Abandoned Uranium Mine Assessment for the Hogback Site (NM0196)

FINAL REPORT

Prepared For:

New Mexico Energy, Minerals and
Natural Resources Department
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NM0196

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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 Hogback Site (AUM Site), MMD ID: NM0196 on August 19, 2010.

1.1 PREVIOUSLY KNOWN INFORMATION ABOUT THE SITE

According to Anderson (1980), workings at the AUM site consisted of three small bulldozer cuts, the main one measuring about 20 ft by 25 ft with a 4 ft high waste pile at one end. The other two were about 100 ft to the west of the main cut, and were much smaller. Several samples collected at the site and assayed by the U.S. AEC showed U_3O_8 in the 0.003% to 0.01% range (Anderson, 1980). According to McLemore and Chenoweth (1989), a total of three pounds of U_3O_8 were removed from the area in 1954.

1.2 SITE LOCATION AND DIRECTIONS

The AUM Site is located on Navajo Nation tribal land in the southwest quarter of Section 15, Township 30 North, Range 16 West. The AUM Site is located in San Juan County, approximately 10 miles northwest of the town of Kirtland. 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 150 miles to Bloomfield, and turn left at US-64 toward Farmington. Travel approximately 32 miles west on US-64 and turn right onto Indian Service Rd 38. Travel north on this road approximately 5 miles to reach the site. Note that permission from the Navajo Nation is required to access Indian Service Rd 38, and an escort may be needed to reach the site.

1.3 SITE GEOLOGY

The AUM Site is located in the northern part of the San Juan Basin. This geologic structural basin contains up to 15,000 feet of sedimentary rocks ranging from Cambrian to recent (Peterson et al., 1965). A series of east-dipping Cretaceous sediments are exposed locally in a prominent southwest-northeast trending ridge, forming the hogback. Minor uraniferous beach-placer sandstone deposits were mined at the prospect from the Upper Cretaceous Point Lookout Sandstone, a sequence of olive-gray, rust-brown, and brownish-black to maroon beach sandstone units (McLemore et al., 1986). These beach-placer sandstone deposits are concentrations of heavy minerals that formed on beaches or in long-shore bars in marginal marine environments during regressions in the late Mesozoic (Mickle and Mathews, 1978; Mickle, 1978; Mathews et al., 1979).

1.4 SITE HYDROGEOLOGY

The AUM Site is located within the Middle San Juan watershed of the San Juan structural basin (San Juan Water Commission, 2003). The surface runoff at the AUM Site discharges to Mine Creek, an adjacent ephemeral stream that flows south-southwest through a shallow channel along the hogback. Mine Creek joins the San Juan River approximately 5 miles south of the AUM Site. There is no nearby permanent surface water.

The Point Lookout Sandstone comprises a shallow, confined aquifer unit that is exposed at the surface near the AUM Site. Recharge for the aquifer may occur at topographically higher outcroppings such as the hogback exposure. This unit ranges in thickness from 40 to 415 ft and groundwater in this unit flows to the southeast from the site location, toward the San Juan River. The Point Lookout Sandstone is underlain by several other major confined aquifer units including the Cretaceous Gallup Sandstone, Dakota Sandstone, and the Jurassic Morrison Formation (San Juan Water Commission, 2003).

1.5 REGIONAL TOPOGRAPHY AND TERRAIN

The AUM Site is found on the Chimney Rock Quadrangle 7.5 minute United States Geological Survey topographic map at an elevation of approximately 5,400 feet above mean sea level (see Figure 2). The AUM Site is located along Mine Creek, within an alluvium-filled valley formed by the hogback to the southeast, and another, slightly lower ridge consisting of Cretaceous and late Jurassic sedimentary exposures to the west. The southwest-northeast trending valley is topographically higher than the surrounding terrain. The two ridges form a mesa between a the Verde oil field to the southeast and broad valley to the west that dips southeast toward the San Juan River.

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. Four open pits, four piles, and two disturbed areas 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

Four open pits were found at the AUM Site. All were shallow excavations into surface alluvium. Three of the pits (Pit-2, Pit-3, Pit-4) are the bulldozer cuts referred to in Anderson (1980) (see Photos 8, 9, 11 and 13 in Appendix A). Pit-1 is located approximately 500 ft southwest of these

cuts (see Photos 1, 2, and 4 in Appendix A). The maximum gamma radiation measurement for these features was 300 µR/hr at 0 ft above ground at radiation survey point Rad-5 in Pit-2.

