

Abandoned Uranium Mine Assessment for the Box Canyon Site (NM0177)

FINAL REPORT

Prepared For:



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NM0177

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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 Box Canyon Site (AUM Site), MMD ID: NM0177 on November 18, 2010.

1.1 PREVIOUSLY KNOWN INFORMATION ABOUT THE SITE

According to Anderson (1980), workings at the site consist of an open cut 260 ft long and up to 50 ft wide exposing a lower Morrison formation sequence of sandstone, mudstone, and claystone. The Todilto limestone was exposed along the base of the south wall (Anderson, 1980). Scintillometer readings at this limestone outcrop were reported ranging up to 1,700 cps and other high readings were found at the waste piles, the majority of the waste was bulldozed into the canyons on either side of the site (Anderson, 1980). Anderson reported that a small, unknown amount of low grade ore was mined in 1957. According to McLemore (1983), 132 tons of ore yielding 253 pounds of 0.10% U_3O_8 and 212 pounds of V_2O_5 were produced in 1957.

1.2 SITE LOCATION AND DIRECTIONS

The AUM Site is located on Santa Fe National Forest land in the east half of the northwest quarter of Section 28, Township 23 North, Range 4 East. The AUM Site is in Rio Arriba County and is approximately 3 miles northeast of the town of Youngsville. The location of this Site was provided to INTERA by MMD.

To reach the AUM Site from Albuquerque, drive approximately 57 miles north on Interstate 25 and take exit 282 for US-84 W/US-285 N. Continue through Santa Fe and follow US-84 W/US-285 N approximately 26 miles north to Española. In Española, turn left on Paseo de Onate to continue following US-84 W/US-285 N. Continue 30 miles further to the junction of US-84 and NM-96, and turn left onto NM-96 W. Go approximately 4 miles and turn left at County Road 194. Follow this road 2.1 miles and turn right onto a 4x4 trail. Go approximately 1 mile west on this trail until it turns into an ATV trail. The AUM Site features can be found approximately 2.25 miles north, northwest of this point, and may be accessed on foot. Note that private landowners north of the AUM Site and Santa Fe National Forest land have specified that their land is not to be trespassed.

1.3 SITE GEOLOGY

The AUM Site is located in the southern part of the Chama Basin, a shallow structural basin bounded by the Nacimiento uplift to the west, the Brazos uplift and the Tusas Mountains to the east, and the Jemez Mountains to the south (Smith et al., 1961). Middle Mesozoic sedimentary rocks are exposed in the vicinity of the AUM Site. The mineralized zone at the AUM Site is associated with an intraformational fold in the Jurassic Todilto Formation (McLemore, 1983).

1.4 SITE HYDROGEOLOGY

The AUM Site is located near the southern boundary of the Rio Chama watershed which covers most of the Rio Chama Water Planning Region (La Calandria Associates, Inc., 2006). Surface runoff at the AUM Site flows to the northwest or southeast, off either side of the mesa spur on which the AUM Site is located. The drainages east and west of the spur flow north through a flat plain where surface runoff percolates into the ground.

Surface runoff that flows onto the plain below the AUM Site will percolate to the Quaternary Alluvium or the Agua Zarca sandstone member of the Triassic Chinle Formation. The Agua Zarca sandstone constitutes a shallow aquifer partially exposed at the surface below the AUM Site. Locally this aquifer contains as much as 200 feet of coarse-grained, permeable sandstone (La Calandria Associates, Inc., 2006). Groundwater flow in this unit is generally to the northwest at the AUM Site.

1.5 REGIONAL TOPOGRAPHY AND TERRAIN

The AUM Site is found on the Youngsville 7.5 minute United States Geological Survey topographic map at an elevation of approximately 7,000 ft above mean sea level (please see Figure 2). The AUM Site is located in the northern foothills of the Jemez Mountains about 3 miles north of the prominent mesa Cerro Pedernal, on a topographical spur near the northern boundary of the Santa Fe National Forest. 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. One open cut, one disturbed area, three piles, and three mine roads were identified onsite. Please see the Photo Log in Appendix A for photos of the AUM Site features, Table 1 for a list of the AUM Site features, and Figures 4a and 4b for the locations of the AUM Site features.

2.1 MINE SHAFTS, ADITS, AND DECLINES

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

2.2 MINING AND EXPLORATION PITS AND OPEN CUTS

One open cut (CutPly-1) was identified at the AUM Site. This feature is a 30 ft deep, 50 ft wide and 275 ft long rim cut that exposes the Jurassic units that form the top of the ridge at the site (see Photos 2-6 in Appendix A). The south wall of the cut exposes a low amplitude fold and a fault in the limestone (see Photo 4 and 6 in Appendix A). The maximum gamma radiation measurement found on CutPly-1 was at survey point Rad-2, measuring 470 $\mu\text{R/hr}$ (microrentgens per hour) at 0 ft above ground and 100 $\mu\text{R/hr}$ at 4ft above ground.

