Uranium Mining on the Navajo Indian Reservation:
An Environmental Examination of the Process and Impact

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To the People of the Navajo Reservation

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Thank you Gieg, for suggesting that I see what was going on with the uranium mining down on the Navajo reservation…this entire project has blossomed from your suggestion.

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FORWARD

The Navajo uranium mining experience affected almost all aspects of Navajo life and should be studied from many perspectives. However, the complex history and political and social development that changed the Navajo Nation through the course of the uranium mining years is a constant theme. The tragic consequences of uranium mining forced the Navajo people to take responsibility for their lands and welfare by strengthening their government and developing their own economy. This argument is discussed in the environmental history thesis: Yellowcake on the Windowsill: Uranium Mining on the Navajo Reservation.

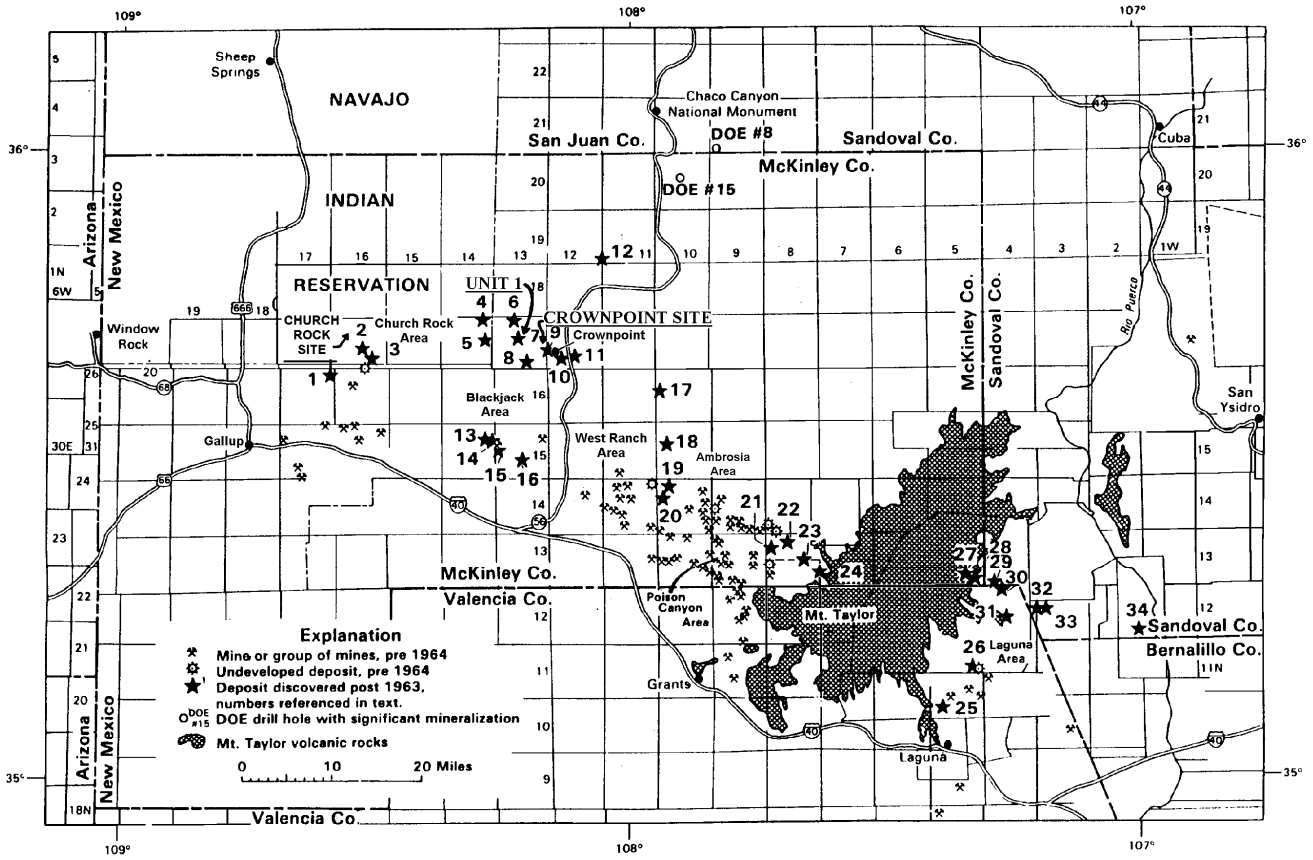
This paper builds on the above argument and examines the actual mechanisms of mining, milling and reclaiming the land. In doing so it illustrates not only the processes, but the commitment and passion of the Navajo people to restore their lands. It argues that the environmental nature of the uranium mining problems is the reason these events, and not numerous political injustices before it, spurred the Navajo Nation to take action.

Further, this paper focuses on environmental damage and restoration particularly related to land and water, for those who are interested in more information on the simultaneous environmental health crisis that affected the miners and their battle for Radiation Exposure Compensation; they should refer to Yellowcake on the Windowsill which details the miners' personal experiences.

MAP

General spread of mines across the Grants Mineral Belt within the Navajo Reservation.
Note: Mt. Taylor is one of the four sacred peaks of the Traditional Navajo Homelands.

URANIUM MINING AND MILLING OPERATIONS IN THE EASTERN NAVAJO AGENCY AND GRANTS URANIUM DISTRICT, 1960s-1980s



Map from: presentation by Mitchell Capitan, Crownpoint, New Mexico Larry J. King, Church Rock, New Mexico ENDAUM Board Members September 9, 2004

INTRODUCTION:

Author's photograph January 2006, Navajo Reservation

It is not often one comes across a bright-yellow road sign that reads "Congested Area" when there are no people or structures in sight. However, a road sign just like this is hard to miss when traversing route 666 north or south through the heart of the Navajo reservation. Here, even "Congested" is all relative.

It is signs like these that remind people passing through that they are in a different country, the Navajo Nation. Spreading across the four corners region of the Southwest, and covering large portions of New Mexico and Arizona, the Navajo Nation is the largest reservation and indigenous nation in the United States. It has been a long journey for the Navajo people as they have sought to define the sovereignty of their Nation.

Like many reservations across the U.S., the Navajo people are situated on land incredibly rich in natural resources. The high desert and impressive mesas of the four corners region were rightly judged as poor land for agriculture, but beneath this arid surface is an abundance of oil, coal, natural gas, and even uranium. When the United States negotiated the Treaty of 1868 with the Navajo people, they had no idea they were

creating the Navajo reservation over such a wealth of resources. Later, in 1923, the U.S. was interested in accessing the reservation's natural resources, and created a Tribal Council of Navajo representative to serve as the Navajo Government. The U.S. then used the Tribal Council to administer leases for the extraction of natural resources. Driven to expedite the leasing process, the U.S. manipulated the Tribal Council into granting Indian Commissioner Hagerman of the Bureau of Indian Affairs (BIA) the right to determine and administer leases across the reservation on behalf of the Navajo people.

In less than ten years, the Navajo peoples' lives changed significantly. The tribal governance system that existed before the instillation of the Tribal Council was deteriorating. Yet, the new Tribal Council did not really have control over the Navajo peoples' most valuable natural resources, and white prospectors and miners came into the reservation, mined and left. The Navajo people endured the degradation of their homelands and received very little money from leases or royalties in return.

However, problems with inadequate royalty and lease payments were still a better situation than on many reservations, where Native American land was first privatized to individual Native Americans and then sold to the federal government or mining companies. Ever since the 1868 treaty, the U.S. government had tried to change the Navajo peoples' relationship with the land. Primarily sheep and cattle herders, the Navajo people roamed through their vast landscape on commonly held lands and seasonally occupied different sections of the reservation. Hoping to make the Navajo people live more like white settlers, the U.S. continually proposed land allotment programs. A family or single man could claim one hundred and sixty acres of land if he then agreed to farm it. The land he chose would no longer be part of the reservation nor eligible for the

support of Federal aid, but would be private property – available for sale at the owner's discretion. However, tied to traditional communal land use and herding, the Navajo people were not receptive to this program.

Again, in 1887, the U.S. government attempted to break down tribal structures by allotting reservation lands across the U.S. This plan, the General Allotment or Dawes Act, succeeded in many other tribes. But the arid conditions and generally unsustainable farming lands of the Navajo reservation made it impossible for the BIA to force the Navajo people onto allotted lands without also forcing them to starve and become dependent on the Federal government for survival.

In the 1930's conditions on the reservation became worse. Despite the Federal government's intent to preserve the precarious self-sufficiency of the Navajo people, they instituted a reservation-wide stock reduction policy. Conservationists, as well as the engineers of the new dams on the Colorado River, believed the large herds on the Navajo reservation were contributing to soil erosion and thus an excess of silt and debris in the Colorado River. These materials were then moving downstream, and dam engineers feared they would cause problems for the new dams designed to provide water for the growing population of white farmers in the southwest. John Collier, a man anachronistically committed to preserving Native American culture, organized a stock reduction plan. Although Collier did not intend to destroy the self-sufficiency of the Navajo people, he did not understand their complete dependence on their herds. Collier's reduction policy most hurt families with small herds who could not survive once their herds were further reduced. Without stock and unable to farm, the Navajo people soon turned to federal government aid for survival.

John Collier took the position as Commission of Indian Affairs during Franklin Roosevelt's administration in 1933. Employed as a journalist and social worker for years, Collier was frustrated with the pressure for all people to assimilate in modern American society, and he romantically sought the preservation of original cultures. Collier first worked among immigrant communities in East Coast cities, but did not find his passion until he came in contact with the Native American tribes of the Southwest. Immersing himself in Indian affairs, Collier was opposed to the assimilation policies of the past decades, and advocated instead for policies to preserve the traditions and promote the sovereignty of Native American tribes.

He brought his philosophy into action with the Indian Reorganization Act of 1934 (IRA). Considered the "Indian New Deal", this legislation required each tribe to accept the program individually. Collier went to the Indian Congresses of tribes across the country and persuaded them to accept the IRA. Tribes that accepted were then guided through the construction of a tribal constitution modeled after the democratic structure of the U.S. constitution. Further, Collier enlisted the assistance of other government agencies to cooperate with the Office of Indian Affairs and help revive many Native American communities. Among these were the Public Works Administration, the Resettlement Administration, and the Civilian Conservation Corps.[1] The IRA significantly changed the direction of Federal Indian policy in the U.S. But, unfortunately, the Navajo people no longer trusted Collier because they were suffering from the effects of the stock reduction policy. A tribal constitution, even one as

[1] Native Americans and the New Deal: The Office Files of John Collier, 1933-1945. LexisNexis Academic, 2205. Available at: http://lexisnexis.com/academic/2upa/Anas/NativeAmericansNewDeal.asp, 1.

undemocratic as those organized for the tribes that did accept the IRA, would have to wait for the Navajo people.

Beyond the economic disaster brought on by the Navajo stock reduction policies, Navajo social structure was disrupted. Women who traditionally managed the herds were no longer contributing to their family's stability, and many men left the reservation and their families to find work. The demand for labor during World War II provided an abundance of off reservation jobs for Navajo men and women in factories. Further, many Navajo men joined the U.S. military for the opportunity to work, as well as prove their honor as Navajo warriors. Among the men who served were the famous Navajo code talkers, who used the Navajo language to transmit military information for many of the battles in the Pacific. During the war the Navajo people were working, but they were displaced from the reservation and slowly rupturing the traditional tribal and family structures.

After World War II, and the close of war industries, many of the Navajo people who had left the reservation returned. Unfortunately, there was little to return to. Without stock or agriculture or any sort of economic infrastructure, the Navajo people were soon starving. Promises of guardianship made by the U.S. government date back to the treaty of 1868, and included providing for the well being of the Navajo people, their education, and assistance in the development of the Navajo reservation. Almost all these promises had gone unfulfilled. Further, National Indian Policy had again changed its focus. John Collier's ideas of tribal sovereignty were lost, and a new movement to end the reservation system and any federal support for Native Americans gained momentum. As with the General Allotment Act, the Navajo people were essentially spared from the new

termination and off-reservation relocation programs because of the poverty and dire conditions across the reservation. The Navajo people remember this period as "the starving time."

