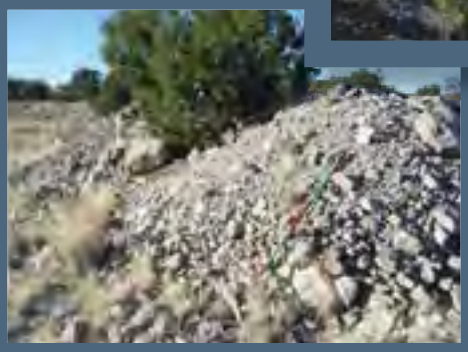
Abandoned Uranium Mine Site Assessment for the Christmas Day Site (NM0119)



FINAL REPORT

Prepared For:

New Mexico Energy, Minerals and
Natural Resources Department
Wendell Chino Building
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Prepared By:

INTERA

May 28, 2010

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

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 Christmas Day Site (AUM Site), MMD ID: NM0119 on April 7, 2010.

1.1 PREVIOUSLY KNOWN INFORMATION ABOUT THE SITE

The Christmas Day mine was operated from 1954 to 1956, and was registered with the State Mine Inspector's Office in 1954. Anderson (1980) visited the Christmas Day site in 1980, noting one C shaped trench up to 20 feet deep. Approximately 15 feet of this pit was aeolian sediment, and the remaining 5 or 6 feet was Todilto Formation. A waste pile was located 300 feet from the pit (Anderson, 1980).

1.2 SITE LOCATION AND DIRECTIONS

The AUM Site is on private land. The Site is located in the eastern half of Section 4, Township 12 North, Range 9 West and 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 2.1 miles to a fork in the road. Turn right and drive another 0.3 miles to the Site. The road can be very sandy in places, especially after a windy day.

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 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).

The Site shows evidence of ongoing aeolian activity, and vegetated sand dunes are present in the area.

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, on 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. One pit, two piles, and a fence 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

One pit was found onsite (see Photos 3-5, 7, 8 in Appendix A). This pit approximately corresponds with the C-shaped pit mentioned by Anderson (Anderson, 1980). However, thirty years of aeolian and perhaps fluvial activity have completely filled in the eastern limb of the pit. The only exposed bedrock is located in the still-open western limb (see Photo 7 in Appendix A).

The highest gamma radiation readings were on a shelf of exposed Todilto Formation limestone in Pit-1 (radiation survey point Rad-4), measuring 900 µR/hr at 0 ft above ground.

2.3 WASTE AND ORE PILES AND DISTURBANCES

Two piles were found at the AUM Site. PilePly-1 consists of waste rock (see Photo 1 in Appendix A) and PilePly-2 is mostly overburden (see Photo 9). PilePly-1 is likely the pile in Photo (c) of the Anderson report.

2.4 MINING RELATED BUILDINGS AND FOUNDATIONS

No mining related buildings and foundations were evident at the AUM Site.

2.5 OTHER MINE FEATURES

A barbed wire fence (Fenc-1, see Photo 6 in Appendix A) crosses the southern portion of Pit-1.

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 near the AUM Site, recording 9 µR/hr at 0 ft above ground and 9 µR/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 900 µR/hr at 0 ft above ground at radiation survey point Rad-4 (see Photo 7 in Appendix A). This reading was taken on a shelf of limestone from the Todilto Formation inside Pit-1. Other notable radiation readings were taken at radiation survey point Rad-6 (600 µR/hr at 0 ft above ground) in Pit-1 and radiation survey point Rad-1 (270 µR/hr at 0 ft above ground) on PilePly-1.

5.0 CURRENT LAND USES

5.1 HUMAN ACTIVITY AND RECREATIONAL SITE USE

A barbed wire fence and cow prints indicate that the AUM Site 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 non-domestic well (B-01341) is located about 1 mile south of the Site (NMOSE, 2008). No domestic wells lie within a mile of the Site.

5.4 EVIDENCE OF GRAZING OR AGRICULTURE

Cow droppings and cow footprints were noted in the area.

5.5 EVIDENCE OF WILDLIFE

Cottontails and jackrabbits were observed onsite and a canyon wren was heard. Deer scat was also found.

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 many 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.