2.3 WASTE AND ORE PILES AND DISTURBANCES

Three waste rock piles and one disturbance area were identified at the AUM Site. PilePly-1 was 5 ft high, 10 wide, and 70 ft long and was located west of the open cut (see Figures 4a and 4b). PilePly-2 was a conical pile near the east end of the open cut and was 10 ft high, 20 ft wide, and 30 ft long. West of PilePly-2 was PilePly-3, a linear pile along the top of the steep ridge on the eastern edge of the site. PilePly-3 measured 10 ft high, 15 ft wide, and 250 ft long. DistPly-1 was an area that had been bulldozed measuring 20 ft deep, 100 ft wide, and 300 ft long to the east of the open cut. The maximum gamma radiation measurement found on these features was 600 $\mu\text{R/hr}$ at 0 ft above ground and 400 $\mu\text{R/hr}$ at 4 ft above ground at radiation survey point Rad-11 taken on PilePly-3.

2.4 MINING RELATED BUILDINGS AND FOUNDATIONS

No mining related buildings or foundations were found at the AUM Site.

2.5 OTHER MINE FEATURES

Three mine roads were found at the AUM Site. Rd-1 extends south from the open cut along the western end of the AUM Site. Rd-2 extends north from the western end of the open cut and follows the mesa edge around to the eastern end of the open cut (see Figures 4a and 4b). Rd-3 extends south from the eastern end of the AUM Site. All roads contained berms along their path and were passable only on foot.

2.6 BOREHOLES

No boreholes were found at the AUM Site.

2.7 RECLAMATION ACTIVITIES

No reclamation activities were identified onsite.

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 near the AUM Site, recording 10 $\mu\text{R/hr}$ at 0 ft above ground and 10 $\mu\text{R/hr}$ 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 was 600 $\mu\text{R/hr}$ recorded at 0 ft above ground at survey point Rad-11 on PilePly-3. The gamma radiation readings at the AUM Site were most elevated at exposures of limestone in the base of CutPly-1 and DistPly-1 and in the waste rock in PilePly-

2 and PilePly-3. Radiation survey point Rad-2 recorded 470 $\mu\text{R/hr}$ at 0 ft above ground in CutPly-1 and radiation survey point Rad-9 recorded 300 $\mu\text{R/hr}$ at 0 ft above ground in DistPly-1. See Table 2 for details on site gamma radiation readings.

5.0 CURRENT LAND USES

5.1 HUMAN ACTIVITY AND RECREATIONAL SITE USE

Human activity at the AUM Site and in the surrounding area included grazing, ATV tracks and domestic dwellings within a 1 mile radius of the site (please see Figure 3).

5.2 NEARBY RESIDENTIAL, COMMERCIAL AND INDUSTRIAL STRUCTURES

Three private residences are located approximately 0.5 miles northeast of the AUM Site and two private residences are located approximately 0.75 miles east of the AUM Site.

5.3 NEARBY DOMESTIC WELLS

One domestic well lies within one mile of the AUM Site. This domestic well was drilled in 2000 to a depth of 70 feet below ground surface with a depth to water of 9 feet below ground surface (NMOSE, 2008). Please see Figures 2 and 3 for the location of this well.

5.4 EVIDENCE OF GRAZING OR AGRICULTURE

Cow and horse droppings and prints observed at the AUM Site indicate that the land is used for grazing.

5.5 EVIDENCE OF WILDLIFE

Deer, elk, rabbit, and coyote tracks and droppings were seen at the AUM Site. A pinyon jay, crows, and other small birds were also identified near the AUM Site.

6.0 VEGETATION

The Box Canyon site is located in the Coniferous and Mixed Woodland vegetation type (Dick-Peddie, 1999). Woody vegetation is dominated by pinyon pine, Utah juniper, rabbitbrush, and ephedra species. The grass species included Indian ricegrass, blue grama and slender wheatgrass. No noxious weeds were observed at the AUM Site.

7.0 POTENTIAL OFFSITE IMPACTS

7.1 EROSION

No evidence of mine related erosion was observed onsite.

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.
- Dick-Peddie, William A, 1999. New Mexico Vegetation: Past, Present, and Future. University of New Mexico Press.
- La Calandria Associates, Inc., 2006. Rio Chama Regional Water Plan. Prepared for Rio de Chama Acequias Association and Rio Arriba County.
- McLemore, Virginia T., 1983. Uranium and Thorium Occurrences in New Mexico: Distribution, Geology, Production, and Resources, with Selected Bibliography. New Mexico Bureau of Mines and Mineral Resources Open File Report OF-183.
- Mining and Minerals Division (MMD), 2009. Mine Feature Data Dictionary.
- New Mexico Office of the State Engineer (NMOSE), 2010. Wells and Surface Diversions in New Mexico. POD_WATERS_june2010.shp. OSE Waters Database.
- Smith, Clay T., Antonius J. Budding and Charles W. Pitrat, 1961. Geology of the Southeastern Part of the Chama Basin. Socorro: New Mexico Bureau of Mines & Mineral Resources Bulletin 75.

