DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH WING (ACC)
HOLLOMAN AIR FORCE BASE NEW MEXICO

ENTERED

28 June 2016

ADAM M. KUSMAK, GS-13, USAF
Chief, Installation Management Flight (49 CES/CEI)
49th Civil Engineer Squadron (49 CES)
Holloman Air Force Base, NM

RECEIVED
JUL 5 2016
NMED
Hazardous Waste Bureau

New Mexico Environment Department
Attn: Mr. John Kieling, Chief
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6063

Re: **Final Decommissioning Plan and Final Interim Measures Work Plan**
**Site RW-42 – Radioactive Waste Disposal Area (SWMU 111)**
EPA ID# NM6572124422, HWB-HAFB-12-007
Holloman Air Force Base, Alamogordo, NM
Contract No. FA8903-13-C-0008

Dear Mr. Kieling,

Attached are the *Final Decommissioning Plan* and *Final Interim Measures Work Plan* for the RW-42 Radioactive Waste Disposal Area at Holloman AFB (SWMU 111). These plans are submitted in response to the NMED's 29 April 2016 Extension Approval letter for a work plan for investigation activities at Site RW-42. The plans are also provided on the enclosed CDs, with native and PDF files.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions regarding this submittal, please contact me at (575) 572-6675 or by email at adam.kusmak@us.af.mil.

Sincerely,

Digitally signed by KUSMAK.ADAM.M.1263331806
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USAF, cn=KUSMAK.ADAM.M.1263331806
Date: 2016.06.28 16:58:38 -06'00'

ADAM M. KUSMAK, GS-13, USAF

Attachment(s): *Final Decommissioning Plan* and *Final Interim Measures Work Plan*. Hard copies and CDs.

cc: Mr. Dave Strasser, NMED HWB (w/Atch)
Mr. Cornelius Amindyas, NMED HWB (w/o Atch)
Mr. Chuck Hendrickson, USEPA (w/CD)
Ms. DeAnna Rothhaupt, HAFB (w/Atch)
Mr. Charles Schick, HAFB (w/Atch)
Mr. Brian Renaghan, AFCEC (w/CD)
Mr. Wayne Bittner, Kirtland AFB (1 CD)

# FINAL
# DECOMMISSIONING PLAN

## Site RW-42 – Radioactive Waste Disposal Area (SWMU 111)

**Holloman Air Force Base, New Mexico**

Prepared for
**Air Force Civil Engineer Center**
2261 Hughes Ave, Suite 155
Joint Base San Antonio Lackland, Texas 78236-9853

Contract No.: FA8903-13-C-0008

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**June 2016**

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# LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AAF | Army Air Field |
| ACM | Accelerated Corrective Measures |
| AEC | U.S. Atomic Energy Commission |
| AFB | Air Force Base |
| AFCEC | Air Force Civil Engineer Center |
| AFRIC | Air Force Radioisotope Committee |
| AFSC/SEW | Air Force Safety Center Weapons Safety Division |
| ALARA | As Low As Reasonably Achievable |
| amsl | above mean sea level |
| AOC | Area of Concern |
| bgs | below ground surface |
| CAC | Corrective Action Complete |
| CFR | Code of Federal Regulations |
| CM | Corrective Measures |
| CME | Corrective Measures Evaluation |
| DCGL | Derived Concentration Guideline Level |
| DOT | Department of Transportation |
| DPT | direct push technology |
| FPM | FPM Remediations, Inc. |
| FSS | Final Status Survey |
| ft | foot/feet |
| HASP | Health and Safety Plan |
| IM | Interim Measures |
| ISOCS | In Situ Object Counting System |
| LLRW | low-level radioactive waste |
| MML | master materials license |
| µg/g | micrograms per gram |
| µg/kg | micrograms per kilogram |
| µg/L | micrograms per liter |
| µR/hr | microRoentgens per hour |
| MARSSIM | Multi-Agency Radiation Survey and Site Investigation Manual |
| mg/L | milligrams per liter |
| mrem/yr | milliRoentgen Equivalent Man per year |
| mSv/yr | milliSieverts per year |
| NFA | No Further Action |
| NMAC | New Mexico Administrative Code |
| NMED | New Mexico Environment Department |
| NORM | Naturally Occurring Radioactive Material |
| NRC | United States Nuclear Regulatory Commission |

| | |
|---|---|
| PBR | Performance Based Remediation |
| pCi/g | picoCurie per gram |
| pCi/L | picoCurie per liter |
| PPE | personal protective equipment |
| PROC | Potential Radionuclides of Concern |
| QAPP | Quality Assurance Project Plan |
| RCB | Radiation Control Bureau |
| RCRA | Resource Conservation and Recovery Act |
| RI | Remedial Investigation |
| RML | Radioactive Materials License |
| RSO | Radiation Safety Officer |
| RSP | Radiation Safety Plan |
| SVOC | semivolatile organic compound |
| SWMU | Solid Waste Management Unit |
| TAL | target analyte list |
| TDS | total dissolved solids |
| TPH | total petroleum hydrocarbons |
| TPH-DRO | diesel-range TPH |
| TPH-GRO | gasoline-range TPH |
| TPH-ORO | oil-range TPH |
| URS | URS Group, Inc. |
| USAF | United States Air Force |
| USEPA | United States Environmental Protection Agency |
| UTL | Upper Tolerance Limit |
| VOC | volatile organic compound |

# 1.0 INTRODUCTION

URS Group, Inc. (URS), as a subcontractor to FPM Remediations, Inc. (FPM), has prepared this Decommissioning Plan for Site RW-42 at Holloman Air Force Base (AFB) as part of the New Mexico-Arizona Group Performance-Based Remediation (PBR) contract. Site RW-42 is listed in Holloman AFB Resource Conservation and Recovery Act (RCRA) Hazardous Waste Facility Permit No. NM6572124422 (NMED 2004) as the Radioactive Waste Disposal Area, Solid Waste Management Unit (SWMU) 111. Site RW-42 is regulated under RCRA and the United States Air Force (USAF) Master Materials License (MML). The lead regulatory agency is the New Mexico Environment Department (NMED). This site is also regulated by the Air Force Radioisotope Committee (AFRIC) under AFI-40-201; however, a possession-only permit has not been issued for Site RW-42. The decommissioning goal for Site RW-42 is the safe removal and disposal of all radioactive waste to allow Site RW-42 to be granted Corrective Action Complete (CAC) without Controls status and moved from Holloman AFB RCRA Hazardous Waste Facility Permit Table A (SWMUs and Areas of Concern [AOCs] Requiring Corrective Action) to Table B (Corrective Action Complete [CAC] without Controls [i.e., Site Closeout (SC)]) (NMED 2004).

This Decommissioning Plan was completed under Air Force Civil Engineer Center (AFCEC) Contract No. FA8903-13-C-0008. The regulatory agency will be the New Mexico Environment Department (NMED) Radiation Control Bureau (RCB). Intrusive site work will be conducted under reciprocity in accordance with Utah Radioactivity Materials License UT1800410 (Appendix A).

Decommissioning is the process of removing a site safely from service and reducing residual radioactivity to a level that permits release of the property (1) for unrestricted use or (2) under restricted conditions. For licensed sites, decommissioning includes termination of the license or amending the license to remove the site as a location of use from the license. For non-permitted sites, like Site RW-42, decommissioning includes documenting in correspondence to the site owner that the site is released for unrestricted use. Decommissioning is regulated by the U.S. Nuclear Regulatory Commission (NRC) under the Air Force Master Material agreement, and in the case of Site RW-42, NMED, an agreement state agency. Decommissioning guidance is provided in New Mexico Administrative Code (NMAC) Title 20 Chapter 3 Radiation Protection and NRC's Consolidated Decommissioning Guidance (NRC 2006).

The NRC *Consolidated Decommissioning Guidance* (NRC 2006) identifies when a formal decommissioning plan is needed. Generally, a decommissioning plan is needed for sites requiring remediation (not just removal of licensed material), or when the activities required are outside of standard operations. A decommissioning plan provides the framework under which work will occur, including site operational history, identification of radionuclides of concern, oversight, financial assurance, potential waste disposal facilities, and radiological release criteria for unrestricted release or requirements for restricted release. Typically a decommissioning plan

includes details to confirm that the facility has in place the resources to support the decommissioning, including personnel to review and approve subsequent plans required for implementation.

A decommissioning plan typically does not include how radioactive material will be removed from a site or a description of the remediation methods. However, because Site RW-42 is being closed under RCRA, the currently proposed Interim Measures (IM) are briefly outlined herein. Details of removal and remediation activities will be provided in the IM and subsequent Corrective Measures (CM) Work Plans.

After removal of all radioactive material and completion of remediation, a Final Status Survey (FSS) will be performed for the soil or remaining site structures in general accordance with the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (NUREG-1575, Revision 1; NRC 2000). The MARSSIM was developed collaboratively by the four federal agencies that have authority and control over radioactive materials: U.S. Department of Defense, U.S. Department of Energy, U.S. Environmental Protection Agency (USEPA), and NRC. An FSS Plan will be developed to identify the radiological survey and sampling requirements needed to document that the soil and any remaining site structures meet the release criteria established in this Decommissioning Plan.

This Decommissioning Plan will be used in conjunction with the IM and CM Work Plans to characterize and remediate Site RW-42 so it can be granted CAC without Controls status and moved from Table A to Table B of the Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004). Because of the uncertainty associated with the waste disposed at Site RW-42, IM will be performed to characterize the waste so that corrective measures can be assessed and a waste profile developed for waste disposal. The characterization needs and investigation approach will be documented in an IM Work Plan. A CM Work Plan will be prepared after the IM is completed and the data evaluated to develop corrective measures for site closure and release. These documents will be submitted to Holloman AFB and the NMED under separate cover for review and approval.

## 1.1 Base Summary

### 1.1.1 Physical Setting

Site RW-42 is located at Holloman AFB in south central New Mexico, in the northwest central part of Otero County, approximately 75 miles north–northeast of El Paso, Texas (USAF 2013) (**Figure 1**). Holloman AFB has a population of 3,054 (U.S. Census 2010) and occupies 59,639 acres in the northeast quarter of Section 1, Township 17 South, Range 8 East. The White Sands Missile Range (WSMR) testing facilities occupy additional land extending northward from the Base. Privately and publicly owned lands border the remainder of Holloman AFB. The major highway servicing Holloman AFB is Highway 70, which runs southwest from the town of

Alamogordo, New Mexico, and separates Holloman AFB from publicly owned lands to the south. Alamogordo, which has a population of 30,401 according to (U.S. Census 2010), is located approximately 7 miles east of the Base.

### 1.1.2 Holloman AFB History

Holloman AFB was first established in 1942 as Alamogordo Army Air Field. From 1942 through 1945, Alamogordo Army Air Field served as the training grounds for over 20 different flight groups, flying primarily B-17s, B-24s, and B-29s. After World War II, most operations had ceased at the Base. In 1947, Air Material Command announced that the air field would be its primary site for the testing and development of unmanned aircraft, guided missiles, and other research programs (USAF 2013). On 13 January 1948, the Alamogordo installation was renamed in honor of the late Colonel George V. Holloman, a pioneer in guided missile research. The facility mission remained largely unchanged until 1971, although the facility identification changed several times during the 20-year span: Air Force Missile Test Center (1951–1952), Holloman Air Development Center (1952–1957), and Air Force Missile Development Center (1957–1971) (Holloman AFB 2008). In 1968, the 49th Tactical Fighter Wing arrived at Holloman AFB and has remained there since. Today, Holloman AFB also serves as the German Air Force's Tactical Training Center.

## 1.2 Site Summary

Site RW-042 is listed on Table A of the Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004) as the Radioactive Waste Disposal Area, SWMU 111. It is approximately 6.5 miles north of the main Base area (**Figure 2**). The site is east of Range Road 9 and south of Hay Draw in the undeveloped northeastern portion of Holloman AFB at latitude 32.9515432 north and longitude -106.1042017 west.

Site RW-42 (**Figure 3**) is in a secluded area south of Hay Draw at an approximate elevation of 4,163 feet (ft) above mean sea level (amsl) on relatively flat desert terrain that gently slopes to the southwest. The site reportedly consists of a buried concrete cylinder containing radioactive waste surrounded by a three-strand barbed wire fence (80 ft x 60 ft x 4 ft) with a three-strand barbed wire gate on a moveable fence post. A concrete pad (**Figure 4**) marks the site location. Warning signs indicating radioactive waste disposal are posted 10 ft outside of each side of the fence (Radian 1992).

Site RW-042 was created in the 1950s by the USAF for burial of radioactive waste in accordance with USAF Technical Order TO-00-110A-1 (AFRIC 1972). The buried concrete cylinder contains unknown quantities of suspected wastes, including research animal carcasses containing low-level radioactivity as well as contaminated laboratory and pharmaceutical supplies (e.g., lab gowns, gloves, syringes, etc.). Former USAF personnel present during the disposal operation described the waste disposal vault as a concrete cylinder approximately 10 ft in length and 5.5 ft in diameter with an internal opening 8 ft long and 1.5 ft in diameter. These dimensions are

consistent with specifications in Technical Order TO-00-110A-1. The cylinder is reportedly buried at a depth of 2 to 4 ft below ground surface (bgs) and covered with a concrete pad (3 ft long by 3 ft wide by 4 inches thick) (**Figure 4**) to indicate its location (Radian 1992). The orientation of the buried cylinder is currently not known. However, based on drilling adjacent to the concrete pad overlying the cylinder, it is assumed to be upright (i.e., vertically oriented) (Bhate 2012). **Figure 5** shows the site layout and features. **Figure 6** is a schematic of the assumed waste containment structure configuration.

### 1.2.1 Site Soils, Geology, and Hydrogeology

Site RW-42 is situated on soils characterized as Holloman-Gypsum Land-Yesum Complex (Deer 1981). The Holloman-Gypsum Land-Yesum Complex (0 to 5 percent slopes) consists of shallow and deep well drained, calcareous, mildly to moderately alkaline, gypsiferous (i.e., gypsum bearing) sandy loam soils. Soil permeabilities are moderate, ranging from $4 \times 10^{-4}$ to $1 \times 10^{-3}$ centimeters per second, and available water capacity is low.

Geologically, Site RW-42 is located within the Tularosa Basin in the Rio Grande Rift. The site is situated on Tertiary alluvial, eolian, and playa basin fill deposits. The subsurface stratigraphy at Site RW-42 is based on four direct push technology (DPT) soil borings (RW42-DP01 through -DP04) and three monitoring wells (RW42-MW01 through -MW03) drilled with hollow-stem augers completed at the site in 2007 (Bhate 2012) (**Figure 5**). Drilling logs from the DPT and hollow-stem auger borings indicate that Site RW-042 is primarily underlain by silty sands interbedded with clayey sands. A dense caliche layer is present, overlaying white fine grained sand layers, at approximately 20 ft bgs. This white sand layer grades into a clayey silt interbedded with gypsum lenses and extends 20 to 25 ft to a water bearing silty sand at approximately 40 to 45 ft bgs.

Site monitoring wells (RW42-MW01 through -MW03) (**Figure 3**) are screened in silty sand from approximately 34 to 49 ft bgs. In July of 2007, the depths to groundwater ranged from approximately 39 to 42 ft below top of casing, and groundwater elevations ranged from approximately 4,119 to 4,123 ft amsl. Groundwater locally flows to the west towards Hay Draw, a northeast-to-southwest-trending arroyo north of Site RW-042, at a horizontal hydraulic gradient of approximately 0.038 ft/ft. Regional groundwater flow at Holloman AFB is to the southwest (Bhate 2012).

## 1.3 Preliminary Site Assessment

A preliminary site assessment was conducted and documented in the 1992 Remedial Investigation (RI) Report (Radian 1992). Radian reported that periodic monitoring (including soil sampling and radiological surface readings) conducted by Holloman AFB's Bioenvironmental Engineering staff (and formerly by Environmental Health Services) has shown normal levels of radioactivity at the site (Andreoli 1980, Cordts 1990). Surface soil samples

taken at the site in February 1990 indicated no significant differences between radioactivity levels adjacent to the concrete pad and background. During Radian's site reconnaissance in February 1991, radiation measurements were taken using portable alpha and beta/gamma detectors (Morahan 1991). These results also indicated background radioactivity levels consistent with previous sampling results.

Radian (1992) concluded that "*Provided that monitoring (as completed to date by Base Bioenvironmental Engineering) of the site continues, site closeout/no further action appears warranted for Site 42*." Radian (1992) also stated that "*Appropriate documentation in the form of a Decision Document will be prepared to record and summarize the data presented in this [Preliminary Assessment] PA*." Radian (1994) referenced Site 42, but did not include any decision documentation. The current goal for Site RW-42 is to close it under RCRA to achieve CAC without Controls status and move it from Table A to Table B of the Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004).

## 1.4 Subsequent Site Investigation and Monitoring

A review of historical site documents indicates periodic radiological surveys were conducted at Site RW-42 between 1976 and 1990. Reported measurements were within the range of background radiation levels. Surface soil samples were collected by Holloman AFB's Bioenvironmental Engineering staff in February 1990 and again in 2008. They also conducted periodic monitoring, reporting the results as not different from background.

In 2007, a subsequent investigation was performed to support corrective action at Site RW-042 that included drilling and sampling four soil borings (RW42-DP01 through -DP04) approximately 5 ft from the concrete pad and installation of three groundwater monitoring wells (RW42-MW01 through -MW03) outside of the fenced site perimeter (**Figure 5**). The locations of the soil borings so close to the concrete suggests that the waste disposal cylinder is most likely in an upright (i.e., vertically oriented) position. The results of the 2007 investigation are summarized in the Final Accelerated CM (ACM) Completion Report (Bhate 2012) and briefly summarized below.

Four groundwater samples, including one duplicate, were collected at monitoring wells RW42-MW01, -MW02, and -MW03 and analyzed for potential chemical contaminants (volatile organic compounds [VOCs], semivolatile organic compounds [SVOCs], target analyte list [TAL] dissolved metals, and total dissolved solids [TDS]) and tritium, the only radionuclide analyzed. Groundwater at the three wells had TDS concentrations of 13,000 milligrams per liter (mg/L) which indicates that it is of poor quality and not suitable for human consumption. No groundwater constituents were detected at concentrations above applicable standards, except manganese.

Dissolved manganese appears to occur naturally in groundwater at concentrations ranging from 48 to 240 micrograms per liter (µg/L). Dissolved manganese at monitoring well RW42-MW03 exceeds the NMED (NMAC 2004) groundwater quality standard of 200 µg/L and the 95 percent upper tolerance limit (95%UTL) for dissolved manganese (118 µg/L) in Holloman AFB background groundwater. However, the NMED (NMAC 2004) groundwater quality standard for manganese was developed for groundwater with TDS concentrations less than 10,000 mg/L.

Fourteen soil samples, including two field duplicates, were collected from the DPT soil borings (RW42-DP01 through -DP04) and analyzed for VOCs; SVOCs; gasoline-, diesel-, and oil-range total petroleum hydrocarbons (TPH-GRO [$C_6$-$C_{10}$], TPH-DRO [$C_{10}$-$C_{22}$], and TPH-ORO [> $C_{22}$-$C_{36}$], respectively); TAL total metals; and tritium, the only radionuclide analyzed. None of these soil constituents exceeded then current applicable NMED (2009) or USEPA (2002) soil screening levels.

## 1.5 Recent Site Monitoring and Investigation

### 1.5.1 Dose Rate Survey

On 9 March 2016, URS conducted a screening-level dose rate survey using a hand-held dose rate meter at Site RW-42. Dose rate measurements were within the background range of 8 to 12 microRoentgens per hour (µR/hr).

### 1.5.2 Ground-Penetrating Radar (GPR) Survey

FPM conducted a ground penetrating radar (GPR) survey at Site RW-42 on 19 May 2016 to determine the depth and orientation of the buried concrete waste cylinder. The survey was conducted using a GSSI SIR 3000 GPR system with 200- and 400-megahertz antennas. The concrete pad marking the location of Site RW-42 was moved to allow the GPR survey to be conducted over the suspected waste cylinder. While moving the pad it was discovered that the concrete pad had been poured directly above the hole dug for the concrete vault leaving an approximately3 ft long, conical concrete “plug” attached to the pad (**Figure 7**). At the bottom of the exposed hole was a concrete disk approximately 2 ft in diameter (Figure 8). Investigation with a steel T-probe into the soil surrounding this disc indicated a solid surface approximately 0.5 ft deep and extending at least 1 ft out from the disc in all directions. FPM interprets this to indicate the top of the buried concrete cylinder. The approximately 2 ft diameter concrete disk likely covers the reported 1.5 ft diameter opening in the concrete vault where radioactive waste is disposed.

Sixteen profiles each of 200- and 400-MHz GPR data were collected from all four sides of the 4- by 4-foot concrete pad (see site sketches for each antenna). Preliminary data shows evidence of the excavation of the pit where the concrete vault was buried, but no reflector from the vault itself (due to the concrete pad being in the way). Even with the moving of the concrete pad and plug it was not possible to locate the GPR lines closer to the vault than approximately 3.5 ft.

Three selected GPR profiles (**Figures 9 through 11**) show examples of significant reflections caused by the excavation pit, and the preliminary interpretation map (**Figure 12**) shows the locations of those reflections spatially. The GPR data shows the edges of the pit excavation, but no indication of the vault, which leads to the suggestion that the vault is vertically oriented with no significant shifting or settling.

## 1.6 Current Site Status

Site RW-42 is currently on Table A of the Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004). NMED reviewed the ACM Completion Report for Sites OT-32 (AOC PRI-A) and RW-42 (SWMU 111) prepared by Bhate (2012). NMED disapproved the No Further Action (NFA) recommendation for Site RW-42 because it considers Site RW-42 to be a landfill and a SWMU that is subject to corrective action and long-term controls (NMED 2014). NMED requested that the waste contained in the buried cylinder be characterized, and based on the results, the waste and cylinder be disposed of. NMED indicated that Holloman AFB must submit a work plan for removal of the waste or complete a CM Evaluation (CME).

Holloman AFB decided to characterize the radioactive waste in the cylinder and, depending on the results, excavate and properly dispose of the waste and disposal cylinder at an appropriately-licensed facility to allow Site RW-42 to be granted CAC without Controls status and moved from Table A to Table B of the Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004). This Decommissioning Plan and a companion IM Work Plan are being prepared for Holloman AFB and the NMED review and approval to fulfill NMED's request (NMED 2014). A CM Work Plan will be prepared to document the proposed corrective measures for Site RW-42 after the IM are completed and the results evaluated.

# 2.0 CURRENT SITE CONDITIONS

## 2.1 MARSSIM Preliminary Historical Site Assessment

The 1992 RI Report (Radian 1992) included a PA for Site RW-42 which provided much of the information needed for the MARSSIM preliminary historical site assessment provided in Table 1. A historical site assessment is an investigation to collect existing information describing a site's complete history from the start of site activities to the present time. To supplement the Radian (1992) PA, URS contacted the current Holloman AFB Radiation Safety Officer (RSO), and reviewed available documentation related to Site RW-42. A summary of the historical documents reviewed by URS is provided in Appendix B. The historical documentation reviewed was limited and provided little additional information regarding waste disposed at Site RW-42. Based on second-hand interviews of base personnel in the 1990s, Site RW-42 is reported to have a buried concrete cylinder that contains unknown types and quantities of wastes. Suspected wastes include animal carcasses containing low-level radioactivity as well as contaminated laboratory and pharmaceutical supplies (e.g., lab gowns, syringes, etc.). The actual waste disposed has not been verified to date. In March 2016, additional interviews were conducted with current staff at the Primate Research Institute.

Based on a review of the information available for Site RW-42, a preliminary historical site assessment was completed by URS using MARSSIM Table 3.1 questions as shown in **Table 1**. The responses are limited to relevant activities that are thought to have only occurred at Site RW-42.

**Table 1**
**MARSSIM Table 3.1 Preliminary Historical Site Assessment for Site RW-42**

| # | | RW-42 Only | Notes |
|---|---|---|---|
| 1 | Was the site ever licensed for the manufacture, use, or distribution of radioactive materials under Agreement State Regulations, NRC licenses, or Armed Services permits, or for the use of 91B material? | No | Site closed during or prior to 1959. RMLs were found for primate research conducted in 1971 and 1986. |
| 2 | Did the site ever have permits to dispose of, or incinerate, radioactive material onsite? | No | Disposal is reported to have occurred under USAF Technical Order TO-00-110A-1. |
| | Is there evidence of such activities? | Yes | A concrete pad currently marks the reported location of the disposal site. |
| 3 | Has the site ever had deep wells for injection or permits for such? | Unknown | No evidence found to indicate that injection permits were issued for the site or injection wells installed and used at the site. |
| 4 | Did the site ever have permits to perform research with radiation generating devices or radioactive materials except medical or dental x-ray machines? | Yes | Research occurred; permit/ licenses were issued in 1971 and 1986. |

**Table 1**
**MARSSIM Table 3.1 Preliminary Historical Site Assessment for Site RW-42**

| # | | RW-42 Only | Notes |
|---|---|---|---|
| 5 | As a part of the site's RML were there ever any Soil Moisture Density Gauges (Americium-Beryllium or Plutonium-Beryllium sources), or Radioactive Thickness Monitoring Gauges stored or disposed of onsite? | No | Not associated with Site RW-42. |
| 6 | Was the site used to create radioactive material(s) by activation? | No | - |
| 7 | Were radioactive sources stored at the site? | Unknown | Sources may have been placed in the disposal cell. |
| 8 | Is there evidence that the site was involved in the Manhattan Project or any Manhattan Engineering District activities (1942-1946)? | No | Site is believed to have been created in the 1950s. |
| 9 | Was the site ever involved in the support of nuclear weapons testing (1945-1962)? | Unknown | Depends on what research was conducted. |
| 10 | Were any facilities on the site used as a weapons storage area? Was weapons maintenance ever performed at the site? | No | - |
| 11 | Was there ever any decontamination, maintenance, or storage of radioactively contaminated ships, vehicles, or planes performed onsite? | No | - |
| 12 | Is there a record of any aircraft accident at or near the site (e.g., depleted uranium counterbalances, thorium alloys, radium dials)? | No | - |
| 13 | Was there ever any radiopharmaceutical manufacturing, storage, transfer, or disposal onsite? | Yes | Contaminated pharmaceutical supplies are a reported waste stream. |
| 14 | Was animal research ever performed at the site? | Yes | Animal carcasses are reported to have been disposed at the site. |
| 15 | Were uranium, thorium, or radium compounds (NORM) used in manufacturing, research, or testing at the site, or were these compounds stored at the site? | Unknown | No data regarding disposal of radium or other dials at the site. |
| 16 | Has the site ever been involved in the processing of NORM (e.g., radium, fertilizers, phosphorus compounds, vanadium compounds, refractory materials, or precious metals) or mining, milling, processing, or production of uranium? | No | - |
| 17 | Were coal or coal products used onsite? | No | - |
| | If yes, did combustion of these substances leave ash or ash residues onsite? | - | - |
| | If yes, are runoff or production ponds onsite? | - | - |
| 18 | Was there ever any onsite disposal of material known to be high in naturally occurring radioactive materials. (e.g., monazite sands used in sandblasting)? | No | - |
| 19 | Did the site process pipe from the oil and gas industries? | No | - |

**Table 1**
**MARSSIM Table 3.1 Preliminary Historical Site Assessment for Site RW-42**

| # | | RW-42 Only | Notes |
|---|---|---|---|
| 20 | Is there any reason to expect that the site may be contaminated with radioactive material (other than previously listed)? | Unknown | The existing data on what material may have been disposed on site are very limited. |

NORM = Naturally Occurring Radioactive Material
NRC = United States Nuclear Regulatory Commission
RML = Radioactive Material License
USAF = United States Air Force

## 2.2 Site RW-42 Radioactive Waste Disposal Activities

Site RW-42 was created in the 1950s by the USAF for burial of radioactive waste in accordance with Technical Order TO-00-110A-1. The site was closed during or prior to 1959 when the USAF rescinded general authority to bury radioactive waste. It is unknown whether hazardous wastes or constituents were placed in the concrete cylinder along with radioactive wastes (Radian 1992).

