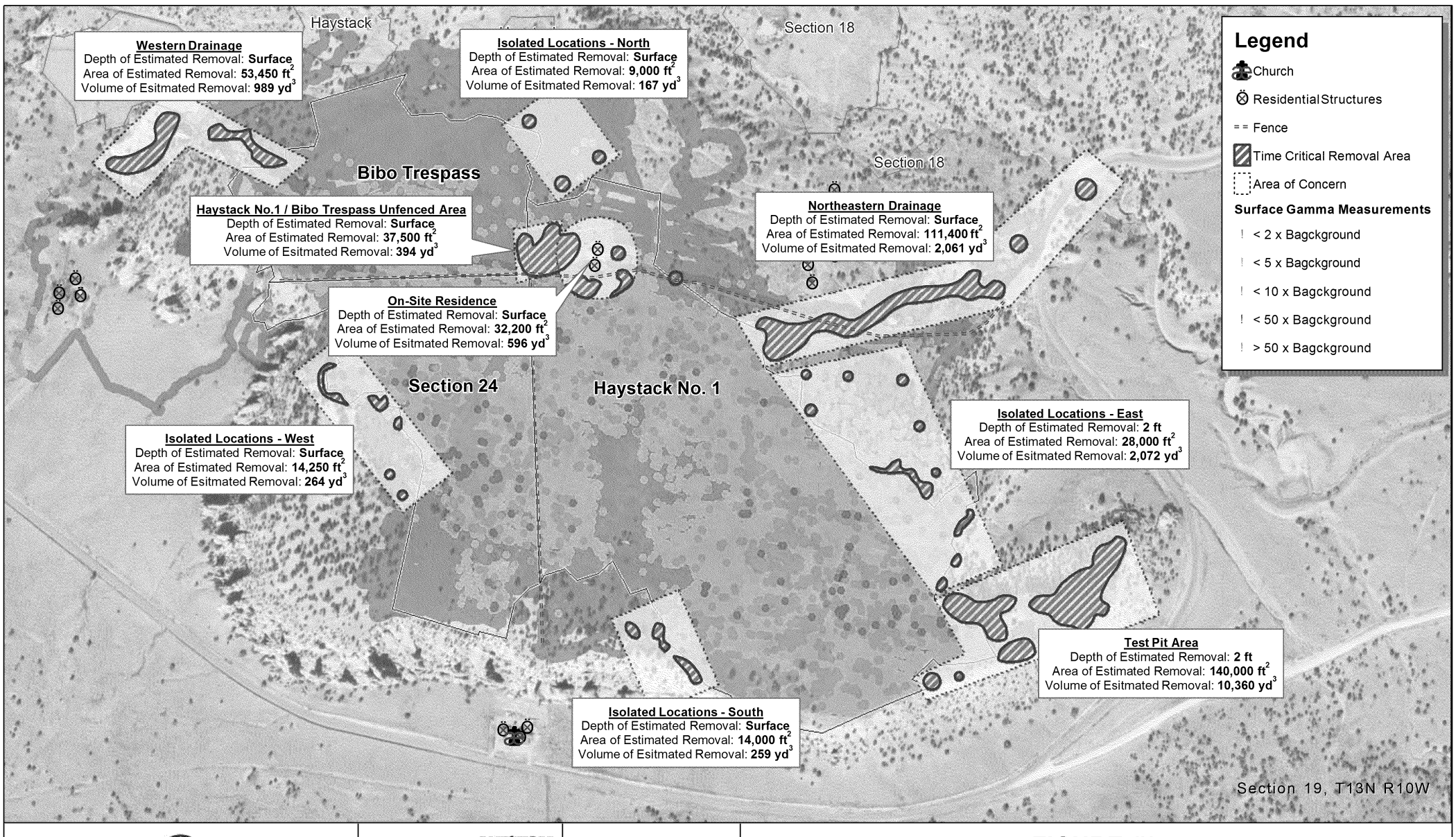

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FIGURE #9
TIME CRITICAL REMOVAL AREA
Haystack No. 1 Removal Assessment
Baca/Haystack Chapter, Navajo Nation, NM

Contract: EP-S5-13-02; **TDD:** 0002/1302-T2-R9-14-07-0001

Document Control Numberr: 0009-08-AAFI

APPENDIX B
PHOTOGRAPHIC LOG

PHOTOGRAPH LOG

Project Name:	Site Location:	TDD No.
Haystack No. 1 Removal Assessment	Baca/Haystack Chapter, Navajo Nation	0002/1302-T2-R9-14-07-0001

Photo No.	Date:
1	8/16/2014

Direction Photo Taken:

West

Description:

Haystack No. 1 Abandoned Uranium Mine (AUM), site overview

Photo No.	Date:
2	8/12/2014

Direction Photo Taken:

North

Description:

Bibo Trespass AUM, site overview

Photo No. 3	Date: 8/12/2014
Direction Photo Taken: South	
Description: Section 24 AUM, site overview	

Photo No. 4	Date: 8/13/2014
Direction Photo Taken: Southeast	
Description: Background area, BG-05 sampling location	

Photo No. 5	Date: 8/13/2014
Direction Photo Taken: Down	
Description: Background area, BG-06 sample collection and static gamma measurement	

Photo No. 6	Date: 8/15/2014
Direction Photo Taken: Down	
Description: Haystack No. 1 AUM, downhole gamma logging	

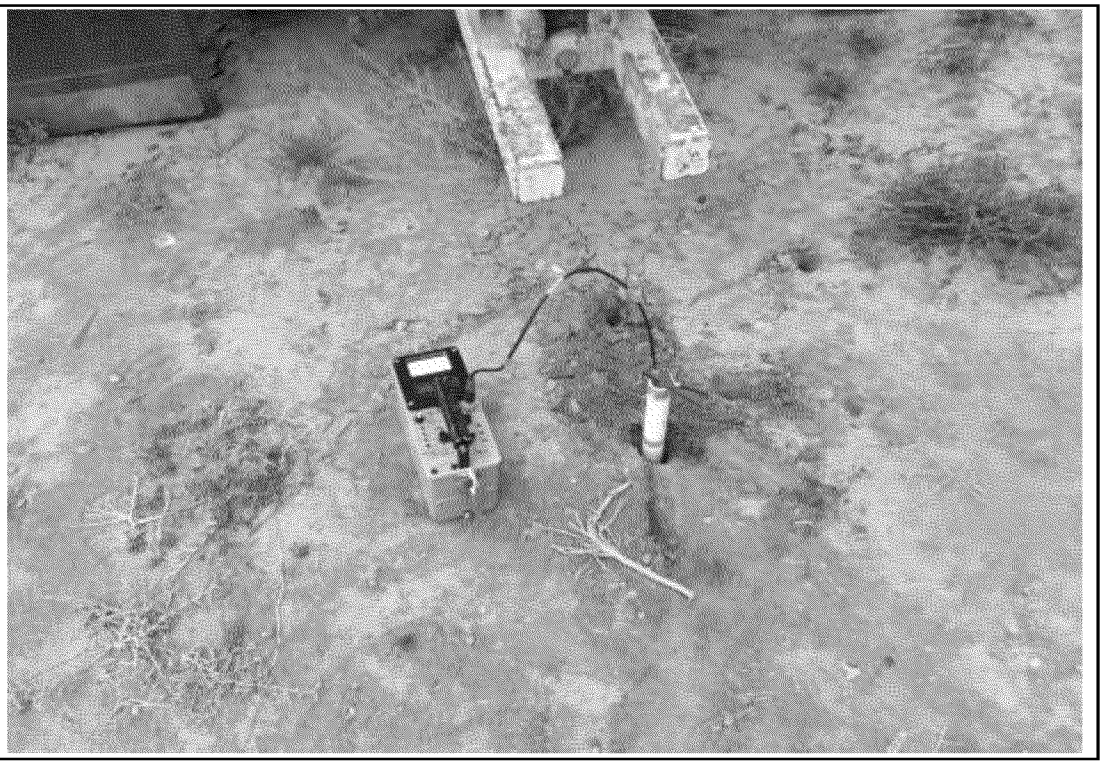


Photo No. 7	Date: 8/18/2014
Direction Photo Taken: East	
Description: Haystack No. 1 AUM, subsurface boring location	

Photo No. 8	Date: 8/17/2014
Direction Photo Taken: West	
Description: Haystack No. 1 AUM, subsurface boring location	

Photo No. 9	Date: 8/17/2014
Direction Photo Taken: North	
Description: Haystack No. 1 AUM, subsurface boring location, onsite residence in the distance	

Photo No. 10	Date: 8/17/2014
Direction Photo Taken: North	
Description: Haystack No. 1 AUM, subsurface boring location, north of AUM boundary	

Photo No. 11	Date: 8/18/2014
Direction Photo Taken: East	
Description: Haystack No. 1 AUM, subsurface boring location, southeast test pit area	

Photo No. 12	Date: 8/17/2014
Direction Photo Taken: West	
Description: Haystack No. 1 AUM, subsurface boring location, waste rock pile	

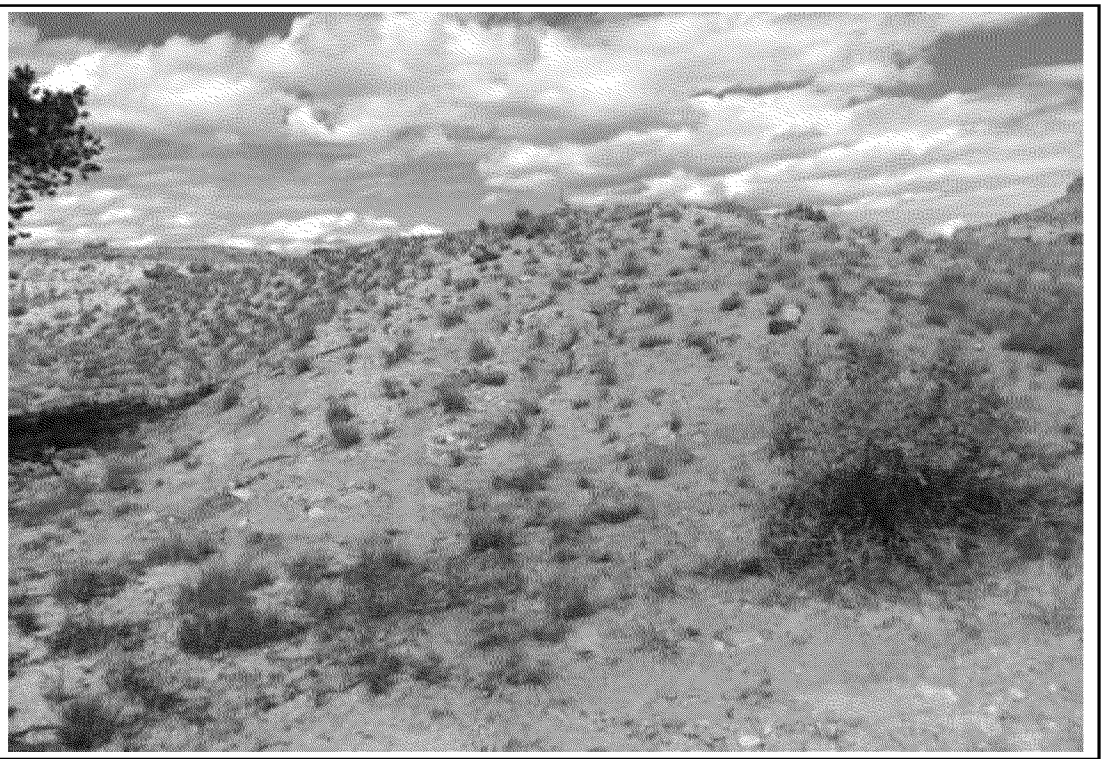


Photo No. 13	Date: 8/18/2014
Direction Photo Taken: West	
Description: Haystack No. 1 AUM, subsurface boring location, southeast test pit area	