McLemore, Virginia T., 1983. Uranium and Thorium Occurrences in New Mexico: Geology, Production, and Resources, with Selected Bibliography. New Mexico Bureau of Mines and Mineral Resources Open File Report 183.

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

Christmas Day-NM0119
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	--	--	--	--	--	--	--	--
Fenc-1	Yes	Barbwire	--	Wood/Barbwire	4	--	--	--	--	--	NM0119_006	--
PilePly-1	Yes	Waste	--	Rock	6	10	30	--	--	--	NM0119_001	--
PilePly-2	Yes	Waste	--	Soil	15	20	30	--	--	--	NM0119_009	--
Pit-1	Yes	Mining	--	--	50	100	300	Yes	--	--	NM0119_003 NM0119_004 NM0119_005 NM0119_006 NM0119_007 NM0119_008	--

Notes:
-- designates no information

Table 2
Gamma Radiation Survey Results

Christmas Day-NM0119
Abandoned Uranium Mine Assessments

Reading ID	0 ft (µR/hr)	4 ft (µR/hr)	Associated Photo	Asssociated Feature
Rad-1	270	90	--	PilePly-1
Rad-2	15	15	NM0119_002	--
Rad-3	40	28	--	Pit-1
Rad-4	900	310	NM0119_007	Pit-1
Rad-5	110	50	--	Pit-1
Rad-6	600	170	--	Pit-1
Rad-7	7	9	--	Pit-1
Rad-8	8	9	--	Pit-1
Rad-9	30	15	NM0119_008	Pit-1
Rad-10	160	15	--	PilePly-2
RadBack-1	9	9	--	--

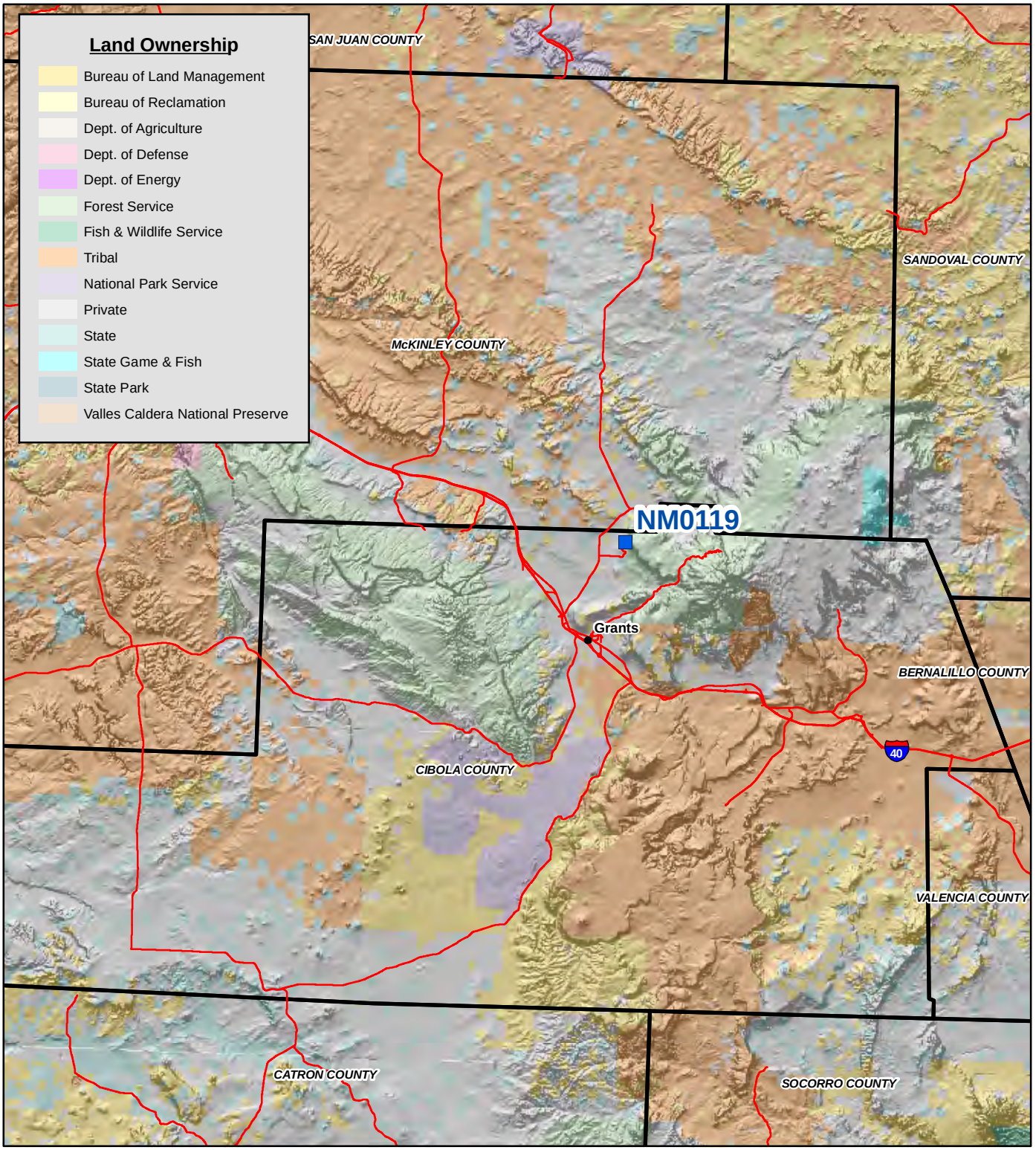
Notes:

