

# Abandoned Uranium Mine Assessment for the Agua Torres Site (NM0252)

**FINAL REPORT**

**Prepared For:**



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**Prepared By:**



**June 1, 2010**

NM0252



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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 Agua Torres Site (AUM Site), MMD ID: NM0252 on May 6, 2010.

### 1.1 PREVIOUSLY KNOWN INFORMATION ABOUT THE SITE

According to McLemore (1983), 149 tons of ore yielding 325 pounds of uranium was produced from the Agua Torres mine from 1955 to 1956. Workings consisted of four open cuts along mineralized fractures in the Madera Group near the contact with the Abo Formation (McLemore, 1983). Anderson (1980) did not visit this AUM Site.

### 1.2 SITE LOCATION AND DIRECTIONS

The AUM is located on the Sevilleta National Wildlife Refuge, administered by the U. S. Fish and Wildlife Service. The land was originally part of the Sevilleta de la Joya Land Grant. The Site lies within Socorro County, approximately 13 miles east of the town of San Acacia. The location of this Site was provided to INTERA by MMD.

To access the AUM Site from Albuquerque, drive south on Interstate 25 for 52 miles. Take Exit 170 towards Mountainair and continue east on US-60 for 9 miles. After 9 miles, turn right onto a dirt road just east of Black Butte. Continue south on this dirt road for 7 miles. After 7 miles, turn left on a dirt road bearing southeast and drive another 7 miles to the AUM Site.

Permission must be obtained from the U. S. Fish and Wildlife Service before accessing the AUM Site.

### 1.3 SITE GEOLOGY

The AUM Site lies on the contact between the Pennsylvanian-age Madera Group and the Permian-age Abo Formation. The Madera Group is interpreted to be a marine limestone and the Abo Formation is believed to represent a terrestrial environment (Kues and Giles, 2004). A thin transition zone consisting of shale with interbedded limestones (see Photo 10 in Appendix A). This transition zone is reported elsewhere in the state as well and is typically considered part of the Madera Group (Kues and Giles, 2004). The Madera-Abo contact at this location consists of a north-striking down-to-the-east normal fault (Rawling, 2005). The Marie prospect (NM0257) is found further north along the same fault.

The Madera limestones are more resistant to erosion than the surrounding strata, and this group tends to form ridges and slot canyons. One such canyon, Cibola Spring, contains flowing water (see Photos 26 and 27 in Appendix A).

Mineralization occurs in irregular masses within the Madera Group limestone near the Madera-Abo contact (see Photo 9 in Appendix A). This mineralization is friable and ranges from rust red to brown in color.

## 1.4 SITE HYDROGEOLOGY

The surface runoff at the AUM Site discharges west to Cibola Canyon, which joins the Rio Grande 10 miles to the west. Running water and pools were observed at Cibola Spring 0.2 miles northwest of the Site (see Photos 26 and 27 in Appendix A).

The AUM Site is located in central region of the Middle Rio Grande Underground Water Basin (NMOSE, 2005). A highly-transmissible aquifer, consisting of fractured Madera Group limestones, discharges at Cibola Spring to the northwest. It is unlikely that the overlying Abo Formation hosts significant groundwater as it consists of numerous interbedded mudstones (Rawling, 2005).

## 1.5 REGIONAL TOPOGRAPHY AND TERRAIN

The AUM Site is found on the Sierra de la Cruz 7.5 minute United States Geological Survey topographic map at an elevation of approximately 5600 ft above mean sea level (see Figure 2). The AUM Site is located in a region of low hills and canyons southwest of the Los Pinos Mountains. Mine features are found on a southwest-facing hillslope.

## 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, one open cut, one trench, one disturbed area, two piles, and an erosional feature 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

One open cut (CutPly-1), one trench (Trench-1), and one pit (Pit-1) were found at the AUM Site. CutPly-1 is a shallow cut located near the Abo-Madera contact (see Photo 20 in Appendix A). No mineralization was apparent in this cut. Pit-1 is a shallow excavation into Madera Formation limestone (see Photo 8 in Appendix A). Mineralization was evident in the north wall of the pit at radiation survey point Rad-4 (470  $\mu$ R/hr at 0 ft above ground; see Photo 9 in Appendix A). A trench (Trench-1) cuts into Madera Group limestone on the northern face of Pit-1 (see Photo 11 in Appendix A). The maximum gamma radiation measurement on these features was 900  $\mu$ R/hr at 0 ft above ground at radiation survey point Rad-9 in Pit-1.

