

# Background

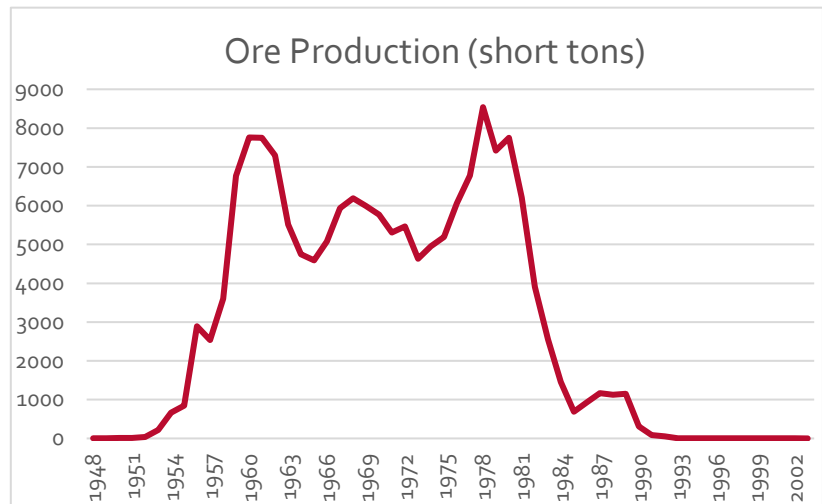
## 2.1. History of Uranium Mining in New Mexico

### 2.1.1. Uranium Mining and the Atomic Energy Commission

Many of the uranium mines in New Mexico date back to the early 1940s, when the Atomic Energy Commission was purchasing ore for defense-related purposes.<sup>1</sup> However, despite the relatively new interest in uranium at the time, many mine sites already existed, focusing primarily on extracting radium in the 1920s and vanadium in the 1930s.<sup>2</sup>

The shift to uranium extraction occurred in 1948 when the US Atomic Energy Commission (AEC) announced a guaranteed price for all US-produced uranium ore through the Atomic Energy Act (AEA). Additionally, uranium prospectors were incentivized with access to federal buying stations and the use and building of access roads to mines as the government sought to thoroughly bolster development of the industry. Many mines were established during this period and many sites were remined or remilled.

Figure 2.1. Uranium Ore Production in New Mexico 1948-2002



### 2.1.2. Commercial Mining

As the AEC's stockpile built up between 1948 and 1962, the federal government began to slow its purchase rate of uranium ore. From 1962 to the official end of the procurement program in 1971, the AEC only honored price incentives for ore discovered before 1958; during this time, uranium production declined steeply and many mines were abandoned. However, by the mid-1960s, the nuclear power industry began ramping up development and was well positioned to take over for the US government as primary purchaser of US-mined uranium ore with the procurement program's termination.

Due to economic shifts in the production of uranium ore described above, the industry saw booms and busts that led to periods of feverish mining followed by sudden abandonment. Mining companies frequently changed hands, leases were transferred or allowed to expire, and the records of historic responsibility for cleaning up a mine site were not well kept. Mine owners would also occasionally vanish alongside a mine's profitability. Various companies owned and managed uranium mines from the 1950s forward, but the large numbers of original individual prospectors and frequent ownership

<sup>1</sup> Department of Energy. 2014. "Defense-Related Uranium Mines Location and Status Topic Report." *US Department of Energy Legacy Management*.

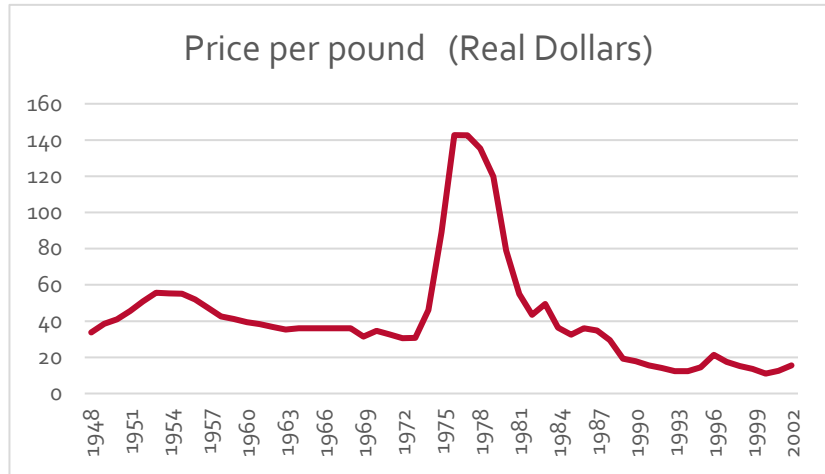
<sup>2</sup> The history of uranium mining and exploration in New Mexico has been well documented. In this section, we used information from Rautman, Christopher. 1977. "The Uranium Industry in New Mexico." *New Mexico Bureau of Mines and Mineral Resources*; Chenowith, William L. 1985. "Historical Review of Uranium Production from the Todilto Limestone, Cibola and McKinley Counties, New Mexico." *New Mexico Geology* 8:80-83.;

Chenowith, William L. 1989. "Geology and Production History of Uranium Deposits in the Dakota Sandstone, McKinley County, New Mexico." *New Mexico Geology* 11(2); and Zhu, Liping. 1995. "The Historical Statistics of the New Mexico Mining Industry." *Mining History Journal*.

changes created a cleanup situation for which Potentially Responsible Parties (PRPs),<sup>3</sup> the person or company liable for cleanup costs cannot always be found.

