

Abandoned Uranium Mine Site Assessment for the Last Chance Site (NM0122)

FINAL REPORT

Prepared For:



New Mexico Energy, Minerals and
Natural Resources Department
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NM0122

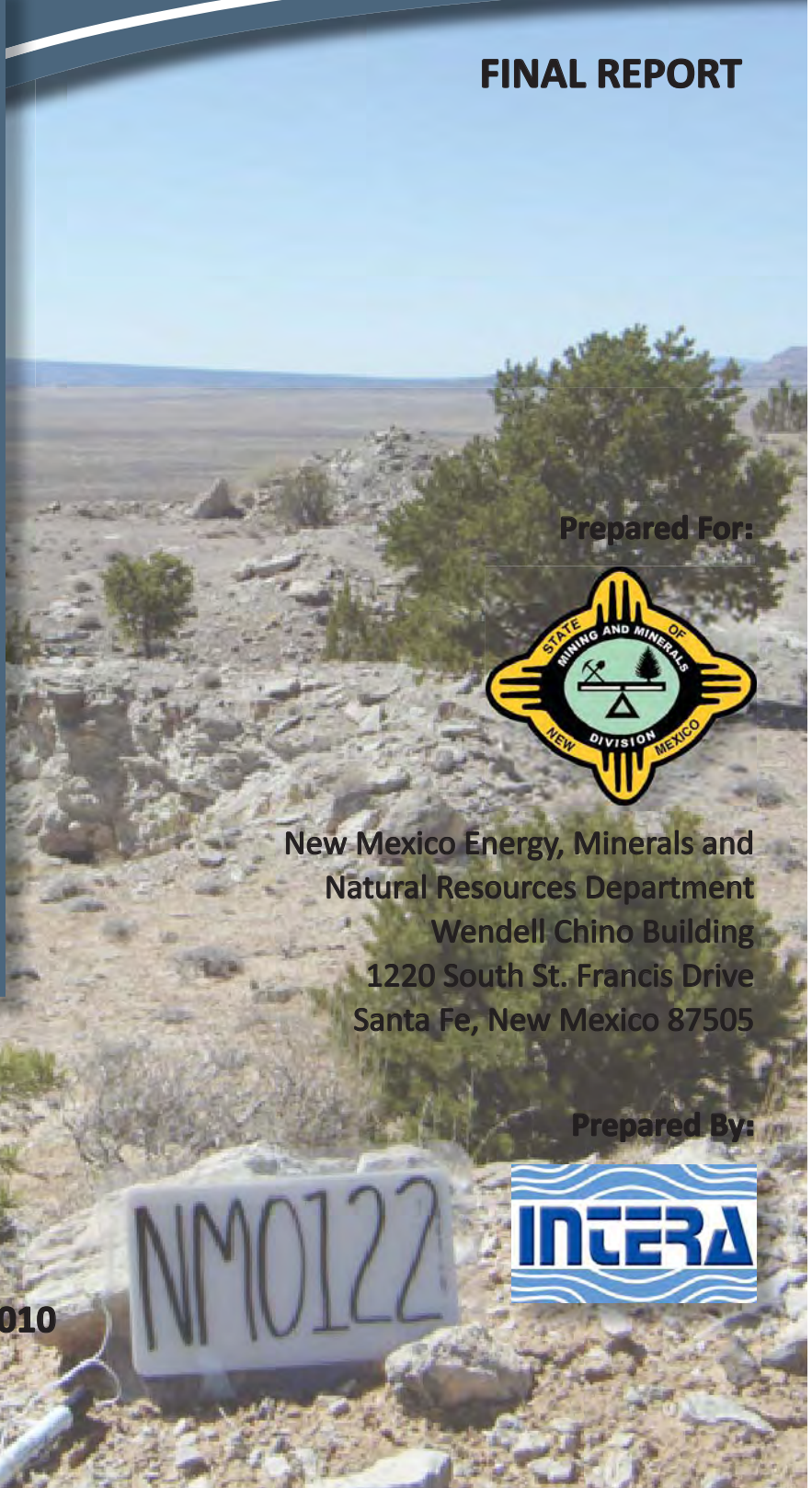


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1.0 INTRODUCTION

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 Last Chance Site (AUM Site), MMD ID: NM0122 on April 8, 2010.

1.1 PREVIOUSLY KNOWN INFORMATION ABOUT THE SITE

Anderson (1980) visited the AUM Site in 1980, finding open pits, trenches, and piles in a 300 by 400 ft area. A jeep trail ascending the face of the mesa was also observed, but the road was impassable. Uranium was extracted from this mine between 1952 and 1956, and the mine was last registered in 1956 (Anderson, 1980).

