

Abandoned Uranium Mine Site Assessment for the Varnum Site (NM0116)

FINAL REPORT

Prepared For:



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NM0116

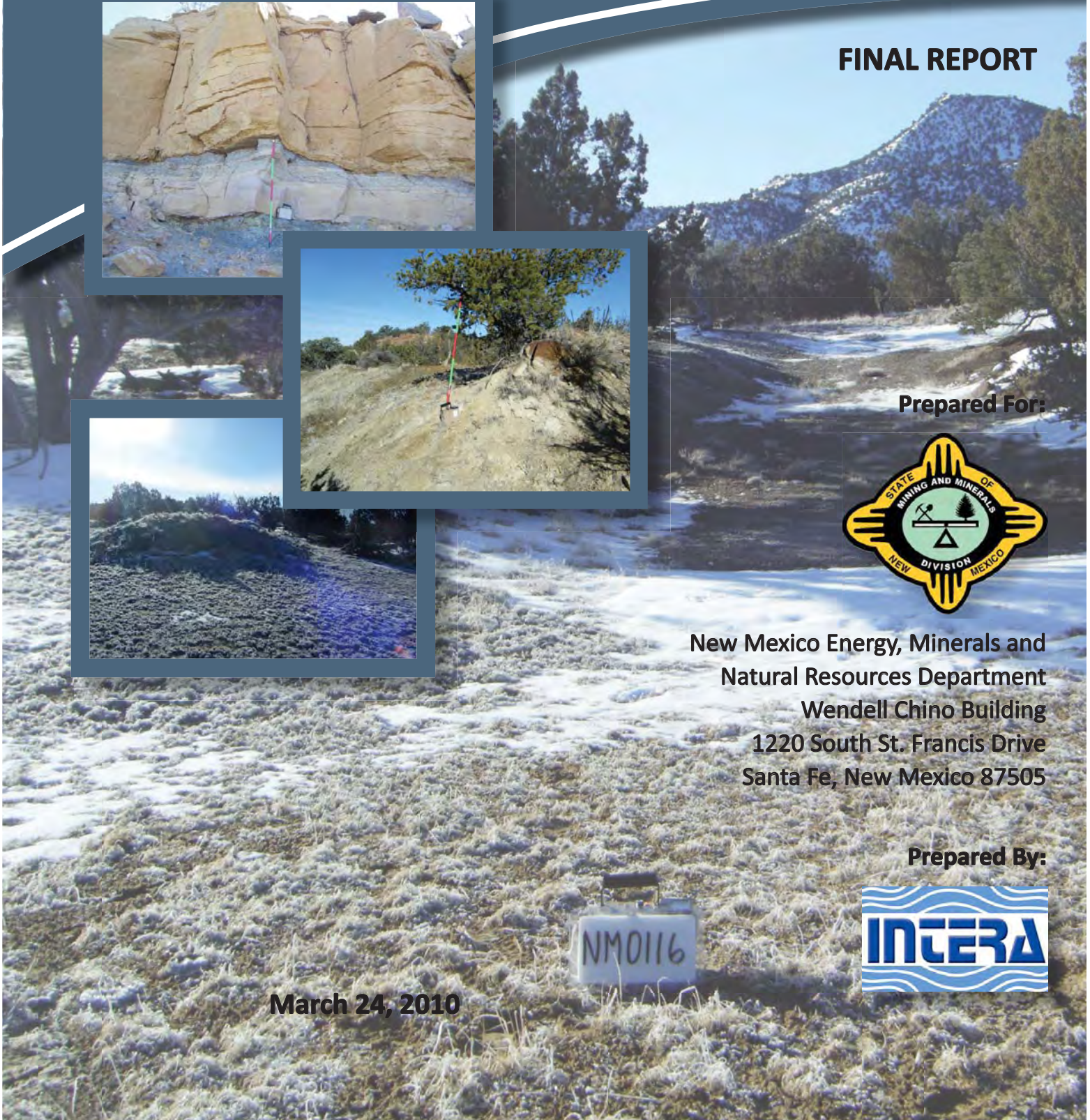


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1.0 INTRODUCTION

INTERA Incorporated (INTERA) has prepared this Abandoned Uranium Mine (AUM) Site Assessment Report for the Mining and Minerals Division (MMD) of the New Mexico Energy, Minerals and Natural Resources Department (EMNRD) in compliance with the Professional Service Agreement dated November 2, 2009. INTERA visited the Varnum Site (AUM Site), MMD ID: NM0116, on February 26, 2010.

1.1 PREVIOUSLY KNOWN INFORMATION ABOUT THE SITE

The AUM Site includes the Varnum prospect. Anderson, 1980, reported that the Site consists of a bulldozer cut (10 x 15 x 2 ft) and a small dump. No radiation readings were recorded and no uranium bearing minerals were found during the Anderson visit. The bulldozer cut was located in Mesaverde Group sandstones (Anderson, 1980).

