# Abandoned Uranium Mine Assessment for the Tusas East Slope Site (NM0179)

## FINAL REPORT

**Prepared For:**

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# 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 Tusas East Slope Site (AUM Site), MMD ID: NM0179 on September 01, 2010.

## 1.1 PREVIOUSLY KNOWN INFORMATION ABOUT THE SITE

According to Anderson (1980), the AUM Site consists of a disturbed area approximately 40 ft wide by 60 ft long formed by a series of bulldozer cuts. The topsoil was removed from the cuts and piled up in dump areas (Anderson, 1980). The bedrock exposed at the site consists of Precambrian schist, granite, and a dike (Anderson, 1980).

McLemore (1983) reported that eight tons of ore yielding six pounds of $U_3O_8$ at an average grade of 0.04% $U_3O_8$ were produced from the site in 1954. One five-ton shipment assayed 0.12% $U_3O_8$ (McLemore, 1983).

## 1.2 SITE LOCATION AND DIRECTIONS

The Tusas East Slope Site is located within the Carson National Forest in the northeast quarter of Section 24, Township 28 North, Range 7 East. This AUM Site is located in Rio Arriba County and is approximately 10 miles west of the town of Tres Piedras.

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 8.5 miles farther to the junction of US-84 W and US-285 N and turn right to continue following US-285 N. Drive approximately 47.5 miles farther on US-285 N and turn left at US-64 W in Tres Piedras. Drive 11.6 miles on US-64 W and then turn left at Forest Rd 91. Follow this road approximately 3.2 miles to a fork, and bear left. Drive 0.3 miles farther to a second fork and bear left again. Drive approximately 0.4 miles farther and turn right onto a road that follows Cleveland Gulch around the west side of Tusas Mountain. Drive 0.5 miles down this road and look for a road bearing off to the left. Follow this road approximately 0.9 miles around the south side of Tusas Mountain to reach the site.

## 1.3 SITE GEOLOGY

The AUM Site is located in the Tusas Mountains, the southernmost subrange of the Rocky Mountains. Precambrian, pale greenish-gray, platy to laminar schist comprises the bedrock throughout much of the surrounding area (Bingler, 1968). At the AUM Site this schist is intruded by a mass of granitic gneiss, which underlies Tusas Peak (Bingler, 1968). Uranium mineralization occurs as fracture fillings within the schist country rock and within epithermal veins associated with the granitic intrusion (Anderson, 1980).

### 1.4 SITE HYDROGEOLOGY

The AUM Site is located on the eastern slope of Tusas Mountain. Surface drainage flows northeast at the site, toward the Rio Tusas approximately 2 miles to the northeast. The Rio Tusas joins the Rio Vallecitos and then the Rio Ojo Caliente. The Rio Ojo Caliente in turns joins the Rio Chama approximately 37 miles south of the AUM Site.

The AUM Site is located near the eastern boundary of the Rio Chama Watershed, which covers most of the Rio Chama Water Planning Region (La Calandria Associates, Inc., 2006). The area surrounding the AUM Site is comprised of Precambrian crystalline rocks overlain by Quarternary alluvial deposits. The Precambrian rocks contain small amounts of groundwater in faults and weathered zones, and may serve as sources of springs and surface stream flow (La Calandria Associates, Inc., 2006). Groundwater flow at the vicinity of the AUM Site tends to follow surface flow, generally to the south.

### 1.5 REGIONAL TOPOGRAPHY AND TERRAIN

The AUM Site can be found on the Burned Mountain Quadrangle 7.5 minute United States Geological Survey topographic map at an elevation of approximately 9,750 feet above mean sea level (please see Figure 2). The AUM Site is located along the eastern slope of Tusas Mountain, a peak over 10,100 feet high. 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. Three waste piles, two pits and one disturbed area 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 mining related declines were evident at the AUM site.

### 2.2 MINING AND EXPLORATION PITS AND OPEN CUTS

Two pits (Pit-1, Pit-2) were found at the AUM Site. Pit-1, the main excavation pit, is a shallow bulldozer cut approximately 40 ft wide and 40 ft long. The maximum gamma radiation measurement for this feature was 230 µR/hr (microroentgens per hour) at 0 ft above ground at radiation survey point Rad-1 (see Table 2). Pit-2 is a small surface excavation into igneous bedrock approximately 200 feet to the east. Gamma radiation for Pit-2 measured 310 µR/hr at 0 ft above ground at radiation survey point Rad-1 (see Table 2).