### **2.3 WASTE AND ORE PILES AND DISTURBANCES**

Two waste piles and one disturbed area were found onsite. PilePly-1 consisted of Madera Group waste rock (see Photo 3 in Appendix A). PilePly-2 was composed of soil and rocks (see Photo 4 in Appendix A). The disturbance (DistPly-1) consisted of a shallow scrape in Madera Group limestone (see Photo 21 in Appendix A). The maximum gamma radiation measurement on these features was 220  $\mu\text{R/hr}$  at 0 ft above ground at radiation survey point Rad-1 on PilePly-1.

### **2.4 MINING RELATED BUILDINGS AND FOUNDATIONS**

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

### **2.5 OTHER MINE FEATURES**

A drainage (ErosLn-1) runs through Pit-1 and cuts into PilePly-2 (see Photo 13 in Appendix A). A slot canyon with running water (ErosPt-1) is located about 0.2 miles to the northwest (see Photos 26 and 27 in Appendix A).

### **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 7  $\mu\text{R/hr}$  at 0 ft above ground and 8  $\mu\text{R/hr}$  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 900  $\mu\text{R/hr}$  at 0 ft above ground at radiation survey point Rad-9 in Pit-1 (see Photo 14 in Appendix A). A gamma radiation measurement taken on mineralization in Pit-1 (radiation survey point Rad-4, see Photo 9 in Appendix A) recorded 470  $\mu\text{R/hr}$  at 0 ft above ground.

## 5.0 CURRENT LAND USES

### 5.1 HUMAN ACTIVITY AND RECREATIONAL SITE USE

Human presence in the Sevilleta National Wildlife Refuge is limited to research 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

Grazing and agriculture is not allowed on the Sevilleta National Wildlife Refuge, but wild horse droppings were found near the AUM Site.

### 5.5 EVIDENCE OF WILDLIFE

Wild horse droppings were noted near the AUM Site. A horned lizard, other lizards, and small birds were seen on or near the Site. A rattlesnake was seen while driving to the Site.

## 6.0 VEGETATION

The AUM site is located in the Juniper Savanna Ecotone. Woody species at the site include one-seed juniper, pinyon pine, littleleaf sumac, mesquite, and rubber rabbitbrush. Sand verbena, desert globemallow, Indian paintbrush, chihuahuan flax, multiple species of primrose, and feathered dalia were also present. Alkali and giant sacaton as well as blue and black grama were the grasses identified at the AUM Site. There was no evidence of noxious weeds at the AUM Site.

## 7.0 POTENTIAL OFFSITE IMPACTS

### 7.1 EROSION

A drainage runs through Pit-1 and cuts through PilePly-2.

### 7.2 ENVIRONMENTAL IMPACTS

There is no evidence of soil staining from chemicals potentially brought to the AUM Site.

## 8.0 REFERENCES

- Dick–Peddie, William A, 1999. *New Mexico Vegetation: Past, Present, and Future*. University of New Mexico Press.
- Kues, Barry S. and Giles, Katherine A., 2004. The Late Paleozoic Ancestral Rocky Mountains System in New Mexico in Mack, Greg H. and Giles, Katherine A., eds., *The Geology of New Mexico, A Geologic History*. New Mexico Geological Society, p. 95-136.
- Julyan, Robert, 2006. *The Mountains of New Mexico*. University of New Mexico Press.
- 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), 2005. *Declared Underground Water Basins in New Mexico*. Accessed April 30, 2010.  
<[http://www.ose.state.nm.us/PDF/Maps/Decl\\_gw\\_basins\\_PLSS\\_Lines.pdf](http://www.ose.state.nm.us/PDF/Maps/Decl_gw_basins_PLSS_Lines.pdf)>
- Rawling, Geoffrey C., 2005. *Geology and Hydrologic Setting of Springs and Seeps on the Sevilleta National Wildlife Refuge*. New Mexico Bureau of Mines and Mineral Resources Open File Report 495.