Looking back at this period of time in the late 1940's, it is easy to see it as a critical juncture in Navajo history. Prior to this time period, the Navajo people had roamed south from Canada along the Rocky Mountains to the southern end of the Colorado Plateau, and established this region as their homelands. For centuries they had defended this area from other tribes, Spanish conquistadors traveling north from Mexico, and eventually Americans. During the hundred years immediately prior they fought not only for their land, but for their identity as a people. Finally, the American mission to assimilate the Navajo people and access the natural resources of their lands left them at the mercy of the American Federal government for survival. In the 1940's this history of dependency, guardianship, and uncertain sovereign identity were all challenged, and the Navajo people and Nation were forever changed. This challenge was the arrival of uranium mining on the Navajo reservation, the environmental health and justice disaster it created, and the response of the Navajo people.

This is the story of how the Navajo people endured the uranium mining industry and helped the United States achieve nuclear superiority, only to later discover that the working conditions in the mines and mills were toxic to the health of the miners and their families. Worse, these health hazards were known and yet no regulations were established to protect the Navajo people. The sacred Navajo homelands were also damaged and irreparably polluted as a result of the uranium mining industry. However, this is also the story of how the Navajo people finally fought back against the injustice

they suffered, and how they were forced to start developing their own governance system and economy. They came to learn how to both exercise their rights as a sovereign nation and their rights as citizens of the United States to gain control over their own destiny. This included the regulation of leases, the establishment of schools, and acceptance of federal funds to jump start their own programs, including the reclamation of mine lands across the reservation.

The experience and history of uranium mining that forced the Navajo Nation to exercise self-determination is a fascinating and dynamic study of its own. However, it is equally important to understand why it took the uranium environmental and health crisis to force the Navajo people to action. Part of the situation was timing. Native American activism advanced dramatically in the 1970's following the Civil Rights movement, and gave Native Americans a new voice with which to protest against injustice and agitate for change. But, beyond the historical timing of the uranium mining experience, issues related to health and the environment disrupted the most important elements of Navajo society. To fully understand the significance of the health and environmental nature of the hardships the Navajo people endured, these problems themselves must be understood. Only after examining the details of the mining experience, environmental damage, and even the environmental restoration process, can one decide if and why environmental activism in particular was a distinctly successful path to self-determination for the Navajo people.

PART ONE: Uranium and Mining

35 gram uranium ore in a sample of carnotite rock from Uravan, Colorado: Picture from E-bay where this piece of carnotite is available for sale with bids starting at a dollar.[2]

Uranium

Although radio-activity had fascinated scientists since the beginning of the twentieth century, uranium had been overlooked in favor of the more highly radio-active compound radon. For a short time it was believed that radon could cure cancer because it killed fast growing cells. Further, radon is luminescent, and by World War I it was included in the paint applied to watch dials and other gages on military equipment to make them visible in the dark for soldiers. Only several years later did scientists realize that prolonged low level exposure to radio-active material actually harmed normal cells and increased the likelihood of tumors. The potential for controlled nuclear energy was only understood years later and put to use by a group of elite scientists including Albert Einstein.

When the United States decided to pursue the development of nuclear weapons, they looked to uranium and made a previously useless mineral incredibly valuable. On the Southern portions of the Colorado Plateau mining was already underway for

[2] E-bay sales, sample sold by rockjimbo, specimen collected in October of 1999. Available information at: http://cgi.ebay.com/URANIUM-ORE-CARNOTITE-IN-SANDSTONE-Uravan-Colorado_W0QQitemZ6626540848QQcategoryZ3224QQssPageNameZWDVWQQrdZ1QQcmdZViewItem

vanadium, a mineral contained in a yellow-green formation called carnotite ($K_2(UO_4)_2(VO_4)_2*3H_2O$). While vanadium was extracted from carnotite deposits and used to strengthen steel, the other minerals in carnotite, uranium and potassium, were discarded. Uranium was sometimes used as a coloring agent in ceramic glazes producing a bright orange-red shade best known as part of a line named Fiestaware, but was otherwise considered of little value.[3] The Manhattan Project, or properly the Manhattan Engineering District (MED), was led by Brigadier General Leslie R. Groves of the U.S. Army Corps of Engineers. Charged with acquiring the materials to develop a nuclear bomb, he restricted all uranium purchase to the U.S. government, bringing an end to red Fiestaware. In particular, the MED took control of the mills and tailings piles in Uravan, Colorado. This mining town was isolated and existed solely to mine the carnotite ores in the area. The MED sent around thirty service men into Uravan to operate one of the mills, and process the discarded vanadium tailings to extract uranium. [4]

While most citizens in the surrounding area were not aware that the government was extracting uranium prior to the bombings in Japan, they were immediately after and were proud of their contribution.[5] However, only one-seventh of the uranium used by the Manhattan project had actually come from the Colorado Plateau. The majority of U.S. ore was purchased from the two largest uranium mines in the world, the Shinkolobwe Mine in the Belgian Congo, and the Eldorado Mine at Port Radium on Bear Lake, Northwest Territories, Canada. These mines were extracting pitchblende or uraninite rather than carnotite. Pitchblende is primarily composed of uranium (UO_2), and therefore a much

[3] Michael A. Amundson, *Yellowcake Towns, Uranium Mining communities in the American West* (Boulder, University Press of Colorado, 2002), 8.
[4] Amundson, 10.
[5] Ibid., 11.

better source of high-grade uranium ore than the carnotite on the Colorado Plateau. Nonetheless, due to the U.S.'s urgency to acquire uranium in the early 1940's, around eighty-six percent of the uranium used in the Manhattan Project was purchased from the Belgian Congo and Canada.[6] In 1944 the MED had purchased just over 6,000 tons of uranium, and felt adequately supplied to produce bombs through the fall of 1945.[7]

While this supplied the uranium needed for the Manhattan Project, it was not a secure and sustainable source of uranium for continuing U.S. nuclear development. After World War II ended, the United States moved to open the new atomic field to general bureaucracy and remove all nuclear control from secret military operations.[8] So, just shy of one year after the War, Congress passed the Atomic Energy Act. This created the Atomic Energy Commission (AEC) and established the Joint Committee on Atomic Energy (JCAE), which was composed of nine senators and nine representatives to oversee the AEC's operations. In 1947, the AEC officially took control, and with it assumed the responsibility of supplying scientists and engineers a reliable supply of U.S. uranium.[9] There was no guarantee that the international purchase of uranium would always be available, nor did the AEC want to create more suspicion about why exactly they were purchasing such large quantities of a mineral not commonly used.

In 1948 the AEC began an extensive program to encourage prospecting and mining for uranium. All ore was purchased by the government at a fixed price. Early purchasing structures made uranium mining lucrative for large corporations, but were not well suited to individual prospectors and entrepreneurs. After considerable tweaking, the

[6] Ibid,., 8.
[7] Ibid., 11.
[8] Ibid., 20.
[9] Ibid., 21.

AEC finally established a plan that could make uranium mining profitable even for a successful novice. This plan included bonuses for new discoveries and new mines, and payment incentives for transporting the ore to AEC facilities.[10] This program drew a rush of uranium prospectors to the southern end of the Colorado Plateau and all throughout the Navajo reservation.

In addition to the AEC's work with the U.S. Geological Survey to scout out potential uranium deposits on the ground and in the air, individual prospectors roamed about with Geiger counters searching for the tell-tale greenish-yellow carnotite ore. Carnotite existed in many forms. Early in geologic time uranium was likely contained in hydrothermal veins at the top of volcanic intrusions. Over time these protruding veins were eroded and washed across the landscape. As the uranium traveled it settled in the sandy materials and helped secure these elements into the sandstone that makes ups the mesas and anti-clines across the Colorado Plateau today. In particular, uranium was attracted to organic materials and is still sometimes found as petrified logs. Although originally igneous, uranium is primarily located in the sedimentary Jurassic Morrison Formation. This formation cuts directly across the Navajo reservation, and has proven to be one of the most uranium rich regions of the United States.[11]

In addition to visually sighting carnotite deposits, because uranium is radio-active it is detectable at considerable distances using devices such as Geiger counters, and similar but more sensitive instruments. Once an outcropping was determined, geologist prospectors called in geologists to conduct test drilling. They typically used rotary drill rigs to drill into the ore horizon. From these holes they could then more accurately

[10] Ibid., 23-25.
[11] Conversation with Dr. Ed Doheny, author's notes, 12 April, 2006.

measure the radiation and determine the ore grade and other geological information. Still, over ninety percent of sites that made it to test drilling were ultimately determined to have insufficient ore to mine.[12]

The most lucrative deposit regions in the Morrison Formation were actually discovered by Navajo men who were incredibly familiar with the landscape. In 1943, when the Navajo people first heard rumors that white men were looking for the yellow-green carnotite ores, Luke Yazzie, a young Navajo man who lived near Cove, Arizona, showed the nearest white man who operated a reservation trading post a sample of carnotite.. (Please see the map of the reservation to identify Cove just south of the four corners and near the border of New Mexico) The trading post owner, Harry Goulding, then showed this ore to geologists and prospectors who confirmed the rock as a very uranium rich carnotite sample. Yazzie ended up leading a group of prospectors to the outcropping where he had collected the ore sample, and opened up one of the most productive regions of uranium production over the next thirty years. Although Yazzie discovered the ore, and worked in several of the mines that later operated in the region, he never received any royalties.[13] The Carrizo Mountains, the area where Yazzie led prospectors, were slowly mined until 1948 when the AEC's uranium program was introduced, at which point the area exploded with prospectors and became littered with new mines and mining communities in the previously empty landscape.

Similarly, in 1951, on the southern end of the reservation near the small town of Grants, New Mexico, a Navajo man named Paddy Martinez also brought white

[12] Information packet titled "Highlights of the Discovery and Production of Uranium in the Grants District" provided upon request by the Grants Uranium Museum, in Grants, NM., 2.
[13] Peter Eichstaedt, *If You Poison Us, Uranium Mining and Native Americans* (Santa Fe, New Mexico: Red Crane Books, 1994), 27, 178-181.

prospectors a sample of ore from the area around his home on the eastern checkerboard section of the reservation. The ore Martinez brought in also proved of excellent quality, and he led prospectors to a range of sites. His discovery came in the midst of the uranium rush, and the Grants area quickly was inundated with new prospectors.[14] This area became known as the Grants mineral belt, and produced a greater quantity and quality or uranium ore than anywhere else in the Southwest. Uranium ore was mined at the surface in mines such as the Anaconda Corporation's Jackpile Mine, and deep underground at depths of 3,000 feet near Ambrosia Lake.