The buried concrete cylinder is assumed to contain unknown quantities of wastes, based on second-hand interviews of base personnel by Radian (1992). Captain F.R. Sprester, USAF (1977) reported that the site was created in the 1950's and that former USAF personnel present during the disposal operation describe the concrete cylinder as 10 ft long, 5.5 ft in diameter, with an center opening 8 ft long and 1.5 ft in diameter. The cylinder is reported to be buried at a depth of 2 to 4 ft and had a 3 ft x 3 ft x 4 inch thick concrete cover (Sprester 1977). **Figure 4** is a present-day photograph of the concrete pad covering the buried concrete cylinder. Suspected wastes disposed in the cylinder may have included animal carcasses containing low-level radioactivity as well as contaminated laboratory and pharmaceutical supplies (e.g., lab gowns, syringes, etc.). The actual waste disposed at Site RW-42 has not been verified to date. The IM will be conducted to confirm the presence of the waste disposal cylinder and its waste quantities and characteristics.

## 2.3 Potential Radionuclides of Concern

Because of the limited knowledge of the radionuclides disposed at Site RW-42, a detailed review of historical documents (Appendix B) describing the use of radioactive materials at Holloman AFB and other AFBs was conducted to identify potential radionuclides that may have been disposed at Site RW-42. This information was used to create the list of Potential Radionuclides of Concern (PROC) for Site RW-42 provided in **Table 2**. This list represents the best information available on which primary radioisotopes may remain in the waste disposed at Site RW-42. These isotopes were either sampled as part of the Holloman AFB Background Study (NationView/Bhate 2009), identified on the first Radioactive Material License (RML) issued to the Albany Medical College Institute of Experimental Pathology and Toxicology who managed

the primate research facility (AEC 1971), the NRC RML issued to the New Mexico State University Primate Research Institute (NRC 1986), reported in the 1992 personnel interviews (Bhate 2012), or mentioned by current primate research facility personnel.

**Table 2**
**Potential Radionuclides of Concern at Site RW-42**

| Atomic Number | Element | Isotope | 1/2 life (years) | Fraction Remaining (%) | Primary Decay Method | Reference |
|---|---|---|---|---|---|---|
| 1 | Hydrogen | H-3 | 1.23E+01 | 4.5 | Beta ($\beta^-$) | Listed on 1971 license |
| 6 | Carbon | C-14 | 5.73E+03 | 99.3 | Beta ($\beta^-$) | Listed on 1971 license |
| 17 | Chlorine | Cl-36 | 3.01E+05 | 100.0 | Beta ($\beta^-$) | Listed on 1971 license |
| 53 | Iodine | I-129 | 1.57E+07 | 100.0 | Beta ($\beta^-$) | Reported by current primate research facility personnel |
| 55 | Cesium | Cs-137 | 3.02E+01 | 28.3 | Beta ($\beta^-$) | Listed on 1971 license |
| 82 | Lead | Pb-210 | 2.23E+01 | 18.1 | Beta ($\beta^-$) | Base background study |
| 88 | Radium | Ra-226 | 1.60E+03 | 97.6 | Alpha ($\alpha$) | Base background study |
| | | Ra-228 | 5.76E+00 | 0.1 | Beta ($\beta^-$) | Base background study |
| 90 | Thorium | Th-228 | 1.91E+00 | 0.0 | Alpha ($\alpha$) | Base background study |
| | | Th-230 | 7.50E+04 | 99.9 | Alpha ($\alpha$) | Base background study |
| | | Th-232 | 1.40E+10 | 100.0 | Alpha ($\alpha$) | Base background study |
| 92 | Uranium | U-234 | 2.40E+05 | 100.0 | Alpha ($\alpha$) | 1992 interview |
| | | U-235 | 7.04E+08 | 100.0 | Alpha ($\alpha$), IT | 1992 interview |
| | | U-236 | 2.34E+07 | 100.0 | Alpha ($\alpha$) | 1992 interview |
| | | U-238 | 4.50E+09 | 100.0 | Alpha ($\alpha$) | 1992 interview |
| 94 | Plutonium | Pu-238 | 8.77E+01 | 64.8 | Alpha ($\alpha$) | 1992 interview |
| | | Pu-239 | 2.41E+04 | 99.8 | Alpha ($\alpha$) | 1992 interview |
| | | Pu-240 | 6.56E+03 | 99.4 | Alpha ($\alpha$) | 1992 interview |
| | | Pu-241 | 1.43E+01 | 6.9 | Beta ($\beta^-$) | 1992 interview |
| | | Pu-242 | 3.75E+05 | 100.0 | Alpha ($\alpha$) | 1992 interview |
| | | Pu-244 | 8.00E+07 | 100.0 | Alpha ($\alpha$) | 1992 interview |

Notes: $\alpha$ = alpha decay by alpha particle emission; $\beta^-$ = beta decay by electron emission; IT = isomeric transition (gamma ray or conversion electron emission from an excited state)

Isotopes with short half-lives (less than 5 years) were generally removed from the table because they have subsequently decayed to *de minimis* activities. The column labeled "Fraction Remaining" shows the calculated percentage of the isotope remaining in the waste, due only to radioactive decay, assuming the waste was disposed in 1960. The decay products of isotopes on the list are also assumed to be present, but are not included in **Table 2**.

## 2.4 Background Soil and Groundwater Data

A basewide soil and groundwater background study was prepared by NationView/Bhate (2009). As part of that study, basewide soil and groundwater UTLs were established for some of the radionuclides which may be present at Site RW-42. The background UTLs developed by

NationView/Bhate (2009) are presented in **Table 3**. However, the proposed soil background values for radionuclides have not been approved by the NMED (2011).

**Table 3**
**95% Background UTLs**

| Isotope | Soil (pCi/g) | | | Groundwater (pCi/L) |
|---|---|---|---|---|
| | Surface | Subsurface | Saturated Subsurface | |
| Carbon-14 (C-14)[1] | 2.4 | 2.4 | 2.4 | 20 |
| Lead-201 (Pb-210) | 1.77 | 1.09 | 1.15 | 3.08 |
| Radium-226 (Ra-226) | 1.34 | 1.2 | 1.12 | 5.23 |
| Radium-228 (Ra-228) | 1.45 | 3.18 | 4 | 580 |
| Thorium-228 (Th-228) | 1.15 | 1.06 | 0.94 | 0.85 |
| Thorium-230 (Th-230) | 2.42 | 1.23 | 1.16 | 0.77 |
| Thorium-232 (Th-232) | 1.06 | 1.04 | 0.91 | 0.85 |
| Uranium-234 (U-234) | 1.61 | 1.09 | 1.11 | 247.65 |
| Uranium-235 (U-235) | 0.66 | 0.12 | 0.19 | 6.08 |
| Uranium-238 (U-238) | 1.08 | 0.85 | 0.95 | 136.67 |
| Total Uranium[2] | 3.04 | 2.53 | 2.68 | 494.43 |

Source: NationView/Bhate 2009
Notes:
pCi/g = picocuries per gram
pCi/L = picocuries per liter
[1] Units for C-14 are in micrograms per gram [ug/g] for soil and micrograms per liter [µg/L] for groundwater.
[2] Units for total uranium are in micrograms per kilogram [µg/kg] for soil and milligrams per liter [mg/L] for groundwater.

## 2.5 Selection of Derived Concentration Guideline Levels

NMED has not established soil cleanup levels for radionuclides in environmental media (NMED 2015) or approved background values for radionuclides in soil or groundwater at Holloman AFB (NMED 2011). Per Appendix 4-F, Section V.1.3 of the Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004), Appendix A of USEPA's *Soil Screening Guidance for Radionuclides: Technical Background Document* (USEPA 2000) will be used for determining if soil has been impacted by radiological contamination (Bhate 2012), unless NRC (2006) screening levels are more conservative.

The 25 milliRoentgen Equivalent Man per year (mrem/y) or 0.25 milliSieverts per year (mSv/y) unrestricted release dose limit specified in 10 Code of Federal Regulations (CFR) 20.1402 will be used as the "clean-up standard" for soil at Site RW-42. Table B2 of NRC's *Consolidated Decommissioning Guidance* (NRC 2006) provides surface soil screening levels for common

radionuclides. These standard Derived Concentration Guideline Levels (DCGLs) represent surficial surface soil concentrations of individual radionuclides that would be deemed in compliance with the 25 mrem/y unrestricted release dose limit. These standard DCGLs will be used for isotopes not screened for in Holloman AFB background soils; for isotopes present in background soils, the site cleanup limit will be the DCGL plus the site-specific background value, as described in **Section 2.4**.

Radiologically screened site soil activities will be compared to the NRC (2006) surface soil screening levels. After removal of the waste containment structure, the bottom of the excavation will be radiologically screened and samples collected for laboratory analysis prior to backfilling. Backfilling will occur after laboratory results are reviewed to confirm that the soils remaining in the excavation are at activities at or below the screening levels or background values (whichever is higher) provided in **Table 4**.

**Table 4**
**USEPA and NRC Surface Soil Screening Levels**

| Atomic Number | Element | Isotope | USEPA Soil Screening Criteria (pCi/g) (USEPA 2000) | | | NUREG 1757 Table B1 (NRC 2006) | | Holloman AFB Soil Background[3] (pCi/g) |
|---|---|---|---|---|---|---|---|---|
| | | | Direct Ingestion of Soil | Inhalation of Fugitive Dusts | External Radiation Exposure | Screening Level (pCi/g) | Screening Level[2] (pCi/g) | |
| 1 | Hydrogen | H-3 | 8580 | 323000000 | —[1] | 110 | | |
| 6 | Carbon | C-14 | 284 | 2570000 | 14300 | 12 | | 2.4 |
| 17 | Chlorine | Cl-36 | 104 | 726000 | 64.10 | 0.36 | | |
| 53 | Iodine | I-129 | 2.93 | 299000 | 18.30 | 0.5 | | |
| 55 | Cesium | Cs-137 | 18.30 | 1530000 | 0.04 | 11 | | |
| 82 | Lead | Pb-210 | 0.30 | 1310 | 26.50 | 0.9 | | |
| 88 | Radium | Ra-226 | 1.09 | 1570 | 0.01 | 0.7 | 0.6 | 1.34 |
| | | Ra-228 | 0.35 | 3470 | 0.02 | | | 1.45 |
| 90 | Thorium | Th-228 | 0.98 | 127 | 0.01 | 4.7 | 4.7 | 1.15 |
| | | Th-230 | 3.93 | 637 | 136 | 1.8 | 0.6 | 2.42 |
| | | Th-232 | 3.44 | 419 | 326 | 1.1 | 1.1 | 1.06 |
| 92 | Uranium | U-234 | 5.02 | 1590 | 443 | 13 | | 1.61 |
| | | U-235 | 48.70 | 1800 | 0.21 | 8 | 0.29 | 0.66 |
| | | U-236 | 5.33 | 1730 | 893 | | | |
| | | U-238 | 3.78 | 1940 | 0.98 | 14 | 0.5 | 1.08 |

# Table 4
# USEPA and NRC Surface Soil Screening Levels

| Atomic Number | Element | Isotope | USEPA Soil Screening Criteria (pCi/g) (USEPA 2000) | | | NUREG 1757 Table B1 (NRC 2006) | | Holloman AFB Soil Background[3] (pCi/g) |
|---|---|---|---|---|---|---|---|---|
| | | | Direct Ingestion of Soil | Inhalation of Fugitive Dusts | External Radiation Exposure | Screening Level (pCi/g) | Screening Level[2] (pCi/g) | |
| 94 | Plutonium | Pu-238 | 2.92 | 540 | 1550 | 2.5 | | |
| | | Pu-239 | 2.88 | 545 | 558 | 2.3 | | |
| | | Pu-240 | 2.87 | 545 | 1600 | | | |
| | | Pu-241 | 241 | 54400 | 27200 | 72 | | |
| | | Pu-242 | 3.02 | 580 | 1790 | | | |
| | | Pu-244 | 2.53 | 620 | 0.07 | | | |

Notes:
NMED = New Mexico Environment Department
NRC = United States Nuclear Regulatory Commission
pCi/g = picocuries per gram
USEPA = U.S. Environmental Protection Agency
[1] Properties for this radionuclide are such that this pathway is not a concern at any soil concentration.
[2] Screening level includes decay products.
[3] Site background soil values from NationView/Bhate (2009); these values have not been approved by NMED (2011)

# 3.0 INTERIM MEASURES

The type, radioactivity, and method of waste disposal at Site RW-42 is poorly understood and requires additional characterization to fill these data gaps prior to deciding on an acceptable remedial action and low-level radioactive waste (LLRW) disposal option. Although the Decommissioning Plan is specifically designed to address release of the site after corrective measures activities have been completed, a brief summary of the proposed characterization and remedial activities are provided in **Sections 3 and 4**. Detailed site characterization and corrective measures activities will be provided in the IM and CM Work Plans and submitted separately to the Holloman AFB and the NMED for review and approval.

The AFRIC Secretariat (AFMSA/SG3PB) oversees USAF radioactive waste site closeouts and coordinates interface with applicable regulatory authorities, including the NRC, NMED, and USAF Safety Center Weapons Safety Division (AFSC/SEW). Site closeout will be performed in general accordance with the MARSSIM guidance (NRC 2000). NMED and AFRIC will review and approve the work plans, corrective measures completed, and the FSS so that CAC without Controls status can be granted, Site RW-42 can be moved from Table A to Table B of the Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004), and site closure achieved.

## 3.1 Interim Measures

The IM will be conducted at Site RW-42 to locate the waste containment structure and characterize its contents, if possible. IM activities will be detailed in an IM Work Plan which will be submitted to the Holloman AFB and the NMED for review and approval. The IM Work Plan will contain a decision tree to demonstrate potential decommissioning and/or investigation pathways which will be developed and modified as additional data are collected on the nature of the vault and waste contents. The proposed IM will include the following:

- Survey the corners of the concrete pad marking the location of Site RW-42.
- Perform a gamma walk-over survey of an approximately 1 acre area surrounding the concrete pad marking the location of Site RW-42.
- Excavate and expose the top and approximately 1 ft of the sides of the waste containment structure to determine whether the waste within the container is accessible or is fully encapsulated in concrete.
- Radiologically screen excavated soils and the top and sides of the waste containment structure for alpha, beta, and gamma radiation. If gamma radiation levels are significantly above background levels, use gamma identification instrumentation or In Situ Object Counting System (ISOCS) measurements (if necessary) to identify the individual radionuclides present.

- If the waste containment structure has a removable cap or a concrete plug, remove the cap or plug and visually examine and photograph the interior of the waste cylinder to identify the waste and its packaging.

- Radiologically screen the interior of the waste containment structure and waste using hand-held radiation instruments and collect swipe samples for laboratory analysis.

- If the waste is accessible **and** poses no radiological or other health or safety hazard, collect samples of the waste for laboratory analysis using appropriate personal protective equipment (PPE) and engineering controls.

- After characterization activities are completed, re-cap the waste containment structure, backfill the excavation with the excavated soils, and replace the concrete pad at its original location.

- If the waste is fully encapsulated in concrete or poses a radiological or other health or safety hazard when remotely radiologically screened, no waste sampling will be performed. Re-cap the waste containment structure, backfill the excavation with the excavated soils, and replace the concrete pad at its original location. Under these circumstances, an alternative waste characterization and sampling and/or corrective measures approach will be subsequently developed in the CM Work Plan.

Results of the IM will be used to identify the waste disposal options and design the CM for removal and disposal of the waste and waste containment structure. A Quality Assurance Project Plan (QAPP), Health and Safety Plan (HASP), and Radiation Safety Plan (RSP) will be developed to support the IM and CM activities.

# 4.0 CORRECTIVE MEASURES

## 4.1 Radioactive Materials License

Remediation work will be conducted under Utah RML UT1800410 (Appendix A). This license will be the basis of a reciprocity request with the NMED RCB. As required by the license, work will be conducted in accordance with the Corporate Radiation Protection Program, to confirm that exposures are below the established administrative limits and follow As Low As Reasonably Achievable (ALARA) principles.

## 4.2 Corrective Measures

The proposed remedial action for Site RW-42 is to remove the waste and waste containment structure while protecting public health and the environment. Site RW-42 remedial activities will be conducted in a manner to prevent exposure of site workers to and release to the environment of radioactive materials. A CM Work Plan will be developed for the proposed excavation and removal activities once the IM are completed and results evaluated.

Results from the IM will be used to develop a CM Work Plan which will be submitted to Holloman AFB and the NMED for review and approval. The CM Work Plan will include an FSS Plan as well as QAPP, HASP, and RSP. The approved CM Work Plan will be implemented including the proposed actions described below. The proposed actions may be revised once the IM are completed. A decision tree similar to the one incorporated within the IM Work Plan may be used to clarify potential pathways which may be modified as additional data are collected during the course of the CM. The CM Work Plan is expected to include the following activities:

- Establish site radiological and health and safety controls, equipment laydown area, and excavated soil stockpile areas.

- Remove the concrete pad marking the location of the waste containment structure.

- **Option 1**: If the characterized waste can be safely handled with appropriate PPE and engineering controls, then excavate, radiologically screen, and stockpile the soils; expose the top of the waste containment structure; remove the cap; and remove and package the waste (in drums or B-25 boxes) for shipment to a licensed disposal facility. Once the waste is removed and packaged, excavate, remove, and package the waste containment structure for shipment to a licensed disposal facility.

- **Option 2**: If the characterized waste can be safely handled with appropriate PPE and engineering controls, but is fully encapsulated in concrete, then excavate, radiologically screen, and stockpile the soils; and excavate and remove the waste containment structure and package it for shipment to a licensed disposal facility. The waste containment

structure can be broken down into smaller pieces (while using appropriate PPE and engineering controls) if needed to facilitate packaging and shipment.

- **Option 3**: If the waste cannot be safely handled with appropriate PPE and engineering controls, then Site RW-42 will be left in place and appropriate site access controls (e.g., fencing and signage) implemented.

- For Options 1 and 2, excavated soils will be radiologically screened with portable instruments during excavation and separately stockpiled depending on whether they meet or exceed screening levels. The stockpiled soils that exceed the screening levels will be sampled for confirmatory laboratory analysis and eventual disposal at a licensed facility (after laboratory results are reviewed to confirm the soil activities).

- For Options 1 and 2, the excavation will be laid-back at 3-to-1 horizontal-to-vertical slopes to allow the waste and waste containment structure to be removed safely and allow safe access to the excavation sidewalls for the FSS.

- For Options 1 and 2, soil samples will be collected during excavation for comparison to screening levels, and in support of determining if the site can be released for unrestricted use. Soil samples will also be collected from soil immediately below the waste containment structure and submitted for laboratory analysis. The excavation will be temporarily left open and stockpiled material may be staged pending confirmation sample analytical results and the FSS.

- For Option 3, a CME will be prepared and submitted to Holloman AFB and the NMED for review and approval of a final corrective action, long-term site controls, and post-closure monitoring requirements.

## 4.3 Final Status Survey

After excavation and prior to backfilling, an FSS, including collection of soil samples, will be conducted in the open excavation (Class 1 FSS) and any other areas (Class 2 or 3 FSS) that may have been impacted by remedial activities. A Class 1 FSS applies to areas with the highest potential for contamination. Class 2 and 3 FSSs apply to areas with low potential for delivering a radiological dose above the release criteria. The FSS will be used to confirm that the site is qualified for unrestricted release.

## 4.4 Groundwater Sampling

The three existing groundwater monitoring wells will be sampled and analyzed for PROCs following completion of excavation and disposal of the waste at Site RW-42 to confirm that groundwater is not impacted. The results will be used to further confirm the site is qualified for unrestricted release.

## 4.5 Site Restoration

The site excavation will be backfilled with excavated soils that are less than screening levels. If sufficient soil is not available for backfill, then additional soil that meets screening levels will be obtained from an off-Base source. Off-Base soils will be radiologically screened and analyzed using the same methods as on-site soils. The backfilled soils will be appropriately compacted as backfilling proceeds to minimize settlement. The site excavation area will be restored to the existing grade.

## 4.6 Waste Disposal

Results of waste characterization will be used to estimate the total radiological activity to establish the waste profile for disposal at a licensed facility. A certified waste broker will be used to assist in determination of the appropriate disposal facility in accordance with that facility's license and agency approval from AFRIC, NMED, and NRC. The containerized waste material may be transported to a waste processor for additional characterization and packaging to satisfy the waste acceptance criteria for the disposal facility. Once the waste profile has been accepted by the disposal facility and approved, and manifest forms have been prepared and signed, loading and shipping of the waste will be scheduled.

## 4.7 Waste Transportation

A certified radioactive-waste broker will be used to support radioactive waste shipment. Waste transportation will be in accordance with the Department of Transportation's (DOT's) Hazardous Material Regulations found in 49 CFR 172 and 173 as well as applicable NRC regulations.

## 4.8 Reporting

Results of the remediation activities will be summarized in a CM Implementation Report and FSS Report that will include final waste disposal and site release documentation. These reports will be submitted to Holloman AFB and the NMED for review and approval. Once approved, Site RW-42 would be granted CAC without Controls and moved from Table A to Table B of the Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004) and approved for unrestricted release.

## 5.0 MILESTONES

**Table 5** lists the milestones tasks/deliverables and completion dates to achieve CAC without Controls and transfer Site RW-42 from Table A to Table B of the Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004).

**Table 5**
**Milestone Completion Schedule**

| Milestone Tasks/Deliverables | Completion Date |
|---|---|
| Decommissioning Plan | November 2016 |
| Interim Measures Work Plan | November 2016 |
| Interim Measures Implementation | January 2017 |
| Interim Measures Report | August 2017 |
| Corrective Measures Work Plan | October 2017 |
| Corrective Measures Implementation | November 2017 |
| Final Status Survey | November 2017 |
| Corrective Measures Implementation Report | July 2018 |
| Final Status Survey Report | July 2018 |
| Monitoring Well Abandonment | November 2018 |
| Corrective Action Complete without Controls; Site transferred to Table B of Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004) | December 2018 |

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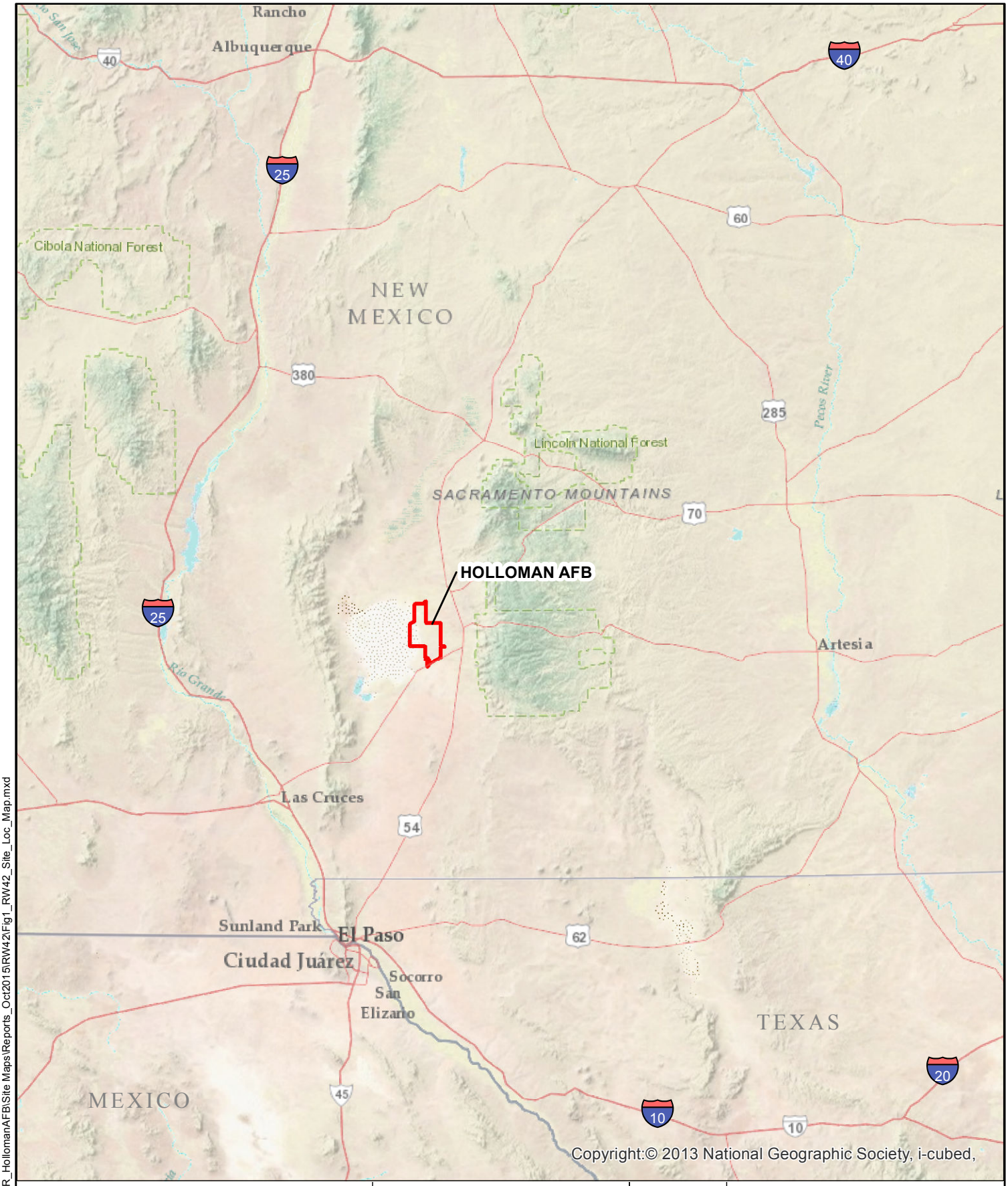
# FIGURES

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Scale in Feet
1 in = 175,000 feet

URS

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|---|---|
| Designed | SF |
| Drawn | LED |
| Checked | RLH |
| Peer Review | DAE |
| Project Manager | BGP |
| Project Number | 60425210.23446543 |

**Figure 1**
**Base Location Map**

**Holloman Air Force Base**
**USAF**

June 2016

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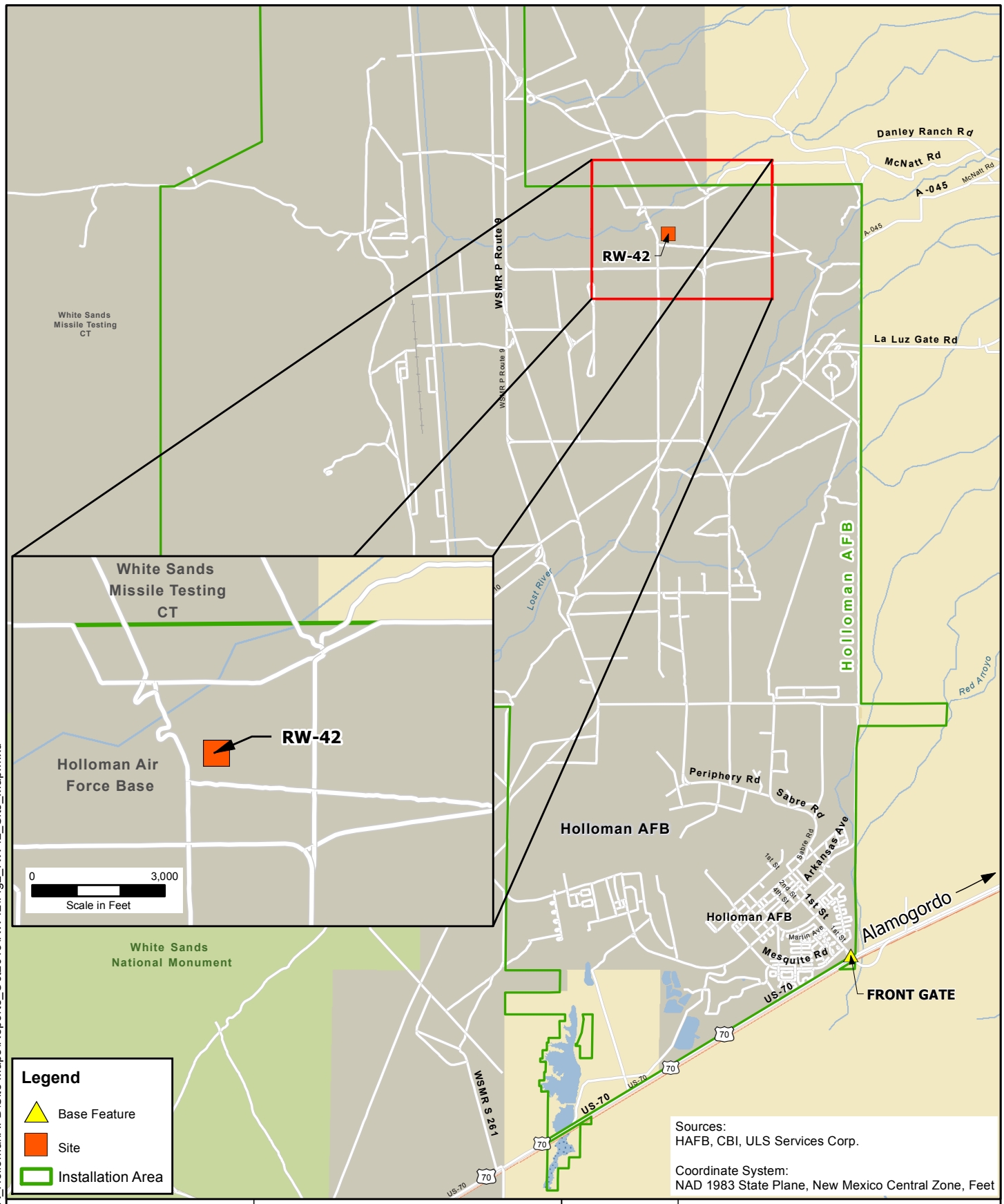