In the late 1970s, uranium production in the United States saw a second peak, with purchases by commercial markets, primarily focused on energy production. However, by the 1980s, Canadian and Australian uranium became favored globally as it was extracted at a lower cost and a higher grade. Additionally, The Three Mile Island (TMI) accident crystallized anti-nuclear safety concerns among activists and the general public, and resulted in new regulations for the nuclear industry.<sup>4</sup> Coupled with the Chernobyl accident in 1986, TMI has been cited as a contributor to the decline of a new reactor construction program in the US and elsewhere, a slowdown that was already underway in the 1970s.<sup>5</sup>

Figure 2.2. Uranium Ore Price per Pound over Time



Nuclear energy began to more fully fall out of favor by the 1990s and the US saw a stoppage of new nuclear power plant construction. Although demand for uranium held steady until 2003, the United States faced an oversupply and the uranium mining industry again declined.

New Mexico has approximately 1100 uranium mines and mine sites, none of which are actively producing ore, and most of which have not been producing ore in decades. However, it wasn't until the 1990s that a regulatory framework was developed within the State of New Mexico to address uranium mine remediation and contamination issues. Because of this, the state has many abandoned mines that need remediation but have no potentially responsible party available to pay for that remediation. Mines that need remediation, have a responsible party, and have undergone CERCLA classification as a Superfund Site involve the EPA working to hold them liable for some or all of the cleanup costs. For some of the mines that are not designated as Superfund Sites limited remediation may have been done on to help reduce airborne contamination or other minor safety issues; however, these efforts rarely addressed issues such as groundwater and were not necessarily permanent solutions. We discuss the CERCLA classification process in more detail in Section 2.4.1.

Tracking down which mines have had any cleanup actions taken was arduous and the information gathered was sometimes incomplete or contradictory. The most comprehensive analysis of mine sites was taken on by New Mexico Tech; BBER utilized their 2002 database of mine sites for much of this report. Unfortunately, the lack of complete long-term records means that not all hazards from mine sites are well documented and of those sites that have had actions taken, many are considered partially remediated needing more work and further analysis to become fully remediated.<sup>6</sup>

<sup>3</sup> PRP is a legal term used by the EPA to pursue the costs of cleaning up sites designated as "Superfund Sites" under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). More information can be found at <https://www.epa.gov/enforcement/superfund-liability>. We have used "PRP" to refer to any party that may be responsible for cleanup funds, whether or not the site has been designated as a Superfund Site.

<sup>4</sup> "Chernobyl Nuclear Accident". [www.iaea.org](http://www.iaea.org) - May 14, 2014

<sup>5</sup> *The Economist*. <https://www.economist.com/briefing/2011/03/24/when-the-steam-clears> March 31, 2011.

<sup>6</sup> Ulmer-Scholle, Dana S. 2019. "Uranium Legacy Issues in New Mexico." *New Mexico Bureau of Geology & Mineral Resources*.

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## 2.2. Uranium Waste Sites

### 2.2.1. Geography and Ownership

The following map illustrates the density and jurisdictional complications involved in uranium mine cleanup efforts. In this section, we discuss the difficulty in determining mine ownership and responsibility as well as the complexity involved in undertaking multijurisdictional cleanup efforts.

Part of the reason for the sheer number of mines in the Colorado Plateau region is the small-to-moderate-sized nature of the ore bodies located in the geologic area. This compounds the issues of tracking down Potentially Responsible Parties (PRPs) as government incentives encouraged exploration and small prospecting operations were able to extract and sell uranium with less visibility than the larger mining operations. As the small pockets were emptied, the mines were often abandoned and the waste left behind. When the AEC ended its procurement program in 1971, many of the smaller sized mines had either become economically unviable or devoid of purchasable ore.

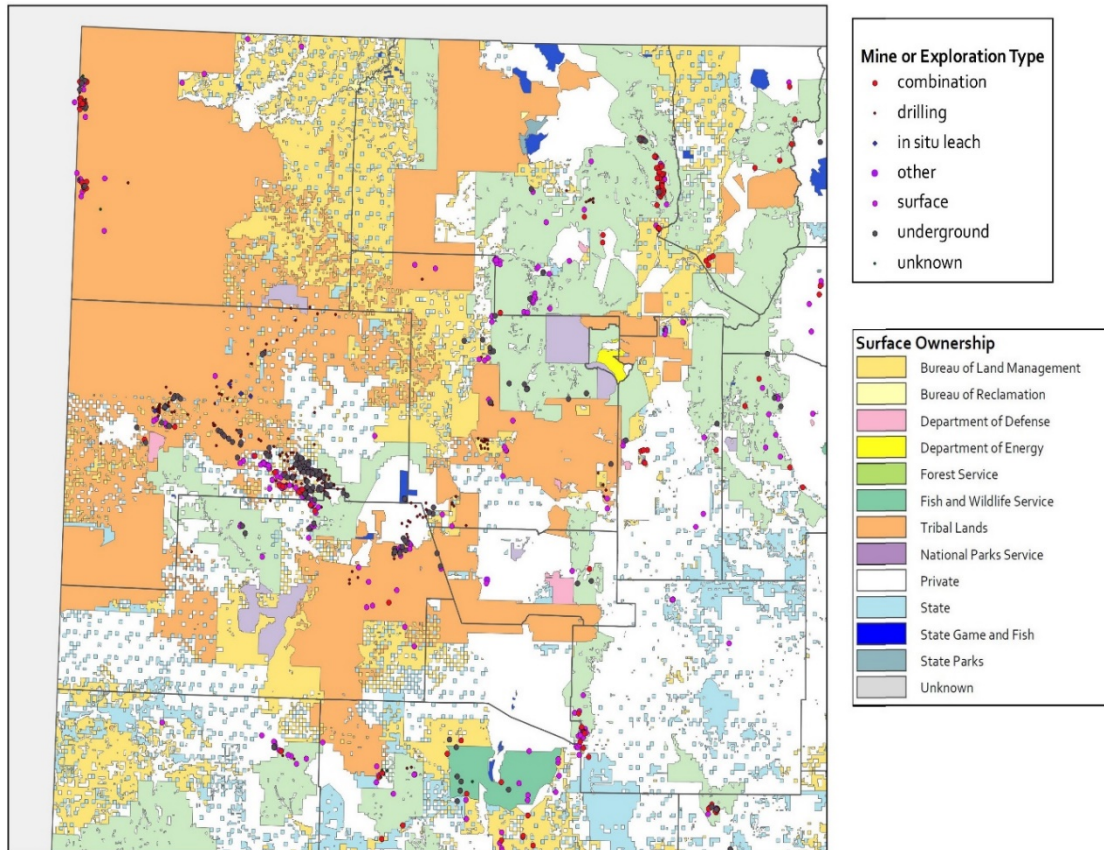
Much of the area in the Grants Mineral Belt is within the “checkerboard”. This term refers to the way in which lands are owned or managed by different entities throughout the region, such that a jurisdictional map of the region looks like a checkerboard. This complicated map of ownership developed over time beginning with attempts to assimilate the Native American population through private land ownership by the federal government’s Dawes Act in the late 1800s. Through this Act, reservation land was allotted to specific tribal members rather than the tribe as a whole. When the original person holding the deed died, the land was divided among the heirs legally, but not physically. As this continued through time, it created a situation known as “fractionated ownership,” often with hundreds or thousands of Native owners having legal claims to the same original plot of land.<sup>7</sup>