### 2.3 WASTE AND ORE PILES AND DISTURBANCES

Three waste piles (PileRidge-1, PilePly-1 and -2) and one disturbed area (DistPly-1) were found onsite. PileRidge-1 forms a low berm around the south and west ends of Pit-1. PileRidge-1 is approximately 2 ft tall, 5 ft wide, and 100 ft long. PilePly-1 and PilePly-2 are located adjacent to DistPly-1 and consist of waste rock excavated from DistPly-1 and Pit-1. DistPly is a bulldozed area approximately 40 ft wide and 60 ft long. The maximum gamma radiation measurement for these features was 425 µR/hr at 0 ft above ground at radiation survey point Rad-8 at PilePly-2 (see Table 2).

### 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 mine road (Rd-1) exists at the AUM Site. This road leads to the AUM Site from the main access road, Access-1. It runs south approximately 650 ft from the main excavation features and joins with Access-1 at its southern end.

### 2.6 BOREHOLES

No boreholes were evident at the AUM Site.

### 2.7 RECLAMATION ACTIVITIES

No evidence of ongoing or past reclamation was found at or near the AUM Site.

## 3.0 ARCHEOLOGICAL SITES

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

## 4.0 SITE GAMMA RADIATION READINGS

The background gamma radiation readings were measured approximately 0.3 miles southwest of the AUM Site boundary, along Access-1 (Please see Figures 2 and 3). The background gamma level was 24 µR/hr at 0 ft above ground and 22 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 measured on site was 425 µR/hr at 0 ft above ground and 130 µR/hr at 4 ft above ground at radiation survey point Rad-8 at PilePly-2 (see Photo 8 in Appendix A). A gamma radiation measurement taken at Pit-2 (radiation survey point Rad-10) recorded 310 µR/hr at 0 ft above ground.

# 5.0 CURRENT LAND USES

## 5.1 HUMAN ACTIVITY AND RECREATIONAL SITE USE

Cows observed nearby indicate that the land at the AUM site is used for ranching. The area also sees hunting and logging activity.

## 5.2 NEARBY RESIDENTIAL, COMMERCIAL AND INDUSTRIAL STRUCTURES

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

## 5.3 NEARBY DOMESTIC WELLS

No wells, domestic or otherwise, lie within a mile of the AUM Site.

## 5.4 EVIDENCE OF GRAZING OR AGRICULTURE

The presence of cows, cow tracks and droppings, fences, and cattle guards at the AUM indicate that the site may see frequent grazing activity.

## 5.5 EVIDENCE OF WILDLIFE

Several species of birds were seen near the AUM Site, as well as squirrels and chipmunks. Deer and elk droppings and tracks were also observed.

# 6.0 VEGETATION

The Tusas East Slope Site is located in the Subalpine Coniferous Forest vegetation type (Dick–Peddie, 1999). Woody vegetation at the site included ponderosa pine, aspen, spruce and douglas fir. The grass species included a green needlegrass and junegrass. No forb species were collected from the site. No noxious weeds were noted from photographs of the site.

# 7.0 POTENTIAL OFFSITE IMPACTS

## 7.1 EROSION

No evidence of mine related erosion was observed on site.

## 7.2 ENVIRONMENTAL IMPACTS

There is no evidence of soil staining from chemicals potentially brought to the AUM Site, or from constituents present in the ore or waste rock.

# 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.

Bingler, Edward C., 1968. Geology and Mineral Resources of Rio Arriba County, New Mexico. New Mexico Bureau of Mines and Mineral Resources Bulletin 91.

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 Resoures Open File Report OF-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

## Tusas East Slope-NM0179
## 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 | -- | -- | -- | -- | -- | -- | -- | -- |
| Access-2 | No | Access | -- | Dirt Maintained | -- | -- | -- | -- | -- | -- | -- | -- |
| DistPly-1 | Yes | -- | -- | -- | -- | 40 | 60 | -- | -- | -- | NM0179_006 | looking west; bulldozed area |
| PilePly-1 | Yes | Waste | -- | Rock | 3 | 10 | 15 | -- | -- | -- | NM0179_005 | looking west |
| PilePly-2 | Yes | Waste | -- | Rock | 1 | 8 | 10 | -- | -- | -- | NM0179_007 | looking east |
| PileRidge-1 | Yes | -- | -- | -- | 2 | 5 | 100 | -- | -- | -- | NM0179_009 | looking north |
| Pit-1 | Yes | Exploration | -- | -- | 5 | 40 | 40 | Yes | -- | -- | NM0179_004 | looking east |
| Pit-2 | Yes | Exploration | -- | -- | 2 | 15 | 20 | Yes | -- | -- | NM0179_010 | looking south |
| Rd-1 | Yes | Dirt | -- | Dirt Nonmaintained | -- | -- | -- | -- | -- | -- | -- | -- |