N
W E
S

0 8,000
Scale in Feet
1 inch = 8,000 feet

URS

| | |
|---|---|
| Designed | LB |
| Drawn | LED |
| Checked | RLH |
| Peer Review | DAE |
| Project Manager | BGP |
| Project Number | 23446543 |

**Figure 2**

**RW-42**
**Site Location**

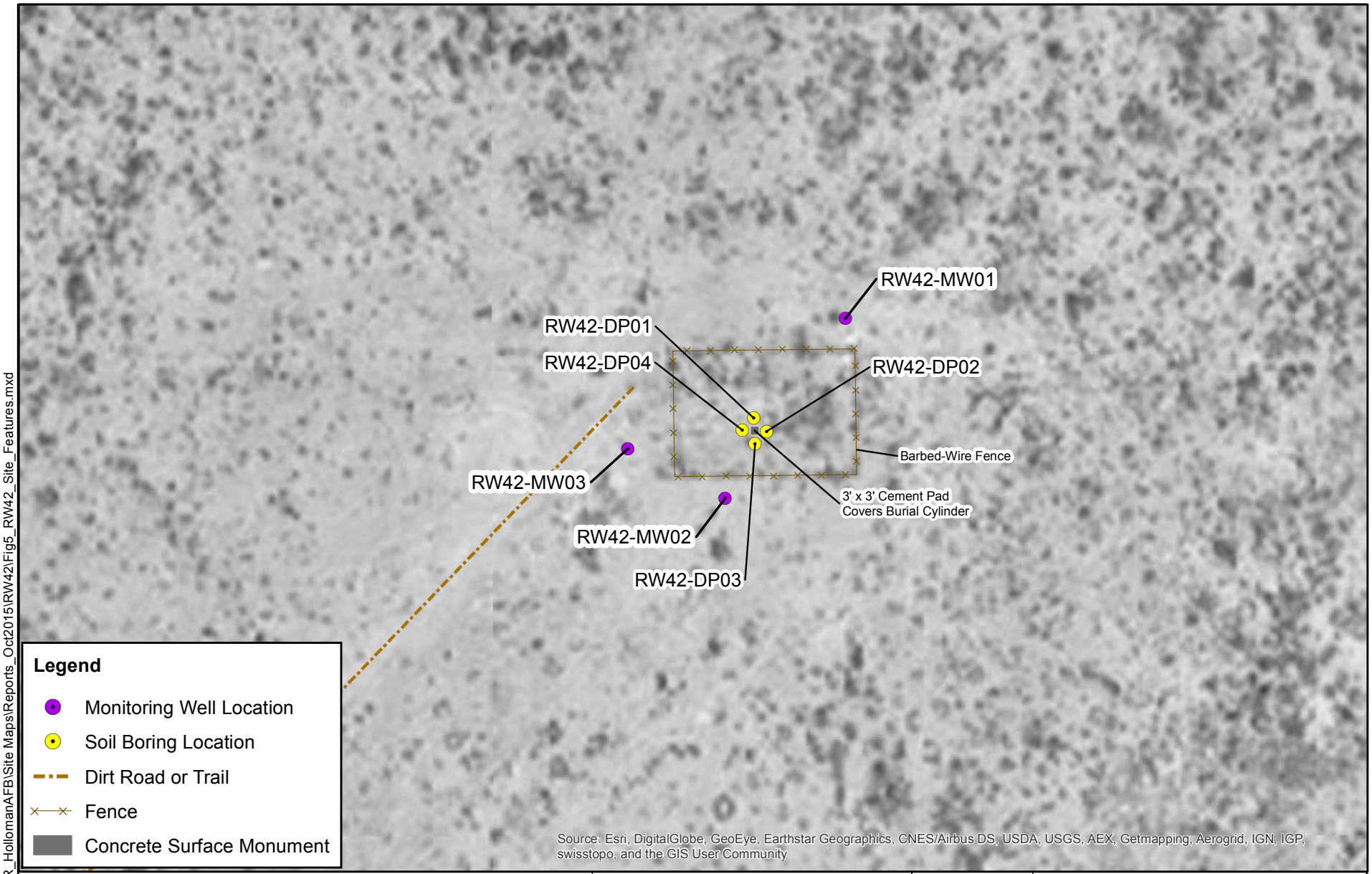
**Holloman Air Force Base**
**USAF**

June 2016

F:\GIS\Projects\AZNM_PBR_HollomanAFB\Site Maps\Reports_Oct2015\RW42\Fig2_RW42_Site_Map.mxd

**Figure 3. Photograph of Site RW-42**

**Figure 4. Concrete Pad Marking Burial Location of Site RW-42**




Note:

Sources:
HAFB, CBI, ULS Services Corp.

Coordinate System:
NAD 1983 State Plane,
New Mexico Central Zone, Feet

N W E S

0 20 40 60 120
Scale in Feet
1 inch = 60 feet

URS

| | |
|---|---|
| Designed | RLH |
| Drawn | LED |
| Checked | LB |
| Peer Review | LB |
| Project Manager | BGP |
| Project Number | 23446543 |

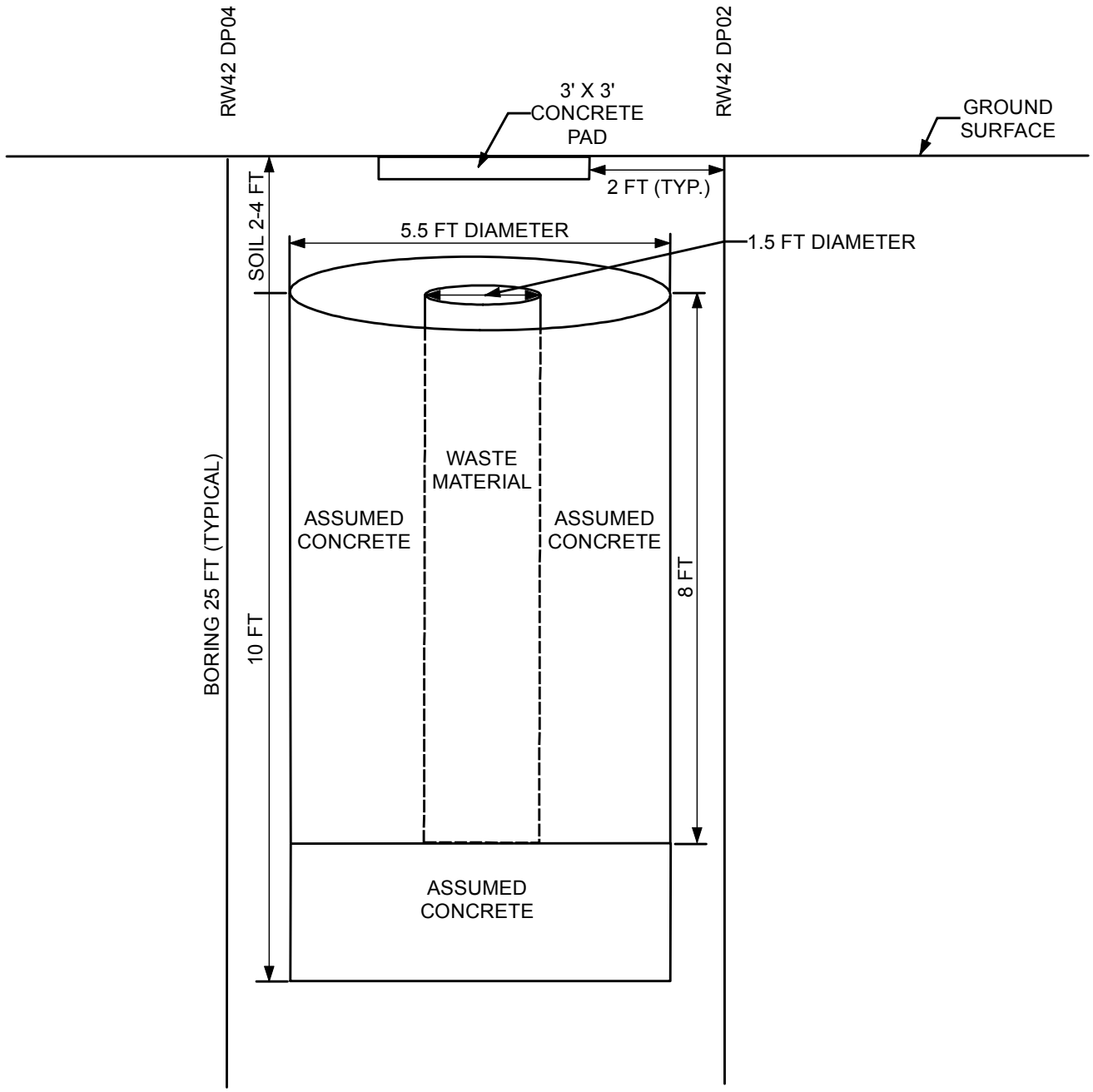
**Figure 5**

**Site RW-42 Features**

**Holloman Air Force Base**
**USAF**

June 2016

F:\GIS\Projects\AZNM_PBR_HollomanAFB\Site Maps\Reports_Oct2015\RW42\Fig5_RW42_Site_Features.mxd




| | |
|---|---|
| Designed | ARJ |
| Drawn | LED |
| Checked | RLH |
| Peer Review | LB |
| Project Manager | BGP |
| Project Number | 60425210.23446543 |

**Figure 6**

**Site RW-42 Buried Waste Containment Structure Schematic**

**Holloman Air Force Base**

**USAF**

June 2016

F:\GIS\Projects\AZNM_PBR_HollomanAFB\Site Maps\Reports_Oct2015\RW42\Fig6_RW42_Cylinder_Schematic.mxd

**Figure 7. Concrete "Plug" Attached to Concrete Pad**

**Figure 8. Exposed Top of Concrete Waste Disposal Cylinder**

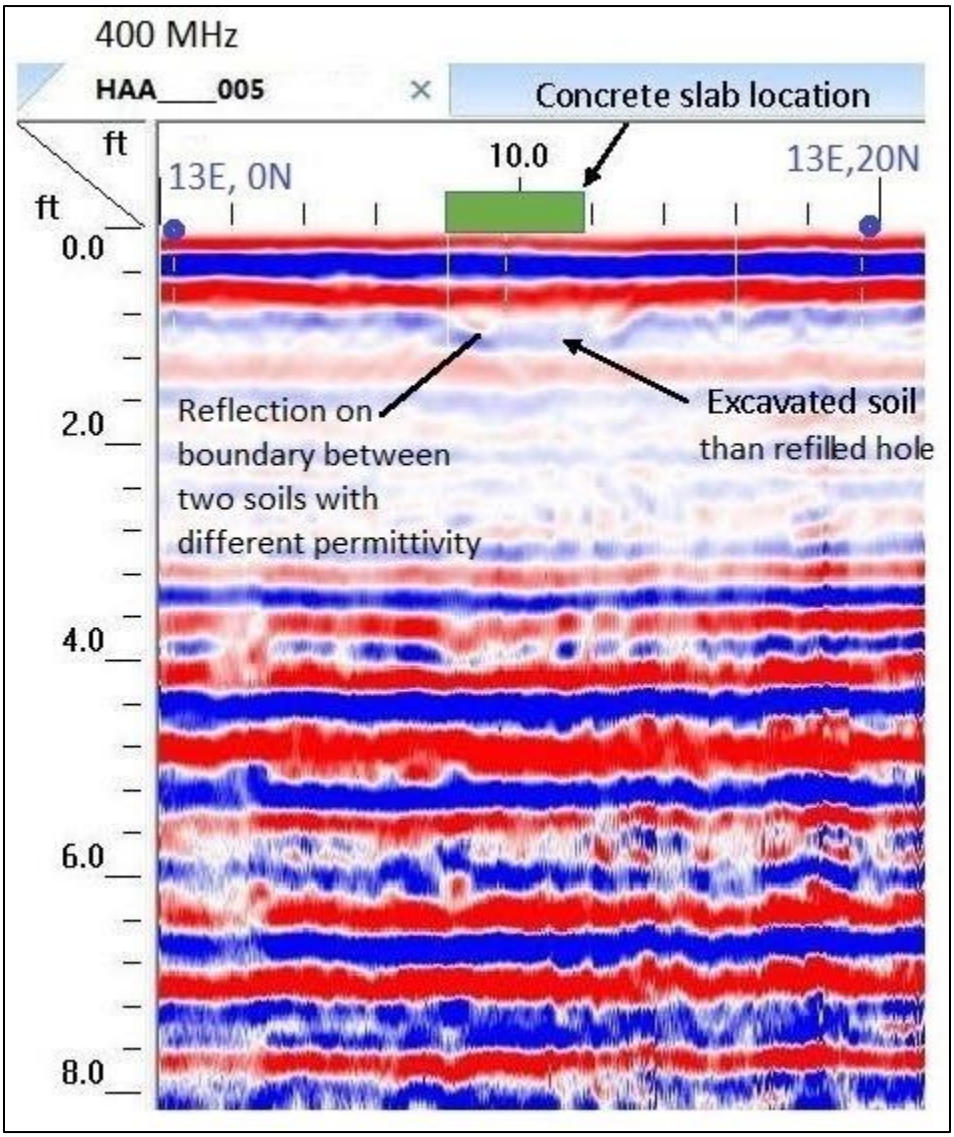



**Figure 9. Site RW-42 GPR Profile 1, 400 MHz Antenna**

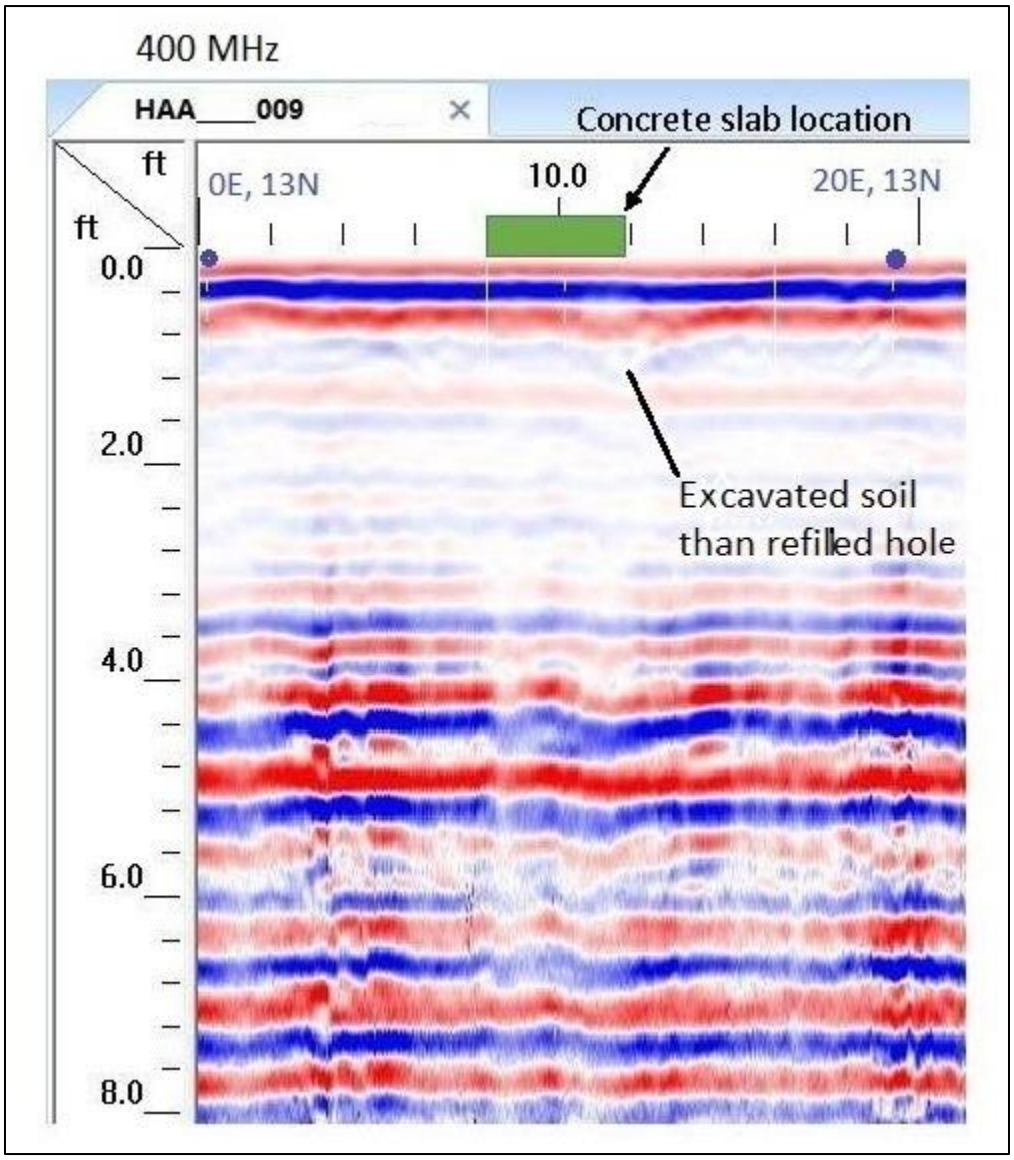



**Figure 10. Site RW-42 GPR Profile 2, 400 MHz Antenna**

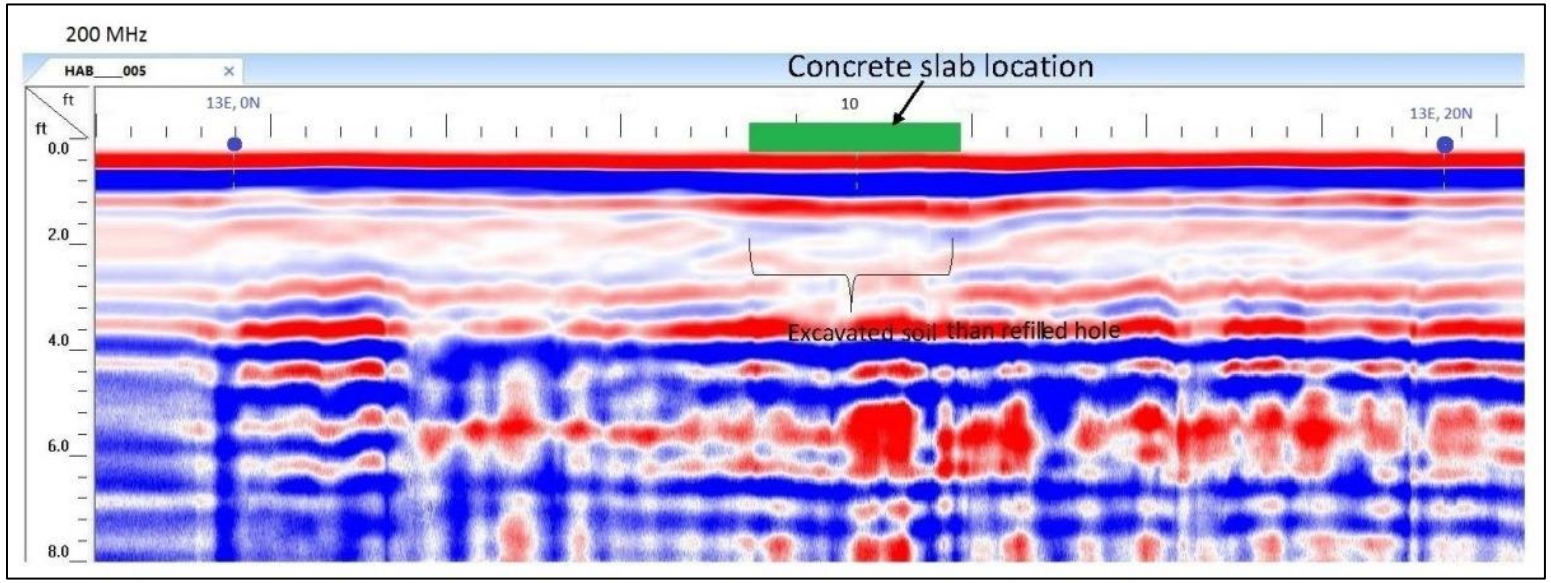
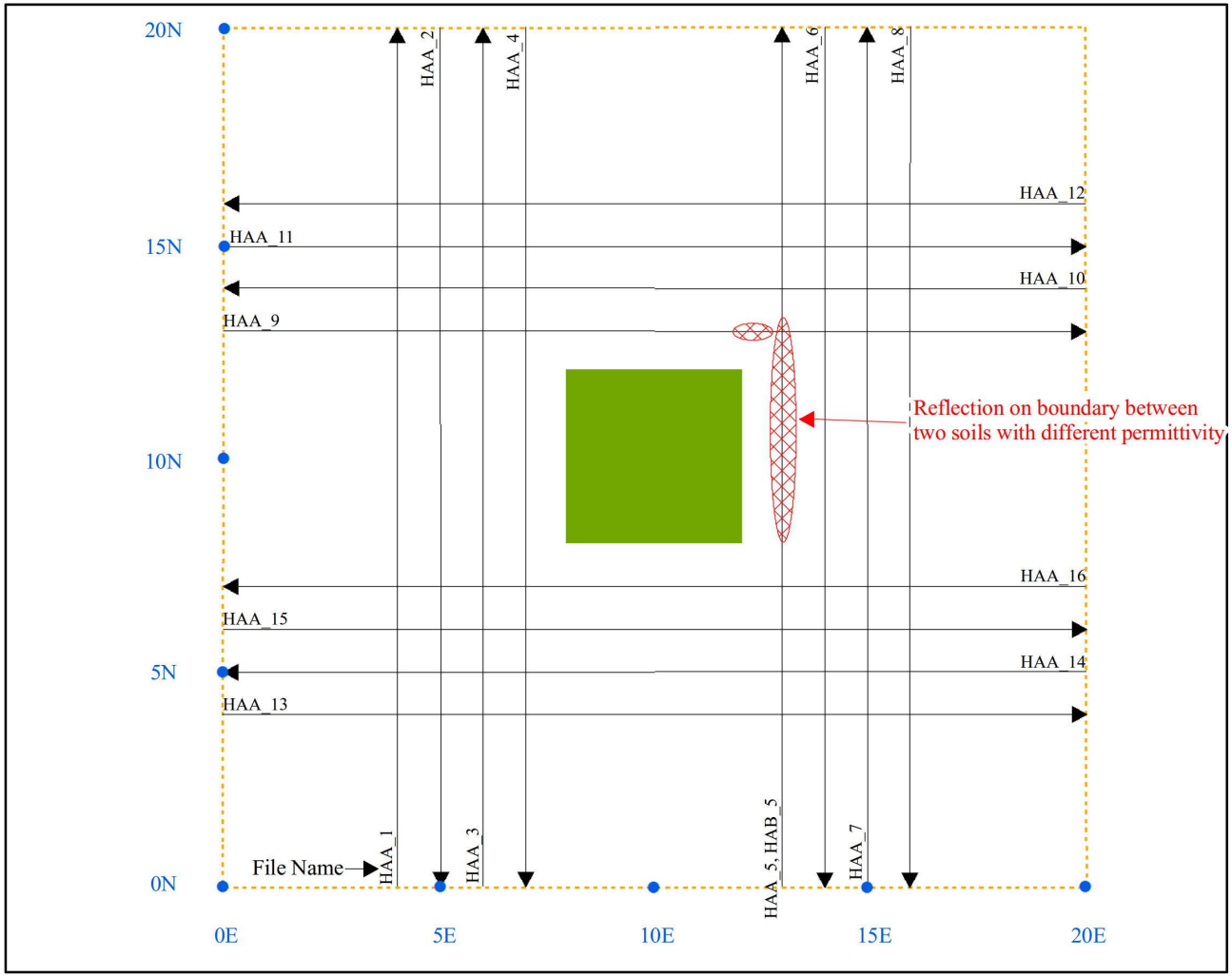
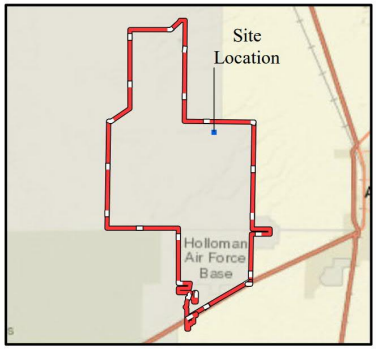



**Figure 11. Site RW-42 GPR Profile 3, 200 MHz Antenna**




## Legend

- GPR Transects (400 MHz)
- Survey Area (20 x 20 feet)
- Concrete Slab (4 x 4 feet)
- Local Coordinate Marker

**Performance Based Remediation**
New Mexico-Arizona
Holloman Air Force Base
Alamogordo, NM
AFCEC

**NOTES:**

Coordinate System:NAD 1983 UTM Zone 13N
Projection: Transverse Mercator
Horizontal Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -105.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

1 inch = 4 feet

0 0.5 1 Meters

0 2 4 Feet

N W E S

**Figure 12**
**Site RW-42 Preliminary GPR Interpretation**
**400-MHz Antenna**
**19 May 2016**

FPM Remediations, Inc.

2016

Path: C:\Projects\New Mexico\GIS\RW42\RW42_Figure 2.mxd

# APPENDIX A

# Utah Radioactive Materials License UT1800410

DRC-03
October 1989

**UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY**
**DIVISION OF RADIATION CONTROL**
**RADIOACTIVE MATERIAL LICENSE**

Pursuant to Utah Code Ann. Title 19, Chapter 3 and the Radiation Control Rules, Utah Administrative Code R313, and in reliance on statements and representations heretofore made by the licensee designated below, a license is hereby issued authorizing such licensee to transfer, receive, possess, and use the radioactive material designated below; and to use such radioactive material for the purpose(s) and at the place(s) designated below. This license is subject to all applicable rules, and orders now or hereafter in effect and to any conditions specified below.

**********

| LICENSEE | | | 3. License Number UT 1800410<br>Amendment # 11 |
|---|---|---|---|
| 1. | Name: | URS Professional Solutions LLC | 4. Expiration Date<br>July 31, 2023 |
| 2. | Address: | 756 East Winchester Street, Suite 400<br>Salt Lake City, Utah 84107 | 5. License Category – 3-n<br>Administrative amendment action |

**********

Effective February 14, 2014, Utah Administrative Code Subsection R313-22-34(1) states that specific licenses for a renewed license shall expire ten years after the expiration date of the previous version of the license. Consequently, the Utah Division of Radiation Control is extending the expiration dates of all previously renewed specific licenses by five (5) years.