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<sup>7</sup> Environmental Protection Agency. 2006. “Technical Report on Technologically Enhanced Naturally Occurring Radioactive Materials from Uranium Mining Volume 1: Mining and Reclamation.” (<https://www.epa.gov/sites/production/files/2015-05/documents/402-r-08-005-v1.pdf>).

Figure 2.3. Uranium Mine and Exploratory Drilling in Northwest New Mexico Map  
Map created by Rose Elizabeth Rohrer using both the database generated by the NM Bureau of Geology and Mineral Resources and data compiled by Sofia Ximenez-Byrne

### Uranium Mines And Exploratory Drilling In Northwest New Mexico



The Dawes Act further divided Native land by claiming reservation land not specifically allocated to an owner as “surplus.” This land was again divided, set aside for the railroad, given federal or state management, and sold to private individuals and corporations. Due to the mixed jurisdictional nature of the space, two neighboring plots of land may have different laws which apply to them. This creates issues with development of a cohesive land-use plan. For example, the Navajo reservation has prohibited uranium extraction and transport within its boundaries. However due to the checkerboard nature of the region, plots of land directly adjacent to Navajo land could be potentially mined. Some of the jurisdictional issues were partially resolved in the 1980s when the Navajo nation in the state of New Mexico entered into a joint power agreement through which they are “able to enforce law within the other’s jurisdiction.”<sup>8</sup>

Abandoned uranium mines (AUMs) are a significant feature on the uranium remediation landscape. Abandoned uranium mines are defined as mines utilized for atomic energy defense related activities by the United States government with no record of a PRP. These mines may have a variety of features including partial remediation, existing permits with abandoned features, large scale or small scale exploration, waste piles, underground features, and the like. Not all of these mines have been fully surveyed so their characteristics are not known. However, the Department of Energy (DOE) was required to re-submit a report to Congress in July 2014, outlining the locations, risks, potential costs, and ranking for reclamation on these sites. 247 of these DOE AUM sites are located in New Mexico. Many of these lands are located on

<sup>8</sup> Indian Land Tenure Foundation. N.d. “Land Tenure Issues.” (<https://iltf.org/land-issues/issues/>).

Bureau of Land Management (BLM) parcels. However, some mines are on non-federal land or land of unknown ownership. This makes jurisdiction over the sites difficult. Additionally, some of the mines may have impacted groundwater, causing higher remediation costs. Cleanup standards also varied from state to state and site to site.

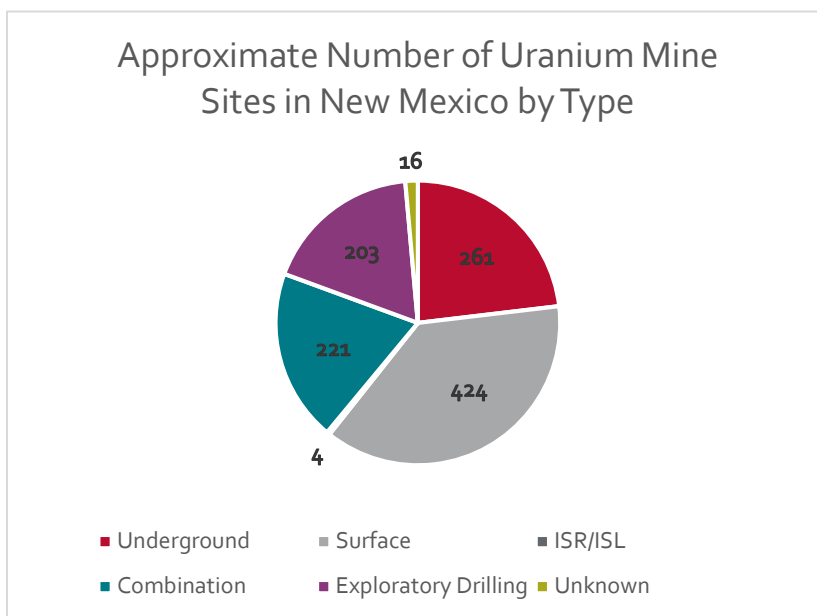
The federal government is in the process of conducting field visits to all of the mines in the AUM database. These visits are being conducted in order to verify the status the size and anything else that needs to be considered in the reclamation of these sites.<sup>9</sup>

### 2.2.2. Type

This section draws heavily on an EPA Technical Report discussing the methods involved in extracting uranium ore.<sup>10</sup> For greater detail on the types of uranium mines, please reference the document listed in the footnotes.