1.2 SITE LOCATION AND DIRECTIONS

The AUM Site is on private land in the northeast quarter of Section 8 and the northwest corner of Section 9, Township 12 North, Range 9 West. The Site is located in Cibola County (formerly part of Valencia County), approximately 10 miles northeast of the town of Milan. The location of this Site was provided to INTERA by MMD.

To access the AUM Site from Albuquerque, drive west on Interstate 40 for 83 miles. Take Exit 79 towards San Mateo and turn right. Continue straight until you reach U. S. 66, less than a quarter mile. Turn left on U.S. 66 and drive 0.2 miles, then turn right onto New Mexico 605. Continue northeast on New Mexico 605 for 7.4 miles, then turn right onto a dirt road, passing through a locked gate. Drive east along this road for approximately 2 miles, after which the road makes a slight bend to the south and then curves north and ascends a mesa. After reaching the top of the mesa, continue north for another 1.1 miles. After 1.1 miles, take a left turn off the main road onto a side road. Continue along this road for another 0.3 miles to reach the AUM Site.

Note that permission from two private landowners is required in order to access and view the AUM Site. The access route from New Mexico 605 to the mesa is owned by one landowner, and the Site is owned by a different landowner.

1.3 SITE GEOLOGY

The AUM Site lies within the Grants uranium region. The topography of this region is characterized by mesas of Triassic, Jurassic, and Cretaceous sediments separated by broad valleys. The Site area is part of the Chaco Slope, the southern part of the San Juan Basin. Strata in the Chaco Slope dip gently to the north (McLemore, 2002).

The AUM Site is located within the Jurassic-age Todilto Formation, a sequence of carbonates and evaporites. This formation likely represents a salt lake environment intermittently connected to the ocean. The Todilto Formation is underlain by the Entrada Formation and overlain by the Summerville Formation (Hilpert, 1963). The Todilto consists of two members, the upper Tonque Arroyo Member and the lower Luciano Mesa Member. The Tonque Arroyo Member

consists of gypsum and is absent from the Site area. The Luciano Mesa Member consists of a thinly laminated, locally deformed lower layer and a massive, vuggy upper layer (Lucas and Anderson, 2000). Primary-type uranium minerals such as pitchblende are reported to occur in the Todilto Limestone as well as secondary minerals such as carnotite and tyuyamunite (McLaughlin, 1963).

Sand dunes and other aeolian features are present in the eastern half of the AUM Site.

1.4 SITE HYDROGEOLOGY

The surface runoff at the AUM Site discharges to San Mateo Creek, which drains into the Rio San Jose approximately 8 miles to the southwest. There is no nearby permanent surface water.

The AUM Site is located in the Bluewater Underground Water Basin. This basin falls between the San Juan Underground Water Basin to the north, the Middle Rio Grande Underground Water Basin to the south and east, and the Gallup Underground Water Basin to the west (Edwards and Kiely, 2004). Aquifers are found in alluvium near major drainages such as San Mateo Creek and throughout the Cretaceous, Jurassic, and Triassic strata in the region. Groundwater flows southward in alluvium and northeast in Mesozoic strata (Brod, 1979).

1.5 REGIONAL TOPOGRAPHY AND TERRAIN

The AUM Site is found on the Dos Lomas Quadrangle 7.5 minute United States Geological Survey topographic map at an elevation of approximately 7000 feet above mean sea level (see Figure 2). The AUM Site is located just west of La Jara Mesa, at the edge of a broad mesa capped by the Todilto Formation.

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. Three pits, five piles, and a mine road were found 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

Three open pits were found at the AUM Site. Pit-1 breaks through the edge of the mesa (see Photo 4-7 in Appendix A). Numerous faults and intraformational folds along with some secondary-type uranium mineralization are visible in the walls of Pit-1. The maximum gamma radiation reading was 1500 $\mu\text{R/hr}$ at 0 ft above ground at radiation survey point Rad-4 (see Photo 7 in Appendix A). Pit-2 and Pit-3 are shallow pits located east of Pit-1. The maximum gamma

radiation level in Pit-3 was 2700 $\mu\text{R/hr}$ (Rad-9) at 0 ft above ground and 220 $\mu\text{R/hr}$ (Rad-6) in Pit-2. See Photo 10 in Appendix A for a view of Pit-2 and Photo 12 for a view of Pit-3.

