

Abandoned Uranium Mine Assessment for the Lucky Strike Site (NM0181)

FINAL REPORT

Prepared For:



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NM0181

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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 Lucky Strike Site (AUM Site), MMD ID: NM0181 on October 1, 2010.

1.1 PREVIOUSLY KNOWN INFORMATION ABOUT THE SITE

According to Anderson (1980), workings at the site consist of a northern and southern rim cut within the Agua Sarca member of the Chinle Formation. The northern cut measures 20 ft wide by 300 ft long with a maximum depth of 6 ft (Anderson, 1980). The southern cut is located 250-300 ft southwest of the northern cut and is 20 ft wide, 200-250 ft long, and 6 ft deep (Anderson, 1980). Small trial shipments from the Lucky Strike Site in 1957 contained 0.07% U_3O_8 (Anderson, 1980). McLemore (1983) reported that three tons of ore yielding four pounds of 0.06% U_3O_8 were produced from the site in 1957.

1.2 SITE LOCATION AND DIRECTIONS

The AUM Site is located within the Santa Fe National Forest, in the northeast quarter of Section 1, Township 22 North, Range 2 East. The AUM Site is in southern Rio Arriba County and is approximately 3 miles west of the town of Coyote. The location of this Site was provided to INTERA by MMD.

To access the AUM Site from Albuquerque, take I-25 north to Bernalillo and exit US-550. Follow US-550 north 68 miles and turn right at NM-96, approximately 3.5 miles north of Cuba. Travel approximately 29 miles east on NM-96 and turn right at Forest Road 172. Go 0.3 miles south and bear left onto Rio Arriba County Road 426. Travel 0.5 miles further south and look for a dirt road on the left. Turn onto this road and proceed 0.7 miles east to where the road ends. The AUM Site is located along the northern slope of the canyon to the south, and can be accessed on foot from by hiking 0.3 miles east along this canyon. Note that permission should be sought from the private landowner nearby to access the site.

1.3 SITE GEOLOGY

The AUM Site is located in the northern Sierra Nacimiento, a laramide uplift that forms the northwestern part of the Jemez Mountains (Pollock et al., 2004). Mesozoic sedimentary rocks are exposed in the vicinity of the AUM Site. Uraniferous sedimentary copper deposits occur locally within sandstone of the Triassic Chinle Formation (McLemore and Chenoweth, 1989).

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 south into the Agua Sarca which joins Salitral Creek approximately 0.4 miles northeast. Salitral Creek joins the Rio Puerco approximately 2.2 miles

to the east and then the Rio Puerco drains into the Abiquiu Reservoir approximately 10 miles northeast of the AUM Site.

The Agua Zarca sandstone member of the Triassic Chinle Formation constitutes a shallow aquifer partially exposed at the surface at 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 north at the AUM Site.

1.5 REGIONAL TOPOGRAPHY AND TERRAIN

The AUM Site is found on the Arroyo del Agua 7.5 minute United States Geological Survey topographic map at an elevation of approximately 7,100 ft above mean sea level (see Figure 2). The AUM Site is located along the southeastern face of a mesa above the Agua Sarca drainage. The AUM Site is on the northeastern end of the San Pedro Mountains, a northwest-trending subrange of the Jemez Mountains.

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 open cuts 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 shafts, adits or declines were found at the AUM Site.

2.2 MINING AND EXPLORATION PITS AND OPEN CUTS

Three open cuts (CutLn-1, CutLn-2, and CutLn-3) were identified onsite. CutLn-1 represents the southern rim cut referred to in Anderson (1980). This cut, approximately 10 ft high and 200 ft long, is cut into the Triassic sedimentary deposits that form the hillside. Approximately 50 ft above CutLn-1 is a smaller bench cut, CutLn-2. CutLn-2 is approximately 15 ft high and 150 ft long. CutLn-3 is a bench cut found approximately 200 north of CutLn-1 and CutLn-2 (see Figures 4a and 4b). CutLn-3 is approximately 20 ft high and 200 ft long, exposing the same deposits as CutLn-1. The maximum gamma radiation measurement for these features was 120 $\mu\text{R/hr}$ (microroentgens per hour) at 0 ft above ground at radiation survey point Rad-5 along CutLn-1 (see Table 2).

