

Workforce Status & Requirements

In the previous section we illustrated the potential economic impact on New Mexico's industries should more money be invested into uranium mine remediation work. We argue that developing an industry explicitly designed to engage in environmental remediation would benefit the State.

In this chapter, we focus specifically on employment related to uranium mine remediation and the occupational skill sets already being developed in our local institutions. To that end, this chapter relies on data from the Federal Bureau of Labor Statistics (BLS) and New Mexico's Department of Workforce Solutions (DWS) rather than the industrial data provided in the previous chapter.

We begin by looking at historical employment in uranium extraction, followed by an examination of recent exploratory efforts and potential changes future extraction. We then discuss major occupational groups involved in uranium mine remediation and break down salary ranges and projected employment growth within those groups. Finally, we briefly overview training and educational programs related to uranium mine remediation, discussing what New Mexico is already engaged in and what is needed for further workforce development.

4.1. Background

At its height, New Mexico was the lead producer of uranium nationally and competitive globally.³⁸ 40% of the uranium produced in the United States between 1948 and 1982 came from New Mexico mines; nearly all of that was sourced from the Grants Mineral Belt. Additionally, New Mexico was home to eight uranium mill sites, which recovered U₃O₈ for ore from New Mexico and the region.

By the mid-1970s, as the primary purchasers of uranium ore transitioned from the federal government to private energy companies and employment numbers peaked in New Mexico, the uranium industry directly employed over 6800 workers in the Grants Uranium Belt alone.³⁹ These numbers fell sharply by the 1980s, as the supply of uranium ore exceeded demand. Many mines entered standby status over this period, and exploration decreased dramatically. However, low-grade ore from the world's largest open pit uranium mine, Jackpile-Paguete, was extracted through 1982.

Since 1998, no uranium ore has been mined in New Mexico, though exploratory drilling has been done. Further, uranium has been recovered from inactive underground operations in the Ambrosia Lake area by Rio Algom Mining LLC.⁴⁰ Only in this past year has an idle permit for a mining operation at Mount Taylor been transitioned to inactive, thereby entering the cleanup phase. These shifts in the industry do not necessarily have to imply an end to regional job opportunities.

As mines move into remediation and reclamation, work will need to occur on a potentially massive scale. Many of the individuals previously employed by the mining industry already have labor skills that could transition to environmental remediation work but may need reorientation or training to complete that transition. Working in uranium mine cleanup requires specific training, but some of the base level skills developed across the mining industry could be transitioned to work in environmental remediation. Mining jobs fluctuate with the market for natural resources, but environmental remediation jobs have the potential to endure over time. We know that cleanups for even the fraction of assessed mines will require multiple years of intensive labor in addition to follow-up monitoring into the foreseeable future. Beyond what we already know, hundreds of mines in New Mexico remain unassessed for remediation actions. Work will depend on the intensity and speed of cleanup actions, but has the potential to last generations in New Mexico alone.

³⁸ For a full account of the height of New Mexico production, see https://geoinfo.nmt.edu/publications/periodicals/nmg/5/n3/nmg_v5_n3_p45.pdf

³⁹ <https://www.nrc.gov/docs/ML1010/ML101030860.pdf>; McLemore 1983.

⁴⁰ Szumigala, D.J. 2006. "State Summaries." *Mining and Engineering*

4.2. A Review of Major Occupational Groups Associated with Uranium Mine Cleanup

Uranium mine cleanup activities range from assessment and evaluation to heavy machinery operation to hazard monitoring and analysis. Thus, it is less important to focus on creating workforce training programs than concentrating on how programs might be retooled to include skills and certifications specifically needed to work in the uranium remediation industry. Rather than recreation, this repositioning of jobs was a common theme across our more than 75 in-depth interviews. We heard from industry professionals and educational programs alike that New Mexico possesses the skills to take on uranium mine remediation but lacks the infrastructure to support steady employment in the field and to match qualified workers with jobs.

