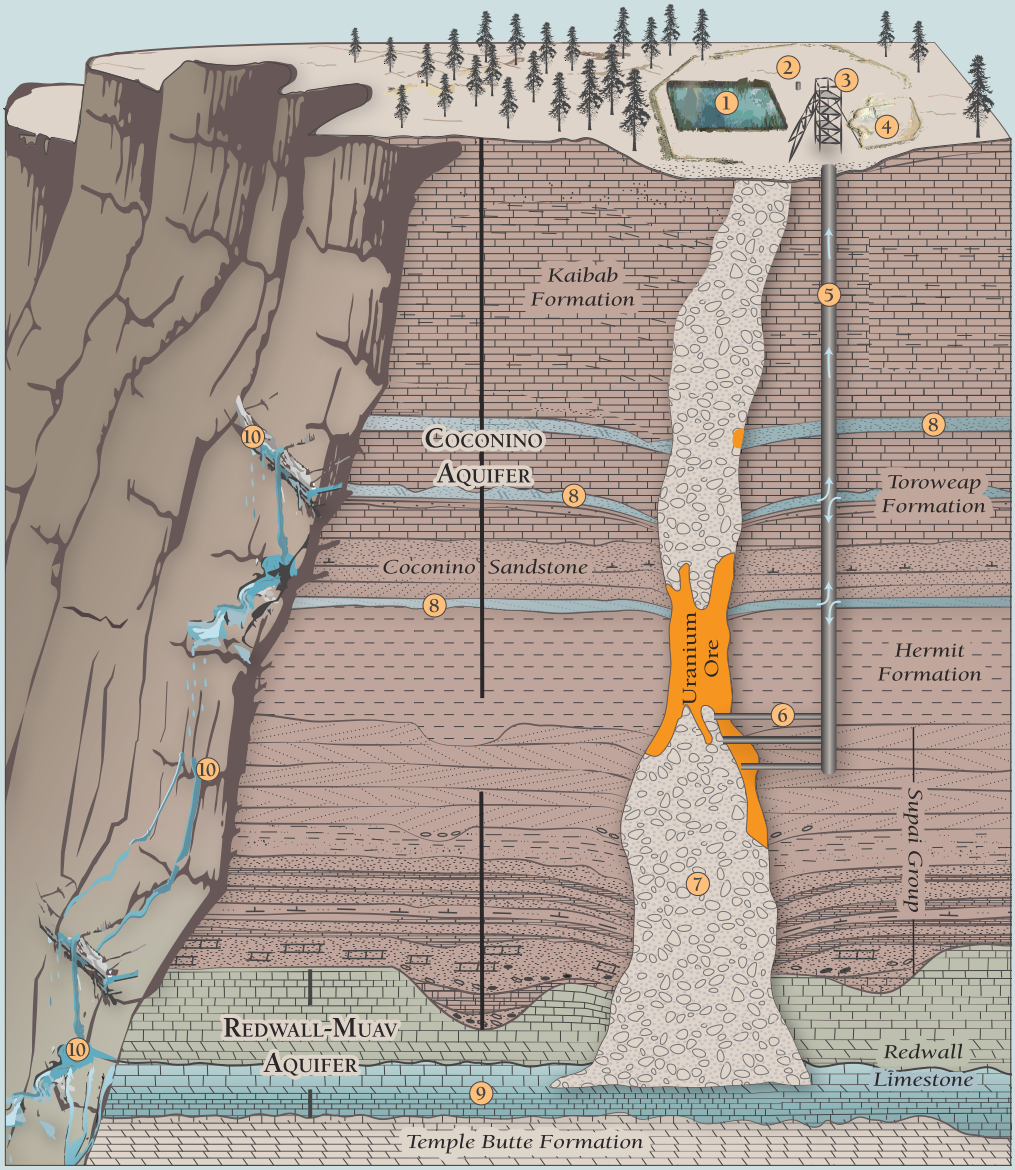
Uranium and the GRAND CANYON

Characterization of Uranium Deposits and Mining near Grand Canyon



Source: Generalized and modified from the USGS Site Characterization of Breccia Pipe Uranium Deposits in Northern Arizona and Uranium Mine Conceptual Model
Graphic By Stephanie Smith, Grand Canyon Trust