2.3 WASTE AND ORE PILES AND DISTURBANCES

Four waste piles and two disturbed areas were found onsite. The waste piles (PilePly-1, PilePly-2, PilePly-3, PilePly-4) consist of rock and soil excavated from the four open pits (see Photos 3, 4, 9, 10, 12, and 14 in Appendix A). The disturbance areas (DistPly-1, DistPly-2) are areas that appear to have been affected by mining-related activities, such as some shallow excavation work and dumping (see Photos 5, 6, and 7 in Appendix A). The maximum gamma radiation measured for these features was 160 µR/hr at 0 ft above ground level at radiation survey point Rad-6 on PilePly-2.

2.4 MINING RELATED BUILDINGS AND FOUNDATIONS

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

2.5 OTHER MINE FEATURES

No other mining related features were found at the AUM site.

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 14 µR/hr at 0 ft above ground and 15 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 onsite was 300 µR/hr at 0 ft above ground at radiation survey point Rad-5 in Pit-2. A gamma radiation measurement taken within Pit-1 (radiation survey point Rad-1) recorded 225 µR/hr at 0 ft above ground, and a measurement taken on PilePly-2 (radiation survey point Rad-6) recorded 160 µR/hr at 0 ft above ground.

5.0 CURRENT LAND USES

5.1 HUMAN ACTIVITY AND RECREATIONAL SITE USE

INTERA was informed by the Navajo Nation escort that the land at the AUM Site is permitted for sheep grazing, though evidence of this activity was not observed during the site assessment.

5.2 NEARBY RESIDENTIAL, COMMERCIAL AND INDUSTRIAL STRUCTURES

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

5.3 NEARBY DOMESTIC WELLS

There are no wells, domestic or otherwise, within a mile of the AUM Site.

5.4 EVIDENCE OF GRAZING OR AGRICULTURE

No evidence of grazing or agriculture was observed near the AUM Site, though INTERA was informed that the land is permitted for sheep grazing.

5.5 EVIDENCE OF WILDLIFE

No evidence of wildlife was observed onsite.

6.0 VEGETATION

The Hogback Site is located in the Great Basin Desert Scrub vegetation type. Woody vegetation is dominated by fourwing saltbush and snakeweed. Forb species include annual spurge and mustard species. Halogeton, which is a class B noxious weed for New Mexico, was observed at the AUM Site.

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.

Dick–Peddie, William A, 1999. New Mexico Vegetation: Past, Present, and Future. University of New Mexico Press.

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

Mining and Minerals Division (MMD), 2009. Mine Feature Data Dictionary.

Mickle, D. G., and Mathews, G. W., 1978, Geologic characteristics of environments favorable for uranium deposits: U.S. Department of Energy, Report GJBX-67(78), 250 pp.

Mickle, D. G., 1978, A preliminary classification of uranium deposits: U.S. Department of Energy, Report GJBX-63(78), 78 pp.

Mathews, G. W., Jones, C. A., Pilcher, R. C., and D'Andrea, R.F., Jr., 1979, Preliminary recognition criteria for uranium occurrences - a field guide: U.S. Department of Energy Report GJBX-32(79), 41 pp.

San Juan Water Commission, 2003. San Juan Basin Regional Water Plan Volume III. Prepared for the New Mexico Interstate Stream Commission.

TABLES

Table 1
Site Features

Hogback-NM0196
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	--	--	--	--	--	--	--	Indn svc rd 38
DistPly-1	Yes	--	--	--	1	30	30	--	--	--	NM0196_005	possible dozer cut
DistPly-2	Yes	--	--	--	2	50	125	--	--	--	NM0196_006 NM0196_007	photo 6 looking south, photo 7 looking north
PilePly-1	Yes	Waste	Pit-1	Rock	5	6	15	--	--	--	NM0196_003	photo 3 looking north
PilePly-2	Yes	Waste	Pit-2	Rock	4	6	30	--	--	--	NM0196_010	photo 10 looking south
PilePly-3	Yes	Waste	Pit-3	Rock	6	10	20	--	--	--	NM0196_012	photo 12 looking west
PilePly-4	Yes	Waste	Pit-4	Rock	5	8	30	--	--	--	NM0196_014	photo 14 looking north
Pit-1	Yes	Exploration	--	--	4	10	10	Yes	--	--	NM0196_001 NM0196_002 NM0196_004	photos 1/2 looking north at pit-1
Pit-2	Yes	Exploration	--	--	4	15	20	Yes	--	--	NM0196_008 NM0196_009	photos 8/9 looking east at pit-2; dozer cut
Pit-3	Yes	Exploration	--	--	3	10	20	Yes	--	--	NM0196_011	photo 11 looking west at pit-3; dozer cut
Pit-4	Yes	Exploration	--	--	3	10	20	Yes	--	--	NM0196_013	photo 13 looking northwest at pit-4; dozer cut