Photo No. 14	Date: 8/17/2014
Direction Photo Taken: East	
Description: Haystack No. 1 AUM, subsurface boring location, southeast test boundary	

Photo No. 15	Date: 8/17/2014
Direction Photo Taken: Down	
Description: Haystack No. 1 AUM, SS-07 soil core, surface depth	

Photo No. 16	Date: 8/17/2014
Direction Photo Taken: South	
Description: Haystack No. 1 AUM, SS-07 soil core, subsurface depth	

Photo No. 17	Date: 8/152014
Direction Photo Taken: West	
Description: Bibo Trespass AUM, subsurface boring location, downhole gamma logging, north of AUM boundary	

Photo No. 18	Date: 8/15/2014
Direction Photo Taken: West	
Description: Bibo Trespass AUM, subsurface boring location, downhole gamma logging, north of AUM boundary	

Photo No. 19	Date: 8/15/2014
Direction Photo Taken: North	
Description: Bibo Trespass AUM, subsurface boring location, southeast of Mobile Command Post	

Photo No. 20	Date: 8/15/2014
Direction Photo Taken: North	
Description: Bibo Trespass AUM, subsurface boring location, southwest of Mobile Command Post	

Photo No. 21	Date: 8/16/2014
Direction Photo Taken: West	
Description: Section 24 AUM, subsurface boring location, western area	

Photo No. 22	Date: 8/16/2014
Direction Photo Taken: West	
Description: Section 24 AUM, subsurface boring location, eastern area	

Photo No. 23	Date: 8/16/2014
Direction Photo Taken: West	
Description: Section 24 AUM, subsurface boring location, undisturbed western area	

Photo No. 24	Date: 8/16/2014
Direction Photo Taken: Down	
Description: Section 24 AUM, SS-04 soil core, surface and subsurface depths	

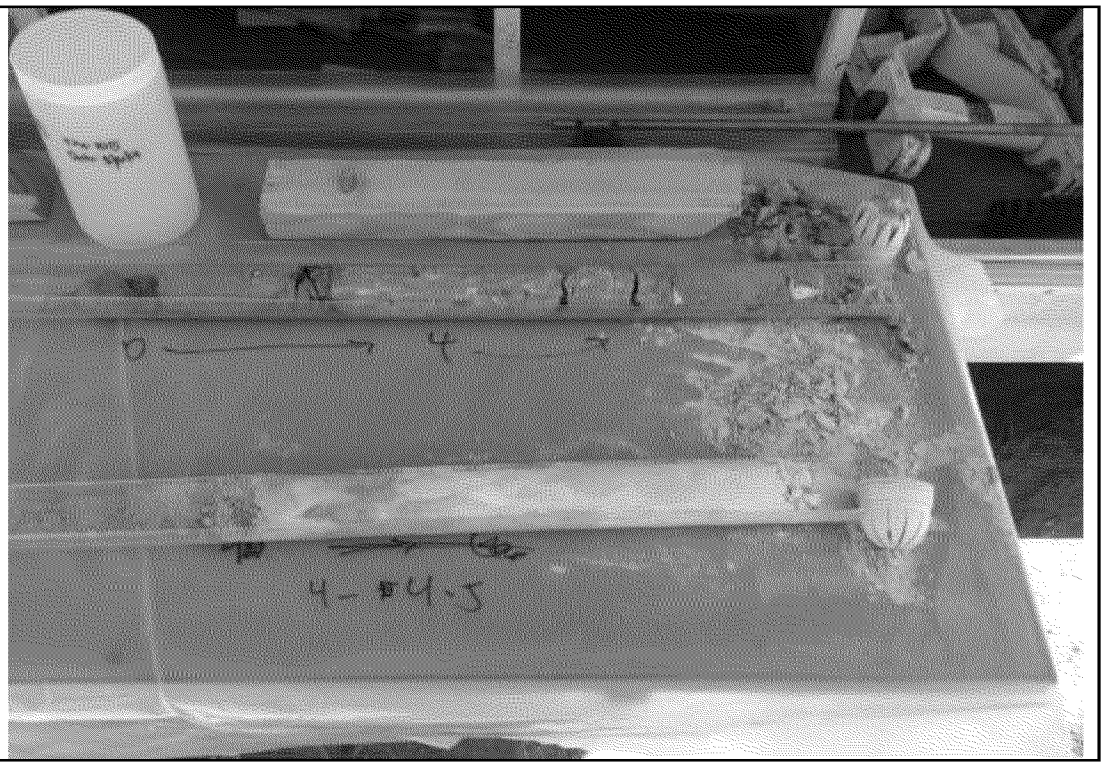


Photo No. 25	Date: 8/17/2014
Direction Photo Taken: Down	
Description: Section 24 AUM, SS-06 soil sample jar	

Photo No. 26	Date: 8/20/2014
Direction Photo Taken: West	
Description: Eastern Drainage, ED-01 sampling location, below outfall, immediately east of CR-41	

Photo No. 27	Date: 8/20/2014
Direction Photo Taken: North	
Description: Western Drainage, WD-01 sampling location, below mesa, northwest of site	

Photo No. 28	Date: 8/12/2014
Direction Photo Taken: Southwest	
Description: Onsite residence, located on the northern portion of Haystack No.1 AUM, immediately east of Bibo Trespass AUM	

Photo No. 29	Date: 8/12/2014
Direction Photo Taken: Southeast	
Description: Church and residence below mesa, south of Haystack No. 1 and Section 24 AUMs	

Photo No. 30	Date: 8/12/2014
Direction Photo Taken: North	
Description: Church and residence below mesa, south of Haystack No. 1 and Section 24 AUMs	

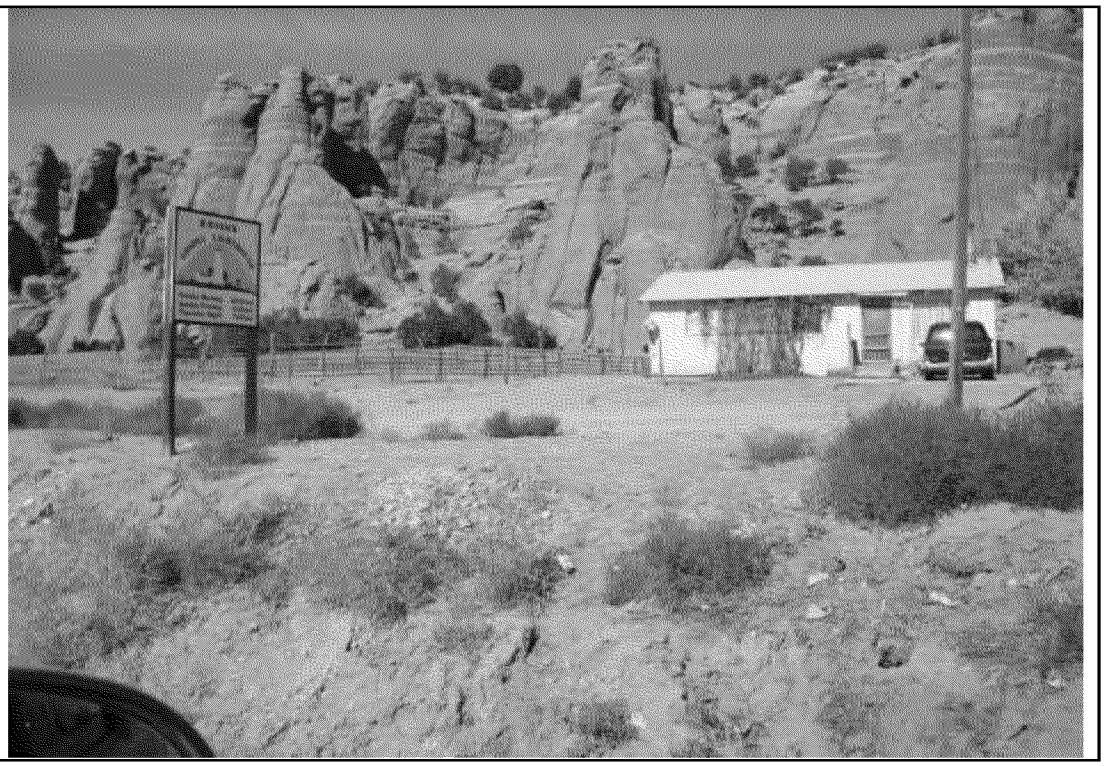


Photo No. 31	Date: 8/12/2014
Direction Photo Taken: West	
Description: EPA Mobile Command Center on site, ATV being fitted for Gamma survey	

Photo No. 32	Date: 8/15/2014
Direction Photo Taken: South	
Description: ATVs each outfitted with two gamma detectors attached to the VIPER remote monitoring system	

Photo No. 33	Date: 8/7/2014
Direction Photo Taken: Southeast	
Description: EPA OSCs performing surface Gamma survey with ATV mounted units	

Photo No. 34	Date: 8/20/2014
Direction Photo Taken: East	
Description: EPA OSC performing surface Gamma survey with handheld unit in East Drainage	

Photo No. 35	Date: 8/16/2014
Direction Photo Taken: West	
Description: START contractor performing direct push borings with a truck mounted Geoprobe unit	

Photo No. 36	Date: 8/15/2014
Direction Photo Taken: Down	
Description: START contractor screening soil cores collected from direct push borings	

Photo No. 37	Date: 8/16/2014
Direction Photo Taken: West	
Description: START contractor performing a vertical Gamma survey in the direct push boring	

Photo No. 38	Date: 8/16/2014
Direction Photo Taken: Northwest	
Description: Worn sign reads, "POTENTIAL RADIOLOGICAL HAZARD BELOW SURFACE" in English, Navajo, and Spanish	