There are three primary methods of uranium mining used in the United States: open-pit, underground, and in-situ leach (ISL). Open-pit and underground mines are generally designated as “conventional” mining methods whereas ISL is considered “unconventional”. Each mine type requires different cleanup methods. Agencies assessing a uranium site for cleanup make such determinations. In our section on assessing the cost of cleanup, we further discuss what that might look like for different types of mines.

Figure 2.4. Approximate Number of Uranium Mine Sites in New Mexico by Type



Open-pit mining<sup>11</sup> generally occurs when desirable ore is found near the surface. It tends to be the least expensive of the three methods of extraction. To create an open-pit mine, a company excavates materials such as soil and other non-desired materials, some of which may be later reclaimed, physically removing them from the desired ore body. These materials may include protore, “conventionally mined uranium ore that is not rich enough to meet the market demand and price.” Once the ore body is exposed, it is assessed and the company has to determine if it will continue to utilize surface mining techniques to extract the ore or if it will need to develop underground mines, thus creating a combination mine site.

Underground mining techniques are utilized when the ore body is deeper below the surface. There are several types of underground mines, characterized by the size, shape, depth, and grade of the ore body, the stability of the ground, and economics. Some extractions require smaller access points such as adits, inclines, or small shafts. Deeper extractions, however, may utilize large, concrete-lined shafts and the development of stopes to access all of the ore body.

<sup>9</sup> Department of Energy. 2014. “Defense-Related Uranium Mines Location and Status Topic Report.” *US Department of Energy Legacy Management*.

<sup>10</sup> Environmental Protection Agency. 2006. “Technical Report on Technologically Enhanced Naturally Occurring Radioactive Materials from Uranium Mining Volume 1: Mining and Reclamation.” (<https://www.epa.gov/sites/production/files/2015-05/documents/402-r-08-005-v1.pdf>).

<sup>11</sup> Definitions of the technical terms used throughout the report can be found in the glossary in Appendix 4

Risks are highest in underground mines due to radon gas – ventilation is key. This means that these mines will have at least two openings, one for access and one for ventilation. These can be shafts (vertical) or adits (horizontal), or a combination. The extent of underground development is the biggest cost consideration in closure, especially if no remediation or reclamation has been done previously. The cost increases are due to the materials and labor needed to fill in the underground development on an increasing scale as well as the need to survey and assess the full extent of the mine.

In-Situ Leach (ISL) mines are unique in their use of groundwater resources to extract low-grade uranium. A solution utilizing the water and other chemicals is pumped into the area with uranium ore to “mobilize” it. Once the ore is mobilized into the solution, it is pumped back to the surface for processing. ISL mining techniques are generally used in conditions that make conventional forms of mining economically unviable. ISL mines require the most future monitoring and groundwater treatment and contracts for these types of mines require restoration plans for the water. However, the restoration process does not ensure post-use potability.

The mining itself is not the only concern for cleanup, as the refining and transportation processes have associated costs and concerns. Milling, or the processing of uranium ore into a usable product, creates large amounts of radioactive and toxic waste products. There are no mills currently in operation in New Mexico, though eight mills were in operation over the course of New Mexico’s uranium extraction history and will need remediation strategies as well.<sup>12</sup> However, the scope of this report focuses primarily on cleanup associated with the mines themselves, as the cost estimate documentation we had available was strictly for mine sites. More information about the issues with other processes can be found in the myriad technical resources we cite throughout the report.

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## 2.3. Current Status of Cleanup Work

Although the Navajo Abandoned Mine Lands Reclamation Department (NAML) has addressed hundreds of abandoned uranium mines on Navajo Nation lands and both State and Federal agencies have engaged in a variety of cleanup efforts, there is still a nearly endless amount of work still to be done. Funding is neither limitless, nor is it predictable, but with greater cooperation and involvement of the State, remediation work could become more streamlined throughout New Mexico. This section will discuss the funding and settlements impacting regional uranium mine cleanup efforts.

### 2.3.1. Available Funding and Settlements

The EPA has the power to enforce US environmental law, including cleanup enforcement. This may include working with companies that conduct their own cleanup efforts, creating legal orders compelling companies to perform cleanup actions, or litigating to have companies pay for cleanup by a third party or the EPA. Both the expenditures and the specific remediation actions taken are easiest to track when the EPA or a third party is responsible for site cleanup. Companies conducting their own cleanup actions, whether compelled by EPA litigation or not, are required to adhere to EPA cleanup standards, but do not offer the same degree of transparency about how they achieve those standards. For the purposes of this report, BBER uses documentation from the EPA and other government agencies on the cost of cleanup; corporate records do not have the same level of detail of hiring practices, wages, and operations.

For many uranium mine cleanup actions, the EPA may first need to find the PRPs as many of the mines were abandoned before they were cleaned up. In the remainder of this section, we will outline a few specific mine site actions and also examine current initiatives to bring in more cleanup funds.