Notes:
-- designates no information

Table 2
Gamma Radiation Survey Results

Hogback-NM0196
Abandoned Uranium Mine Assessments

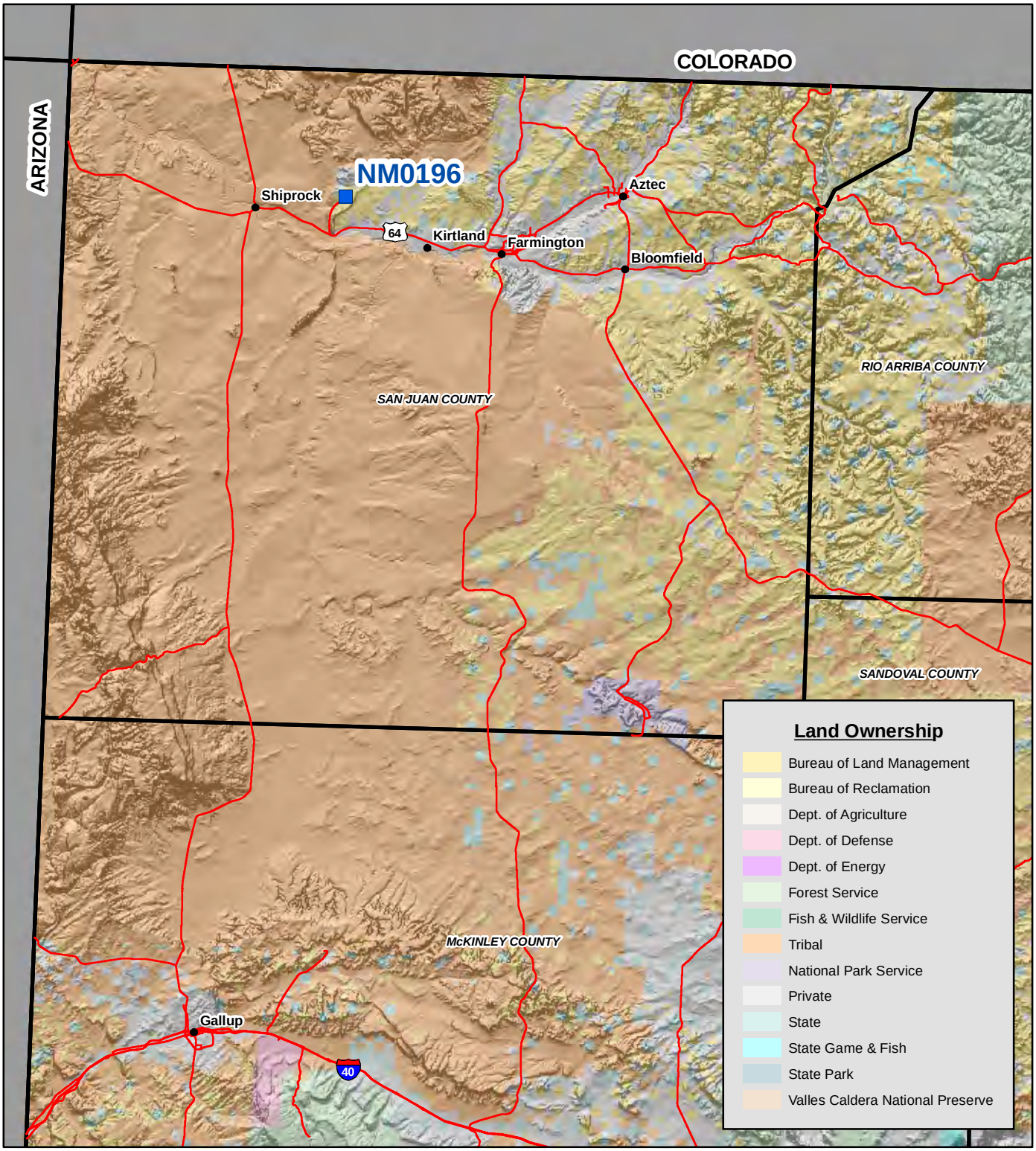
Reading ID	Associated Features	0 ft (µR/hr)	4 ft (µR/hr)	Associated Photos
Rad-1	pit-1	225	105	--
Rad-2	pileply-1	80	70	--
Rad-3	distply-1	25	23	--
Rad-4	distply-2	45	38	--
Rad-5	pit-2	300	180	--
Rad-6	pileply-2	160	110	--
Rad-7	pit-3	90	60	--
Rad-8	pileply-3	60	38	--
Rad-9	pit-4	80	60	--
Rad-10	pileply-4	80	70	--
RadBack-1	--	14	15	--