## TABLES

**Table 1  
Site Features**

**Agua Torres-NM0252  
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    | --                   | --                     | --          | --   | --        | --           | --                       | Access to NM0252 and NM0257 |
| CutPly-1     | Yes      | --           | --                 | --                 | 5                    | 40                     | 15          | --   | --        | --           | NM0252_020               | --                          |
| DistPly-1    | Yes      | --           | --                 | --                 | 1                    | 8                      | 40          | --   | --        | --           | NM0252_021               | --                          |
| ErosLn-1     | Yes      | Drainage     | --                 | --                 | 1                    | 5                      | 120         | --   | --        | --           | NM0252_013               | --                          |
| PilePly-1    | Yes      | Waste        | --                 | Rock               | 5                    | 66                     | 90          | --   | --        | --           | NM0252_003               | --                          |
| PilePly-2    | Yes      | Waste        | --                 | Soil               | 5                    | 135                    | 15          | --   | --        | --           | NM0252_004               | --                          |
| Pit-1        | Yes      | Mining       | --                 | --                 | 6                    | 25                     | 45          | Yes  | --        | --           | NM0252_008               | --                          |
| Spring-1     | No       | Drainage     | --                 | --                 | 40                   | 50                     | 400         | --   | --        | --           | NM0252_025<br>NM0252_026 | Cibola Spring               |