**Notes:**

-- designates no information

# Table 2
# Gamma Radiation Survey Results

## Tusas East Slope-NM0179
## Abandoned Uranium Mine Assessments

| Reading ID | Associated Features | 0 ft (µR/hr) | 4 ft (µR/hr) | Associated Photos |
|---|---|---|---|---|
| Rad-1 | pit-1 | 230 | 60 | -- |
| Rad-2 | pit-1 | 60 | 46 | -- |
| Rad-3 | pit-1 | 39 | 40 | -- |
| Rad-4 | pileply-1 | 180 | 70 | -- |
| Rad-5 | distply-1 | 80 | 60 | -- |
| Rad-6 | distply-1 | 70 | 43 | -- |
| Rad-7 | distply-1 | 140 | 60 | -- |
| Rad-8 | pileply-2 | 425 | 130 | NM0179_008 |
| Rad-9 | pileridge-1 | 230 | 70 | -- |
| Rad-10 | pit-2 | 310 | 140 | -- |
| Rad-11 | -- | 65 | 47 | -- |
| RadBack-1 | -- | 24 | 22 | -- |

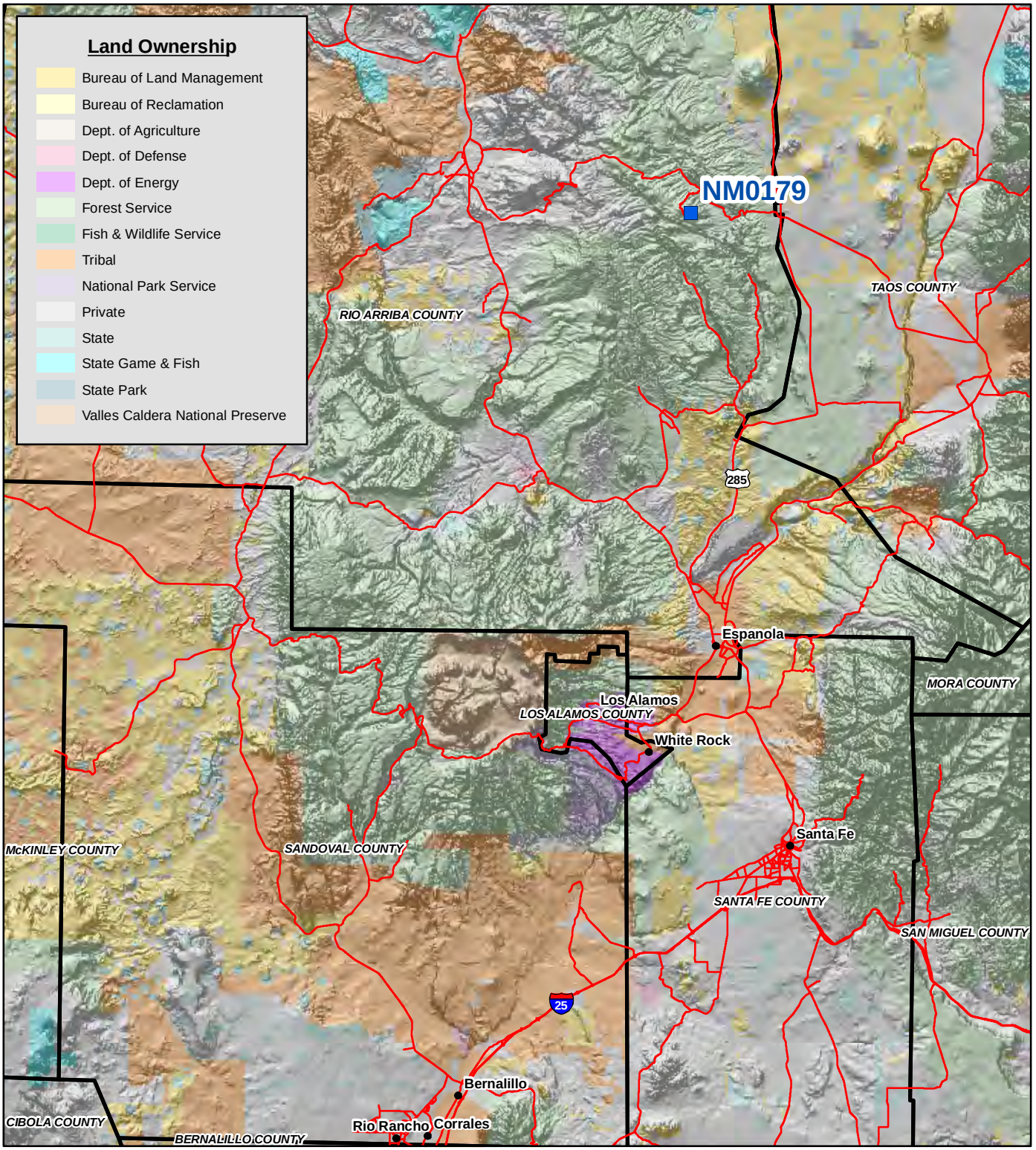
**Notes:**

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

µR/hr=microroetgens per hour

-- designates no information

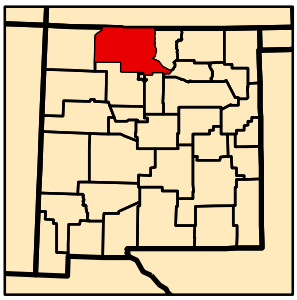
# FIGURES




Map Source(s):
Ownership - BLM, 2008

0 7.5 15 30
Miles

NORTH

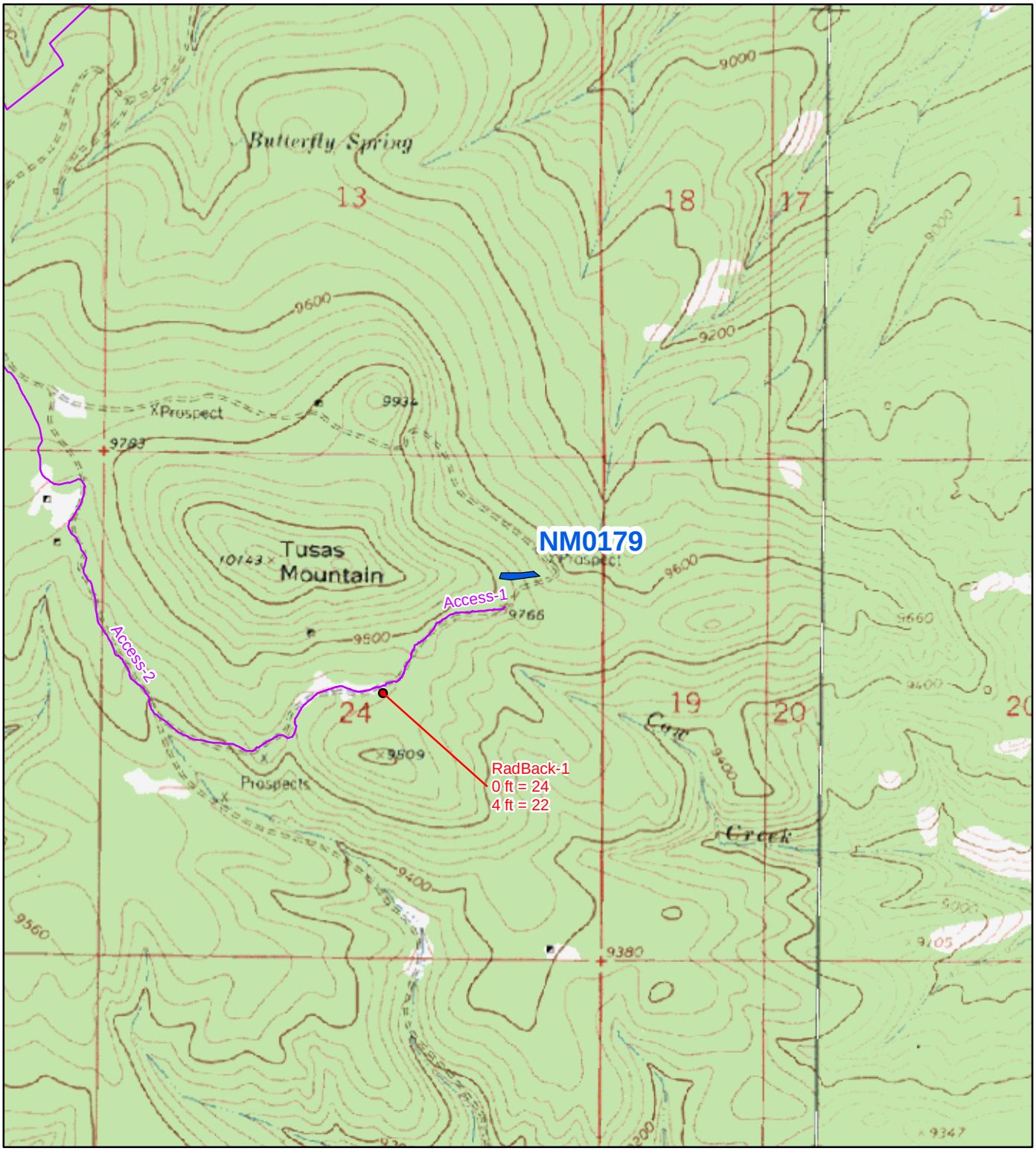


**Legend**

- AUM Location
- Road
- County Boundary

**Figure 1**
**Site Location Map**
**NM0179-Tusas East Slope**
Abandoned Uranium Mine Assessment

File: S:\Projects\EMMD-001_Abandoned Uranium Mine Assessment\Sites\NM0179-Tusas_East_Slope\GIS\Maps\Site_Map_TusasEastSlope_CP.mxd 09/14/2010




Map Source(s):
U.S. Geological Survey 7.5-Minute
Topographic Map
-Burned Mountain, 1963
-Mule Canyon, 1963