To illustrate the workforce needs for uranium mine remediation, we will overview a few of the relevant occupational groups and the types of jobs associated with them, using the most current BLS and DWS data available. These data show where specific skills are employed within the state, providing an emphasis on the workforce itself rather than industrial profiles. For example, a construction laborer may have the appropriate training to engage in remediation work, but may be working in housing development. That individual's labor skills are better captured in the BLS and DWS data, showcasing the skills available in New Mexico, rather than persons already engaged in remediation activities.

4.2.1. Construction and Extraction

Jobs within the construction and extraction occupational group related to uranium mine remediation include operating heavy equipment, building roads and safety structures, and/or removal of waste materials. Many of these jobs require no formal educational credentialing at the entry level, though they generally require various certifications, formal training, and on-the-job skills development. Nationally, these occupations are projected to grow steadily on an average rate with other occupations over the next ten years.⁴¹

Location quotient measures reported by DWS show that New Mexico's construction and extraction occupational group is relatively large compared to other states.⁴² Further, in the Farmington Metropolitan Statistical Area (MSA), 10.7% of total area employment was in the construction and extraction group in 2016. This indicates strong workforce numbers within the group, illustrating the idea that New Mexico already has skilled workers who may require only repositioning and/or additional training to engage in uranium mine remediation activities instead of recruitment into full workforce development programs. Further, the closure of the San Juan Generating Station will reduce area employment opportunities for workers in construction and extraction, increasing the need for job creation in this sector.⁴³

The following table shows the jobs related to uranium mine remediation within the construction and extraction occupational group alongside their 2019 salary range in New Mexico and projected growth according to DWS data. We chose the jobs listed in each group using the data from the Engineering Evaluation/Cost Analysis (EE/CA) documentation discussed in the Economic Impact chapter of this report. The average salary range for construction and extraction workers is between \$52,820 and \$59,080. Additionally, all jobs within this group are projected to grow over 10 years by an average of 10.8%.

⁴¹ <https://www.bls.gov/ooh/construction-and-extraction/home.htm>

⁴² https://www.dws.state.nm.us/Portals/0/DM/LMI/OccBulletin_May18_Construction.pdf

⁴³ O'Donnell, Kelly. 2019.. <https://www.nmvoices.org/wp-content/uploads/2019/01/San-Juan-Tax-Study-report.pdf>

Table 4.1. New Mexico Construction and Extraction Occupational Group Salary and Growth Projection⁴⁴

Construction & Extraction	Average Salary Range (2019)	Growth projection
	\$52,820 - \$59,080	10.8%
Paving, Surfacing & Tamping Equipment Operators	\$30,860 - \$45,300	12.3%
Earth Drillers, Explosive Ordinance Handling, Blasters	\$39,510 - \$63,960	11.9%
Construction Laborers	\$25,210 - \$37,090	11.3%
Hazardous Materials Removal Workers	\$35,120 - \$62,900	10.9%
First-Line Supervisors of Construction Trades & Extraction Workers	\$41,480 - \$77,330	10.8%
Helpers, Construction Trades, Other	\$22,970 - \$30,650	10.7%
Operating Engineers & Other Construction Equipment Operators	\$33,600 - \$50,880	10.0%
Fence Erectors	\$22,820 - \$34,350	9.8%
Underground Mining Machine Operators & Extraction Workers, All Other	\$39,570 - \$61,130	9.4%
Misc. Construction & Related Workers	\$27,800 - \$65,390	9.1%
Construction & Building Inspectors	\$43,240 - \$67,130	5.5%

⁴⁴ Data for all tables in this section were compiled using the most recent NM DWS (<https://www.dws.state.nm.us/>) data available at the time of writing.

4.2.2. Architecture and Engineering

Uranium mine remediation work requires a variety of engineers and technicians from the architecture and engineering occupational group. These jobs generally require a minimum of a four-year degree, though some entry-level technician positions require an associate's degree. The assessment, evaluation, planning, and long-term testing of uranium sites are critical tasks related to the architecture and engineering occupational group. The majority of associated jobs are projected to grow in New Mexico and nationally over the next ten years.

According to BLS data, New Mexico's architecture and engineering occupational group is large relative to other states.⁴⁵ Again, this illustrates that New Mexico has relatively high employment in these fields, indicating a strong foundation for growth. Further, wages for this occupational group are somewhat higher in New Mexico than in the United States on the whole and are competitive regionally.