| Trench-1     | Yes      | --           | --                 | --                 | 7                    | 15                     | 30          | --   | --        | --           | NM0252_011               | --                          |

**Notes:**

-- designates no information



**Table 2  
Gamma Radiation Survey Results**

**Agua Torres-NM0252  
Abandoned Uranium Mine Assessments**

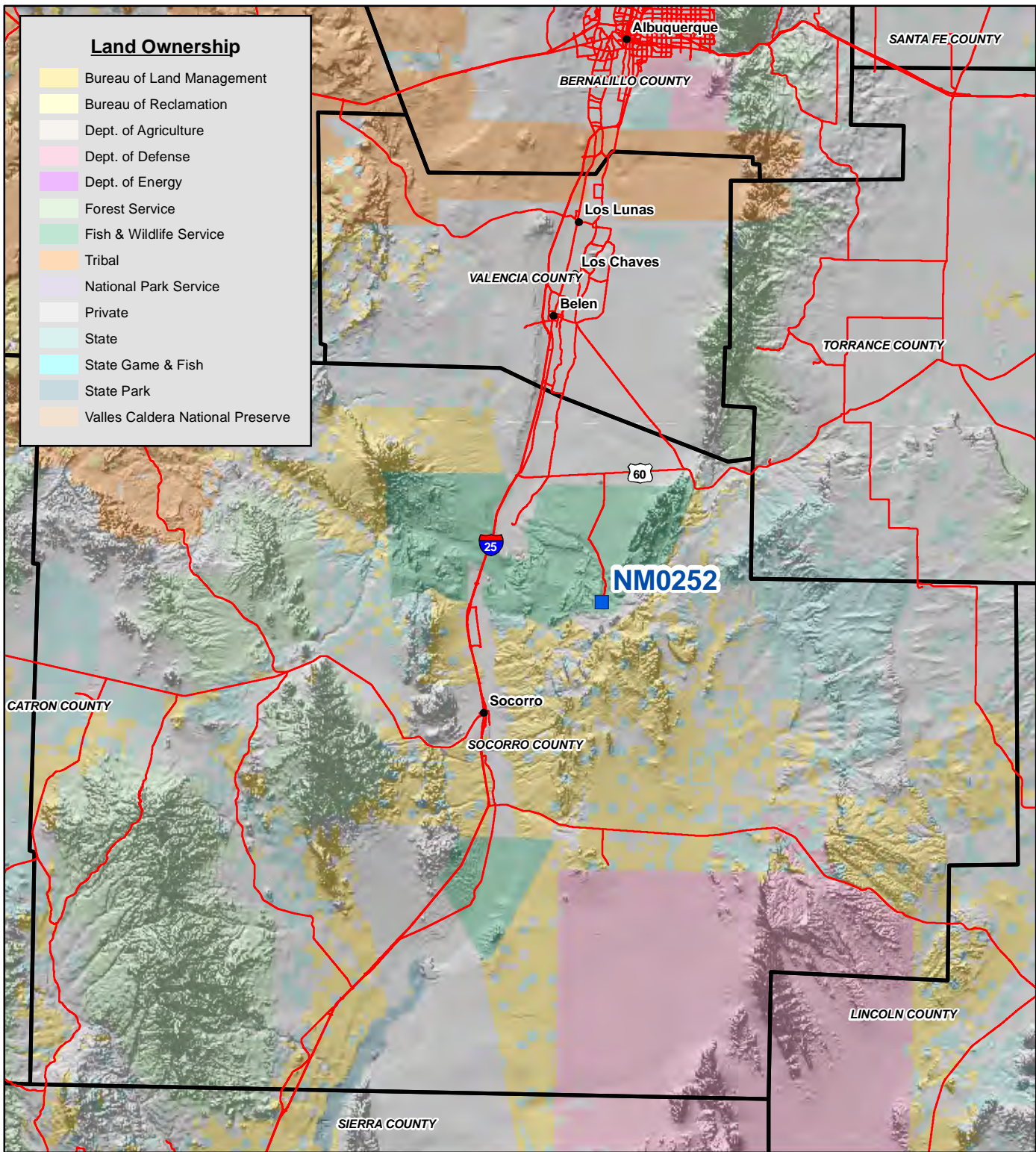
| Reading ID | Associated Features | 0 ft<br>( $\mu$ R/hr) | 4 ft<br>( $\mu$ R/hr) | Associated Photos |
|------------|---------------------|-----------------------|-----------------------|-------------------|
| Rad-1      | PilePly-1           | 220                   | 130                   | --                |
| Rad-2      | PilePly-1           | 49                    | 42                    | --                |
| Rad-3      | PilePly-2           | 140                   | 80                    | --                |
| Rad-4      | Pit-1               | 470                   | 100                   | NM0252_009        |
| Rad-5      | Pit-1               | 26                    | 27                    | --                |
| Rad-6      | Trench-1            | 350                   | 190                   | --                |
| Rad-7      | Trench-1            | 470                   | 140                   | NM0252_012        |
| Rad-8      | --                  | 40                    | 34                    | --                |
| Rad-9      | Pit-1               | 900                   | 300                   | NM0252_014        |
| Rad-10     | CutPly-1            | 12                    | 12                    | --                |
| Rad-11     | DistPly-1           | 6                     | 11                    | --                |
| RadBack-1  | Access-1            | 7                     | 8                     | --                |