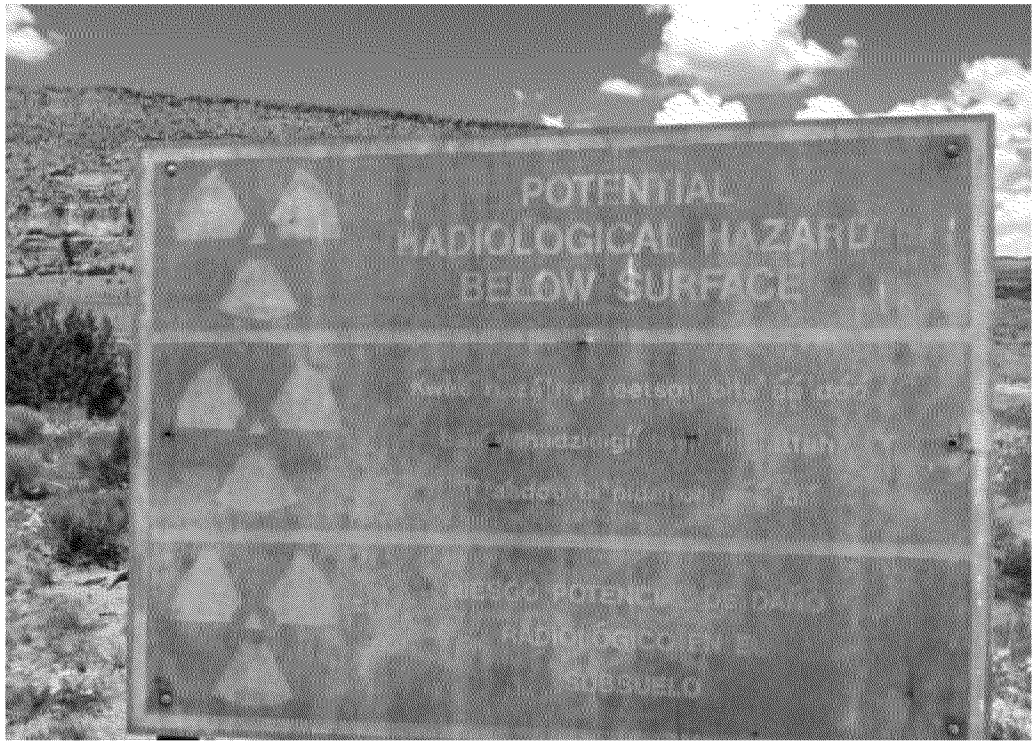


Photo No. 39	Date: 8/20/2014
Direction Photo Taken: Down	
Description: Yellow uranium ore in one of the offsite drainages, representative of rock found onsite	

Photo No. 40	Date: 8/20/2014
Direction Photo Taken: Down	
Description: Yellow uranium ore in one of the offsite drainages, representative of rock found onsite	

APPENDIX C
DATA SUMMARY TABLES

Table 1. Regional Background Site
Summary of Soil Sample Results for Ra-226 and Associated One-minute Gamma Activity Count
Haystack No. 1 Removal Assessment

Sample ID	Ra-226 (pCi/g)	Method Detection Limit (pCi/g)	One-minute Gamma Activity Count (cpm)
BG-01-A	0.316	0.0937	17,756
BG-02-A	0.295	0.0916	18,019
BG-03-A	0.417	0.0713	18,817
BG-04-A	0.397	0.105	18,558
BG-05-A	0.264	0.0526	13,633
BG-06-A	0.425	0.115	16,845
SS-16-A[d1]	0.324	0.106	18,558
MINIMUM	**0.264**	**0.0526**	**13,633**
MAXIMUM	**0.425**	**0.115**	**18,817**
AVERAGE	**0.352**	**0.091**	**17,271**
STANDARD DEVIATION	**0.069**	**0.022**	**1,911**
R^2 COEFFICIENT VALUE	**0.7972**		
RESIDENTIAL DCGL VALUE	**1.732**		
SITE-WIDE DCGL VALUE	**2.212**		

Notes:

1) Soil samples analyzed for Radium 226 by EML HASL 300, 4.5.2.3

2) One-minute Gamma activity counts measured by Ludlum Measurements Inc. Model 2241 Ratemeter & Detector Model 44-20 3"x3" NaI Gamma Scintillator

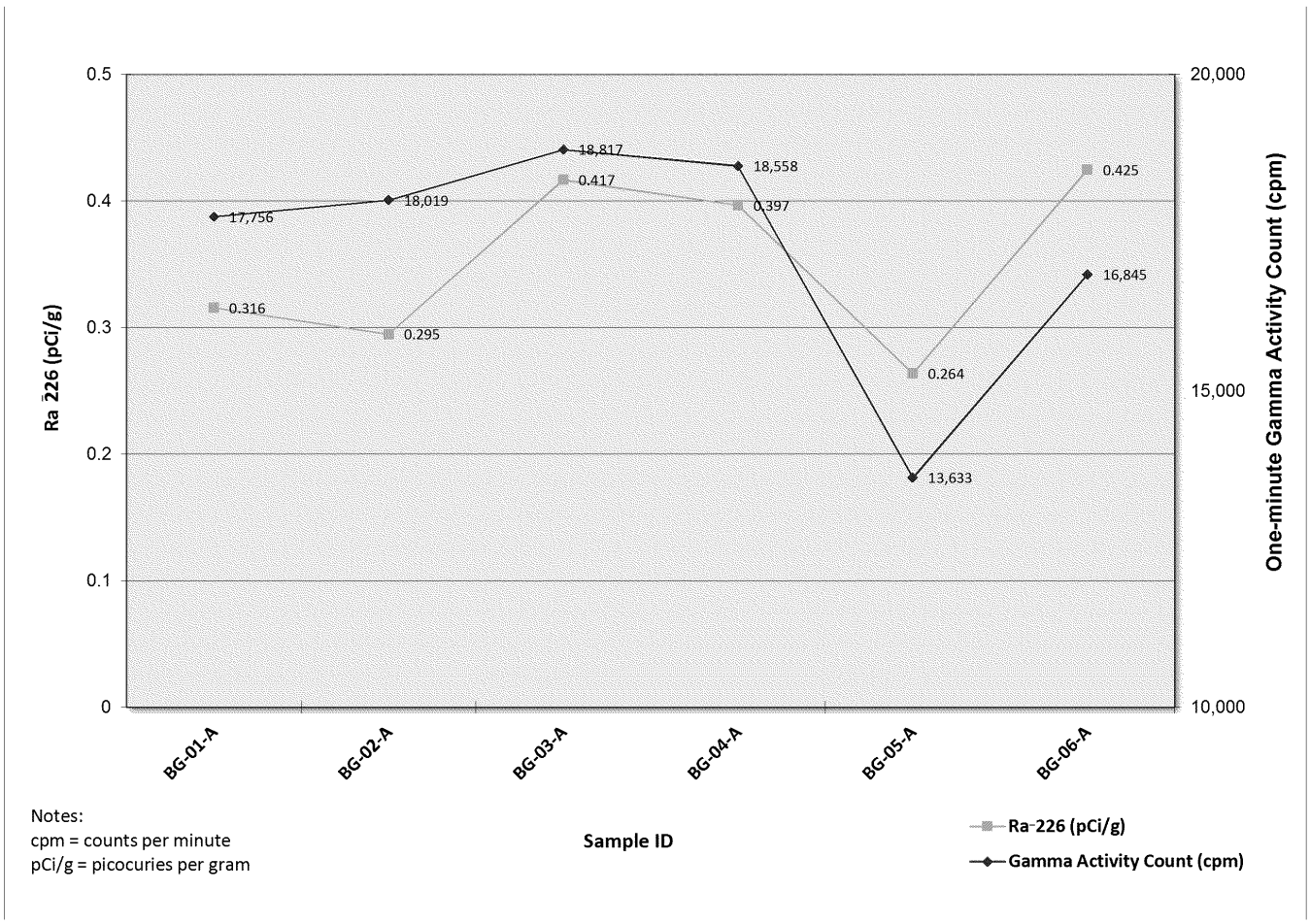
3) cpm = counts per minute

4) DCGL = Derived Concentration Guidance Level

5) pCi/g = picocuries per gram

6) R^2 = linear regression analysis coefficient of determination value

7) d1 = duplicate sample of BG-04-A



Notes:
cpm = counts per minute
pCi/g = picocuries per gram

Background Sample Results and One-Minute Gamma Activity Counts

Table 2. Removal Assessment Area
Summary of Surface Soil Sample Results for Ra-226 and Associated One-minute Gamma Activity Count
Haystack No. 1 Removal Assessment

Sample ID	Ra-226 (pCi/g)	Method Detection Limit (pCi/g)	One-minute Gamma Activity Count (cpm)
Surface Soil Samples			
SS-01-A	1.99	0.0911	48,173
SS-02-A	4.09	0.177	57,826
SS-03-A	0.527	0.0881	24,055
SS-04-A	15.90	0.333	134,388
SS-05-A	1.56	0.125	21,472
SS-06-A	3.26	0.156	33,652
SS-07-A	26.0	0.187	66,158
SS-08-A	1.29	0.446	45,422
SS-09-A	0.827	0.192	36,330
SS-10-A	15.2	0.324	93,120
SS-11-A	0.552	0.107	22,446
SS-12-A	0.423	0.0849	45,817
SS-13-A	1.51	0.109	38,941
ED-01-A	0.883	0.124	19,899
WD-01-A	3.76	0.146	17,133
SS-16-B[d1]	2.34	0.179	48,173
SS-17-A[d2]	10.7	0.322	134,388
SS-17-B[d3]	0.689	0.112	19,899
MINIMUM	**0.423**	**0.0849**	**17,133**
MAXIMUM	**26**	**0.446**	**134,388**
AVERAGE	**5.18**	**0.18**	**46,989**
STANDARD DEVIATION	**7.6**	**0.1**	**31,643**
R^2 COEFFICIENT VALUE	**0.7972**		
RESIDENTIAL DCGL VALUE	**1.732**		
SITE-WIDE DCGL VALUE	**2.212**		

Notes:

1) Soil samples analyzed for Radium 226 by EML HASL 300, 4.5.2.3

2) One-minute Gamma activity counts measured by Ludlum Measurements Inc. Model 2241 Ratemeter & Detector Model 44-20 3"x3" NaI Gamma Scintillator