The New Mexico Church Rock mine and mill sites serve as an example of complex liability and delays in cleanup. In 1959, the Santa Fe Pacific Railway entered into an agreement with the “Navajo Tribe of Indians” to prospect and mine for

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<sup>12</sup> [https://geoinfo.nmt.edu/staff/mclemore/projects/uranium/documents/50C\\_URANIUM\\_inprog\\_013ginger.pdf](https://geoinfo.nmt.edu/staff/mclemore/projects/uranium/documents/50C_URANIUM_inprog_013ginger.pdf)

uranium in specific areas of the Navajo Nation, including areas near Church Rock, New Mexico. These mines would change hands throughout the 1950s and 1960s, with the United Nuclear Corporation (UNC) and Kerr-McGee mining the Church Rock area extensively. In 1974-1975, UNC built a mill and tailings disposal area, forcing the relocation of Navajo families who had established camps and grazing areas on the land. Mill tailings were held in holding ponds until July 16, 1979, when the dam holding the tailings collapsed, causing largest release by volume of radioactive waste in US history. The UNC mines and mill were not closed until 1982. The Kerr-McGee mines did not close until 1983. Remediation is not yet complete on this site, despite the tireless advocacy work done by nearby and affected communities. The EPA completed an Engineering Evaluation/Cost Estimate for this site in 2012. The specific extraction and cleanup history of the Church Rock Mine and Mill Sites is illustrated in the timeline found on the next two pages of this report and detailed in Appendix 5.<sup>13</sup>

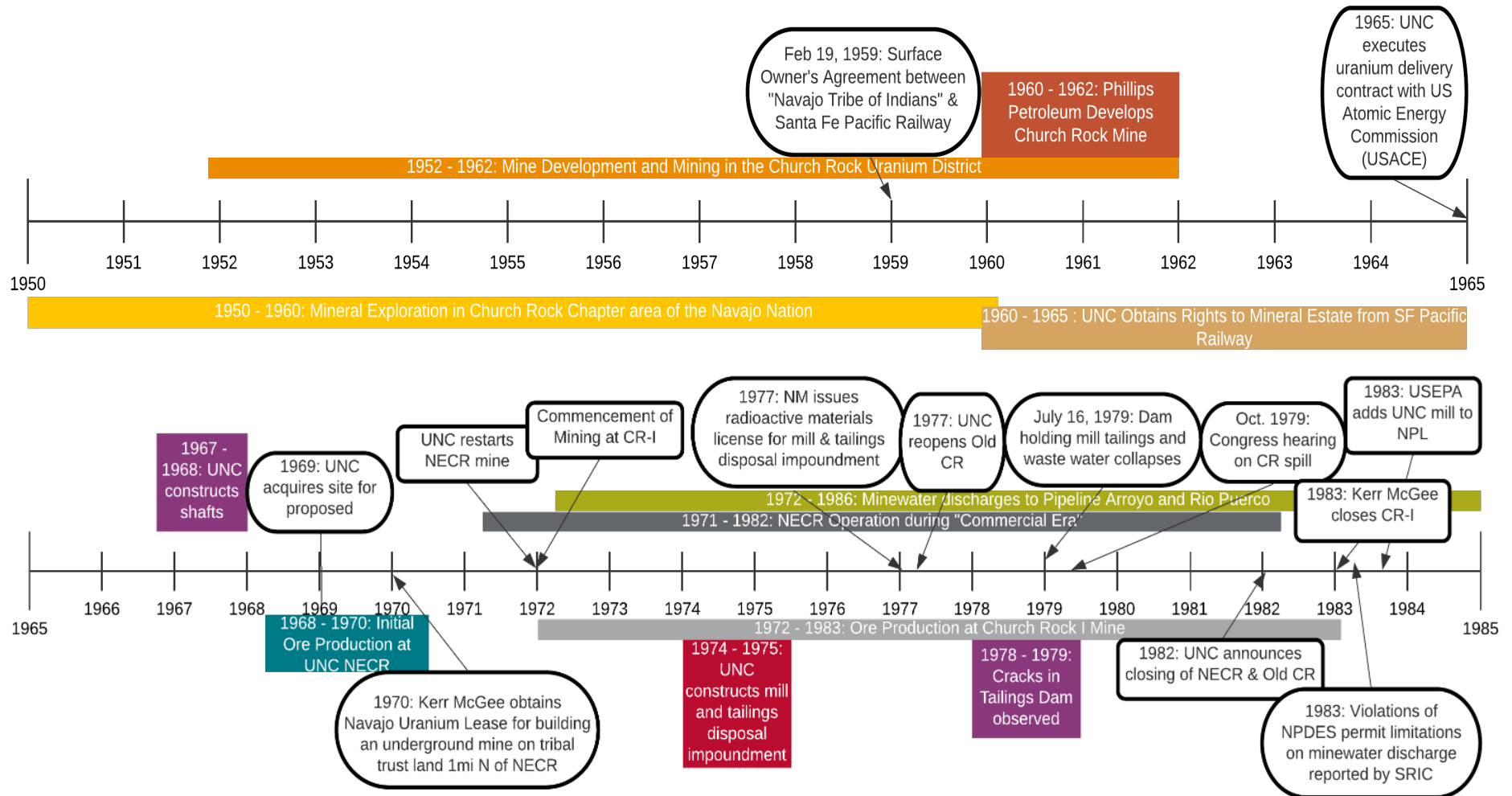
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<sup>13</sup> Data for this timeline was generated by the Southwest Research and Information Center; the timeline was designed by BBER's Sofia Ximenez-Byrne.