The following table shows the jobs related to uranium mine remediation within the architecture and engineering occupational group alongside their 2019 salary range in New Mexico and projected growth according to DWS data. The average salary range for workers in architecture and engineering is \$54,260-120,920, and the growth projection is 7.2%. Additionally, all but one occupation (Industrial Engineering Technicians) within this group are projected to grow over 10 years.

⁴⁵ <https://www.bls.gov/oes/current/oes170000.htm>

Table 4.2. New Mexico Architecture and Engineering Occupational Group Salary and Growth Projection

Architecture & Engineering	Average Salary Range (2019)	Growth projection
	\$54,260 - \$120,920	7.2%
Chemical Engineers	\$97,700 - \$134,360	14.0%
Environmental Engineering Technicians	\$37,140 - \$63,170	9.8%
Drafters, Other	\$35,250 - \$71,170	8.8%
Calibration Technologists & Technicians & Engineering Technologists & Technicians, Except Drafters, All Other	\$52,900 - \$105,150	8.1%
Health & Safety Engineers	\$72,720 - \$139,600	7.5%
Environmental Engineers	\$60,500 - \$104,180	7.1%
Surveyors	\$50,700 - \$94,100	6.4%
Surveying & Mapping Technicians	\$32,860 - \$56,740	4.7%
Industrial Engineers	\$69,310 - \$123,210	4.4%
Mining & Geological Engineers	\$80,550 - \$151,130	0.8%
Industrial Engineering Technicians	\$70,330 - \$86,020	-6.6%

4.2.3. Life, Physical, and Social Science

Although the occupational group of life, physical, and social science is very broad, it encompasses key occupations related to uranium mine remediation work. Jobs in these fields often require at least a four-year degree, but specialist and technician positions typically require an associate's degree. Essential work done in these occupations includes assessing, evaluating, and monitoring uranium sites along with implementing and enforcement of OSHA regulations.

Location quotient measures reported by the Bureau of Labor Statistics (BLS) show New Mexico's life, physical, and social science occupational group is relatively large compared to other states and has a higher than average mean annual wage.⁴⁶ Employment in this field is consistent across the country, though some consistency is due to the broadness of the occupational group itself. However, with high wages and high employment, the workforce has been well-developed in New Mexico; skills could be translated into uranium mine remediation work.

The following table shows the jobs related to uranium mine remediation within the life, physical, and social science occupational group alongside their 2019 salary range in New Mexico and projected growth according to DWS data. The average salary range for workers in life, physical, and social science is \$42,700-104,700, and the growth projection is 9.1%. All relevant occupations within this group are projected to grow over 10 years.

⁴⁶ <https://www.bls.gov/oes/current/oes190000.htm>

Table 4.3. New Mexico Life, Physical, and Social Science Occupational Group Salary and Growth Projection

Life, Physical, & Social Science	Average Salary Range (2019) \$42,700 - \$104,700	Growth projection 9.1%
Hydrologists	\$50,970 - \$105,390	11.9%
Occupational Health & Safety Technicians	\$39,290 - \$70,540	10.8%
Environmental Scientists & Specialists	\$51,900 - \$90,890	10.6%
Occupational Health & Safety Specialists	\$49,590 - \$86,590	10.6%
Environmental Science & Protection Technicians	\$32,410 - \$55,970	9.3%
Geological & Hydrologic Technicians	\$36,900 - \$73,220	9.2%
Geoscientists	\$53,080 - \$94,650	6.3%
Biological Scientists, Other	\$58,730 - \$86,430	4.9%
Conservation Scientists	\$45,350 - \$80,280	4.1%
Chemists	\$45,230 - \$105,600	2.0%
Forest & Conservation Technicians	\$28,820 - \$49,760	1.8%

4.2.4. Transportation and Material Moving

Another occupational group essential to uranium mine remediation is transportation and material moving. Remediation activities will include the use and transportation of heavy equipment, earthwork, and sometimes the relocation of hazardous waste materials. These jobs include machine operators, material movers, heavy and tractor-trailer truck drivers, and rail and freight loading and transport positions. Many of these jobs do not require formal educational credentials, though they require particular training and on-the-job experience. Some of these jobs are expected to grow over the next ten-year period in New Mexico, but many at a slower rate than the other occupational groups we have reviewed. Nationally, this occupational group is expected to grow at a similar rate to other groups.⁴⁷