1. Containment pond
2. Ventilation shaft
3. Mine headframe
4. Waste rock, ore pile, & top soil storage
5. Mine shaft
6. Horizontal shaft ("drifts")
7. Breccia collapse feature
8. Perched aquifer
9. Regional aquifer
10. Seep or spring

Potential water flow in mine shaft

FREQUENTLY ASKED QUESTIONS

1 What is uranium?

Uranium is one of the most common elements in the Earth's crust, though not all uranium deposits are technically mineable. Known mineable uranium deposits are called "reserves." Uranium deposits sit deep within sandstone, siltstone, and mudstone layers across the Southwest. Uranium ore near the Grand Canyon is found in geologic features called "breccia pipes."

2 What is a breccia pipe?

Breccia pipes are vertical collapse features that typically range from 100 to 400 feet in diameter and up to 3,000 feet deep. Picture deep wells that are filled not with water but with columns of rock and mineral deposits. Uranium deposits within breccia pipes formed over millennia as oxygenated groundwater carried trace amounts of uranium through the pipe. The groundwater deposited the uranium where oxygen levels dropped, rendering the uranium no longer soluble in water. Uranium, when exposed to oxygen (for example, when miners drill into an ore body and expose uranium to air), becomes soluble in water. Uranium exposed to air can contaminate water.

3
Are all uranium deposits the same?

The quality of uranium deposits (aka grade, or the ratio of uranium oxide contained in ore) varies, and so do the resources required to mine them. Deposits in Australia and Canada are among the highest quality. Some Canadian ore can range upward of 20 percent uranium oxide. The grade of U.S. uranium is much lower. Pinyon Plain Mine (formerly Canyon Mine), the only uranium mine with current operations near the Grand Canyon's south rim, has a uranium grade of 0.88 percent. The grade of ore, combined with the mining method required to extract it from breccia pipes, mean Pinyon Plain Mine's ore is more expensive to mine than many deposits elsewhere in the U.S. or abroad.

4
How is uranium mined?

Open pit mining strips away topsoil and rock above the uranium ore which is then blasted and excavated.

Underground mining extracts rock through a mineshaft. This method is employed at breccia pipe mines such as Pinyon Plain Mine.

Chemical solution (often called in-situ leaching or ISL) dissolves uranium ore into a solution underground and brings the fluid to the surface for uranium extraction. This method requires the mining company to obtain a permit that exempts the operation from the Safe Drinking Water Act and allows for degradation of groundwater quality. Groundwater in the area of the mining operation will be henceforth unavailable as drinking water.

5
How does uranium mining impact human health?

More than 500 uranium mines remain abandoned on the Navajo Nation, where they continue to contaminate land and water and endanger wildlife and people.[1] Uranium is toxic to humans and accumulates in bone, liver, kidney, lung, and reproductive tissues.[2] Exposure to low levels of uranium radiation can cause cancer, reduce fertility, and shorten lifespans. Uranium mines and mills emit radon-222, the second leading cause of lung cancer in the United States.[3] Ingesting uranium through contaminated drinking water or food can be deadly. Ingested radionuclides find their way to soft tissues in the body where they remain and emit gamma rays, which alter DNA and lead to different types of cancers, kidney failure, and other serious health problems. The health consequences of uranium mining on the Navajo Nation are still being experienced by communities and studied today.

6
Why should you care?

Uranium mine wastes contain complex mixtures of heavy metals and radionuclides. When uranium is dug up and subjected to industrial processes, it is pulverized and oxidized, making radionuclides more soluble in water, or airborne where they can be inhaled or ingested. Uranium mill tailings contain radioactive materials, including radium-226 and heavy metals, which can leach into groundwater and contaminate drinking water and soils.[4] Near tailings piles (piles of contaminated dirt and rock that are the byproducts of uranium milling), water samples have shown levels of contaminants at hundreds of times the government's acceptable levels for drinking water.[5]