2.3 WASTE AND ORE PILES AND DISTURBANCES

Five piles were found at the AUM Site. These piles consist of aeolian sand overburden, waste rock, or a combination of the two. PilePly-1 and PilePly-2 consist mostly of waste rock (see Photos 2, 3, and 8 in Appendix A). PilePly-3 and PilePly-4 contained both overburden and waste rock (see Photos 11 and 13 in Appendix A). PilePly-5 consists mostly of overburden (see Photo 14 in Appendix A).

2.4 MINING RELATED BUILDINGS AND FOUNDATIONS

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

2.5 OTHER MINE FEATURES

One mine road (Rd-1) extends down the mesa face to the west. This road is probably the jeep trail mentioned in Anderson (1980).

2.6 BOREHOLES

No boreholes were found 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 near the AUM Site, recording 14 $\mu\text{R/hr}$ at 0 ft above ground and 14 $\mu\text{R/hr}$ 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 2700 $\mu\text{R/hr}$ at 0 ft above ground at radiation survey point Rad-9 in Pit-3. Other notable radiation readings were taken at radiation survey point Rad-11 (2600 $\mu\text{R/hr}$ at 0 ft above ground) on PilePly-5 and radiation survey point Rad-4 (1500 $\mu\text{R/hr}$ at 0 ft above ground; see Photo 7 in Appendix A) in Pit-1.

5.0 CURRENT LAND USES

5.1 HUMAN ACTIVITY AND RECREATIONAL SITE USE

Barbed wire fences in the surrounding area and cow prints indicate that the area is active ranchland.

5.2 NEARBY RESIDENTIAL, COMMERCIAL AND INDUSTRIAL STRUCTURES

No structures were sighted within a mile of the AUM Site.

5.3 NEARBY DOMESTIC WELLS

One domestic well (B-01340) is located about 0.9 miles southeast of the AUM Site. This well is 300 ft deep, but depth to water and installment date are not known. A non-domestic well (B-01341) is located about 0.8 miles southeast of the Site. Another non-domestic well (B-00778) is located about 0.8 miles to the southwest (NMOSE, 2008).

5.4 EVIDENCE OF GRAZING OR AGRICULTURE

Barbed wire fences in the surrounding area and cow prints indicate that the AUM Site is likely being grazed.

5.5 EVIDENCE OF WILDLIFE

No evidence of wildlife was found onsite; however jackrabbits, cottontails, coyotes, scrub jays, and crows were observed nearby.

6.0 VEGETATION

The AUM Site is located in the Coniferous and Mixed Woodland vegetation type and borders the Desert Grassland (Ecotone). Woody species at the site include Utah juniper, pinyon pine, fourwing saltbush and rubber rabbitbush. Snakeweed, narrowleaf yucca, and common sagewort were also present. Scapose bitterweed was present at the AUM Site along with grama grass, dropseed, and Indian ricegrass. Cryptogamic crust was present in areas. No noxious weeds were observed.

7.0 POTENTIAL OFFSITE IMPACTS

7.1 EROSION

No evidence of 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.
- Brod, Robert C., 1979. Hydrogeology and Water Resources of the Ambrosia Lake-San Mateo Area, McKinley and Valencia Counties, New Mexico. Master's thesis. New Mexico Institute of Mining and Technology, Socorro, New Mexico.
- Edwards, Mark H. and Kiely, Jeffrey, 2004. Cibola-McKinley Regional Water Plan. Prepared for the New Mexico Interstate Stream Commission.
- Hilpert, Lowell S., 1963. Regional and Local Stratigraphy of Uranium-Bearing Rocks in Kelley, Vincent C., ed. Geology and Technology of the Grants Uranium Region. New Mexico Bureau of Mines and Mineral Resources, Memoir 15.
- Lucas, S. G. and Anderson, Orin J., 2000. The Todilto Salina Basin, Middle Jurassic of the U. S. Southwest in E. H. Gierlowski-Kordesch and K. R. Kelts, eds, Lake Basins Through Space and Time: AAPG Studies in Geology, 46, p. 153-158.
- McLaughlin, E. D., Jr., 1963. Uranium Deposits in the Todilto Limestone of the Grants District in Kelley, Vincent C., ed. Geology and Technology of the Grants Uranium Region. New Mexico Bureau of Mines and Mineral Resources, Memoir 15.
- McLemore, Virginia T., 2002. Navajo Lake State Park: New Mexico Geology, v. 24, no. 3, p. 91-96,103.
- 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**