1.2 SITE LOCATION AND DIRECTIONS

The AUM Site is on State Trust land administered by the New Mexico State Land Office. Access to this site was by permission of the State Land Office. Part of the site is also located on private land owned by the Great Western Cattle Company. Mine features are found in the northern half of Section 21, Township 3 North, Range 16 West. The Site is located in Catron County and is approximately 9 miles north of the town of Quemado. The location of this Site was provided to INTERA by MMD.

To access the AUM Site from Albuquerque, drive west on Interstate 40 for 73 miles. Take Exit 89 towards Quemado and continue south along New Mexico 117 for 57 miles. At the junction between New Mexico 117 and New Mexico 36, turn left and continue south on New Mexico 36 for 21.5 miles. When you reach the town of Quemado, turn right on US 60, then take any of the roads on your right through the town. Proceed through Quemado and turn left on Candelaria Street (the last street on the north side of town). Follow Candelaria Street as it takes a sharp turn to the right (north) and becomes County Road A028. Continue north on County Road A028 for about 9 miles. As you drive north along the County Road, you will pass to the east of an isolated mesa named Mesa Tinaja. The road will bend west around this mesa, and you will drive through headquarters of a ranch. Once past the ranch, drive northwest on the County Road for another 0.5 mile, then park and continue to the AUM Site on foot (approximately 0.25 miles).

1.3 SITE GEOLOGY

The AUM Site is located in the transition zone between the Colorado Plateau to the north and the Basin and Range to the south (DBSA, 2005). The AUM Site consists of the Cretaceous Moreno Hill Formation, which outcrops extensively northwest of Quemado. The Moreno Hill Formation represents a shoreline environment during a predominantly regressive stage of the Western Interior Seaway. A variety of sedimentary rocks are found within this formation, including channel sandstones, siltstones, mudstones, and some coal (Hoffman, 1996). The Moreno Hill Formation is approximately 500 feet thick at Tejana Mesa, south of the Site. Beds in this region

dip gently to the south (Chamberlin *et al*, 1994). At the AUM Site itself, sandstone forms the caprock of low mesas, separated by shallow valleys incising mudstones and shales. Photo NM0116_015 was taken alongside one such mesa and shows the resistant sandstone underlain by friable shale. Radioactive anomalies were found along hillsides in loose soil. No actual rock samples were found that had above-background radiation levels, suggesting that the source of the anomaly may be a shale or very loose sandstone.

1.4 SITE HYDROGEOLOGY

The surface runoff at the AUM Site discharges northwest to Tejana Draw. No permanent surface water is visible within a 10 mile radius of the AUM Site.

The AUM Site lies within the Carrizo Wash Basin. This basin lies between the Gallup Basin to the north and the San Francisco Basin to the south. The Cretaceous Mesaverde Group is the only significant aquifer in the AUM Site area. Water resources are not extensive, and are mostly useful for stock wells (DBSA, 2005).

1.5 REGIONAL TOPOGRAPHY AND TERRAIN

The AUM Site is found on the Tejana Mesa Quadrangle 7.5 minute United States Geological Survey topographic map at an elevation of approximately 6800 feet above mean sea level (please see Figure 2). The AUM Site is located along the north side of a shallow valley north of Mesa Tinaja, a small, freestanding mesa that rises about 700 feet above the surrounding area. Figure 3 shows an aerial photograph of the terrain surrounding the AUM Site.

2.0 MINE FEATURES

The mine features described below are based on the features provided to INTERA by MMD in the GIS Data Dictionary (MMD, 2009). INTERA marked the locations of the AUM Site features using a Trimble Global Positioning System (GPS) and entered details about the features into the GPS using the MMD data dictionary. Please see the Photo Log in Appendix A, Table 1 for a list of AUM Site features, and Figures 4a and 4b for the locations of the AUM Site features.

2.1 MINE SHAFTS, ADITS, AND DECLINES

No shafts, adits, or declines were found at the AUM Site.

2.2 MINING AND EXPLORATION PITS AND OPEN CUTS

One shallow open cut (Cut-1) was found onsite. No bedrock was found inside the cut, although infilling due to erosion may have obscured the original target of excavation. A gamma reading conducted inside Cut-1 found 14 $\mu\text{R/hr}$, which is approximately equivalent to background level for the Site.

2.3 WASTE AND ORE PILES AND DISTURBANCES

Two piles were discovered at the AUM Site. One pile (PilePly-1) probably represents material excavated from Cut-1. PilePly-1 consists of mostly soil with scattered rocks about a foot in diameter. The other pile (PilePly-2) is a low mound of broken rocks. Neither pile showed gamma readings above background for the Site.

