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The Health Impacts of Uranium Mining in Native American Communities

Policy Brief

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Overview & Summary

In the late 19th century, Uranium's radioactive properties were discovered after mining for the heavy metal began on an increasingly large scale in Europe in order to study radium.¹ By World War II, uranium mining was a booming industry in the United States, particularly on or near tribal lands. The extensive negative health impacts and need for safety measures and protections for uranium workers were already well documented and even legislated in some European countries.² However, for decades, Native American uranium miners, millers, and their families were not informed of the growing research warning of severe long-term risks to their physical health and communities' well-being. Moreover, uranium mines and mills were largely unregulated, with little to no protections or safety measures in place to prevent or mitigate the health effects of exposure to radioactive chemicals and heavy metals associated with uranium mining.³

This deliberate deception of Native American communities related to the hazards posed by uranium mining has led to ongoing physical, mental, cultural, and spiritual health impacts that continue to affect Native American families, economies, and lifeways today. While state, tribal, and federal governments increasingly recognize many of these health injustices with the creation of the Radiation Exposure Compensation Act (RECA) and new environmental justice policies, the original injustices stemming from federal and corporate uranium mining activities continue to be compounded as communities fight for the restoration and future protection of their lands, waters, and homes.

In order to address the ongoing intergenerational health impacts related to uranium mining, as well as to prevent future environmental health disasters, innovative policies are needed that include the following three critical components:

- Center voices of impacted communities through comprehensive and proactive community engagement throughout the entire lifecycle of uranium projects and policies.
- Develop health studies that build on cultural and biomedical knowledge to benefit communities and heal damage caused by uranium.
- Require the evaluation of the totality of health impacts with requirements for cumulative burden and environmental justice assessments for all former and potential uranium sites, with mandatory permit denial for disproportionate impacts as well as for the establishment of nuclear free zones.

Introduction

Hard rock mining operations, such as those used for uranium, gold, molybdenum, vanadium, lead, silver, and other natural resources, have long contaminated Native American lands. Throughout the western United States, there are more than 160,000 abandoned hard rock mines, often unmarked, unfenced, and unsecured. At the same time, Native American communities are disproportionately exposed to many of these abandoned mines as more than 600,000 Native Americans are estimated to live within 6 miles of an abandoned mine. Volumes of research and community experience has shown a clear link between colonization and ecological violence, demonstrating how both historic and contemporary policies in the United States continue to shape environmental injustices today through the disruption of relationships among nature with devastating health outcomes.^{4, 5, 6}

Under the framework of radioactive colonization, this policy dynamic is exemplified through the development of the uranium mining industry in the United States. Up to two thirds of the uranium deposits that the United States claims is on tribal land, and 80% of nuclear fuel

cycles¹ take place on tribal land. Additionally, the workforce for uranium mining and milling has disproportionately been made up of Native American workers.^{8, 9} As a result, uranium extraction has remained outside of general public discourse in spite of the major intergenerational health impacts that are heavily concentrated in Indigenous communities and have often been brushed aside as collateral damage. Although Native American reservations make up only 5.6% of land area in the American West, approximately one in five uranium mines are located within 6 miles of a reservation, and more than 75% of uranium mines are located within 50 miles of a reservation. The disproportionate concentration of uranium extraction and processing, coordinated misinformation, lack of safety measures, as well as federal and corporate inaction throughout uranium site life cycles, including after their abandonment, these mines have left a legacy of health injustices in Indigenous communities.^{10,}
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Uranium's radioactive properties have been well documented since the late 19th century, when it began to be mined on an increasingly large scale in Europe in order to study radium.¹ In the United States, uranium mining became a booming industry in the lead up to World War II due to its role in developing nuclear weapons. Yet the inequitable distribution and intensity of abandoned mine exposures in Native American communities is not an accidental byproduct of economic development or national security. Rather, it is the result of systematic exclusion and marginalization of community voices in permitting and cleanup processes, as well as the deliberate deception of communities about risks to their residents' health.

In the 1940s, uranium mining began on the Navajo Nation under the guise of close-to-home jobs.³ Through the then-Atomic Energy Commission (now the Nuclear Regulatory Commission), the U.S. federal government was designated, by law, to be the sole purchaser of uranium mined in the United States until 1966.¹¹ During that time, not only did the federal government alone have access to U.S. uranium ore but it also guaranteed purchase of all mined uranium. For private companies, such as the United Nuclear Corp. (UNC), Kerr-McGee Corp., the Vanadium Corporation of America, and many others, this was a major incentive to mine as much uranium as quickly and cheaply as possible. As a result, the uranium industry boomed primarily at the expense of Native American miners and their homelands.