TABLES

**Table 1
Site Features**

**Box Canyon-NM0177
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	No	Access	--	Dirt Nonmaintained	--	--	--	--	--	--	--	hiking
Access-2	No	Access	--	Dirt Nonmaintained	--	--	--	--	--	--	--	driving
CutPly-1	Yes	--	--	--	30	50	275	--	--	--	NM0177_002, NM0177_003, NM0177_004, NM0177_005	--
DistPly-1	Yes	Other	--	--	20	100	300	--	--	--	NM0177_012	--
PilePly-1	Yes	Waste	--	Rock	5	10	70	--	--	--	NM0177_008	--
PilePly-2	Yes	Waste	--	Rock	10	20	30	--	--	--	NM0177_010	--
PilePly-3	Yes	Waste	--	Rock	10	15	250	--	--	--	NM0177_013	--
Rd-1	Yes	Dirt	--	Dirt Nonmaintained	--	--	--	--	--	--	NM0177_009	--
Rd-2	Yes	Dirt	--	Dirt Nonmaintained	--	--	--	--	--	--	NM0177_011	--
Rd-3	Yes	Dirt	--	Dirt Nonmaintained	--	--	--	--	--	--	NM0177_015	--

Notes:
-- designates no information



**Table 2
Gamma Radiation Survey Results**

**Box Canyon-NM0177
Abandoned Uranium Mine Assessments**

Reading ID	Associated Features	0 ft ($\mu\text{R/hr}$)	4 ft ($\mu\text{R/hr}$)	Associated Photos
Rad-1	CutPly-1	23	19	NM0177_006
Rad-2	CutPly-1	470	100	NM0177_007
Rad-3	CutPly-1	240	40	--
Rad-4	CutPly-1	15	13	--
Rad-5	PilePly-1	16	13	--
Rad-6	CutPly-1	210	120	--
Rad-7	PilePly-2	130	65	--
Rad-8	Rd-2	36	30	--
Rad-9	DistPly-1	300	80	--
Rad-10	DistPly-1	70	60	--
Rad-11	PilePly-3	600	400	NM0177_014
Rad-12	PilePly-3	230	130	--
RadBack-1	--	10	10	--

Notes:

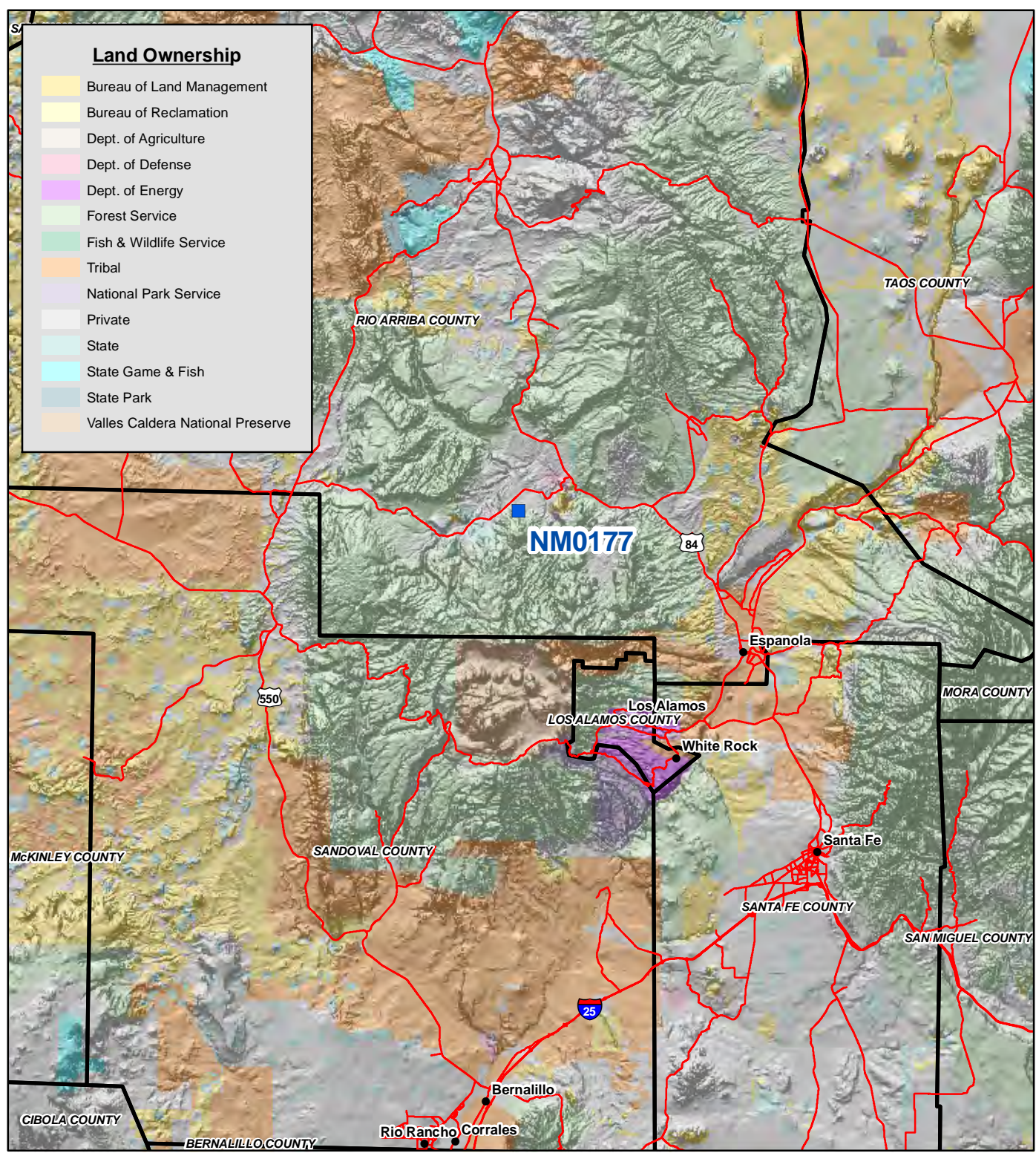
All gamma readings at this site taken by Ludlum 192 $\mu\text{R/Ratemeter}$
 $\mu\text{R/hr}$ =microroetgens per hour
 -- designates no information