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

µR/hr=microroetgens per hour

-- designates no information

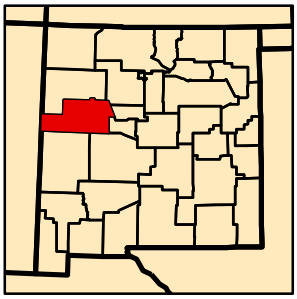
FIGURES



Map Source(s):
Ownership - BLM, 2008

0 7.5 15 30
Miles

NORTH

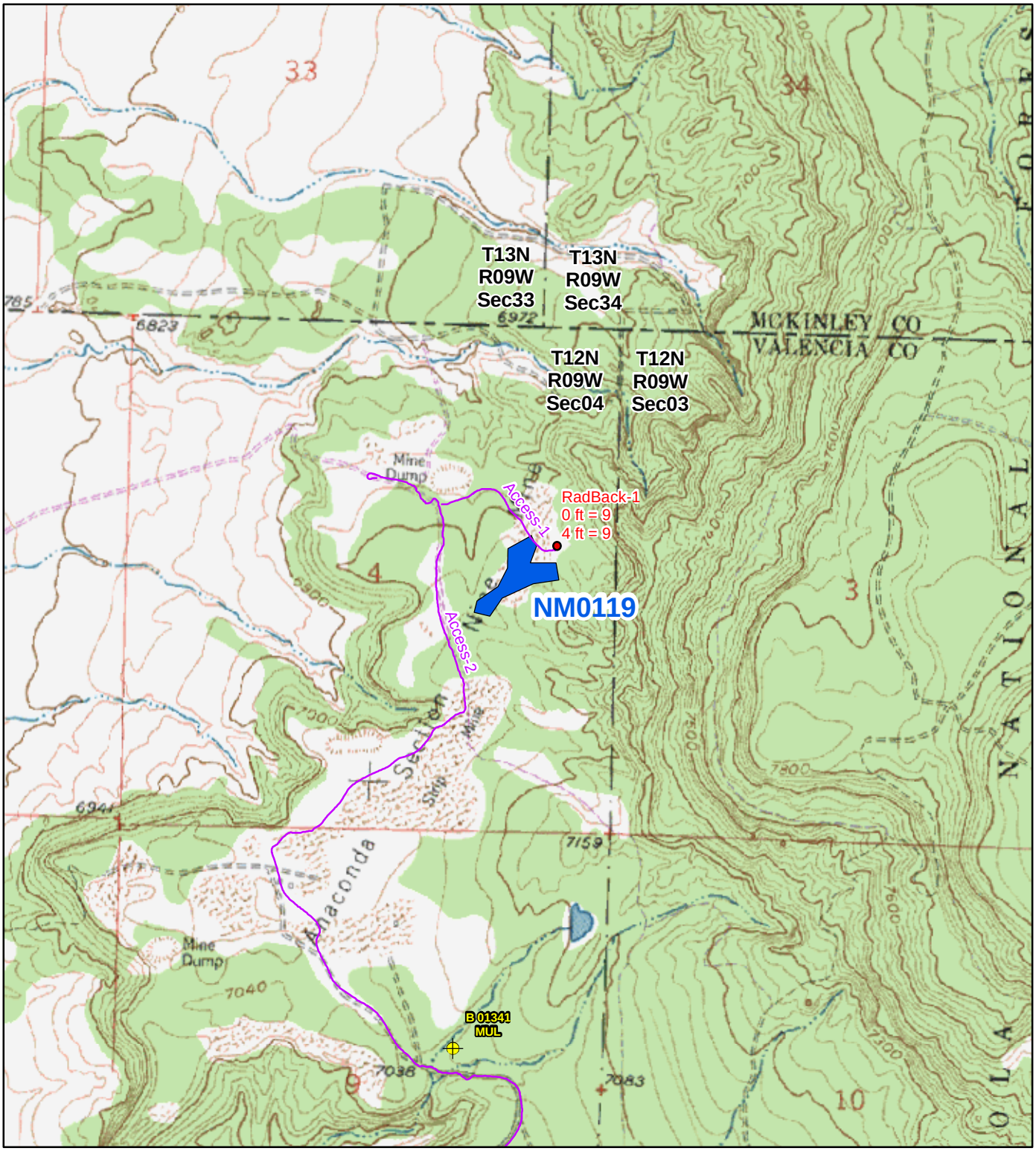


Legend

- AUM Location
- Road
- County Boundary

Figure 1
Site Location Map
NM0119-Christmas Day
Abandoned Uranium Mine Assessment

File: S:\Projects\EMMD-001_Abandoned Uranium Mine Assessment\Sites\NM0119-Christmas_Day\GIS\Map\Site_Map_ChristmasDay_CP.mxd 04/16/2010