Mining Practices

Author's picture from the Grants Uranium Mining Museum

While the need for uranium and many locations of uranium deposits were developed by the early 1950's, mining and milling practices were done primitively, especially in the more remote areas of the reservation. Both open-pit and underground mining methods were used. If the overburden, the surface materials between the ground and the ore deposit, was not too thick, open-pit mining was conducted. Although there

[14] "Highlights of the Discovery and Production of Uranium in the Grants District" 2.

was a large initial cost to remove the overburden and access the ore, once extraction was underway the mining process was faster, safer, and less likely delayed as the result of unexpected intrusions of other minerals or problems in mine stability. Open-pit mines existed primarily in the Grants region and not farther north in the Carrizo Mountains. They demanded an incredible amount of labor, and drew enough workers, families, and services to build-up and change the Grants, Gallup, and Laguna populations. Just the recorded direct payroll to these communities for the thirty-eight years that mining occurred is estimated to exceed $1 billion.[15]

Underground mining was both more complicated and dangerous; however, it was the most common form of uranium mining. The often unstable host rock, difficult saturated environment below the water table, and a prevalence of aquifers throughout the Colorado Plateau, made uranium mining especially difficult. Eventually, a standard methodology for uranium mining was developed. First large access shafts approximately 8' x 18' were sunk into the ore horizon. Sometimes large oil drilling bits up to 16' in diameter were used. (Please see picture of drill bit outside of the Grants Uranium Museum). The main shafts in the Grants region typically extended anywhere from 200' to 3200' depending on the location of the ore, as well as the surface topography.[16] These shafts were the main highway for all mine activity to the surface - for men, supplies, and the ore. Near the shaft a building housed the machinery to operate an electric hoist. For mines built into the side of mountains with horizontal or sloped entrance shafts, it was not

[15] Ibid., 2.
[16] Ibid., 3.

uncommon during the first decade of mining that the laborers hauled out the ore themselves.[17]

From the main shaft haulage drifts, tunnels approximately 8'x 8' used to access the ore and transport it to the shaft, were cut. These tunnels were cut horizontally below the ore bodies to make use of gravity to remove the ore and drain water. Properly constructed, water would drain from the area where ore was extracted, travel down the haulage tunnels and into the bottom of the shaft were it was collected and pumped out. Some mines pumped water at one hundred gallons per minute while others reached 5,000 gallons per minute. The removed water was held in storage tanks and often used in the milling process.

All ore removal occurred by repeatedly drilling and blasting in promising locations. Generally large 'rooms' or stopes of ore were blasted out, leaving only narrow pillars for support while equipment called a slusher removed the ore. Removed ore was then dropped into carts in the haulage tunnels below. The slusher was:

> a heavy duty electric hoist, with two or three independently acting cable drums. Steel cable extended from one drum through a sheave attached to the drift heading, and then to the rear of a scraper type bucket. A second cable extended from the second drum to the front of the bucket and in operations, pulled the bucket-broken ore to a raise [sic] position [sic] For extracting pillars, three drums were used, two to position the bucket at any location in the open stope area, and the third to pull the rock to the raise discharge point.[18]

Removed ore was kept in piles near the mine before it was transported to a mill. Waste materials were removed in the same manner, but always kept separate from the ore.[19]

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[17] Ibid.
[18] Ibid.
[19] Ibid.

Mining Safety: A Jumbled Mess of Mixed Messages

Author's picture taken at the Uranium Mining Museum in Grants, New Mexico

The physical challenges of working underground and removing large quantities of ore from often unstable conditions presented many hazards to the miners. More unique to mining uranium and a more persistent danger to the health of all miners, was poor ventilation and radiation exposure. Basic ventilation to provide even limited breathable air came from holes 36" to 76" in diameter connecting the working areas to the surface. Large exhaust fans were placed on the top of these holes to pull air through the shafts.[20] But given the radioactive nature of uranium, this meager ventilation was not adequate to provide fresh air for the miners.

The majority, if not all, of the miners on the Navajo reservation were Navajo men who had no knowledge or concept of radio-activity, radiation, or their related health risks. Most miners were relieved to have work on the reservation and end the cycle of leaving their families for short term employment. They were aware of the immediate dangers involved in mining, and many were severely hurt or killed in mining accidents. In 1960

[20] Ibid., 4.

fatal mine accidents were steadily increasing, and prompted the creation of the Uranium Operators Safety Council. Member companies were voluntary participants. When the council was established in 1960, there were three fatal accidents per million man hours worked in the mines; that year in the Ambrosia Lake area, a single site in the Grants Mineral District, five and a half million man hours were worked.[21] The council established a list of new safety measures to increase safety in the mines. These measures were successful the next year, and there were one-third the number of fatal accidents for the same working hours.[22] However, none of the new changes suggested to members of the council made any mention of ventilation, air quality or radiation exposure. All changes were focused on mine stability and the importance of trained employees.[23] Only in the last paragraph of the report is air quality mentioned, where it says,

> In all the underground uranium mines, the control of radon and its daughter products is of the utmost importance. Although the State Department of Mines and Department of Health conduct periodic surveys, it is felt that additional training should be given to company engineers who are responsible for the frequent surveys needed for radiation control.[24]

No air quality standards were proposed, and the council only suggested that more educational classes on the subject be arranged. This is a notable omission. The Public Health Service officials had spent the last ten years surveying mine ventilation and air quality, and determining safe standards for the regulations to reduce radiation exposure.[25]

The experience of one miner, Wilson P. Benally, attests to the danger of mining as well as how little he was warned about health problems related to radiation exposures.

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[21] H.J. Abbiss, *Geology and Technology of the Grants Uranium Region,* Vincent C. Kelley, comp, Memoir 15 (New Mexico Bureau of Mines and Mineral Resources, 1963), 265.
[22] Ibid., 265 (figure 1 and 2).
[23] Ibid., 264.
[24] Ibid. 266-7.
[25] Eichstaedt, 67-77.

He said that he "was severely hurt when a mine collapsed on him. He was told they were mining uranium "for cars, gas and welding", and when the mine collapsed on him "he almost lost his sight. And on one side, his arm was paralyzed." Yet, in regards to the risks associated with uranium itself he was only told, "the uranium was a bit hazardous to his health, but he was never told how it might affect his health later."[26] This was far from the truth. Underlying the casual overlooking of radiation exposure by mine management, safety councils, and the AEC, there was a substantial base of knowledge proving radiation was dangerous to the miners' health. Working in the mines continuously exposed the miners to the same radio-activity that was used to locate the uranium originally. Uranium breaks down into a long sequence of other radio-active materials, among them radium. Close contact with concentrated uranium and radium exposes one to incredibly dangerous gamma radiation, which can only be stopped by a foot of concrete or an inch of lead. Most miners were effected less from exposure to radium's gamma radiation than they were from the effects of the radon gas produced from the breakdown of radium. The half-life of radium to radon gas is 1,600 years, yet in closed mine spaces accessed for the first time the air was often full of radon gas.

The radon gas continues to break-down into alpha and beta radio-active particles. These particles are not as powerful as gamma radiation, but beta radiation can still burn skin and are especially hazardous if ingested. Alpha particles are the weakest form of radiation, and can be stopped by human skin or even a piece of paper. But, while these particles can not be absorbed through the skin, they can be inhaled and ingested. Once lodged inside the body they continue to emit particles and bombard the surrounding tissues. Alpha particles are released during the breakdown of Radon to Polonium-218 and

[26] Wilson P. Benally, Red Valley, Ariz., interviewed 12 February 1993, Eichstaedt, 176.

Polonium to Lead-214. Beta particles are released during the next series of breakdowns, which occur rapidly because the longest half life of the next four stages is only 26.8 minutes for Lead-214 to Bismuth -214.

Mismanagement and the hard labor required to mine uranium increased the miners' exposure and ingestion of radio-active particles. Radon daughters can attach to dust particles within the air and were easily inhaled with the heavy breaths of hard-working miners.[27] Further, the Navajo men were often forced back into the mines very soon after explosions, and well before most of the dust had settled. Don Yellowhorse remembers that:

> mechanical ventilation was rare in the mines, and with the constant drilling and blasting it was often hard to breathe. 'In some mines there [were] close to forty people. There was a lot of smoke' 'They had plastic flexible pipes to blow the smoke' he said, but the systems were inadequate. 'They [the miners] had a hard time working because of the smoke. You could only see about three feet'[28] We had a hard time getting into the fresh air.

Under such conditions it was difficult not to inhale dangerous particles, and once inside the body these particles became lodged in lung tissues. The particles they emitted then created a constant bombardment on the nearby cells. Eventually, and this could take over a decade, the continual cell damage resulted in a variety of lung cancers.

Because of the poor ventilation and extreme working conditions, miners also inhaled fine silica particles contained in the mine dust. Silica is a sharp mineral that also caused severe damage to the miners' lungs. Often miners became sick with Silicosis, a disease where damaged alveoli produce excessive amounts of mucus and greatly impaired breathing, before they had lung cancer.

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[27] Eichstaedt, 49.
[28] Don Yellowhorse, Red Valley Ariz., interviewed 10 April 1994 Eichstaedt, 189. (brackets in original text)

Although inhalation associated risks were the primary hazard to the miners' health, the miners also ingested uranium ore particles because they ate their lunch and drank the water that ran down the mine walls. Aside from its radio-active properties, uranium is a toxic substance. Over time uranium builds in the kidneys and bone marrow of the body and causes severe problems. Uranium is also teratogenic, meaning it causes birth defects. While most miners were men, they typically had no showers or changes of clothes from the mines before they returned home to their wives and children. Women were exposed to the dust their husbands and fathers brought home. In the later uranium mining years, birth defects occurred among miners' children at abnormally high rates. Mary Louise Johnson has vivid memories of her husband returning from the mines covered in dust and said that "when he came home he was all muddy, even his face. At that time there was no running water, so we went to sleep just like that with him not even washing…There was no laundromat so we washed their clothes by hand, not even knowing the danger of the mine dust. And they did not warn us. We thought it was just dirt."[29]

The AEC, Public Health Service, and mining companies were aware of the long-term effects of radiation exposure as well as the dangerously high levels of exposure in the Navajo reservation mines as early as 1950. Documentation of their failure to inform the miners of known health risks, as well as their refusal to impose regulations to protect the miners during the first twenty years of mining, was collected as part of the Navajo

[29] Mary Louise Johnson, Mitten Rock, New Mexico, interview Timothy Benally, trans. Timothy Benally, , in *Memories Come to Us in the Rain and Wind, Oral Histories and Photographs of Navajo Uranium Miners and their Families,* dir. Doug Brugge (Jamaica Plain, Massachusetts: Red Sun Press, 2000), 48.

peoples' fight to receive compensation from the U.S. government for the severe health problems they later suffered.

Uranium Milling:

Uranium Café: serving "Yellowcake burgers"
Author's photo Grant's New Mexico

Though uranium mining has received the most attention in recent years, the milling process was equally damaging for its employees and the environment. The Radiation Exposure and Compensation Act (RECA) does not apply to sickness, death or disability from work in uranium mills, and its restriction has prevented due attention to the hazards of the milling process.

Refined uranium ore - or yellowcake - was the finished milled product, and this product as well as the waste tailings produced were familiar sights in mining communities. Taylor Dixon, a former mill worker from Two Grey Hills, New Mexico, described how he saw the uranium industry and the intrusion of yellowcake and mill tailings collide with Navajo culture from observing his children. He said,

> You see it is not good for my children, who come back from school to play in the piles. Whatever they brought home from the piles they used as toys. Corn Pollen and uranium are the same color and they ate some uranium. This is true; they put them on their window sills. *Corn pollen is used by the Navajos in house blessing and other ceremonies. In the Blessingway ceremony, pollen is usually applied to the head, to the tongue and scattered before one in prayer [eds.].*[30]

In many ways milling was more harmful to the Navajo people as a whole because the tailings produced and left in the community exposed everyone including women and children. Further, tailings also damaged the environment -- even contaminating the ground water that the Navajo people relied on for drinking and watering their livestock.