This dynamic is an important element in the story of uranium mining on Native American land because in defining Indigenous tribes' unique legal and political status, federal Indian law also explicitly establishes a trust responsibility that the United States holds to protect tribes' rights to their lands, waters, resources, and health of their members.^{12, 13} Numerous treaties between the United States and tribes establish reservations as areas where tribes maintain sovereign control over their land. However, as valuable mineral resources such as uranium were found to exist on tribal land, the United States sought ways to open reservations for mineral extraction, thereby betraying many of the responsibilities designated in these treaties, as well as the relationships defined in past U.S. Supreme Court decisions and Indigenous sovereignty. For instance, in the early 20th century, federal laws were written to define policies for leasing tribal land to extractive industries as well as to prohibit the creation of additional reservations on public land.¹⁰ By the 1970s, the Bureau of Indian Affairs had approved hundreds of leases on a quarter million acres of Navajo land for mining and milling, where private companies' contracts allowed them to artificially depress wages, pay royalties at only 3.4% of market rate, and conduct no post-mining cleanup.⁸

¹ Nuclear fuel cycles include the entire span of the nuclear energy supply chain – including mining, milling and purification, chemical dissolution (in-situ leach mining), enrichment and power generation, along with waste storage and disposal.⁷

Since 1879, uranium mining has been linked to workers' lung disease and lung cancer, with early studies showing that up to 75% of deaths in uranium miners were caused by these respiratory illnesses. By 1932, Germany and Czechoslovakia had designated lung cancer as a "compensable" disease for uranium miners—a simple tertiary measure the United States did not enact until almost 60 years later with RECA in 1990. In the interim, the U.S. Public Health Service (USPHS) conducted a study of health risks to uranium miners but excluded Native Americans from the study.² Moreover, when USPHS research unequivocally established associations between a number of illnesses and uranium mining, Native American miners were not informed of the findings, and many times researchers were banned from disclosing health risks to impacted communities by federal officials, who participated in an expensive campaign of misinformation and deception in the name of "national security."^{14, 8}

Because some of the richest uranium deposits in the world are located on the Colorado Plateau within the Four Corners Region of the United States, the Navajo, Hopi, Ute, Pueblos, and other tribes that call this area home have been particularly impacted by the uranium industry. During the peak years of Colorado Plateau uranium mining until 1969, there were no established or enforced standards in the United States to protect miners from radiation.¹⁵ As the uranium demand declined with the end of the Cold War, mine companies closed, sold, went out of business, and abandoned more than 4,000 mines. Some 520 of those abandoned uranium mines are on the Navajo Nation, accounting for nearly 12% of the abandoned uranium mines in the United States. With the inclusion of uranium mills and waste sites as well, well over 1,600 former uranium mining-related sites remain abandoned on the Navajo Nation, contaminating land, water, and communities.^{16, 10}

While these hundreds of mines, mills, and waste sites remain to be cleaned up, radioactive and co-occurring heavy metal contamination spreads in wind, dust, water, air, and through animals that graze on contaminated lands.^{17, 18} Even as European countries began to legislate protections for uranium workers, such as minimum mine ventilation requirements and personal protective equipment, attempts to protect and support uranium workers in the United States were repeatedly sidelined in order to prioritize cheap extraction of ore.⁸

Key Health Issues

Given the high toxicity of radiation, particularly in combination with additional chemicals and heavy metals, and as more research is conducted on the health impacts of uranium mining, the list of severe health consequences continues to grow. Moreover, health impacts are not limited to physiological responses alone. No clear line can be drawn around a specific geographic or physical set of impacts because of the interconnectedness of social and environmental relationships in many Indigenous communities. Rather, the harms and impacts related to uranium extraction extend throughout networks of ecological, social, and spiritual relationships.¹⁴

To date, research has identified connections between exposure to uranium mining operations and many kinds of cancers, especially lung cancer. A USPHS study from 1991 to 2005 found that 25% of the deaths in 4,137 former uranium miners were attributed to lung cancer, with Native American miners experiencing three times the expected rate.¹⁰ Uranium mining has also been linked to pulmonary fibrosis, hypertension, birth defects, cardiovascular diseases, silicosis, emphysema, kidney failure, Down syndrome, miscarriage, learning disabilities. Further research has also increasingly shown connections to inflammatory diseases, such as diabetes, an illness with a high prevalence in Native American communities but whose association with extractive industry is rarely highlighted.^{15, 19, 20, 17}

A confounder in USPHS studies of white miners has been the high prevalence of smoking due to the fact that many of the same cardiovascular and respiratory illnesses are caused by

cigarette smoke. However, the confounding potential of smoking among white miners further highlights the disparities experienced by *Diné* miners because *Diné* miners smoke far less than their white counterparts. In fact, among the *Diné*, uranium mining is a unique example of an exposure (uranium mining) in a single occupation accounting for the vast majority of lung cancers in an entire population. In a study covering 25 years, from 1969 to 1993, 67% of lung cancer cases among *Diné* men occurred in former uranium miners, and *Diné* men with lung cancer were 28.6 times more likely to have worked in uranium mines than those without lung cancer.¹⁵ Yet, private uranium corporations, endorsed and aided by the federal government, coordinated a major campaign to market secondhand smoke as the main reason for lung cancer amongst non-smokers in order to further shield the connection with military-industrial pollutants such as uranium.⁸