**Notes:**

All gamma readings at this site taken by Ludlum 192  $\mu$ R/Ratemeter  
 $\mu$ R/hr=microroetgens per hour



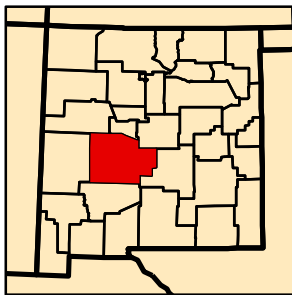
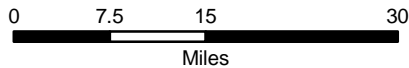
## FIGURES



**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                |
| Blue         | State Park                       |
| Light Orange | Valles Caldera National Preserve |

Map Source(s):  
Ownership - BLM, 2008

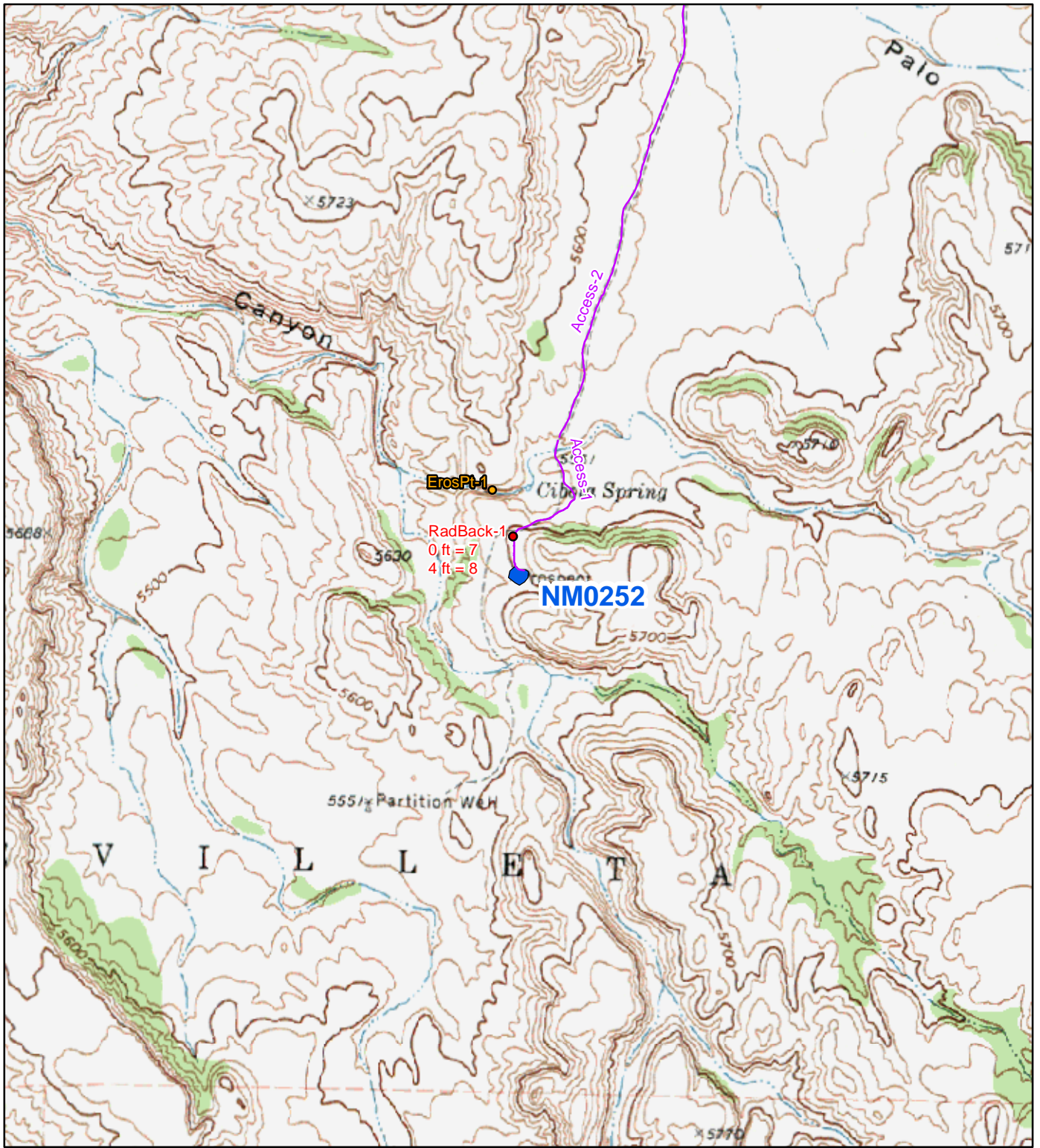


**Legend**

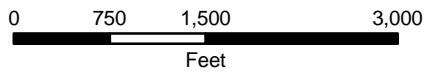
|               |                 |
|---------------|-----------------|
| Blue square   | AUM Location    |
| Red line      | Road            |
| Black outline | County Boundary |

**Figure 1**  
**Site Location Map**  
**NM0252-Agua Torres**  
Abandoned Uranium  
Mine Assessment





Map Source(s):  
 U.S. Geological Survey 7.5-Minute  
 Topographic Map  
 -Sierra De La Cruz, 1972



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

**Legend**

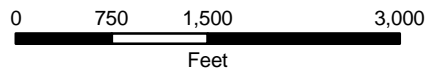
- Radiation Readings ( $\mu\text{R/hr}$ )
- Erosion Location
- Access Route
- AUM Location Boundary (MMD Provided)

**Figure 2**  
**Topographic Map**  
**NM0252-Agua Torres**  
 Abandoned Uranium  
 Mine Assessment





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



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

### Legend

- Radiation Readings ( $\mu\text{R/hr}$ )
- Erosion Location
- Access Route
- AUM Location Boundary (MMD Provided)