Yet, milling was a crucial process in the uranium industry on the Navajo reservation because uranium ore was in carnotite deposits. In the Grants Mineral District, there were generally only four pounds of uranium-308 per ton of ore processed. Other areas had slightly higher yields; however, because of the nature of the sandstone carnotite deposits, the ore was never as rich as the ore mined from pitchblende deposits such as those in Canada and the Belgian Congo.[31]

Processing the ore first required that the ore was crushed to sand-sized particles, to expose the uranium coating the sand particles in the sandstone. Then, to dissolve the uranium, the sand was soaked with hydrochloric acid or sodium carbonate-bicarbonate, depending on the mill and specifics of the ore. The sand was washed to ensure all the uranium had been removed before the sand was separated and placed in tailings piles. Then the "uranium in solution was subjected to numerous chemical and physical changes to obtain an overall extraction percentage as high as economically possible."[32] Finally, the uranium was extracted from solution, filtered, dried and placed in 55 gallon drums,

[30] Taylor Dixon, interview by Timothy Benally, in Brugge, 22.
[31] "Highlights of the Discovery and Production of Uranium in the Grants District" 4.
[32] Ibid.

weighing about 800 pounds. The final product was called yellowcake and was approximately eighty-three-percent uranium-308.[33]

Most milling procedures followed the same pattern of processing, but were each tuned to best extract uranium from the ores of their providing mines. This often required the use of different chemicals to more effectively and efficiently extract uranium. The New Mexico Bureau of Mines and Mineral Resources published *Geology and Technology of the Grants Uranium Region*, a book prepared for the Society of Economic Geologists for their Uranium Field Conference in 1963. Among the articles is the "Rudiments of Uranium Ore Metallurgy" by Dale C. Matthews. He traces the variables in ore grinding, ore leaching, solids-fluid separation, solution extraction, precipitation, and special heat treating. His analysis is highly specific, but reveals how important it was to properly address all the additional components in uranium ore to best extract uranium. Chemical costs to process uranium ore could therefore vary from one to seven dollars per ton of ore. By 1960 the milling process was well established, and 27 mills were operating across the country. In 1961 alone 17,400 tons of U-308 were produced and valued at $300,000,000.[34]

This great quantity of ore meant an even greater quantity of waste was produced. The tailings and used chemicals were stored near the mills in large piles and settling pools. The heavy metals, radio-active particles, and acids from this waste slowly leached into the surrounding environment. Further, although the uranium was removed, most of the piles were still highly radio-active. Even today there are unhealthy levels of radiation in the general vicinity around tailings piles. During the mining years most residents of

[33] Ibid.
[34] Dale C. Matthews, *Geology and Technology of the Grants Uranium Region,* Vincent C. Kelley, comp, Memoir 15 (New Mexico Bureau of Mines and Mineral Resources, 1963), 268-9..

mine communities were unaware of the dangers from the tailings piles. Lorraine Jack of Cudei, New Mexico, even remembers being on and around the uranium mill tailings piles while she was pregnant and said, "As a pregnant mother I used to go there. So the babies were born; from there to now they grew and they played there, just as I did. Ore that was dangerous was piled up and they played on it…didn't know it was dangerous. So we exposed them all [Children], just as we were exposed before…"[35] The most drastic environmental problems from the uranium mining industry were in fact not from the mines themselves, but from the tailings and settling pools left behind from the milling process.

[35] Lorraine Jack, Cudei, New Mexico, interview by Timothy Benally, trans. Timothy Benally in Brugge, 44.

PART TWO: The Church Rock Uranium Mill Tailings Spill

Author's photo Eastern Navajo reservation

Uranium mining continued on the Navajo reservation following similar procedures for the first twenty years of its operations. Then, in the 1960's, the AEC felt it had an adequate supply of uranium for U.S. defense and development purposes. Slowly the AEC started to open uranium purchasing to commercial interests. The timing could not have been better - new technology was just expanding into large-scale energy production. Nuclear plants would soon spring up in the United States, and each demanded uranium. Further, in 1969 Secretary of Labor Willard Wirtz had finally secured regulations and standards to limit uranium miners' radiation exposure. His standards required that radiation levels within the mines not only be monitored, but maintained at low levels. While these regulations came seventeen years after the start of the uranium industry, and seventeen years too late for many miners who were already

dying from diseases related to radiation exposure, the regulations did protect future miners.[36]

The uranium industry was slowly becoming less deadly for its employees, but unfortunately no less dangerous for the environment. The decades of mining had produced tremendous amounts of unaddressed wastes scattered across the Navajo reservation. Each site had it own set of problems. Yet, as these sites remained, even more abandoned mines, tailing piles and settling ponds were produced. United Nuclear Corporation, one of the largest uranium mining companies in the southwest, began new mining operations in the Church Rock, New Mexico area in 1969. To meet the demand of their mines, and that of the Kerr-McGee mines in Northeast Church Rock, United Nuclear opened their Church Rock mill. These mines and mills contributed to the tremendous production of the Grants Uranium Region, where forty-five percent of the U.S.'s uranium was produced from 1966-1979. [37]

The tailing and settling pools of this mill were constantly a cause for concern for the New Mexico Environmental Improvement Division (NMEID), who per the Agreement States program was "responsible for licensing nuclear industrial facilities and regulating the handling of specific types of radioactive materials" in place of the Nuclear Regulatory Commissions (NRC), but still in accordance with their guidelines. NMEID was also responsible for the water quality in the state of New Mexico, including all discharges into the groundwater and related aquifers. The United Nuclear Corporations' (UNC) seepage of tailings fluid was the worst of all five licensed and active uranium

[36] Eichstaedt, 92-3.
[37] Report of the Rio Puerco Review Team regarding Church Rock Uranium Mill Tailings Spill, July 1979. Rio Puerco Coordinating Committee, New Mexico Conference of Churches. (Nuclear Regulatory Commission, Office of International Affairs, 27 June 1983) Accessed at Dine College Library Tsaile, Ariz., by author January 2006. 7.

tailings facilities in New Mexico.[38] "An estimated 15,000 to 80,000 gallons of raw tailings 'raffinate', high in radioactivity and toxic metals and process chemicals, seep daily from the UNC evaporation ponds into underlying aquifers…contamination is evident in site monitoring wells at depths up to 240 feet below the surface, according to the company's own information."[39] These problems were first addressed as early as 1976. John Dudley, a NMEID hydrologist, was concerned because the tailing impoundment was unlined and there were "permeable areas in the tailings impoundment exposed during construction."[40] Despite this information, no plans for a seepage discharge system were ordered by NMEID until October of 1979 – after disaster had already occurred.

On July 16, 1979 part of the UNC tailings dam in Church Rock, New Mexico broke. Estimates of almost 100 million gallons of radioactive and contaminated water and debris flooded into the Rio Puerco River. Typically running low-dry at that time of year, the banks of the Rio Puerco were overflowing as the hazardous waste traveled downstream. Two hundred and fifty acres and thirty to seventy miles of the Rio Puerco were severely damaged for an undeterminable amount of time.[41] What happened - or did not happen - to bring about this problem? Were there not better alternatives before and after the spill?

Prior to the spill, three hundred and fifty Navajo families lived in the area surrounding Church Rock and the Rio Puerco, working in the uranium industry and often also herding cattle, goats, and sheep across the arid land. For both the people and the

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[38] Chris Shuey, "Accident Left Long-Term Contamination of Rio Puerco, But Seepage Problem Consumes New Mexico's Response" in *Mine Talk* "Church Rock Revisited" Summer/Fall 1982, Vol. 2 No. 1-2. Accessed at Dine College Library, Tsaile Ariz., by the author January 2006, 10.
[39] Ibid., 10.
[40] Ibid., 23.
[41] "Tailings Dam Break:" American Indian Journal, May 1979. Accessed from the files of Dine College Library, Tsaile Ariz., by the author January 2006.

animals, the Rio Puerco was a life source. This all changed when "eleven hundred tons of radioactive mill wastes and ninety million gallons of contaminated liquid [went] pouring towards Arizona. The wall of water backed up sewers and lifted manhole covers in Gallup, twenty miles downstream, and caught people all along the river unawares". Herbert Morgan of Mauelito, New Mexico remembers that he "'was wondering where it came from. Not for a few days were we told.'"[42]

The tailings and liquor, the acid milling liquids, were held in ponds by UNC to allow evaporation of the liquids and then removal of the solid wastes. The pond was only planned to stay in place for eighteen months, but had already been operating for twenty-five months at the time of the accident. The dam holding the material was earthen and lined with clay stretching twenty-five feet high and thirty-feet wide. The accident occurred when a twenty-five foot wide section gave way. The contaminated materials poured out of this opening to the Rio Puerco along a wash created from the wastewater produced from mine dewatering. This contaminated water had paved a way to the river.

There was little immediate action or outcry to the spill. Within a few days, signs in English, Navajo, and Spanish were placed along the Rio Puerco warning people to stay away from the river and keep their animals away as well.[43] Slowly, as the extent of the spill was revealed and the situation investigated, community outrage grew. While his brother Stewart Udall was fighting for compensation for the Navajo uranium miners, Representative Morris K. Udall brought congressional attention to the Church Rock spill.

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[42] Quoting Kathie Saltzstein, "Navajos Ask $12.5 Million in UNC Suits," Gallup Independent, August 14, 1980 in Harvey Wasserman and Norman Solomon, "Chapter Nine: Uranium Mining and the Church Rock Disaster" in Killing our Own, the Disaster of America's Experience with Atomic Radiation (New York: Dell Publishing, 1982) 1. (Complete text available online at http://www.ratical.org/radiation/KillingOurOwn/K009.html

[43] "Tailings Dam Break", 1.

He believed it could have been avoided had appropriate decisions and planning been carried out. In a Congressional hearing he said, "'at least three and possibly more Federal and state regulatory agencies had ample opportunity to conclude that such an accident was likely to occur.' Even before the dam had been licensed 'the company's own consultant predicted that the soil under this dam was susceptible to extreme settling which was likely to cause [its] cracking and subsequent failure."[44] In addition to the seepage problems already discussed before the dam break, cracks were visible in the dam in its first year. Evidence continued to mount against UNC.

Its chief operating officer J. David Hann admitted that they took a chance the dam would be unsettled because it was contrasted partly on bedrock and partly on softer ground. Hann said this divide "'served as a fulcrum, resulting in transverse cracking.' The breach was 'like many things you undertake…they have a risk, and we undertook this.'"[45]

But Hann and UNC were no longer operating in the glow of the nuclear age. For several years, beginning as early as the discontinuation of the AEC and the establishment of the Nuclear Regulatory Commission (NRC), the public was growing wary of the nuclear industry. Occurring only fourteen weeks after the Three-Mile Island incident in Pennsylvania, and the severe skepticism it produced, the NRC could not justify taking hasty and risky actions due to the importance of development, or for national security. The NRC's Office of Nuclear Material Safety and Safeguards, as well as the New Mexico State Engineer's Office, made clear the spill occurred as the result of UNC negligence. The spokesman for the New Mexico State Engineers office said at the same

[44] Quoting Representative Morris K Udall (D-Ariz.) U.S. House Committee on the Interior and Insular Affairs, Subcommittee on Energy and the Environment, Mill Tailings Dam Break at Church Rock, New Mexico, 96th Congress, October 22, 1979, in Harvey Wasserman and Norman Solomon, "Chapter Nine: Uranium Mining and the Church Rock Disaster", 2.
[45] Ibid., 2.

Congressional hearing led by Morris Udall that, "a 'consensus' of engineers who reviewed the accident agreed that 'had the drain zone been constructed according to the approved plans and specifications, and had the tailings breach been in place as recommended by [UNC's] engineers, it is likely that failure would not have occurred.'"[46]

The clean-up and subsequent management of the tailings piles and materials were just as disorganized and unreliable as the original construction and maintenance of the dam. UNC was charged with the clean-up, but unfortunately did only a bare minimum to reclaim the lands damaged by the mines. Because there were few readings before the spill to accurately measure natural conditions farther downstream, there were no baseline levels of radioactivity for reclamation to achieve.[47] Appallingly, UNC sent small crews of no more than thirty-five men along the banks of the Rio Puerco to remove affected sediment from the streambed and place it in fifty-five gallon drums. Such action was almost farcical because pollutants had already been transferred far downstream and penetrated thirty feet below the surface. Worst, it was feared that the precious aquifers may have also been contaminated. Beyond the river, the flooding from the spill had created small pools of pollutants separate from the river, and easily accessible to unknowing children and animals.