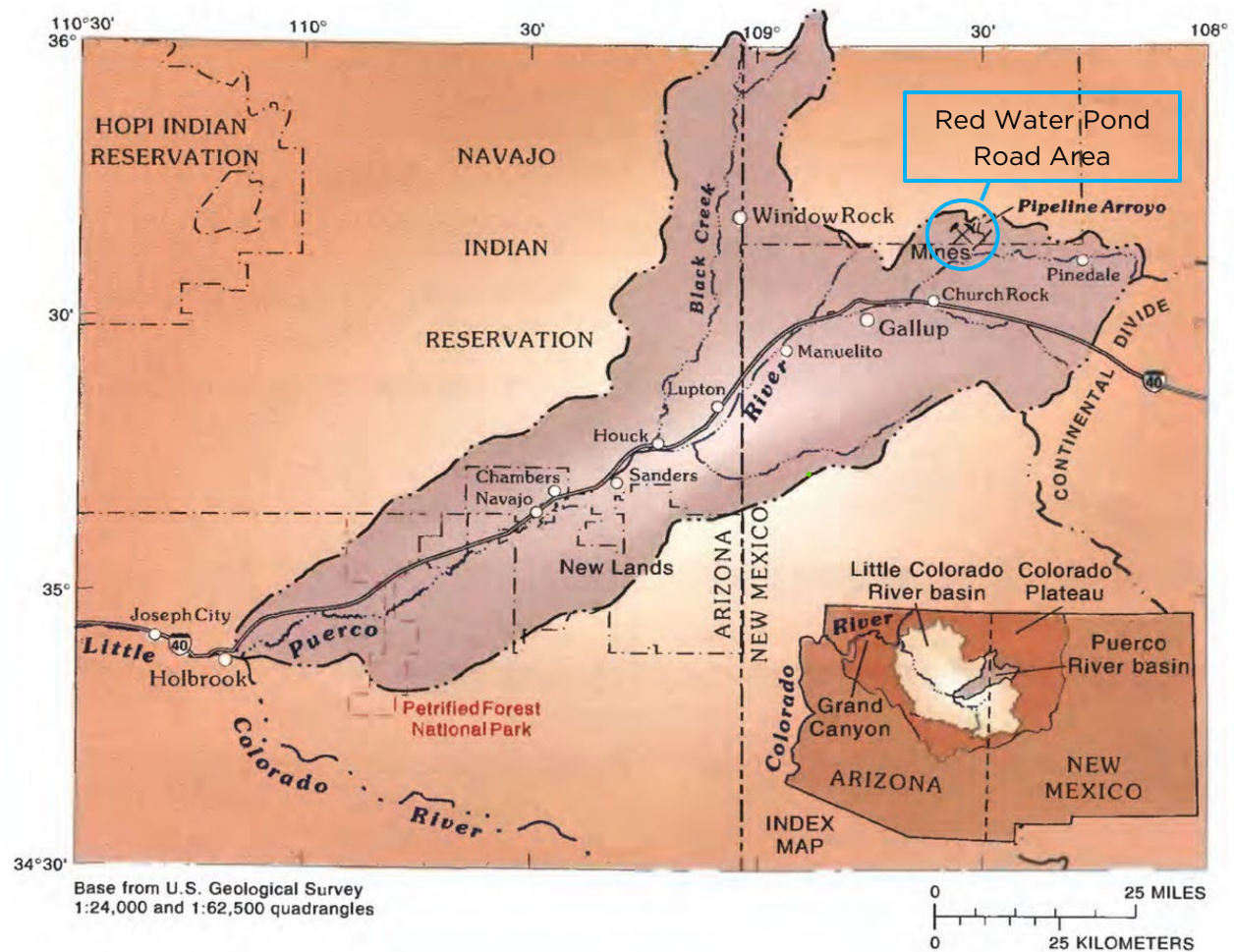
Even more stark, of the 150 *Diné* uranium miners who worked at the uranium mine in Shiprock, New Mexico, which was variously owned by both Kerr-McGee and the Vanadium Corp. of America, until 1970, 133 died of lung cancer or various forms of fibrosis by 1980. This means that in the 10 years following the mine closure, there were only 17 survivors. Not to mention the many other radiation-related health conditions that those 17 survivors and their families (given that miners would have come home with radioactive dust on their clothes, and community members who lived in the vicinity of mines would have breathed in dust as well) may have continued to face or experience to this day.²¹

In addition to the many impacts on physical health, Native American miners and their families also report intergenerational post-traumatic stress disorder (PTSD) related to the legacy of uranium mining. Understanding the disruption of environmental relationships through layering of acute and chronic disasters, such as in the historic patterns of the uranium industry alongside catastrophic spills, including those at Church Rock, and the Gold King Mine, shed light on the complex, but often overlooked, emotional, spiritual, and social dimensions of energy sacrifice zones.^{22, 14, 23} Uranium miners report anxiety, depression, deep psychological stress, trauma, and despair related to uranium-related changes in their lives and communities.¹⁹ These data give just a glimpse of the range of intergenerational physical, emotional, and cultural health disparities experienced by Native American uranium miners, while children, families, friends, and loved ones continue to experience the grief, economic hardship, and additional health consequences caused by the loss of primary breadwinners, fathers, brothers, and generations of men in their communities.