2.4 MINING RELATED BUILDINGS AND FOUNDATIONS

No mining related buildings and foundations were evident at the AUM Site. A ranch house with associated corrals and barns is located approximately 0.8 miles southeast of the Site.

2.5 OTHER MINE FEATURES

No other mine features were evident at the AUM Site.

2.6 BOREHOLES

No boreholes were evident at the AUM Site.

2.7 RECLAMATION ACTIVITIES

No apparent reclamation activities have taken place at the AUM Site.

3.0 ARCHEOLOGICAL SITES

No apparent archeological sites were identified at or near this AUM Site.

4.0 SITE GAMMA RADIATION READINGS

One background gamma radiation reading was taken at the AUM Site, recording 11 $\mu\text{R/hr}$ at contact and 12 $\mu\text{R/hr}$ at 4 ft above ground. Please see Table 2 for all of the gamma radiation readings taken at the AUM Site and Figures 4a and 4b for the locations of the radiation readings.

The maximum gamma radiation reading for the AUM Site was 100 $\mu\text{R/hr}$ at contact at point Rad-8. This reading was recorded on a soil-covered hillside (see Photo 13). Adjacent bedrock was not radioactive. One other location (point Rad-5) recorded 30 $\mu\text{R/hr}$ at contact, approximately 3 times background level. Like point Rad-8, this location was covered with soil; nearby rocks were not radioactive.

5.0 CURRENT LAND USES

5.1 HUMAN ACTIVITY AND RECREATIONAL SITE USE

The AUM Site and surrounding land are used for cattle ranching. No human activity other than ranching was noted.

5.2 NEARBY RESIDENTIAL, COMMERCIAL AND INDUSTRIAL STRUCTURES

No structures were noted on the AUM Site. A ranch house is located approximately 0.8 miles southeast of the Site.

5.3 NEARBY DOMESTIC WELLS

No wells were observed within a mile of the AUM Site.

5.4 EVIDENCE OF GRAZING OR AGRICULTURE

Cow droppings were noted in the area.

5.5 EVIDENCE OF WILDLIFE

Deer or elk tracks were noted in the snow (see Photo 2 in Appendix A). Possible rodent nests were also observed.

6.0 VEGETATION

The Varnum site is located in a Juniper Savanna (Ecotone). The site appears to be dominated by shrub species which include pinyon pine as well as juniper species (most likely Utah juniper), snakeweed and banana yucca. A grass community was observed that may contain various species of *Aristida* Spp. (three-awns). No forbs were collected at the site and no evidence of noxious weeds was observed on the site.

7.0 POTENTIAL OFFSITE IMPACTS

7.1 EROSION

No erosion was associated with mine features.

7.2 ENVIRONMENTAL IMPACTS

There is no evidence of soil staining from chemicals potentially brought to the AUM Site.

8.0 REFERENCES

- Anderson, Orin J., 1980. Abandoned or Inactive Uranium Mines in New Mexico. New Mexico Bureau of Mines and Mineral Resources Open File Report 148.
- Chamberlin, Richard M., Cather, Steven M., Anderson, Orin J., Jones, Glen E., 1994. Reconnaissance Geologic Map of the Quemado 30 x 60 Minute Quadrangle, Catron County, New Mexico. New Mexico Bureau of Mines and Mineral Resources Open File Report 406.
- Daniel B. Stephens & Associates, Inc (DBSA), 2005. Southwest New Mexico Regional Water Plan. Prepared for: Southwest New Mexico Regional Water Plan Steering Committee, Deming, New Mexico.
- Hoffman, Gretchen K., 1993. Influence of Depositional Environment on Clay Mineralogy in the Coal-Bearing Lower Moreno Hill Formation, Salt Lake Coal Field, West-Central New Mexico. New Mexico Bureau of Mines and Mineral Resources Open File Report 427.
- Mining and Minerals Division (MMD), 2009. Mine Feature Data Dictionary.
- New Mexico Office of the State Engineer (NMOSE), 2008. Wells and Surface Diversions in New Mexico. WATERS_PODS_may08.shapfile. OSE Waters Database.

TABLES

**Table 1
Site Features
Varnum-NM0116
Abandoned Uranium Mine Assessments**

Feature Name	On Site?	Feature Type	Associated Feature	Material	Height or Depth (ft)	Width or Diameter (ft)	Length (ft)	Open	Collapsed	Closure Type	Associated Photos	Notes
Access-1	Yes	Access Road	--	Dirt	--	--	--	--	--	--	--	--
Cut-1	Yes	Open Cut	--	--	2	20	50	--	--	--	NM0116_001	--
PilePly-1	Yes	Pile	--	Soil	8	20	20	--	--	--	NM0116_003-004	--
PilePly-2	Yes	Pile	--	Rock	3	10	15	--	--	--	NM0116_006-007	--