**Last Chance-NM0122
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 Photo	Notes
Access-1	No	Access	--	Dirt	--	--	--	--	--	--	--	--
Access-2	No	Access	--	Dirt	--	--	--	--	--	--	--	--
PilePly-1	Yes	Waste	--	Rock	15	70	150	--	--	--	NM0122_002 NM0122_003	--
PilePly-2	Yes	Waste	--	Rock	10	30	300	--	--	--	NM0122_008	--
PilePly-3	Yes	Waste	--	Rock	10	120	150	--	--	--	NM0122_011	--
PilePly-4	Yes	Waste	--	Rock	6	30	40	--	--	--	NM0122_013	--
PilePly-5	Yes	Waste	--	Soil	15	20	30	--	--	--	NM0122_014	--
Pit-1	Yes	Mining	--	--	15	10	75	Yes	--	--	NM0122_004 NM0122_005 NM0122_006 NM0122_007	--
Pit-2	Yes	Mining	--	--	8	40	180	Yes	--	--	NM0122_010	--
Pit-3	Yes	Mining	--	--	10	40	200	Yes	--	--	NM0122_012	--
Rd-1	Yes	2-Track	--	Dirt	--	--	--	--	--	--	--	Impassable

Notes:

-- designates no information



Table 2
Gamma Radiation Survey Results

Last Chance-NM0122
Abandoned Uranium Mine Assessments

Reading ID	0 ft (μ R/hr)	4 ft (μ R/hr)	Associated Photo	Associated Feature
Rad-1	430	120	--	PilePly-1
Rad-2	21	25	--	Pit-1
Rad-3	190	90	--	Pit-1
Rad-4	1500	470	NM0122_007	Pit-1
Rad-5	90	38	--	PilePly-2
Rad-6	220	80	--	Pit-2
Rad-7	90	100	--	Pit-2
Rad-8	480	110	--	PilePly-3
Rad-9	2700	440	--	Pit-3
Rad-10	200	41	--	PilePly-4
Rad-11	2600	240	--	PilePly-5
RadBack-1	14	14	--	--

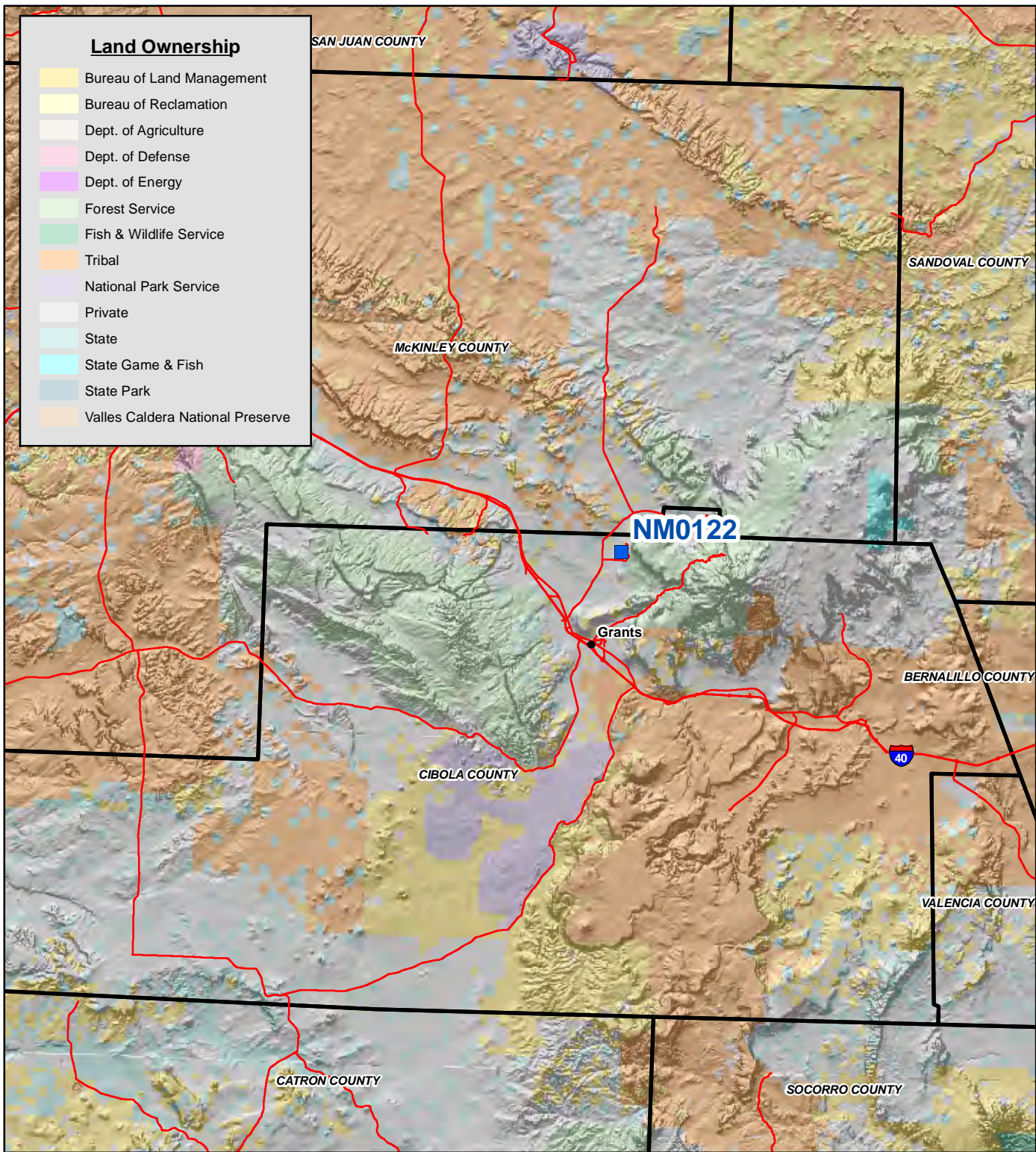
Notes:

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

μ R/hr=microroetgens per hour

-- designates no information

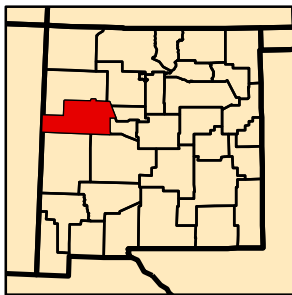
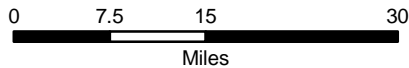
FIGURES



Land Ownership

Yellow	Bureau of Land Management
Light Yellow	Bureau of Reclamation
White	Dept. of Agriculture
Pink	Dept. of Defense
Purple	Dept. of Energy
Light Green	Forest Service
Green	Fish & Wildlife Service
Orange	Tribal
Light Purple	National Park Service
White	Private
Light Blue	State
Cyan	State Game & Fish
Dark Blue	State Park
Light Orange	Valles Caldera National Preserve

Map Source(s):
Ownership - BLM, 2008

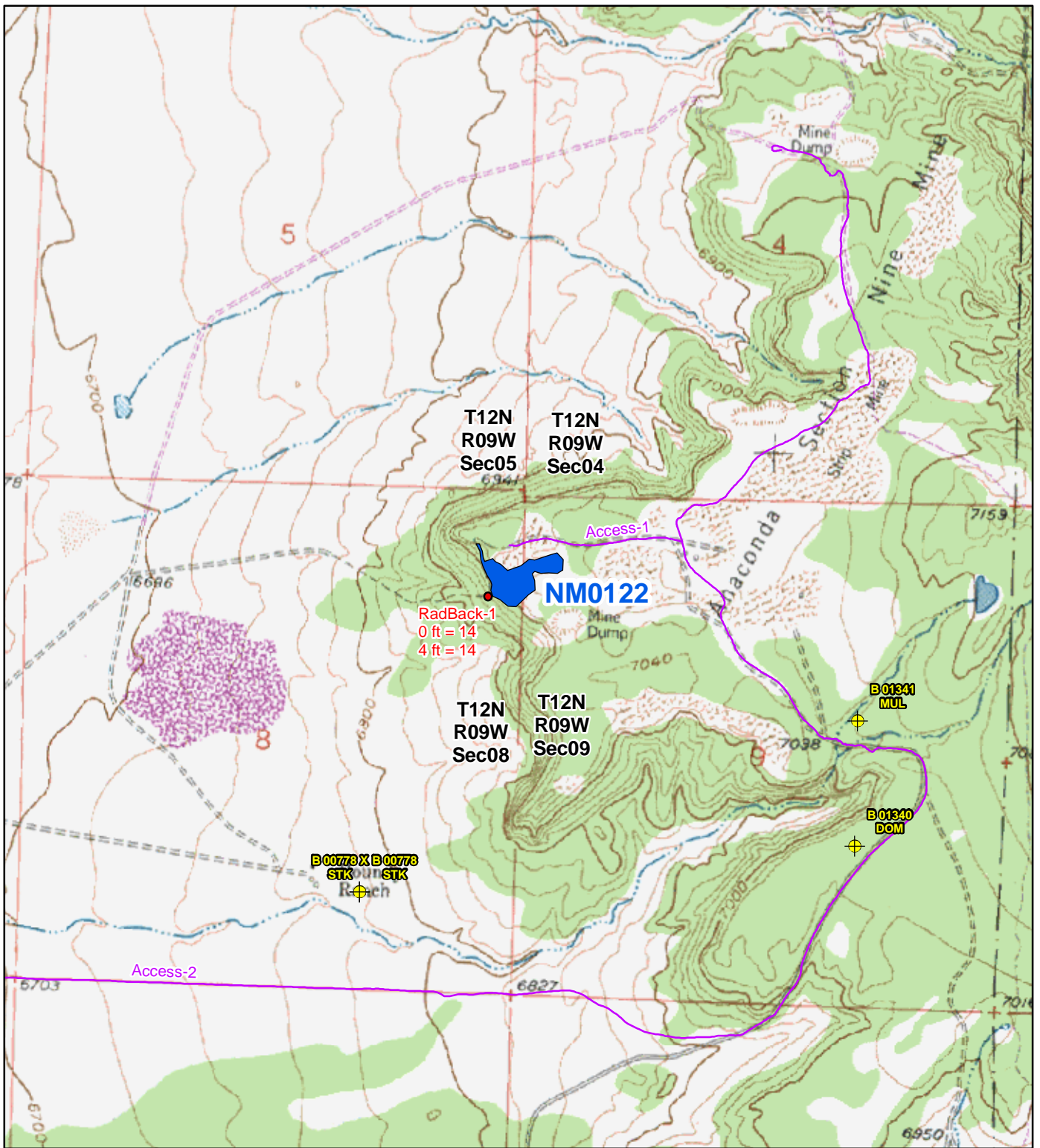


Legend

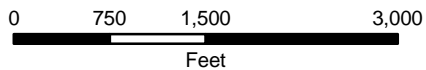
Blue square	AUM Location
Red line	Road
Black outline	County Boundary

Figure 1
Site Location Map
NM0122-Last Chance
Abandoned Uranium
Mine Assessment





Map Source(s):
 U.S. Geological Survey 7.5-Minute
 Topographic Map
 -Dos Lomas, 1980



Legend

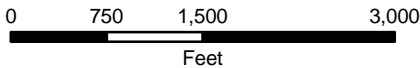
- Radiation Readings ($\mu\text{R/hr}$)
- ⊕ Well Within 1 Mile of Site
- Access Route
- AUM Location Boundary (MMD Provided)

Figure 2
Topographic Map
NM0122-Last Chance
 Abandoned Uranium
 Mine Assessment





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



Legend

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

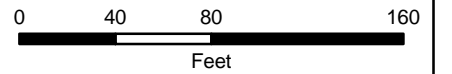
Figure 3
Aerial Photo
NM0122-Last Chance
 Abandoned Uranium
 Mine Assessment