BLS data show that the transportation and material moving occupational group is relatively small in New Mexico compared to other states, especially in the Northwest region of the state.⁴⁸ This may indicate a low demand for these types of occupations at this time, though significant industrial remediation activity would change that demand significantly. There may be a need to improve workforce development in this occupational group to support the demand for uranium mine remediation positions with a local workforce.

The following table shows the jobs related to uranium mine remediation within the transportation and material moving occupational group alongside their 2019 salary range in New Mexico and projected growth according to DWS data. The average salary range for workers in transportation and material moving is \$21,290-42,550, and the growth projection over the next ten years is 4.5%.

⁴⁷ <https://www.bls.gov/ooh/transportation-and-material-moving/home.htm>

⁴⁸ <https://www.bls.gov/oes/current/oes530000.htm>

Table 4.4. New Mexico Transportation and Material Moving Occupational Group Salary and Growth Projection

<p style="text-align: center;">Transportation & Material Moving</p>	<p>Average Salary Range (2019)</p> <p style="text-align: center;">\$21,290 - \$42,550</p>	<p>Growth projection</p> <p style="text-align: center;">4.5%</p>
Crane & Tower Operators	\$57,500 - \$73,050	13.9%
Hoist & Winch Operators	\$44,580 - \$59,540	13.7%
Refuse & Recyclable Material Collectors	\$24,750 - \$37,930	7.5%
Heavy & Tractor-Trailer Truck Drivers	\$32,080 - \$49,440	6.7%
Industrial Truck & Tractor Operators	\$25,150 - \$44,980	5.7%
First-Line Supervisors of Transportation & Material-Moving Machine & Vehicle Operators	\$34,520 - \$70,270	4.8%
Laborers & Freight, Stock & Material Movers, Hand	\$20,710 - \$33,500	3.2%
Conveyor Operators & Tenders	\$28,070 - \$40,940	1.0%
Transportation Inspectors	\$30,730 - \$70,360	-0.6%
Railroad Conductors & Yardmasters	\$51,920 - \$76,960	-1.1%
Locomotive Engineers	\$57,320 - \$82,330	-1.2%
Tank Car, Truck & Ship Loaders	\$32,160 - \$54,250	-1.6%

4.2.5. Other (including mining, health, office administrative services, etc.)

The occupational groups detailed above are a cross-section of the needed skills to tackle uranium mine remediation activities. However, uranium mine cleanup work will also include work in office administrative services, business support services, and consulting services. In an interview with a larger corporation, the representative repeatedly referenced the need for technical writers and business administrators, illustrating how uranium mine remediation activities do not all occur at the mine site. These considerations are essential to note when developing a well-rounded workforce.

Further, although previously discussed in passing, it is important to reiterate that mining may not have a major role in uranium mine remediation directly; skills associated with that occupation are potentially translatable with minimal additional training. Individuals working on active mines will possess similar skills but will have completed the US Mine Safety and Health Administration (MSHA) trainings. Individuals seeking employment in uranium mine remediation will need to complete OSHA (Occupational Safety and Health Administration) trainings despite potentially engaging in similar work. In the next section, we overview the training programs and certifications available for uranium mine remediation work.

4.3. Training Programs and Certifications

4.3.1. New Mexico's Training and Educational Programs

BBER's research into the workforce capacity for uranium mine remediation in New Mexico illustrates the diversity and comprehensiveness of the state's education programs. In general, there are two skill sets required for on-the-ground assessments and cleanups of uranium mines: technical, e.g., environmental engineering, generally requiring a bachelor's degree or higher, and physical cleanup skills, e.g., bulldozer operator, general construction skills, etc. Most New Mexico universities, colleges, and other vocational programs train individuals in the fields described above, though few focus on uranium remediation activities specifically. In the following paragraphs, we overview a few programs training workers in the skills needed to potentially address uranium mine remediation. It is not a comprehensive list, but rather a sample of what is available.