Notes:

-- designates no information



**Table 2
Gamma Radiation Survey Results**

**Varnum-NM0116
Abandoned Uranium Mine Assessments**

Reading ID	Associated Features	Reading at 0ft Above Ground (μR/hr)	Reading at 4ft Above Ground (μR/hr)	Associated Photos
Rad-1	Cut-1	14	14	--
Rad-2	PilePly-1	16	15	--
Rad-3	--	14	11	NM0116_005
Rad-4	PilePly-2	11	11	--
Rad-5	--	31	20	NM0116_011
Rad-6	--	11	12	--
Rad-7	--	14	12	--
Rad-8	--	100	27	NM0116_013
Rad-9	--	12	11	NM0116_014
Rad-10	--	20	18	NM0116_015
RadBack-1	--	11	12	--

Notes:

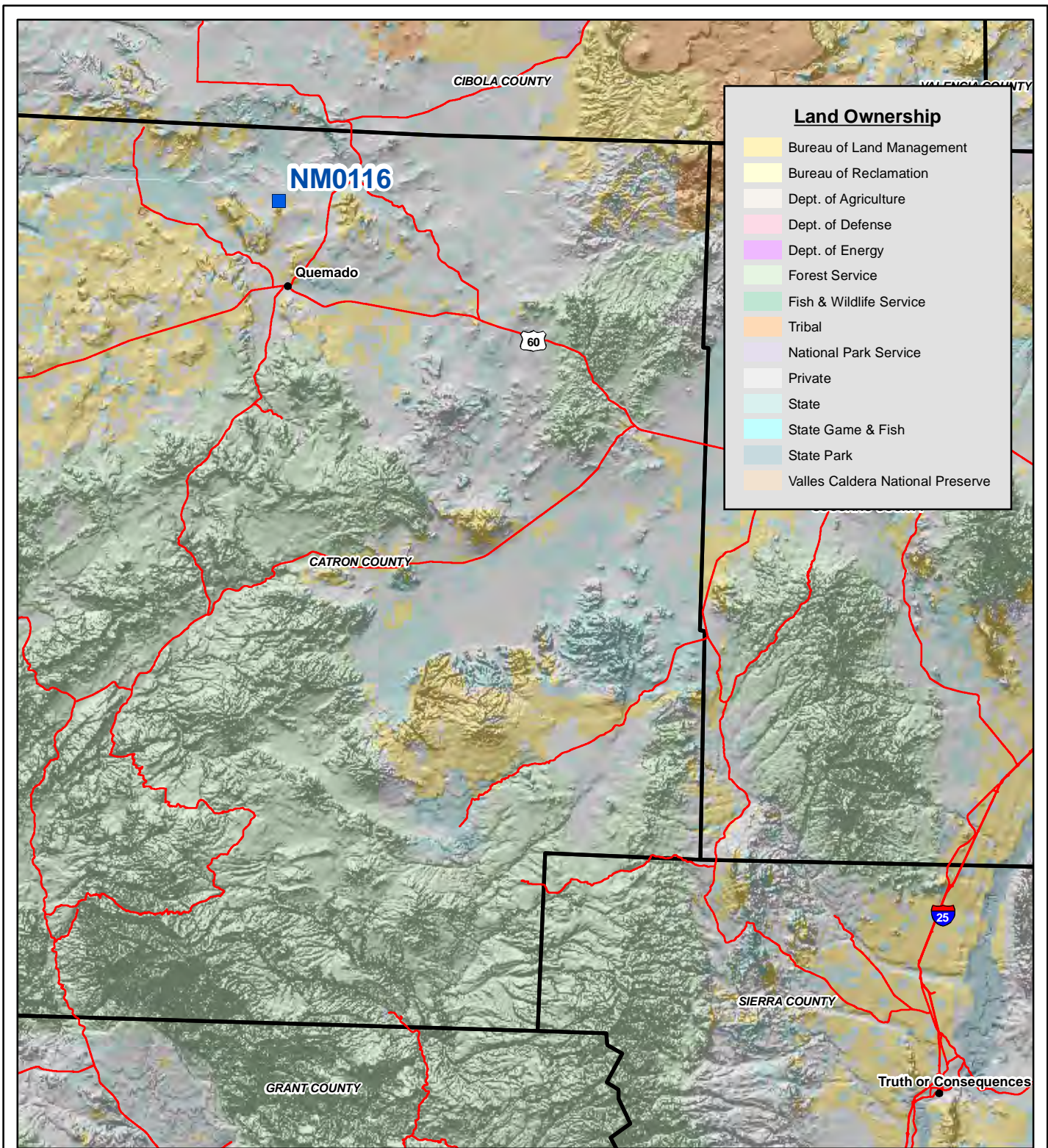
All gamma readings at this site taken by Ludlum 192 μR/Ratemeter