3) (*) indicates field duplicate sample not included within statistical analysis

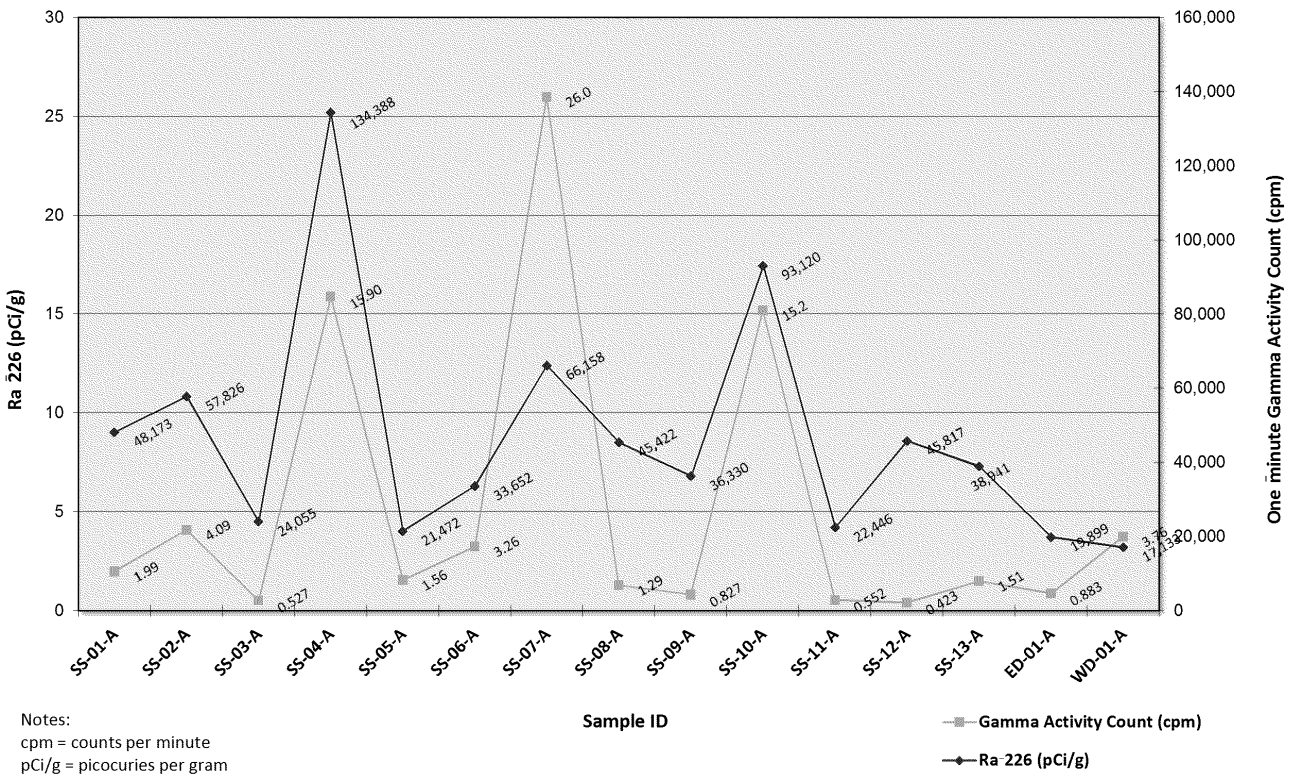
4) cpm = counts per minute

5) DCGL = Derived Concentration Guidance Level

6) pCi/g = picocuries per gram

7) R^2 = linear regression analysis coefficient of determination value

8) d1 = duplicate sample of SS-01-A; d2 = duplicate sample of SS-04-A; d3 = duplicate sample of ED-01-A



Notes:
cpm = counts per minute
pCi/g = picocuries per gram

Surface Sample Results and One-Minute Gamma Activity Counts

Table 3. Removal Assessment Area
Summary of Subsurface Soil Sample Results for Ra-226 and Associated One-minute Gamma Activity Count
Haystack No. 1 Removal Assessment

Sample ID	Sample Depth (ft bgs)	Ra-226 (pCi/g)	Method Detection Limit (pCi/g)	One-minute Gamma Activity Count (cpm)
Subsurface Soil Samples				
BG-03-B	1-2	0.037	0.296	228
SS-01-B	3-4	0.806	0.102	1,234
SS-03-B	11-12	2.300	0.126	1,057 (@9')
SS-04-B	3.5-4.5	25.700	0.402	21,708
SS-06-B	17-18	0.433	0.125	1,069 (@9')
SS-07-B	1.5-2.5	10.500	0.240	18,520
SS-09-B	2-2.5	7.240	0.226	4,680
SS-12-B	0.5-1.5	37.200	0.615	9,379
MINIMUM		**0.433**	**0.102**	**1,057**
MAXIMUM		**37.2**	**0.615**	**21,708**
AVERAGE		**12.03**	**0.26**	**8,235**
STANDARD DEVIATION		**14.1**	**0.2**	**8,690**
R^2 COEFFICIENT VALUE		**0.7972**		
RESIDENTIAL DCGL VALUE		**1.732**		
SITE-WIDE DCGL VALUE		**2.212**		

Notes:

1) Soil samples analyzed for Radium 226 by EML HASL 300, 4.5.2.3

2) One-minute Gamma activity counts measured by Ludlum Measurements Inc. Model 2241 Ratemeter & Detector Model 44-20 3"x3" NaI Gamma Scintillator

3) (*) indicates field duplicate sample not included within statistical analysis

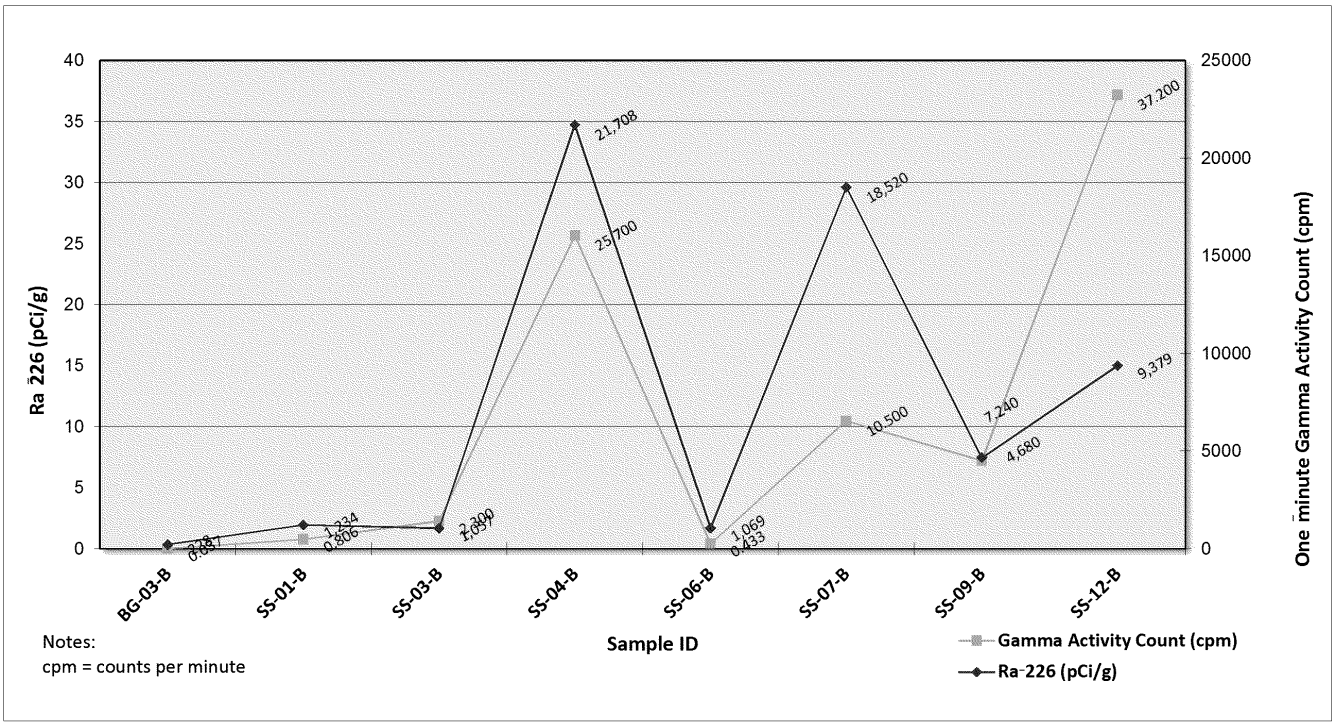
4) cpm = counts per minute

5) DCGL = Derived Concentration Guidance Level

6) pCi/g = picocuries per gram

7) R^2 = linear regression analysis coefficient of determination value

8) ft bgs = feet below ground surface



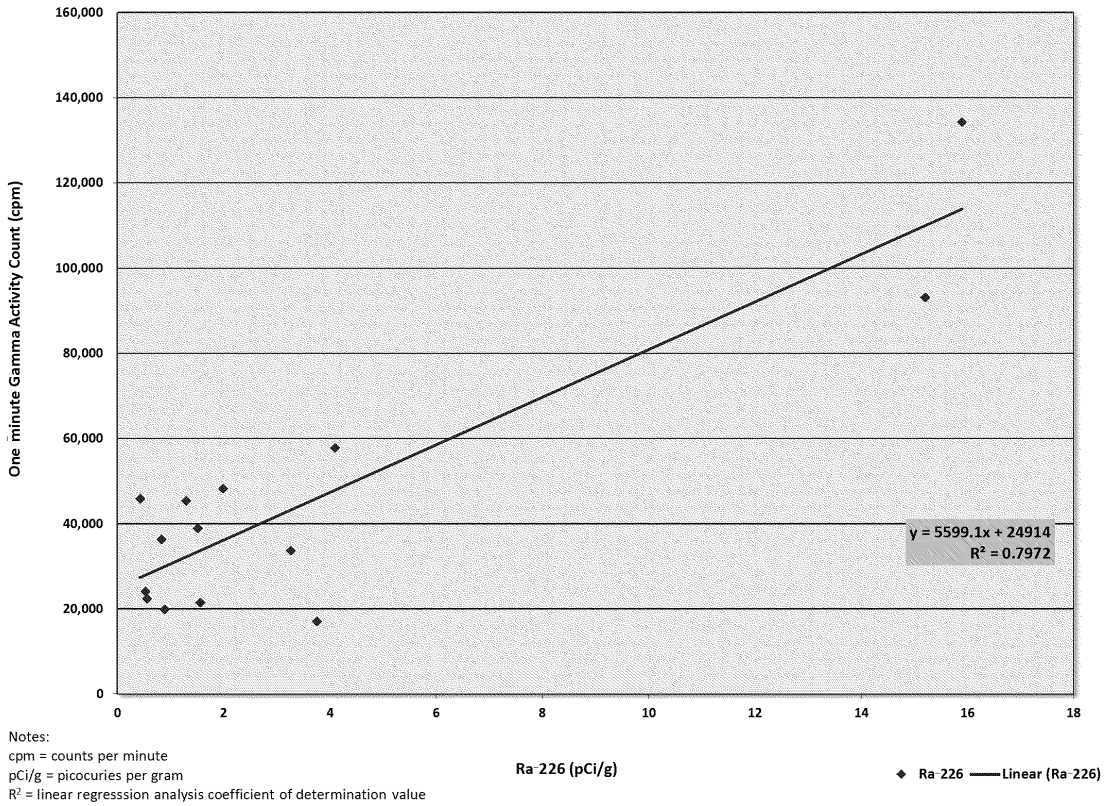
Subsurface Sample Results and One-Minute Gamma Activity Counts

Table 4. Removal Assessment Area Gamma Activity Correlation Study Summary of Soil Sample Results for Ra-226 Surface Concentrations <20 pCi/g and Associated One-minute Gamma Activity Count

Sample ID	Ra-226 (pCi/g)	One-minute Gamma Activity Count (cpm)
SS-01-A	1.99	48,173
SS-02-A	4.09	57,826
SS-03-A	0.527	24,055
SS-04-A	15.9	134,388
SS-05-A	1.56	21,472
SS-06-A	3.26	33,652
SS-08-A	1.29	45,422
SS-09-A	0.827	36,330
SS-10-A	15.2	93,120
SS-11-A	0.552	22,446
SS-12-A	0.423	45,817
SS-13-A	1.51	38,941
ED-01-A	0.883	19,899
WD-01-A	3.76	17,133
MINIMUM	**0.42**	**17,133**
MAXIMUM	**15.9**	**134,388**
AVERAGE	**3.70**	**45,620**
STANDARD DEVIATION	**5.16**	**32,373**
R^2 COEFFICIENT VALUE	**0.7972**	
RESIDENTIAL DCGL VALUE	**1.732**	
SITE-WIDE DCGL VALUE	**2.212**	

Notes:

1) Soil samples analyzed for Radium 226 by EML HASL 300, 4.5.2.3
2) One-minute Gamma activity counts measured by Ludlum Measurements Inc. Model 2241 Ratemeter & Detector Model 44-20 3"x3" NaI Gamma Scintillator
3) cpm = counts per minute
4) DCGL = Derived Concentration Guidance Level
5) pCi/g = picocuries per gram
6) R^2 = linear regression analysis coefficient of determination value



Notes:
cpm = counts per minute
pCi/g = picocuries per gram
R^2 = linear regresssion analysis coefficient of determination value

Removal Assessment Area Gamma Activity Correlation Study

APPENDIX D
DATA VALIDATION REPORT

HAYSTACK NO. 1 REMOVAL ASSESSMENT
MCKINLEY COUNTY, NEW MEXICO
DATA VALIDATION REPORT

Date: September 25, 2014
Laboratory: TestAmerica Laboratories, Inc.(TestAmerica), Earth City, Missouri
Laboratory Project #: 160-8030-1
Data Validation Performed By: Lisa Graczyk, Weston Solutions, Inc. (WESTON) Superfund Technical Assessment and Response Team (START)
Weston Work Order #/TDD #: 20409.012.002.0009.00/0002-1407-001

This data validation report has been prepared by WESTON START under the START IV Region 9 contract. This report documents the data validation for 33 soil and four equipment rinsate blanks collected for the Haystack No. 1 Site that were analyzed for the following parameters and methods.