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

0 750 1,500 3,000
Feet

NORTH

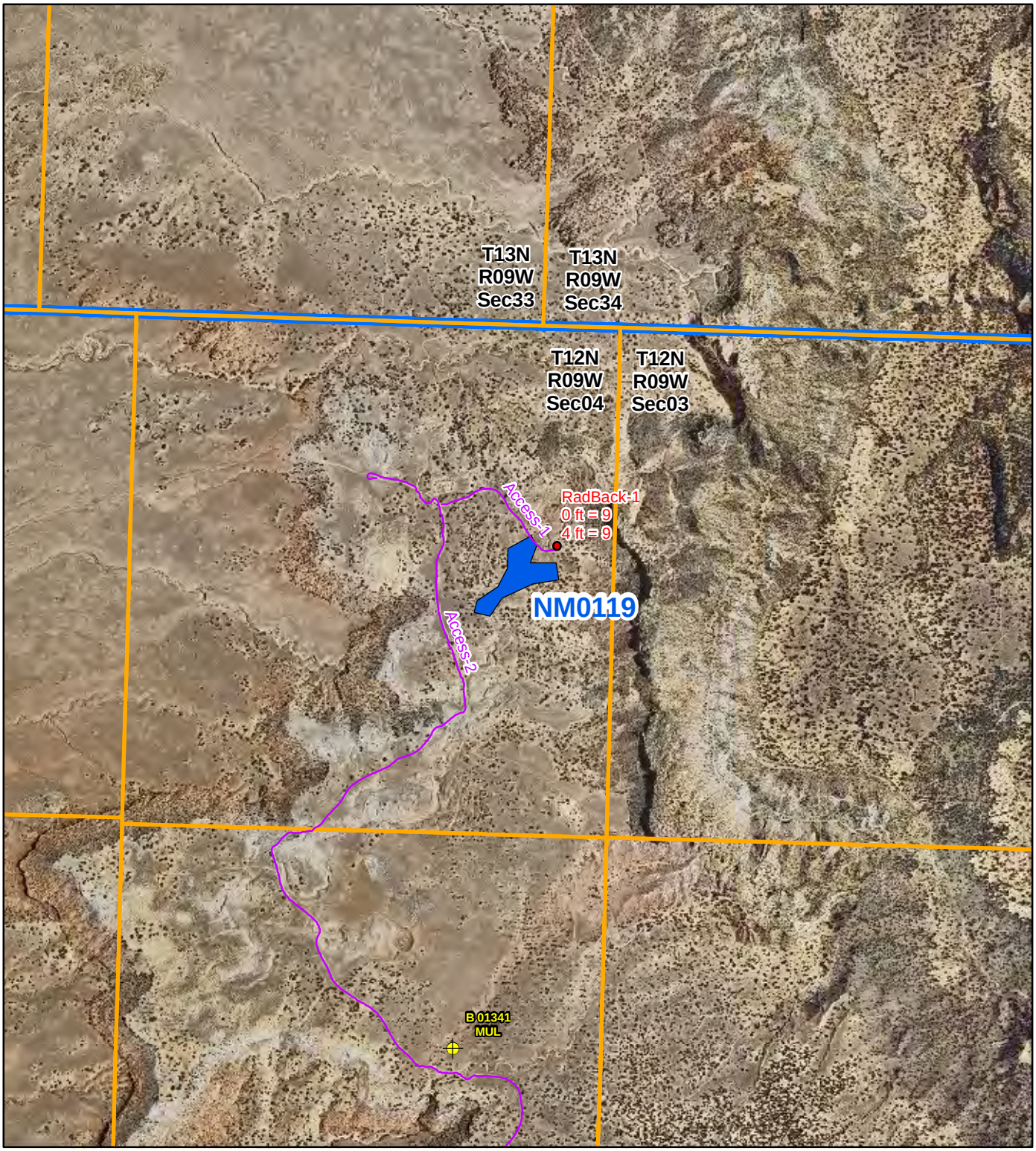
Legend

- Radiation Readings (µR/hr)
- Well Within 1 Mile of Site
- Access Route
- AUM Location Boundary (MMD Provided)

Figure 2
Topographic Map
NM0119-Christmas Day
Abandoned Uranium
Mine Assessment

INTERA

File: S:\Projects\EMMD-001_Abandoned Uranium Mine Assessment\Sites\NM0119-Christmas_Day\GIS\Map\Topo_Map_ChristmasDay_CP.mxd 04/16/2010



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

0 750 1,500 3,000
Feet

NORTH

Legend

- Radiation Readings (µR/hr)
- Well Within 1 Mile of Site
- Access Route
- AUM Location Boundary (MMD Provided)
- Section Boundary
- Township/Range Boundary

Figure 3
Aerial Photo
NM0119-Christmas Day
Abandoned Uranium
Mine Assessment

File: S:\Projects\EMMD-001_Abandoned Uranium Mine Assessment\Sites\NM0119-Christmas_Day\GIS\Map\Aerial_Map_ChristmasDay_CP.mxd 04/16/2010