μR/hr=microroetgens per hour

-- designates no information



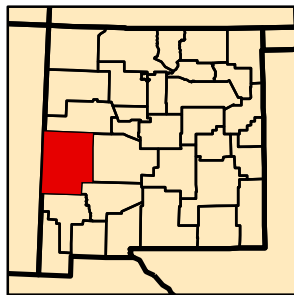
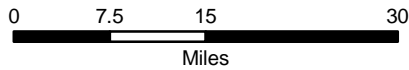
FIGURES



Land Ownership

- Bureau of Land Management
- Bureau of Reclamation
- Dept. of Agriculture
- Dept. of Defense
- Dept. of Energy
- Forest Service
- Fish & Wildlife Service
- Tribal
- National Park Service
- Private
- State
- State Game & Fish
- State Park
- Valles Caldera National Preserve

Map Source(s):
Ownership - BLM, 2007

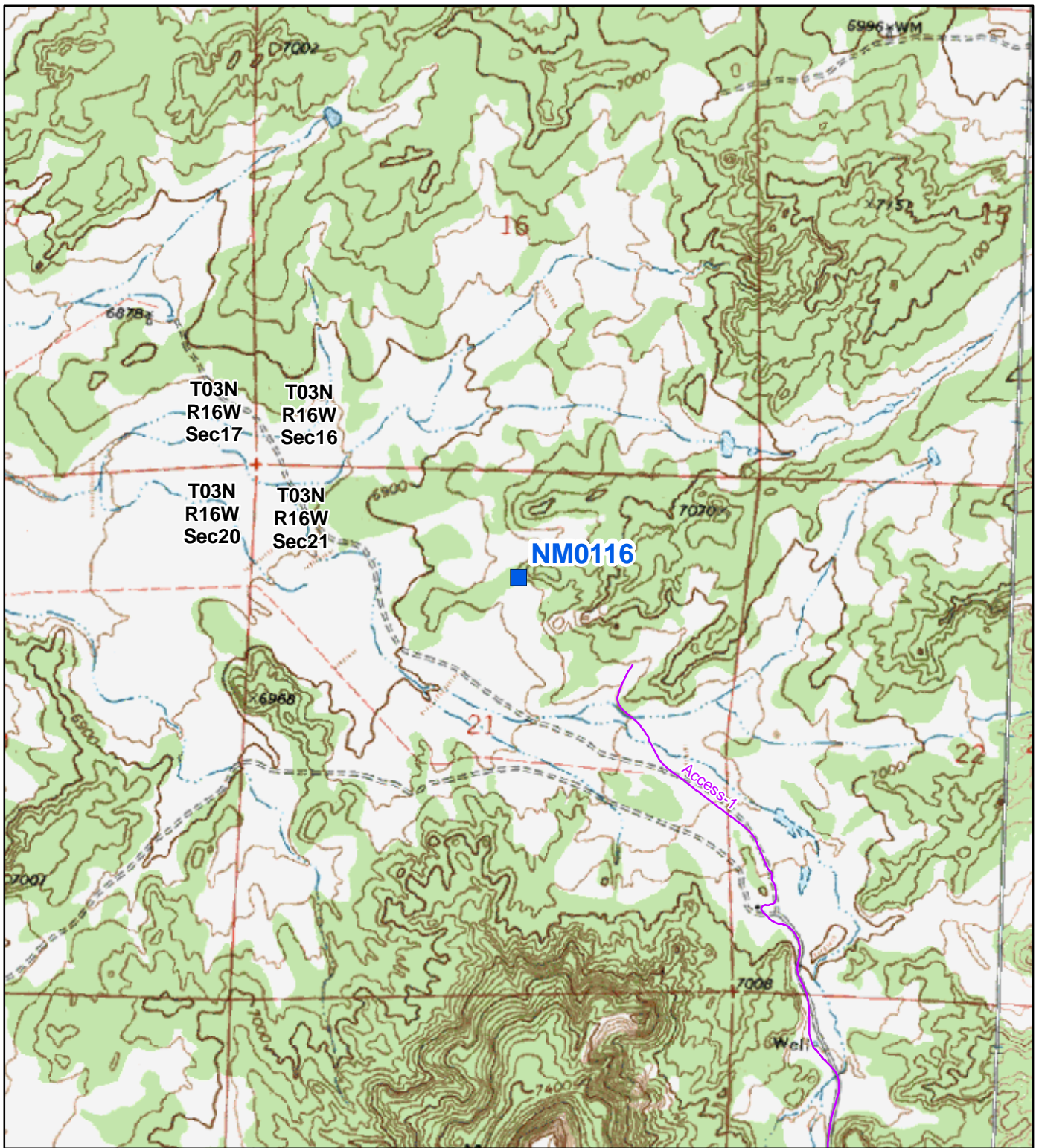


Legend

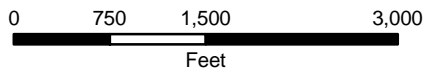
- AUM Location
- City/Town
- Road
- County Boundary

Figure 1
Site Location Map
NM0116-Varnum
Abandoned Uranium
Mine Assessment





Map Source(s):
 U.S. Geological Survey 7.5-Minute
 Topographic Map
 -Mariano Springs, 1967
 -Tejana Mesa, 1972



Note:
 There are no wells within 1 mile of the Site.