Diné College's Uranium Education Program

https://www.dinecollege.edu/about_dc/dine-environmental-institute-dei/

https://www.dinecollege.edu/about_dc/uranium-education-program/

The Uranium Education Program (UEP) is housed in the Diné Environmental Institute at Diné College. This program works with Navajo students and community members to research and rectify environmental health issues arising from the legacy of uranium mining on the Navajo lands. The program is designed to empower the community to design mitigation actions, establish research plans, and evaluate the effectiveness and cultural competency of educational efforts in their own communities.

The research in the UEP ranges in scope from specific health impacts of uranium exposure to investigations of the pathways of exposure, such as locally sourced food and water. This is critical training as it includes economic, social, environmental, and health research opportunities for faculty and students. Students graduating from this program are trained specifically in technical and professional activities related to uranium mine remediation.

Navajo Technical University's (NTU) Environmental Science & Natural Resources Department

<http://www.navajotech.edu/academics/bachelor-of-science/environmental-science-natural-resources>

Navajo Technical University (NTU) is a tribal university on the Navajo Nation, with community-based academic and vocational education programs. The university was named as a collaborative partner in the recent EPA awarded Tetra Tech contract to conduct assessments on the Tronox uranium mines. NTU's Environmental Science and Natural Resources Department has the training and capacity to conduct such work and is training students directly in remediation studies.

NTU offers associate's through master's degrees in relevant disciplines such as environmental engineering, environmental sciences, and radiation health physics. Students conduct field and laboratory research, particularly in the environmental science master's program. Additionally, NTU is a participant in the Community College Consortium for Health and Safety Training (CCCHST)⁴⁹ and is therefore able to offer required OSHA trainings for students directly entering into uranium mine remediation work.

New Mexico Tech's (NMT) Earth and Environmental Science Department

<https://www.nmt.edu/academics/ees/>

<https://www.nmt.edu/academics/mining/index.php>

<https://geoinfo.nmt.edu/resources/uranium/research/home.cfm>

The Earth and Environmental Science Department at New Mexico Tech (NMT) has both undergraduate and graduate level programs with research in geology, geochemistry, geobiology, geophysics, and hydrology. It is home to various research facilities and conducts both laboratory and fieldwork with its students.

The Mineral Engineering Program at NMT also has undergraduate and graduate level programs and many of their graduates work in mining exploration.⁵⁰ However, the skills acquired in the Mineral Engineering program are highly translatable to remediation work and some students conduct research on state-held abandoned mine lands. At this time, the Mining Safety Health Administration trainings are built into the curriculum; these are the trainings necessary for active mine sites. The analogous trainings required for inactive mine sites are discussed in the next section.

Although these departments do not specifically focus on uranium-related research, the degrees they confer include training the requisite skills to enter into remediation work. Further, NMT is home to the New Mexico Bureau of Geology & Mineral Resources, which serves as the geological survey for the State and engages in a wide variety of uranium-specific research.

New Mexico Water Resources Research Institute (WRRI) at New Mexico State University (NMSU)

<https://cduaws.nmwri.nmsu.edu>

<https://nmwri.nmsu.edu>

Focusing on New Mexico's water supplies, the Water Resources Research Institute (WRRI) at New Mexico State University (NMSU) houses students and faculty researching complex water quality and supply issues. This institute was established by the New Mexico legislature in 1963 and funds research by faculty and students at

⁴⁹ <https://nationalpete.org/ccchst/>; In our interviews with NTU, they supported the idea of a state-led OSHA training as opposed to a piecemeal, institution-by-institution subscription to said trainings as offering the trainings is not always efficient or straightforward.

⁵⁰ Interview with NMT's Mineral Engineering Department 01/31/2020.

multiple universities throughout the state. Additionally, the institute hosts the annual New Mexico Water Conference at various locations statewide.

WRRI's work is not limited to a specific degree path or research orientation; students who participate in the work come from a variety of skilled backgrounds. Some of the research partners with the Bureau of Reclamation (BOR) and seeks to innovate and examine technological solutions for treating otherwise unusable water. The collaboration with the BOR has funded 20 water research projects since it was established in 2011.