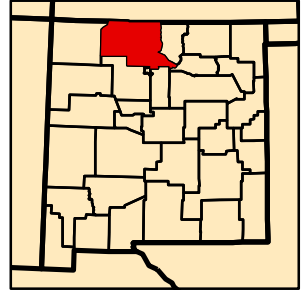
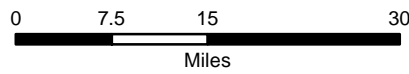
FIGURES

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, 2008

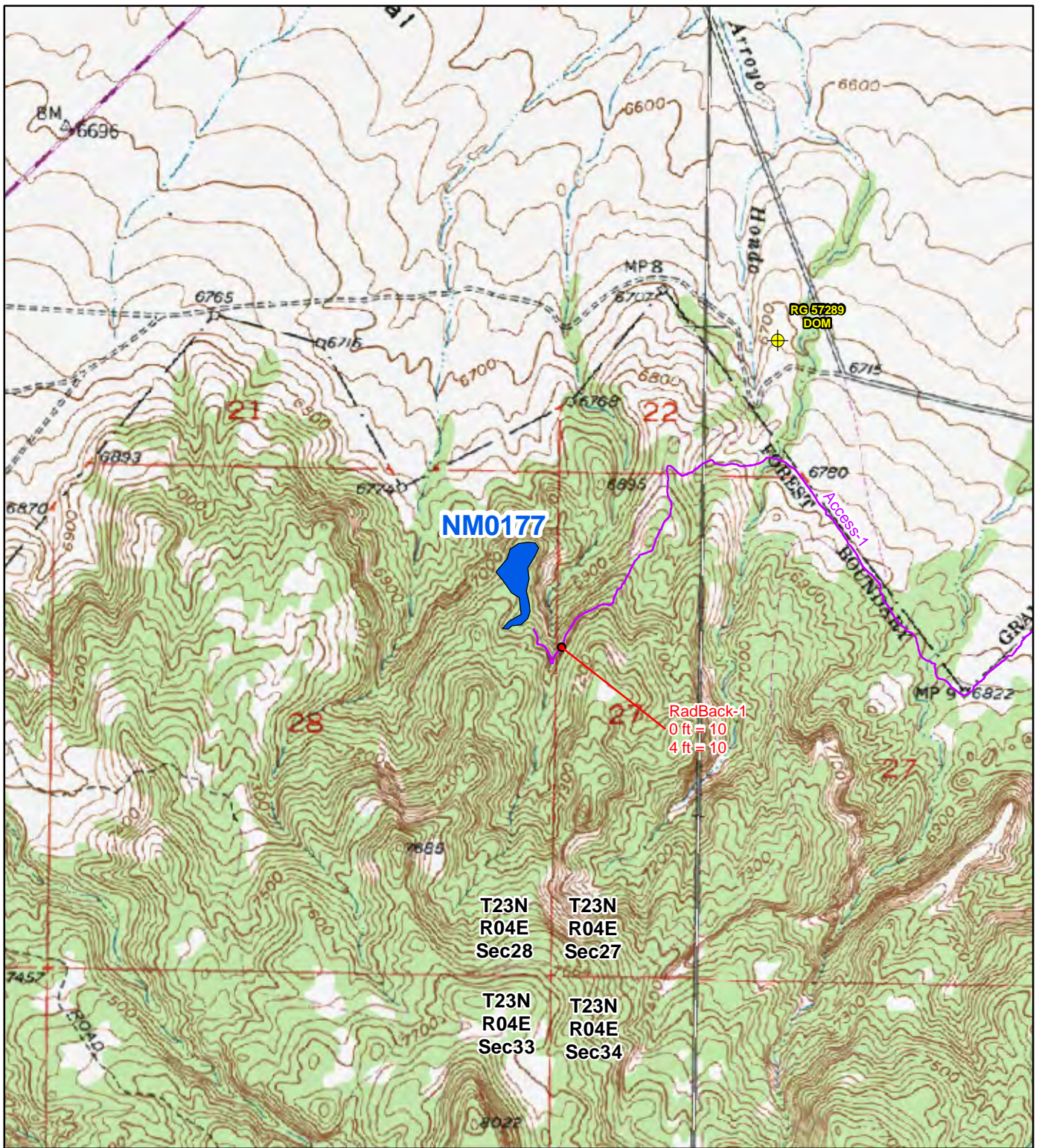


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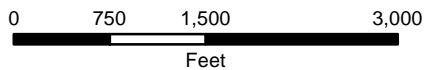
- AUM Location
- Road
- County Boundary

Figure 1
Site Location Map
NM0177-Box Canyon
Abandoned Uranium
Mine Assessment





Map Source(s):
 U.S. Geological Survey 7.5-Minute
 Topographic Map
 -Canones, 1979
 -Youngsville, 1979