2.3 WASTE AND ORE PILES AND DISTURBANCES

No waste piles or disturbances were identified at the AUM Site.

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) was found onsite. This road extends southeast from the southern workings several hundred feet into the canyon below (see Figures 4a and 4b).

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 9 $\mu\text{R/hr}$ at 0 ft above ground and 9 $\mu\text{R/hr}$ 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 measured onsite was 120 $\mu\text{R/hr}$ at 0 ft above ground at radiation survey point Rad-5 on CutLn-1. A gamma radiation measurement taken at CutLn-3 (radiation survey point Rad-12) recorded 100 $\mu\text{R/hr}$ at 0 ft above ground.

5.0 CURRENT LAND USES

5.1 HUMAN ACTIVITY AND RECREATIONAL SITE USE

Tire tracks and trash observed along Access-2 indicate that the area is used for recreation. In addition, cattle tracks and dropping indicate the land is used for grazing.

5.2 NEARBY RESIDENTIAL, COMMERCIAL AND INDUSTRIAL STRUCTURES

A private residence along NM-96 is located approximately 800 ft east of the AUM Site. Several other homes and farms are located along the highway east of the AUM Site (see Figure 3).

5.3 NEARBY DOMESTIC WELLS

Five domestic wells lie within 1 mile of the AUM Site. These domestic wells were drilled from 1999 to 2005 and range in depth from 50 to 105 feet below ground surface with a depth to water of 40 to 78 feet below ground surface (NMOSE, 2008). Please see Figures 2 and 3 for the locations of the domestic wells.

5.4 EVIDENCE OF GRAZING OR AGRICULTURE

Cow droppings, cow prints, and fences observed near the AUM Site indicate that the land is used for cattle grazing.

5.5 EVIDENCE OF WILDLIFE

Ravens and a jackrabbit were seen at the AUM Site, as well as rabbit and deer droppings.

6.0 VEGETATION

The Lucky Strike site is located in the Coniferous and Mixed Woodland vegetation types (Dick-Peddie, 1999). Woody species include pinyon pine and Utah juniper as well as snakeweed. Grass species present were blue grama and little seed ricegrass. A species of locoweed was the dominant forb at the AUM Site. No evidence of noxious weeds was found at the AUM 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.
- 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.

McLemore, Virginia T., and William L. Chenoweth, 1989. Uranium Resources in New Mexico. Socorro: New Mexico Bureau of Mines & Mineral Resources.

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.

Pollock, Caleb J., Kevin G. Stewart, James P. Hibbard, Laura Wallace, and Ruben A. Giral, 2004. Thrust wedge tectonics and strike-slip faulting in the Sierra Nacimiento, New Mexico. New Mexico Bureau of Geology & Mineral Resources Bulletin 160.

TABLES

**Table 1
Site Features**

**Lucky Strike-NM0181
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	--	--	--	--	--	--	--	--	--	--	hiking
Access-2	No	Dirt	--	Dirt Nonmaintained	--	--	--	--	--	--	--	--
Access-3	No	Paved	--	Paved Good	--	--	--	--	--	--	--	--
CutLn-1	Yes	--	--	--	10	15	200	--	--	--	NM0181_003 NM0181_004 NM0181_005	--
CutLn-2	Yes	--	--	--	15	10	150	--	--	--	NM0181_008	--
CutLn-3	Yes	--	--	--	20	25	200	--	--	--	NM0181_009	--
Rd-1	Yes	Dirt	--	Dirt Nonmaintained	--	--	--	--	--	--	NM0181_002	--

Notes:

-- designates no information



Table 2
Gamma Radiation Survey Results

Lucky Strike-NM0181
Abandoned Uranium Mine Assessments

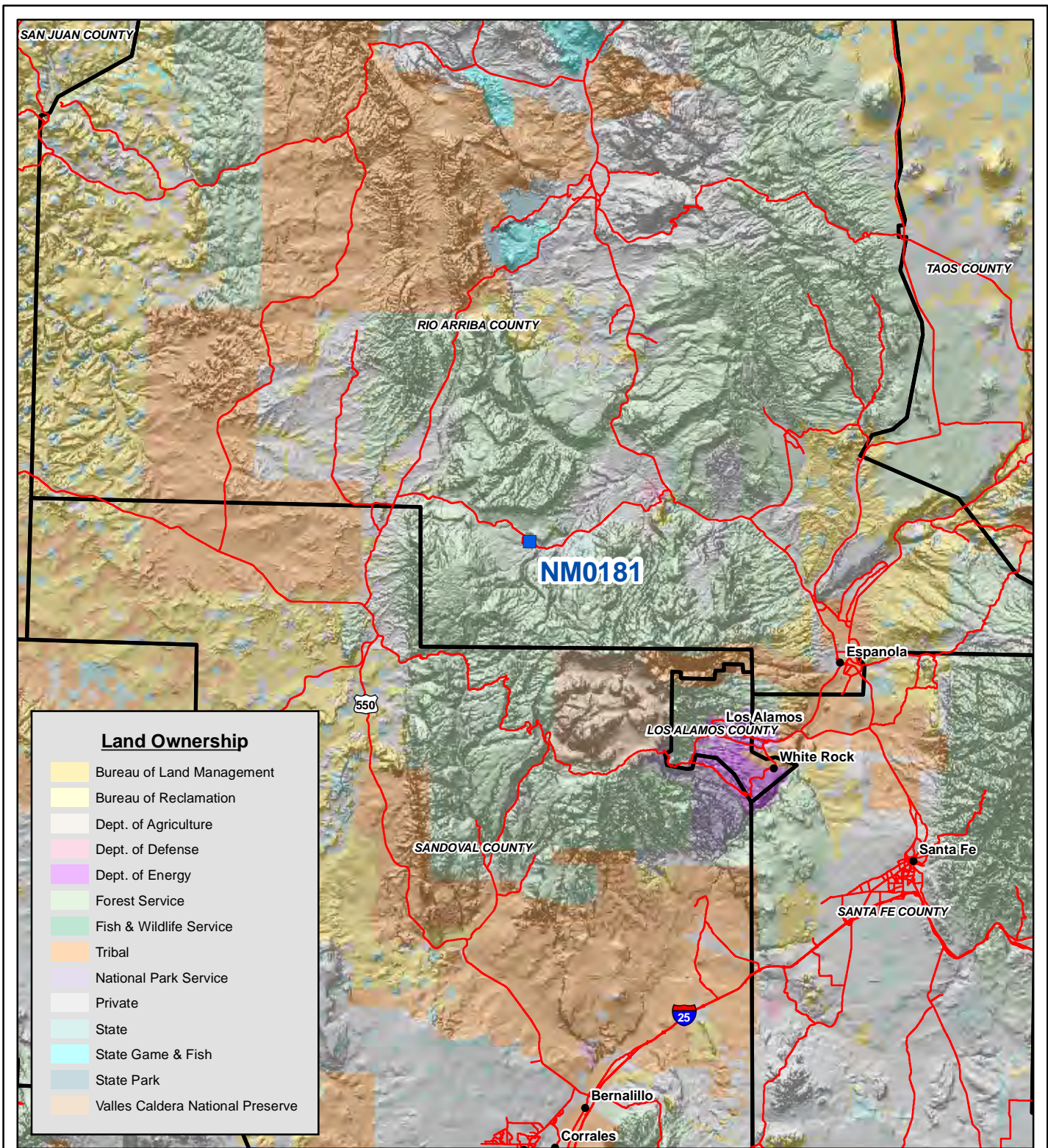
Reading ID	Associated Features	0 ft ($\mu\text{R/hr}$)	4 ft ($\mu\text{R/hr}$)	Associated Photos
Rad-1	rd-1	10	9	--
Rad-2	cutln-1	24	15	--
Rad-3	cutln-1	28	18	--
Rad-4	cutln-1	70	21	NM0181_006.jpg
Rad-5	cutln-1	120	17	NM0181_007.jpg
Rad-6	cutln-1	11	11	--
Rad-7	cutln-2	16	11	--
Rad-8	cutln-2	18	12	--
Rad-9	cutln-2	15	11	--
Rad-10	cutln-3	48	17	--
Rad-11	cutln-3	10	9	--
Rad-12	cutln-3	100	22	--
RadBack-1	--	9	9	--

Notes:

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



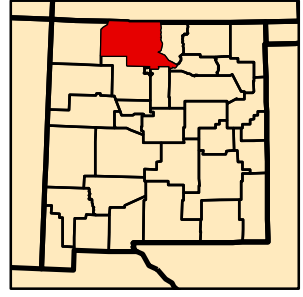
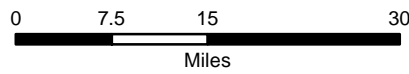
FIGURES



Land Ownership

Yellow	Bureau of Land Management
Light Yellow	Bureau of Reclamation
Light Orange	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
Blue	State Park
Light Brown	Valles Caldera National Preserve

Map Source(s):
Ownership - BLM, 2008

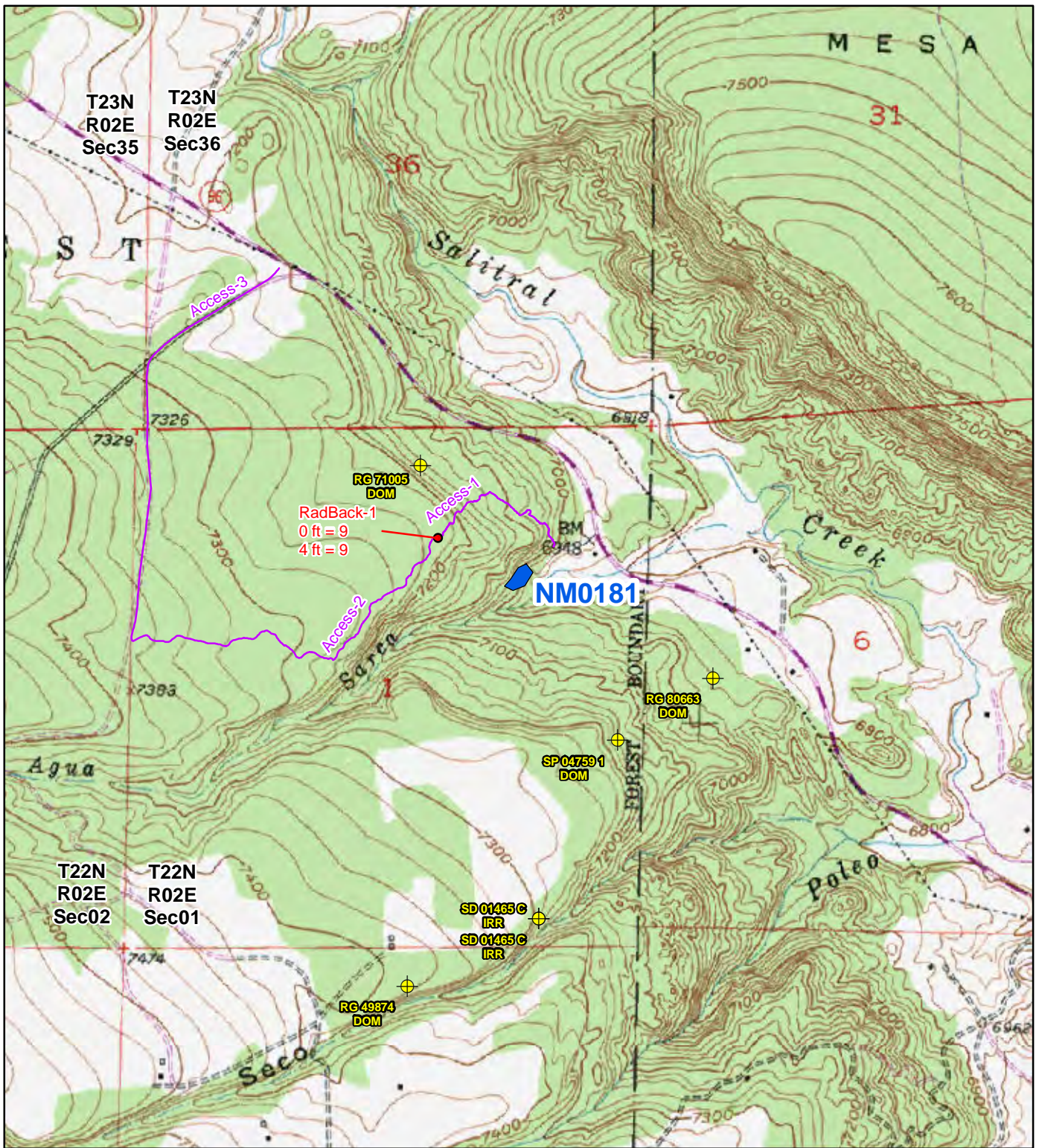


Legend

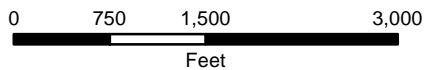
Blue square	AUM Location
Red line	Road
Black outline	County Boundary