- Radium-226 and Radium-228 by U.S. Department of Energy (DOE) Environmental Measurements Laboratory (EML) Health and Safety Laboratory (HASL)-300 Method GA-01-R for Gamma Radioassay (soil samples)
- Radium-226 by SW-846 Method 9315 (water samples)

A level II data package was requested from TestAmerica. The data package was reviewed for completeness and found to be complete. The data validation was conducted in general accordance with the EPA "Contract Laboratory Program National Functional Guidance for Inorganic Superfund Data Review" dated January 2010. The Attachment contains the results summary sheets with the hand-written qualifiers applied during data validation.

RADIUM-226 AND RADIUM-228 BY EML HASL-300 METHOD GA-01-R

1. Samples

The following table summarizes the samples for which this data validation is being conducted.

Samples	Lab ID	Matrix	Date Collected	Date Analyzed
SS-06-A	160-8030-1	Soil	8/16/2014	9/18/2014
SS-06-B	160-8030-2	Soil	8/16/2014	9/18/2014
SS-09-A	160-8030-3	Soil	8/18/2014	9/18/2014
SS-09-B	160-8030-4	Soil	8/18/2014	9/18/2014
SS-10-A	160-8030-5	Soil	8/18/2014	9/18/2014
SS-12-A	160-8030-6	Soil	8/19/2014	9/18/2014
SS-12-B	160-8030-7	Soil	8/19/2014	9/18/2014
ED-01-A	160-8030-8	Soil	8/20/2014	9/18/2014
WD-01-A	160-8030-9	Soil	8/20/2014	9/18/2014
SS-17-B	160-8030-10	Soil	8/20/2014	9/18/2014

Data Validation Report
Haystack No. 1
TestAmerica Laboratories, Inc.
Laboratory Project #: 160-8030-1

Samples	Lab ID	Matrix	Date Collected	Date Analyzed
SS-16-A	160-8030-11	Soil	8/13/2014	9/18/2014
BG-01-A	160-8030-12	Soil	8/13/2014	9/18/2014
BG-02-A	160-8030-13	Soil	8/13/2014	9/18/2014
BG-03-A	160-8030-14	Soil	8/13/2014	9/18/2014
BG-03-B	160-8030-15	Soil	8/13/2014	9/18/2014
BG-04-A	160-8030-16	Soil	8/13/2014	9/18/2014
BG-05-A	160-8030-17	Soil	8/13/2014	9/18/2014
BG-06-A	160-8030-18	Soil	8/13/2014	9/18/2014
SS-11-A	160-8030-19	Soil	8/14/2014	9/18/2014
SS-01-A	160-8030-20	Soil	8/14/2014	9/18/2014
SS-01-B	160-8030-21	Soil	8/14/2014	9/17/2014
SS-16-B	160-8030-22	Soil	8/14/2014	9/17/2014
SS-13-A	160-8030-23	Soil	8/15/2014	9/17/2014
SS-02-A	160-8030-24	Soil	8/15/2014	9/17/2014
SS-03-A	160-8030-25	Soil	8/15/2014	9/17/2014
SS-03-B	160-8030-26	Soil	8/15/2014	9/17/2014
SS-04-A	160-8030-27	Soil	8/16/2014	9/17/2014
SS-04-B	160-8030-28	Soil	8/16/2014	9/17/2014
SS-17-A	160-8030-29	Soil	8/16/2014	9/17/2014
SS-05-A	160-8030-30	Soil	8/16/2014	9/17/2014
SS-08-A	160-8030-31	Soil	8/17/2014	9/17/2014
SS-07-A	160-8030-32	Soil	8/17/2014	9/17/2014
SS-07-B	160-8030-33	Soil	8/17/2014	9/17/2014

2. Holding Times

The samples were analyzed within the required holding time limit of 6 months from sample collection.

3. Blanks

Method blanks were analyzed with the radium analyses and contained no detections of target analytes above the reporting limits.

4. Laboratory Control Sample (LCS) Results

The LCS recoveries were within laboratory quality control (QC) limits.

5. Laboratory Duplicate Results

The relative error ratios and relative percent differences (RPD) were below QC limits.

6. Field Duplicate Results

There are four field duplicates associated with this work order as follows.

Investigative Sample	Field Duplicate
BG-04-A	SS-16-A
ED-01-A	SS-17-B
SS-01-A	SS-16-B
SS-04-A	SS-17-A

The RPDs were calculated for detected analytes and ranged from 16 to 39 which are acceptable.

7. Overall Assessment

The radium data are acceptable for use based on the information received.

RADIUM-226 BY SW-846 METHOD 9315

1. Samples

The following table summarizes the samples for which this data validation is being conducted.

Samples	Lab ID	Matrix	Date Collected	Date Analyzed
EB-01	160-8030-34	Water	8/15/2014	9/15/2014
EB-02	160-8030-35	Water	8/16/2014	9/15/2014
EB-03	160-8030-36	Water	8/17/2014	9/15/2014
EB-04	160-8030-37	Water	8/20/2014	9/15/2014

2. Holding Times

The samples were analyzed within the required holding time limit of 6 months from sample collection.

3. Blanks

A method blank was analyzed with the radium analyses and contained no detections of target analytes above the reporting limits.

4. LCS Results

The LCS recoveries were within laboratory quality control (QC) limits.

5. Laboratory Duplicate Results

The relative error ratios and RPDs were below QC limits.

6. Carrier Solution

The barium recoveries in the barium carrier solution were within QC limits for percent recovery.

7. Overall Assessment

The radium data are acceptable for use based on the information received.

Data Validation Report
Haystack No. 1
TestAmerica Laboratories, Inc.
Laboratory Project #: 160-8030-1

ATTACHMENT

TESTAMERICA LABORATORIES, INC.
RESULTS SUMMARY

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-8030-1
TestAmerica Sample Delivery Group: Haystack No 1
Client Project/Site: Start Region 5 - McKinley County, NM

For:
Weston Solutions, Inc.
20 N Wacker Dr
Suite 2035
Chicago, Illinois 60606

Attn: Lisa Graczyk

Authorized for release by:
9/19/2014 4:19:15 PM

Erika Gish, Project Manager II
(314)298-8566
erika.gish@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Sample Summary 12
Client Sample Results 13
QC Sample Results 21
QC Association Summary 23
Tracer Carrier Summary 25

Case Narrative

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Job ID: 160-8030-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Weston Solutions, Inc.

Project: Start Region 5 - McKinley County, NM

Report Number: 160-8030-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 8/21/2014 9:15 AM; the samples arrived in good condition, properly preserved. The temperatures of the 3 coolers at receipt time were 2.9º C, 6.4º C and 6.6º C.

RADIUM 226 (21 DAY INGROWTH)

Samples EB-01 (160-8030-34), EB-02 (160-8030-35), EB-03 (160-8030-36) and EB-04 (160-8030-37) were analyzed for Radium 226 (21 day ingrowth) in accordance with SW- 846 Method 9315. The samples were prepared on 08/22/2014 and analyzed on 09/15/2014.

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

RADIUM-226 BY GAMMA SPEC (21 DAY INGROWTH)

Samples SS-06-A (160-8030-1), SS-06-B (160-8030-2), SS-09-A (160-8030-3), SS-09-B (160-8030-4), SS-10-A (160-8030-5), SS-12-A (160-8030-6), SS-12-B (160-8030-7), ED-01-A (160-8030-8), WD-01-A (160-8030-9), SS-17-B (160-8030-10), SS-16-A (160-8030-11), BG-01-A (160-8030-12), BG-02-A (160-8030-13), BG-03-A (160-8030-14), BG-03-B (160-8030-15), BG-04-A (160-8030-16), BG-05-A (160-8030-17), BG-06-A (160-8030-18), SS-11-A (160-8030-19), SS-01-A (160-8030-20), SS-01-B (160-8030-21), SS-16-B (160-8030-22),

Case Narrative

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Job ID: 160-8030-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

SS-13-A (160-8030-23), SS-02-A (160-8030-24), SS-03-A (160-8030-25), SS-03-B (160-8030-26), SS-04-A (160-8030-27), SS-04-B (160-8030-28), SS-17-A (160-8030-29), SS-05-A (160-8030-30), SS-08-A (160-8030-31), SS-07-A (160-8030-32) and SS-07-B (160-8030-33) were analyzed for Radium-226 by gamma spec (21 day ingrowth) in accordance with EPA GA_01_R. The samples were leached on 08/22/2014, prepared on 08/27/2014 and analyzed on 09/17/2014 and 09/18/2014.