0 750 1,500 3,000
Feet

NORTH

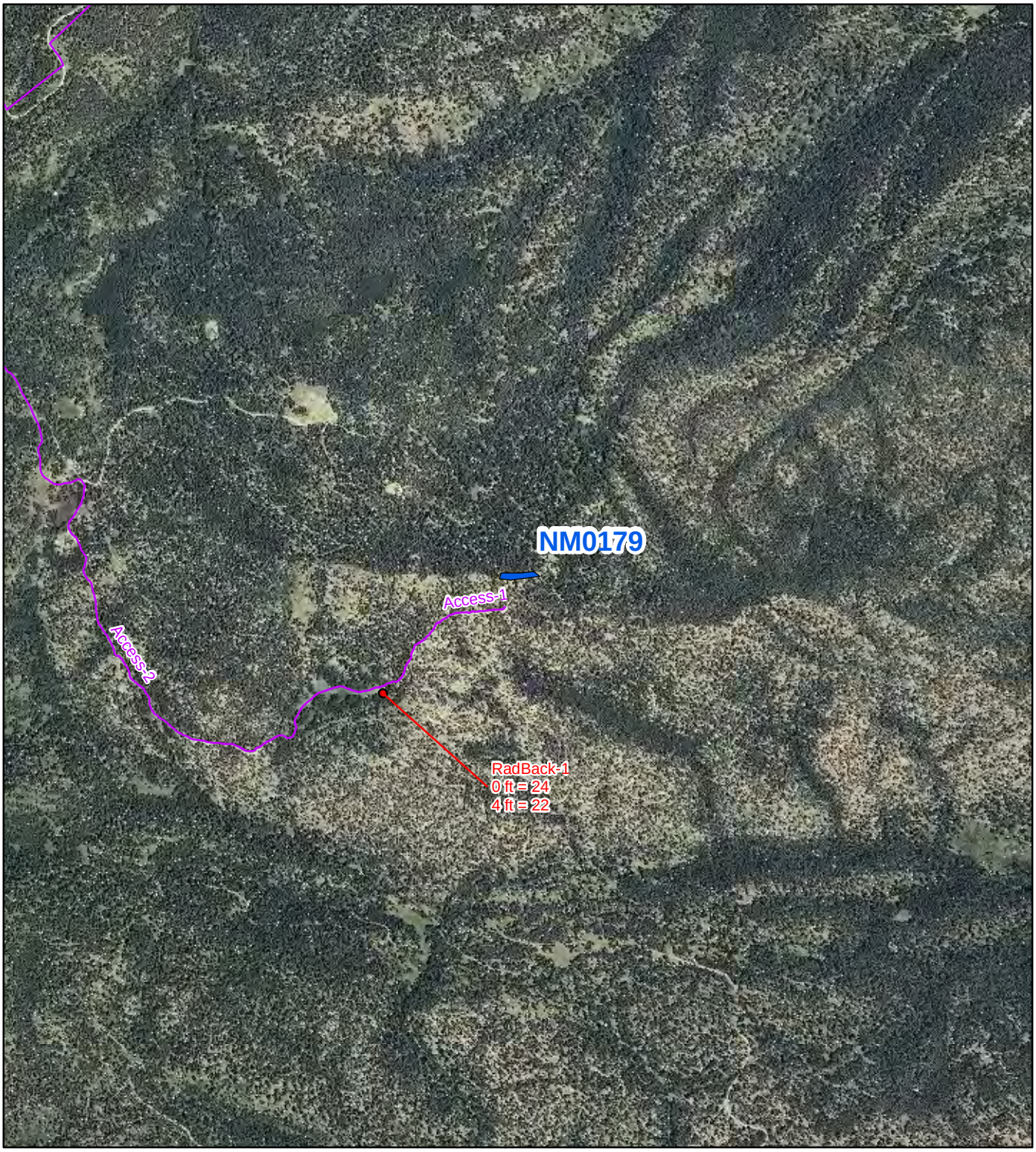
## Legend

- Radiation Readings (µR/hr)
- Access Route
- AUM Location Boundary (MMD Provided)

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

**Figure 2**
**Topographic Map**
**NM0179-Tusas East Slope**
Abandoned Uranium
Mine Assessment

File: S:\Projects\EMMD-001_Abandoned Uranium Mine Assessment\Sites\NM0179-Tusas_East_Slope\GIS\Maps\Topo_Map_TusasEastSlope_CP.mxd 09/15/2010




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

0 750 1,500 3,000
Feet

NORTH

## Legend

- Radiation Readings (µR/hr)
- Access Route
- AUM Location Boundary (MMD Provided)

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

**Figure 3**
**Aerial Photo**
**NM0179-Tusas East Slope**
Abandoned Uranium Mine Assessment

File: S:\Projects\EMMD-001_Abandoned Uranium Mine Assessment\Sites\NM0179-Tusas_East_Slope\GIS\Maps\Aerial_Map_TusasEastSlope_CP.mxd 09/15/2010


## Legend

- Radiation Readings (µR/hr)
- Photo Location
- Mine Road
- Pile Ridge
- Access Route
- Pile Boundary
- Pit Boundary
- Other Disturbance Area