**Figure 3**  
**Aerial Photo**  
**NM0252-Agua Torres**  
 Abandoned Uranium  
 Mine Assessment





RadBack-1  
0 ft = 7  
4 ft = 8

Trench-1

Rad-1  
0 ft = 220  
4 ft = 130

Rad-6  
0 ft = 350  
4 ft = 190

Rad-2  
0 ft = 49  
4 ft = 42

Rad-7  
0 ft = 470  
4 ft = 140

Rad-8  
0 ft = 40  
4 ft = 34

ErosLn-1

Rad-3  
0 ft = 140  
4 ft = 80

PilePly-1

Photo-2

Pit-1

PilePly-2

DistPly-1

CutPly-1

Access-1

Rad-11  
0 ft = 6  
4 ft = 11

Rad-10  
0 ft = 12  
4 ft = 12

Rad-4  
0 ft = 470  
4 ft = 100

Rad-5  
0 ft = 26  
4 ft = 27

Rad-9  
0 ft = 900  
4 ft = 300

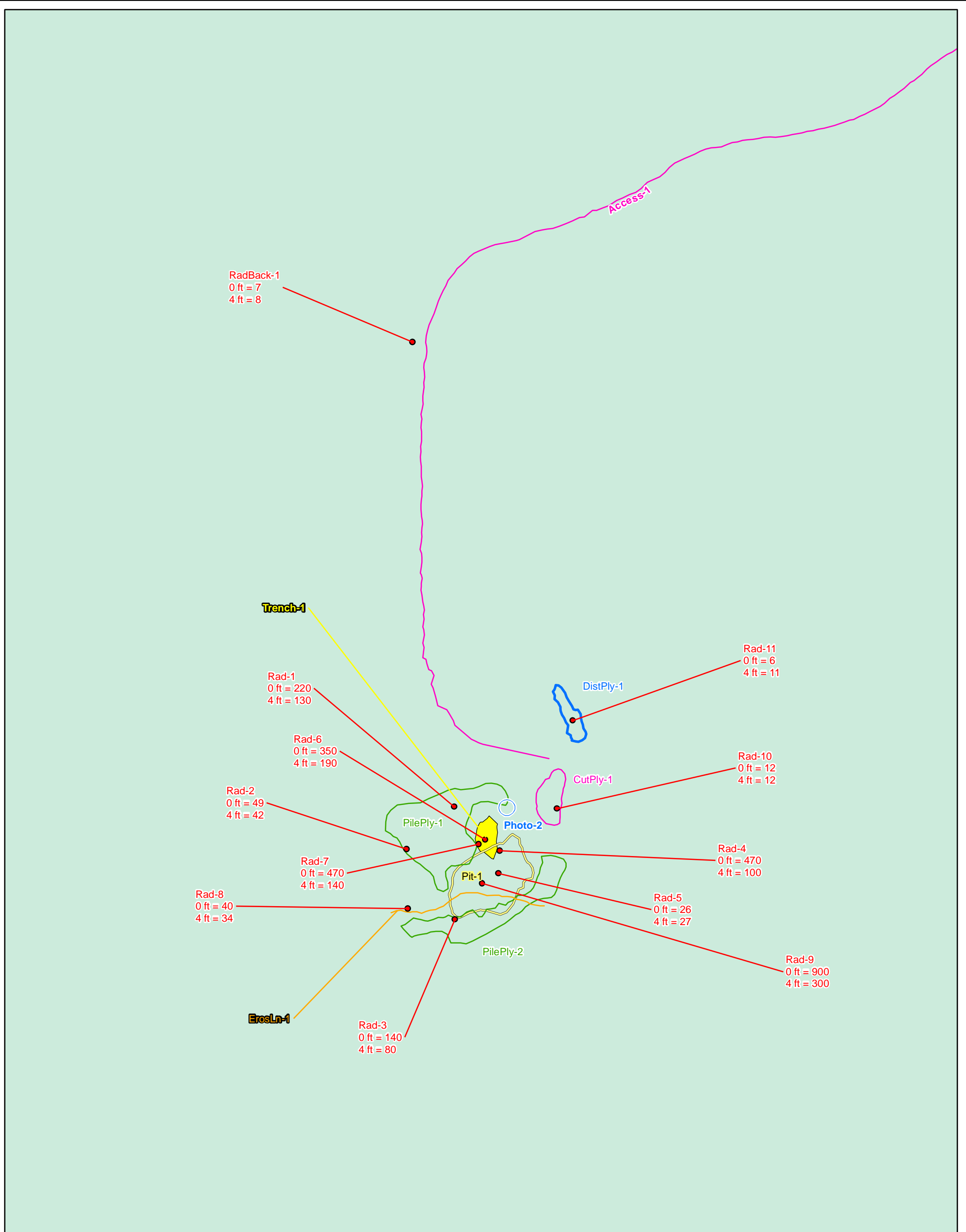
Map Source(s):  
U.S. Geological Survey 7.5-Minute  
DOQQ County Mosaic  
-Socorro County, 2009