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone (314) 298-8566 Fax (314) 298-8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information	Sampler: Alex Gubb	Lab PM: Gish, Erika K.	Carrier Tracking No(s):
Client Contact: Lisa Graczyk	Phone: ~~[illegible]~~ 925-928-2656	E-Mail: erika.gish@testamericainc.com	COC No: 160-1722-833.1
Company: Weston Solutions, Inc.			Page: Page 1 of 1
Address: 20 N Wacker Dr Suite 2035	Due Date Requested:		Job #:
City: Chicago	TAT Requested (days):		
State, Zip: IL, 60606			
Phone: 312-424-3339(Tel)	PO #: Purchase Order Requested		
Email: lgraczyk@css-dynamac.com	WO #:		
Project Name: Start Region 5 - McKinley County, NM	Project #: 16003503		
Site:	SSOW#:		

Analysis Requested

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2SO3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - ph 4-5, Z - other (specify)
Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=wasteoil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	EML HASL 300 4.5.2.3	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
SS-06-A	8/16/14	1735	G	Soil			X	1	
SS-06-B	8/16/14	1740						1	
SS-09-A	8/18/14	1243						1	
SS-09-B	8/18/14	1249						1	
SS-10-A	8/18/14	1559						1	
SS-12-A	8/19/14	1225							
SS-12-B	8/19/14	1226							
ED-01-A	8/20/14	1135		Soil					
WD-01-A	8/20/14	1005						1	
SS-17-B	8/20/14	1410						1	
SS-16-A	8/13/14	1215	X	Soil			X	1	

160-8030 Chain of Custody

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☒ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:		
Relinquished by:	Date/Time: 8/20/14 1700	Company: WESTON	Received by: CWS	Date/Time: 8-21-14 9:15	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Custody Seal No.:

Cooler Temperature(s) °C and Other Remarks:

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone (314) 298-8566 Fax (314) 298-8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information	Sampler: Alex Grubb	Lab PM: Gish, Erika K	Carrier Tracking No(s):	COC No: 160-1722-833.1
Client Contact: Lisa Graczyk	Phone: 915 928 9774	E-Mail: erika.gish@testamericainc.com		Page: Page 1 of 1
Company: Weston Solutions, Inc.				Job #:
Address: 20 N Wacker Dr. Suite 2035	Due Date Requested:			
City: Chicago	TAT Requested (days):			
State, Zip: IL, 60606				
Phone: 312-424-3339(Tel)	PO #: Purchase Order Requested			
Email: lgraczyk@css-dynamac.com	WO #:			
Project Name: Start Region 5 - McKinley County, NM	Project #: 16003503			
Site: Haystack No. 1	SSOW#:			

Analysis Requested

Ra-226 EPA HASL 300 4.5.2.3

Preservation Codes:

A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2SO3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - ph 4-5, Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	Ra-226 EPA HASL 300 4.5.2.3	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
BG-01-A	8/13/14	1115	G	Soil			X	1	
BG-02-A	8/13/14	1135						1	
BG-03-A	8/13/14	1155						1	
BG-03-B	8/13/14	1200						1	
BG-04-A	8/13/14	1210						1	
BG-05-A	8/13/14	1340						1	
BG-06 A	8/13/14	1355						1	
SS-11-A	8/14/14	1440						1	
SS-01-A	8/14/14	1630						1	
SS-01-B	8/14/14	1635						1	
SS-16-B	8/14/14	1640						1	

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:		
Relinquished by:	Date/Time: 8/20/14 1700	Company: Weston	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.: | Cooler Temperature(s) °C and Other Remarks:

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone (314) 298-8566 Fax (314) 298-8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information	Sampler: Alex Andb	Lab PM: Gish, Erika K	Carrier Tracking No(s):	COC No: 160-1722-833.1
Client Contact: Lisa Graczyk	Phone: 925-948-2656	E-Mail: erika.gish@testamericainc.com		Page: Page 2 of 2
Company: Weston Solutions, Inc.				Job #:
Address: 20 N Wacker Dr Suite 2035	Due Date Requested:			
City: Chicago	TAT Requested (days):			
State, Zip: IL, 60606				
Phone: 312-424-3339(Tel)	PO #: Purchase Order Requested			
Email: lgraczyk@css-dynamac.com	WO #:			
Project Name: Start Region 5 - McKinley County, NM	Project #: 16003503			
Site:	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2SO3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - ph 4-5, Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	EML HASL 300 4.5.2.3	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
SS-13-A	8/15/14	1110	G	Soil			X	1	
SS-02-A	8/15/14	1510						1	
SS-03-A	8/15/14	1845						1	
SS-03-B	8/15/14	1855						1	
SS-04-A	8/16/14	1650						1	
SS-04-B	8/16/14	1655						1	
SS-17-A	8/16/14	1100						1	
SS-05-A	8/16/14	1600						1	
SS-08-A	8/17/14	1045						1	
SS-07-A	8/17/14	1250						1	
SS-07-B	8/17/14	1255						1	

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☒ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:			
Relinquished by:	Date/Time: 8/20/14 1700	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Custody Seal No.:

Cooler Temperature(s) °C and Other Remarks:

>>> Select a Laboratory <<<

#N/A
#N/A Haystack No. 1
#N/A
#N/A Start Regin 9

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact	Project Manager: Alex Gnbb	Site Contact: Alex Gnbb	Date:	COC No:
Your Company Name here Weston	Tel/Fax: 925.948-2656	Lab Contact:	Carrier:	1 of 1 COCs
Address 20 N. Wacker St. 2035	Analysis Turnaround Time			Sampler:
City/State/Zip Chicago	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
(xxx) xxx-xxxx 312 [illegible] Phone	TAT if different from Below _____			Walk-in Client:
(xxx) xxx-xxxx FAX	☐ 2 weeks			Lab Sampling:
Project Name: Haystack No. 1	☐ 1 week			
Site:	☐ 2 days			Job / SDG No.:
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Ra-226	Sample Specific Notes:
EB-01	8/15/14	1900	G	✓	2			X	
EB-02	8/16/14	1900	↓	↓	2			X	
EB-03	8/17/14	1700	↓	↓	2			X	
EB-04	8/20/14	1245	↓	↓	0			X	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: _____ Corr'd: _____ Therm ID No.: _____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	Weston	8/20/14 1700			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.3, dated 12/05/2013

Login Sample Receipt Checklist

Client: Weston Solutions, Inc.

Job Number: 160-8030-1
SDG Number: Haystack No 1

Login Number: 8030
List Number: 1
Creator: Daniels, Brian J

List Source: TestAmerica St. Louis

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Method	Method Description	Protocol	Laboratory
9315	Radium-226 (GFPC)	SW846	TAL SL
GA-01-R	Radium-226 & Other Gamma Emitters (GS)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-8030-1	SS-06-A	Solid	08/16/14 17:35	08/21/14 09:15
160-8030-2	SS-06-B	Solid	08/16/14 17:40	08/21/14 09:15
160-8030-3	SS-09-A	Solid	08/18/14 12:43	08/21/14 09:15
160-8030-4	SS-09-B	Solid	08/18/14 12:49	08/21/14 09:15
160-8030-5	SS-10-A	Solid	08/18/14 15:59	08/21/14 09:15
160-8030-6	SS-12-A	Solid	08/19/14 12:25	08/21/14 09:15
160-8030-7	SS-12-B	Solid	08/19/14 12:26	08/21/14 09:15
160-8030-8	ED-01-A	Solid	08/20/14 11:35	08/21/14 09:15
160-8030-9	WD-01-A	Solid	08/20/14 10:05	08/21/14 09:15
160-8030-10	SS-17-B	Solid	08/20/14 11:40	08/21/14 09:15
160-8030-11	SS-16-A	Solid	08/13/14 12:15	08/21/14 09:15
160-8030-12	BG-01-A	Solid	08/13/14 11:15	08/21/14 09:15
160-8030-13	BG-02-A	Solid	08/13/14 11:35	08/21/14 09:15
160-8030-14	BG-03-A	Solid	08/13/14 11:55	08/21/14 09:15
160-8030-15	BG-03-B	Solid	08/13/14 12:00	08/21/14 09:15
160-8030-16	BG-04-A	Solid	08/13/14 12:10	08/21/14 09:15
160-8030-17	BG-05-A	Solid	08/13/14 13:40	08/21/14 09:15
160-8030-18	BG-06-A	Solid	08/13/14 13:55	08/21/14 09:15
160-8030-19	SS-11-A	Solid	08/14/14 14:40	08/21/14 09:15
160-8030-20	SS-01-A	Solid	08/14/14 16:30	08/21/14 09:15
160-8030-21	SS-01-B	Solid	08/14/14 16:35	08/21/14 09:15
160-8030-22	SS-16-B	Solid	08/14/14 16:40	08/21/14 09:15
160-8030-23	SS-13-A	Solid	08/15/14 11:10	08/21/14 09:15
160-8030-24	SS-02-A	Solid	08/15/14 15:10	08/21/14 09:15
160-8030-25	SS-03-A	Solid	08/15/14 18:45	08/21/14 09:15
160-8030-26	SS-03-B	Solid	08/15/14 18:55	08/21/14 09:15
160-8030-27	SS-04-A	Solid	08/16/14 10:50	08/21/14 09:15
160-8030-28	SS-04-B	Solid	08/16/14 10:55	08/21/14 09:15
160-8030-29	SS-17-A	Solid	08/16/14 11:00	08/21/14 09:15
160-8030-30	SS-05-A	Solid	08/16/14 16:00	08/21/14 09:15
160-8030-31	SS-08-A	Solid	08/17/14 10:45	08/21/14 09:15
160-8030-32	SS-07-A	Solid	08/17/14 12:50	08/21/14 09:15
160-8030-33	SS-07-B	Solid	08/17/14 12:55	08/21/14 09:15
160-8030-34	EB-01	Water	08/15/14 19:00	08/21/14 09:15
160-8030-35	EB-02	Water	08/16/14 19:00	08/21/14 09:15
160-8030-36	EB-03	Water	08/17/14 17:00	08/21/14 09:15
160-8030-37	EB-04	Water	08/20/14 12:45	08/21/14 09:15

Client Sample Results

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Client Sample ID: SS-06-A

Lab Sample ID: 160-8030-1
Date Collected: 08/16/14 17:35
Matrix: Solid
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	3.26		0.345	0.483	1.00	0.156	pCi/g	08/27/14 09:30	09/18/14 09:41	1
Radium-228	0.295	U	0.258	0.260		0.369	pCi/g	08/27/14 09:30	09/18/14 09:41	1

Client Sample ID: SS-06-B

Lab Sample ID: 160-8030-2
Date Collected: 08/16/14 17:40
Matrix: Solid
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.433		0.131	0.138	1.00	0.125	pCi/g	08/27/14 09:30	09/18/14 09:42	1
Radium-228	0.232		0.133	0.135		0.206	pCi/g	08/27/14 09:30	09/18/14 09:42	1

Client Sample ID: SS-09-A

Lab Sample ID: 160-8030-3
Date Collected: 08/18/14 12:43
Matrix: Solid
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.827		0.214	0.230	1.00	0.192	pCi/g	08/27/14 09:30	09/18/14 10:29	1
Radium-228	0.335	U	0.179	0.182		0.342	pCi/g	08/27/14 09:30	09/18/14 10:29	1

Client Sample ID: SS-09-B

Lab Sample ID: 160-8030-4
Date Collected: 08/18/14 12:49
Matrix: Solid
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	7.24		0.481	0.893	1.00	0.226	pCi/g	08/27/14 09:30	09/18/14 10:01	1
Radium-228	0.907		0.329	0.341		0.411	pCi/g	08/27/14 09:30	09/18/14 10:01	1

Client Sample ID: SS-10-A

Lab Sample ID: 160-8030-5
Date Collected: 08/18/14 15:59
Matrix: Solid
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	15.2		0.723	1.73	1.00	0.324	pCi/g	08/27/14 09:30	09/18/14 10:31	1
Radium-228	0.384	U	0.388	0.390		0.586	pCi/g	08/27/14 09:30	09/18/14 10:31	1

Client Sample Results

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Client Sample ID: SS-12-A

Lab Sample ID: 160-8030-6
Date Collected: 08/19/14 12:25
Matrix: Solid
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.423		0.0976	0.107	1.00	0.0849	pCi/g	08/27/14 09:30	09/18/14 10:34	1
Radium-228	0.182	U	0.130	0.131		0.200	pCi/g	08/27/14 09:30	09/18/14 10:34	1