The primary components of the pollution were radioactive particles and acids. After uranium was removed, eighty-five percent of the ore's original radioactivity was left behind in the tailings along with ninety-nine percent of the original volume. In addition to dissolving the uranium, the acids used in milling dissolved thorium 230,

[46] Ibid., 2.
[47] "Report of the Rio Puerco Review Team regarding…", 9.

radium 222, lead 210 and other isotopes.[48] These particles are more soluble after the milling process, and thus more dangerous when released into the environment or in humans and animals that ingest it. An alpha emitter, thorium is also toxic, perhaps as toxic as plutonium, and if ingested is deposited like uranium in the liver, bone marrow and lymphatic tissues. Again, like uranium, such deposits create fatal cancers and disease.[49]

While people read the signs and cleared away from the river, it was very difficult to prevent livestock from ingesting pollutants. A study of eleven animals by the CDC confirmed that the kidneys and livers of local livestock contained elevated levels of pollutants and should not be eaten.[50] But, for many of the Navajo people living in the area, these livestock were their primary means of survival. As one Navajo shepherd said, there are signs saying, "contaminated wash, keep out. But, our cows, sheep and horses can't read that."[51]

The contaminated water has forced changes in the way of life for many of the Navajo people living around the Rio Puerco, and they suffer isolation from their neighbors who fear trade and contact will risk spreading the contamination.[52] The closing of several of the area's mines forced the men out of work and placed more need for survival off of potentially contaminated livestock. Many families were forced to

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[48] Harvey Wasserman and Norman Solomon, "Chapter Nine: Uranium Mining and the Church Rock Disaster" in *Killing our Own, the Disaster of America's Experience with Atomic Radiation* (New York: Dell Publishing, 1982) 1.
[49] Ibid., 4.
[50] Ibid.,, 4.
[51] Ibid., 4.
[52] Janet Siskind, "'Toinjoni'" – A Beautiful River that Turned Sour." in *Mine Talk* "Church Rock Revisited" Summer/Fall 1982, Vol. 2 No. 1-2. Accessed at Dine College Library, Tsaile Ariz., by the author 28 January 2006.

travel daily to the Manuelito Chapter House (the smallest unit of Navajo government) to collect fresh water because they could no longer use the water from the Rio Puerco. The changes have altered Navajo cultural life as well. Anthropologist Donna Deyhle wrote an article in *Century* magazine in May of 1982 describing some of the cultural changes. "'Navajos from the communities [affected by the Rio Puerco spill] are reluctant to donate sheep that might not be healthy to relatives for ceremonies. Ceremonies are less frequently held in these communities.'"[53] Many of the Navajo people affected by the spill learned about radiation for the first time when they sought explanations for the problems with the river, and the sickness and unhealing sores they were witnessing on their livestock. Years after the spill they are still living in fear of the long term consequences to the health of their families and land.[54]

While the Navajo people waited and worried about their health, UNC continued operations relatively undisturbed by the events of the spill. Some mine sites had closed, but uranium operations in the region did not cease. Shockingly, the repaired tailings pool was still in operation in 1981. Continuing corporate negotiations with government regulatory agencies had prevented the close of the tailings site. Constant letters from NMEID director Thomas Baca, such as that of May 26, 1981 to UNC, repeated "the existing site is not suitable for long-term or permanent disposal of tailings". Even this failed to close the site. Finally, in 1982 UNC announced it would temporarily close the tailings site because of the poor uranium market. Using this juncture as his opportunity to permanently close the site, new NMEID director Russell Rhoades "withdrew permission for UNC to continue to discharge tailings without an approved discharge plan" and the

[53] Ibid, 39.
[54] Ibid., 40.

review of a public hearing.[55] While active discharge to the site stopped, problems to control seepage were never fully addressed.

Today the site is still dangerously contaminated, and there is no solution to clean-up either the complete tailings site or the Rio Puerco wash. NMEID is in fact not optimistic that the groundwater will ever be completely restored because so much damage had been done.[56] Interviewed by Chris Shuey in April of 1981, Thomas Bailey, President of United Nuclear Corporation, was surprisingly cavalier about the effects of the spill and proud of UNC's efforts to restore the site and aid the community. Bailey did not want to talk about the cause of the spill but said,

> I firmly believe that nobody was harmed by it. The only danger anybody would have had was if they were in the bottom of the wash when the damn thing broke – and then they'd probably have drowned. The Nuclear Regulatory Commission said the danger to the livestock was for about 24 hours, and if they'd drank any of the water, it was so acidic it'd have burned their tongues. In the first place, the animals are smarter than that, and they'll stick their tongue in once and that will be the end of it.[57]

When Shuey asked Bailey, "So do you think the regulatory and public outcry has been too stringent toward UNC?" Bailey was eager to describe the efforts of UNC to assist the Navajo community. He said, "It was an overreaction. You know, we had the Three-Mile Island incident, then this thing happened, people were worrying about old buildings made out of uranium mill tailings, and so everybody overreacted, including us probably."[58] He added the expense of $100,000 a month to remove the top layer of sediment from the Rio Puerco was a waste of money that didn't help anyone because there were no baseline measurements to determine if addressed areas were in fact clean.

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[55] Shuey, 23.
[56] Ibid., 26.
[57] Thomas Bailey, interviewed by Chris Shuey 23 April 1981, in Chris Shuey, "Accident Left Long-Term Contamination of Rio Puerco, But Seepage Problem Consumes New Mexico's Response" in *Mine Talk, 27.*
[58] Ibid.

The best thing Bailey thought UNC did in response was provide fresh drinking water to residents of the Rio Puerco area. He said, "We went to them and said, 'Hey, who needs water and who was affected by this thing?' We were hauling clear to the Arizona border."[59] Despite this self-praise, UNC was contractually obligated to provide fresh drinking water if there was a spill. Moreover, they only provided water for less than a year after the spill even though the water in the Rio Puerco was still unsuitable for drinking over a year after the spill.

The Church Rock tailings spill is still an open sore for the Navajo people today. Although it was the largest spill of radioactive materials in the United States, most people are completely unaware of the incident. Today, residents in Chapters surrounding the river and the Gallup area are still very wary of the water. Brother Simon, of the St. Bonaventure Indian Mission in Thoreau, New Mexico, helps to run a water service operation to the people of the Boca Chapter who do not have running water or resources for water near their homes. Slightly farther east on the checkerboard reservation than Church Rock, he makes a point to tell visitors to the reservation just how badly the spill has affected and scared people on the reservation, and yet how little anyone else knows about it.[60]

Although just one incident among many in the uranium mining industry on the Navajo Reservation, the Church Rock Spill is compelling evidence of the lack of responsibility and mismanagement among corporations, as well as government agencies, that brought harm to reservation lands and the Navajo people. Also, like most of the

[59] Ibid.
[60] Brother Simon, conversation with author on the Bocca Chapter in Eastern New Mexico, St. Bonaventure Indian Mission, Thoreau, New Mexico. Authors notes, 24 January 2006

problems related to uranium mining on the reservation, this too is often overlooked and still ongoing.

PART THREE: Land Reclamation and Uranium Mining Today

The Navajo Office of Abandoned Mine Lands

Author's photo Navajo AML Office, in Widow Rock, New Mexico

Simultaneous to the uranium miners organizing to pursue compensation for their radiation induced health problems, a combination of Federal policies and Navajo government development started intensive efforts to reclaim the Navajo lands damaged from uranium mining. Both these movements started in the mid-1970's and just prior to the Church Rock Tailings spill. After nearly thirty years of mining uranium across the reservation the damages were unavoidable. Not only were people falling sick, but the earth was also in distress. Situations similar to the Church Rock spill affecting both the land and communities were seemingly everywhere. No longer trusting either the Federal government or uranium companies to act with responsibility or respect for the Navajo people, the Navajo Nation was forced to develop its own government infrastructure and economy to provide for and protect its own well being. Perhaps the most successful department to emerge in the slow climb to Navajo self-development was the Navajo Office of Abandoned Mine lands (NAML).

In 1977 the U.S. Office of Surface Mines enacted the Surface Mining Control and Reclamation Act. The act was created to address dangerous coal mine sites in which

accidents were occurring, primarily in Pennsylvania and West Virginia. Part of the act detailed regulations on mining practices, and the other half created and provided for the administration of a fund to reclaim abandoned mine lands. The fund was built by a thirty-five cent fee collected on every ton of coal mined. The funds were kept separately for each state. Originally, the funds were only applicable to mines abandoned prior to 1977, but the policy was changed in 1990 to apply to all abandoned mine lands.[61]

In addition to uranium deposits, the Navajo reservation is rich with coal, oil and natural gas. The SMCRA legislation collected fees on the coal mining that took place on the reservation because it is considered federal land. Established under the era of cooperative federalism, SMCRA legislation usually handed the funds over to state agencies once they provided a system to administer and regulate the funds. On most Indian reservation there is no corresponding agency to direct reclamation projects and the work is carried out by the federal government. The Navajo Nation AML is unique, and one of the few extremely successful Native American government agencies to earn independent control of U.S government funds. The NAML quickly addressed all of the abandoned coal mines across the reservation, and were then eligible to use their funding for non-coal reclamation projects, including uranium mine sites.[62]

NAML directors scoured the reservation and identified all open mine sites and tailing piles, identifying over a thousand different projects. The NAML prioritized these projects based on their proximity and affect on Navajo communities. Next, plans for removing the hazards of the sites were constructed. Unfortunately, SMCRA legislation limits its funding to physical hazards and not to address long term assessments of the best

[61] Public Law 95-87, Surface Mining Control and Reclamation Act of 1977
[62] Dayzie, Gilbert interviewed by author, author's notes during interview, Navajo Office of Abandoned Mine Lands, Shiprock, New Mexico, 27 January 2006.

clean-up to prevent continued environmental damage. Typically, mine reclamation consists of sealing entrances to open mine shafts with foam, boarding the entrances, and then covering the area with concrete. This process is meant to stop excessive escaping radiation in the vicinity of the mine opening, and prevent any person or animal from entering the mine.[63]

Open pit mines are more difficult to reclaim and often require moving large amounts of earth. If the removed ore is still in the vicinity of the mine it is often used as fill. Most open-pit mines collect water, and with disuse are generally full of murky, polluted water that is dangerously used by livestock and animals as a watering spot. Draining the mine is thus the first step in the reclamation process. Then, the mine is lined with clay, or if necessary some site specific and relatively non-porous substance. The most contaminated debris is used to fill the mine first, followed by increasingly clean layers until the surface area, which is covered with several feet of top soil. Projects like this are enormous undertakings and require extensive use of heavy equipment and numerous employees. The NAML is proud to employee Navajo workers for these projects and train them with marketable job skills, such as operating heavy machinery or the rudiments of environmental engineering.[64]

The NAML also works with the funding provided by the Uranium Mill Tailings Remedial Action Legislation (UMTRA), to reclaim uranium tailings piles. One of the largest projects the NAML conducted involved closing many of the first uranium mines on the reservation in Cane Valley, Arizona and moving several separate tailing piles to a central location in a remote western region of the reservation. The project utilized the

[63] Ibid.
[64] Ibid.

most sophisticated removal methods and culturally sensitive timing for conducting the work, and even began the project with a traditional Navajo blessing ceremony. In addition to reclaiming the lands, the project was also aimed at restoring the community. Over the course of the work $5 million was paid in wages to local Navajos.[65]

The culturally sensitive and community oriented approach to reclamation has made the NAML a world model for uranium reclamation – and they certainly have the most uranium mine reclamation experience to date. Soon however, other nations will also need to address their uranium mines and tailings and it may be that they look to the NAML for the best methods to reclaim their lands.[66]

Currently the NAML, in cooperation with UMTRA, has been very successful at stabilizing most of the tailings piles across the reservation. Unfortunately, their work is ongoing. The mines that closed in 1978 left behind approximately 25 million tons of uranium tailings, yet the increased productivity of the later mining years is estimated to have increased the total national uranium tailings to nearly 450 million tons. [67]

Even just stabilizing these piles is proving a challenge. It is not clear what methods will actually contain the radioactivity of the piles for the hundreds if not thousands of more years that these piles will be radiation hazards. Many "questions have been raised about how long dirt covering the piles would last through the millennia the tailings will be radioactive. Or if the piles can actually be covered at all. In some instances they are a hundred feet high and more, and cover hundreds of acres of ground.