Legend

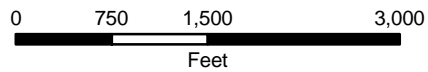
- AUM Location
- Access Route

Figure 2
Topographic Map
NM0116-Varnum
 Abandoned Uranium
 Mine Assessment





Map Source(s):
 U.S. Geological Survey 7.5-Minute
 DOQQ County Mosaic
 -Catron County, 2009



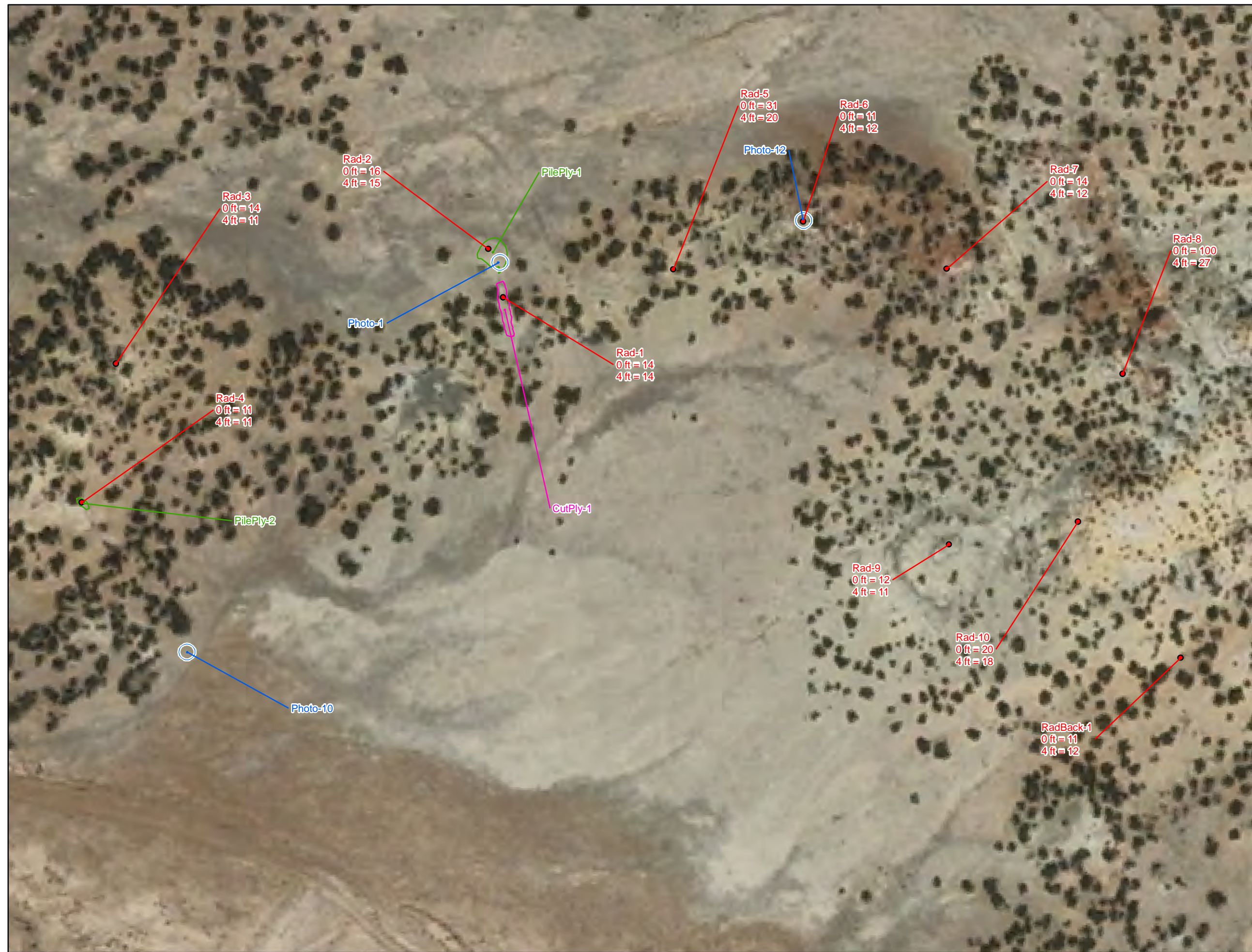
Note:
 There are no wells within 1 mile of the Site.