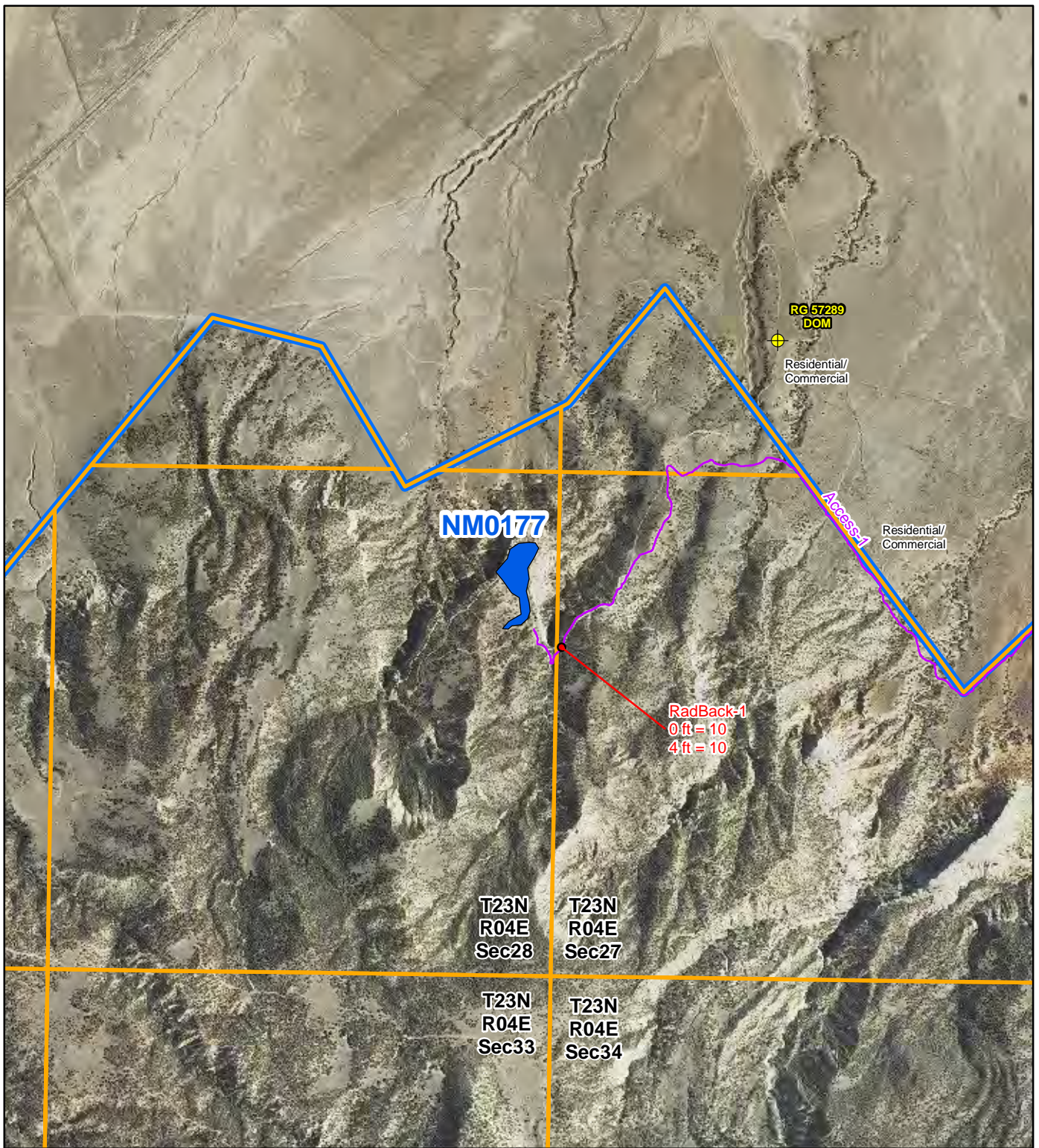


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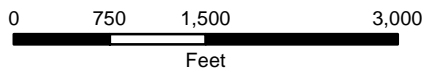
- Radiation Readings ($\mu\text{R/hr}$)
- ⊕ Well Within 1 Mile of Site
- Access Route
- AUM Location Boundary (MMD Provided)

Figure 2
Topographic Map
NM0177-Box Canyon
 Abandoned Uranium
 Mine Assessment





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



Legend

- Radiation Readings ($\mu\text{R/hr}$)