Figure 1
Site Location Map
NM0181-Lucky Strike
Abandoned Uranium
Mine Assessment





Map Source(s):
 U.S. Geological Survey 7.5-Minute
 Topographic Map
 -Arroyo Del Agua, 1979

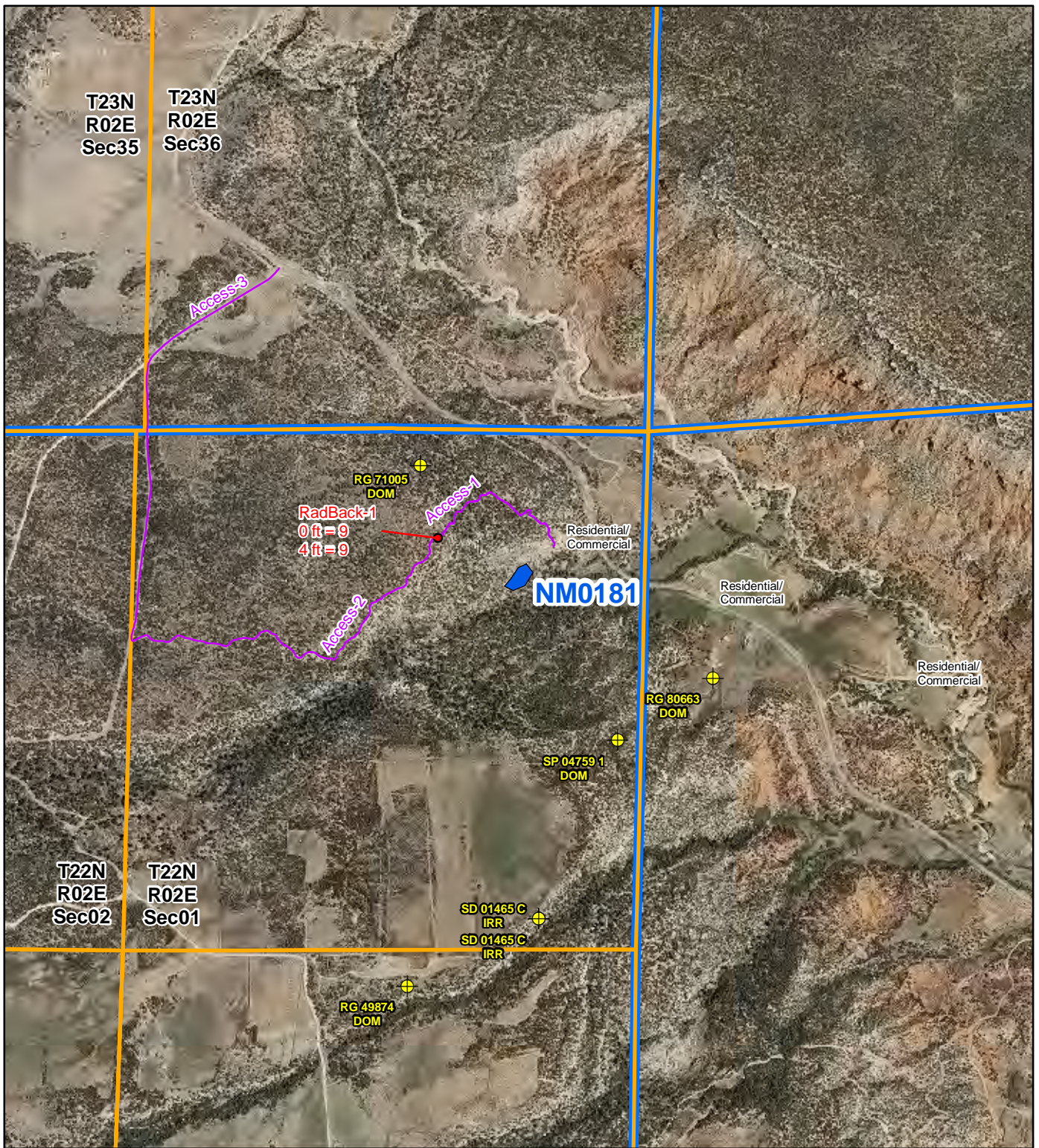


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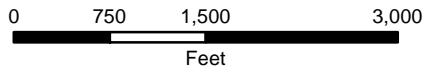
- Radiation Readings ($\mu\text{R/hr}$)
- ⊕ Well Within 1 Mile of Site
- Access Route
- AUM Location Boundary (MMD Provided)