Legend

- AUM Location
- Access Route
- Section Boundary

Figure 3
Aerial Photo
NM0116-Varnum
 Abandoned Uranium
 Mine Assessment



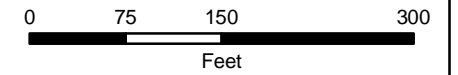


Legend

- Radiation Readings ($\mu\text{R/hr}$)
- Photo Location
- Open Cut Boundary
- Pile Boundary

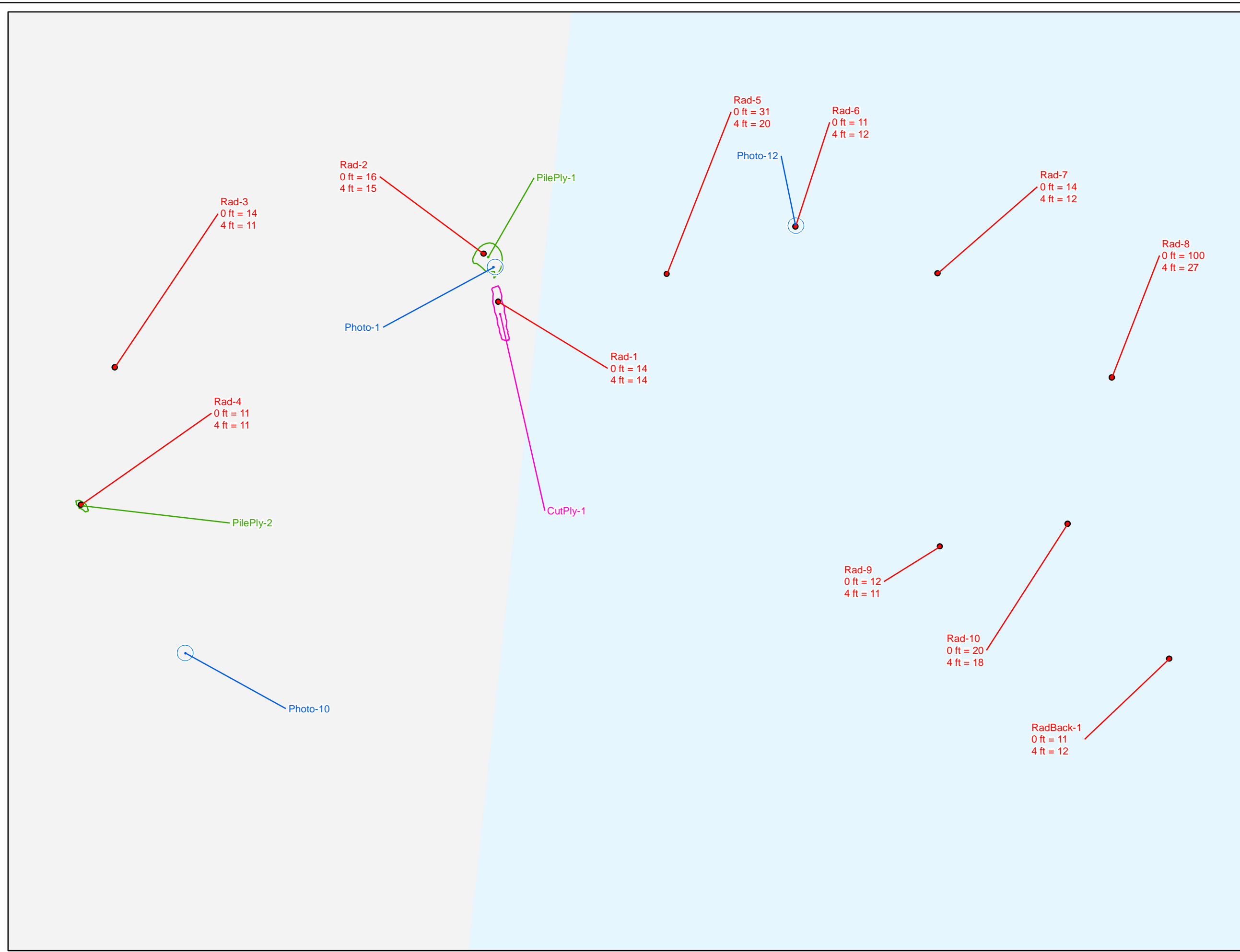
Surface Ownership

- State
- Private



Map Source(s):
 U.S. Geological Survey 7.5-Minute
 DOQQ County Mosaic
 -Catron County, 2009

Figure 4a
Site Map on
Aerial Photo
NM0116-Varnum
 Abandoned Uranium
 Mine Assessment

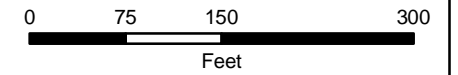


Legend

- Radiation Readings (µR/hr)
- Photo Location
- Open Cut Boundary
- Pile Boundary

Surface Ownership

- State
- Private



Map Source(s):
Ownership - BLM, 2007

Figure 4b
Site Map with
Surface Ownership
NM0116-Varnum
 Abandoned Uranium
 Mine Assessment

APPENDIX A

PHOTO LOG

Note: Gaps in the numbering sequence of the photos is the result of removing photos not suitable for the report. A full set of photos is provided in the electronic deliverable.