Figure 2.5. Northeast Church Rock Uranium Mine Timeline of Key Events

## Northeast Church Rock Mining Timeline

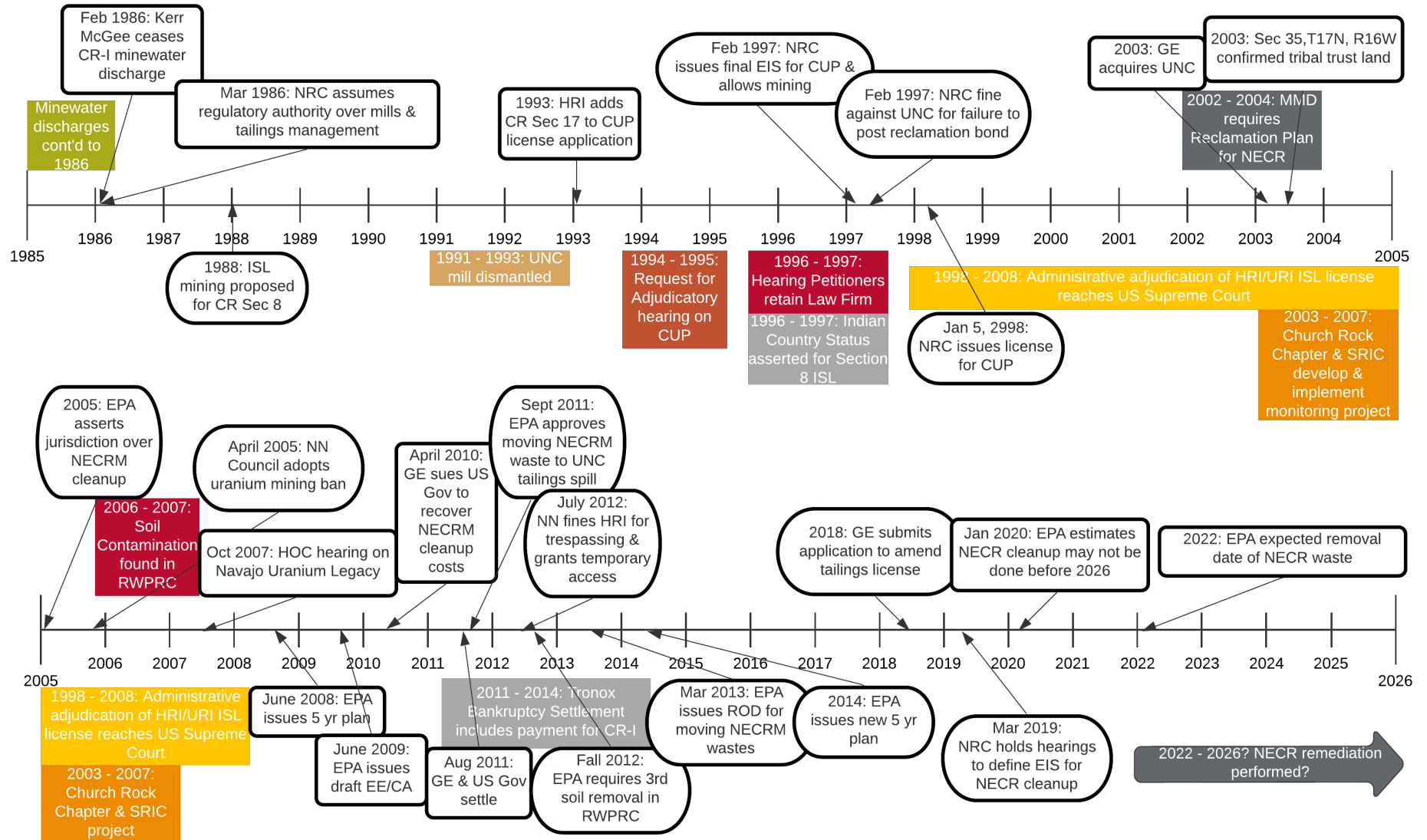
1950 - 1985





## Northeast Church Rock Mining Timeline

1986-2026



On the Laguna Pueblo sits the Jackpile-Paguete uranium mine site, once the biggest open pit uranium mine in the world. Uranium was extracted from this site between 1953 and 1982 by Anaconda Minerals Company. In 1986, the Laguna Pueblo and Anaconda's parent corporation, Atlantic Richfield Company (ARCO) entered into an agreement to remediate the mine site. Remediation activities took place from 1986-1995, but in 2007 follow-up testing demonstrated that the cleanup work was incomplete. The EPA determined that surface and groundwater were still being impacted by discharges from the remediated mine site. In 2013 that Jackpile-Paguete was listed on the EPA's National Priorities List (NPL), the "most serious sites identified for long-term cleanup."<sup>14,15</sup> This work needed to complete remediation is still undergoing investigation, 7 years later.

In 2013, the El Paso Natural Gas Company, LLC signed an Administrative Order on Consent (AOC) to take on remediation actions at 19 mines on the Navajo Nation in Arizona. Remediation of the sites began in 2015, but the company had to enter into a modification to the AOC in 2017, agreeing to complete additional cleanup work.<sup>16</sup> What makes this case particularly noteworthy is the Arizona Federal District Court's ruling in 2019 that only 65% of past and future costs of cleanup are to be paid by El Paso Natural Gas Company; the remaining 35% are to be paid by the Federal Government.<sup>17</sup> This case and the Tronox case represent significant precedents that may inform future uranium mine remediation decisions in New Mexico and throughout the US.