7
Why are Indigenous people disproportionately affected?

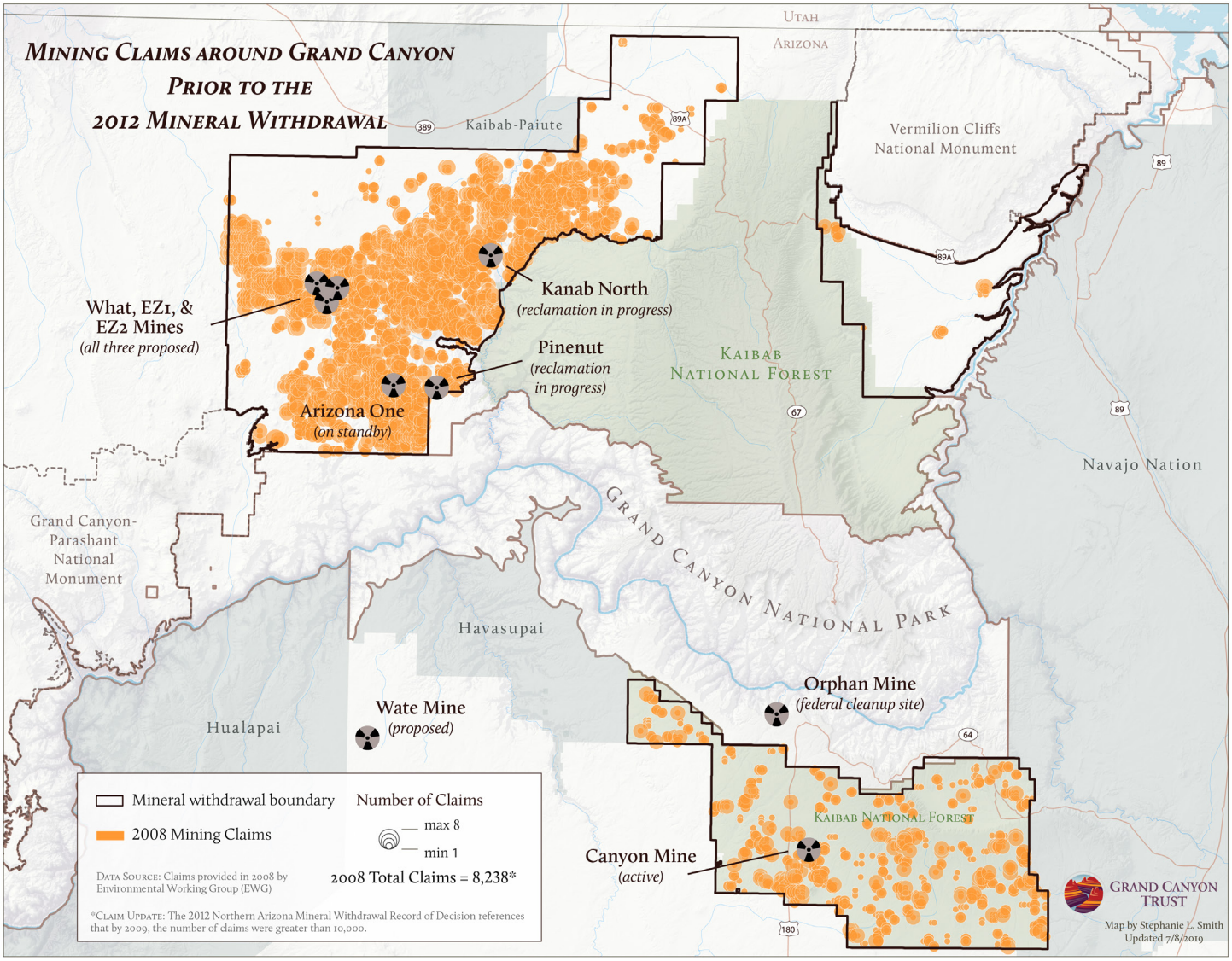
Uranium mining and milling operations have disproportionately affected Indigenous populations. Nearly one in five uranium mines is situated within 10 kilometers of a Native American reservation and more than 75 percent are situated within 80 kilometers.[6] Many Navajo uranium workers have died of lung cancer linked to their occupation, while other Navajo people, including non-miners, still suffer the dire effects of land and water contamination near their homes.[7]

> A University of New Mexico study screened 781 Navajo women and found that 26% had concentrations of uranium in their bodies that exceeded levels found in the highest 5% of the U.S. population.[8]

The Grand Canyon region is the ancestral homeland of at least 11 Native American tribes. Detrimental impacts to groundwater resources have occurred at a number of previous and ongoing uranium mining sites throughout northern Arizona, including near the Grand Canyon. The Havasupai Tribe considers the Pinyon Plain uranium mine a threat to their sole source of drinking water and to their existence as Havasupai people.