Photo 1-Site photo and view of Cut-1 in background, looking south (point Photo-1).



Photo 2-Animal tracks at the AUM Site.



Photo 3-Looking southeast at PilePly-1.



Photo 4-Looking southwest at PilePly-1 (foreground) and Cut-1 (background).



Photo 5-Looking southwest at point Rad-3.



Photo 6-Looking north at PilePly-2.



Photo 7-Looking west at PilePly-2.



Photo 8-Site photo, looking north.



Photo 10-Site photo, looking northwest (point Photo-10).



Photo 11-Photo of point Rad-5. Scintillometer marks the point of highest gamma readings.



Photo 12-Looking down and west at the AUM Site from a nearby hill (point Photo-12).



Photo 13-Looking west at point Rad-8. Scintillometer indicates area of highest gamma ray readings.



Photo 14-Point Rad-9, looking NE at the eastern edge of the AUM Site.



Photo 15-Looking east at point Rad-10.

APPENDIX B
FIELD NOTES

2/26/10 AEA

Abandoned Uranium Mines

Site Name: NMO116, Varnum

Objective: Site Assessment

Personnel: Amy Andrews
Danny Bowman

Equipment: Rental truck, Trimbel Geo XM
(SN: 4948447271, 2008 Series), Ludlum 142
(SN: 234149), Fuji Film digital camera
(No. 8U839493), backup Garmin GPS,
cell phone amplifier, field laptop

600 Pack truck + leave Datil for site

745 Arrive near site via Coburn County Road A028.
We had stopped at a ranch house not far
from the site + spoke to the woman who
lived there, who pointed us in the right
direction. Currently the roads are frozen
mud + ice, she said they thaw out around
noon and become very muddy + slippery.

810 Arrived at MMD shapefile location, no
visible features at the location, but found
a pile and a cut nearby. They do not
appear to be the ones in the Anderson
Report

2/26/10 AEA Abandoned Uranium Mines

Cut 1 - 20ft x 50ft, 2ft deep

Rad 1 - contact = 14 μ R/hr; 1m = 14 μ R/hr

Photo 1 - cut 1, looking S

Photo 2 - animal tracks, probably deer

Pile 1 - 20ft x 20ft, 8ft high

Rad 2 - contact = 16 μ R/hr; 1m = 15 μ R/hr

Photo 3 - pile 1, cut 1 is in background,
looking SE

Photo 4 - pile 1, cut 1 in background,
looking SW

Photo 5 - rad 3, looking SW

Rad 3 - contact = 14 μ R/hr; 1m = 11 μ R/hr

Pile 2 - 15ft x 10ft, 3ft high

Photo 6 - pile 2, looking N

Photo 7 - pile 2, looking W

Rad 4 - contact = 11 μ R/hr; 1m = 11 μ R/hr

Photo 8 - site photo, looking N

Photo 9 - evidence of wildlife

Photo 10 - site photo, looking NW

Rad 5 - contact = ~~35~~^{AEA} 31 μ R/hr; 1m = 20 μ R/hr

Photo 11 - Rad 5, anomalous high reading, no
mine features nearby, rock in upper left
of photo is not rad source

2/26/10 AEA Abandoned Uranium Mines

Photo 12 - site photo looking down on area where first 3 mine features were found, looking W

Rad 6 - contact = $11 \mu\text{R/hr}$; $1\text{m} = 12 \mu\text{R/hr}$

Rad 7 - contact = $14 \mu\text{R/hr}$; $1\text{m} = 12 \mu\text{R/hr}$

Rad 8 - contact = $100 \mu\text{R/hr}$; $1\text{m} = 27 \mu\text{R/hr}$

Photo 13 - rad 8, looking W

Rad 9 - contact = $12 \mu\text{R/hr}$; $1\text{m} = 11 \mu\text{R/hr}$

Photo 14 - rad 9, looking NE

Rad 10 - contact = $20 \mu\text{R/hr}$; $1\text{m} = 18 \mu\text{R/hr}$

Photo 15 - rad 10, looking E

Photos 16-20 vegetation

Radback - contact = $11 \mu\text{R/hr}$; $1\text{m} = 12 \mu\text{R/hr}$

1030 Offsite to Abq

Radiation at this site did not appear to originate from any visible outcrops