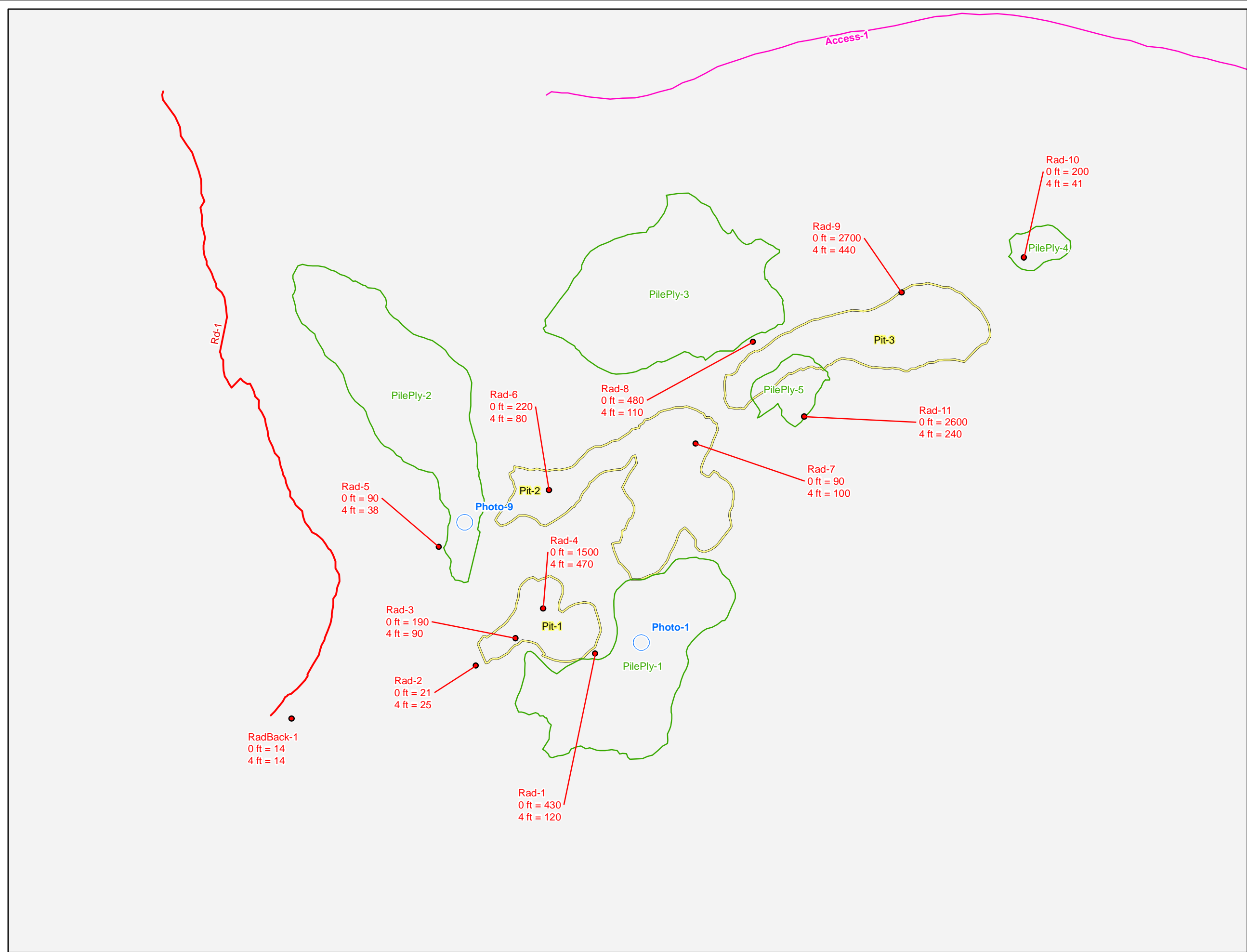
Legend

- Radiation Readings (µR/hr)
- Photo Location
- Access Route
- Mine Road
- ▭ Pile Boundary
- ▭ Pit Boundary



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

Figure 4a
Site Map on
Aerial Photo
NM0122-Last Chance
 Abandoned Uranium
 Mine Assessment

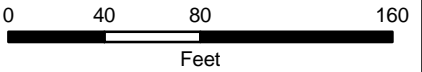


Legend

- Radiation Readings (µR/hr)
- Photo Location
- Access Route
- Mine Road
- ▭ Pile Boundary
- ▭ Pit Boundary

Surface Ownership

- ▭ Private



Map Source(s):
Ownership - BLM, 2008

Figure 4b
Site Map with
Surface Ownership
NM0122-Last Chance
 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, looking west.



Photo 2-Looking northeast at PilePly-1.



Photo 3-Looking southwest at PilePly-1.



Photo 4-Looking southwest at Pit-1, matching Anderson Photo (a).



Photo 5-Looking north at Pit-1.