Client Sample ID: SS-12-B

Lab Sample ID: 160-8030-7
Date Collected: 08/19/14 12:26
Matrix: Solid
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	37.2		1.55	4.17	1.00	0.615	pCi/g	08/27/14 09:30	09/18/14 11:53	1
Radium-228	0.437	U	0.769	0.771		1.16	pCi/g	08/27/14 09:30	09/18/14 11:53	1

Client Sample ID: ED-01-A

Lab Sample ID: 160-8030-8
Date Collected: 08/20/14 11:35
Matrix: Solid
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.883		0.218	0.236	1.00	0.124	pCi/g	08/27/14 09:30	09/18/14 11:03	1
Radium-228	0.168	U	0.186	0.187		0.344	pCi/g	08/27/14 09:30	09/18/14 11:03	1

Client Sample ID: WD-01-A

Lab Sample ID: 160-8030-9
Date Collected: 08/20/14 10:05
Matrix: Solid
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	3.76		0.351	0.525	1.00	0.146	pCi/g	08/27/14 09:30	09/18/14 11:06	1
Radium-228	0.135	U	0.177	0.178		0.388	pCi/g	08/27/14 09:30	09/18/14 11:06	1

Client Sample ID: SS-17-B

Lab Sample ID: 160-8030-10
Date Collected: 08/20/14 11:40
Matrix: Solid
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.689		0.164	0.179	1.00	0.112	pCi/g	08/27/14 09:30	09/18/14 11:05	1
Radium-228	0.105	U	0.161	0.162		0.367	pCi/g	08/27/14 09:30	09/18/14 11:05	1

Client Sample Results

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Client Sample ID: SS-16-A — Lab Sample ID: 160-8030-11

Date Collected: 08/13/14 12:15 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.324		0.111	0.116	1.00	0.106	pCi/g	08/27/14 09:30	09/18/14 11:54	1
Radium-228	0.0995	U	0.131	0.131		0.315	pCi/g	08/27/14 09:30	09/18/14 11:54	1

Client Sample ID: BG-01-A — Lab Sample ID: 160-8030-12

Date Collected: 08/13/14 11:15 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.316		0.122	0.126	1.00	0.0937	pCi/g	08/27/14 09:30	09/18/14 11:55	1
Radium-228	0.167	U	0.128	0.129		0.240	pCi/g	08/27/14 09:30	09/18/14 11:55	1

Client Sample ID: BG-02-A — Lab Sample ID: 160-8030-13

Date Collected: 08/13/14 11:35 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.295		0.0899	0.0949	1.00	0.0916	pCi/g	08/27/14 09:30	09/18/14 11:55	1
Radium-228	0.124	U	0.105	0.106		0.139	pCi/g	08/27/14 09:30	09/18/14 11:55	1

Client Sample ID: BG-03-A — Lab Sample ID: 160-8030-14

Date Collected: 08/13/14 11:55 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.417		0.101	0.110	1.00	0.0713	pCi/g	08/27/14 09:30	09/18/14 12:21	1
Radium-228	0.0587	U	0.0609	0.0612		0.173	pCi/g	08/27/14 09:30	09/18/14 12:21	1

Client Sample ID: BG-03-B — Lab Sample ID: 160-8030-15

Date Collected: 08/13/14 12:00 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.0370	U	0.110	0.110	1.00	0.296	pCi/g	08/27/14 09:30	09/18/14 12:48	1
Radium-228	0.0127	U	0.0720	0.0720		0.480	pCi/g	08/27/14 09:30	09/18/14 12:48	1

Client Sample Results

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Client Sample ID: BG-04-A — Lab Sample ID: 160-8030-16

Date Collected: 08/13/14 12:10 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.397		0.121	0.128	1.00	0.105	pCi/g	08/27/14 09:30	09/18/14 12:49	1
Radium-228	0.207	U	0.188	0.189		0.281	pCi/g	08/27/14 09:30	09/18/14 12:49	1

Client Sample ID: BG-05-A — Lab Sample ID: 160-8030-17

Date Collected: 08/13/14 13:40 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.264		0.0868	0.0910	1.00	0.0526	pCi/g	08/27/14 09:30	09/18/14 12:50	1
Radium-228	0.214	U	0.146	0.148		0.256	pCi/g	08/27/14 09:30	09/18/14 12:50	1

Client Sample ID: BG-06-A — Lab Sample ID: 160-8030-18

Date Collected: 08/13/14 13:55 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.425		0.124	0.132	1.00	0.115	pCi/g	08/27/14 09:30	09/18/14 12:54	1
Radium-228	0.211	U	0.146	0.147		0.213	pCi/g	08/27/14 09:30	09/18/14 12:54	1

Client Sample ID: SS-11-A — Lab Sample ID: 160-8030-19

Date Collected: 08/14/14 14:40 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.552		0.132	0.144	1.00	0.107	pCi/g	08/27/14 09:30	09/18/14 12:58	1
Radium-228	0.506		0.162	0.170		0.0957	pCi/g	08/27/14 09:30	09/18/14 12:58	1

Client Sample ID: SS-01-A — Lab Sample ID: 160-8030-20

Date Collected: 08/14/14 16:30 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.99		0.314	0.376	1.00	0.0911	pCi/g	08/27/14 09:30	09/18/14 13:48	1
Radium-228	0.321	U	0.256	0.258		0.548	pCi/g	08/27/14 09:30	09/18/14 13:48	1

Client Sample Results

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Client Sample ID: SS-01-B — Lab Sample ID: 160-8030-21

Date Collected: 08/14/14 16:35 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.806		0.205	0.221	1.00	0.102	pCi/g	08/27/14 13:22	09/17/14 14:33	1
Radium-228	0.338	U	0.284	0.286		0.535	pCi/g	08/27/14 13:22	09/17/14 14:33	1

Client Sample ID: SS-16-B — Lab Sample ID: 160-8030-22

Date Collected: 08/14/14 16:40 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	2.34		0.314	0.397	1.00	0.179	pCi/g	08/27/14 13:22	09/17/14 14:29	1
Radium-228	0.344	U	0.210	0.213		0.446	pCi/g	08/27/14 13:22	09/17/14 14:29	1

Client Sample ID: SS-13-A — Lab Sample ID: 160-8030-23

Date Collected: 08/15/14 11:10 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.51		0.201	0.255	1.00	0.109	pCi/g	08/27/14 13:22	09/17/14 14:30	1
Radium-228	0.342		0.180	0.183		0.331	pCi/g	08/27/14 13:22	09/17/14 14:30	1

Client Sample ID: SS-02-A — Lab Sample ID: 160-8030-24

Date Collected: 08/15/14 15:10 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	4.09		0.388	0.576	1.00	0.177	pCi/g	08/27/14 13:22	09/17/14 14:31	1
Radium-228	0.594		0.251	0.259		0.270	pCi/g	08/27/14 13:22	09/17/14 14:31	1

Client Sample ID: SS-03-A — Lab Sample ID: 160-8030-25

Date Collected: 08/15/14 18:45 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.527		0.121	0.133	1.00	0.0881	pCi/g	08/27/14 13:22	09/17/14 15:27	1
Radium-228	0.260		0.181	0.183		0.258	pCi/g	08/27/14 13:22	09/17/14 15:27	1

Client Sample Results

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Client Sample ID: SS-03-B — Lab Sample ID: 160-8030-26

Date Collected: 08/15/14 18:55 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	2.30		0.343	0.418	1.00	0.126	pCi/g	08/27/14 13:22	09/17/14 16:00	1
Radium-228	0.107	U	0.133	0.133		0.201	pCi/g	08/27/14 13:22	09/17/14 16:00	1

Client Sample ID: SS-04-A — Lab Sample ID: 160-8030-27

Date Collected: 08/16/14 10:50 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	15.9		0.699	1.80	1.00	0.333	pCi/g	08/27/14 13:22	09/17/14 16:05	1
Radium-228	0.363	U	0.352	0.354		0.652	pCi/g	08/27/14 13:22	09/17/14 16:05	1

Client Sample ID: SS-04-B — Lab Sample ID: 160-8030-28

Date Collected: 08/16/14 10:55 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	25.7		0.985	2.85	1.00	0.402	pCi/g	08/27/14 13:22	09/17/14 16:07	1
Radium-228	0.246	U	0.266	0.267		0.976	pCi/g	08/27/14 13:22	09/17/14 16:07	1

Client Sample ID: SS-17-A — Lab Sample ID: 160-8030-29

Date Collected: 08/16/14 11:00 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	10.7		0.675	1.30	1.00	0.322	pCi/g	08/27/14 13:22	09/17/14 16:05	1
Radium-228	0.329	U	0.359	0.361		0.632	pCi/g	08/27/14 13:22	09/17/14 16:05	1

Client Sample ID: SS-05-A — Lab Sample ID: 160-8030-30

Date Collected: 08/16/14 16:00 — **Matrix: Solid**
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.56		0.211	0.266	1.00	0.125	pCi/g	08/27/14 13:22	09/17/14 20:47	1
Radium-228	0.306		0.163	0.166		0.234	pCi/g	08/27/14 13:22	09/17/14 20:47	1

Client Sample Results

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Client Sample ID: SS-08-A

Lab Sample ID: 160-8030-31
Date Collected: 08/17/14 10:45
Matrix: Solid
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.29		0.236	0.272	1.00	0.187	pCi/g	08/27/14 13:22	09/17/14 20:45	1
Radium-228	0.550		0.228	0.234		0.375	pCi/g	08/27/14 13:22	09/17/14 20:45	1

Client Sample ID: SS-07-A

Lab Sample ID: 160-8030-32
Date Collected: 08/17/14 12:50
Matrix: Solid
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	26.0		1.02	2.89	1.00	0.446	pCi/g	08/27/14 13:22	09/17/14 20:46	1
Radium-228	0.517	U	0.535	0.537		0.796	pCi/g	08/27/14 13:22	09/17/14 20:46	1

Client Sample ID: SS-07-B

Lab Sample ID: 160-8030-33
Date Collected: 08/17/14 12:55
Matrix: Solid
Date Received: 08/21/14 09:15

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	10.5		0.615	1.25	1.00	0.240	pCi/g	08/27/14 13:22	09/17/14 19:08	1
Radium-228	0.342	U	0.312	0.314		0.578	pCi/g	08/27/14 13:22	09/17/14 19:08	1

Client Sample ID: EB-01

Lab Sample ID: 160-8030-34
Date Collected: 08/15/14 19:00
Matrix: Water
Date Received: 08/21/14 09:15

Method: 9315 - Radium-226 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.00433	U	0.0442	0.0442	1.00	0.0871	pCi/L	08/22/14 18:22	09/15/14 08:46	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*93.2*		*40 - 110*	*08/22/14 18:22*	*09/15/14 08:46*	*1*

Client Sample ID: EB-02

Lab Sample ID: 160-8030-35
Date Collected: 08/16/14 19:00
Matrix: Water
Date Received: 08/21/14 09:15

Method: 9315 - Radium-226 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	-0.00617	U	0.0494	0.0494	1.00	0.0988	pCi/L	08/22/14 18:22	09/15/14 08:47	1