This Radioactive Materials License is amended as follows:

Item 4. to read: July 31, 2023

UTAH DIVISION OF RADIATION CONTROL

6/17/2014
Date

Rusty Lundberg
Rusty Lundberg, Director

DRC-03
October 1989

**RENEWAL**

# UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
# DIVISION OF RADIATION CONTROL
# RADIOACTIVE MATERIAL LICENSE

Pursuant to Utah Code Ann. Title 19, Chapter 3 and the Radiation Control Rules, Utah Administrative Code R313, and in reliance on statements and representations heretofore made by the licensee designated below, a license is hereby issued authorizing such licensee to transfer, receive, possess and use the radioactive material designated below; and to use such radioactive material for the purpose(s) and at the places(s) designated below. This licensee is subject to all applicable rules, and orders now or hereafter in effect and to any conditions specified below.

**********

LICENSEE

1. Name: URS Professional Solutions LLC

2. Address: 756 East Winchester Street, Suite 400
Salt Lake City, Utah 84107

3. License Number UT 1800410
Amendment #10

4. Expiration Date
July 31, 2018

5. License Category - 3-n
In accordance with letter dated January 10, 2013, and electronic mail dated July 3, 2013, this license is amended in its entirety.

**********

| 6. Radioactive material (element and mass number) | 7. Chemical and/or physical form | 8. Maximum quantity licensee may possess at any one time |
|---|---|---|
| A. Radionuclides with atomic numbers 3 through 92, inclusive; depleted Uranium; natural Uranium; natural Thorium | A. Environmental or wipe sample(s) | A. Not to exceed 296 kilobecquerels (8 μCi) of Radium-226; and 1.85 gigabecquerels (50 mCi) total activity; 150 kilograms $U_{depleted}$; 73 kilograms $U_{nat}$; 227 kilograms $Th_{nat}$ |
| B. Radionuclides with atomic numbers 3 through 92, inclusive; depleted Uranium; natural Uranium; natural Thorium | B. Metal, sludge, soil type materials, debris, including sample size quantities stored in U.S. Department of Transportation approved shipping containers | B. Not to exceed 37 gigabecquerels (1 Ci) total activity; 3,000 kilograms $U_{depleted}$; 1,465 kilograms $U_{nat}$; 4,541 kilograms $Th_{nat}$ |
| C. Radionuclides with atomic numbers 10 through 92, inclusive | C. Standard Reference Materials: commercial check sources and solids sealed in laboratory assay containers | C. Not to exceed activity limits specified in R313-15-1401(2)(c); Ra-226 not to exceed 74 kilobecquerels (2 μCi) per container or 222 kilobecquerels (6μCi) total |

**UTAH DIVISION OF RADIATION CONTROL**
**RADIOACTIVE MATERIALS LICENSE**
**SUPPLEMENTARY SHEET**

License # UT 1800410
Amendment # 10

**********

9. AUTHORIZED USE

A. For possession and use as contamination incidental to sample analysis.

B. For possession incidental to decontamination, decommissioning, surveying, packaging, and transfer in accordance with R313-19-41.

C. For possession and use as check, calibration, or reference sources.

**********

CONDITIONS

10. A. Licensed materials in Item 6.A and 6.B shall be used only at temporary job sites of the licensee anywhere in the State of Utah where the Division maintains jurisdiction for regulating the use of licensed material. Except for calibration sources, reference standards, and radioactive contaminated equipment owned by the licensee, possession of licensed material at each temporary job site shall be limited to material originating from each site. This material must either be transferred to an authorized recipient or remain at the site after licensee activities are completed.

B. Licensed material in Item 6.C shall be used at the licensee's facilities located at 756 East Winchester Street, Suite 400, Salt Lake City, Utah, and at temporary job sites of the licensee anywhere in the State of Utah where the Division maintains jurisdiction.

11. The licensee shall comply with the provisions of R313-18 "Notices, Instructions and Reports to Workers, by Licensees or Registrant--Inspections" and R313-15, "Standards for Protection Against Radiation."

12. Licensed material shall be used by, or under the supervision and in the physical presence of, individuals who have been trained, as specified in the licensee's application dated May 28, 2008 and who have been designated by the licensee's Radiation Safety Officer. The licensee shall maintain records of individuals so designated.

13. The Radiation Safety Officer for the activities authorized by this license is Amy Robin Jones.

14. The Radiation Safety Officer may delegate certain duties to specific individuals provided that:

A. The licensee maintain, for a period of three years, records of all individuals designated by the Radiation Safety Officer to perform duties or meet regulatory requirements that would otherwise be required as a duty of the Radiation Safety Officer. These records shall include:

**UTAH DIVISION OF RADIATION CONTROL**
**RADIOACTIVE MATERIALS LICENSE**
**SUPPLEMENTARY SHEET**

License # UT 1800410
Amendment # 10

(1) The name of the individual;

(2) A list of all duties the Radiation Safety Officer's designee is authorized to perform;

(3) The date upon which the designation became effective;

(4) The signature of the Radiation Safety Officer's designee; and

(5) The signature of the Radiation Safety Officer.

B. The Radiation Safety Officer shall review records generated by designees and the performance of designees quarterly. In addition, the licensee shall maintain for Division inspection for a period of three years, records of the quarterly reviews of records generated by designees and quarterly reviews of designee's performance. These records shall include:

(1) The date of the review;

(2) The records being reviewed and the name of the designee being reviewed;

(3) A list of all duties performed by the designee;

(4) The results of the Radiation Safety Officer's review and any corrective measures taken, if applicable, based on the review; and

(5) The signature of the Radiation Safety Officer.

15. The licensee shall notify the Director in writing at least 14 days before initiating activities under this license at a temporary job site located in the State of Utah. This notification shall include:

A. The estimated type, quantity, and physical/chemical forms of licensed material to be used;

B. The specific site location;

C. A description of planned activities including waste management and disposition;

D. The estimated start date and completion date for the job; and

E. The name and title of a point of contact for the job, including information on how to contact the individual.

**UTAH DIVISION OF RADIATION CONTROL**
**RADIOACTIVE MATERIALS LICENSE**
**SUPPLEMENTARY SHEET**

License # UT 1800410
Amendment # 10

16. This license does not authorize the use of licensed material at temporary job sites for uses already specifically authorized by a customer's license. If a customer also holds a license issued by the Director, Nuclear Regulatory Commission or an Agreement State, the licensee shall establish a written agreement between the licensee and the customer specifying which licensee activities shall be performed under the customer's license and supervision, and which licensee activities shall be performed under the licensee's supervision pursuant to this license. The agreement shall include a commitment by the licensee and the customer to ensure safety, and any commitments by the licensee to help the customer clean up the temporary job site if there is an accident. A copy of this agreement shall be included in the notification required by License Condition 15.

17. The licensee shall maintain records of information important to decommissioning each temporary job site at the applicable job site pursuant to R313-22-35(7) or equivalent Nuclear Regulatory or Agreement State regulations. The records shall be made available to the customer upon request. At the completion of activities at a temporary job site, the licensee shall transfer these records to the customer for retention.

18. Pursuant to R313-12-55, and License Condition 10, the licensee is exempted from the requirements of R313-22-35 to establish decommissioning financial assurance.

19. Notwithstanding the requirements in R313-22-32(8), the licensee is not required to establish an emergency plan. Before taking possession of licensed material at a temporary job site in quantities requiring an emergency plan the licensee shall either:

    A. Obtain the Director's approval of an evaluation demonstrating that an emergency plan is not required pursuant to R313-22-32(8); or

    B. Submit written confirmation to the Director, that licensee personnel have been trained and will follow the provisions of an existing emergency plan approved by the Division, Nuclear Regulatory Commission or an Agreement State for the temporary job site.

20. If approved by the Radiation Safety Officer specifically identified in this license, the licensee may take reasonable action in an emergency that departs from conditions in this license when the action is immediately needed to protect public health and safety and no action consistent with all license conditions that can provide adequate or equivalent protection is immediately apparent. The licensee shall notify the Director before, if practicable, and in any case immediately after taking such emergency action using the reporting procedure specified in R313-19-50(3).

21. Within 30 days of completing activities at each job site location, the licensee shall notify the Director in writing of the temporary job site status and the disposition of any licensed material used.

22. The licensee shall conduct a physical inventory every six months to account for all licensed material possessed under this license. The records of the inventories shall be maintained for three years from the date of the inventory for inspection by the Division, and shall include the quantities and kinds of radioactive

# APPENDIX B

# Isotope and Radiological Screening Summary

The documents identified below included documentation of radioactive materials used at Holloman and other AFB's. These documents were used to develop a master list of Potential Radionuclides of Concern (PROC) for Holloman RW-42. In the table below summarizes the isotopes mentioned in each of the references. The final ROC list included in the Decommissioning plan includes only the isotopes in bold.

- **1992 Interviews** (Phone interviews conducted in 1992 by Radian but included in "Final Accelerated Corrective Measures Completion Report Sites OT-32 and RW-42 Holloman AFB, New Mexico", September 2012. (Bhate. 2012).

- **RI-** Remedial Investigation (RI) Report Volume 1 Text and Plates Investigation, Study and Recommendation for 29 Waste Sites, October 1992. (Radian 1992).

- **1971 RML** -U.S. Atomic Energy Commission Byproduct Materials License #31-00803-03 issued May 28, 1971 to Albany Medical College Institute of Experimental Pathology and Toxicology which covered activities at the Holloman site. (NRC, 1971).

- **BKGD Study-** Final Base Wide Background Study Report Holloman Air Force Base, New Mexico, January 2009. (NationView Bhate 2012).

- **1986 RML-**U.S. Nuclear Regulatory Commission Materials License #30-26860-01 issued January 1986 to New Mexico State University Primate Research Institute (NRC, 1986). In addition to specifically listed isotopes, the license authorized use of isotopes with atomic numbers 1 through 83, inclusive. For this list authorized isotopes are flagged as "A", in the table.

- **PRI D&D plan-** Final Radiological Characterization and Decontamination of the Primate Research Institute, August 1996 (NMSU, 1996).

- **SD-27** Summary of Radiological Site Background and Sampling at HAFB Site SD-27: excerpts from the Air Force Response to DASDE Request for Additional Information (Summary of Radiological Sampling Summary at HAFB Site SD-027, 1992).

- **Exposure Studies-** Isotopes typically used in exposure studies.

- **Decay product-**Isotopes which are decay products of primary isotopes in the list

The column labeled fraction remaining shows the percentage of the isotope that would still be present in the waste if the material had been in the disposal cell since 1960.

| Atomic Number | Element | Isotope | 1/2 Life (year) | Fraction Remaining (%) | 1992 Interviews | RI | 1971 RML | BKGD study | 1986 RML | PRI D&D | Exposure studies | Decay Product |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **Hydrogen** | **H-3** | **1.23E+01** | **4.5** | | | **X** | | **X** | **X** | | |
| **6** | **Carbon** | **C-14** | **5.73E+03** | **99.3** | | | **X** | | **X** | **X** | | |
| **17** | **Chlorine** | **Cl-36** | **3.01E+05** | **100.0** | | | **X** | | **A** | | | |
| 19 | Potassium | K-40 | 1.25E+09 | 100.0 | | X | | | A | | | |
| 25 | Manganese | Mn-53 | 3.74E+06 | 100.0 | | | | | A | | | |
| 27 | Cobalt | Co-60 | 5.27E+00 | 0.1 | | X | X | | A | | X | |
| 28 | Nickel | Ni-63 | 9.20E+01 | 66.1 | | | | | X | X | | |
| 36 | Krypton | Kr-85 | 1.08E+01 | 2.9 | | | | | A | | | |
| 38 | Strontium | Sr-90 | 2.86E+01 | 26.4 | | | | | A | | X | |
| 39 | Yttrium | Y-90 | 7.32E-03 | 0.0 | | | | | A | | | Sr-90 |
| 40 | Zirconium | Zr-93 | 1.53E+06 | 100.0 | | | | | A | | | |
| | Zirconium | Zr-96 | 2.00E+19 | 100.0 | | | | | A | | | |
| 43 | Technetium | Tc-99 | 2.11E+05 | 100.0 | | | | | A | | | |
| 53 | Iodine | I-123 | 1.51E-03 | 0.0 | | | | | A | | | |
| | | I-125 | 1.62E-01 | 0.0 | | | | | A | | | |
| | | **I-129** | **1.57E+07** | **100.0** | | | | | **A** | | | |
| | | I-131 | 2.19E-02 | 0.0 | | | | | A | | | |
| 55 | Cesium | Cs-134 | 1.74E-06 | 0.0 | | X | | | A | | | |
| | **Cesium** | **Cs-137** | **3.02E+01** | **28.3** | | **X** | **X** | | **A** | | | |
| 56 | Barium | Ba-137m | 8.09E-08 | 0.0 | | | | | A | | | Cs-137 |
| 81 | Thallium | TI-208 | 5.80E-06 | 0.0 | | | | | A | | | Th-232 |
| 82 | **Lead** | **Pb-210** | **2.23E+01** | **18.1** | | | | **X** | **A** | | | **Ra-226** |
| | Lead | Pb-211 | 6.87E-05 | 0.0 | | | | | A | | | U-235 |
| | Lead | Pb-212 | 1.21E-03 | 0.0 | | X | | | A | | | Th-232 |
| | Lead | Pb-214 | 5.13699E-05 | 0.0 | | X | | | A | | | Ra-226 |
| 83 | Bismuth | Bi-210 | 1.37E-02 | 0.0 | | | | | A | | | Ra-226 |
| | Bismuth | Bi-211 | 4.07E-06 | 0.0 | | | | | A | | | U-235 |
| | Bismuth | Bi-212 | 1.15E-04 | 0.0 | | X | | | A | | | Th-232 |
| | Bismuth | Bi-214 | 3.79E-05 | 0.0 | | X | | | A | | | Ra-226 |
| 84 | Polonium | Po-210 | 3.79E-01 | 0.0 | | | X | | | | | Ra-226 |
| | Polonium | Po-212 | 1.57E-13 | 0.0 | | | | | | | | Th-232 |
| | Polonium | Po-214 | 8.67E-11 | 0.0 | | | | | | | | Ra-226 |
| | Polonium | Po-215 | 9.30E-12 | 0.0 | | | | | | | | U-235 |
| | Polonium | Po-218 | 5.90E-06 | 0.0 | | | | | | | | Ra-226 |
| | Polonium | Po-216 | 7.93E-11 | 0.0 | | | | | | | | Th-232 |
| 86 | Radon | Rn-219 | 1.08E-02 | 0.0 | | | | | | | | U-235 |
| | Radon | Rn-222 | 1.04E-02 | 0.0 | | | | | | | | Ra-226 |
| 87 | Francium | Fr-223 | 4.19E-05 | 0.0 | | | | | | | | U-235 |

| Atomic Number | Element | Isotope | 1/2 Life (year) | Fraction Remaining (%) | 1992 Interviews | RI | 1971 RML | BKGD study | 1986 RML | PRI D&D | Exposure studies | Decay Product |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 88 | Radium | Ra-220 | 2.94E-08 | 0.0 | | | | | | | | Th-232 |
| | Radium | Ra-223 | 3.12E-02 | 0.0 | | | | | | | | U-235 |
| | Radium | Ra-224 | 1.00E-02 | 0.0 | | | | | | | X | Th-232 |
| | **Radium** | **Ra-226** | **1.60E+03** | **97.6** | | **X** | | **X** | | | **X** | |
| | **Radium** | **Ra-228** | **5.76E+00** | **0.1** | | | | **X** | | | | **Th-232** |
| 89 | Actinium | Ac-227 | 2.17E+01 | 17.3 | | | | | | | | U-235 |
| | Actinium | Ac-228 | 7.02E-04 | 0.0 | | X | | | | | | Th-232 |
| 90 | Thorium | Th-227 | 5.12E-02 | 0.0 | | | | | | | | U-235 |
| | **Thorium** | **Th-228** | **1.91E+00** | **0.0** | | **X** | | **X** | | | | **Th-232** |
| | Thorium | Th-229 | 7.34E+03 | 99.5 | | | | | | | | |
| | **Thorium** | **Th-230** | **7.50E+04** | **99.9** | | | | **X** | | | | **U-238** |
| | Thorium | Th-231 | 2.91E-03 | 0.0 | | | | | | | | U-235 |
| | **Thorium** | **Th-232** | **1.40E+10** | **100.0** | | **X** | | **X** | | | | |
| | Thorium | Th-234 | 6.60E-02 | 0.0 | | X | | | | | | U-238 |
| 91 | Protactinium | Pa-231 | 3.28E+04 | 99.9 | | | | | | | | U-235 |
| | Protactinium | Pa-234m | 2.23E-06 | 0.0 | | | | | | | | U-238 |
| **92** | **Uranium** | **U-234** | **2.40E+05** | **100.0** | **X** | | | **X** | | | | **U-238** |
| | **Uranium** | **U-235** | **7.04E+08** | **100.0** | **X** | | | **X** | | | | |
| | **Uranium** | **U-236** | **2.34E+07** | **100.0** | **X** | | | **X** | | | | |
| | **Uranium** | **U-238** | **4.50E+09** | **100.0** | **X** | **X** | | **X** | | | | |
| **94** | **Plutonium** | **Pu-238** | **8.77E+01** | **64.8** | **X** | | | | | | | |
| | **Plutonium** | **Pu-239** | **2.41E+04** | **99.8** | **X** | | | | | | **X** | |
| | **Plutonium** | **Pu-240** | **6.56E+03** | **99.4** | **X** | | | | | | | |
| | **Plutonium** | **Pu-241** | **1.43E+01** | **6.9** | **X** | | | | | | | |
| | **Plutonium** | **Pu-242** | **3.75E+05** | **100.0** | **X** | | | | | | | |
| | **Plutonium** | **Pu-244** | **8.00E+07** | **100.0** | **X** | | | | | | | |
| 95 | Americium | Am-241 | 4.32E+02 | 91.6 | | | | | | | X | |

Attached excerpts include.

- **Appendix B-1 -** Phone Interviews with Colonel Sprester and Mr Andreoli.
- **Appendix B-2 -** U.S. Atomic Energy Commission Byproduct Materials License #31-00803-03 issued May 28, 1971 to Albany Medical College Institute of Experimental Pathology and Toxicology.
- **Appendix B-3 -** U.S. Nuclear Regulatory Commission Materials License #30-26860-01 issued January 1986 to New Mexico State University Primate Research Institute (NRC, 1986).
- **Appendix B-4 -** Final Radiological Characterization and Decontamination of the Primate Research Institute, August 1996 (NMSU, 1996).

# APPENDIX B1

# Phone Interviews Conducted by Radian in 1992 With Colonel Spresterand Mr Andreoli (Bhate 2012)

**PA REFERENCE 9**

**Telephone conversation with: Col. F.R. Sprester,**

**Former Holloman AFB Bioenvironmental Engineering Chief**

**Date: 4 April 1992**

REF 9
PAGE 1 OF 1

**RADIAN CORPORATION**

TELEPHONE CALL RECORD
☐ Incoming Call
☐ Outgoing Call

| | |
|---|---|
| Project No. | |
| Project Name | Holloman AFB |
| Date | 3 April 92 |
| Time | 200pm |
| Person Calling | Bob Borger |
| Activity | Radian |
| Person Called | Col. Forest Spresser |
| Activity | March AFB (714)655 3952 |
| General Subject | Past activities at Site 42 |

Distribution

TOPICS DISCUSSED AND ACTION TAKEN

Col Spresser stated that he conducted interviews with local workers (in the 70's - 76 or 77) that constructed and filled the concrete encasement/vault. He said that the only materials that were reportedly placed in the vault were monkeys that had been injected with radio isotopes (that died) and the syringes, gowns, and other things that were contaminated. He couldn't remember the types of isotopes (plutonium, uranium?) but he thought that information was written down elsewhere (it isn't). He said to contact Mr. Bob Andreoli for further information.

Signature: RC Borger

9-85-21364

**PA REFERENCE 10**

**Telephone conversation with: Mr. R.J. Andreoli,**

**Former Holloman AFB Environmental Health Services Chief**

**Date: 7 April 1992**

REF 10
PAGE 1 OF 1

**RADIAN CORPORATION**

TELEPHONE CALL RECORD
☐ Incoming Call
☐ Outgoing Call

| | |
|---|---|
| Project No. | |
| Project Name | HOLLOMAN AFB PA |
| Date | 7 April 92 |
| Time | 1400 |
| Person Calling | Bob Borger |
| Activity | Radian |
| Person Called | Mr. Bob Andreoli |
| Activity | White Sands Missile Facility ~~(505) 678 2224~~ |
| General Subject | Prior Activities at Site 42 |

Distribution

TOPICS DISCUSSED AND ACTION TAKEN

Mr. Andreoli stated that he, as Col Spresser, believed that the contents of the vault were contaminated, experimented on, monkeys and lab wastes from experimentation. He remembers recommending to have the site exhumed/remediated, but that decision was rejected. So the decision to continue monitoring was made. He also said that drawings of the concrete vault were once at Holloman CE department. But, when he tried to re find them, they were gone. He remembers that the structure was solid concrete with a small open area in the center (as described by Spresser).

Signature: R B Borger

9-85-21364

# APPENDIX B2

## U.S. Atomic Energy Commission Byproduct Materials License #31-00803-03 Issued May 28, 1971 to Albany Medical College Institute of Experimental Pathology and Toxicology

FORM AEC-374
(7-66)
10 CFR 30

# U. S. ATOMIC ENERGY COMMISSION
## BYPRODUCT MATERIAL LICENSE



Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 32, 33, 34, and 35, and in reliance on statements and representations heretofore made by the license is hereby issued authorizing the licensee to receive, acquire, own, possess, transfer and import bypr rial listed below; and to use such byproduct material for the purpose(s) and at the place(s) design This license shall be deemed to contain the conditions specified in Section 183 of the Atomic En 1954, and is subject to all applicable rules, regulations, and orders of the Atomic Energy Commiss hereafter in effect and to any conditions specified below.

| Licensee | |
|---|---|
| 1. Albany Medical College<br>Institute of Experimental Pathology and Toxicology<br>2. Albany, New York 12208 | 3. License number 31-00803-03<br>4. Expiration date October 31, 1<br>5. Reference No. |

| 6. Byproduct material (element and mass number) | 7. Chemical and/or physical form | 8. Maximum amount of r tivity which licensee possess at any one tim |
|---|---|---|
| A. Cesium 137, Manganese 54, Cobalt 60, Carbon 14, Chlorine 36 | A. Sealed sources (Atomic Accessories or Nuclear Chicago) | A. No single sour exceed 0.5 mic curie each. |
| B. Polonium 210 | B. Sealed source (Nuclear Chicago) | B. 1 source of 10 microcuries |
| C. Hydrogen 3 | C. Foil (U.S. Radium Corp. Model LAB 508-1) | C. 1 source of 13 millicuries |
| D. Hydrogen 3 | D. Any | D. 0.06 microcuri |
| E. Carbon 14 | E. Any | E. 0.11 microcuri |

9. Authorized use

A. and B. To be housed in Atomic Accessories or Nuclear-Chicago calibrated source sets.

C. To be housed in a Perkin-Elmer Model 154-0709 detector cell in a Perkin-Elmer Model 008-0550 oven assembly in a Perkin-Elmer Mode 801 gas chromatography device.

D. and E. Residual byproduct material contained in Chimpanzees # 24 and # 251.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE LOGISTICS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433

REPLY TO ATTN OF: SGPR

7 Jul 1971

SUBJECT: AEC Byproduct Material License No. 31-00803-03, Albany Medical College

TO: 6580th USAF Hospital/MDHEM
Holloman AFB NM 88330

Attached, for your information and file, is a copy of AEC Byproduct Material License No. 31-00803-03, which covers the activities of the Albany Medical College at Holloman AFB.

FOR THE COMMANDER

Victor C. Furtado

VICTOR C. FURTADO, Major, USAF, BSC
Secretary, USAF Radioisotope Committee

1 Atch
a/s

Copy to:
DNS/IGDNM

CONDITIONS

10. Byproduct material shall only be stored or housed in Building 12 North Area, Holloman Air Force Base, New Mexico.

11. The licensee shall comply with the provisions of Title 10, Chapter 1, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation."

12.A.(1) Each sealed source containing byproduct material, other tha Hydrogen 3, with a half-life greater than thirty days and i any form other than gas shall be tested for leakage and/or contamination at intervals not to exceed six months. In th absence of a certificate from a transferor indicating that test has been made within six months prior to the transfer, the sealed source shall not be put into use until tested.

(2) Notwithstanding the periodic leak test required by this condition, any licensed sealed source is exempt from such leak tests when the source contains 100 microcuries or less of beta and/or gamma emitting material or 10 microcuries or less of alpha emitting material.

(3) The periodic leak test required by this condition does not apply to sealed sources that are stored and not being used. The sources excepted from this test shall be tested for leakage prior to any use or transfer to another person unle they have been leak tested within six months prior to the date of use or transfer.

B. The test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. The test sample shall be taken from the sealed source or from the surfaces of the device in which the sealed source is permanently mounted or stored on which one might expect contamination to accumulate. Records of leak test results shall be kep in units of microcuries and maintained for inspection by the Commission.

12. continued

C. If the test reveals the presence of 0.005 microcurie or more removable contamination, the licensee shall immediately withd the sealed source from use and shall cause it to be decontami ted and repaired or to be disposed of in accordance with Commission regulations. A report shall be filed within 5 day the test with the Director, Division of Materials Licensing, U. S. Atomic Energy Commission, Washington, D. C., 20545, describing the equipment involved, the test results, and the corrective action taken. A copy of such report shall also be sent to the Director, Region IV, Division of Compliance, USAE 10395 West Colfax Avenue, Denver, Colorado, 80215.

D. Tests for leakage and/or contamination shall be performed by persons specifically authorized by the Commission or an Agreement State to perform such services.

13. Except as specifically provided otherwise by this license, the licensee shall possess and use byproduct material described in Items 6, 7, and 8 of this license in accordance with statements representations, and procedures contained in letter dated May 11, 1971, signed by Travis B. Griffin, Ph.D.

For the U. S. Atomic Energy C

Original Signed by
John E. Bowyer

Date MAY 28 1971

by Materials Branch
Division of Materials I
Washington, D. C. 205

SGPR 7 Jul 1971

AEC Byproduct Material License No. 31-00803-03, Albany Medical College

6580th USAF Hospital/MDHEM
Holloman AFB NM 88330

Attached, for your information and file, is a copy of AEC Byproduct Material License No. 31-00803-03, which covers the activities of the Albany Medical College at Holloman AFB.

FOR THE COMMANDER

VICTOR C. FURTADO, Major, USAF, BSC
Secretary, USAF Radioisotope Committee

1 Atch
a/s

Copy to:
DNS/IGDNM

# APPENDIX B3

## NRC Materials License #30-26860-01 Issued January 1986 To New Mexico State University Primate Research Institute (NRC 1986)

for eval 19 Dec 89

NRC Form 374
(5-84)

U.S. NUCLEAR REGULATORY COMMISSION



# MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 40 and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

| Licensee | |
|---|---|
| 1. New Mexico State University<br>Primate Research Institute | 3. License number 30-26860-01 |
| 2. P. O. Box 1027<br>Holloman AFB, New Mexico 88330 | 4. Expiration date January 31, 1992 |
| | 5. Docket or Reference No. 030-29613 |

| 6. Byproduct, source, and/or special nuclear material | 7. Chemical and/or physical form | 8. Maximum amount that licensee may possess at any one time under this license |
|---|---|---|
| A. Any byproduct material with Atomic Numbers 1 through 83, inclusive | A. Any | A. 10 millicuries of each radionuclide with Atomic Numbers 1-83 with a total possession limit of 2 curies except as specifically listed below:<br><br>Hydrogen-3 1 curie<br>Carbon-14 1 curie<br>Nickel-63 50 millicuries<br>Iodine-125 50 millicuries |

9. Authorized use:

A. Laboratory research as defined in 10 CFR 30.4(q) and as tracers in non-human biologic systems.

**MATERIALS LICENSE**
SUPPLEMENTARY SHEET

License number
30-26860-01
Docket or Reference number
030-29613

CONDITIONS

10. Licensed material shall be used only at Primate Research Institute, Holloman AFB, Building 1264, North Area, Holloman AFB, New Mexico.