- ⊕ Well Within 1 Mile of Site
- Access Route
- AUM Location Boundary (MMD Provided)
- Section Boundary
- Township/Range Boundary

Figure 3
Aerial Photo
NM0177-Box Canyon
 Abandoned Uranium
 Mine Assessment





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

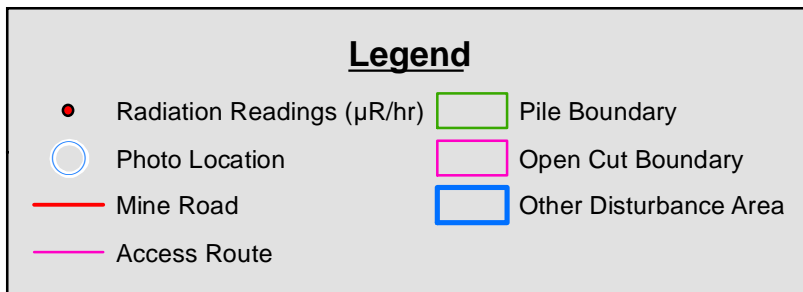
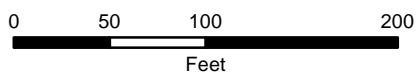
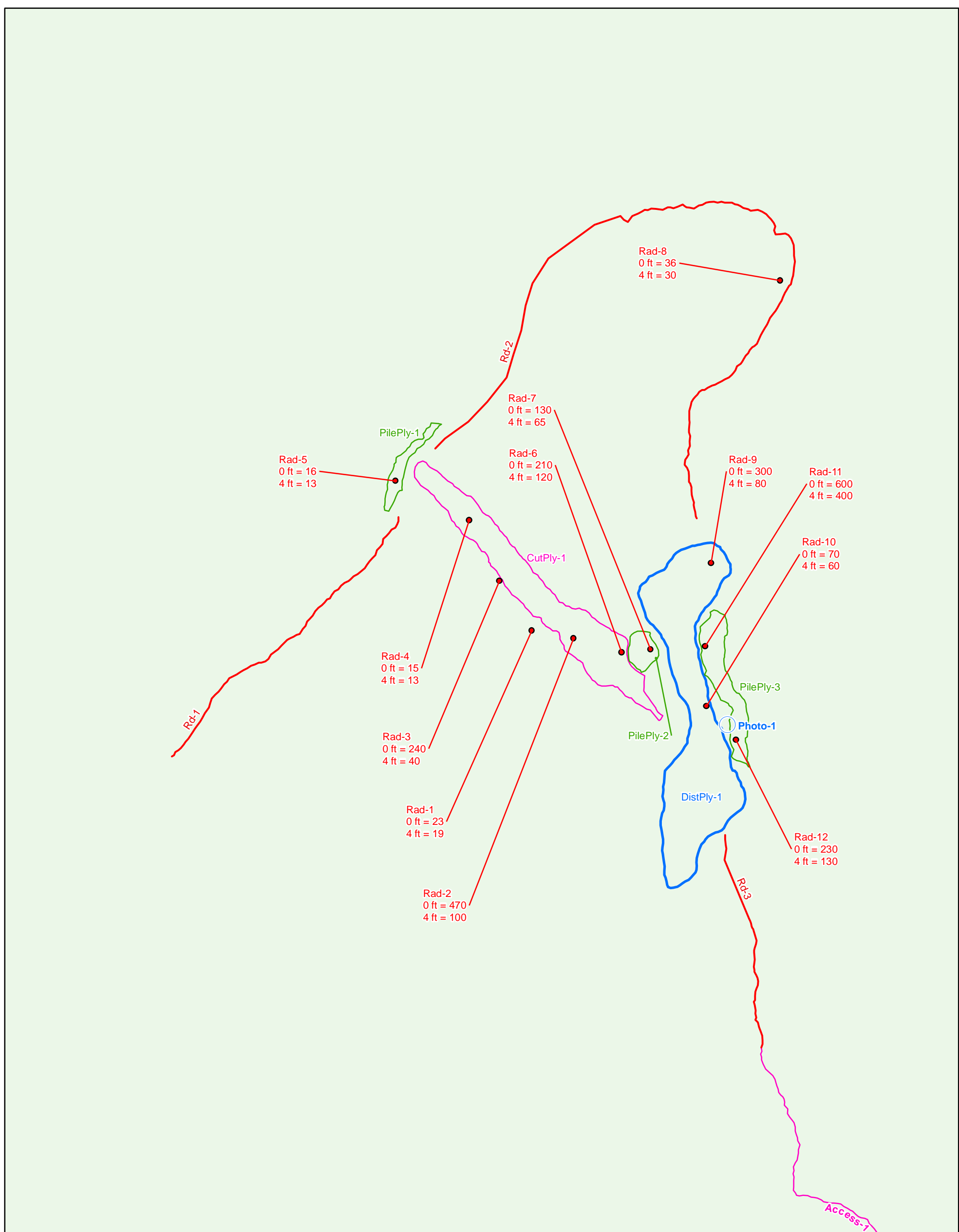
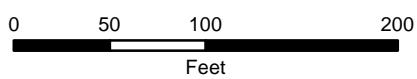


