A Tour of Abandoned Uranium Mines in Navajo Country and Beyond
Compiled by SRIC, October 2013

Red Water Pond Road resident Jack Hood with horse in front of Quivira Church Rock I Mine, circa 1975. Photo courtesy of Tony Hood.
The Uranium Legacy of the Western U.S.

- USEPA estimates about 10,400 abandoned uranium "mine features" in 15 western states.
- U.S. Bureau of Mines estimates ~4,100 discrete uranium mines.

Source: http://www.epa.gov/rpweb00/tenorm/uranium.html
Most AUM sites in Navajo Country NOT reclaimed

AUM Sites Navajo Nation, Northwest NM

Navajo Nation Environmental Protection Agency/WRCD/Superfund Abandoned Uranium Mines Locations and Reclamation Status

Modified by SRIC, 2008-2009
77% of 521 AUM sites in Navajo Country have gamma radiation levels more than 2x background
14% of AUM sites located within 1/4 mile of inhabited structure
USEPA’s list of top priority abandoned uranium mines on Slide 7.
# USEPA’s Top Priority Navajo AUM List*

<table>
<thead>
<tr>
<th>Mine Site</th>
<th>Region</th>
<th>Action</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mariano Lake Mine</td>
<td>Eastern</td>
<td>Investigation/Cleanup</td>
<td>Urgent actions have been taken. Investigation ongoing. Evaluation of Cleanup options in 2013.</td>
</tr>
<tr>
<td>Skyline Mine</td>
<td>North Central</td>
<td>Cleanup</td>
<td>Clean up completed October 2011; total cost of $8M. <a href="http://www.epa.gov/region09/superfund/navajo-nation/abandoned-uranium.html">Skyline Mine</a></td>
</tr>
<tr>
<td>Cove Transfer Stations</td>
<td>Northern</td>
<td>Cleanup</td>
<td>Investigation complete. Urgent actions occurred October 2012. <a href="http://www.epa.gov/region09/superfund/navajo-nation/abandoned-uranium.html">Cove Transfer Stations</a></td>
</tr>
<tr>
<td>Sections 32 and 33</td>
<td>Eastern</td>
<td>Cleanup</td>
<td>Investigation ongoing. Urgent actions occurred October/November 2012. <a href="http://www.epa.gov/region09/superfund/navajo-nation/abandoned-uranium.html">Sections 32-33 Abandoned Uranium Mine</a></td>
</tr>
<tr>
<td>Ruby Mines 1-4</td>
<td>Eastern</td>
<td>Negotiations with responsible party</td>
<td>Starting negotiations with responsible party. Urgent actions conducted October 2012</td>
</tr>
<tr>
<td>20 Mine Claims in Cameron Area</td>
<td>Western</td>
<td>Negotiations with responsible party</td>
<td>Starting negotiations with responsible party. Site visits conducted September and November 2012.</td>
</tr>
</tbody>
</table>

*http://www.epa.gov/region09/superfund/navajo-nation/abandoned-uranium.html
Western AUM Area: Cameron Open Pits, Then and Now

1982: SRIC staff took the photos below before these open pit uranium mines were backfilled and closed by NMAML in the 1990s. Most of these pits no longer have standing water. Residents and livestock consumed water from these pits, which was shown to be contaminated by uranium and other radioactive substances.

2013: (A) Unreclaimed ore transfer station and (B) open pit mine, ~10.5 mi SE Cameron Chapter within ¼-mile Little Colorado River; (C) Western Nuclear benchmark next to open pit.

High levels of uranium & radium found in water in these pits in 1970s

Max gamma radiation level = 1,000 µR/hr; background range: 10-13 µR/hr

EPNG will conduct site assessments in 2014 under USEPA order of 9/13/13

Max gamma radiation level = 1,800 µR/hr on exposed ore vein at bottom of pit; background range 10-13 µR/hr
Then and Now: Rare Metals Uranium Mill Tailings Disposal Cell (aka, Tuba City UMTRA Site)