11. Licensed material shall be used by, or under the supervision of, New Mexico State University Primate Research Institute Radiation Safety Committee.

12. A. (1) Each sealed source acquired from another person and containing licensed material, other than hydrogen-3, with a half-life greater than 30 days and in any form other than gas shall be tested for contamination and/or leakage before use. In the absence of a certificate from a transferor indicating that a test has been made within 6 months before the transfer, a sealed source received from another person shall not be put into use until tested.

(2) Notwithstanding the periodic leak test required by this condition, any licensed sealed source is exempt from such leak tests when the source contains 100 microcuries or less of beta and/or gamma emitting materials or 10 microcuries or less of alpha emitting material.

(3) Except for alpha sources, the periodic leak test required by this condition does not apply to sealed sources that are stored and not being used. The sources excepted from this test shall be tested for leakage before any use or transfer to another person unless they have been leak tested within 6 months before the date of use or transfer.

B. Each sealed source fabricated by the licensee shall be inspected and tested for construction defects, leakage, and contamination prior to use or transfer as a sealed source. If the inspection or test reveals any construction defects or 0.005 microcurie or greater of contamination, the source shall not be used or transferred as a sealed source until it has been repaired, decontaminated, and retested.

C. Each sealed source containing licensed material, other than hydrogen-3, with a half-life greater than 30 days and in any form other than gas shall be tested for leakage and/or contamination at intervals not to exceed 6 months except that each source designed for the purpose of emitting alpha particles shall be tested at intervals not to exceed 3 months.

**MATERIALS LICENSE**
SUPPLEMENTARY SHEET

License number
30-26860-01

Docket or Reference number
030-29613

12. (continued)

D. The test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. The test sample shall be taken from the sealed source or from the surfaces of the device in which the sealed source is permanently or semipermanently mounted or stored on which one might expect contamination to accumulate. Records of leak test results shall be kept in units of microcuries and maintained for inspection by the Commission. Records may be disposed of following Commission inspection.

E. If the test required by Subsection A. or C. of this condition reveals the presence of 0.005 microcurie or more of removable contamination, the licensee shall immediately withdraw the sealed source from use and shall cause it to be decontaminated and repaired or to be disposed of in accordance with Commission regulations. A report shall be filed within 5 days of the test with the U. S. Nuclear Regulatory Commission, Region IV, 611 Ryan Plaza Dr., Suite 1000, Arlington, Texas 76011, ATTN: Chief, Radiological and Safeguards Programs Branch, describing the equipment involved, the test results, and the corrective action taken.

13. Sealed sources containing licensed material shall not be opened.

14. Licensed material shall not be used in or on human beings.

15. The licensee shall conduct a physical inventory every 6 months to account for all sources and/or devices received and possessed under the license. Records of inventories shall be maintained for 2 years from the date of each inventory.

16. A. Detector cells containing titanium tritide foil shall only be used in conjunction with a properly operating temperature control mechanism which prevents foil temperatures from exceeding 225 degrees Centigrade.

B. Detector cells containing scandium tritide foil shall only be used in conjunction with a properly operating temperature control mechanism which prevents foil temperatures from exceeding 325 degrees Centigrade.

17. In lieu of using the conventional radiation caution colors (magenta or purple on yellow background) as provided in Section 20.203(a)(1), of 10 CFR Part 20, the licensee is hereby authorized to label detector cells and cell baths, containing licensed material and used in gas chromatography devices, with conspicuously etched or stamped radiation caution symbols without a color requirement.

**MATERIALS LICENSE**
SUPPLEMENTARY SHEET

License number
30-26860-01

Docket or Reference number
030-29613

18. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

    A. Application dated November 7, 1986
    B. Letter dated January 9, 1987

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date JAN 30 1987

By

Nuclear Materials Safety Section
Region IV
Arlington, Texas 76011

# APPENDIX B4

# Final Radiological Characterization and Decontamination of the Primate Research Institute (NMSU 1996)

# FINAL

# RADIOLOGICAL CHARACTERIZATION AND DECONTAMINATION OF THE PRIMATE RESEARCH INSTITUTE

FOR RELEASE FOR UNRESTRICTED USE

Prepared for:
NEW MEXICO STATE UNIVERSITY
LAS CRUCES, NEW MEXICO

Contract No. 34G15300

August 1996

## 2.0 BACKGROUND

Non-human primates are essential components of the United States research and development of diagnostic tests, drug therapies, and vaccines for many human diseases, including hepatitis, cancer, and human immunodeficiency virus. The PRI on Holloman AFB is a major research facility in such areas as reproductive biology, metabolic toxicology, pharmacology, virology, and immunology.

The PRI also operated a macaque research, holding, and breeding colony which held up to 1375 animals. The PRI's objective was to conduct independent, innovative basic and applied research on biomedical problems of human concern. The facility had several laboratories equipped for analytic and metabolic chemistry, and hormonal assays. The PRI also performed X-ray work, surgery, clinical chemistry, hematology, microbiology, and pathology laboratory work. Radioactive material was a component of the medical research, particularly as a tracer material.

This section provides the background of the PRI. Besides a discussion of the site operating history, it also describes the radionuclides that the PRI used in performing their research and the potential for contamination.

### 2.1 SITE DESCRIPTION AND OPERATING HISTORY

In the late 1950s, the United States Air Force (USAF) imported chimpanzees for use at the USAF Aeromedical Research Laboratory at Holloman AFB. The original importation of chimpanzees supported the United States space program research.

In the late 1960s, the space program's need for chimpanzees declined. From 1970 to 1980 the Albany Medical College of New York operated the colony of over 400 chimpanzees, most of which were at the Holloman AFB facility. The Holloman AFB colony became the PRI. The Division of Research Resources and the Food and Drug Administration provided grants to run the PRI.

In 1980, NMSU acquired the PRI. Building 1204 and 1264 are the two primary research facilities, and those which fall under the area of this decontamination effort. Table 2.1 provides a list of "affected" rooms in each building, in accordance with the Work Plan. The table also includes additional areas that NMSU surveyed because of potential contamination. Figure A.1 (in Appendix A) depicts the general location of the site. Figures A.2 (Building 1204) and A.3 (Building 1264) provide the floor plans for those facilities, and indicate the affected areas with respect to this activity.

## TABLE 2.1 "AFFECTED AREAS" OF THE PRI BUILDING
which we characterized and remediated as necessary

| ROOM NO. | HISTORICAL OR CURRENT USE | ROOM NO. | HISTORICAL OR CURRENT USE |
|---|---|---|---|
| **BUILDING 1264** | | | |
| 112 | Security Vault Area (Note 6) | 419 | RMA |
| 151 | Isotope handling and dosing | 523A | RMA |
| 201 | Rad materials use | 523B | RMA |
| 201A | $^{125}I$, storage and use | 523C | RMA |
| 202 | RMA | 525 | Count lab, rad storage |
| 203 | RMA | 526 | RMA |
| 207 | RMA | 529 | RMA |
| 210 | Rad materials storage and use | 529A | RMA |
| 210A | $^{125}I$, storage and use | 530 | Rad isotope, solution prep |
| 210B | Rad materials storage | 531 | RMA (Note 1) |
| 211 | RMA | 532 | RMA (Note 1) |
| 212 | Rad materials storage | 533 | RMA (Note 1) |
| 214 | $^{125}I$, $^{3}H$ storage | 534 | RMA (Note 2) |
| 303 | RMA | 535 | RMA (Note 2) |
| 304 | RMA | 536 | RMA (Note 2) |
| 305 | RMA | 540 | RMA |
| 306 | RMA | 542 | Oxidation of isotopes |
| 407 | RMA | 543 | Oxidation of isotopes |
| 413 | RMA | Fruit Locker | RMA |
| 414 | RMA | | |
| **BUILDING 1204** | | | |
| 101 | Necropsy | 111 | Equipment room |
| 102 | $^{35}S$ storage | 112 | RMA |
| 103 | RMA | 124 | Special Procedures |
| 104 | RMA | 207 | RMA (Note 3, 6) |
| 105 | RMA | 210 | RMA (Note 4) |
| 106 | RMA | 210 Airlock | RMA (Note 5) |
| 109 | Isotope handling and dosing | Bldg 1207 | Rad Storage Area (Note 6) |

NOTE:
(1) 531, 532, and 533 are currently a single room which PRI now identifies as 531 (PRI previously removed the walls that separated the three rooms). Figure A.3 is correct.
(2) 534, 535, and 536 are currently a single room which PRI now identifies as 535 (PRI previously removed the walls that separated the three rooms) Figure A.3 is correct.
(3) The room label identifies this room as "207, Darkroom" which the Figure A.2 and the Work Plan Figure 2.2 identify as "107."
(4) Figure A.2 and Work Plan Figure 2.2 identify this as "Cold Room."
(5) The 210 airlock in Figure A.2 is now an open addition to Room 109 in the facility.
(6) These rooms had the potential for contamination (based on observation); therefore we included them in this remediation activity.

RMA = Radioactive Materials Area

The Coulston Foundation is the current operator of the PRI. They do not anticipate the need of a Radioactive Materials License for their operations.

For familiarization with the PRI today, NMSU has provided photographs as Appendix B to this report. The pictures show the PRI at various representative locations and conditions.

## 2.2 RADIONUCLIDE USAGE AND POTENTIAL CONTAMINATION

NMSU began using radioisotopes at the PRI in the early 1980s. Although the license permits NMSU to possess any by-product material with atomic numbers less than 84, the PRI only used seven isotopes in the maximum quantities which Table 2.2 indicates. Appendix C provides a reproduction of the current radioactive material license.

**TABLE 2.2 RADIONUCLIDE POSSESSION LIMITS AND USE**
of material which NMSU used at PRI based on current Material License (Amendment No. 4)

| RADIONUCLIDE | HALF-LIFE | AMENDMENT 4 LIMITS | USE |
|---|---|---|---|
| Sulfur-35 | 88 days | 0.5 Ci | biological studies |
| Hydrogen-3 (Tritium) | 12 years | 100 mCi | biological studies |
| Carbon-14 | 5730 years | 25 mCi | biological studies |
| Nickel-63 | 92 years | 0 mCi | check-source inside GC |
| Iodine-125 | 60 days | 100 mCi | biological studies |
| Phosphorous-32 | 14 days | 50 mCi | biological studies |
| Chromium-51 | 28 days | 100 mCi | biological studies |

NOTES: Ni-63 had possession limits under prior amendments.
Ci = Curie.
GC = gas chromatograph/mass spectrometer.
mCi = milliCurie.

Table 2.2 clearly shows that the majority of the radionuclides -- sulfur-35, iodine-125, phosphorous-32, and chromium-51 -- have very short half-lives, and would not **currently** be present due to natural decay. The nickel-63 was an internal stabilization source for the gas chromatograph.

NMSU protocol and procedures indicate that the PRI used between 0.1 and 20 micro-curies of a single radionuclide per animal under study. A former Radiation Safety Officer for NMSU issued a memo stating that the PRI used only phosphorous-32 in animal studies between July 1993 and September 1995. On 25 March 1993, NMSU requested a change in the quantity of radioactive material to a maximum of 1 microcurie of each radionuclide

with atomic numbers less than 84, and a total possession limit of 2.0 curies with the exception of the specific radionuclides.

The only residual radionuclides which NMSU expects to be present at the PRI as contamination are tritium (hydrogen-3) and carbon-14. However, NMSU performed gamma scans of "affected" areas (Table 2.1) to ensure that gamma-emitting radionuclides are not present.

# FINAL
# INTERIM MEASURES WORK PLAN

## Site RW-42 – Radioactive Waste Disposal Area (SWMU 111)
**Revision 0**

**Holloman Air Force Base, New Mexico**

Prepared for
**Air Force Civil Engineer Center**
2261 Hughes Ave, Suite 155
Joint Base San Antonio Lackland, Texas 78236-9853

Contract No.: FA8903-13-C-0008

*Prepared by:*

URS Group, Inc.
Greenwood Village, Colorado

*In Association with:*

FPM Remediations, Inc.
584 Phoenix Drive
Rome, New York 13441

**June 2016**

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**Appendix A** URS Utah Radioactive Materials License UT1800410

# LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AAF | Army Air Field |
| ACM | accelerated corrective measures |
| AFB | Air Force Base |
| AFCEC | Air Force Civil Engineer Center |
| AFMSA/SG3PB | Air Force Medical Support Agency/Surgeon General |
| AFRIC | Air Force Radioisotope Committee |
| AFSC/SEW | Air Force Safety Center Weapons Safety Division |
| ALARA | As Low As Reasonably Achievable |
| amsl | above mean sea level |
| AOC | area of concern |
| bgs | below ground surface |
| CAC | Corrective Action Complete |
| CM | Corrective Measures |
| CME | Corrective Measures Evaluation |
| COC | contaminants of concern |
| cpm | counts per minute |
| DOT | United States Department of Transportation |
| DPT | direct push technology |
| EM | electromagnetic |
| FIDLER | field instrument for the detection of low-energy radiation |
| FPM | FPM Remediations, Inc. |
| FSS | Final Status Survey |
| ft | feet |
| GPR | ground-penetrating radar |
| GPS | global positioning system |
| GSSI | Geophysical Survey Systems, Inc. |
| GWS | gamma walkover survey |
| HASP | health and safety plan |
| IDW | investigation-derived waste |
| LLRW | low-level radioactive waste |
| MARSSIM | Multi-Agency Radiation Survey and Site Investigation Manual |
| mg/L | milligrams per liter |
| MHz | megahertz |
| MML | Master Materials License |
| mrem/hr | milliRoentgen Equivalent Man per hour |
| NAD83 | North American Datum 1983 |
| NaI | sodium iodide |
| NFA | no further action |
| NMED | New Mexico Environment Department |
| NRC | United States Nuclear Regulatory Commission |
| PBR | performance-based remediation |
| PID | photoionization detector |

| | |
|---|---|
| PPE | personal protective equipment |
| PROC | potential radionuclides of concern |
| QA/QC | quality assurance/quality control |
| QAPP | quality assurance project plan |
| Radian | Radian Corporation |
| RCA | radiological control area |
| RCB | Radiation Control Bureau |
| RCRA | Resource Conservation and Recovery Act |
| RI | Remedial Investigation |
| RML | radioactive materials license |
| RSO | Radiation Safety Officer |
| SMS | safety management standard |
| SOP | standard operating procedure |
| SVOC | semivolatile organic compound |
| SWMU | solid waste management unit |
| TAL | target analyte list |
| TDS | total dissolved solids |
| TPH-DRO | total petroleum hydrocarbons diesel range organics ($C_{10}$-$C_{22}$) |
| TPH-GRO | total petroleum hydrocarbons gasoline range organics ($C_6$-$C_{10}$) |
| TPH-ORO | total petroleum hydrocarbons oil range organics (> $C_{22}$-$C_{36}$) |
| URS | URS Group, Inc. |
| USAF | United States Air Force |
| USDA | United States Department of Agriculture |
| USEPA | United States Environmental Protection Agency |
| UTL | upper tolerance limit |
| VOC | volatile organic compound |
| µg/L | micrograms per liter |
| µR/hr | microRoentgens per hour |

# 1.0 INTRODUCTION

URS Group, Inc. (URS), as a subcontractor to FPM Remediations, Inc. (FPM), has prepared this Interim Measures (IM) Work Plan for Site RW-42 at Holloman Air Force Base (AFB) as part of the New Mexico-Arizona Group Performance-Based Remediation (PBR) contract. Site RW-42 is listed on Table A of Holloman AFB Resource Conservation and Recovery Act (RCRA) Hazardous Waste Facility Permit No. NM6572124422 as the Radioactive Waste Disposal Area, Solid Waste Management Unit (SWMU) 111. Site RW-42 is regulated under RCRA and the United States Air Force (USAF) Master Materials License (MML). The lead regulatory agency is the New Mexico Environment Department (NMED). This site is also regulated by the Air Force Radioisotope Committee (AFRIC) under AFI-40-201; however, a possession-only permit has not been issued for Site RW-42.

This IM Work Plan was completed under Air Force Civil Engineer Center (AFCEC) Contract No. FA8903-13-C-0008. Intrusive site work will be conducted under reciprocity with the NMED Radiation Control Bureau (RCB) in accordance with URS Utah Radioactivity Materials License UT1800410 (Appendix A).

## 1.1 Interim Measures Purpose

The purpose of this IM is to facilitate a timely corrective measure which will minimize or prevent the release of contaminants disposed at Site RW-42 and limit actual or potential human and environmental exposure to contaminants. Given the uncertainties regarding the historical waste disposal activities at Site RW-42, this IM Work Plan describes methods to collect additional information on the location and configuration of the buried waste disposal structure; radiologically screen its exterior and interior; and sample and analyze the disposed waste to develop a waste profile for disposal, as practicable. This information will be used to support development of Corrective Measures (CM) to remediate Site RW-42 and to identify waste processing and packaging requirements prior to waste being removed and shipped to a licensed low-level radioactive-waste (LLRW) disposal facility.

As stated in the Decommissioning Plan (URS 2016a), the remediation goal for Site RW-42 is the safe removal and disposal of all radioactive waste to allow Site RW-42 to be granted Corrective Action Complete (CAC) without Controls status and moved from Holloman AFB RCRA Hazardous Waste Facility Permit Table A (SWMUs and Areas of Concern [AOCs] Requiring Corrective Action) to Table B (Corrective Action Complete [CAC] without Controls [i.e., Site Closeout (SC)]) (NMED 2004). Table A is a list of SWMUs which require corrective action. Table B is a list of SWMUs that have been granted CAC without Controls status. To achieve this goal, Site RW-42 will be closed under No Further Action (NFA) Criterion 5 specified in the Holloman AFB RCRA Hazardous Waste Facility Permit which states that "the SWMU has been characterized or remediated in accordance with current applicable state or federal regulations and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use."

## 1.2 Interim Measures Objectives

The primary objectives of the IM are to:

- Radiologically screen the surface soils at Site RW-42 using a gamma walkover survey;
- Collect additional information on the location and configuration of the buried concrete waste

disposal cylinder;

- Excavate and expose the upper portion of the buried concrete waste disposal cylinder and radiologically screen its exterior; interior; and sample and analyze the disposed waste to develop a waste profile for future disposal at a licensed LLRW disposal site, as practicable;
- Collect confirmatory soil and groundwater samples for laboratory analysis to determine whether any radionuclides have been released from the waste to the environment; and
- Provide the necessary data to support a CAC proposal to NMED to delist the site from the RCRA Permit.

These IM objectives will be achieved in part through the following field activities, which are described in this Work Plan:

- Task 1 - Gamma Walkover Survey;
- Task 2 - Mobilization Activities;
- Task 3 - Site Characterization Excavation;
- Task 4 - Waste Inspection, Screening, Sampling, and Analysis;
- Task 5 - Soil Sampling and Analysis;
- Task 6 - Groundwater Sampling and Analysis;
- Task 7 - Waste Management; and
- Task 8 - Site Restoration/Demobilization

## 1.3 Regulatory Setting

Pursuant to the RCRA Permit, IM activities conducted at Holloman AFB are performed under the New Mexico Hazardous Waste Act (HWA), the New Mexico Hazardous Waste Management Regulations, and RCRA. The NMED Hazardous Waste Bureau (HWB) and NMED RCB have regulatory enforcement authority for the State of New Mexico. In addition, decommissioning of a radioactive waste disposal site is regulated by the U.S. Nuclear Regulatory Commission (NRC) under the USAF MML, and in the case of Site RW-42, NMED RCB, an agreement state agency. Decommissioning guidance for radiological sites is provided in New Mexico Administrative Code (NMAC) *Title 20 Chapter 3 Radiation Protection*, the NRC's *Consolidated Decommissioning Guidance* (NRC 2006), and the MARSSIM (NUREG-1575, Revision 1; NRC 2000).

A companion Decommissioning Plan (URS 2016a) has been prepared for Site RW-42 and will be used to decommission the site per NMED RCB and NRC regulations and guidance so it can be granted CAC without Controls status and moved from Table A to Table B of the Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004). The media of concern for Site RW-42 include surface and subsurface soils and groundwater. Pursuant to the RCRA Permit, cleanup levels for impacted soil or groundwater under this IM will be to the latest revision of NMED, NRC, and EPA soil and groundwater cleanup criteria at the time of work plan approval and/or execution of the fieldwork.

NMED has not established soil cleanup levels for radionuclides in environmental media (NMED 2015) or approved background values for radionuclides in soil or groundwater at Holloman AFB (NMED 2011).

Per Appendix 4-F, Section V.1.3 of the Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004), Appendix A of USEPA's *Soil Screening Guidance for Radionuclides: Technical Background Document* (USEPA 2000) will be used to determine if soil has been impacted by radiological contamination (Bhate 2012), unless NRC (2006) screening levels are more conservative.

The 25 milliRoentgen Equivalent Man per year (mrem/y) or 0.25 milliSieverts per year (mSv/y) unrestricted release dose limit specified in NMAC 20.3.4.426B and 10 Code of Federal Regulations (CFR) 20.1402 *Radiological Criteria For Unrestricted Use* will be used as the "clean-up standard" for soil at Site RW-42. Table B2 of NRC's *Consolidated Decommissioning Guidance* (NRC 2006) provides surface soil screening levels for common radionuclides. These standard Derived Concentration Guideline Levels (DCGLs) represent surficial surface soil concentrations of individual radionuclides that would be deemed in compliance with the 25 mrem/y unrestricted release dose limit. These standard DCGLs will be used for isotopes not screened for in Holloman AFB background soils; for isotopes present in background soils, the site cleanup limit will be the DCGL plus the site-specific background value.

## 1.4 Interim Measures Work Plan Organization

The IM Work Plan is divided into six sections and one appendix including:

- Section 1 – Introduction,
- Section 2 – Background Information and Previous Investigations,
- Section 3 – Procedures for Implementation,
- Section 4 – Interim Measures Report,
- Section 5 – Project Schedule,
- Section 6 – References, and
- Appendix A – URS Utah Radioactive Materials License UT1800410.

# 2.0 BACKGROUND INFORMATION AND PREVIOUS INVESTIGATIONS

## 2.1 Site Location

Site RW-42 is located at Holloman AFB in south central New Mexico, in the northwest central part of Otero County, approximately 75 miles north–northeast of El Paso, Texas (USAF 2013) (**Figure 1**). Holloman AFB has a population of 3,054 (U.S. Census Bureau 2010) and occupies 59,639 acres in the northeast quarter of Section 1, Township 17 South, Range 8 East. The White Sands Missile Range (WSMR) testing facilities occupy additional land extending northward from the Base. Privately and publicly owned lands border the remainder of Holloman AFB. The major highway servicing Holloman AFB is Highway 70, which runs southwest from the town of Alamogordo, New Mexico, and separates Holloman AFB from publicly owned lands to the south. Alamogordo, which has a population of 30,401 according to (U.S. Census Bureau 2010), is located approximately 7 miles east of the Base.

## 2.2 Holloman AFB History

Holloman AFB was first established in 1942 as Alamogordo Army Air Field. From 1942 through 1945, Alamogordo Army Air Field served as the training grounds for over 20 different flight groups, flying primarily B-17s, B-24s, and B-29s. After World War II, most operations had ceased at the Base. In 1947, Air Material Command announced that the air field would be its primary site for the testing and development of unmanned aircraft, guided missiles, and other research programs (USAF 2013). On 13 January 1948, the Alamogordo installation was renamed in honor of the late Colonel George V. Holloman, a pioneer in guided missile research. The facility mission remained largely unchanged until 1971, although the facility identification changed several times during the 20-year span: Air Force Missile Test Center (1951–1952), Holloman Air Development Center (1952–1957), and Air Force Missile Development Center (1957–1971) (Holloman AFB 2008). In 1968, the 49th Tactical Fighter Wing arrived at Holloman AFB and has remained there since. Today, Holloman AFB also serves as the German Air Force's Tactical Training Center.

## 2.3 Site Summary

Site RW-042 is listed on Table A of the Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004) as the Radioactive Waste Disposal Area, SWMU 111. It is approximately 6.5 miles north of the main Base area (**Figure 2**). The site is east of Range Road 9 and south of Hay Draw in the undeveloped northeastern portion of Holloman AFB at latitude 32.9515432 north and longitude -106.1042017 west.

Site RW-42 (**Figures 3, 4, and 5**) is in a secluded area south of Hay Draw at an approximate elevation of 4,163 feet (ft) above mean sea level (amsl) on relatively flat sparsely vegetated desert terrain that gently slopes to the southwest. According to historical reports (Sprester 1977), the site consists of a buried concrete cylinder containing radioactive waste surrounded by a three-strand barbed wire fence (80 ft x 60 ft x 4 ft) with a three-strand barbed wire gate on a moveable fence post. A concrete pad (**Figure 4**) marks the site location. Warning signs indicating radioactive waste disposal are posted 10 ft outside of each side of the fence (Radian 1992).

Site RW-042 was created in the 1950s by the USAF for burial of radioactive waste in accordance with USAF Technical Order TO-00-110A-1 (AFRIC 1972). The buried concrete cylinder may contain unknown quantities of suspected wastes, possibly including research animal carcasses containing low-

level radioactivity as well as contaminated laboratory and pharmaceutical supplies (e.g., lab gowns, gloves, syringes, etc.). Former USAF personnel present during the disposal operation described the waste disposal vault as a concrete cylinder approximately 10 ft in length and 5.5 ft in diameter with an internal opening 8 ft long and 1.5 ft in diameter (Sprester 1977). These dimensions are consistent with specifications in USAF Technical Order TO-00-110A-1. The cylinder is reportedly buried at a depth of 2 to 4 ft below ground surface (bgs) and covered with a concrete pad (3 ft long by 3 ft wide by 4 inches thick) (**Figure 4**) to indicate its location (Radian 1992). The locations of soil borings drilled adjacent to the concrete pad in 2007 (Bhate 2012) and the recent GPR survey results (Section 2.7.2) suggest that the concrete waste disposal cylinder is buried about 3 ft bgs and is most likely in an upright (i.e., vertically oriented) position. **Figure 7** is a schematic of the assumed concrete waste disposal cylinder configuration.

## 2.4 Site Soils, Geology, and Hydrogeology

### 2.4.1 Site Soils

Site RW-42 is situated on soils characterized as Holloman-Gypsum Land-Yesum Complex (Deer 1981). The Holloman-Gypsum Land-Yesum Complex (0 to 5 percent slopes) consists of shallow and deep, well drained, calcareous, mildly to moderately alkaline, gypsiferous (i.e., gypsum bearing) sandy loam soils. Soil permeabilities are moderate, ranging from $4 \times 10^{-4}$ to $1 \times 10^{-3}$ centimeters per second, and available water capacity is low.

### 2.4.2 Site Geology and Hydrogeology

Geologically, Site RW-42 is located within the Tularosa Basin in the Rio Grande Rift. The site is situated on Tertiary alluvial, eolian, and playa basin fill deposits. The subsurface stratigraphy at Site RW-42 is based on four direct push technology (DPT) soil borings (RW42-DP01 through -DP04) and three monitoring wells (RW42-MW01 through -MW03) drilled with hollow-stem augers completed at the site in 2007 (Bhate 2012) (**Figure 3**). Drilling logs from the DPT and hollow-stem auger borings indicate that Site RW-042 is primarily underlain by silty sands interbedded with clayey sands. A dense caliche layer is present, overlaying white fine grained sand layers, at approximately 20 ft bgs. This white sand layer grades into a clayey silt interbedded with gypsum lenses and extends 20 to 25 ft to a water bearing silty sand at approximately 40 to 45 ft bgs.

Site monitoring wells (RW42-MW01 through -MW03) (**Figure 3**) are screened in silty sand from approximately 34 to 49 ft bgs. In July of 2007, the depths to groundwater ranged from approximately 39 to 42 ft below top of casing, and groundwater elevations ranged from approximately 4,119 to 4,123 ft amsl. Groundwater locally flows to the west towards Hay Draw, a northeast-to-southwest-trending arroyo north of Site RW-042, at a horizontal hydraulic gradient of approximately 0.038 ft/ft. Regional groundwater flow at Holloman AFB is to the southwest (Bhate 2012).