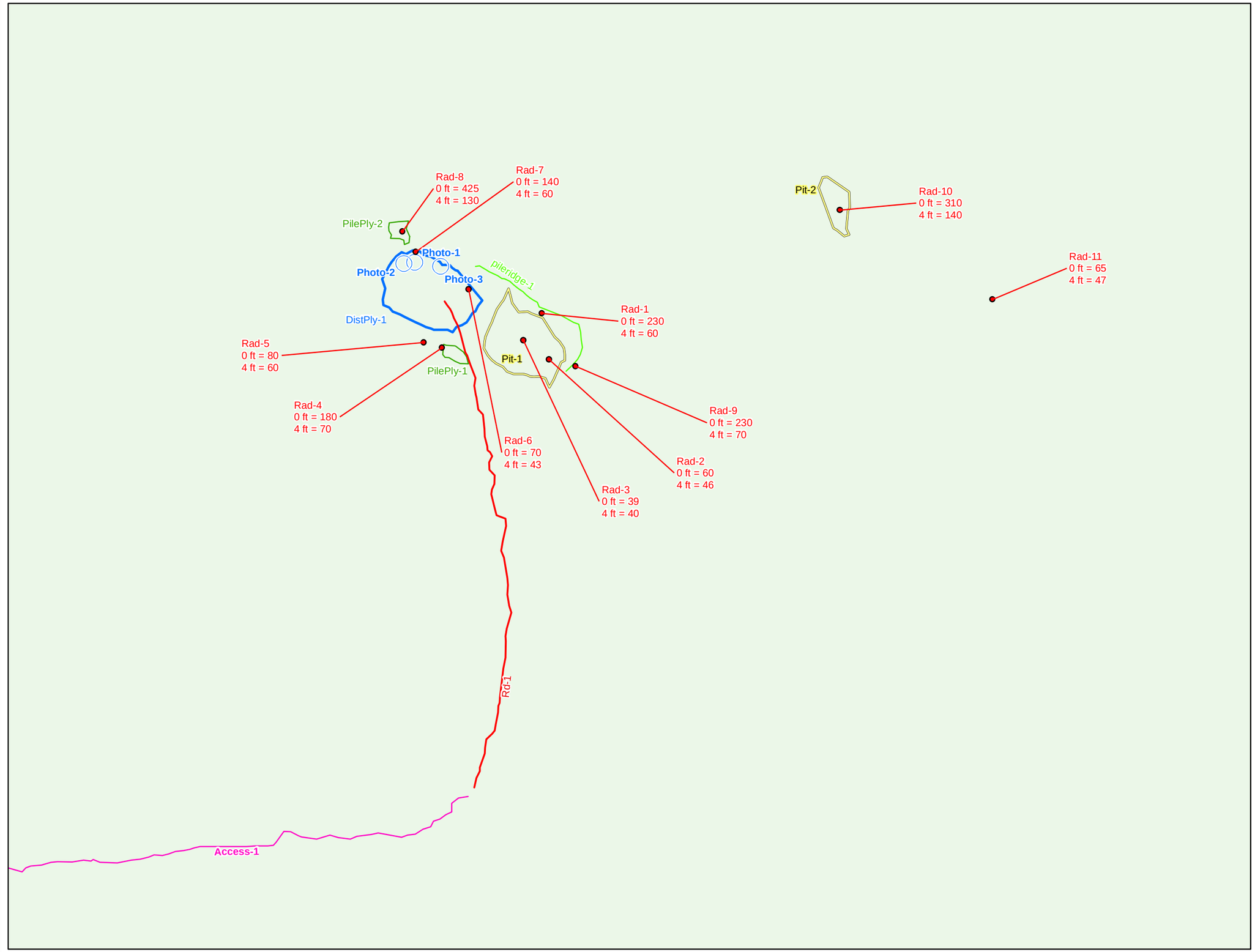
0 30 60 120
Feet

NORTH

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

**Figure 4a**
**Site Map on**
**Aerial Photo**
**NM0179-Tusas East Slope**
Abandoned Uranium
Mine Assessment

File: S:\Projects\EMMD-001_Abandoned Uranium Mine Assessment\Sites\NM0179-Tusas_East_Slope\GIS\Maps\CloseUpAerial_Map_TusasEastSlope_CP.mxd 09/15/2010




## Legend

- Radiation Readings (µR/hr)
- Photo Location
- Mine Road
- Pile Ridge
- Access Route
- Pile Boundary
- Pit Boundary