Figure 4a
Site Map on
Aerial Photo
NM0177-Box Canyon
 Abandoned Uranium
 Mine Assessment





Map Source(s):
Ownership - BLM, 2008



Legend

● Radiation Readings (µR/hr)	▭ Pile Boundary
○ Photo Location	▭ Open Cut Boundary
— Mine Road	▭ Other Disturbance Area
— Access Route	Surface Ownership
	▭ Forest Service

Figure 4b
Site Map with
Surface Ownership
NM0177-Box Canyon
 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 location photo looking northwest, replicating Anderson photo A.



Photo 2-Looking northwest at CutPly-1.



Photo 3-Looking north at northern wall of CutPly-1.

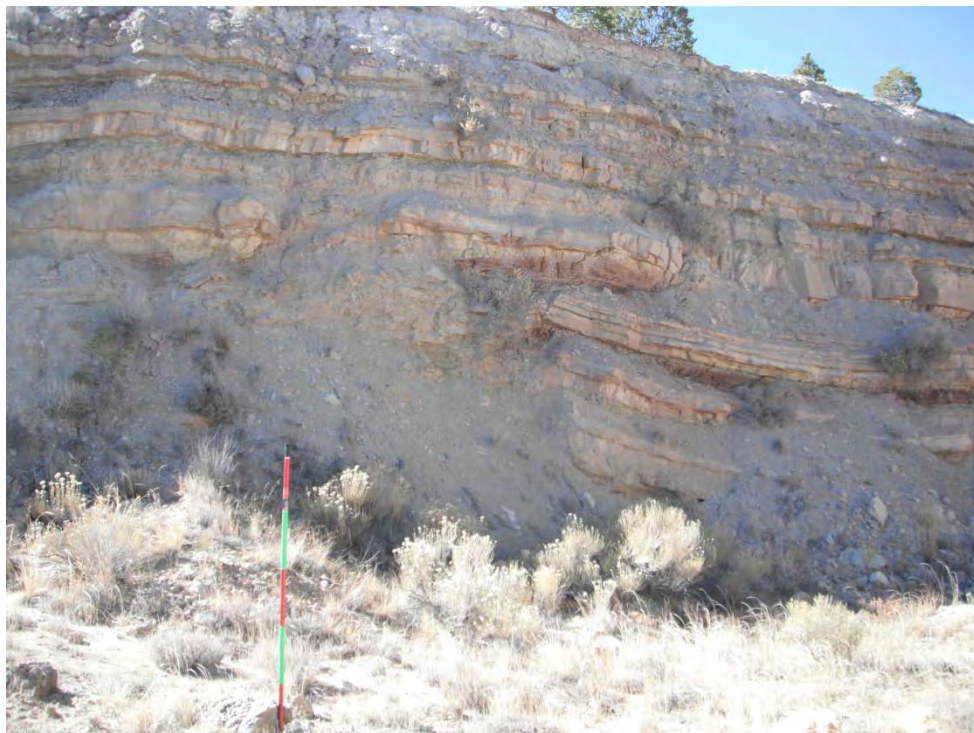


Photo 4-Looking southwest at southern wall of CutPly-1.



Photo 5-Looking east-southeast at CutPly-1, replicating Anderson photo B.



Photo 6-Looking south at radiation survey point Rad-1, replicating Anderson photo C.



Photo 7-Looking down at radiation survey point Rad-2, grey limestone with brown mineralization.



Photo 8-Looking north at PilePly-1.