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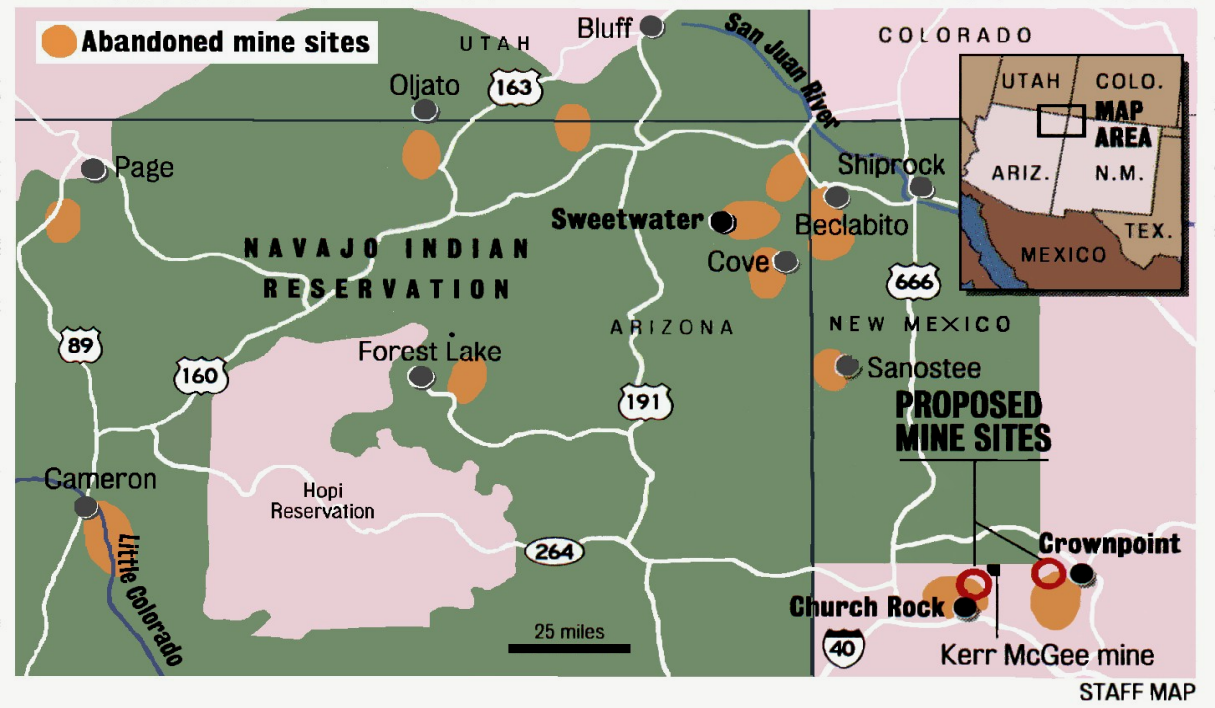
[65] Eichstaedt, 145
[66] Ibid., 149.
[67] Harvey Wasserman and Norman Solomon, "Chapter Nine: Uranium Mining and the Church Rock Disaster" in *Killing our Own, the Disaster of America's Experience with Atomic Radiation* (New York: Dell Publishing, 1982) 7.

Huge strip-mining operations would be required just to get enough soil to do the job."[68]

(Please see map on the following page for the location of many reclamation sites)



Map from: presentation by Mitchell Capitan, Crownpoint, New Mexico, Larry J. King, Church Rock, New Mexico ENDAUM Board Members September 9, 2004[69]

Shiprock and Tuba City Tailings Projects: Groundwater treatment

Today two of the largest ongoing reclamation projects are in Shiprock, New Mexico and Tuba City, Arizona. In both locations there were expansive tailings piles that have been physically stabilized, but contaminants continue to leach into the ground water. In Shiprock, the tailings piles contain 1.7 million tons of materials covering seventy-two acres. During the rainy season the leaching process is exacerbated, and risks entering into the nearby San Juan River. Again, as with the Rio Puerco River, the San Juan is highly

[68] Ibid.

[69] Map from: presentation by Mitchell Capitan, Crownpoint, New Mexico, Larry J. King, Church Rock, New Mexico ENDAUM Board Members September 9, 2004[69]

utilized by the local population.[70] The mill that produced these tailings operated from 1954-1967 and was owned at various times by Kerr-McGee, The Vanadium Corporation of America, and Foote Mineral Company. During its years of operation the mill produced 1.5 million tons of ore. Throughout its operation the mill site was leased from the Navajo Nation, and in 1973 the last lease expired and the mill reverted back to the Navajo Nation. For a short time the site was used to instruct Navajo students how to use earth moving equipment, but soon the Navajo Nation placed a request to the USEPA for assistance in stabilizing the tailings piles.[71]

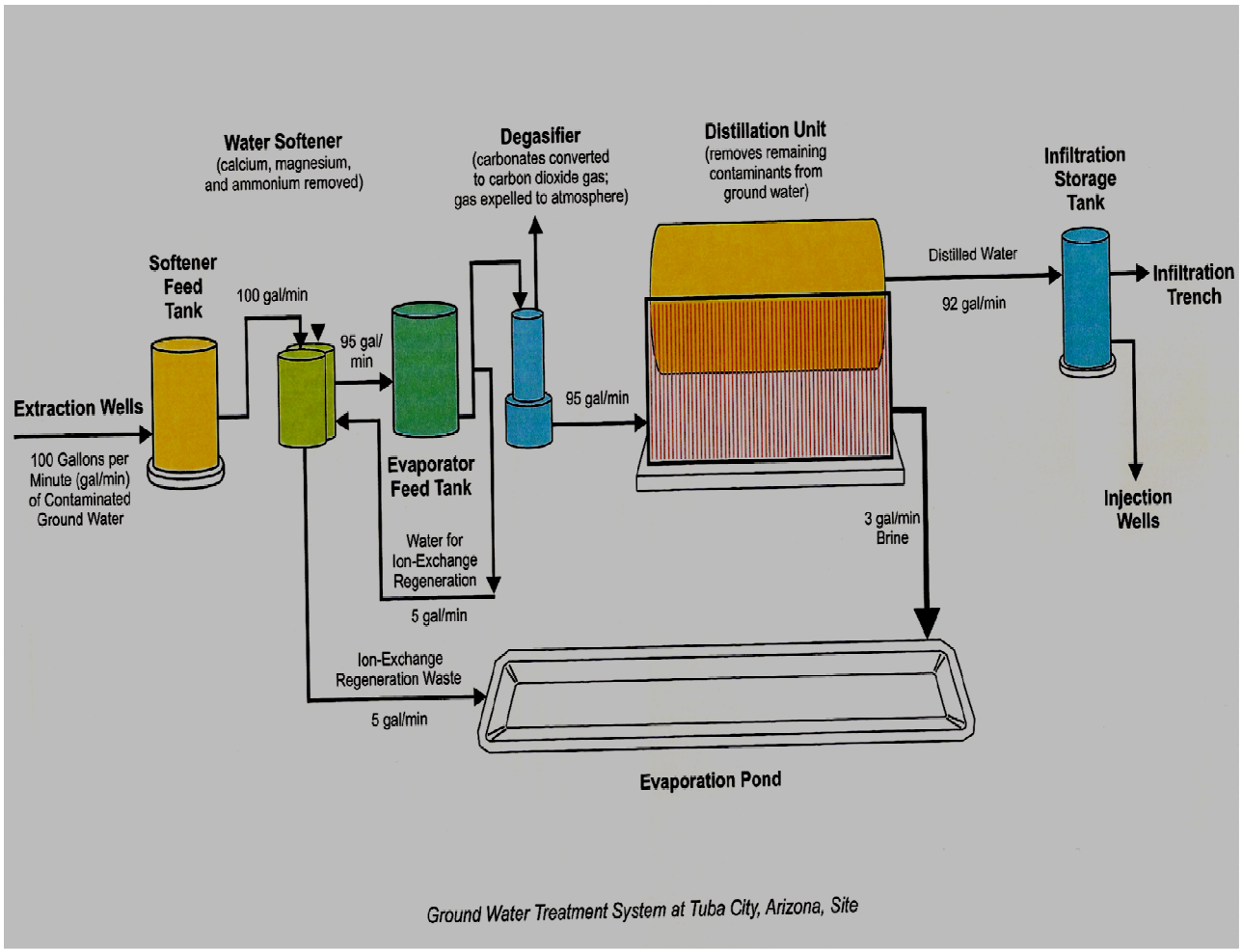
Decontamination at the site began in January of 1975 and continued throughout the mid-80's. This clean up, however, did not authorize work to clean up contaminated groundwater. As a result, more recent efforts have focused on decontaminating the groundwater. The Shiprock tailings that are precariously positioned next to the San Juan River have led to the designation of three geological areas or concern: the river floodplain, the eastern terrace, and the western terrace. Water in the floodplain is being cleaned through natural flushing, which is expected to flush mill-related constituent in one hundred years. Long term monitoring will determine the actual effectiveness of the natural flushing. To supplement the natural flushing "during the next 10 to 20 years, active remediation will consist of pumping contaminated ground water from two extraction wells in the most contaminated part of the floodplain aquifer next to the San Juan River. This water and water from the terrace regions collected in French drains is then pumped to an evaporation pond. Institutional controls are also in place to prohibit

[70] Ibid.,8.

[71] "Fact Sheet: Uranium Mill Tailings Remedial Action (UMTRA) Groundwater Project at Shiprock, New Mexico, 9/2002. Available at the Navajo Office of Abandoned Land Mines, Window Rock, Ariz., obtained by author January 2006.

grazing and the drilling of new water wells on the floodplain or terrace regions around the tailing piles. Most of the drainage facilities and use restrictions will need to operate for twenty years before contamination levels are adequately reduced.[72] (Please see the map and graph on the following pages for the Shiprock site location and sample diagram of the groundwater remediation system operating in Tuba City, Arizona.[73] For the most updated progress at mine sites, please check Energy Information Administration (EIA) online which has more information on the status of tailings and groundwater remediation.[74])

[72] Ibid.
[73] Office of Legacy Management, Tuba City, Arizona, Site, 27 September 2004. Informational Booklet obtained by author at the Navajo Office of Abandoned Mine lands in Window Rock, Arizona, January 2006.
[74] Energy Information Administration, "Mexican Hat Mill Site, San Juan County, Utah" and "Tuba City Mill Site, Coconino County, Arizona, available online: http://www.eia.doe.gov/cneaf/nuclear/page/umtra/mexican _hat_title 1.html Accessed: 2 March 2006.