Access-1

Rad-9
0 ft = 30
4 ft = 15

RadBack-1
0 ft = 9
4 ft = 9

Rad-7
0 ft = 7
4 ft = 9

Rad-10
0 ft = 160
4 ft = 15

PilePly-2

Rad-6
0 ft = 600
4 ft = 170

Pit-1

Rad-8
0 ft = 8
4 ft = 9

Rad-4
0 ft = 900
4 ft = 310

Rad-5
0 ft = 110
4 ft = 50

Fenc-1

Rad-3
0 ft = 40
4 ft = 28

Rad-1
0 ft = 270
4 ft = 90

Rad-2
0 ft = 15
4 ft = 15

PilePly-1

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

0 45 90 180
Feet

NORTH

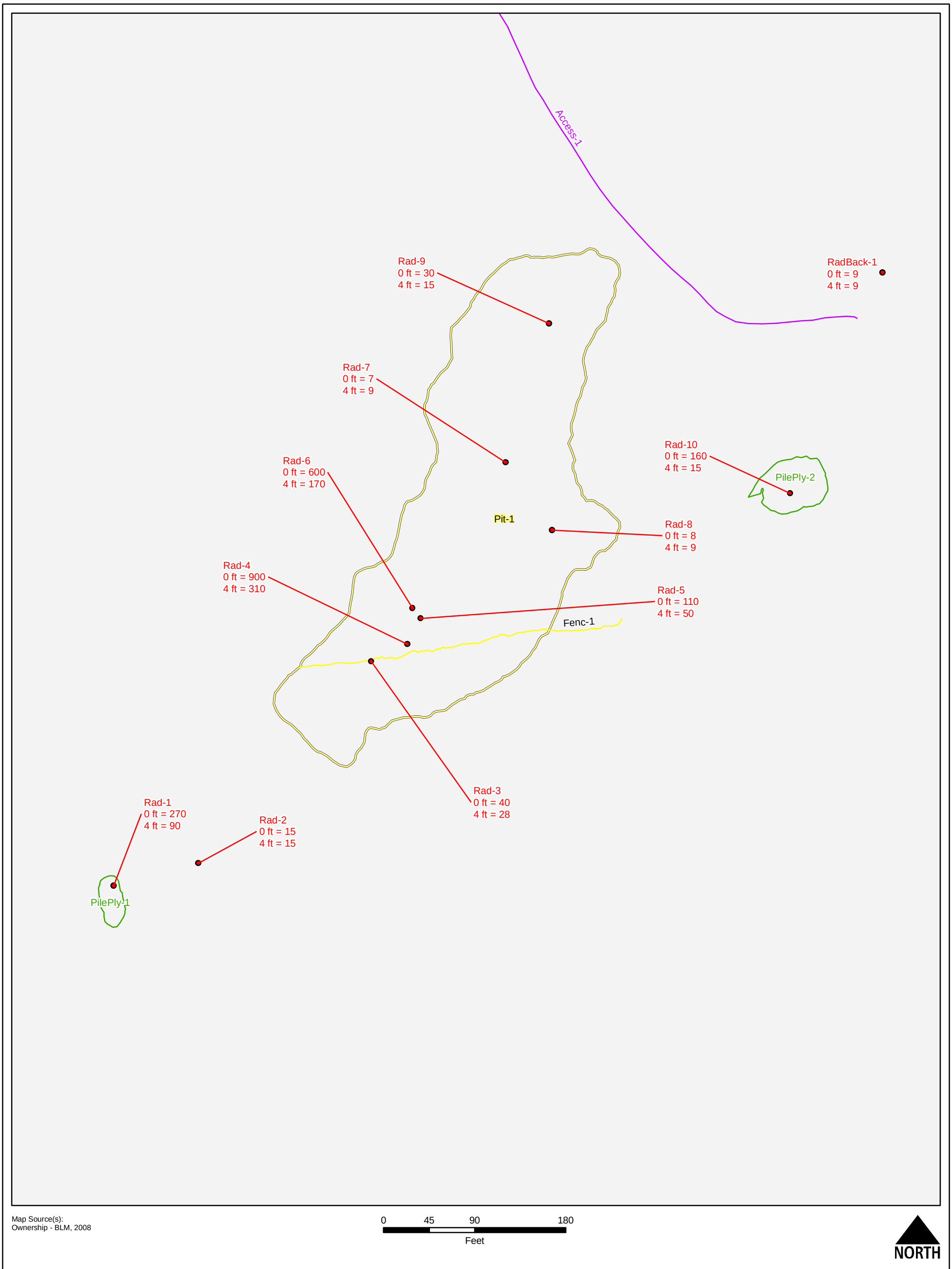
Legend

- Radiation Readings (µR/hr)
- Fence
- Access Route
- Pile Boundary
- Pit Boundary

INTERA

Figure 4a
Site Map on
Aerial Photo
NM0119-Christmas Day
Abandoned Uranium
Mine Assessment

File: S:\Projects\EMMD-001_Abandoned Uranium Mine Assessment\Sites\NM0119-Christmas_Day\GIS\Map\CloseUp_Map_Aerial_ChristmasDay_CP.mxd 04/16/2010



Map Source(s):
Ownership - BLM, 2008

0 45 90 180
Feet

NORTH

Legend

- Radiation Readings (µR/hr)
- Fence
- Access Route
- Pile Boundary
- Pit Boundary

Surface Ownership

- Private

Figure 4b
Site Map with
Surface Ownership
NM0119-Christmas Day
Abandoned Uranium
Mine Assessment

File: S:\Projects\EMMD-001_Abandoned Uranium Mine Assessment\Sites\NM0119-Christmas_Day\GIS\Map\CloseUp_Map_Ownership_ChristmasDay_CP.mxd 04/16/2010

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-Looking south at PilePly-1.