Notes:

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

µR/hr=microroetgens per hour

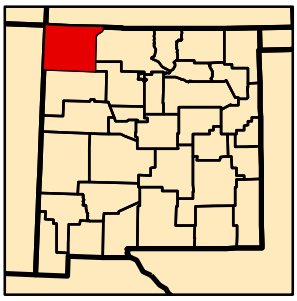
FIGURES



Map Source(s):
Ownership - BLM, 2008

0 7.5 15 30
Miles

NORTH

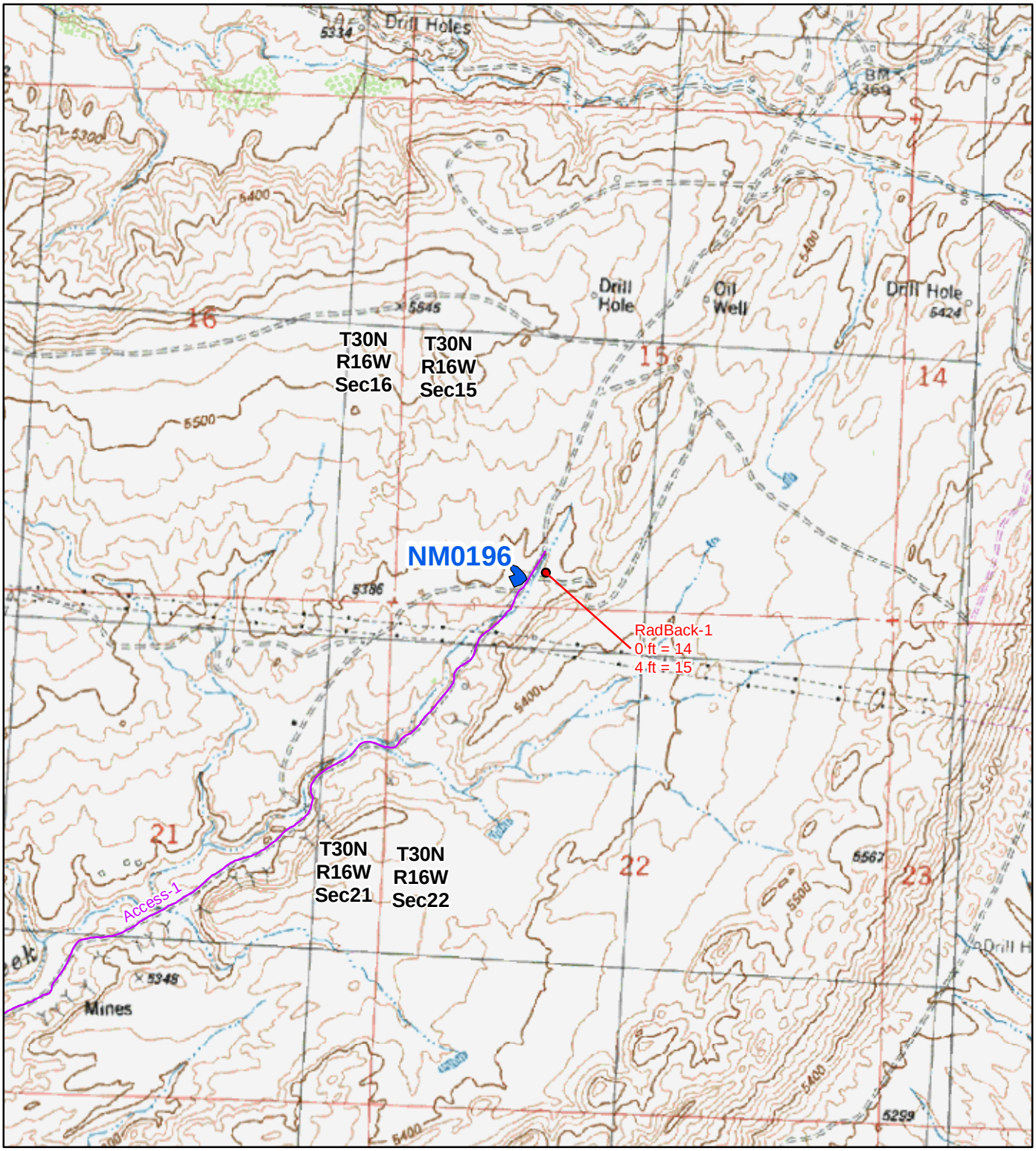


Legend

- AUM Location
- Road
- County Boundary

Figure 1
Site Location Map
NM0196-Hogback
Abandoned Uranium Mine Assessment

File: S:\Projects\EMMD-001_Abandoned Uranium Mine Assessment\Sites\NM0196-Hogback_Claim\GIS\Maps\Site_Map_Hogback_CP.mxd 08/20/2010



Map Source(s):
U.S. Geological Survey 7.5-Minute Topographic Map
-Chimney Rock, 1983
-Waterflow, 1979

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.

INTERA

Figure 2
Topographic Map
NM0196-Hogback
Abandoned Uranium Mine Assessment

File: S:\Projects\EMMD-001_Abandoned Uranium Mine Assessment\Sites\NM0196-Hogback_Claim\GIS\Maps\Topo_Map_Hogback_CP.mxd 08/26/2010

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

0 750 1,500 3,000
Feet

NORTH

Legend

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

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

INTERA

Figure 3
Aerial Photo
NM0196-Hogback
Abandoned Uranium
Mine Assessment

File: S:\Projects\EMMD-001_Abandoned Uranium Mine Assessment\Sites\NM0196-Hogback_Claim\GIS\Maps\Aerial_Map_Hogback_CP.mxd 08/26/2010

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

0 40 80 160
Feet

NORTH

Legend

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

Figure 4a
Site Map on
Aerial Photo
NM0196-Hogback
Abandoned Uranium
Mine Assessment

INTERA

File: S:\Projects\EMMD-001_Abandoned Uranium Mine Assessment\Sites\NM0196-Hogback_Claim\GIS\Maps\CloseUpAerial_Map_Hogback_CP.mxd 08/26/2010