Client Sample Results

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Client Sample ID: EB-02

Lab Sample ID: 160-8030-35
Matrix: Water

Date Collected: 08/16/14 19:00
Date Received: 08/21/14 09:15

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*95.0*		*40 - 110*	*08/22/14 18:22*	*09/15/14 08:47*	*1*

Client Sample ID: EB-03

Lab Sample ID: 160-8030-36
Matrix: Water

Date Collected: 08/17/14 17:00
Date Received: 08/21/14 09:15

Method: 9315 - Radium-226 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.00530	U	0.0432	0.0432	1.00	0.0848	pCi/L	08/22/14 18:22	09/15/14 08:47	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*95.6*		*40 - 110*	*08/22/14 18:22*	*09/15/14 08:47*	*1*

Client Sample ID: EB-04

Lab Sample ID: 160-8030-37
Matrix: Water

Date Collected: 08/20/14 12:45
Date Received: 08/21/14 09:15

Method: 9315 - Radium-226 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	-0.00866	U	0.0493	0.0493	1.00	0.100	pCi/L	08/22/14 18:22	09/15/14 08:47	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*96.5*		*40 - 110*	*08/22/14 18:22*	*09/15/14 08:47*	*1*

QC Sample Results

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Method: 9315 - Radium-226 (GFPC)

Lab Sample ID: MB 160-139626/1-A
Matrix: Water
Analysis Batch: 143948

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 139626

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.03291	U	0.0503	0.0504	1.00	0.0862	pCi/L	08/22/14 18:22	09/15/14 08:46	1

Carrier	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*87.0*		*40 - 110*	*08/22/14 18:22*	*09/15/14 08:46*	*1*

Lab Sample ID: LCS 160-139626/2-A
Matrix: Water
Analysis Batch: 143948

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 139626

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Radium-226	11.2	10.63		1.07	1.00	0.106	pCi/L	95	68 - 137

Carrier	*LCS %Yield*	*LCS Qualifier*	*Limits*
Ba Carrier	*88.5*		*40 - 110*

Lab Sample ID: 160-8030-37 DU
Matrix: Water
Analysis Batch: 143948

Client Sample ID: EB-04
Prep Type: Total/NA
Prep Batch: 139626

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Radium-226	-0.00866	U	0.03650	U	0.0510	1.00	0.0860	pCi/L	0.45	1

Carrier	*DU %Yield*	*DU Qualifier*	*Limits*
Ba Carrier	*99.7*		*40 - 110*

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-140385/1-A
Matrix: Solid
Analysis Batch: 144718

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 140385

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.07029	U	0.163	0.164	1.00	0.288	pCi/g	08/27/14 09:30	09/18/14 09:38	1
Radium-228	0.04234	U	0.135	0.135		0.253	pCi/g	08/27/14 09:30	09/18/14 09:38	1

Lab Sample ID: LCS 160-140385/2-A
Matrix: Solid
Analysis Batch: 144706

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 140385

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium-241	97.4	99.63		10.5		1.38	pCi/g	102	87 - 116
Cesium-137	30.9	30.87		3.32		0.306	pCi/g	100	87 - 120

QC Sample Results

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS) (Continued)

Lab Sample ID: LCS 160-140385/2-A
Matrix: Solid
Analysis Batch: 144706

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 140385

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Cobalt-60	21.5	21.55		2.25		0.196	pCi/g	100	87 - 115

Lab Sample ID: 160-8030-1 DU
Matrix: Solid
Analysis Batch: 144718

Client Sample ID: SS-06-A
Prep Type: Total/NA
Prep Batch: 140385

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Radium-226	3.26		2.985		0.522	1.00	0.207	pCi/g	0.27	1
Radium-228	0.295	U	0.2289	U	0.281		0.556	pCi/g	0.12	1

Lab Sample ID: MB 160-140433/1-A
Matrix: Solid
Analysis Batch: 144593

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 140433

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.001496	U	0.0130	0.0130	1.00	0.141	pCi/g	08/27/14 13:22	09/17/14 20:45	1
Radium-228	0.008366	U	0.0714	0.0714		0.0924	pCi/g	08/27/14 13:22	09/17/14 20:45	1

Lab Sample ID: LCS 160-140433/2-A
Matrix: Solid
Analysis Batch: 144565

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 140433

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium-241	97.4	99.07		10.5		1.47	pCi/g	102	87 - 116
Cesium-137	30.9	30.82		3.37		0.377	pCi/g	100	87 - 120
Cobalt-60	21.5	21.48		2.27		0.159	pCi/g	100	87 - 115

Lab Sample ID: 160-8030-21 DU
Matrix: Solid
Analysis Batch: 144607

Client Sample ID: SS-01-B
Prep Type: Total/NA
Prep Batch: 140433

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Radium-226	0.806		0.8067		0.218	1.00	0.171	pCi/g	0	1
Radium-228	0.338	U	0.4997		0.206		0.155	pCi/g	0.33	1

QC Association Summary

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Rad

Leach Batch: 139536

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-8030-1	SS-06-A	Total/NA	Solid	Dry and Grind	
160-8030-1 DU	SS-06-A	Total/NA	Solid	Dry and Grind	
160-8030-2	SS-06-B	Total/NA	Solid	Dry and Grind	
160-8030-3	SS-09-A	Total/NA	Solid	Dry and Grind	
160-8030-4	SS-09-B	Total/NA	Solid	Dry and Grind	
160-8030-5	SS-10-A	Total/NA	Solid	Dry and Grind	
160-8030-6	SS-12-A	Total/NA	Solid	Dry and Grind	
160-8030-7	SS-12-B	Total/NA	Solid	Dry and Grind	
160-8030-8	ED-01-A	Total/NA	Solid	Dry and Grind	
160-8030-9	WD-01-A	Total/NA	Solid	Dry and Grind	
160-8030-10	SS-17-B	Total/NA	Solid	Dry and Grind	
160-8030-11	SS-16-A	Total/NA	Solid	Dry and Grind	
160-8030-12	BG-01-A	Total/NA	Solid	Dry and Grind	
160-8030-13	BG-02-A	Total/NA	Solid	Dry and Grind	
160-8030-14	BG-03-A	Total/NA	Solid	Dry and Grind	
160-8030-15	BG-03-B	Total/NA	Solid	Dry and Grind	
160-8030-16	BG-04-A	Total/NA	Solid	Dry and Grind	
160-8030-17	BG-05-A	Total/NA	Solid	Dry and Grind	
160-8030-18	BG-06-A	Total/NA	Solid	Dry and Grind	
160-8030-19	SS-11-A	Total/NA	Solid	Dry and Grind	
160-8030-20	SS-01-A	Total/NA	Solid	Dry and Grind	
160-8030-21	SS-01-B	Total/NA	Solid	Dry and Grind	
160-8030-21 DU	SS-01-B	Total/NA	Solid	Dry and Grind	
160-8030-22	SS-16-B	Total/NA	Solid	Dry and Grind	
160-8030-23	SS-13-A	Total/NA	Solid	Dry and Grind	
160-8030-24	SS-02-A	Total/NA	Solid	Dry and Grind	
160-8030-25	SS-03-A	Total/NA	Solid	Dry and Grind	
160-8030-26	SS-03-B	Total/NA	Solid	Dry and Grind	
160-8030-27	SS-04-A	Total/NA	Solid	Dry and Grind	
160-8030-28	SS-04-B	Total/NA	Solid	Dry and Grind	
160-8030-29	SS-17-A	Total/NA	Solid	Dry and Grind	
160-8030-30	SS-05-A	Total/NA	Solid	Dry and Grind	
160-8030-31	SS-08-A	Total/NA	Solid	Dry and Grind	
160-8030-32	SS-07-A	Total/NA	Solid	Dry and Grind	
160-8030-33	SS-07-B	Total/NA	Solid	Dry and Grind	

Prep Batch: 139626

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-8030-34	EB-01	Total/NA	Water	PrecSep-21	
160-8030-35	EB-02	Total/NA	Water	PrecSep-21	
160-8030-36	EB-03	Total/NA	Water	PrecSep-21	
160-8030-37	EB-04	Total/NA	Water	PrecSep-21	
160-8030-37 DU	EB-04	Total/NA	Water	PrecSep-21	
LCS 160-139626/2-A	Lab Control Sample	Total/NA	Water	PrecSep-21	
MB 160-139626/1-A	Method Blank	Total/NA	Water	PrecSep-21	

Prep Batch: 140385

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-8030-1	SS-06-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-1 DU	SS-06-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-2	SS-06-B	Total/NA	Solid	Fill_Geo-21	139536

QC Association Summary

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Rad (Continued)

Prep Batch: 140385 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-8030-3	SS-09-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-4	SS-09-B	Total/NA	Solid	Fill_Geo-21	139536
160-8030-5	SS-10-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-6	SS-12-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-7	SS-12-B	Total/NA	Solid	Fill_Geo-21	139536
160-8030-8	ED-01-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-9	WD-01-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-10	SS-17-B	Total/NA	Solid	Fill_Geo-21	139536
160-8030-11	SS-16-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-12	BG-01-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-13	BG-02-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-14	BG-03-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-15	BG-03-B	Total/NA	Solid	Fill_Geo-21	139536
160-8030-16	BG-04-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-17	BG-05-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-18	BG-06-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-19	SS-11-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-20	SS-01-A	Total/NA	Solid	Fill_Geo-21	139536
LCS 160-140385/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-21	
MB 160-140385/1-A	Method Blank	Total/NA	Solid	Fill_Geo-21	

Prep Batch: 140433

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-8030-21	SS-01-B	Total/NA	Solid	Fill_Geo-21	139536
160-8030-21 DU	SS-01-B	Total/NA	Solid	Fill_Geo-21	139536
160-8030-22	SS-16-B	Total/NA	Solid	Fill_Geo-21	139536
160-8030-23	SS-13-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-24	SS-02-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-25	SS-03-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-26	SS-03-B	Total/NA	Solid	Fill_Geo-21	139536
160-8030-27	SS-04-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-28	SS-04-B	Total/NA	Solid	Fill_Geo-21	139536
160-8030-29	SS-17-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-30	SS-05-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-31	SS-08-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-32	SS-07-A	Total/NA	Solid	Fill_Geo-21	139536
160-8030-33	SS-07-B	Total/NA	Solid	Fill_Geo-21	139536
LCS 160-140433/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-21	
MB 160-140433/1-A	Method Blank	Total/NA	Solid	Fill_Geo-21	

Tracer/Carrier Summary

Client: Weston Solutions, Inc.
Project/Site: Start Region 5 - McKinley County, NM

TestAmerica Job ID: 160-8030-1
SDG: Haystack No 1

Method: 9315 - Radium-226 (GFPC)

Matrix: Water **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)						
		Ba						
Lab Sample ID	Client Sample ID	(40-110)						
160-8030-34	EB-01	93.2						
160-8030-35	EB-02	95.0						
160-8030-36	EB-03	95.6						
160-8030-37	EB-04	96.5						
160-8030-37 DU	EB-04	99.7						
LCS 160-139626/2-A	Lab Control Sample	88.5						
MB 160-139626/1-A	Method Blank	87.0						

Tracer/Carrier Legend

Ba = Ba Carrier