Photo 9-Looking south at Rd-1.



Photo 10-Looking north at PilePly-2.



Photo 11-Looking east at Rd-2.



Photo 12-Looking north at DistPly-1.



Photo 13-Looking south at PilePly-3.



Photo 14-Looking down at radiation survey point Rad-11.



Photo 15-Looking south at Rd-3.



Photo 16-Vegetation representative of the AUM Site.



Photo 17-Vegetation representative of the AUM Site.



Photo 18-Vegetation representative of the AUM Site.



Photo 19-Vegetation representative of the AUM Site.



Photo 20-Vegetation representative of the AUM Site.



Photo 21-View looking southeast at the AUM Site.

APPENDIX B
FIELD NOTES

Site Name: NMD177, Box Canyon

Objective: Site Assessment

Personnel: Annelia Tinklenberg
Spencer Whitman

Equipment: Rental truck, Trimbel GPS GeoXM (SN: 49484472, 2008 series), Ludlum 192 (SN: 234149), Fuji film digital camera (No. OTB31259), backup Garmin GPS, cell phone amplifier, field laptop

547
647
AT Measured Ludlum Scintillometer against ^{137}Cs source = 260 uR/h at contact.

550
659
AT HASP, discussed the remoteness of the site.

610 Leave Albuquerque

857 Arrive at end of drivable road, pack to hike to AUM site

1057 Arrive at AUM site

Photo ID-1 - site ID location photo, looking northwest, cut open cut-1, replicating Anderson photo A.

Cut-1 - 275' long, 50' wide, and 30' deep cut (or trough) trends northwest to southeast

Photo 2 - looking northwest at cut-1

Photo 3 - looking north at wall of cut-1

Photo 4 - looking southwest at wall of cut-1

Photo 5 - looking east-southeast at cut-1, replicating Anderson B

Rad 1 - Om - 23 uR/h; Im - 19 uR/h - south wall of cut-1

Photo 6 - Rad 1, replicating Anderson C looking south

Rad 2 - Om - 470 uR/h; Im - 100 uR/h in cut-1

Photo 7 - Rad 2 looking down at grey limestone with brown mineralization

Rad 3 - Cut-1 - Om - 240 uR/h; Im - 40 uR/h

Rad 4 - Cut-1; Om - 15 uR/h; Im - 13 uR/h

1200
Pile Ply-1 - west of cut-1, along edge of mesa
Photo 8 - Pile Ply-1 - 70ft long, 10' wide, 5' tall

Photo 8 - Pile Ply-1 looking north

Rad 5 - Pile Ply-1; Om - 16 uR/h; Im - 13 uR/h

Mine Rd-1 - on the west side of cut-1, extends north-south

Photo 9 - Mine Rd-1 looking south

Rad 6 - Cut-1 - Om - 210 uR/h; Im - 120 uR/h

Pile Ply-2 - 10' tall, 20' wide, 30' long, 30° slope

Photo 10 - Pile Ply-2 looking north

Rad 7 - Pile Ply-2 - Om - 130 uR/h; Im - 65 uR/h

Mine Rd-2 - on north east side of mesa

Photo 11 - Mine Rd 2 looking east

Rad 8 - Mine Rd-2; Om - 36 uR/h; Im - 30 uR/h

Dist Ply-1 - 100' wide x 300' long x 20' high; east end of cut-1

Photo 12 - Dist Ply-1 looking north

Rad 9 - Dist Ply-1; Om - 300 uR/h; Im - 80 uR/h

Rad 10 - Dist Ply-1; Om - 70 uR/h; Im - 60 uR/h

Pile Ply-3 - 10' tall, 15' wide, 250' long

Photo 13 - Pile Ply 3 looking south

Rad 11 - Pile Ply-3; Om - 600 uR/h; Im - 400 uR/h

Photo 14 - Rad 11 on Pile Ply-3; close up

Rad 12 - Pile Ply-3; Om - 230 uR/h; Im - 130 uR/h

Mine Rd-3 - southeast of site

Photo 15 - Mine Rd 3 looking south

Access 1 - mine roads and hiking cross-country

Background Rad - Om - 10 uR/h; Im - 10 uR/h

1320 Learning site Vegetation collection

Photos 16-19 - Vegetation

87 11/18/10 ACT Abandoned Uranium Mines

1335 Leaving site

1530 Back at the truck

Access Rd - 2 - Driving out

Soils: Light tan, sandy-silty soils. Thin and rocky.

Rocks: Lower Morrison limestone (grey); tan sandstone, mudstones. The ~~last~~ target rock was Tod: to limestone at the base of the mine cut.

Wildlife: Pinyon Jay, crows, tarantula; rabbit, deer, elk, and coyote prints and droppings.

Human activities: Grazing: fences, cow prints and droppings, horse prints. ATV tracks, probably for hunting and grazing. Historic mining: tin cans and gas can.