### 2.3.2. Remediation Completed and Underway

A recent case of EPA cleanup enforcement is the Tronox Settlement of 2015. This settlement was a larger case against the Anadarko Petroleum Corporation and its related subsidiaries found responsible for a variety of environmental damage across the United States. The settlement yielded approximately \$917 million to the EPA for cleanup of 54 uranium sites across and near Navajo Nation territory, \$92 million to the EPA for cleanup of Quivira mine site, and \$45 million to the Navajo Nation for work on the Shiprock Uranium Mill Site.<sup>18</sup> Although the cleanup associated with mill sites is outside this report's scope, the distribution is noteworthy, and many of the constraints and recommendations we discuss later in the report could also apply to mill sites.

The most recent EPA documentation shows \$44.6 million spent through FY2018 for approved projects related to the Tronox and Quivira sites.<sup>19</sup> This money was used primarily on contracts for infrastructure upgrades to access the sites; site assessments; educational outreach; and emergency and rapid response services, which provide "management, field personnel, and equipment resources to execute decontamination, demolition, and removal services."<sup>20</sup> This is a mere 4.2% of the total allocated for cleanup efforts and has focused on pre-cleanup work.

The share of the total funding for these sites that will be spent on preliminary work remains to be seen. Still, the report illustrates the broad scope of work to be done before addressing any contaminated land. Depending on the site, this work may consist of access improvement, technical assistance, and community outreach. Additionally, each site must be thoroughly evaluated, and a plan formulated to decide how the cleanup will be done. Tetra Tech<sup>21</sup> was awarded an \$85

<sup>14</sup> <https://www.epa.gov/superfund/about-superfund-cleanup-process#tab-2>

<sup>15</sup> <https://semspub.epa.gov/work/o6/300064.pdf>

<sup>16</sup> <https://www.epa.gov/navajo-nation-uranium-cleanup/el-paso-natural-gas-mines>

<sup>17</sup> <https://casetext.com/case/el-paso-natural-gas-co-v-united-states-g>

<sup>18</sup> Details of the Tronox Financial Settlement can be found at <https://www.epa.gov/navajo-nation-uranium-cleanup/tronox-abandoned-uranium-mines>.

<sup>19</sup> The complete financial report can be found on the EPA website at: <https://www.epa.gov/sites/production/files/2020-03/documents/tronox-naum-report-fy2011-2018-2020-03-05.pdf.pdf>.

<sup>20</sup> Ibid.

<sup>21</sup> Tetra Tech (<https://www.tetrattech.com>) is a multinational firm that provides engineering and consulting services related to "water, environment, infrastructure, resource management, energy, and international development."

million capacity contract in 2017 to complete these assessments. The Removal Site Evaluation reports (RSEs), which document the nature of the contamination and assess the work to be done at each site, were published early in 2020.<sup>22</sup>

With this information, we can estimate that roughly 8-9% of the total costs of mine remediation efforts may go into assessment tasks alone. Because of the nature of the agreement and the involvement of the EPA in managing the funds, far more is known about Tronox than other cleanup efforts.

In addition to the Tronox Settlement, other noteworthy cases of funded cleanup enforcement include the following:<sup>23</sup>

- Cyprus Amex and Western Nuclear have been required through a 2017 settlement to clean up 94 uranium mine sites on the Navajo Nation, with the federal government providing half of the approximately \$600 million, requiring both US EPA and NN EPA oversight.<sup>24</sup> This includes the priority cleanup of the Ruby Mines in the Smith Lake Chapter, about 30 miles east of Gallup.
- Two agreements between the Navajo Nation and the US government to assess, evaluate, and clean up AUMs across the Navajo Nation. The first agreement established a trust of \$13 million to assess 16 priority mines in 2015; the second an initial funding of \$8.5 million for the assessment of 30 additional mines and the cleanup of the 16 mines from the first agreement. A trustee has been established to oversee the work and administer the contracts.
- Additionally, the EPA has enforcement agreements for the evaluation of 37 uranium mines across the Four Corners region. These sites must also have preliminary safety precautions installed, including, but not limited to, warning signs and appropriate fencing. Some of these agreements have funding associated with them, but not necessarily the full amount required to conduct a cleanup.
  - Within New Mexico, these agreements include the BNSF Railway Company's Haystack Mines near Prewitt, New Mexico, Chevron's Mariano Lake Mine southwest of Crownpoint, and Homestake's four mines near Mariano Lake and Smith Lake, United Nuclear Corporation's Northeast Church Rock Mine.

### 2.3.3. Other Cleanup Efforts in Discussion

Conversations with both the EPA Region 6 and EPA Region 9 staff indicate that the Tronox funding is not only unprecedented, but unlikely to be repeated at such a great scale. However, various entities continue to pursue cleanup funding and corporate responsibility for remediation. We will discuss a few of these cases below.

In July 2019, the EPA sent General Notice Letters to ten corporations under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), naming them as Potentially Responsible Parties (PRPs) that may be responsible for cleanup actions. These letters focus on the San Mateo Creek Basin Legacy Uranium Mines Superfund Site in Cibola and McKinley Counties. As the EPA took responsibility under Superfund authority for the assessment of these sites, the letters serve to notify the corporations of the potential cost for compensating the EPA for assessment costs and the potential cost for cleanup efforts. The letters suggest the corporations could conduct the cleanup work in-house with EPA supervision through the Superfund Alternative Approach; if the corporations do not agree to this action, the mines could be listed on the National Priorities List (NPL) and be subject to litigation for cleanup funds. The timeline for receipt of

<sup>22</sup> Access to the RSEs is found on this main EPA Tronox website: <https://www.epa.gov/navajo-nation-uranium-cleanup/tronox-abandoned-uranium-mines>.