- Other Disturbance Area

**Surface Ownership**

- Forest Service

0 30 60 120

Feet

NORTH

Map Source(s):
Ownership - BLM, 2008

**Figure 4b**
**Site Map with**
**Surface Ownership**
**NM0179-Tusas East Slope**
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 east.

Photo 2-Looking southeast at site, replicating Anderson photo A.

Photo 3-Looking southeast at site, replicating Anderson photo B.

Photo 4-Looking east at Pit-1.

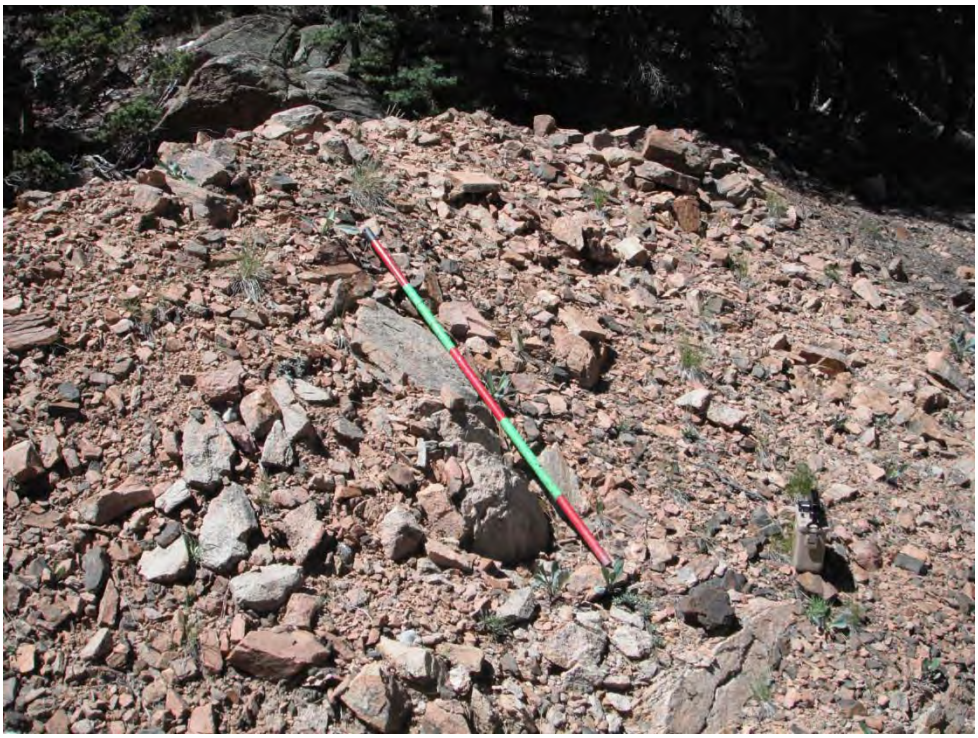


Photo 5-Looking west at PilePly-1.

