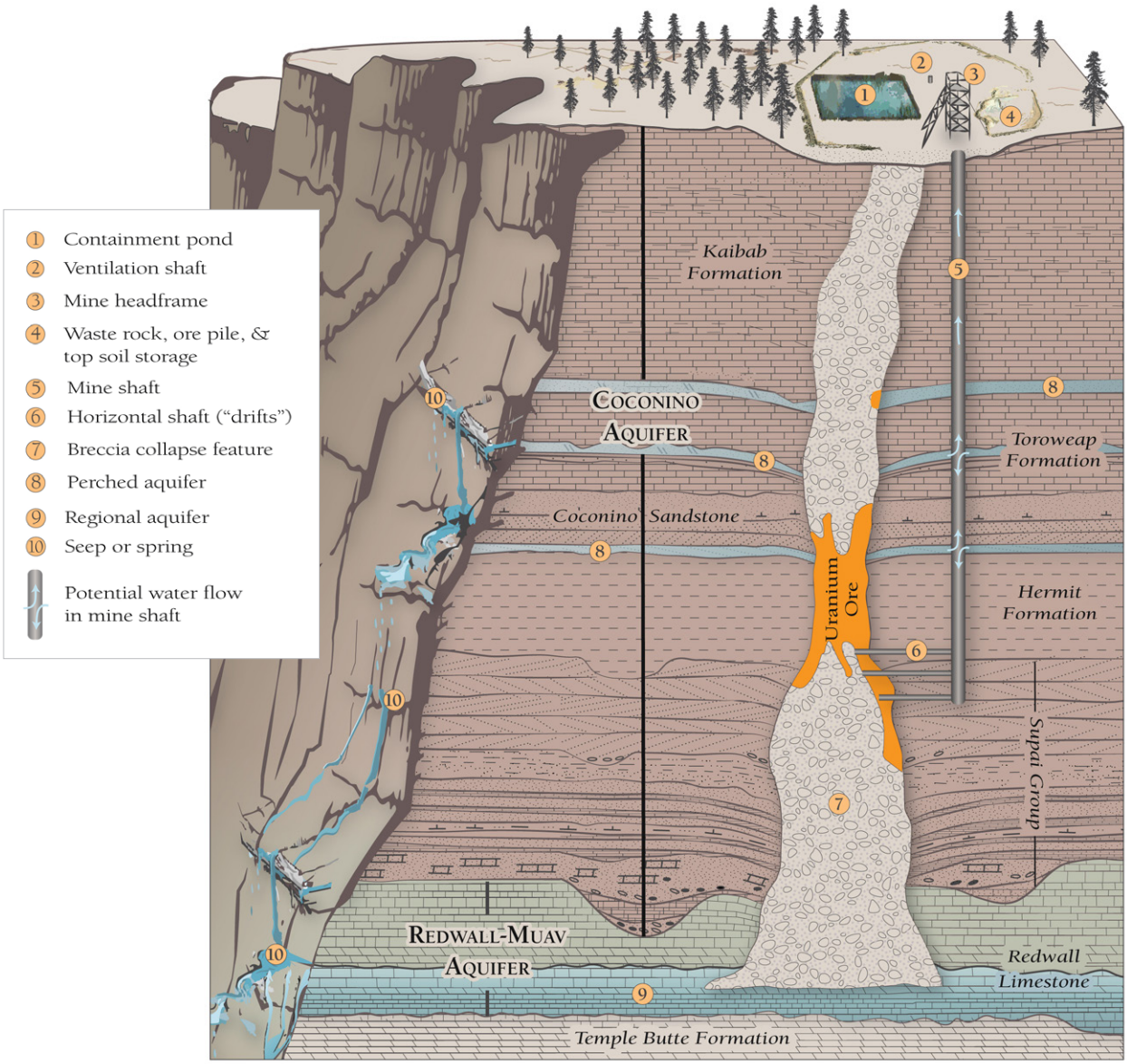
Uranium and the Grand Canyon
FREQUENTLY ASKED QUESTIONS

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 What is uranium?

Uranium is one of the most common elements in the Earth's crust, though not all geologic deposits (aka endowments) of uranium are technically mineable (a category called "reserves"). Uranium deposits sit deep within the inner folds of sandstone, siltstone, and mudstone layers that characterize the Southwest. Breccia pipes are the geologic features that host uranium ore near the Grand Canyon.

2 What's 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. Uranium deposits within breccia pipes formed over millennia as oxygenated groundwater carried trace amounts of uranium through the pipe, depositing the uranium where oxygen levels dropped, rendering the uranium no longer soluble in water.

3 Are all uranium deposits the same?

The quality of uranium deposits (aka grade, or the ratio of uranium oxide contained in ore), and consequently, the resources required to mine them, vary globally. Deposits in Australia and Canada are among the highest quality. Canadian ore can range upwards of 20 percent uranium oxide. The grade of U.S. uranium is much lower. 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, means Canyon Mine's ore is less economical to mine than deposits elsewhere in the U.S. or world.

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 the Canyon Mine.

Chemical solution (i.e. in-situ recovery or ISR) dissolves uranium ore into a solution underground and brings the fluid to the surface for uranium extraction. This method is increasingly common and is the only method currently used elsewhere in the U.S. Unlike other mining methods, ISR does not require the conventional milling methods offered at the White Mesa Mill in southeastern Utah.