8
What's the Northern Arizona Mineral Withdrawal (the temporary mining ban)?

In 2012, the U.S. Department of the Interior issued Public Land Order 7787, which temporarily withdrew more than 1 million acres of federal public lands and national forest lands surrounding Grand Canyon National Park from new mining



claims under the 1872 Mining Law. This order banned new mining claims and the development of all but a handful of preexisting mines, for a period of 20 years, the maximum allowed, as a result of public concern about the dangers of uranium mining. Hundreds of active mining claims remain in the temporary mining ban footprint,[9] waiting for the ban to be lifted or expire.

9

Why do we need to make the temporary mining ban permanent?

The clock is ticking on the temporary mining ban. It remains a political target and attempts have been made to overturn it. Meanwhile, the mining industry and its supporters continue to push for measures to prop up U.S. uranium mining.

Groundwater flow in the Grand Canyon region is complex and not well understood. If contamination occurs at a uranium mine in the Grand Canyon region, it's sure to be extremely expensive to manage, if not completely irreversible. The risk of irreversible contamination that endangers the lands, water, and wildlife of the Grand Canyon, and the people and economies that depend upon them—today and for generations to come—is too great. Uranium mining doesn't belong near the Grand Canyon.

10

How do we permanently ban mining around the Grand Canyon?

A permanent mining ban could be achieved through legislation passed by Congress and signed into law by the president, or through administrative action by the president.

BLAKE MCCORD

Endnotes

[1] U.S. Environmental Protection Agency. "Abandoned Mines Cleanup." https://www.epa.gov/navajo-nation-uranium-cleanup/abandoned-mines-cleanup. Accessed 20 December 2022.

[2] U.S. Environmental Protection Agency. "Uranium and Radiation on the Navajo Nation." December 2014. https://www.epa.gov/sites/default/files/2016-06/documents/atsdr_uranium_and_radiation_basics_dec_2014_0.pdf. Accessed 20 December 2022.

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[4] Abdelouas, Abdesselam. (2006). "Uranium Mill Tailings: Geochemistry, Mineralogy, and Environmental Impact." Elements. 2. 335-341. 10.2113/gselements.2.6.335. https://pubs.geoscienceworld.org/msa/elements/article-abstract/2/6/335/137720/Uranium-Mill-Tailings-Geochemistry-Mineralogy-and?redirectedFrom=fulltext. Accessed 20 December 2022.

[5] Faroon, O, Keith S, Roney N, et al. "Toxicological Profile for Uranium." Agency for Toxic Substances and Disease Registry. February 2013. https://www.atsdr.cdc.gov/ToxProfiles/tp150.pdf. Accessed 20 December 2022.

[6] Lewis J, Hoover J, MacKenzie D. "Mining and Environmental Health Disparities in Native American Communities." Current Environmental Health Report 2017; 4(2):130–141. April 26, 2017. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5429369/. Accessed 20 December 2022.

[7] Brugge, Doug, and Rob Goble. "The History of Uranium Mining and the Navajo People." Public Health Then and Now: American Journal of Public Health. September 2002. Vol. 92. No. 9. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3222290/. Accessed 20 December 2022.

[8] Hudetz, Mary. The Associated Press. "US official: Research Finds Uranium in Navajo Women, Babies." Oct. 7, 2019. https://apnews.com/article/334124280ace4b36beb6b8d58c328ae3. Accessed 20 December 2022.

[9] U.S. Bureau of Land Management LR2000 Land and Mineral Systems Report, downloaded May 2022. See: "Map of Active Mining Claims Within Grand Canyon Withdrawal Area May 2022" available at https://www.grandcanyontrust.org/map-active-mining-claims-within-grand-canyon-withdrawal-area-may-2022. Accessed 20 December 2022.