<sup>23</sup> See ETD, Inc. 2018. "Abandoned Uranium Mine Funding Sources." <https://etd-inc.com/recent-news/abandoned-uranium-mine-funding-sources> for further documentation.

<sup>24</sup> <https://www.epa.gov/navajo-nation-uranium-cleanup/cyprus-amax-and-western-nuclear-mines>

a response was 14 days after the PRPs received the letter; however, due to confidentiality issues, we are unable to report the results of the conversations between the EPA and the individual corporations at this time.

In early 2020, Rio Grande Resources announced the closure of their 148-acre Mount Taylor uranium mine. This mine had not been active since the 1990s but held a permit to resume mining through New Mexico’s Mining and Minerals Division (MMD). With this closure, the company enters into the cleanup phase, reclaiming the land and plugging or demolishing any underground structures and waste disposal ponds.<sup>25</sup> Although Rio Grande Resources is in charge of its own cleanup, there may be opportunity for local job development. This could also potentially apply to those PRPs named in the San Mateo Creek Basin letters.

## 2.4. Uranium Remediation

### 2.4.1. Defining “Cleanup”

Any cleanup of New Mexico’s uranium mines falls under the jurisdiction of the New Mexico Mining Act (NMMA) and the New Mexico Water Quality Act.<sup>26,27</sup> These acts are administered by the New Mexico Energy, Minerals, and Natural Resources Department (EMNRD) and the New Mexico Environment Department (NMED). New Mexico agencies employ standards in guidance documents from various federal sources as well as locally established standards. There is no single standard for uranium mine reclamation; rather, each site is assessed, and a plan is put into place for remediation or reclamation. After a cleanup in New Mexico is deemed “complete” by the EPA, the State has the ability to assess the site according to State standards and law.

Regulations for cleanup vary depending on whether the mine site is new, recently active, idle, abandoned, and/or partially reclaimed as well as whether the contamination is in the soil, the air, or the water. Mine closeouts, as specified by NMMA, require reclamation of the “physical environment of the permit area to a condition that allows for the reestablishment of a self-sustaining ecosystem on the permit area following closure.” However, should this reestablishment be technically or economically unfeasible or environmentally unsound, this requirement may be waived by the EMNRD Director, as long as cleanup meets other federal and state laws, regulations, and standards. The NMMA outlines the rights and responsibilities of utilizing and reclaiming mined lands in New Mexico and the MMD and NMED Joint Guidance for Cleanup and Reclamation covers the layers of regulatory framework for uranium mining operation cleanup in detail.

When a uranium mine site is found to have released or potentially released hazardous materials into the environment, CERCLA may apply and the location may be placed by the Environmental Protection Agency (EPA) on the National Priorities List (NPL). CERCLA requires that site be evaluated for potential damage to both environmental and human health and authorizes short-term, immediate actions and/or longer-term, remedial actions. This act gives the EPA the power to both identify companies responsible for environmental damage and to levy cooperation from those companies for cleanup compliance.

Remediation and restoration both refer to the cleanup of polluted sites but have different specifications. Remediation efforts work to reduce or stop pollution, focusing on the removal of pollutants and immediate reduction of contamination.<sup>28</sup> Restoration aims to rehabilitate the contaminated site to a healthy habitat. The majority uranium mine

<sup>25</sup> Davis, Theresa. 2020. “Owners to Close Mount Taylor Uranium Mine.” *Albuquerque Journal*.

<https://www.abqjournal.com/1407671/owners-to-close-mount-taylor-uranium-mine-ex-navajo-pueblo-groups-hope-healing-can-start-with-cleanup-of-the-site.html>

<sup>26</sup> Full text of the NMMA can be found at <http://www.emnrd.state.nm.us/MMD/MARP/documents/MiningAct.PDF>

<sup>27</sup> Full text of the Water Quality Act can be found in NMSA 1978, §§ 74-6-1 to 74-6-17, <https://laws.nmresources.com/w/nmos/Chapter-74-NMSA-1978>

<sup>28</sup> The definition of reclamation from New Mexico’s Energy, Minerals, and Natural Resources and Environment Departments (2016) reads as follows: “Employment of the measures during and after a mining operation designed to mitigate the disturbance of affected

sites within New Mexico have seen minimal remediation work and little-to-no restoration work, though assessments for several sites are currently underway.<sup>29</sup>

The documents that inform this report’s economic impact analysis look at the first steps toward remediation. They represent a fraction of the work to be done if uranium mine sites in New Mexico are restored rather than remediated; however, cleanup is limited by what is feasible technically, economically, and politically.

#### 2.4.2. Potential Scope and Cost is Infinite

This background section serves as a brief overview of the history and future of uranium mine cleanup. The creation of this section, and the whole of this report, relied on many resources that delve more deeply into the legal, social, and environmental ramifications of remediation. It is important to note that the scope of remediation work will change dramatically as stakeholders continue to gather information and legal actions are taken to hold corporations responsible for cleanups. With approximately 1100 sites to cleanup in New Mexico alone, the cost is infinite and the timeline indeterminate. Remediation work will assuredly be taking place well into the future, with jobs and opportunities to follow, should New Mexico seize upon them.

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areas and permit areas and to the extent practicable, provide for the stabilization of a permit area following closure that will minimize future impact to the environment from the mining operation and protect air and water resources.”

<sup>29</sup> Office of Response and Restoration (NOAA). 2020. “Remediation vs. Restoration: A Tale of Two Terms.”

<https://response.restoration.noaa.gov/remediation-vs-restoration-tale-two-terms.html>