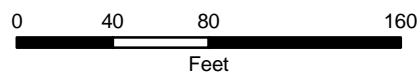
| Legend |   |
|--------|---|
| ●      | Radiation Readings ( $\mu\text{R/hr}$ ) |
| ○      | Photo Location                          |
| —      | Erosion                                 |
| —      | Access Route                            |
| □      | Open Cut Boundary                       |
| □      | Pile Boundary                           |
| □      | Pit Boundary                            |
| □      | Other Disturbance Area                  |
| □      | Trench                                  |

**Figure 4a**  
**Site Map on**  
**Aerial Photo**  
**NM0252-Agua Torres**  
Abandoned Uranium  
Mine Assessment





Map Source(s):  
Ownership - BLM, 2008



**Legend**

|   |                           |
|---|---------------------------|
| ● Radiation Readings ( $\mu\text{R/hr}$ ) | ▭ Pile Boundary           |
| ○ Photo Location                          | ▭ Pit Boundary            |
| — Erosion                                 | ▭ Other Disturbance Area  |
| — Access Route                            | ▭ Trench                  |
| ▭ Open Cut Boundary                       | <b>Surface Ownership</b>  |
|   | ▭ Fish & Wildlife Service |

**Figure 4b**  
**Site Map with**  
**Surface Ownership**  
**NM0252-Agua Torres**  
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-AUM Site vegetation.



Photo 2-Site photo, looking southwest.



Photo 3-Looking west at PilePly-1.



Photo 4-Looking southwest at PilePly-2.



Photo 8-Looking north at Pit-1.



Photo 9-Looking north at radiation survey point Rad-4 (470  $\mu$ R/hr at 0 ft above ground).



Photo 10-Looking north at the contact between the Abo Formation (right) and the Madera Formation (left).



Photo 11-Looking north at Trench-1.



Photo 12-Mineralization at radiation survey point Rad-7 (470  $\mu$ R/hr at 0 ft above ground).



Photo 13-Looking east at ErosLn-1.



Photo 14-Looking north at radiation survey point Rad-9 (900  $\mu$ R/hr at 0 ft above ground).



Photo 20-Looking north at CutPly-1.



Photo 21-Looking north at DistPly-1.



Photo 26-A pool in a canyon about 0.2 miles northwest of the AUM Site (ErosPt-1). This is Cibola Spring.



Photo 27-Another view of Cibola Spring (ErosPt-1).

**APPENDIX B**  
**FIELD NOTES**

17 5/6/10 at ~~Abandoned Tink~~<sup>ALT</sup>  
Abandoned Uranium Mines

Site Name: NMO252

Objective: Site Assessment

Personnel: Annelia Tinklenberg  
- Danny Bowman

Equipment: Rental truck, Trimble GeoXM  
(SN: 494844727, 2008 series), Ludlum 192  
(SN: 234149), Fuji film digital camera  
(No. 80839493), backup Garmin GPS, cell phone  
Amplifier, field laptop