Photo 6-Looking west at DistPly-2.

Photo 7-Looking east at PilePly-2.

Photo 8-Closeup of rocks at Rad-8.

Photo 9-Looking north at PileRidge-1.

Photo 10-Looking south at Pit-2.

Photo 11-Vegetation at AUM Site.

Photo 12-Vegetation at AUM Site.

Photo 13-Vegetation at AUM Site.

Photo 14-Vegetation at AUM Site.

Photo 15-Vegetation at AUM Site.

Photo 16-Vegetation at AUM Site.

# APPENDIX B

# FIELD NOTES

9/1/10 ALT Abandoned Uranium Mines

Site Name: NM0179, Tusas East Slope

Objective: Site Assessment

Personnel: Amelia Tinklenberg
Alex Resovsky

Equipment: Rented truck, Trimbel GeoXM (SN: 4948447 27, 2005 Series), Ludlum 192 (SN: 234149), Fujifilm digital camera (No. OTB31259), backup Garmin GPS, cell phone amplifier, field laptop.

~~tea~~ ALT

1200 Leaving for AUM site

Access Rd-1 - road from turnoff to NM0178 to site

Background Rad - 0m - 24 uR/h; 1m - 22 uR/h

1220 Photo 1 - Site ID location looking east

Photo 2 - site location southeast replicating Anderson ~~photo~~ ALT photo a.

Photo 3 - site location southeast replicating Anderson photo b.

Pit-1 - 5' deep, 40' x 40'

Photo 4 - Pit1 looking east

Rad-1 - Pit-1; 0m - 230 uR/h; 1m - 60 uR/h

Rad-2 - Pit-1; 0m - 60 uR/h; 1m - 46 uR/h

Rad-3 - Pit-1; 0m - 39 uR/h; 1m - 40 uR/h

PilePly-1 - 3' tall, 10' wide, 15' long, 40° slope

Photo 5 - PilePly-1 looking west

Rad 4 - PilePly-1; 0m - 180 uR/h; 1m - 70 uR/h

DistPly-1 - 60' x 40'; bulldozed area

Photo 6 - DistPly-1 looking west

Rad 5 - DistPly-1; 0m - 80 uR/h; 1m - 60 uR/h

Rad 6 - DistPly-1; 0m - 70 uR/h; 1m - 43 uR/h

9/1/10 ALT Abandoned Uranium Mines

Rad 7 - DistPly-1; 0m - 140 uR/h; 1m - 60 uR/h

PilePly 2 - 1' tall, 8' wide, 10' long, 10° slope

Photo 7 - PilePly 2 looking east

Rad 8 - PilePly 2; 0m - 425 uR/h; 1m - 130 uR/h

Photo 8 - Rad 8 rocks.

PileRidge-1 - 2' tall, 5' wide, 100' long

Photo 9 - PileRidge-1 looking north

Rad 9 - PileRidge-1; 0m - 230 uR/h; 1m - 70 uR/h

Pit-2; 2' deep, 20' long, 15' wide

Photo 10 - Pit 2 looking south

Rad 10 - Pit-2; 0m - 310 uR/h, 1m - 140 uR/h

Rad 11 - east end of polygon; 0m - 85 uR/h; 1m - 47 uR/h

Vegetation Photos 11 - 16

~~MineRd-1 to main road~~

~~Access Rd-1 ALT Photo 17 - MineRd-1~~ ALT

Access Rd-2 - from intersection with Access Rd to J.O.L.

1345 - Leaving AUM site

1405 - At truck to drive out.

Soils: Light tan sandy soil. Thin and rocky.

Rocks: Pink granite, feldspar and quartz-rich. Gray and black schist.

Wildlife: Gray squirrel, chipmunk, robin, other small birds. Rabbit, deer, and elk droppings and tracks.

Human Activities: Hunting and logging. Cattle grazing: cows, droppings, tracks, fences, cattle guards.