## 2.5 Preliminary Site Assessment

A preliminary site assessment was conducted and documented in the Remedial Investigation (RI) Report (Radian 1992). Radian reported that periodic monitoring (including soil sampling and radiological surface readings) conducted by Holloman AFB's Bioenvironmental Engineering staff (and formerly by Environmental Health Services) has shown normal levels of radioactivity at the site (Andreoli 1980, Cordts 1990). Surface soil samples taken at the site in February 1990 indicated no significant differences

between radioactivity levels adjacent to the concrete pad and background soil. During Radian's site reconnaissance in February 1991, radiation measurements were taken using portable alpha and beta/gamma detectors (Morahan 1991). These results also indicated background radioactivity levels in soils consistent with previous sampling results.

Radian (1992) concluded that "*Provided that monitoring (as completed to date by Base Bioenvironmental Engineering) of the site continues, site closeout/no further action appears warranted for Site 42*." Radian (1992) also stated that "*Appropriate documentation in the form of a Decision Document will be prepared to record and summarize the data presented in this [Preliminary Assessment] PA*." Radian (1994) referenced Site 42, but did not include any decision documentation. The current remedial goal for Site RW-42 is to close it under RCRA using NFA Criterion 5 specified in the Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004) to achieve CAC without Controls status and move it from Table A to Table B.

## 2.6 Previous Site Investigation and Monitoring

A review of historical site documents (Andreoli 1980; Cordts 1990; Morahan 1991; Radian 1992) indicates periodic radiological surveys were conducted at Site RW-42 between 1976 and 1990. Reported measurements were within the range of background radiation levels. Surface soil samples were collected by Holloman AFB's Bioenvironmental Engineering staff in February 1990 and again in 2008. They also conducted periodic monitoring, reporting the results as not different from background.

In 2007, a subsequent investigation was performed to support corrective action at Site RW-042 that included drilling and sampling four soil borings (RW42-DP01 through -DP04) approximately 5 ft from the concrete pad and installation of three groundwater monitoring wells (RW42-MW01 through -MW03) outside of the fenced site perimeter (**Figure 3**). The results of the 2007 investigation are summarized in the Final Accelerated CM (ACM) Completion Report (Bhate 2012) and briefly summarized below.

Four groundwater samples, including one duplicate, were collected at monitoring wells RW42-MW01, -MW02, and -MW03 and analyzed for potential chemical contaminants (volatile organic compounds [VOCs], semivolatile organic compounds [SVOCs], target analyte list [TAL] dissolved metals, and total dissolved solids [TDS]) and tritium, the only radionuclide analyzed. Groundwater at the three wells had TDS concentrations of 13,000 milligrams per liter (mg/L) which indicates that it is of poor quality and not suitable for human consumption. No groundwater constituents were detected at concentrations above applicable standards, except manganese.

Dissolved manganese appears to occur naturally in groundwater at Site RW-42 at concentrations ranging from 48 to 240 micrograms per liter (µg/L). Dissolved manganese at monitoring well RW42-MW03 exceeds the NMED (NMAC 2004) groundwater quality standard of 200 µg/L and the 95 percent upper tolerance limit (95%UTL) for dissolved manganese (118 µg /L) in Holloman AFB background groundwater. However, the NMED (NMAC 2004) groundwater quality standard for manganese was developed for groundwater with TDS concentrations less than 10,000 mg/L.

Fourteen soil samples, including two field duplicates, were collected from the DPT soil borings (RW42-DP01 through -DP04) and analyzed for VOCs; SVOCs; gasoline-, diesel-, and oil-range total petroleum hydrocarbons (TPH-GRO [$C_6$-$C_{10}$], TPH-DRO [$C_{10}$-$C_{22}$], and TPH-ORO [> $C_{22}$-$C_{36}$], respectively); TAL

total metals; and tritium, the only radionuclide analyzed. None of these soil constituents exceeded then current applicable NMED (2009) or USEPA (2002) soil screening levels.

## 2.7 Recent Site Monitoring and Investigation

### 2.7.1 Dose Rate Survey

On 9 March 2016, URS conducted a screening-level dose rate survey at Site RW-42 using a hand-held dose rate meter. Dose rate measurements were within the background range of 8 to 12 microRoentgens per hour (µR/hr).

### 2.7.2 Ground-Penetrating Radar (GPR) Survey

On 19 May 2016, FPM conducted a ground penetrating radar (GPR) survey at Site RW-42 to determine the depth and orientation of the buried concrete waste disposal cylinder. The survey was conducted using a Geophysical Survey Systems, Inc. (GSSI) SIR 3000 GPR system with 200- and 400-megahertz antennas. The concrete pad marking the location of Site RW-42 was moved to allow the GPR survey to be conducted over the suspected waste cylinder. While moving the pad it was discovered that the concrete pad had been poured directly above the hole dug for the concrete vault leaving an approximately3 ft long, conical concrete "plug" attached to the pad (**Figure 8**). At the bottom of the exposed hole was a concrete disk approximately 2 ft in diameter (**Figure 9**). Investigation with a steel T-probe into the soil surrounding this disc indicated a solid surface approximately 0.5 ft deep and extending at least 1 ft out from the disc in all directions. FPM interprets this to indicate the top of the buried concrete cylinder. The approximately 2 ft diameter concrete disk likely covers the reported 1.5 ft diameter opening in the concrete vault where radioactive waste is disposed.

Sixteen profiles each of 200- and 400-MHz GPR data were collected from all four sides of the 4- by 4-foot concrete pad. Preliminary data shows evidence of the excavation of the pit where the concrete vault was buried, but no reflector from the vault itself (due to the concrete pad being in the way). Even with moving the concrete pad, it was not possible to locate the GPR lines closer to the vault than approximately 3.5 ft.

Three selected GPR profiles (**Figures 10 through 12**) show examples of significant reflections caused by the excavation pit. The preliminary interpretation map (**Figure 13**) shows the locations of those reflections spatially. The GPR data shows the edges of the pit excavation, but no indication of the concrete vault, which suggests that the vault is vertically oriented with no significant shifting or settling.

## 2.8 Current Site Status

Site RW-42 is currently on Table A of the Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004). NMED reviewed the ACM Completion Report for Sites OT-32 (AOC PRI-A) and RW-42 (SWMU 111) prepared by Bhate (2012). NMED disapproved the No Further Action (NFA) recommendation for Site RW-42 because it considers Site RW-42 to be a landfill and a SWMU that is subject to corrective action and long-term controls (NMED 2014). NMED requested that the waste contained in the buried cylinder be characterized, and based on the results, the waste and cylinder be disposed. NMED indicated that Holloman AFB must submit a work plan for removal of the waste or complete a CM Evaluation (CME).

Holloman AFB decided to characterize the radioactive waste in the cylinder and, depending on the results, excavate and properly dispose of the waste and disposal cylinder at an appropriately-licensed facility to allow Site RW-42 to be granted CAC without Controls status and moved from Table A to Table B of the Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004). This Decommissioning Plan and a companion IM Work Plan are being prepared for Holloman AFB and the NMED review and approval to fulfill NMED's request (NMED 2014). A CM Work Plan will be prepared to document the proposed corrective measures for Site RW-42 after the IM are completed and the results evaluated.

## 2.9 Current and Future Land and Water Use

### 2.9.1 Current and Future Land Use

The land surrounding Holloman AFB consists of residential areas to the east and northeast (city of Alamogordo), rangeland to the south, White Sands National Monument to the west, and areas where military activities are conducted to the north. The desert terrain immediately surrounding Holloman AFB has limited development, Mesa Verde Ranch operates along the eastern border, and there are no residential communities, or large industrial operations located adjacent to the Base. Holloman AFB is an active military installation and is expected to remain active for the foreseeable future. No transfer of military property to the public is anticipated, and public access to the Base is restricted (Foster Wheeler 2002). Future land use is not expected to differ significantly from current land use practices (Foster Wheeler 2002).

### 2.9.2 Current and Future Water Use

Currently, there are no potable supplies of groundwater or surface water located on the Base (Foster Wheeler 2002). Holloman AFB obtains its water supply from the city of Alamogordo and Holloman AFB wells in the Boles, San Andres, and Douglas well fields at the Base of the Sacramento Mountains. No water supply wells are located on or near the Base because of poor groundwater quality with TDS concentrations greater than 10,000 mg/L. There are no potable or irrigation wells near or immediately downgradient of the Base.

## 2.10 Potential Radionuclides of Concern

Historical documents describing the documented use of radioactive materials at Holloman AFB and other AFB's in the 1970s and 1980s were used to develop a list of potential radionuclides of concern (PROCs) in the Draft Final Decommissioning Plan (URS 2016a) that may be present at Holloman AFB Site RW-42. **Table 1** provides a list of the PROCs that may be present in the waste. Radiological decay of the primary radionuclides results in the generation of additional daughter isotopes which may also be present at Site RW-42.

**Table 1**
**Potential Radionuclides of Concern and Decay Products (URS 2016a)**

| Atomic Number | Element | Isotope | 1/2 life (years) | Fraction Remaining (%) | Primary Decay Mode |
|---|---|---|---|---|---|
| 1 | Hydrogen | H-3 | 1.23E+01 | 4.5 | $\beta^-$ |
| 6 | Carbon | C-14 | 5.73E+03 | 99.3 | $\beta^-$ |
| 17 | Chlorine | Cl-36 | 3.01E+05 | 100.0 | $\beta^-$ |
| 53 | Iodine | I-129 | 1.57E+07 | 100.0 | $\beta^-$ |
| 55 | Cesium | Cs-137 | 3.02E+01 | 28.3 | $\beta^-$ |
| 82 | Lead | Pb-210 | 2.23E+01 | 18.1 | $\beta^-$ |
| 88 | Radium | Ra-226 | 1.60E+03 | 97.6 | α |
| | | Ra-228 | 5.76E+00 | 0.1 | $\beta^-$ |
| 90 | Thorium | Th-228 | 1.91E+00 | 0.0 | α |
| | | Th-230 | 7.50E+04 | 99.9 | α |
| | | Th-232 | 1.40E+10 | 100.0 | α |
| 92 | Uranium | U-234 | 2.40E+05 | 100.0 | α |
| | | U-235 | 7.04E+08 | 100.0 | α, IT |
| | | U-236 | 2.34E+07 | 100.0 | α |
| | | U-238 | 4.50E+09 | 100.0 | α |
| 94 | Plutonium | Pu-238 | 8.77E+01 | 64.8 | α |
| | | Pu-239 | 2.41E+04 | 99.8 | α |
| | | Pu-240 | 6.56E+03 | 99.4 | α |
| | | Pu-241 | 1.43E+01 | 6.9 | $\beta^-$ |
| | | Pu-242 | 3.75E+05 | 100.0 | α |
| | | Pu-244 | 8.00E+07 | 100.0 | α |

Notes: The fraction remaining refers to the percentage remaining of the isotope based on the isotope half-life and a final waste disposal date of 1960; α = alpha decay by alpha particle emission; $\beta^-$ = beta decay by electron emission; IT = isomeric transition (gamma ray or conversion electron emission from an excited state)

# 3.0 PROCEDURES FOR IMPLEMENTATION

## 3.1 Introduction

As described in Section 1, the remediation goal for Site RW-42 is the safe removal and disposal of all radioactive waste to allow Site RW-42 to be granted CAC without Controls status and moved from Holloman AFB RCRA Hazardous Waste Facility Permit Table A (SWMUs and AOCs Requiring Corrective Action) to Table B CAC without Controls [i.e., SC]) (NMED 2004). To accomplish this goal, the radioactive waste, waste containment structure, and impacted soils will be removed and disposed at a facility licensed to accept low-level radioactive waste (LLRW)

The lack of site-specific knowledge regarding the waste disposed at Site RW-42 requires characterization to confirm the size, depth, orientation, and integrity of the buried waste containment structure, whether the waste within the structure is accessible or is fully encapsulated in concrete, and, if practicable, collect radiation measurements inside and outside the waste container and sample and analyze the disposed waste in the container for radionuclides and other constituents to develop a waste profile for disposal

This information will be used to support development of CM for Site RW-42 (including a waste removal approach), and to identify waste handling, processing, and packaging requirements prior to waste being accepted at a licensed radioactive-waste disposal facility, and ultimately, final closure and unrestricted radiological release of the site.

## 3.2 Site Closure Oversight and Guidance

Site RW-42 is regulated under RCRA and the USAF MML. The lead regulatory agency is NMED. This site is also regulated by AFRIC under AFI-40-201; however, a possession-only permit has not been issued for Site RW-42. As detailed in Air Force Instruction 40-201, Attachment 4 “Radioactive Waste Site Responsibilities,” the AFRIC Secretariat (AFMSA/SG3PB) oversees USAF radioactive waste site closeouts and coordinates with all applicable regulatory authorities, including the United States Nuclear Regulatory Commission (NRC), NMED, and USAF Safety Center Weapons Safety Division (AFSC/SEW). Site closeout will be performed in general accordance with the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) guidance (NRC 2000). Site characterization activities will be conducted in a manner that supports the MARSSIM Final Status Survey (FSS) discussed in the Final Decommissioning Plan (URS 2016a).

## 3.3 Health and Safety

Site characterization work will be conducted under the current *URS Project-Specific Health and Safety Plan for Performance-Based Remediation (Various Sites)* (URS 2016b) and the *URS Site RW-42 Radiation Safe Work Plan* (URS 2016c). Invasive site work will be performed under URS Utah RML UT1800410. The RML will be the basis of a reciprocity request with NMED RCB to allow URS to conduct related intrusive work at Site RW-42. As required by the URS RML, radiological work will be conducted in accordance with the URS Radiation Protection Program (Safety Management Standard [SMS] 52) to confirm exposures are below the established administrative limits and follow As Low As Reasonably Achievable (ALARA) principles. Daily tailgate meetings will be held to discuss the work to

be completed each day, health and safety requirements, potentially changed site conditions, and lessons learned.

## 3.4 Site Access and Notifications

URS and subcontractor personnel working at Site RW-42 will be properly badged in accordance with Holloman AFB policies. If required, escorts will be provided by Holloman AFB. Holloman AFB, including the Radiation Safety Officer (RSO) and NMED will be notified 30 days in advance of URS IM field activities at Site RW-42.

## 3.5 Task 1 - Gamma Walkover Survey

A gamma walkover survey (GWS) will be performed at Site RW-42 to measure the surface gamma radiation across the site. The GWS will be conducted over the 2-acre area shown on **Figure 14** using a sodium Iodide (NaI) detector for high energy gamma, a Field Instrument for the Detection of Low-Energy Radiation (FIDLER) detector, and a survey-grade global positioning system (GPS). The location/boundaries of the GWS area may be modified in the field to ensure it covers areas that may be disturbed during excavation and removal operations, or used as equipment laydown or soil stockpile areas.

The GWS will be conducted by walking transects across the site while automatically recording radiation levels and relative position. This allows the data to be plotted on color-coded maps based on the radiation instrument measurements in counts per minute (cpm). The color scale on the final gamma maps will be based on an average background value and calculated standard deviations. Background radiation levels will be measured at the approximate location of soil sample location BWBG-SB08 (**Table 2**) established during the Basewide Soil Background Study (NationView/Bhate 2009). Sample location BWBG-SB-08 is located near Site RW-42.

The GWS will be completed using a Ludlum Model 2221 portable scaler rate meter with a RS-232 data port paired with and a Ludlum Model 44-10 NaI gamma scintillator probe, and Ludlum Model 2221 portable scaler rate meter with a RS-232 data port paired with FIDLER probe. These meters will be coupled with a survey-grade Trimble GPS (e.g., GEO6000XH or similar) with an external antenna. The radiological instruments and probes will be calibrated, and undergo daily operational checks to ensure they are functioning properly in accordance with URS Standard Operating Procedure (SOP) RP-4, Portable Survey Instruments, included in the Radiation Safe Work Plan (URS 2016c). The GWS system will be configured and operated in accordance with URS SOP RS-11.0, GPS Gamma Radiation Surveys, provided in the Radiation Safe Work Plan (URS 2016c).

The GWS system may be configured as a stroller or other site-specific configuration that allows the NaI detector to be placed approximately 12 inches above the ground, and the FIDLER detector to be placed at approximately 4 inches above the ground. The GPS external antenna will be attached above the detectors to record the position of the detector. Radiation data will be automatically recorded every 2 seconds and GPS position data every second as the system is moved at a speed of approximately 1.6 ft per second along serpentine grid transects spaced approximately 2 ft apart. This method will be used to cover the designated survey area. Transects may be modified as necessitated by field conditions, or site obstructions (e.g., fence, vegetation); however, the goal is for 100 percent coverage of the survey area.

Each logged radiological data measurement includes the radiation level (in cpm), northing, easting, elevation, date, time, and other supporting data which allows the data to be mapped. The coordinate system and projection for the GPS data will be New Mexico State Plane Central Zone, North American Datum 1983 (NAD83). In the field, the data will be downloaded and processed using Trimble Pathfinder Office, and exported into a Microsoft Excel spreadsheet for mapping. Coverage maps will be generated in the field using the collected data and Golden Software's Surfer gridding and mapping software, and reviewed to ensure proper coverage of the site. If data gaps or other issues are identified, the area will be resurveyed. After completion of the GWS, the GPS data will be differentially corrected and exported into the final GWS Microsoft Excel spreadsheet to facilitate preparation of the final color gamma radiation maps.

## 3.6 Task 2 – Mobilization Activities

### 3.6.1 Pre-Mobilization Activities

Prior to mobilization of personnel and equipment to Site RW-42 for intrusive activities, subcontractors (e.g., excavation contractor and approved analytical laboratories) will be procured. Sampling containers and shipping coolers will be requested from the laboratory. Necessary Holloman AFB permits (e.g., construction, digging permit) and a reciprocity request with the NMED RCB will be initiated. Site activities will be coordinated with appropriate Holloman AFB personnel.

Prior to initiating intrusive activities, a completed and approved Air Force Form 332 will be obtained for authorization of construction work at Holloman AFB. A request for locating underground utilities in the site area will be submitted to the local one-call utility notification center, as applicable. Additionally, Air Force Form 103 (e.g., Dig Permit) will be submitted to request that the location of underground utilities be marked at the site. Excavation locations will be identified with paint, flags, or stakes, as appropriate for the surface material. Utility clearance approvals will be completed by the appropriate Holloman AFB utility office (e.g., telephone, sewer, water, natural gas, etc.).

An application for RML reciprocity will be filed with NMED RCB at least 30 days in advance of intrusive work at Site RW-42. The application will be completed in accordance with the requirements of the NMED RCB. The purpose of the reciprocity request is to allow radiologically-related site intrusive work to be conducted in accordance with URS Utah RML UT1800410 (Appendix A).

### 3.6.2 Mobilization

After completion of the pre-mobilization activities and approval of the reciprocity request, personnel, excavation equipment, other field items, and radiological support instruments will be mobilized to Site RW-42 to conduct the IM. Equipment, tools, and other items will be screened for radiological contamination upon arrival at the site and decontaminated as needed. A radiological controlled area (RCA) and work exclusion zone will be established by the URS RSO and Site Safety Officer around the perimeter of the working area at Site RW-42. The RCA will be designated and signed as appropriate, to control access to the site; limit the spread of radiological contamination; minimize the potential for injury during excavation at the site; and minimize the potential for radiological exposures. Photographs of Site RW-42 will be taken to document prior to conducting the IM to document the existing site condition.

## 3.7 Task 3 – Site Characterization Excavation

Following the completion of Tasks 1 and 2, Site RW-42 will be characterized using a limited depth excavation to the top of the concrete cylinder to assess its location, size, depth, and integrity; assess whether the waste within the cylinder is accessible or is fully encapsulated in concrete; survey the level of alpha, beta, and gamma radioactivity on and adjacent to the cylinder and remaining in the waste (if accessible); obtain visual evidence of the waste, its packaging, remote evidence of gamma-emitting radioactive isotopes; and, if practicable, sample and analyze the waste. The approximate depth of the initial excavation will be approximately 4 ft bgs based on the GPR survey results (Section 2.7.2). Site activities will be recorded in a field log book or field forms, and photographed to document the "as found" conditions as well as the site characterization activities.

The concrete waste disposal cylinder at Site RW-42 will be initially accessed, as appropriate, using hand tools and subsequently excavated using a hydraulic excavator capable of excavating to a depth up to 16 ft bgs. Recent GPR investigation results indicate that the concrete waste disposal cylinder is buried approximately 3 ft bgs (**Figure 9**). Historical reports indicate that the concrete waste disposal cylinder is approximately 10 ft in length.

Site characterization excavation will be accomplished as outlined below.

- Review health and safety requirements for site characterization excavation.
- Survey location of the concrete pad (**Figure 4**) marking the location of Site RW-42 using a survey-grade GPS so the pad may be replaced when excavation activities are completed.
- Radiologically screen the surface of the concrete pad (**Figure 4**) for alpha, beta, and gamma radiation using hand-held instruments identified in **Table 3**, in accordance with RP-04 "Radiation Surveys" provided in the Quality Assurance Project Plan (QAPP) (URS 2016d).
- Designate a temporary soil stockpile area in general accordance with the Holloman AFB RCRA Hazardous Waste Facility Permit (NMED 2004). The soil stockpile area will have a lined bottom, bermed sides, and a cover to minimize erosion and atmospheric dispersion. Dust control measures will be implemented during soil excavation and stockpiling.
- Remove the concrete pad (**Figures 4 and 8**) and transport it to the soil stockpile area for temporary storage.
- Pothole, as needed, immediately beneath the concrete pad using hand tools (e.g., shovel) to expose the top of the buried concrete waste disposal cylinder. Recent GPR results (Section 2.7.2) indicate that the concrete waste disposal cylinder is buried approximately 3 ft bgs (**Figure 9**).
- Once the top of the concrete waste disposal cylinder is found, excavate the remaining soils using an excavator to a depth not more than 1 ft below the top of the cylinder on all sides to facilitate access. The excavated soils will be placed at the designated temporary soil stockpile area. Soils with gamma radiation levels twice background will be stockpiled separately. The stockpiled soils will be used to backfill the excavation once IM activities are completed.

- Survey the center location and elevation of the top of the concrete waste disposal cylinder using a survey-grade GPS. Survey the outer edges of the cylinder along its north, south, east, and west sides.

- Soils removed from the excavation will be visually screened for waste debris and radiologically screened using alpha, beta, and gamma radiation instruments (**Table 3**). If gamma radiation levels are significantly above background levels, use gamma identification instrumentation or In Situ Object Counting System (ISOCS) measurements (if necessary) to identify the individual radionuclides present.

- Visually identified waste and/or debris observed during excavation will be removed as the soil is excavated and placed in a drum or other appropriate container for subsequent storage and disposal.

- The excavation will be laid back at 3:1 horizontal-to-vertical slopes on all sides of the cylinder to facilitate safe access for personnel. For example, if the excavation is 4 ft deep, the excavation will be approximately 12 ft wide on each side of the cylinder to accommodate 3:1 side slopes.

- Visually inspect and photograph the exterior of the waste disposal cylinder to document its condition and integrity.

- Radiologically screen the exposed exterior concrete waste disposal cylinder concrete surfaces using portable alpha, beta, and gamma radiation instruments (**Table 3**) and record the results in a field log book, documenting the approximate location of any results greater than twice background.

## 3.8 Task 4 – Waste Inspection, Screening, Sampling, and Analysis

Following the completion of Task 3, the waste disposal cylinder will be opened and the interior radiologically screened, visually inspected, photographed, and, if practicable, the disposed waste sampled for laboratory analysis of the PROCs (**Table 1**). Site activities will be recorded in a field log book or field forms, and photographed to document the "as found" conditions as well as the waste inspection, screening, and sampling activities. Task 4 activities are outlined below.

### 3.8.1 Task 4.1 – Waste Disposal Cylinder Interior Accessible

If the concrete waste disposal cylinder has a removable concrete cap or plug the following waste inspection, screening, and sampling activities will be conducted, as practicable.

- Review health and safety requirements for waste inspection, screening, and sampling prior to opening the waste cylinder.

- Photograph the top of the cylinder, and determine whether the waste disposal cylinder is sealed with a removable cap or poured concrete plug that can be mechanically removed.

- Remotely remove concrete cap or plug using an excavator equipped with appropriate cables, harnesses, or mechanical hammer. Place the removed cap and/or concrete debris on the soil stockpile area.

- Once the cap or plug is removed, allow the waste disposal cylinder to sit open for at least 15 minutes to minimize personnel exposure to any radiological or gaseous constituents that may have accumulated in the waste cylinder since burial. Use portable field instruments to screen for radiation and gases using multi-gas meter or volatile organics using a photoionization detector (PID).

- **The cylinder is a confined space. Personnel will not enter the cylinder under any circumstances. Screening inside the cylinder will only be conducted with remotely handled instrumentation and tools.**

- Visually examine and photograph, using a still and/or video (e.g., Go Pro) camera, the interior of the waste cylinder to document the waste present and its packaging, if practicable.

- Radiologically screen the interior of the waste containment structure and waste using hand-held radiation instruments and collect smear samples from outside and inside the cylinder for screening and laboratory analysis. Screen the smears for alpha and beta contamination per the QAPP (URS 2016d). Up to five smear samples will be collected and submitted for laboratory analysis of PROCs.

- Determine the gamma-emitting radionuclides present in the waste using field gamma spectrometry instruments (**Table 3**).

- If the waste is easily accessible **and** poses no radiological or other health or safety hazard, collect samples of the waste for laboratory analysis using appropriate personal protective equipment (PPE) and engineering controls.

- Remote sampling tools may be used to retrieve an intact waste container or samples of loose waste material for screening or analysis as described below:

    - Extract waste packages using hand tools from the waste disposal cylinder and place them on plastic and/or in a large, clear plastic bag. The clear plastic bag will serve as a “glove box” to minimize personnel exposures to the waste or release to the environment. A second large, clear plastic bag will be placed over the initial bag as secondary containment, if practicable.
    - Use field gamma spectrometry instruments to identify radionuclides present in the waste.
    - Record any information that may be labeled on the waste package label or exterior.
    - Collect and analyze smear samples from the waste package exterior.
    - Open the waste package and collect a representative sample of the waste material. Place the sample in laboratory-supplied sample bottles. Samples will be labeled, recorded on

the chain-of-custody forms, and stored in an approved shipping container in accordance with the QAPP (URS 2016d).

  - Close the waste package(s) and return to the waste disposal cylinder.

- Ship samples to the laboratory (i.e., TestAmerica or Isotech) for radionuclide analyses under chain-of-custody control in accordance with the QAPP (URS 2016d). Sample shipment will conform to United States Department of Transportation (DOT) regulations for radioactive materials, as appropriate.

### 3.8.2 Task 4.2 – Waste Disposal Cylinder Interior Not Accessible

If the waste appears to be fully encapsulated in concrete and the disposal cylinder cannot be opened or poses a radiological or other health or safety hazard when remotely radiologically screened, waste sampling will not be performed. Under these circumstances, an alternative waste characterization and sampling and/or CM approach will be subsequently developed in the CM Work Plan. However, the exterior of the cylinder will be visually inspected, photographed, and screened as discussed in Section 3.8.1.

### 3.8.3 Task 4.3 – Characterization of the Exterior of the Waste Disposal Cylinder

Following completion of Tasks 4.1 and 4.2, the concrete waste disposal cylinder will be re-capped and excavation along the exterior of the waste cylinder will be conducted to document the cylinder's length, inspect its integrity, radiologically screen the cylinder's exterior, and radiologically screen and sample soils for laboratory analysis from the excavation sidewalls to total depth. These activities will be performed as described below.

- Re-cap the waste disposal cylinder to prevent soil and debris from falling into the cylinder during continued excavation along the cylinder exterior.

- Continue excavation to a depth of 2 to 4 ft below the top of the cylinder to allow for visual inspection of its integrity, photographs, and radiological screening of the exterior of the waste disposal cylinder as described in Section 3.8.1.

- If practicable, continue to excavate along one side of the cylinder to verify the total cylinder length which is assumed to be 12 to 14 ft below grade. The excavation will be laid back at 3:1 horizontal-to-vertical slopes on all sides of the cylinder to facilitate safe access for personnel. For example, if the excavation is 14 ft deep, the excavation will be approximately 42 ft wide on each side of the cylinder to accommodate 3:1 side slopes. The cylinder should be temporarily supported using harnesses or cables to prevent it from shifting laterally during excavation along its exterior length.