1982 – Mill buildings, tailings before consolidation, covering

2013 – disposal cell (black rock “tomb”) and water treatment plant

- Operated 1956-1966, processing Cameron uranium ores
- Groundwater contamination, leakage into Moenkopi Wash ongoing after 30 years of treatment
- See, http://www.lm.doe.gov/tuba/
Central Navajo AUM Area: Abandoned Uranium Mines and Contaminated Water Sources in Tachee/Blue Gap Chapter

- Tachee/Blue Gap in the central portion of Navajo Nation about 40 miles west of Chinle, AZ
- 13 different mines (open pits, rim cuts, shafts) developed on mesa tops and steep slopes, 1954-1968*
- 16,800 tons of uranium ore yielding 55,700 lbs uranium oxide (U₃O₈)
- Young boys hired by company geologists to find radioactive anomalies, mid-1950s**
- Not on USEPA top AUM priority list

**Interview with James T. Badoni Sr., July 10, 2013.
Several Occupied Residences Close to Claim 28 Mine

- 5 residences (20-25 people) within 1 mile of mine dump
- 3rd largest mine in terms of uranium ore production in Tachee Mining District
  - 4.2 million tons ore produced, 1957-1968
- NNAML placed dirt cover on waste dump in 1992 to stabilize materials
- SRIC radiation survey 7/9/13:
  - Gamma radiation on waste dump slope 2 to 5 times greater than local background (i.e., 40-100 microRoentgens per hour)
  - Several “hot spots” (gamma rates at least 2x background) found in surrounding community
  - Area has higher background radiation than other places on Navajo Nation
NOTE:
Waterfall Spring and White Clay Spring had uranium levels exceeding drinking water standards in samples collected in 1998. No testing has been done since then. These springs are still used by local residents.

<table>
<thead>
<tr>
<th>USACE Sample Name</th>
<th>Sample ID</th>
<th>Site Type</th>
<th>Sample Date</th>
<th>Total Uranium (pCi/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benally Spring</td>
<td>KY981008CHS001</td>
<td>Spring</td>
<td>10/08/1998</td>
<td>47.1</td>
</tr>
<tr>
<td>Burro Spring</td>
<td>KY981008CHS002</td>
<td>Spring</td>
<td>10/08/1998</td>
<td>60.1</td>
</tr>
<tr>
<td>Cottonwood Spring</td>
<td>CH981123CHS001</td>
<td>Spring</td>
<td>11/23/1998</td>
<td>22.4</td>
</tr>
<tr>
<td>Tank 10R-51</td>
<td>CH990316TCW004</td>
<td>Wind Mill</td>
<td>03/16/1999</td>
<td>22.3</td>
</tr>
<tr>
<td>Tank 10T-533</td>
<td>CH981119TCW003</td>
<td>Wind Mill</td>
<td>11/19/1998</td>
<td>73.0</td>
</tr>
<tr>
<td>Tinyehtoh Spring</td>
<td>KY981008CHS003</td>
<td>Spring</td>
<td>10/08/1998</td>
<td>39.9</td>
</tr>
<tr>
<td>Waterfall Spring</td>
<td>CH981104BGS001</td>
<td>Spring</td>
<td>11/04/1998</td>
<td>61.7</td>
</tr>
<tr>
<td>White Clay Spring</td>
<td>CH981124BGS002</td>
<td>Spring</td>
<td>11/24/1998</td>
<td>45.9</td>
</tr>
</tbody>
</table>

Photos by Paul Robinson
Mary Helen Begay (right), a member of the Cly-Begay family who lives at base of Oljato Mesa, has been active in advocating for cleanup of Skyline Mine and for community health studies. The family is featured in the documentary, *Return of Navajo Boy* (http://navajoboy.com/).
Two uranium ore transfer stations located in Cove Chapter (map on left) were the sites of removal of radioactive wastes by USEPA and Navajo EPA in 2012. The two sites were contaminated by years of dumping and storing uranium ore removed from mines on nearby mesa slopes. Radiation surveys showed high levels of gamma radiation near homes (middle map) and a school (right map). Maps courtesy USEPA.

In the maps above, green dots indicate “background,” or natural radiation levels. Yellow, red and purple dots indicate increasing levels of gamma radiation indicative of mining-related contamination.
Eastern Agency Area: Map of Uranium Mining and Milling Sites, 1980
(priority areas shown in red ovals)
Waste water discharges from uranium mining and milling operations in Puerco River headwaters contributed to basin-wide contamination from 1960s into 1990s.