Figure 2
Topographic Map
NM0181-Lucky Strike
 Abandoned Uranium
 Mine Assessment





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



Legend

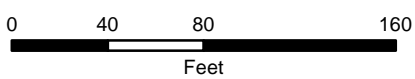
- Radiation Readings ($\mu\text{R/hr}$)
- ⊕ Well Within 1 Mile of Site
- Access Route
- AUM Location Boundary (MMD Provided)
- Section Boundary
- ▭ Township/Range Boundary

Figure 3
Aerial Photo
NM0181-Lucky Strike
 Abandoned Uranium
 Mine Assessment





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

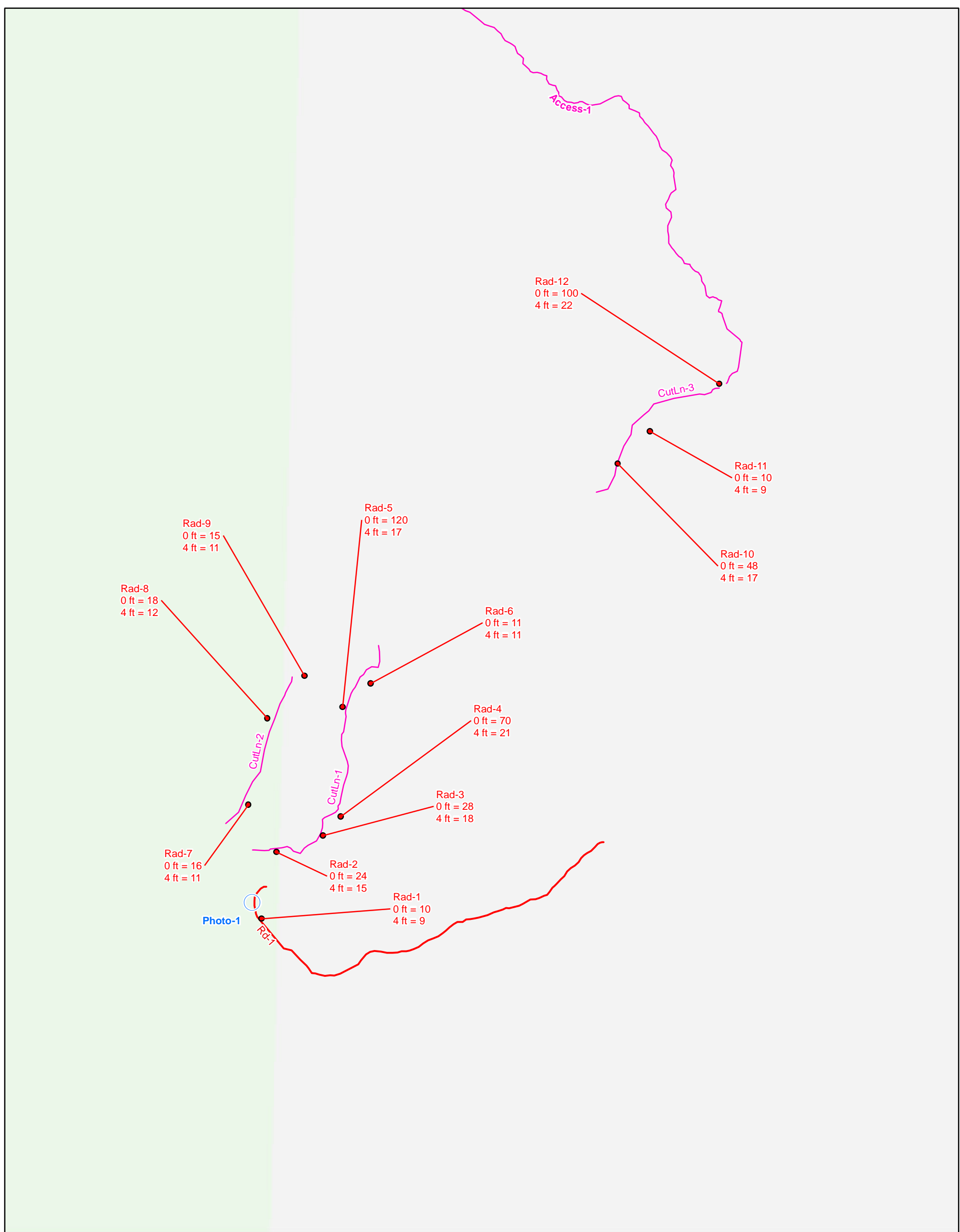


Legend

- Radiation Readings (µR/hr)
- Photo Location
- Access Route