Hands-on experience provided at WRRI prepares students for potential entry into uranium mine remediation work related to water issues, though its current work is not uranium-specific. However, the research done at the institute could lend itself to larger-scale innovation and collaboration as it is already an inter-university program.⁵¹

UNM METALS Superfund Research Program Center

<https://hsc.unm.edu/pharmacy/research/areas/metals/>

The UNM Metal Exposure and Toxicity Assessment on Tribal Lands in the Southwest (UNM METALS) Superfund Research Program Center focuses its efforts on researching uranium and mixed metals exposure and toxicity amongst tribal communities. The first program of its kind in the United States, UNM METALS works directly with communities affected by uranium exposure and brings together professionals from the health and sciences to innovate and explore solutions with community members. METALS works with and trains technical professionals in public health, pharmaceutical sciences, engineering, health communication, and other related fields. They partner with local organizations as well as community members to solve problems and inform policy.

Some organizations such as the Greater Gallup Economic Development Corporation (GGEDC)⁵² have worked with local employers to develop industrial workforce programs. This collaboration with local businesses should be further explored, especially given the scale of cleanup we describe in this report. The GGEDC's programming built in the necessary OSHA training described in the next section, which made their program uranium remediation ready. However, specialized training and specific risks posed by activities involved in uranium mine remediation are not usually captured in general educational programs.

New Mexico's institutions provide essential skills training, but there could be improvement in the specificity of the training, the communication among institutions with similar educational programs, and the availability and timing of specialized trainings designed to place workers on the ground. In the next section, we briefly discuss the OSHA training requirements needed to enter into the field of uranium mine remediation.

4.3.2. OSHA Trainings

One of the significant barriers to entering into uranium mine reclamation, even with a relevant degree or with relevant experience, is the need for specialized Occupational Safety and Health Administration (OSHA) trainings that deal with hazardous waste and radiation. The most general of these trainings is the Hazardous Waste Operations and Emergency Response (HAZWOPER) training, which addresses a variety of topics related to health and safety relevant to hazardous waste operations. Various levels of this training are required for all on-site personnel, and the training must be renewed annually.

⁵¹ WRRI also maintains a directory of water experts throughout the state and a searchable library database for research related to water issues. These are key informational repositories that could be better utilized by the State when creating a clearinghouse for all potential remediation resources.

⁵² <https://www.gallupedc.com/>

Generally, technically qualified workers for on-the-ground assessments and cleanups will easily maintain their certification because they can perform these technical jobs on multiple hazardous material sites and thereby maintain consistent employment. Typical technical skills are transportable and can move from site to site, which may mean working on sites in different states. That sort of mobility is usually not as feasible for general contract labor. Maintaining OSHA trainings for employees becomes more problematic for general construction labor, as they may or may not be initially certified, and their employment opportunities will not always be related to hazardous waste. These workers may have no occasion to utilize the certification prior to its expiration and will need to renew with no work necessarily at hand, due to uncertain timelines for uranium remediation. The sort of mobility seen in technical careers is usually not as feasible for general contract labor.

Additionally, certain jobs may call for training specific to remediating types of mines, e.g., confined spaces training. These specific trainings are required on a task-by-task basis and are not needed for all employees at a given firm. However, our interviews with major remediation corporations indicated that subcontract proposals for cleanup activities from businesses that included a wider variety of relevant OSHA training for their staff had a slight advantage over proposals that did not. Workforce development with a focus on specialized trainings could be more responsive to specific remediation needs with better coordination at the state level.

4.4. Conclusions

In this chapter, we examined the workforce skills available in New Mexico to address uranium mine remediation. We briefly outlined the history of work in uranium mining and discussed how that may translate into the field of environmental remediation. Overviewing some of the career paths and the institutions that train our workforce, we illustrated that New Mexico has the skills to tackle remediation issues, but needs both a repositioning and slight retraining of workers and consistency in available employment.

In the next section, we will discuss constraints on uranium mine remediation in New Mexico, addressing industrial concerns, workforce concerns, and additional issues that arose in our research.