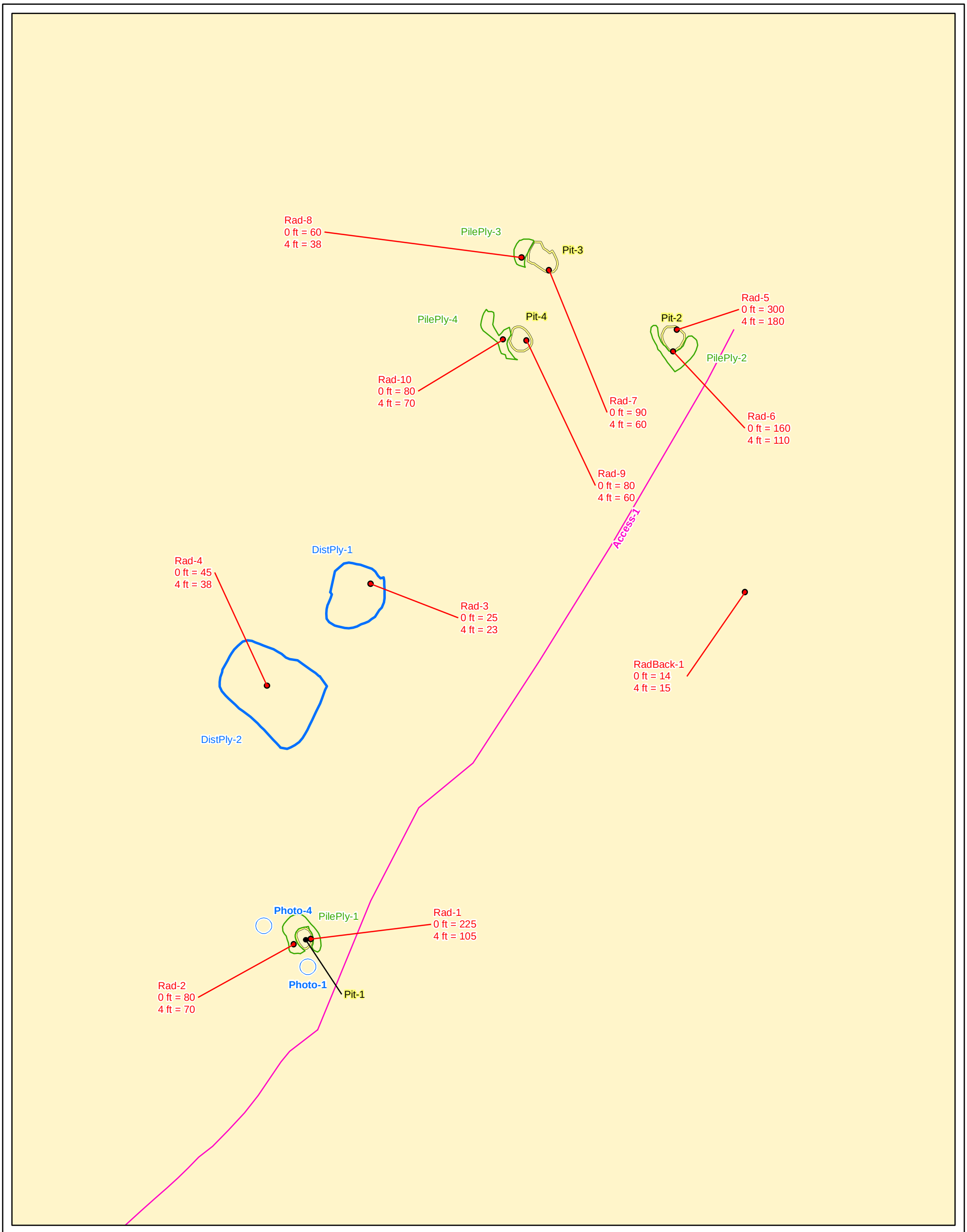


Figure 4b
Site Map with
Surface Ownership
NM0196-Hogback
Abandoned Uranium
Mine Assessment

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.