In the northwest region of New Mexico, the Church Rock spill (CRS) remains the largest nuclear disaster in U.S. history. On July 16, 1979, a uranium tailings pond, holding waste from multiple uranium mines in the area, dumped more than 94 million gallons of a radioactive slurry that included uranium and other heavy metals as well as 1,000 tons of solid waste into the Puerco River and Pipeline Arroyo for more than 80 miles when its dam was breached.²⁴ The Three Mile Island nuclear meltdown, which occurred only four months earlier in Pennsylvania, released significantly less radiation than the Church Rock spill. Yet, there was far less national reporting on the Church Rock spill compared to Three Mile Island. In what little coverage there was, the area was described as “sparsely populated” with no significant danger to human health.²⁵ However, in the checkerboard area of Navajo land, many *Diné* communities, such as the Red Water Pond Road community, are located throughout the spill area. Moreover, communities all along the 80-plus mile stretch of the spill’s plume experienced acute toxic exposures, the devastation of their agricultural flocks and crops, and continue to feel the health impacts to this day.

Still today, only a fraction of the contamination of the Church Rock spill has been cleaned up. Community members describe illnesses and amputations after coming into contact with the radioactive waste. Elementary schools have needed bottled water brought to the school because the drinking water supplies of many communities remain contaminated by uranium.

The following map from the U.S. Geological Survey shows the Puerco River watershed, a major tributary of the Little Colorado River, where the spill occurred.²⁶ Decades of uranium mining and the Church Rock spill have contaminated drinking and irrigation water in the Puerco River watershed. Importantly, community members only learned of this contamination through their own environmental testing in partnership with local organizations, because the federal government never adequately assessed the range of contamination from the Church Rock spill.²⁷



Map Source: Wirt, L. Radioactivity in the Environment; a Case Study of the Puerco and Little Colorado River Basins, Arizona and New Mexico. U.S. Geological Survey; 1994. doi:10.3133/wri944192

The *Diné* community of Red Water Pond Road is located at ground zero of the Church Rock spill. Residents have experienced their entire community change following the spill. When the mines originally opened, flocks of sheep sickened, and crops failed. Following the spill, homes and grazing areas were officially declared to be located within a Superfund site, and community members were asked to move off of the Navajo reservation to the nearest city, Gallup, New Mexico; separating families from each other and from the land they had lived on for generations. This separation has also resulted in the disruption of the community's cultural and spiritual traditions because the air, soil, water, and plants are now contaminated. A pile of radioactive waste to the east affects community members' ability to perform morning prayers, burial sites have been disturbed, and areas important for traditional practices have

been blocked off and important vegetation located there removed due to radioactivity. Even where federal efforts have been made to replant desecrated areas, care has not been taken to replant the native species, with generic “southwest seed mixes” being scattered rather than piñon trees and other more appropriate, native species.

“Our morning prayers to the east were disrupted by a pile of radioactive waste, and the community no longer was able to leave offerings due to our traditional-use areas blocked off by the land these corporations have designated as belonging to them. Due to the impact on the earth, air, water, vegetation, and our people, we no longer are able to hold traditional events in our community.”

- **Teracita Keyanna**, *Red Water Pond Road Community, 2023*

Many traditional community events can no longer be held, and areas once used for gathering materials for ceremonies or medicines as well as sacred places with longstanding oral traditions have been contaminated and desecrated by mining operations.¹⁹ Now, residents of Red Water Pond Road often must travel to other communities to maintain those critical ties to their traditional lifeways. Residents describe the importance of being grounded in their community and culture, which requires strong ties to the elements, including air, land, and water, but because of uranium contamination, maintaining those ties through traditional practices often endangers human health. These disruptions caused by the uranium industry then trigger cascading economic, cultural, spiritual, and mental health effects. Red Water Pond Road community members have described depression, anxiety, and bipolar disorders because of the Church Rock spill and the neglect of federal and corporate officials to adequately respond and clean up the pollution. Such mental health impacts intersect with substance abuse and economic consequences related to the spill, such as the poisoning of sheep and crops, which are integral to the community’s economic livelihood.