- Collect exploratory soil samples for laboratory analysis of PROCs as described in Task 5 (Section 3.9).

- After characterization activities are completed, the excavation will be backfilled with soils removed from the excavation and restored as described in Task 8.

## 3.9 Task 5 – Soil Sampling and Analysis

Exploratory soil samples will be collected and analyzed for the PROCs to provide data to determine whether soils have been contaminated and to determine possible contaminated soil disposal requirements to support the CM. A soil sample will be collected from soils immediately overlying the waste disposal cylinder and at depths of 5, 10, and 15 ft below grade from the excavation sidewalls. The soil samples will be collected from the excavation sidewalls by hand using a decontaminated hand auger, stainless steel scoop, or similar tool and placed in laboratory-supplied sample bottles, Ziploc-type bags, or other appropriate sample containers. The soil samples will be collected, handled, and shipped to the laboratory for analysis in accordance with the QAPP (URS 2016d). Quality assurance/quality control (QA/QC) samples will be collected as specified in the QAPP (URS 2016d).

## 3.10 Task 6 – Groundwater Sampling and Analysis

Groundwater samples will be collected from the three existing monitoring wells and analyzed for the total (unfiltered) and dissolved (filtered) PROCs to provide data to support development of CM. Prior to sampling, groundwater water levels will be measured to determine if groundwater is present at the site and the approximately volume of water available for sampling. If sufficient groundwater is present, the monitoring wells will be purged and samples collected using low-flow sampling techniques in accordance with the QAPP and SOPs (URS 2016d). Field parameters (e.g., temperature, pH, conductivity, and turbidity) will be measured during purging. Groundwater samples will be collected when the field parameters stabilize with minor fluctuation between consecutive readings. Samples for dissolved potential radionuclides of concern (PROC) analysis will be field-filtered using a 0.45 micron disposable cartridge or syringe filter. QA/QC samples will be collected as specified in the QAPP (URS 2016d).

## 3.11 Task 7 – Waste Management

### 3.11.1 Non-Investigative Waste

Non-investigative waste, such as trash and other similar garbage, will be collected on an as-needed basis to maintain the site in a clean and orderly manner. This waste will be accumulated in plastic garbage bags and transported to a designated sanitary landfill or collection bin.

### 3.11.2 Investigation-Derived Waste

Investigation-derived waste (IDW) such as contaminated personal protective equipment (PPE) and disposal sampling equipment/supplies will be properly containerized and temporarily stored at a location specified by Holloman AFB prior to disposal. Depending on the contaminants of concern (COCs), fencing or other special marking may be required. Acceptable waste containers include sealed, DOT-approved, steel 55-gallon drums. The contaminated IDW may also be bagged and placed in the waste disposal cylinder, if room is available, for eventual disposal with the cylinder. Approval to store contaminated IDW in the waste disposal cylinder must be obtained in advance from Holloman AFB and/or NMED. A waste generation log will be maintained to support waste characterization and subsequent disposal at a licensed facility.

## 3.12 Task 8 – Site Restoration/Demobilization

Following completion of site characterization activities, site conditions will be restored to a similar state as the pre-mobilization condition. The excavation will be backfilled with the soil removed from the excavation and compacted using an excavator. The concrete pad will be placed over the location of the waste disposal cylinder. GPS coordinates of the center of the waste containment vessel will be used to locate the concrete surface monument. The area will be graded to maintain positive drainage to conform to site conditions. Site fencing will be restored and the site secured to prevent inadvertent access. Personnel and equipment will be subsequently demobilized.

**Table 2**
**GWS Survey Area Grid Coordinates**

| Area/Grid Corner | New Mexico State Plan Northing | New Mexico State Plane Easting |
|---|---|---|
| GWS/Northeast Corner | 710004.730216 | 1685210.373920 |
| GWS/Northwest Corner | 710004.730216 | 1684910.309260 |
| GWS/Southeast Corner | 709704.665561 | 1685210.373920 |
| GWS/Southwest Corner | 709704.665561 | 1684910.309260 |
| Soil Background Sample BWBW-SB08 Location | 708021.12 | 1683406.69 |

Note:
GWS = gamma walkover survey

**Table 3**
**Field Radiological and Other Screening Instruments**

| Function | Radiation Detected | Instrument | Detector |
|---|---|---|---|
| Radiation Exposure Rates (µR/hr) | Gamma | Ludlum Model 12s or Ludlum Model 19 | Integrated NaI Detector |
| Radiation Dose Rate (mrem/hr) | Gamma and X-Ray | Bicron Thermo Micro-Rem<br>Fluke Model 451P<br>GammaRAE | Integrated NaI Detector<br>Pressurized Ionization Chamber |
| Gamma Walkover Survey | Gamma | Ludlum Model 2221 Scaler/Ratemeter with RS-232 Port | Ludlum Model 44-10 NaI scintillator (2 inches x 2 inches) |
| FIDLER Walkover Survey | Low Energy Gamma Probe | Ludlum Model 2221 Scaler/Ratemeter with RS-232 Port | Alpha Spectra FIDLER |
| Soil screening timed counts and direct contamination | Alpha-Beta-Gamma | Ludlum Model 2241 Ratemeter | Ludlum Model 44-9 Geiger-Mueller (Pancake) |
| Frisking, Concrete Screening, Direct Contamination | Alpha-Beta | Ludlum Model 2360 Dual Channel Scaler | Ludlum Model 43-93 Scintillator |
| Smear and Air Sampler Counting | Alpha-Beta | Ludlum Model 2929 Dual Channel Scaler /Ludlum 3030E | Ludlum Model 43-10-1 Scintillator |
| Isotope Identifier | Gamma | Exploranium GR-135<br>Canberra Inspector 1000 Identifier<br>Berkley Nucleonics SAM 945 | |
| Particulate Air Sampler | ----- | Mine Safety Appliances (MSA) Escort Elf Sampler | Particulates |
| Volatile Gas Screening | ----- | Q-Rae MultiRae | Oxygen (O2), methane (CH4), hydrogen sulfide (H2S), carbon monoxide (CO), and volatile organic compounds (VOCs) |

Notes:
FIDLER = field instrument for the detection of low-energy radiation; mrem/hr = milliRoentgen Equivalent Man per hour (mrem/hr); µR/hr = microRoentgen per hour

# 4.0 INTERIM MEASURES (IM) REPORT

Documentation of the project will be maintained, including field notes/forms, photographs, analytical, and survey data. An IM Report will be prepared to document the site characterization activities and results. The report will include a description of the site activities conducted; results of the GWS; and a description of the location, configuration, and depth of the buried waste cylinder, exterior and interior (if accessible) condition, dimensions, capped configuration, and visual inspection, radiological, and other screening results. Results of laboratory analysis will be provided along with an evaluation of the data and an estimate of the waste inventory based on the results. The IM results will be used to perform a CME and CM Work Plan.

The IM Report will include the following elements:

- A description of the IM activities performed, including:
  - Purpose of the IM;
  - Summary of the IM activities conducted at Site RW-42, including the GPR survey and GWS, site characterization excavation activities, and waste inspection, screening, and sampling activities; and
  - Description of field operations conducted and deviations from the Work Plan.
- Summaries of results, including:
  - Photo documentation results
  - Visual integrity inspection results
  - Radiological screening results;
  - Exploratory soil and groundwater sampling results; and
  - Explanation of data verification and validation efforts.
- Summary of findings, including:
  - A discussion of field screening and laboratory results; and
  - Recommendations of any additional site characterization that may be required to complete the CM.
- Copies of relevant field and laboratory data, including:
  - Pertinent field data, sampling forms, and laboratory data packages in appendices.

# 5.0 PROJECT SCHEDULE

**Table 4** lists the milestones identified in the Integrated Master Schedule, the associated deliverables, and projected completion date for each milestone. The schedule is dependent on many independent factors including, but not limited to, USAF and NMED review and comment, subcontractor availability, weather, and site conditions.

The USAF and NMED will be notified 30 days prior to the start of the IM activities. Additionally, during the IM, brief daily status reports may be submitted to Holloman AFB representatives by electronic mail. These reports will summarize the previous day's activities, planned activities for the following day, and other pertinent information.

The IM is expected to proceed quickly with only one field mobilization, if practicable. The milestone completion schedule allows for the evaluation of the IM data to formulate a CM approach for Site RW-42.

**Table 4**
**Milestone Completion Schedule**

| Milestone Tasks | Completion Date |
|---|---|
| Decommissioning Plan | November 2016 |
| Interim Measures Work Plan | November 2016 |
| Interim Measures Implementation | January 2017 |
| Interim Measures Report | August 2017 |
| Corrective Measures Work Plan | October 2017 |
| Corrective Measures Implementation | November 2017 |
| MARSSIM FSS | November 2017 |
| Corrective Measures Implementation Report | July 2018 |
| MARSSIM FSS Report | July 2018 |
| Monitoring Well Abandonment | November 2018 |
| Corrective Action Complete without Controls; Site transferred to Table B of Holloman AFB RCRA Hazardous Waste Facility Permit | December 2018 |

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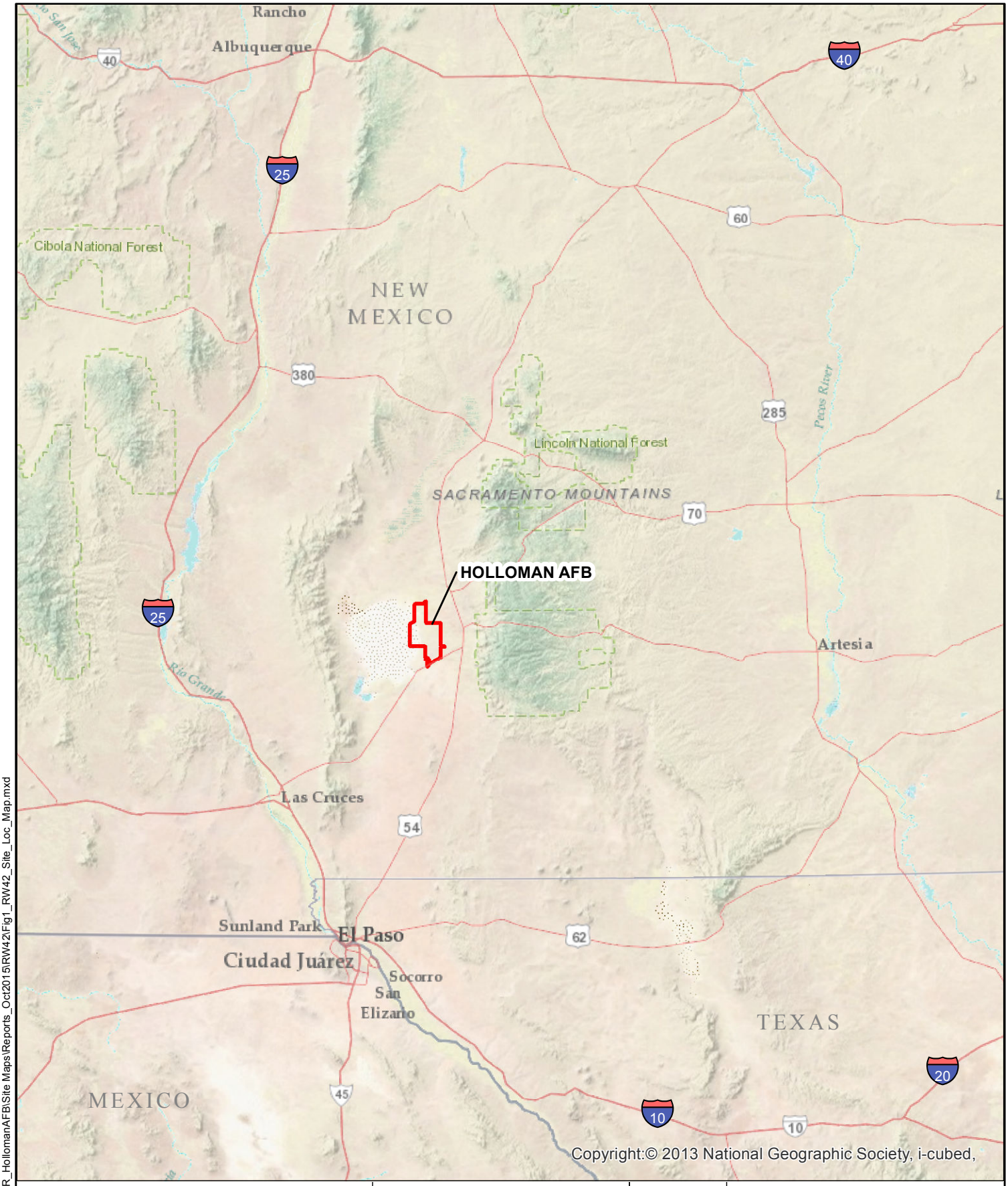
# FIGURES

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Scale in Feet
1 in = 175,000 feet

URS

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|---|---|
| Designed | SF |
| Drawn | LED |
| Checked | RLH |
| Peer Review | DAE |
| Project Manager | BGP |
| Project Number | 60425210.23446543 |

**Figure 1**
**Base Location Map**

**Holloman Air Force Base**
**USAF**

June 2016

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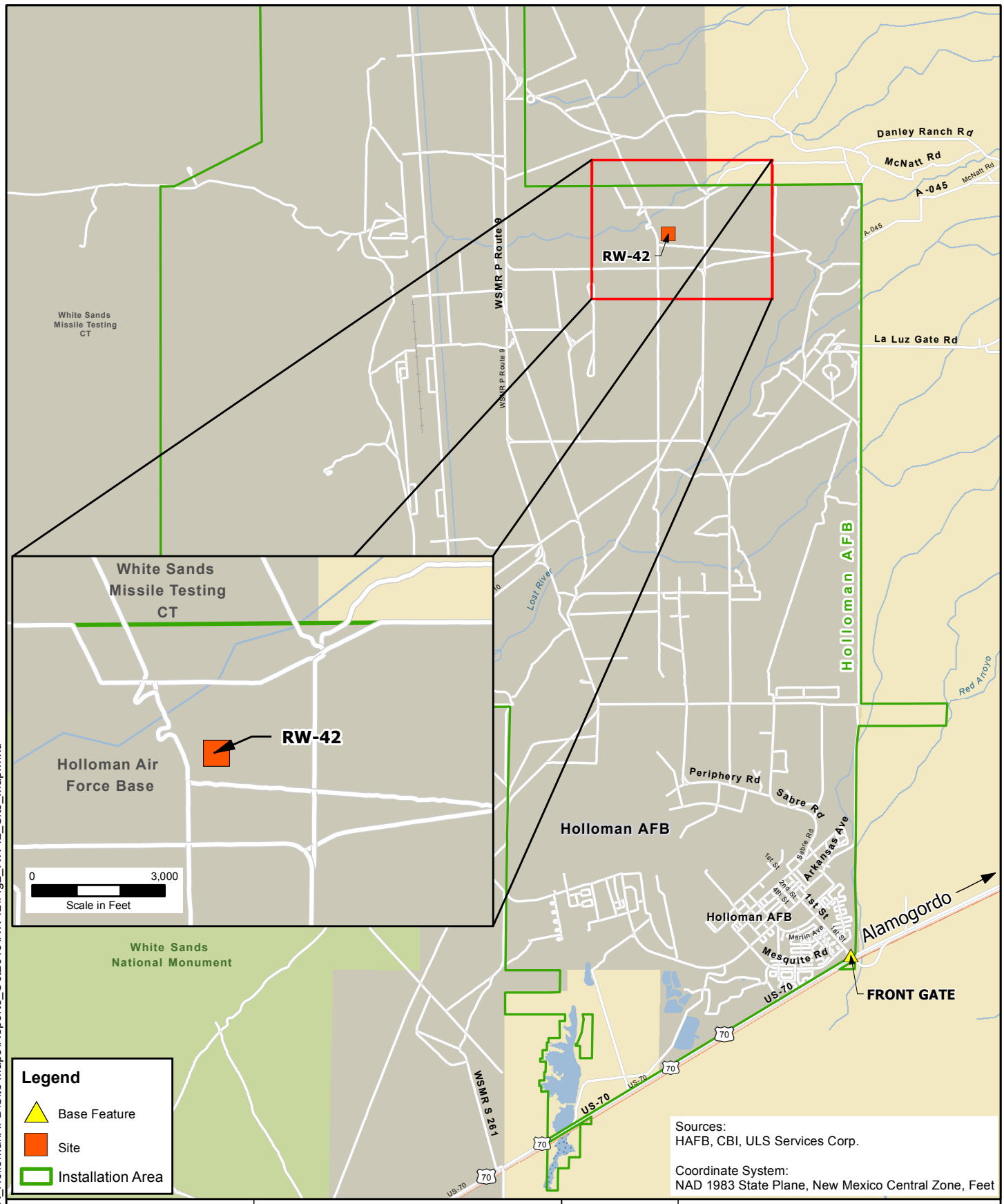


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Scale in Feet
1 inch = 8,000 feet

URS

| | |
|---|---|
| Designed | LB |
| Drawn | LED |
| Checked | RLH |
| Peer Review | DAE |
| Project Manager | BGP |
| Project Number | 23446543 |

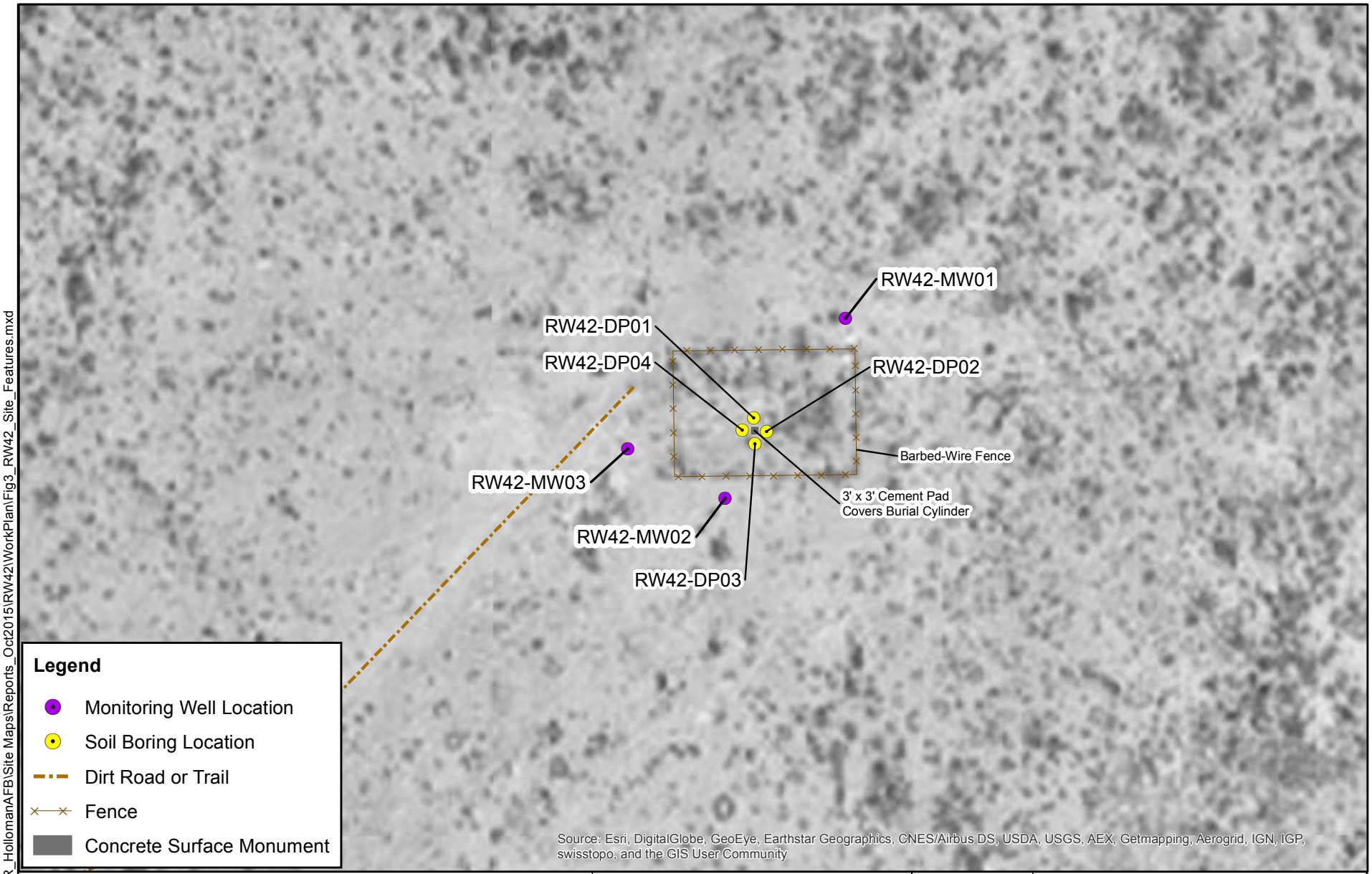
**Figure 2**

**RW-42**
**Site Location**

**Holloman Air Force Base**
**USAF**

June 2016

F:\GIS\Projects\AZNM_PBR_HollomanAFB\Site Maps\Reports_Oct2015\RW42\Fig2_RW42_Site_Map.mxd




F:\GIS\Projects\AZNM_PBR_HollomanAFB\Site Maps\Reports_Oct2015\RW42\WorkPlan\Fig3_RW42_Site_Features.mxd

Note:

Sources:
HAFB, CBI, ULS Services Corp.

Coordinate System:
NAD 1983 State Plane,
New Mexico Central Zone, Feet

N W E S

0 20 40 60 120
Scale in Feet
1 inch = 60 feet

URS

| | |
|---|---|
| Designed | RLH |
| Drawn | LED |
| Checked | LB |
| Peer Review | LB |
| Project Manager | BGP |
| Project Number | 23446543 |

**Figure 3**

**Site RW-42 Features**

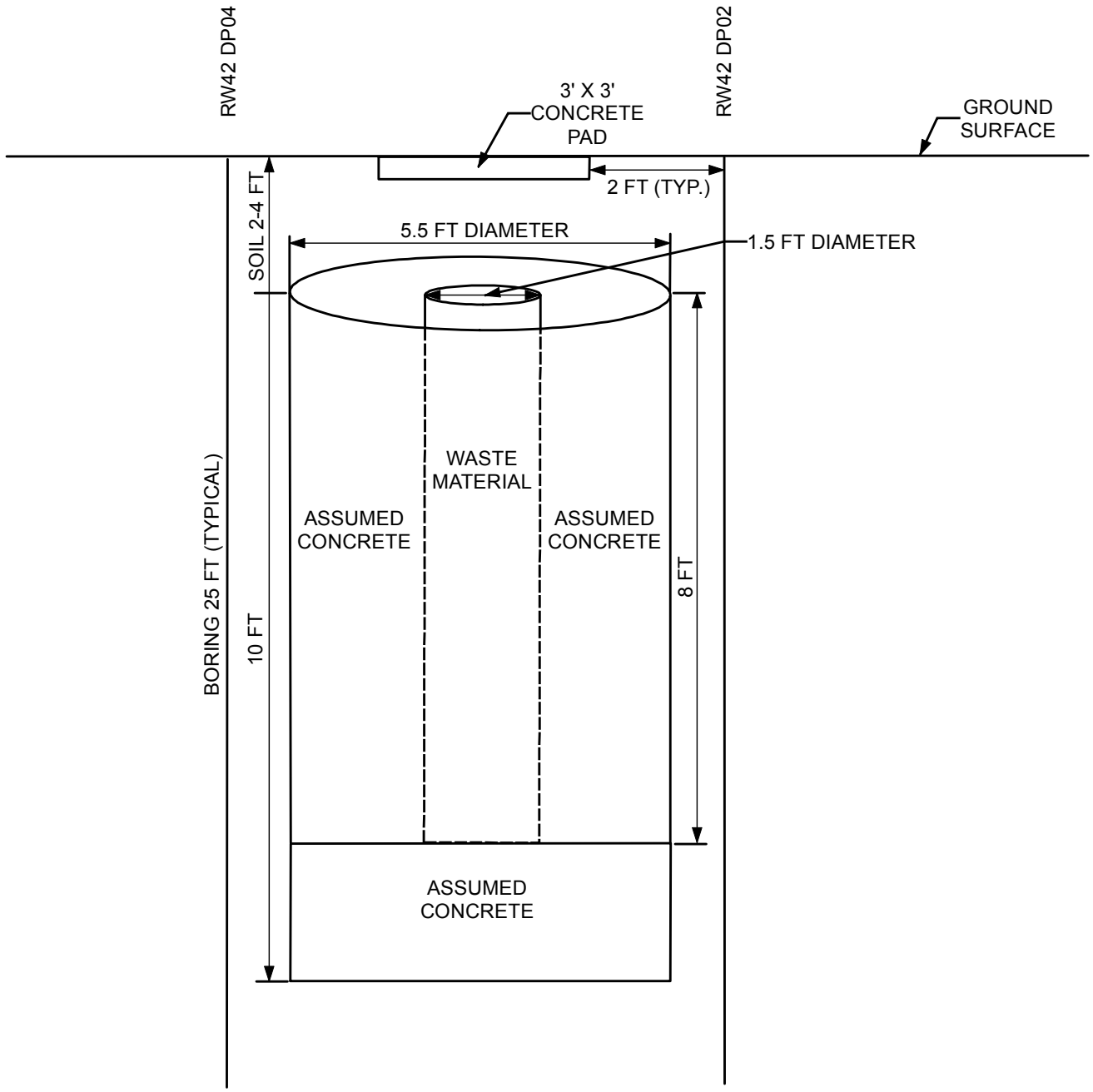
**Holloman Air Force Base**
**USAF**

June 2016

**Figure 4. Concrete Pad Marking Location of Buried Waste Container at Site RW-42**

**Figure 5 Photograph of Site RW-42 Looking West**

**Figure 6 Photograph of Site RW-42 Access Gate Looking North to Concrete Pad**




| | |
|---|---|
| Designed | ARJ |
| Drawn | LED |
| Checked | RLH |
| Peer Review | LB |
| Project Manager | BGP |
| Project Number | 60425210.23446543 |

**Figure 7**

**Site RW-42 Buried Waste Containment Structure Schematic**

**Holloman Air Force Base**

**USAF**

June 2016

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**Figure 8. Concrete "Plug" Attached to Concrete Pad**