- Mine Road
- Open Cut

Figure 4a
Site Map on
Aerial Photo
NM0181-Lucky Strike
 Abandoned Uranium
 Mine Assessment





Map Source(s):
Ownership - BLM, 2008

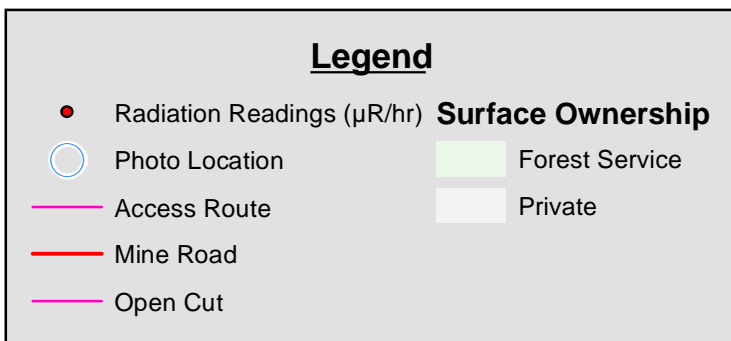
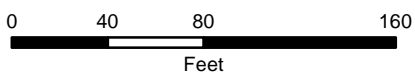


Figure 4b
Site Map with
Surface Ownership
NM0181-Lucky Strike
Abandoned Uranium
Mine Assessment



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 north.



Photo 2-Looking east at Rd-1.



Photo 3-Looking southwest at CutLn-1, replicating Anderson photo C.

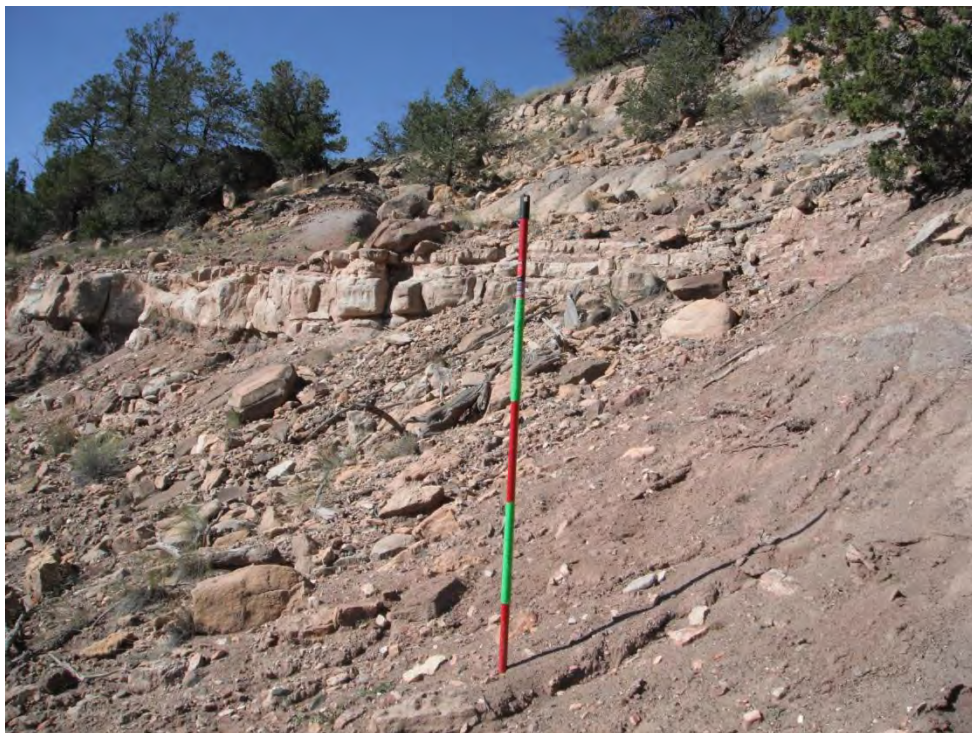


Photo 4-Looking southwest at CutLn-1, replicating Anderson photo B.