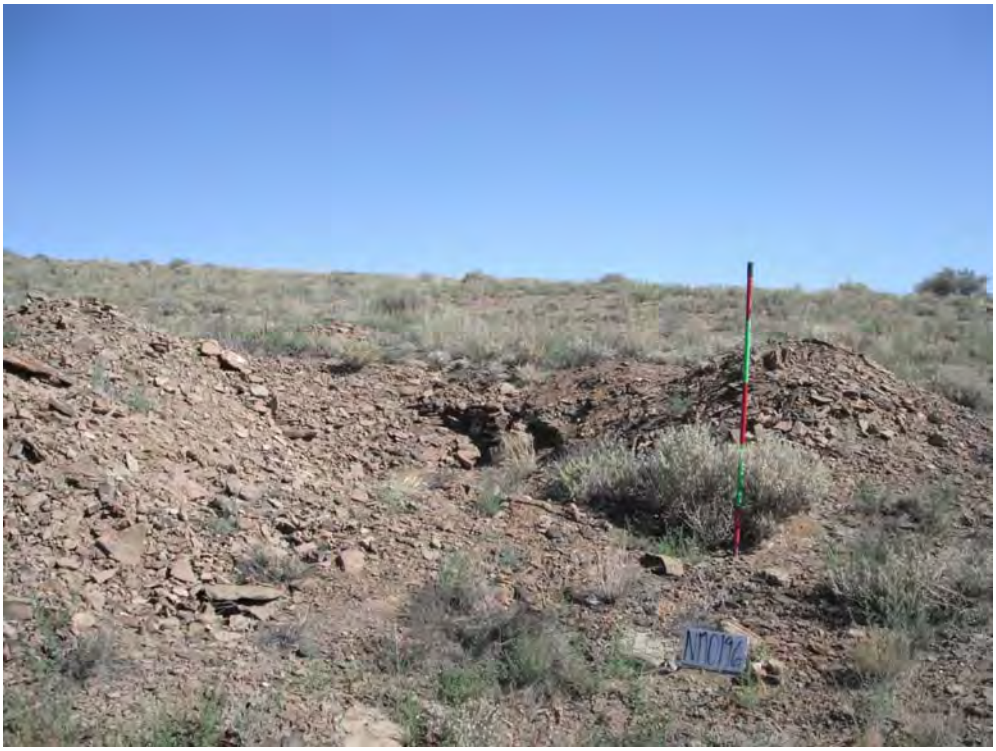


Photo 1-Site location photo, looking north at Pit-1.

Photo 2-Looking north at Pit-1.

Photo 3-Looking north at PilePly-1.

Photo 4-Looking east at Pit-1.

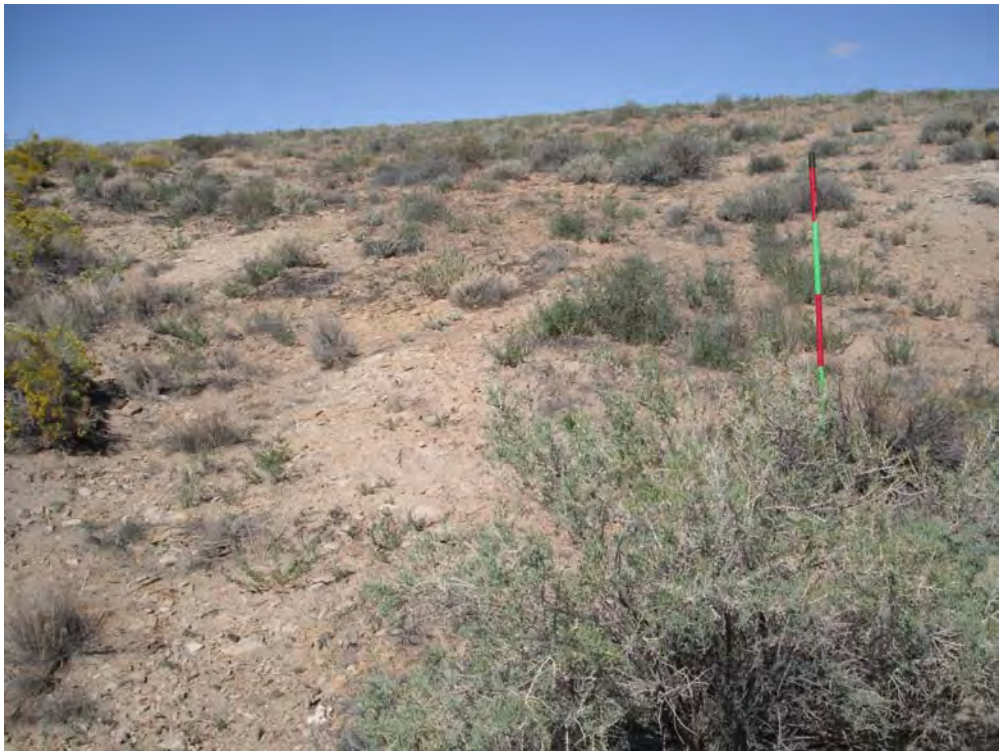


Photo 5-Looking west at DistPly-1.

Photo 6-Looking south at DistPly-2.

Photo 7- Looking north at DistPly-2.

Photo 8- Looking east at Pit-2.

Photo 9- Looking east at Pit-2, replicating Anderson photo A.

Photo 10-Looking south at PilePly-2.

Photo 11-Looking west at Pit-3, replicating Anderson photo C.

Photo 12-Looking west at PilePly-3.

Photo 13-Looking northwest at Pit-4.

Photo 14-Looking north at PilePly-4.

Photo 18-Vegetation at AUM Site.

Photo 19-Vegetation at AUM Site.

Photo 20-Vegetation at AUM Site.

Photo 21-Vegetation at AUM Site.

Photo 22-Vegetation at AUM Site.

Photo 23-Vegetation at AUM Site.

Photo 24-Vegetation at AUM Site.

Photo 25-Vegetation at AUM Site.