More recently, the 2015 Gold King Mine wastewater spill (GKMS) reflects many similar experiences and disproportionate impacts to the Church Rock spill. These injustices, multiplied many times over by the scale of such environmental health disasters, represent a chronic pattern of neglect, underfunding, and lack of accountability regarding uranium mining activity and cleanup. On August 5, 2015, at the Gold King uranium mine in southwestern Colorado, U.S. Environmental Protection Agency activity at the mine resulted in the accidental release of 3 million gallons of bright yellow, radioactive acid mine drainage from mine into the Animas River, a major tributary of the San Juan River. The disaster affected not only southwestern Colorado but northwestern New Mexico as well. Agriculture is the main source of livelihood for *Diné* residents in that region, but following the spill, irrigation water was cut off in the midst of the growing season due to contamination.^{28, 14} *Diné* people have more than 40 distinct livelihood, spiritual, recreational, cultural, dietary, and arts activities related to the San Juan River that were impacted by the spill. As a result, the impacts *Diné* farmers experienced were many that non-Indigenous residents did not have to grapple with.²⁹ Beyond the immediate disruption of livelihoods and river-related activities in the region, the spill catalyzed long-term negative impacts related to physical health and mental health. The uncertainty about the safety of locally grown agricultural crops for consumption or ceremonial purposes further harms *Diné* social and spiritual relations across time and space; compounding disharmony that has been connected to undue stress, domestic violence, substance abuse, stigmatization, and other intersecting forms of violence. Following the Gold King Mine spill, *Diné* residents identified not only the return of the ability to irrigate and engage with the river safely as needed recourse but also the restoration of balance and the healing of disharmony in relationships as critical to meaningful remedy of the injustices inflicted in their communities.¹⁴

Apart from the cultural and spiritual impacts, the ongoing Navajo Birth Cohort Study (NBCS) is the only comprehensive study to date of the physical health impacts of uranium mining. Most importantly, the NBCS has shed light on some of the critical impacts of co-occurring heavy metal contamination, such as arsenic, cadmium, lead, and mercury, with uranium, for expecting mothers and their children. The birth study has found increased heavy metal and uranium levels in participants to also be associated with increased infant mortality, stunted growth, immunosuppressive effects, and neurodegenerative diseases.^{30, 17} Each of the above cases—the Church Rock spill and the Gold King Mine spill—along with the NBCS, highlights the fact that the current scope of cumulative research on the health impacts of uranium mining in Native American communities pales in comparison to the likely breadth, depth, and complexity of the industry’s health impacts, further underscoring the need for significant changes in federal policies regarding uranium mining and community health.

Current Policies

Since the decline of the initial uranium mining boom, numerous environmental policies have been enacted to address concerns for environmental degradation in new industrial projects. These include: the National Environmental Policy Act (NEPA) and the Clean Air Act (CAA) of 1970, the Clean Water Act (CWA) of 1972, the Safe Drinking Water Act (SDWA) of 1974, the Radiation Exposure Compensation Act (RECA) of 1990, and others.^{31, 32, 33, 34} However, these laws provide an inadequate and piecemeal regulatory approach to decision making, and while intended to protect and support impacted communities, are often inconsistently enforced, create gaps, and add additional barriers for communities seeking justice. For instance, as uranium mine companies have been closed, sold, and abandoned, approximately 4,600 uranium mines across the West, in addition to the thousands of uranium mills, waste sites, and spills, few legal resources remain for communities fighting legacy contamination and health impacts in their communities.¹⁰ In 2005, the Navajo Nation government banned uranium mining and milling on its land. However, this rule does not cover the federal, state, private, and other land ownership statuses prevalent in the checkerboard areas of the Navajo and Hopi reservations. Moreover, that decision was challenged in court by Uranium Resources Inc., and in 2006, the federal Nuclear Regulatory Commission (NRC) permitted Uranium Resources Inc. to mine.⁹

Moreover, the powerful General Mining Act of 1872 continues to allow companies to mine on public land (of which there are vast amounts in the Four Corners region) for uranium and other minerals and metals essentially for free—continuing to incentivize new extraction without safeguards for communities in an already disproportionately heavily impacted landscape. The designation of uranium as a “critical mineral” by the federal government in 2018 created additional shortcuts for companies to sidestep environmental reviews and protections.³⁵ Since uranium mining began in the Red Water Pond Road community in the 1960s, the community has experienced an influx of outsiders coming in to probe for natural resources. Yet even after the Church Rock spill community members are continually ignored by mining companies and government officials, both tribal and nontribal, failing to support the community in its efforts to have waste cleaned up. Cleanup efforts have been long marred by the perceived “infeasibility” from government agencies, while corporations are rarely held financially liable for these environmental health disasters, and the federal money needed to clean up contamination, particularly from catastrophic spills, becomes tied up in bureaucratic processes despite representing only a fraction of the investment needed to restore affected areas.