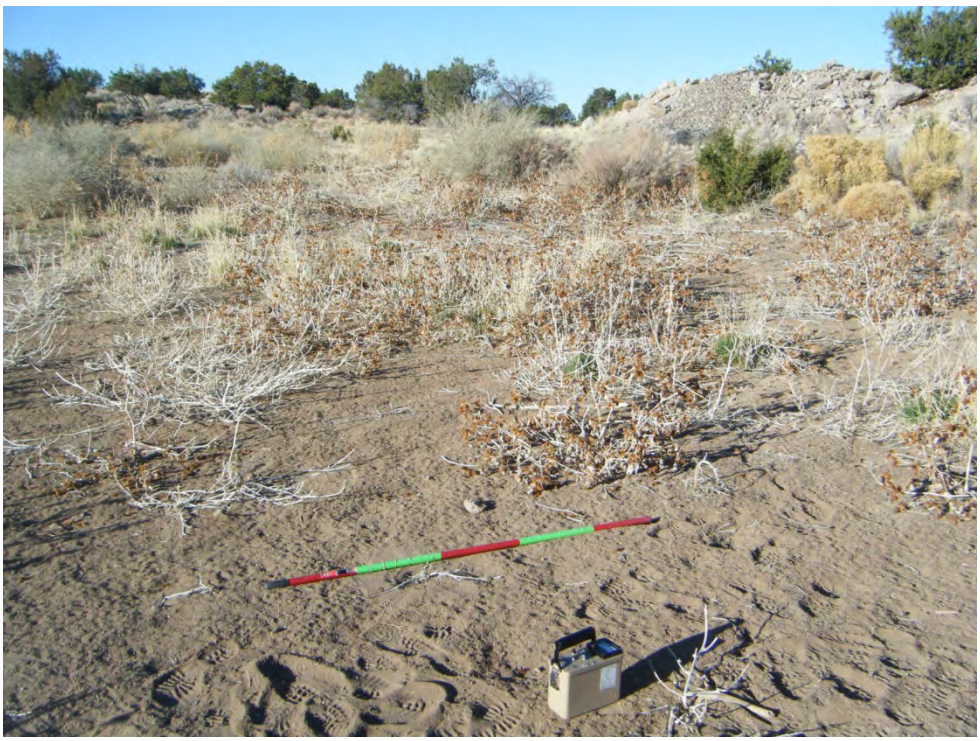


Photo 2-Radiation survey point 2 (15 µR/hr at contact).

Photo 3-Site photo looking north at Pit-1 in the background.

Photo 4-Looking south from the center of Pit-1.

Photo 5-Looking north from the center of Pit-1.