Photo 26-Vegetation at AUM Site.

Photo 27-Vegetation at AUM Site.

APPENDIX B

FIELD NOTES

Site Name: NM0196, Hogback

Objective: Site Assessment

Personnel: Annelia Tinklenberg
Alex Resovsky

Equipment: Rental truck, Trimbel GeoXM (SN: 4948447 27, ~~2008~~ 2005 ALT Series), Ludlum 192 (SN: 234149), Fuji Film digital camera (No. 0TB31259), backup Garmin GPS, field laptop.

8am Leave Farmington, pickup new locks and hammer
Yesterday received phone message from Melvin Yazzie that they could not find the key to the gate along the dirt road.

9am At turn off to meet with Melvin Yazzie
Melvin Yazzie c. 505-860-6901, w. 505-368-1224

910 Meet with Melvin and two others from Navajo Abandoned Mines and Land Remediation
Cut through fence

1000 At site.

Photo 1 - Site ID location looking north

Pit-1 - 10'x10', 4' deep; ~~may be "main pit"~~ ALT

Rad-1 - Pit-1; 0m - 225 uR/h; 1m - 105 uR/h

Photo 2 - looking north at Pit-1

PilePly-1 - wastepile associated with Pit 1; 15' long, 6' wide, 5' tall, 25% slope

Photo 3 - looking north at PilePly1

Rad-2 - PilePly-1; 0m - 80 uR/h; 1m - 70 uR/h

Photo 4 - ALT ~~replicating Anderson report photo a~~, looking east

DistPly-1 - may be self-remediating; 1' deep, 30' x 30'

Photo 5 - looking west at DistPly-1

Rad-3 - DistPly-1; 0m - 25 uR/h; 1m - 23 uR/h

DistPly-2 - 50' wide, 125' long, 2' deep, maybe self-remediating dozer cut

Photo 6 - looking south at DistPly-2

Rad-4 - DistPly-2; 0m - 45 uR/h; 1m - 38 uR/h

Photo 7 - looking north at DistPly-2

Pit-2 - 4' deep, 15' wide, 20' long; "main pit" in Anderson report

Photo 8 - looking east at Pit-2

Photo 9 - looking east at Pit-2 replicating Anderson photo a

Rad 5 - Pit-2; 0m - 300 uR/h; 1m - 180 uR/h

PilePly-2 - with Pit-2 - 4' tall, 6' wide, 30' long; 30%

Photo 10 - looking south at PilePly 2

Rad 6 - PilePly-2; 0m - 160 uR/h; 1m - 110 uR/h

Pit 3 - 3' deep, 10' wide, 20' long, dozer cut in Photo c

Photo 11 - looking west at Pit 3, replicating Anderson Photo C

Rad 7 - Pit 3; 0m - 90 uR/h; 1m - 60 uR/h

PilePly-3 - with Pit3; 6' high, 10' wide, 20' long 35%

Photo 12 - looking west at PilePly3

Rad 8 - PilePly 3; 0m - 60 uR/h; 1m - 38 uR/h

Pit 4 - 3' deep, 10' wide, 20' long; dozer cut in Anderson Photo d

Photo ~~12~~ 13 ALT - looking northwest at Pit 4, replicating

Rad 9 - Pit 4; 0m - 80 uR/h; 1m - 60 uR/h

PilePly 4 - 5' high, 8' wide, 30' long,

Photo ~~13~~ 14 ALT - looking north at PilePly 4

Rad 10 - PilePly-4; 0m - 80 uR/h; 1m - 70 uR/h

Back ground Rad - 0m - 14 uR/h; 1m - 15 uR/h

35 8/19/2010 ACT Abandoned Uranium Mines

1130 Leaving site. No vegetation samples collected due to similarity with NM0190, Boyd.
Access Rd-1, dirt Non maintained

1210 At US. 64
Thanked Melvin and others, told them MMD would supply them with a report and repaired the fence/gate.

Soils: tan, thin and rocky. Sandy. Locally black from coal deposits.

Rocks: yellowish brown to grey sandstone of Point Lookout Formation. Coal beds from the Menefee Formation. The beds dip at about 10° angle to the east.

Wildlife: Did not see wildlife.

Human Activities: The site is used for sheep grazing. We did not see any evidence of grazing but Melvin informed ACT bs of the use.