Much of the policy recourse made available to communities is limited to procedural objections for future projects and to requests for compensatory reparations after health impacts are already felt. For example, while the Radiation Exposure Compensation Act (RECA) represents landmark legislation, it only provides one-time compensation to former

uranium mineworkers experiencing eligible illnesses, such as lung cancer. Although RECA claimants have been awarded more than \$2.5 billion since its inception, these funds do not equate to the sprawling scale of the health crisis caused by uranium extraction. For one, the RECA program was originally slated to end in 2022. Following a two-year extension, RECA compensation will now run out for uranium miners and their families in 2024.³⁶ Secondly, RECA applications follow a lengthy process that require birth certificates and proof of employment for claimants, documents that many Native American uranium workers may not have. Furthermore, the complexity of the application process often requires an attorney, resulting in additional fees that claimants must pay in order to receive the benefits they are due.³

At the same time, the limited set of eligible illnesses excludes many impacted workers and their families. Tracing which toxicological responses and illnesses have been caused by uranium exposure is complex but even more so for Native American communities whose cultural practices often “create distinct exposure patterns not captured in the assumptions of standard suburban, recreational, or occupational exposure scenarios used for risk assessments” (1).¹⁰ Although RECA has provided critically important compensation for impacted families, it is also representative of the larger piecemeal, top-down, and vertical policy framework that facilitates ongoing federal evasion of accountability and cleanup, as well as the marginalization of community voices and experiences in uranium policy.

Future Implications

Without policy innovations that equitably include communities in decision-making processes and provide mechanisms for support and restoration at scale, environmental injustices created by uranium extraction will continue to amplify health disparities and displacement in Native American communities. In order to understand the entire network of impacts to communities’ physical, mental, cultural, and spiritual health significant additional research is needed. For instance, new research has found that uranium reacts with microplastics in freshwater, suggesting significant implications for ecological health, toxicology, and human health responses to exposure.³⁷ As noted above, many of the reasons for the reported “infeasibility” of abandoned uranium site cleanup is cost-related. The cost to remove contaminated material, to safely transport and store it, and to ultimately restore polluted landscapes is exorbitant, and the technology is required to do so is often not even available.

Yet, while it is clear that there is no responsible way to mine, mill, and transport uranium given the complexities of contamination and the sheer length of time needed for recovery (resulting in intergenerational contamination), new uranium mines are currently being considered to fuel America’s nuclear energy development as part of the “green,” “clean,” or “renewable” transition.³⁸ This greenwashing of extractive industries such as uranium mining focuses all critical examination of energy production processes on end-of-line generation, rather than on practices and outcomes throughout the entire supply chain. This is the case with toxic lithium mines proposed in and around tribal land to supply batteries for electrification, as well as with uranium needed to fuel nuclear energy generation—even while radioactive mine tailings are known to contain radioactive chemicals with a 10,000-year half-life, an impossible time span for which there is no cleanup plan.^{39, 40, 8} Thus, painting nuclear energy as “clean” or “green” ignores the widespread, intergenerational contamination and destruction of land, water, air, animals, and people.

For context, an average nuclear reactor requires around 200 tons of uranium per year.⁴¹ In recent years, much of this uranium has come from outside of the United States, particularly from Russia, but with the war against Ukraine and an increased desire to fuel the “energy transition” at home, the demand for domestic uranium is growing once again. At present, Energy Fuels Inc.’s White Mesa Uranium Mill, adjacent to the Ute Mountain Ute Tribe’s White

Mesa community in southeastern Utah, is currently the only operating uranium mill in the United States. In response to the growing demand for nuclear energy, the mine has begun increasing its activity. Along with growth at the mill, above-water storage practices continually violate air quality regulations. At the same time, the aquifer below the mine clocks levels of chemical contamination orders of magnitude above what is expected from naturally occurring sources. Next door, the White Mesa community has noticed correspondingly increased levels of cancers and other health issues in their community and has concerns about contamination reaching nearby sacred sites, including Bears Ears National Monument.⁴²

The importance of understanding the impacts of uranium mining on water supplies cannot be understated, particularly given the growing uncertainty of water availability in the desert Southwest. Uranium extraction in and of itself requires vast amounts of water, and even more concerning, no uranium mining operation has ever successfully protected nearby ground or surface water from contamination. Despite the fact that Energy Fuels Inc. previously pierced an aquifer in the Grand Canyon watershed, flushing uranium and arsenic into drinking water supplies, in April 2022, the Arizona Department of Environmental Quality (ADEQ) approved another permit for the company to reopen the Pinyon Plain Mine, risking irreversible radioactive contamination in the Havasupai Nation's land and water as well as in the greater Grand Canyon watershed. While the ADEQ permit requires Energy Fuels Inc. to add more water quality testing wells and to continue to monitor water quality for 30 years after the mine closes, radioactive contamination lasts many lifetimes longer, and there is little to enforce accountability and cleanup once leaks and spills occur.⁴³ Moreover, uranium tailings (waste) retain 85% of the ore's radioactivity.⁸ In fact, the vast amount of tailings left abandoned and un-remediated have been found to compose a stockpile of "usable material for nuclear power and weapons so large that there is no need for new uranium" (1).⁹