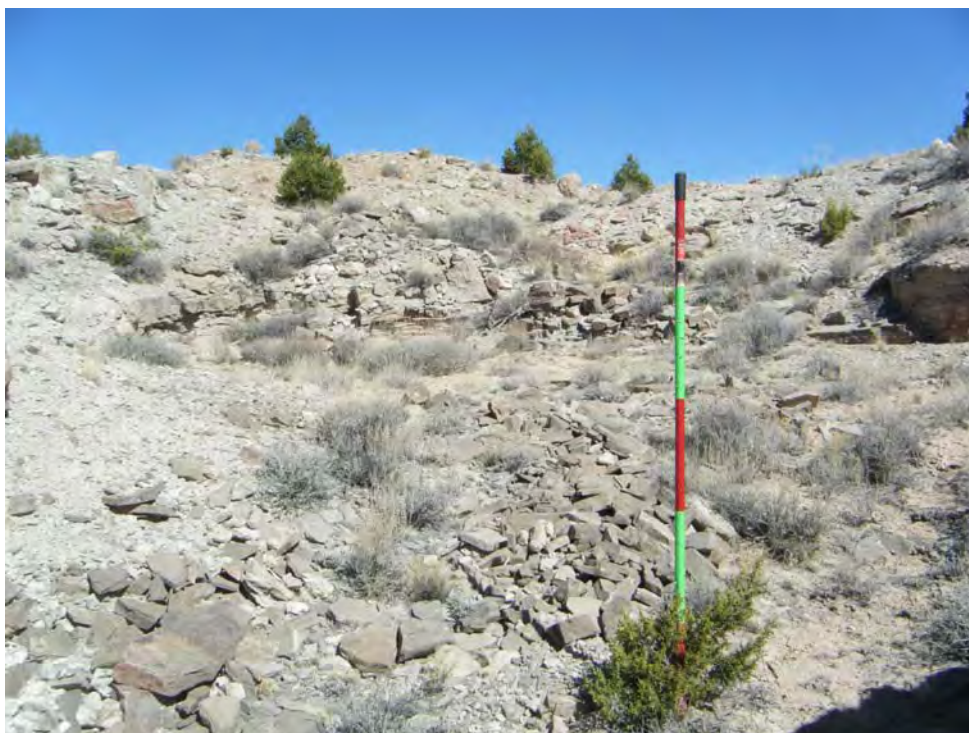


Photo 6-Looking east up the eastern arm of Pit-1.



Photo 7-Radiation survey point Rad-4 (1500 μ R/hr at 0 meters) in Pit-1.



Photo 8-Looking northwest at PilePly-2.



Photo 9-Site photo, looking east.



Photo 10-Looking northeast at Pit-2.



Photo 11-Looking north at PilePly-3.



Photo 12-Looking east at Pit-3.



Photo 13-Looking east at PilePly-4.



Photo 14-Looking east at PilePly-5.

APPENDIX B
FIELD NOTES

Site Name: NMO122, Last Chance

Objective: Site Assessment

Personnel: Annelia Tinklenberg
 Danny Bowman

Equipment: Rental truck, Trimbel GeoXM (SN: 494844727),
 2008 series), Ludlum 192 (234149), Fujifilm digital camera
 (No: 80839493), backup Garmin GPS, cell phone amplifier,
 field laptop

1500 Hiking to Last Chance

Photo 1 - ALT Background Rad - Om - 14 uR/h; 1m - 14 uR/h

1520 AT AUM Site

Photo 1 - Site Name looking west

Pile Ply 1 - 15' high, 70' wide, 150' long

Photo 2 - Pile Ply 1 looking northeast

Rad 1 - Pile Ply 1; Om - 430 uR/h; 1m - 204 uR/h

Photo 3 - Pile Ply 1 looking southwest

Pit 1 - 15' deep, 10' wide, 75' long; "T" shaped

Photo 4 - Pit 1 looking southwest, per Anderson

Photo 5 - Pit 1 looking north

Photo 6 - Pit 1 looking east up the eastern arm

Rad 2 - southwest end Pit 1; Om - 21 uR/h; 1m - 25 uR/h

Rad 3 - Pit 1; Om - 190 uR/h; 1m - 90 uR/h

Rad 4 - Pit 1; Om - ^{1500 ALT} 1200 uR/h; 1m - 470 uR/h

Photo 7 - Rad 4, black and yellow mineralization

Pile Ply 2 - 10' high, 30' wide, 300' long

Photo 8 - Pile Ply 2 looking northwest

Rad 5 - Pile Ply 2; Om - 40 uR/h; 1m - 31 uR/h

Photo 9 - looking east at site, Pit 2 on left

Pit 2 - 8' deep, 40' wide, 180' long; "T" shaped

Photo 10 - looking northeast at Pit 2

Rad 6 - Pit 2; Om - 220 uR/h; 1m - 80 uR/h

Rad 7 - Pit 2; Om - 92 uR/h; 1m - 100 uR/h

Pile Ply 3 - 10' high, 120' wide, 150' long

Photo 11 - looking north at Pile Ply 3

Rad 8 - Pile Ply 3; Om - 480 uR/h; 1m - 110 uR/h

Pit 3 - 10' high, 40' wide, 200' long

Photo 12 - looking east at Pit 3

Rad 9 - Pit 3; Om - 2700 uR/h; 1m - ^{ALT} 440 uR/h

Pile Ply 4 - 6' high, 30' wide, 40' long

Photo 13 - looking east at Pile Ply 4

Rad 10 - Pile Ply 4; Om - 200 uR/h; 1m - 41 uR/h

Pile Ply 5 - 15' high, 20' wide, 30' long

Photo 14 - looking east at Pile Ply 5

Rad 11 - Pile Ply 5; Om - 2600 uR/h; 1m - 240 uR/h

Mine Rd - non maintained

Rd 1 - impassable