Ground Water Treatment System at Tuba City, Arizona, Site

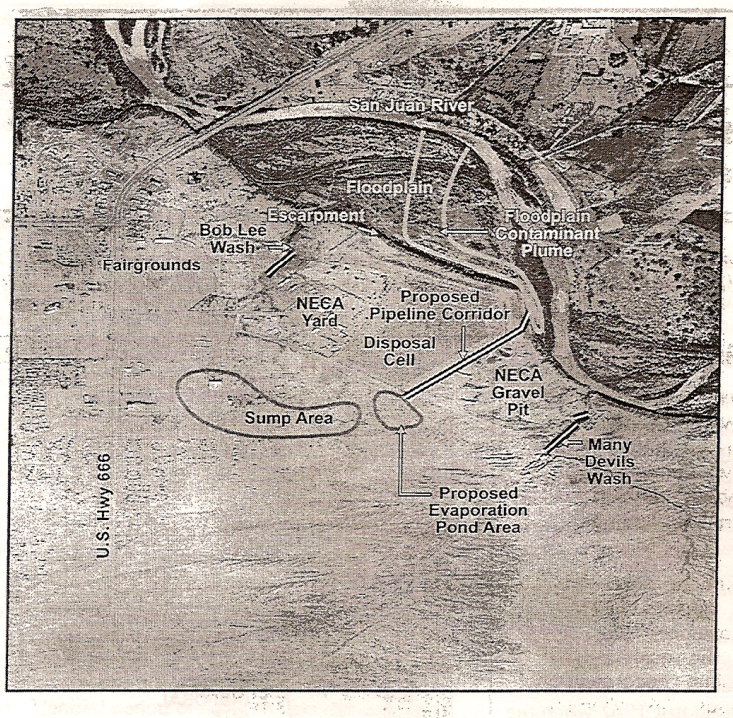


Figure 2. View of the Shiprock Site

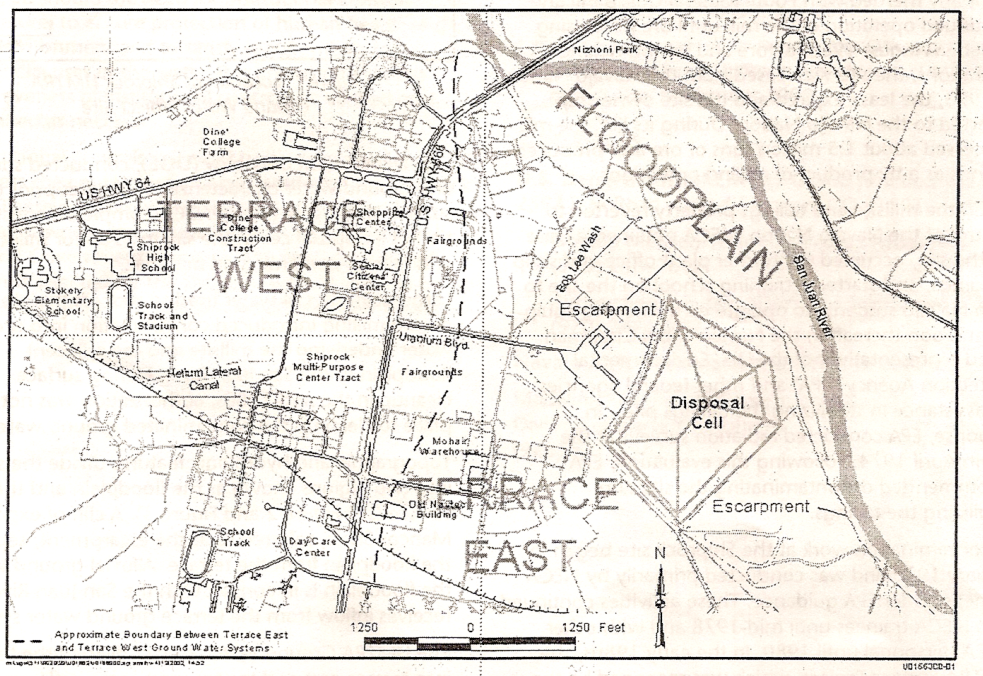


Figure 3. Terrace West, Terrace East, and Floodplain Areas

"Fact Sheet: Uranium Mill Tailings Remedial Action (UMTRA) Groundwater Project at Shiprock, New Mexico, 9/2002. Available at the Navajo Office of Abandoned Land Mines, Window Rock, Ariz., obtained by author January 2006.

Although changes are underway, they may have come too late for some. Doctors working for the Indian Health Service in the Shiprock area were already reporting increased rates of birth defects in the 1980's. Dr. Evelyn Odin, a pediatrician in the Shiprock area, reported to *The Albuquerque Tribune* that she had recently seen an increase in strange birth defects ranging from a baby whose trachea and esophagus were fused together to a baby whose intestines were not contained within his body. Although her experiences were not conclusive evidence, her reports and those of other physicians encouraged comprehensive medical studies that found links to uranium related radiation exposure and birth defects.

Homes Made of Tailings and threats to SMRCA funding

The impact of the uranium mining and tailings on the Navajo communities is often unimaginable. In several communities where there were few building materials, many miners living near tailings piles used the disregarded ore to build their hogans, traditional Navajo homes. There are many of these homes in the Oakspring, Arizona area near the Tutt Mines. A Ms. Begay, interviewed by The Dallas Morning News, grew up in a Hogan built of uranium tailings by her father, who was a miner. She recalled that, "The miners found that with a little chipping, the waste ore rocks from the mines could be squared up for excellent building materials for walls, floors, and foundations." Now Ms. Begay has thyroid problems she attributes to the radiation exposure from her home while growing up – a danger her family did not know about. She has worked to make these homes an EPA Superfund site, but while EPA officials acknowledge the problems with

the homes, they say "it falls short of Superfund cleanup status because of the area's sparse population and an incomplete knowledge of all problem locations."[75] Although problems with structures made of tailings were known in the early 1980's, it was not until 1994 that the USEPA formed a cooperative plan with the NNEPA to address deconstruction of these homes.[76]

Most recently, the Navajo Nation is fighting to maintain their funding under the SMCRA legislation. President Joe Shirley has been traveling to Washington D.C. and engaging the press to persuade Congress to prevent the unused SMCRA funds from coal mining from leaving Navajo Control. Current proposals suggest collecting all unused money and allocating it to the states the farthest behind on their reclamation projects. President Shirley has argued before the Senate Energy and Natural Resources Committee that the Navajo Nation is in more need of the SMCRA funding than any state in the nation. He said, "There is not a state in the Union that faces the vast array of infrastructure problems confronting the Navajo people." He cited the facts that Navajo "unemployment hovers around 50%, 70% percent of the Navajo people lack domestic and municipal water for everyday use, 78% of the public roads are dirt based, with little or no gravel, 60% of the Navajo Nation lacks basic communication services, and 60% of the Navajo Nation lacks electrical power lines."[77]

Taking the message public, Shirley's action have been closely followed by the Navajo publication the *Division of Natural Resources, "Land, Water, Power and Quality*

[75] Bill Papich, "Tribe urges cleanup for radioactive homes but Superfund help not likely for now, EPA says." *The Dallas Morning News*, 29 December 2000. Among the collected materials of Doug Brugge held at the Navajo Nation Library Archive in Window Rock, Accessed by the author January 2006.
[76] Document, "Navajo Nation, Navajo Nation Abandoned Uranium Project Plan" December 2001.
[77] Navajo Nation President Joe Shirley, Statement before the Committee on Senate Energy and Natural Resources, 11 March 2004.

of Life" Newsletter. For example the headline of the October 2005 newsletter read, "Navajo President Joe Shirley Jr. asks Senate committee to allow mining reclamation law to treat Nation as it treats states."[78] He has also gained the attention of regional non-Navajo newspapers, including an article published in the Gallup Independent on Friday, March 12, 2004, the day after he first testified before the Senate committee.[79]

Tracking the variety of reclamation projects makes it obvious that the uranium mining companies operated with little regard to the welfare of the Navajo people or their homelands. A passionate article in American Indian Journal expresses it best,

> "The companies have the technology on how to extract uranium. So why couldn't they have developed the technology of taking care of people and protecting their environment? The companies have cleared our gazing land, they have cut down our trees, they have bulldozed over our religious sacred sites and grave sites. They have dried up our wells". [80]

The Navajo people have finally acted against these problems and addressed them independently, as well as with the support of the Federal government. Through this process they have in fact demonstrated the very best elements of Navajo self-determination.

ENDAUM and ISL

[78] *Division of Natural Resources, "Land, Water, Power and Quality of Life" Newsletter (Vol. III No. 3 October 2005).*
[79] Kathy Helms, "Navajo Poverty cited in pursuit of Federal Funds", 12 March 2004, *The Gallup Independent*.
[80] "Tailings Dam Break", 2.

Division of Natural Resources

"Land, Water, Power and Quality of Life"

Vol. IV, No. 1 • JANUARY 2006 www.navajoaml.osmre.gov NAVAJO NATION, P/O BOX 1875 WINDOW ROCK, ARIZONA 86515-1875

US OSM recognized DES and CIO for Outstanding Work

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Window Rock, AZ - Mr. Willis Gainer, Director of Office of Surface Mining Albuquerque Field Office, recognized the Division of Community Development, Design and Engineering Services (DES) and Capital Improvement Office (CIO) for "Innovative Architectural & Engineering Designs" and "Outstanding Project Management of Public Facility Projects" at the 2005 Navajo Nation Project Management Workshop, held on December 13th, in Gallup, New Mexico at the Holiday Inn.

"DES and CIO deserve this recognition for being a dedicated and conscientious department that provided exemplary support to the Navajo Abandoned Mine Land (AML) Program. Furthermore, they have provided technical services that would benefit communities of the Navajo Nation.

Centers $300,000 $817,064
Twin Lakes Senior Citizen Centers $214,734 $832,731
Huerfano Multipurpose Facility $300,000 $704,873
Standing Rock Chapter House Renovation $300,000 $360,000
TOTAL $2,954,734 $7,399,583

Navajo AMLR extends its gratitude to DES and CIO staff for their exceptional support and allegiance in the joint effort of

rationed their staff's time with countless hours of paper work, attending meetings, planning, designing, and most importantly, managing these projects. The new facilities are fine examples of what can be accomplished by the various Navajo Nation entities working together; Navajo AML activity supports the concept of providing leverage funds towards mining impacted communities for PFP's. These new buildings are well intended and constructed plausibly and immediately address current and future community business needs and activities.

Since 2002, Navajo AML has funded 33 PFP's at an overall contribution construction cost of $17.4 million. For the 2007 PFPs, Navajo AML will advertise for proposals in April 2006 for Fiscal Year 2007 funding. For more information please

In addition to recent conflicts over SMCRA legislation, the Navajo people are still currently fighting against new proposals to start uranium mining operations on the reservation. Most of the proposals are for operations in the Church Rock and Crownpoint areas, located at almost the very center of the Navajo Reservation. These new operations would be neither underground nor open mines, but rather a developing method called In Situ Leach mining or ISL.

The Navajo people first successfully organized against uranium mining in the spring and summer of 1979. Navajo communities spread information and recruited residents of uranium mining areas to come and protest along with 85,000 anti-nuclearists who demonstrated in Washington D.C. on Sunday, May 6, 1979. Elsia Peshlakai, a Navajo woman, gave a speech that afternoon and declared uranium mining the "industry of death".[81] She reminded the crowd that "fifty-five percent of the nation's uranium was on Indian land, and most of it on land belonging to the Navajos."[82] Further, she said, "we are fighting for our families, we're fighting now in the courts of Washington - right here.

[81] "Indians as Anti-Nuclearists" American Indian Journal, May 1979, pg 27. Held in a collection of pamphlets at the Dine College Library, accessed by the author in January 2006.
[82] Ibid.

The Navajo people in Dalton Pass and Crownpoint, New Mexico have stopped the mines in our area - at least for the time being."[83]

Peshlakai was right, and in 1994 the next and strongest group of Navajo activists united against proposed ISL mining in their community. This group is the Eastern Navajo Dine Against Uranium Mining (ENDAUM). Mitchell Capitan, a resident of Crownpoint, New Mexico started ENDAUM when he heard the NRC "was proposing to issue a license to a company called Hydro Resources Inc. or HRI."[84] Although a small community of 4,000 people, this one grocery store stop is nonetheless the hub of the Eastern Dine Agency and contains the Indian Health Service regional hospital. In 1994 when the news about the HRI mining proposal broke Capitan had already had experience with ISL mining. From 1979 to 1985 Capitan was a laboratory technician a small pilot-scale ISL mine located five miles west of Crownpoint. The operation was run by Mobil Oil Corporation and was "designed to prove that uranium could be mined without digging tunnels and shafts and sending workers into dangerous conditions underground. From [his] experience, [he] learned that, sure enough, uranium can be recovered in this way. But what happens underground, out of sight of human beings is troublesome….[he] immediately told Rita [his wife and ENDAUM co-founder] that the proposed mining was not a good idea because restoring the groundwater to its original quality after mining is nearly impossible."[85]

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[83] Ibid.
[84] Mitchell Capitan, Statement, Representing Eastern Navajo Dine Against Uranium Mining Crownpoint, New Mexico, USA, to the United Nations 57th annual Department of Public Informations/Non-Governemental ORagnizations Conference Millenium Development Goals: Civil Society Takes Action, 8 September 2004, 1. (available through the ENDAUM website: www. ENDAUM.org)
[85] Ibid., 2.