The now-abandoned Laguna Jackpile-Paguete Mine in New Mexico, once one of the largest open pit uranium mines in the world, is part of a ~8,000-acre site of which nearly 3,000 acres has been disturbed by uranium mining activity. During its operation, the U.S. Department of the Interior leased the Pueblo of Laguna's land to Anaconda Minerals Co., which also operated another uranium mill in the region. Abandoned in the 1980s, the site was not listed on the Environmental Protection Agency's National Priorities List for Superfund Sites until 2012 and to this day remains largely un-remediated, continuing to contaminate water, air, and communities in both Laguna and the Pueblo of Acoma.⁴⁴ In the decades since its abandonment, a plume of radioactive contamination has breached its initial footprint and spread into Acoma Pueblo's drinking water supply. Yet neither the federal authorities nor the responsible mining corporation, now Marathon, has made any effort to contain the plume or clean up Acoma's drinking water. In 1977, Anaconda Mineral Co., was sold to the Atlantic Richfield Co. (ARCO). This marked the beginning of a slate of petroleum company sales and mergers, including ARCO's subsequent purchase by BP in 2000 and then Tesoro in 2013. Following the purchase by Tesoro, the company's name was changed to Andeaver in 2017, before finally merging with Marathon in 2018.⁴⁵ This practice of selling, merging, rebranding, and changing a company's corporate status allows private entities to avoid accountability for uranium cleanup, even as paper trails do trace industry fault.

As corporations continue to skirt liability and responsibility for these environmental disasters, communities continue to fight for accountability and cleanup. The Red Water Pond Road community established its own grassroots organization in 2006 to organize and represent the community's interests. Community members have spoken out on state, national, and international levels, including requesting a thematic hearing in front of the United Nations. The community organizes an annual commemoration for the Church Rock disaster and a march to clean up the toxic waste poisoning their community. They have participated in health studies to better understand the physical harm they have faced and are working

toward developing a framework to navigate the legal, bureaucratic, and governmental roadblocks that hinder small communities in achieving justice for their homelands.

In the Grand Canyon watershed, tribes and environmental groups have pushed for a permanent ban on uranium mining. While the addition of nearly a million acres of land adjacent to Grand Canyon National Park as *Baaj Nwaavjo I'tah Kukveni*—Ancestral Footprints of the Grand Canyon National Monument in August of 2023—is an important tool to preventing new uranium mining. However, this designation still allows for existing mining claims to continue, notably, the Pinyon Plain Mine. There are an additional 600 other preexisting mining claims in the region as well.⁴⁶ Each of the cases of White Mesa, Red Water Pond Road, the Laguna Jackpile-Paguete Mine, and the Pinyon Plain Mine not only demonstrate a pattern of extraction, abuse, and disregard of Native American communities but also the inadequacy of state and federal policies to ensure accountability of corporations and protection of communities. As a result, local communities have been left to shoulder the burden of administrative, legal, cleanup, and protection battles for their health and their homelands.

Policy Recommendations

Policy recommendations that address key gaps and inadequacies in existing frameworks revolve around prioritizing the voices and experiences of impacted communities through every step of the permitting, regulation, enforcement, cleanup, and reparative processes; developing health studies that build on cultural and biomedical knowledge to heal damage caused by uranium exposure; and requiring cumulative burden and environmental justice assessments that consider the totality of potential physical, mental, cultural, and spiritual health impacts for all new and reopened uranium sites. Paramount is the ultimate need to ban uranium mining, milling, enrichment, fuel use, weapons testing, and waste dumping in and around Indigenous lands, a policy already passed in countries such as Vanuatu, an archipelago in the South Pacific Ocean.⁹

- **Center voices of impacted communities throughout the entire lifecycle of uranium projects and policies.**

Members of impacted communities must be involved from the start, beginning with planning and decision making for all industrial development projects, particularly for uranium, given that the impacts will be felt for many generations after. While NEPA and other environmental laws usually require elements of consultation, none, not even more recent environmental justice executive orders, require community engagement from start to finish. Prioritizing community participation from a project's inception allows communities to incorporate their goals and needs into plans for new projects (and perhaps most critical to this is the necessary veto power for communities to prevent mining on their land), oversight of existing projects, and cleanup and restoration after the termination of site activity. Establishing positions within the Environmental Protection Agency, whose primary role is as liaison between local communities and federal agencies, would be an important step forward, as well as would establishing a transition plan for staff turnover in order to prevent all-too-common frustration and confusion when communication and institutional memory fails following staff turnover.