800 Leave Albuquerque for Sevilleta

900 At Sevilleta National Wildlife Refuge

1030 At AUM site with Rob Sengebusch, John Pfiel, Susan  
Loren Kamat, and Rachel Freund (Sevilleta)

Photo 1 - Feathered Dalia

Photo 2 - Site Name of site location, looking southwest

Pile Ply 1 - 5' high, 66' wide, 90' long

Photo 3 - looking west at Pile Ply 1

Rad 1 - Pile Ply 1; 0m - 220  $\mu$ R/h; 1m - 130  $\mu$ R/h

Rad 2 - Pile Ply 1; 0m - 49  $\mu$ R/h; 1m - 42  $\mu$ R/h

Pile Ply 2 - 5' high, 15' wide, 130' long

Photo 4 - looking southwest at Pile Ply 2

Rad 3 - Pile Ply 2; 0m - 140  $\mu$ R/h; 1m - 80  $\mu$ R/h

Photo 5-6 - Vegetation; Indian Point Brush, Chihuahuan  
Flax

5/6/10 at Abandoned Uranium Mines

18

Photo 7 - Desert Holly

Pit-1 - 6' deep, 20' wide, 45' long

Photo 8 - looking north at Pit-1

Rad 4 - Pit-1; 0m - 470  $\mu$ R/h; 1m - 100  $\mu$ R/h - on bedrock  
face

Rad 5 - Pit-1 center <sup>ALT</sup> 0m - 26  $\mu$ R/h; 1m - 26  $\mu$ R/h

Photo 9 - looking north at Rad 4

Photo 10 - looking north at Abo-Madera Contact

Trench-1 - 7' deep; 15' wide; 30' long

Photo 11 - looking north at Trench-1

Rad 6 - Trench-1; 0m - 350  $\mu$ R/h; 1m - 150  $\mu$ R/h

Rad 7 - Photo 12; 0m - 470  $\mu$ R/h; 1m - 140  $\mu$ R/h

Photo 12 - Rad 7 location, just west of Trench-1

Erosion-1; 120' long; 5' wide; 1' deep; drainage in site

Photo 13 - looking east at Erosion-1

Rad 8 - Erosion-1; 0m - 40  $\mu$ R/h; 1m - 34  $\mu$ R/h

Rad 9 - in Pit-1; 0m - 900  $\mu$ R/h; 1m - 300  $\mu$ R/h

Photo 14 - looking north at Rad 9

Alkali Sackaton, Side oat Gramma, little leaf Soma  
sand Verbena, Mesquite, Juniper (one-seed),  
Globe mallow, primrose, Pinon Pine, Blue Gramma, Black  
Gramma  
Vegetation 15-19 Photos

Open Cut-1 Cut Ply-1; 5' deep, 40' long, 15' wide

Photo 20 - looking north at Cut Ply-1

Rad 10, Cut Ply-1; 0m - 12  $\mu$ R/h; 1m - 12  $\mu$ R/h

Dist Ply-1; 1' high; 8' wide, 40' long

Photo 21 - looking north at Dist Ply-1

Rad 11 - Dist Ply-1; 0m - 6  $\mu$ R/h; 1m - 9  $\mu$ R/h

Photo 22-23; Aster, Brown snake weed

Rad Back; 0m - 7  $\mu$ R/h; 1m - 8  $\mu$ R/h

19 5/6/10 ACT Abandoned Uranium Mines

Photo 24 - Vegetation

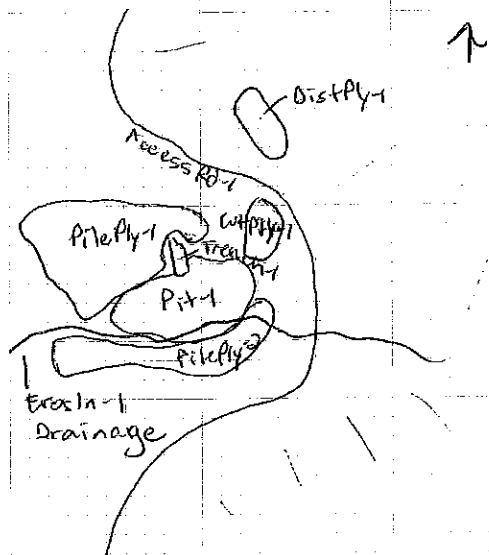
Erosion - 1 - Cibola Springs

Photo 25 - looking north at waterfall

Photo 26 - looking west down canyon

Access Rd - 1 - To truck

1130 Back at truck



Soil: Sandy, tan, rocky

Rock: Grey-tan Madera limestone and purple Abo sandstone  
orange to black iron oxide locally.

Human Activities: Current activities are research conducted  
by the Sevilleta National Wildlife Refuge, access is  
limited. Past activities were mining and grazing.  
Saw old windmill, fences, corral. Horse prints, droppings.

Wildlife: Saw evidence of a horse. Horny-toad lizard,  
other lizards, rattlesnake, small birds.

ACT