See Slide 18 for details.
Puerco River Contaminant Source:
Church Rock Uranium Mill Tailings Spill,* July 16, 1979
*Largest release of radioactive wastes, by volume, in US history

United Nuclear Corp. Uranium Mill Tailings Dam, July 16, 1979

Dam breach location, July 17, 1979

Livestock tracks in Puerco River downstream of spill, July 17, 1979

NMEID Sampling in Puerco R. after spill

Puercio River warning sign

Community leaders Larry J. King (L) and Robinson Kelly addressed long-term impacts of spill in 2009.

Photos courtesy of Southwest Research and Information Center, New Mexico Environmental Improvement Division, Albuquerque Journal.
Northeast Church Rock Mine and Red Water Pond Road Community, 1972-2009


1st removal action, 2007

2nd removal action, 2009

3rd removal action, 2012

CRUMP radiation monitoring, 2002
Old Churchrock Mine site assessment after flood event, August 2006*
(Gamma radiation rates in micro Roentgens per hour [µR/hr]; background rate, 11-13 µR/hr)

OCRM Periods of operation:
1960-62, 1977-82


*2013 Status: HRI/URI responsible for Sec. 17 cleanup under 2012 agreement with NNDOJ

Approximate shape of mud delta at mouth of arroyo after flood event

Unnamed arroyo in Sec. 17, T16N, R16W

Old Church Rock Mine Road

King Grazing Permit Area (shaded)

Sec. 8

Sec. 9

Sec. 17

Sec. 16

IX building

State Route 566

Mine water ponds

420-460

70-120

15-30

max 350
(1987)

max 180
(2003)

Sealed mine shafts

Mining debris in arroyo: concrete, dirt, steel chute

King Ranch (3 occupied residences)

Section lines approximate
Locations of home sites next to Mariano Lake Mine; radiation levels surveyed, 2009-10

Map from Mariano Lake Navajo AUM Site Assessment Summary (fig. 1), prepared by Ecology and Environment, Inc., for USEPA Region 9, Jan. 5, 2010.
USEPA consolidated uranium mine wastes and covered them with clean dirt and riprap in “interim action” in Fall 2012. Local residents who live 0.25-mile west of site confer with USEPA and NAIHS officials.
Milan resident Jonnie Head, who lives within ½-mile of the Homestake Mill, is a leading advocate for uranium cleanup.
Area of groundwater contamination (outlined in red) in San Mateo Creek watershed, based on BVDA review of available documentation.

1. Rio Algom Mining Co. Ambrosia Lake Uranium Mill; ~33 million tons
2. Phillips Petroleum Inactive Tailings (owned by DOE); ~3 million tons
3. Anaconda Corp. Bluewater Uranium Mill (owned by USDOE); ~25 million tons
4. Homestake Mining Co./Barrick Gold Uranium Mill; ~23 million tons
Jackpile Mine, Laguna Pueblo, NM
35.135638N, -107.331767W  T11N, R5W, Secs. 26, 35

Years Operated: 1953-1982
Operator: Anaconda Co.

Production: 400 million tons earth moved, 24 million tons U ore
Status: Reclamation, 1989-1995; currently off limits to humans, livestock; added to the Superfund National Priorities List in 2012

Paguate Village resident Larry Lente discusses mine reclamation with NIEHS director Lynda Birnbaum, March 2013.

Dorothy Purley, who drove an ore-hauling truck at the Jackpile Mine, was a leading advocate for reclamation and health studies prior to her death from cancer in 2003.

Photo showing mine at height of production in 1979.
St. Anthony Mine, Cebolleta Land Grant (Laguna District)

11N, 4W, Sec. 30.243; 35.15909N, -107.30614W
Period of Operation: 1951-1982
Production: 78,722 tons ore (pre-71); no data after 1971
Operators: Hanosh Mines; St. Anthony Uranium Co.; American Metal-Climax Corp.; United Nuclear Corp.
Status: Reclamation and groundwater remediation plans under review by NMMMD, NMED

Open pits of St. Anthony Mine still unreclaimed in 2013, more than 30 years after last production.