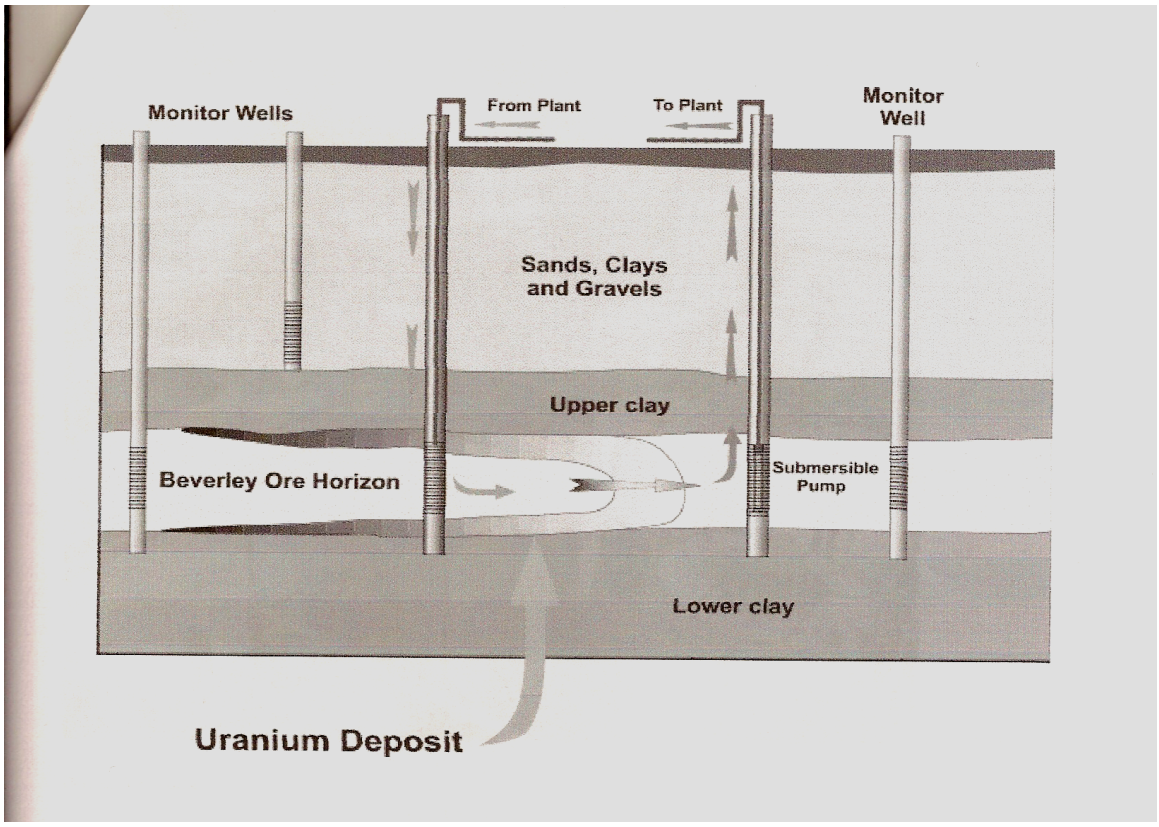
The Capitan's took their knowledge and passion for community safety to town meetings to inform their neighbors about the coming situation. Capitan was then employed with the Navajo Tribal Utility Authority and worked to bring the fresh Crownpoint water to the homes of Crownpoint residents. Knowing how precious this pure water was to the community only further spurred Capitan to action. He founded ENDAUM and has used community awareness, media attention, government channels and the assistance of the Southwest Research and Information Center and New Mexico Environmental Law Center to prevent HRI from opening an ISL mine near the Crownpoint community for the last fourteen years.

The ISL mining process can remove uranium from depth without massive ore removal operations. Leaching production holes are drilled on seventy-five to one hundred and fifty foot center across the ore trend. The mining corporation then pumps water with gaseous oxygen and sodium bicarbonate into the trend to chemically free the uranium from the rock in the presence of this solution. The uranium-laden solution is then forced through the ore sands under great pressure and pumped back up another hole. It is processed at the surface by extracting it from the water using a system similar to a household water softer, but designed to deposit uranium on the collector. The water is then reused. For this system to work, the "uranium minerals in the ore must be soluble in water, the geological features of the ore body cannot prohibit movement of fluids within the ore; and the porosity of the host rock [cannot] unduly restrict movement of solutions between drill holes."[86]

The ISL method is also being used to mine uranium in Australia and projects in the U.S. are increasing. In 2003 about sixteen percent of the world's uranium was

[86] "Highlights of Discovery Document…" 4.

produced by ISL mining, and eighty-five percent of U.S. uranium production was ISL[87]. U.S. productions generally uses alkaline solutions while Australian systems use acid leaching.[88] However, both systems average overall ore recovery around eighty percent, and most sites are only operable for one to three years depending on how quickly flow through the ore is decreased by the build up of clay and silt trapped in the permeable sediments.[89] (Please see diagram below)



In Situ Leach (ISL) Minning of Uranium, Nuclear Issues Briefing Paper 40, June 2003. Available online: http://www.uic.com.au/nip40.htm

[87] In Situ Leach (ISL) Minning of Uranium, Nuclear Issues Briefing Paper 40, June 2003. Available online: http://www.uic.com.au/nip40.htm
[88] Ibid.,3.
[89] Ibid., 2.

After the uranium is precipitated, generally through the use of hydrogen peroxide, the water is re-used. However, about .5% is bled off to maintain a pressure gradient in the well field. This is treated as waste and contains dissolved materials such as radium, arsenic and iron. It is pumped into disposal wells, in a depleted portion of the ore body. The re-injected water is intended to maintain a flow of water from the aquifer to the well field and maintain pressure around the site to restrict the flow of mining solutions away from the mining area.[90] Nonetheless when the operations are complete, the groundwater must all be treated to try and restore it to the original condition before the mining. This is typically done through evaporation ponds.[91]

It is this contamination of the groundwater that most concerns the Capitans and ENDAUM. There is considerable evidence that ISL mining will contaminate the Crownpoint groundwater and this is a risk they are just not willing to take on top of the long legacy of human and environmental abuse because of the uranium industry. ENDAUM'S action to prevent mining has set a precedent. This is the "first time a grass-roots organization—not to mention a Native American organization, has challenged the licensing of an in-situ leach uranium mine by the Nuclear Regulatory Commission (NRC)." So far, they have been successful. Most recently ENDAUM prevented HRI from operating because they failed to supply or arrange funding for a predetermined clean up plan. As a result, "now every ISL mining company in the United States will have to include cost estimates and a full plan for cleanup in their application so that it may be

[90] Ibid., 3.
[91] Ibid.,5.

thoroughly reviewed by the public.[92] This victory is just a small step in the ongoing battle to keep ISL uranium mining out to Crownpoint— but as long as the demand for uranium still exists companies will still persist in trying to gain access.

The struggle is made more difficult because the U.S. federal government, the New Mexico state government, the Navajo Nation government until recently, and many of the Navajo people who serve to profit if they sell their land to HRI, are in favor of opening ISL mining operations. The Bush administration has called for a new investment in nuclear power, and HRI would mine using federal subsidies.[93] The Navajo Nation was initially interested in gaining the revenue of the mining operations. Navajo individuals who owned allotted lands were offered payments of $367,000 once the NRC grants licenses for the operations. These people argue that in contrast to their annual yearly income, ranging from 2,000-10,000 dollars, this is their ticket out of poverty.[94] Their willingness to take the money has divided the community and hurt their neighbors. As Capitan's mother said, "'The mining operation will occur on lands that surround my own. There will be hundreds of wells and miles of pipes throughout Crownpoint if the HRI project is approved. Would you want this to happen to your community?'"[95] The Plant would be a half-mile from churches, schools, businesses, government offices and most residences. Ultimately, allowing ISL mining is accepting that the "the success or failure of this in situ (ISL) leach, or solution mining, process hinges on HRI's ability to prevent radioactive and trace metal contaminants from escaping the mining zone and

[92] "HRI- ENDAUM Uranium Mining Case" New Mexico Environmental Law Center, available on-line at http://www.nmenvirolaw.org/cases/hri.htm
[93] Winona LaDuke, "Navajos Ban Uranium Mining" *Earth Island Journal*; Autumn 2005, Vol. 20 Issue 3 p37-38.
[94] Chris Shuey, "Uranium Mining Plan Splits Navajo Communities in New Mexico", Southwest Research and Information Center Albuquerque, New Mexico. June 1996. Available at Crownpoint Uranium ISL project http://www.wise-uranium.org/upcrp.html
[95] Ibid., 1.

contaminating the regions sole aquifer" and this is a risk that most Crownpoint residents do not want to take.[96]

Just last year, ENDAUM's effort helped bring the Navajo Nation to pass the Dine Natural Resources Protection Act. This legislation is the Navajo Nation's long-in-coming exercise of their sovereignty to prevent further destruction of their land and natural resources. The Act bans conventional open pit and shaft uranium mining, places a moratorium on uranium processing including solution or ISL mining and as a result protects the economic value of the Navajo Nation's water resources, which are more valuable now than their uranium resources. This ban will protect the health, safety and way of life of the Navajo people and impose civil penalties on anyone who violates them.[97] Further, this ban is an acknowledgement of the bans already enacted in nearly all of the Navajo Chapters and brings a definite resolution to ENDAUMS years of investigation and activism.

[96] Ibid., 2.
[97] Resolution of the Navajo Nation Council, 20th Navajo Nation Council—third year, 2005 "The Dine Natural Resource and Protection Act of 2005"

CONCLUSION:

Author's photo: Sunset against the Mesa, Navajo Reservation January 2006

Although, only starting to engage in the details of environmental problems on the Navajo reservation it is still clear that these issues are not isolated from the daily lives of the Navajo people. The Navajo people are more connected to their land than most people living in the United States and the environmental damage that has befallen them as a result of the uranium industry has therefore had a tremendously profound impact. To answer the question posed at the beginning of this paper asking if it was significant that the uranium industry problems that finally forced the Navajo Nation to exert their self-determination were related to environmental degradation, health and justice: the answer is yes. Decades of poverty, political abuse and mistreatment did not shake the foundation of Navajo society, the people and the land, in the same way the consequences of the uranium industry did. The extensive action, concern, innovative methods, and labor poured into addressing the remediation of Navajo lands is evidence of this.

While there are many lesson the United States can learn from its indigenous nations it should especially take note of the way indigenous nations care for the earth and prioritize protecting it for the future. A plea in the American Indian Journal said,

> The uranium drillers that have moved into Crownpoint have running water and electricity in their mobile homes while my people, not even two miles away do not have these conveniences. These people working for uranium companies have come onto our land with no respect for our way of life. They have given liquor to the people and have lured young girls to go with them." "Uranium has killed and harmed our people. Why didn't the companies think of what is necessary for human beings to thrive in this life? Why can't it be done honestly, safely and with a noble purpose? Why must people waste the resources of the earth, to use up the gas, oil and coal supplies? The sun has been here all along.[98]

The United States must learn from past mistakes and from the strength of the Navajo People and ask themselves the same question. Just like the sign that indicated congestion on a seemingly open stretch of road the Navajo people have a different understanding of how to treat the earth justly. Their commitment to the land has forced them to develop into the nation they are today. This earth appreciation is relative to the history and culture of the Navajo people, but the time has certainly come when this environmental awareness also needs to become more relative to the way the United States addresses environmental issues among some of its most disadvantaged citizens.

[98] "Tailings Dam Break", 2.

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