**Figure 9. Exposed Top of Concrete Waste Disposal Cylinder**

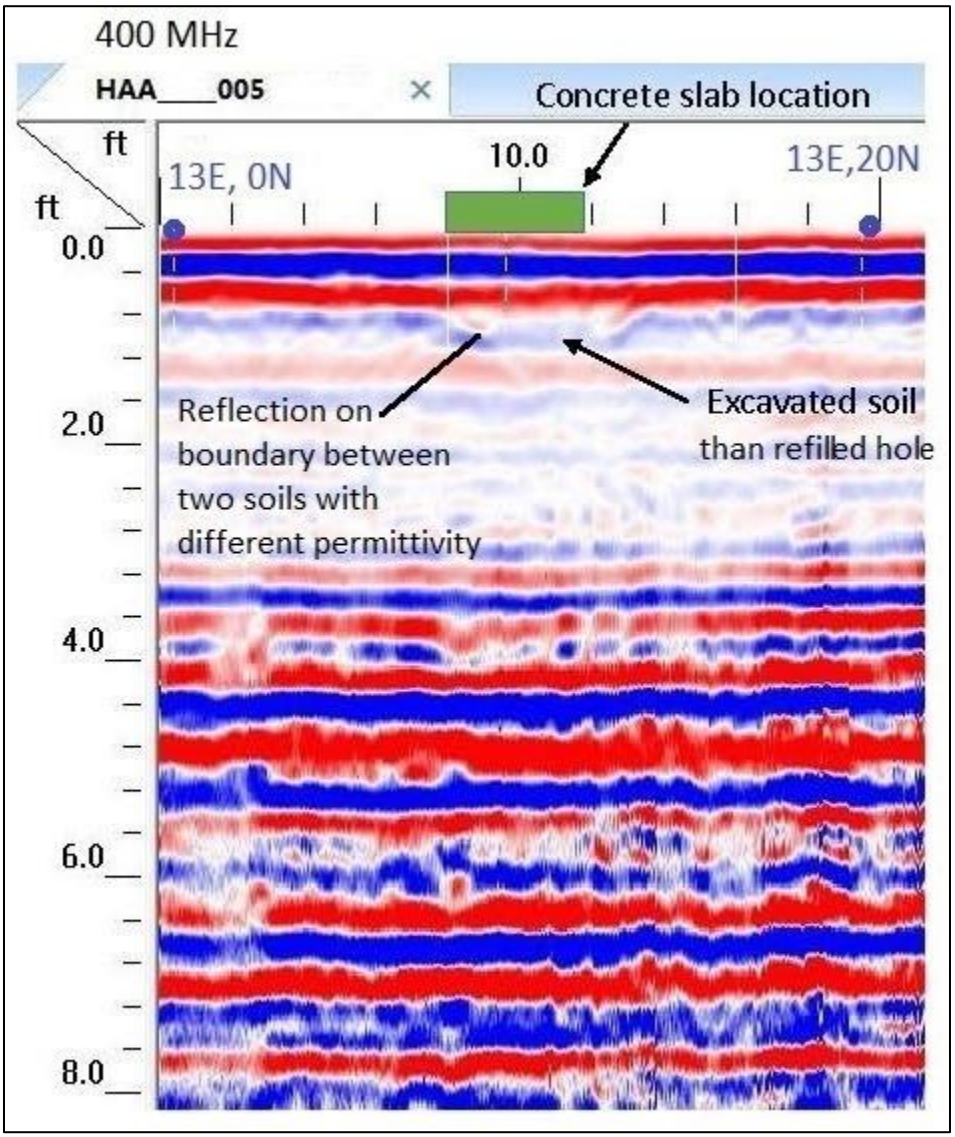



**Figure 10. Site RW-42 GPR Profile 1, 400 MHz Antenna**

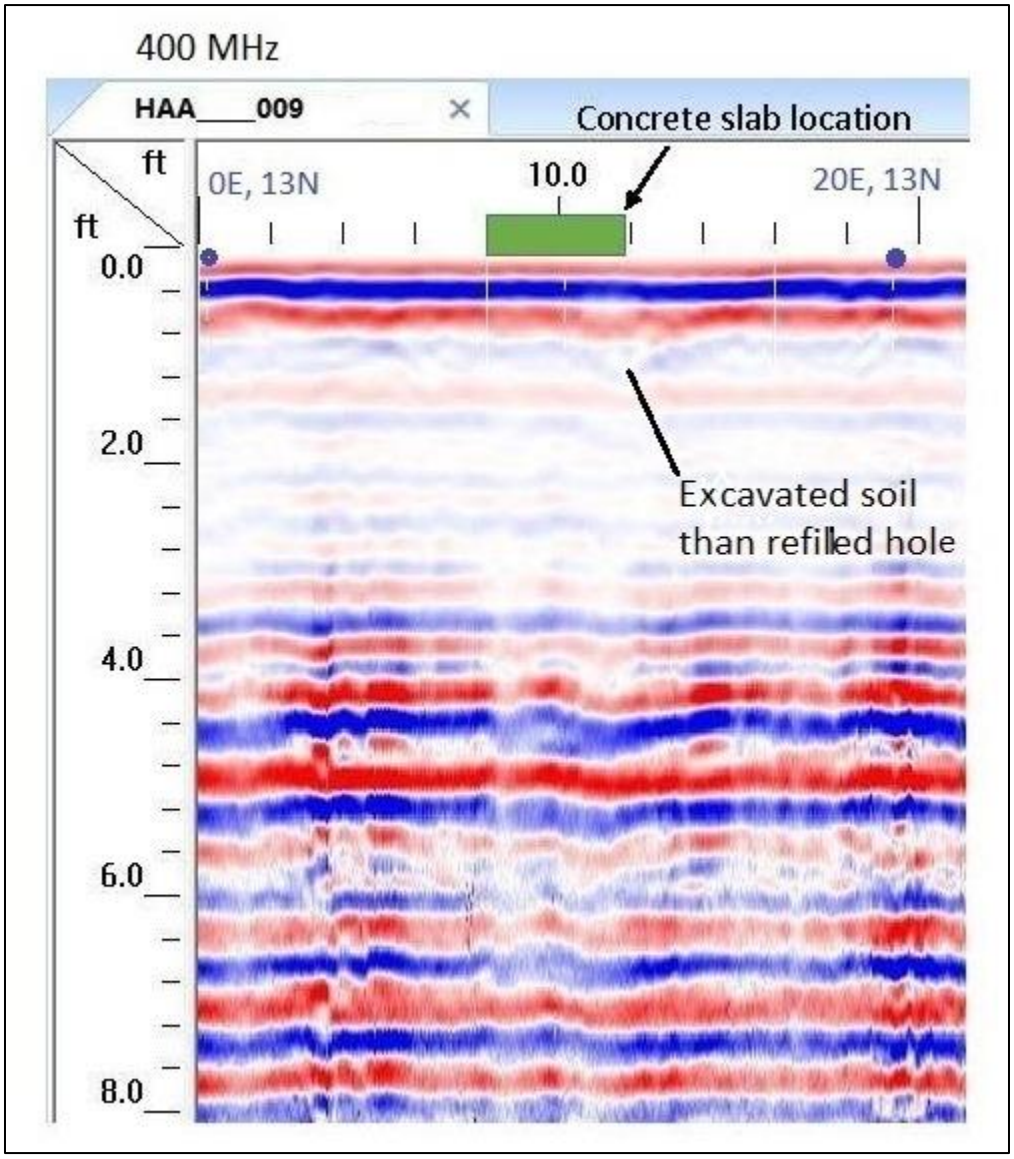



**Figure 11. Site RW-42 GPR Profile 2, 400 MHz Antenna**

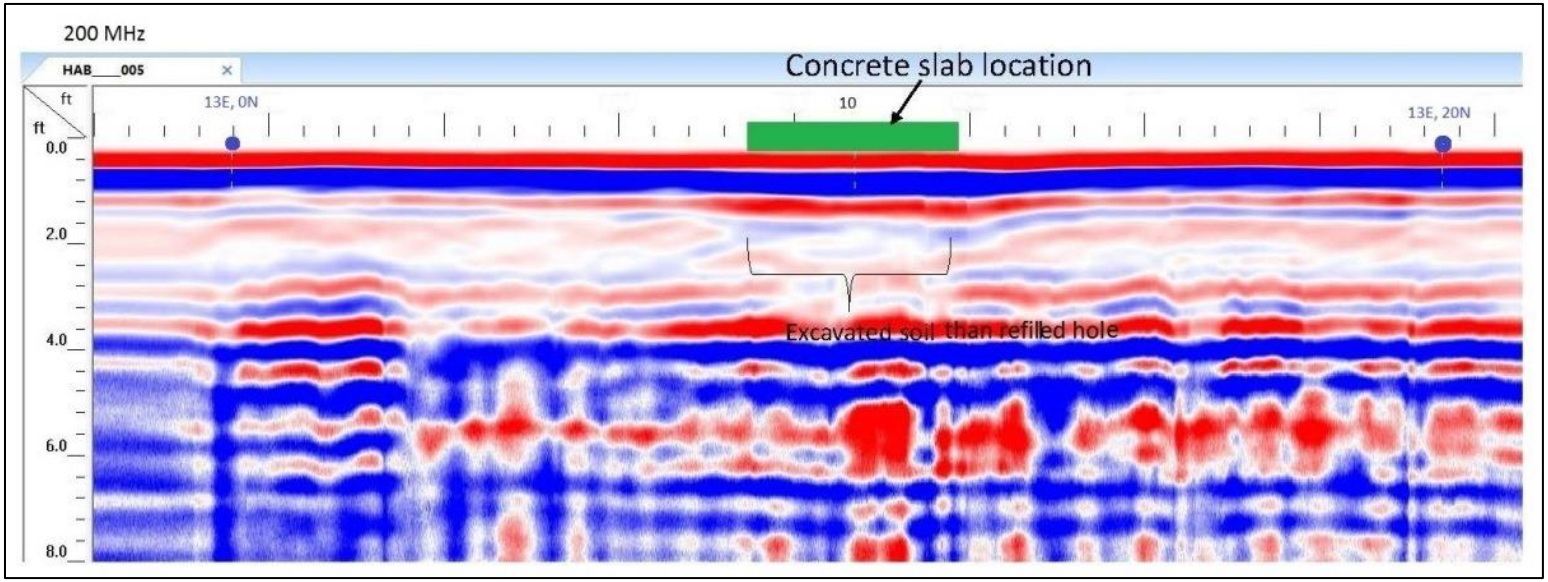
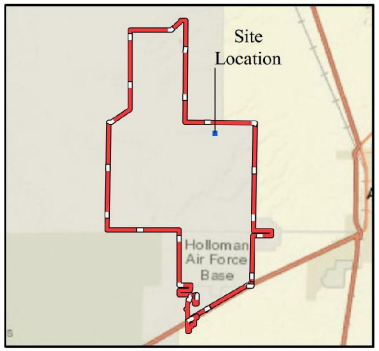
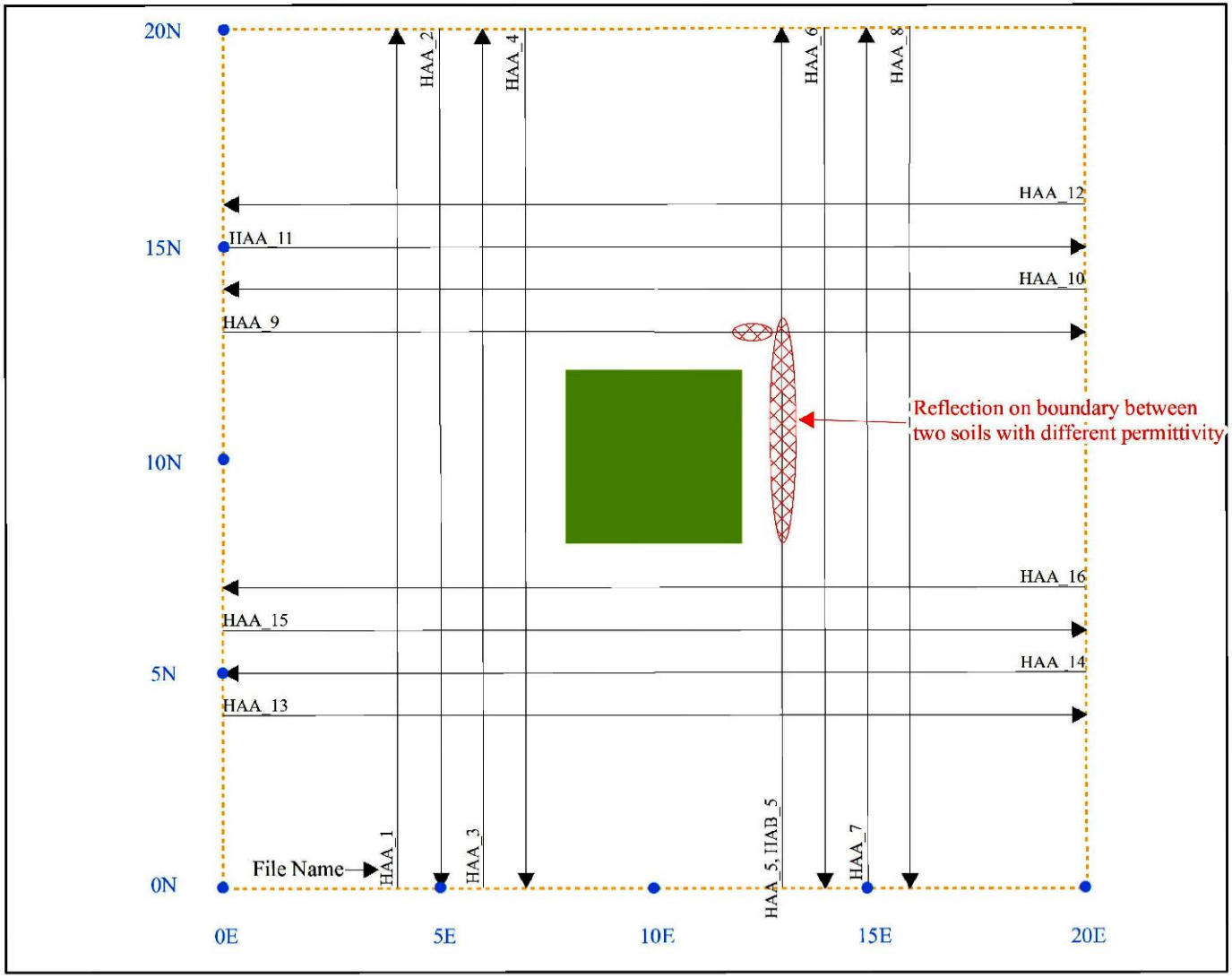



**Figure 12. Site RW-42 GPR Profile 3, 200 MHz Antenna**




**Legend**

- GPR Transects (400 MHz)
- Survey Area (20 x 20 feet)
- Concrete Slab (4 x 4 feet)
- Local Coordinate Marker




Source:
Modified from FPM Remediations, Inc., 2016.

Coordinate System:NAD 1983 UTM Zone 13N
Projection: Transverse Mercator
Horizontal Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -105.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

1 inch = 4 feet

0 0.5 1 Meters

0 2 4 Feet

URS

| | |
|---|---|
| Designed | RLH |
| Drawn | LED |
| Checked | LB |
| Peer Review | JDM |
| Project Manager | BGP |
| Project Number | 23446543 |

**Figure 13**

**Site RW-42**
**Preliminary GPR Interpretation, 400MHz-Antenna**

**Holloman Air Force Base**
**USAF** June 2016

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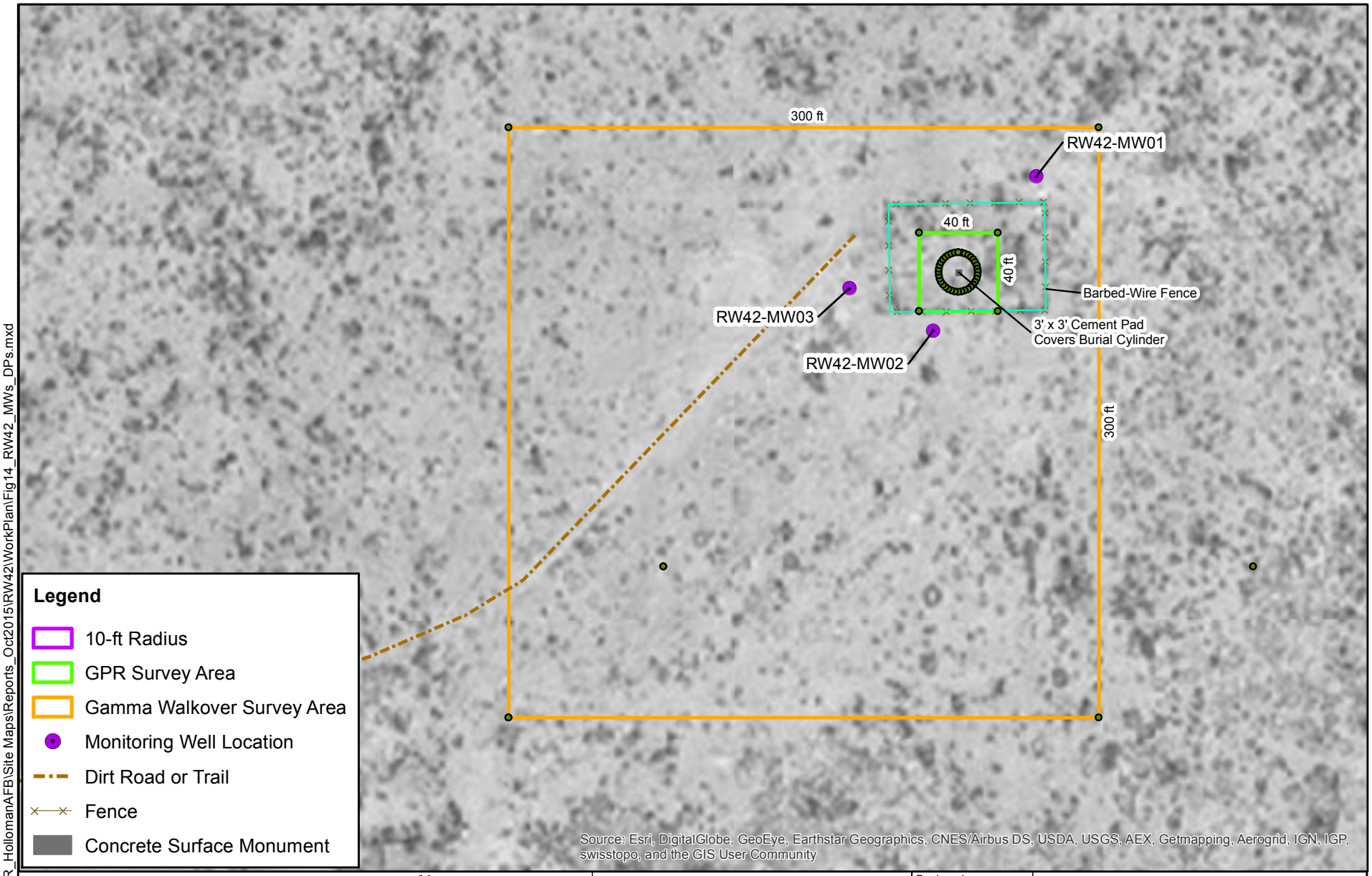


Note:

Sources:
HAFB, CBI, ULS Services Corp.

Coordinate System:
NAD 1983 State Plane,
New Mexico Central Zone, Feet

N W E S

0 10 20 30 40 50 60 70 140
Scale in Feet
1 inch = 70 feet

URS

| | |
|---|---|
| Designed | RLH |
| Drawn | LED |
| Checked | LB |
| Peer Review | LB |
| Project Manager | BGP |
| Project Number | 23446543 |

**Figure 14**

**Site RW-042**
**Survey Areas**

**Holloman Air Force Base**
**USAF**

June 2016

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# APPENDIX A

# URS Utah Radioactive Materials License UT1800410

DRC-03
October 1989

# UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
# DIVISION OF RADIATION CONTROL
# RADIOACTIVE MATERIAL LICENSE

Pursuant to Utah Code Ann. Title 19, Chapter 3 and the Radiation Control Rules, Utah Administrative Code R313, and in reliance on statements and representations heretofore made by the licensee designated below, a license is hereby issued authorizing such licensee to transfer, receive, possess, and use the radioactive material designated below; and to use such radioactive material for the purpose(s) and at the place(s) designated below. This license is subject to all applicable rules, and orders now or hereafter in effect and to any conditions specified below.

**********

| LICENSEE | | |
|---|---|---|
| 1. Name: | URS Professional Solutions LLC | 3. License Number UT 1800410<br>Amendment # 11 |
| 2. Address: | 756 East Winchester Street, Suite 400<br>Salt Lake City, Utah 84107 | 4. Expiration Date<br>July 31, 2023 |
| | | 5. License Category – 3-n<br>Administrative amendment action |

**********

Effective February 14, 2014, Utah Administrative Code Subsection R313-22-34(1) states that specific licenses for a renewed license shall expire ten years after the expiration date of the previous version of the license. Consequently, the Utah Division of Radiation Control is extending the expiration dates of all previously renewed specific licenses by five (5) years.

This Radioactive Materials License is amended as follows:

Item 4. to read: July 31, 2023

UTAH DIVISION OF RADIATION CONTROL

6/17/2014
Date

Rusty Lundberg
Rusty Lundberg, Director

**RENEWAL**

# UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
# DIVISION OF RADIATION CONTROL
# RADIOACTIVE MATERIAL LICENSE

Pursuant to Utah Code Ann. Title 19, Chapter 3 and the Radiation Control Rules, Utah Administrative Code R313, and in reliance on statements and representations heretofore made by the licensee designated below, a license is hereby issued authorizing such licensee to transfer, receive, possess and use the radioactive material designated below; and to use such radioactive material for the purpose(s) and at the places(s) designated below. This licensee is subject to all applicable rules, and orders now or hereafter in effect and to any conditions specified below.

**********

LICENSEE

1. Name: URS Professional Solutions LLC

2. Address: 756 East Winchester Street, Suite 400
Salt Lake City, Utah 84107

3. License Number UT 1800410
Amendment #10

4. Expiration Date
July 31, 2018

5. License Category - 3-n
In accordance with letter dated January 10, 2013, and electronic mail dated July 3, 2013, this license is amended in its entirety.

**********

| 6. Radioactive material (element and mass number) | 7. Chemical and/or physical form | 8. Maximum quantity licensee may possess at any one time |
|---|---|---|
| A. Radionuclides with atomic numbers 3 through 92, inclusive; depleted Uranium; natural Uranium; natural Thorium | A. Environmental or wipe sample(s) | A. Not to exceed 296 kilobecquerels (8 μCi) of Radium-226; and 1.85 gigabecquerels (50 mCi) total activity; 150 kilograms $U_{depleted}$; 73 kilograms $U_{nat}$; 227 kilograms $Th_{nat}$ |
| B. Radionuclides with atomic numbers 3 through 92, inclusive; depleted Uranium; natural Uranium; natural Thorium | B. Metal, sludge, soil type materials, debris, including sample size quantities stored in U.S. Department of Transportation approved shipping containers | B. Not to exceed 37 gigabecquerels (1 Ci) total activity; 3,000 kilograms $U_{depleted}$; 1,465 kilograms $U_{nat}$; 4,541 kilograms $Th_{nat}$ |
| C. Radionuclides with atomic numbers 10 through 92, inclusive | C. Standard Reference Materials: commercial check sources and solids sealed in laboratory assay containers | C. Not to exceed activity limits specified in R313-15-1401(2)(c); Ra-226 not to exceed 74 kilobecquerels (2 μCi) per container or 222 kilobecquerels (6μCi) total |

**UTAH DIVISION OF RADIATION CONTROL**
**RADIOACTIVE MATERIALS LICENSE**
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Amendment # 10

**********

9. AUTHORIZED USE

A. For possession and use as contamination incidental to sample analysis.

B. For possession incidental to decontamination, decommissioning, surveying, packaging, and transfer in accordance with R313-19-41.

C. For possession and use as check, calibration, or reference sources.

**********

CONDITIONS

10. A. Licensed materials in Item 6.A and 6.B shall be used only at temporary job sites of the licensee anywhere in the State of Utah where the Division maintains jurisdiction for regulating the use of licensed material. Except for calibration sources, reference standards, and radioactive contaminated equipment owned by the licensee, possession of licensed material at each temporary job site shall be limited to material originating from each site. This material must either be transferred to an authorized recipient or remain at the site after licensee activities are completed.

B. Licensed material in Item 6.C shall be used at the licensee's facilities located at 756 East Winchester Street, Suite 400, Salt Lake City, Utah, and at temporary job sites of the licensee anywhere in the State of Utah where the Division maintains jurisdiction.

11. The licensee shall comply with the provisions of R313-18 "Notices, Instructions and Reports to Workers, by Licensees or Registrant--Inspections" and R313-15, "Standards for Protection Against Radiation."

12. Licensed material shall be used by, or under the supervision and in the physical presence of, individuals who have been trained, as specified in the licensee's application dated May 28, 2008 and who have been designated by the licensee's Radiation Safety Officer. The licensee shall maintain records of individuals so designated.

13. The Radiation Safety Officer for the activities authorized by this license is Amy Robin Jones.

14. The Radiation Safety Officer may delegate certain duties to specific individuals provided that:

A. The licensee maintain, for a period of three years, records of all individuals designated by the Radiation Safety Officer to perform duties or meet regulatory requirements that would otherwise be required as a duty of the Radiation Safety Officer. These records shall include:

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(1) The name of the individual;

(2) A list of all duties the Radiation Safety Officer's designee is authorized to perform;

(3) The date upon which the designation became effective;

(4) The signature of the Radiation Safety Officer's designee; and

(5) The signature of the Radiation Safety Officer.

B. The Radiation Safety Officer shall review records generated by designees and the performance of designees quarterly. In addition, the licensee shall maintain for Division inspection for a period of three years, records of the quarterly reviews of records generated by designees and quarterly reviews of designee's performance. These records shall include:

(1) The date of the review;

(2) The records being reviewed and the name of the designee being reviewed;

(3) A list of all duties performed by the designee;

(4) The results of the Radiation Safety Officer's review and any corrective measures taken, if applicable, based on the review; and

(5) The signature of the Radiation Safety Officer.

15. The licensee shall notify the Director in writing at least 14 days before initiating activities under this license at a temporary job site located in the State of Utah. This notification shall include:

A. The estimated type, quantity, and physical/chemical forms of licensed material to be used;

B. The specific site location;

C. A description of planned activities including waste management and disposition;

D. The estimated start date and completion date for the job; and

E. The name and title of a point of contact for the job, including information on how to contact the individual.

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16. This license does not authorize the use of licensed material at temporary job sites for uses already specifically authorized by a customer's license. If a customer also holds a license issued by the Director, Nuclear Regulatory Commission or an Agreement State, the licensee shall establish a written agreement between the licensee and the customer specifying which licensee activities shall be performed under the customer's license and supervision, and which licensee activities shall be performed under the licensee's supervision pursuant to this license. The agreement shall include a commitment by the licensee and the customer to ensure safety, and any commitments by the licensee to help the customer clean up the temporary job site if there is an accident. A copy of this agreement shall be included in the notification required by License Condition 15.

17. The licensee shall maintain records of information important to decommissioning each temporary job site at the applicable job site pursuant to R313-22-35(7) or equivalent Nuclear Regulatory or Agreement State regulations. The records shall be made available to the customer upon request. At the completion of activities at a temporary job site, the licensee shall transfer these records to the customer for retention.

18. Pursuant to R313-12-55, and License Condition 10, the licensee is exempted from the requirements of R313-22-35 to establish decommissioning financial assurance.

19. Notwithstanding the requirements in R313-22-32(8), the licensee is not required to establish an emergency plan. Before taking possession of licensed material at a temporary job site in quantities requiring an emergency plan the licensee shall either:

    A. Obtain the Director's approval of an evaluation demonstrating that an emergency plan is not required pursuant to R313-22-32(8); or

    B. Submit written confirmation to the Director, that licensee personnel have been trained and will follow the provisions of an existing emergency plan approved by the Division, Nuclear Regulatory Commission or an Agreement State for the temporary job site.

20. If approved by the Radiation Safety Officer specifically identified in this license, the licensee may take reasonable action in an emergency that departs from conditions in this license when the action is immediately needed to protect public health and safety and no action consistent with all license conditions that can provide adequate or equivalent protection is immediately apparent. The licensee shall notify the Director before, if practicable, and in any case immediately after taking such emergency action using the reporting procedure specified in R313-19-50(3).

21. Within 30 days of completing activities at each job site location, the licensee shall notify the Director in writing of the temporary job site status and the disposition of any licensed material used.

22. The licensee shall conduct a physical inventory every six months to account for all licensed material possessed under this license. The records of the inventories shall be maintained for three years from the date of the inventory for inspection by the Division, and shall include the quantities and kinds of radioactive

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material, the location of the radioactive material, and the date of the inventory.

23. Radioactive material shall not be used in products distributed to the public.

24. The licensee shall not use licensed material in or on human beings except as provided otherwise by specific condition of this license.

25. This license does not authorize commercial distribution of licensed material.

26. The licensee shall transport licensed material or deliver licensed material to a carrier for transportation only in accordance with the provisions of R313-19-100 "Transportation."

27. The licensee shall notify the Division in writing when the licensee decides to permanently discontinue activities in Utah involving materials authorized under the license, and report to the Division the disposition of the material.

28. Except as specifically provided otherwise, by this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The Utah Radiation Control Rules shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the rules.

    A. Letter dated January 10, 2013 [LA# 9-2013]
    B. Electronic mail dated July 3, 2013 [LA# 112-2013]

UTAH DIVISION OF RADIATION CONTROL

8/1/2013
Date

Rusty Lundberg
Rusty Lundberg, Director