Rather than bringing an agency-created plan to communities for comment and approval, environmental policies should require that communities be involved in the planning from the outset. Not only would this result in a more just approach to resource management, community members having a seat at the table from the beginning could follow the decision-making process throughout its entire development, advocate for their

communities, develop the institutional knowledge necessary to navigate governmental processes and ways of thinking, and operate as a liaison between agencies and their communities, thus supporting other community members to have a voice in processes as well as bridging the gap that exists in institutional knowledge and power.

As an example, the state of Washington passed the Healthy Environment for All (HEAL) Act in 2021, creating a statewide Environmental Justice Council whose voting membership must comprise at least a quarter of tribal representatives; requiring all state agencies to develop community and tribal engagement plans; and requiring environmental justice assessments as a part of all major state agency decisions, including budgets, rulemaking, and other policies.^{47, 48} This kind of legislation is necessary at both the state and national levels in order to begin to codify community engagement and co-governance into existing policies for extractive industry and environmental quality.

- **Develop health studies that build on both cultural and biomedical knowledge to benefit communities and to heal damage caused by uranium.**

It is critical that research into the impacts of uranium mining have tangible benefits for impacted communities. Health studies that center community goals and initiatives should be funded and expanded to support the healing of land and people. “Thinking Zinc - *Beesh Doot’izh Bantsáhákees*” is an example of the kind of research necessary, while also providing a beneficial intervention to support the healing of cell damage by radiation and heavy metal exposure.⁴⁹

Following the Gold King Mine wastewater spill, researchers and impacted community members designed a focus group-based study to better understand the cultural and spiritual impacts of the contamination to downstream *Diné* communities. Everything from the framing of the issues to the questions asked of focus group participants were organized by members of the community, resulting in important insights about the impacts from the spill related to the Animas-San Juan river system.¹⁴ In particular, a major finding that this study identified was the emphasis on a communal sense of healing the “community’s harmonious state of being” and balance as central to how communities are able to move forward. Studies such as these that incorporate a “science of wholeness” and that are led by impacted communities are more insightful and effective at serving the goals of the community and providing real tangible benefits (455).¹⁴ Similarly, RECA limits reparative measures to compensation. However, Indigenous-led research and community engagement can identify reparative measures that support healing beyond monetary compensation by making space for communities to define what, how much, and through which means restoration and health needs can be met.¹⁴

- **Require the evaluation of the totality of health impacts in requirements for environmental justice assessments, including cumulative burden impact assessments, for all former and potential uranium sites, with mandatory permit denial for disproportionate impacts, as well as requiring the establishment of nuclear free zones.**

Rarely do federal and state administrative processes for permits, cleanup, compensation, or other aspects of resource extraction management consider the full historic and present burden of inequities that neighboring communities face, including as they relate to social determinants of health or community lifeways. This pattern has resulted in grave impacts to Native American communities located near high-demand resources such as uranium. Policies that require consideration of the cumulative effects of historic practices, current determinants of health, community lifeways, as well as the full spectrum of physical, mental, cultural, and spiritual impacts should be built into federal regulations that include

how sites are chosen and operated to how they are cleaned up. Importantly, this is possible only through centering community engagement because only communities themselves can define impacts best.

Environmental justice is beginning to be considered in investment such as through the federal Justice40 Initiative and Washington's HEAL Act.⁵⁰ While these policies are critical in reorienting the way governments invest in communities, contemporary investment cannot be a license to continue unjust patterns of causation. The same way that new policies are designed to respond to environmental justice with proportional investment, policies related to the creation of new, reopened, or expanded sites for uranium extraction should consider the proportional burden that communities already face. An example of a policy shift toward this end is New Jersey's Environmental Justice (EJ) Law passed in 2020, which requires that state's Department of Environmental Protection to conduct environmental and public health analyses when considering permit applications for projects proposed in overburdened communities. The law is the first of its kind to require mandatory permit denials if analyses show disproportionate impacts.⁵¹ However, beyond permit denials, where disproportionate impacts are found, "nuclear free zones" should be established; in other words, uranium mining should be banned.⁹ State laws such as the HEAL Act and EJ Law should be built on to evaluate permits based on the historic and current burden of environmental and public health impacts through a holistic lens that includes community-identified environmental exposures and relationships, social determinants of health, and historic treatment by corporate interests and government policies.

At the federal level, new agencywide EPA guidance to institute cumulative impact assessments, while an important step forward, must be rigorously evaluated to ensure community-defined definitions of exposures and impacts, and those mandates then must be codified into law.⁵² Indigenous-led health studies are again central to ensuring such improvements. Without changing existing systems that allow the clustering and magnification of environmental injustices, such as uranium mining in Native American communities, investment after the fact responds only to symptoms rather than to known causes, allowing health impacts to be compounded and expanded over time. Those three core areas of policy recommendations form an evidence-based web of necessary improvements for community-centered environmental health policy to support Native American communities impacted by uranium mining.

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