Photo 5-Looking north at CutLn-1.



Photo 6-Closeup of red, ore-bearing rock at Rad-4.



Photo 7-Closeup of dark red lens in outcrop at Rad-5.



Photo 8-Looking southwest at CutLn-2.



Photo 9-Looking southwest at CutLn-3, replicating Anderson photo A.



Photo 10-Vegetation at AUM Site.



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.

APPENDIX B
FIELD NOTES

73 10/1/10 ~~at~~ Abandoned Uranium Mines

800 Leaving Cuba for mine sites in the Coyote area.
Recon of NMO181, NMO180, NMO183 and NMO177.

900 Talked to landowner below NMO181, he gave us permission to access the site.

Site Name: NMO181, Lucky Strike

Objective: Site Assessment

Personnel: Annelia Tinklenberg
Alex Resovsky

Equipment: Rental truck, Trimbel GeoXM (SN:494844727, 2008 Series), Ludlum 192 (SN:234149) Fujifilm digital camera (No. 0+B31259), backup Garmin GPS, cell phone amplifier, field laptop

930 - on cliff above AUM site, End of road.

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

1000 At AUM polygon

Photo 1 - Site ID location looking north at site

Mine Rd - 1 - leads east and northeast from site downhill

Photo 2 - mine Rd - 1 looking east

Rad - 1 - mine Rd - 1 - Om - 10 uR/h; 1m - 9 uR/h

Cutln - 1 - 10' high, 15' wide, 200' long - bench cut, southern cut

Photo 3 - Cutln - 1 looking southwest replicating Anderson c

Photo 4 - Cutln - 1 looking southwest replicating Anderson b

Photo 5 - Cutln - 1 looking north

Rad - 2 - Cutln - 1; Om - 24 uR/h; 1m - 15 uR/h

Rad 3 - Cutln - 1; Om - 28 uR/h; 1m - 18 uR/h

Rad 4 - Cutln - 1; Om - 70 ^{ALT} uR/h; 1m - 21 uR/h

Photo 6 - Rad - 4 closeup reddish-black rock

10/1/10 ~~at~~ Abandoned Uranium Mines

74

Rad 5 - Cutln - 1; Om - 75 ¹²⁰ uR/h; 1m - 17 uR/h

Photo 7 - Rad 5 - reddish-black lens

Rad 6 - Cutln - 1; Om - 11 uR/h; 1m - 11 uR/h

Cutln - 2 - 15' tall, 150' long, 10' wide

Photo 8 - looking southwest at Cutln - 2

Rad 7 - Cutln - 2; Om - 16 uR/h; 1m - 11 uR/h

Rad 8 - Cutln - 2; Om - 18 uR/h; 1m - 12 uR/h

Rad 9 - Cutln - 2; Om - 15 uR/h; 1m - 11 uR/h

Cutln - 3 - 20' tall, 25' wide, 200' long; northern cut

Photo 9 - looking southwest at Cutln - 3, replicating Anderson a

Rad 10 - Cutln - 3; Om - 48 uR/h; 1m - 17 uR/h

Rad 11 - Cutln - 3; Om - 10 uR/h; 1m - 9 uR/h

Rad 12 - Cutln - 3; Om - 100 uR/h; 1m - 22 uR/h

Access - 1 - hiking out, back to truck.

1120 Back at truck

Photos 10 - Vegetation

Access - 2 - driving access, forest roads

Soils: Tan, sandy silty thin soils.

Recks: Tan - brown sandstone, ~~mudstone~~ ^{ALT} with brown to red-black mudstone layers

Wildlife: Flicker, rabbit; deer and rabbit droppings.

Human Activities: Fences and cow prints and droppings, and sheep prints and droppings evidence of grazing.