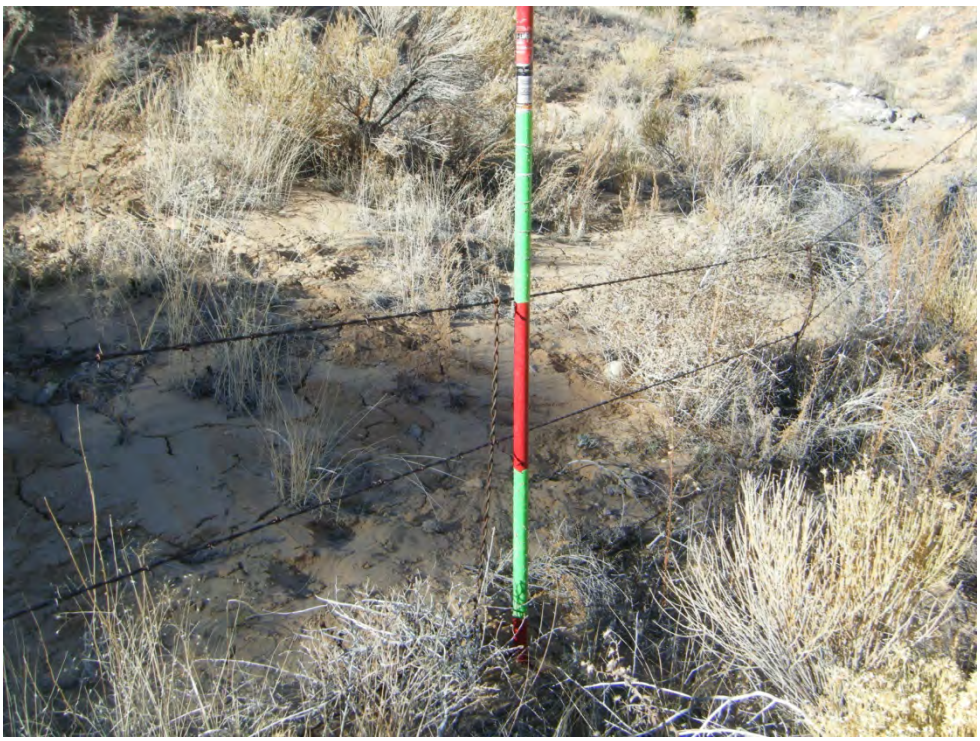


Photo 6-Fence being buried by sand (Fenc-1).

Photo 7-Limestone of the Todilto Formation exposed in the bottom of Pit-1. This is the location of radiation survey point Rad-4 (900 µR/hr at 0 ft above ground). Note aeolian sand above the Todilto.

Photo 8-Looking south at Pit-1.

Photo 9-Looking southwest at PilePly-2.

APPENDIX B

FIELD NOTES

4/7/10 ALT Abandoned Uranium Mines

Site Name: NM0119, Christmas Day

Objective: Site Assessment

Personnel: Annelia Tinklenberg
Danny Bowman

Equipment: Rental truck, Trimbel Geo XM (SN: 4948447271, 2008 series), Ludlum 192 (SN: 234149), FujiFilm digital camera (No. 80839493), backup Garmin GPS, cell phone amplifier, field laptop

750 At AUM site

Background Rad - 0m - 9uR/h; 1m - 9uR/h

PilePly-1 ~6' high, 10' wide, 30' long; waste rock
Photo: 1 - looking south at ~~Pily~~ ALT PilePly1
Rad - 1 - PilePly-1 - 0m - 270 uR/h; 1m - 90uR/h

Rad 2: 0m - 15 uR/h; 1m - 15uR/h
Photo 2 - looking south in depression - watering hole

Photo 3 - looking north at Pit1 with site Name from south side of Pit

Pit-1 - 50' deep, 100' wide, 300' long; exposed Todilto at bottom of pit, filling with sand, overburden is sand
Photo 4: looking south from center of Pit-1
Photo 5 - looking north from center of Pit-1

Rad 3 - southern end of exposed Todilto in Pit-1
0m - 40 uR/h; 1m - 28 uR/h
Fence In-1 - along southern end of Pit-1
Photo 6 - Fence being buried by sand

Rad 4 - center of exposed Todilto in Pit-1
0m - 900 uR/h; 1m - 310uR/h
Photo 7 - Todilto exposure in Pit-1

Rad 5 - north end of exposed Todilto in Pit-1
0m - 110 uR/h; 1m - 50 uR/h

Rad 6 - Todilto rock in Pit-1
0m - 600 uR/h; 1m - 170 uR/h

Rad 7 - Pit-1; 0m - 7uR/h; 1m - 9uR/h

Rad 8 - Pit-1; 0m - 8 uR/h; 1m - 9 uR/h

Rad 9 - ALT north end Pit-1; 0m - 30uR/h; 1m - 15uR/h

Photo 8 - looking south at Pit-1

PilePly 2 - 15' high, 20' wide, 30' long; sand and waste rock from Pit-1
Photo 9 - looking southwest at PilePly 2

Rad 10 - PilePly 2 - 0m - 160 uR/h; 1m - 15 uR/h
910 - Back at truck for next site.

133 4/7/10 ALT. Abandoned Uranium Mines

Soils: Tan to red sandy, rocky soils. Locally grey silty.

Rocks: Tan, red sandstone (Red = Entrada), grey Todilto Limestone

Human Activities: Grazing, fences, cowprints
Past mining activity,

Wildlife: Cottontail and jackrabbits. Deer scat.