5 How does uranium mining impact human health?

More than 500 uranium mines remain abandoned on the Navajo Nation, and the history of still unresolved, uranium-caused water contamination is a shameful one.[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. Radon-222, the second leading cause of lung cancer in the United States,[3] is emitted at uranium mines and mills. Ingestion of 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 is still being experienced by communities and studied today.

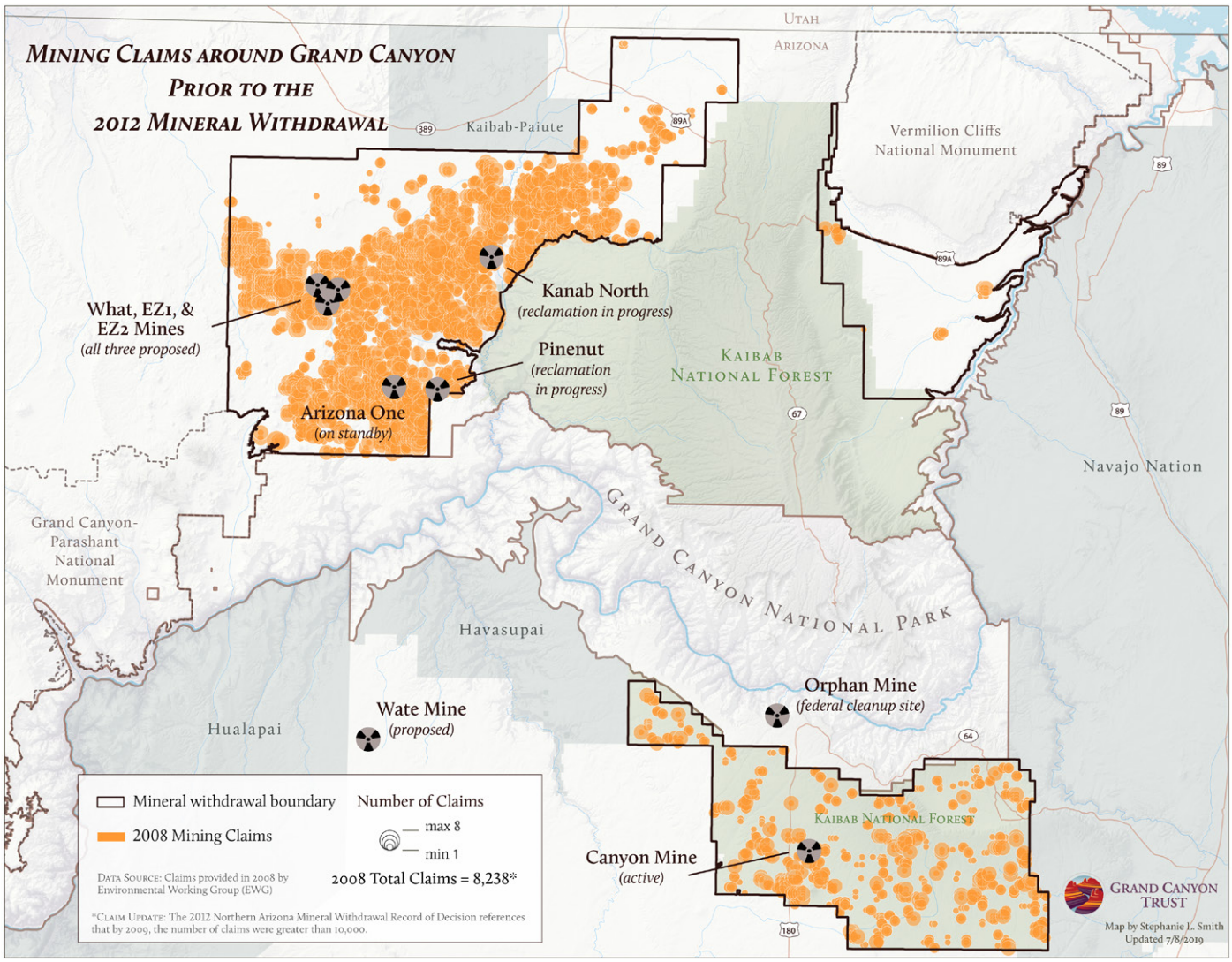
6 Why should you care?

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, water samples have shown levels of contaminants at hundreds of times the government's acceptable levels for drinking water.[5]

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 others, including non-miners, still suffer the dire effects of land and water contamination.[7] Furthermore, a recent 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 numerous Native American tribes. Detrimental impacts to groundwater resources have been seen at a number of previous and ongoing uranium mining sites throughout northern Arizona, including near the Grand Canyon.

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

In 2012, the Department of the Interior issued Public Land Order 7787, which temporarily withdrew more than 1 million acres of public and national forest lands surrounding Grand Canyon National Park from new mining claims under the 1872 Mining Law. This meant a ban on new mining claims and the development of all but a handful of pre-existing mines for a period of 20 years, the maximum allowed administratively. The temporary ban is intended to allow scientists more time to conduct research and better understand the geology and groundwater flow of the region, to determine whether uranium mining is or can be done safely there. The necessary research is complex and extensive and requires significant funding, which has not been provided by Congress.



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

As scientific research has been strangled with shoestring budgets, mining companies have presented this dearth of research as equivalent to a dearth of evidence that their operations could be harmful. Meanwhile administrative actions have placed a target on the temporary mining ban. A critical minerals strategy[9] developed by the Department of Commerce in June 2019 specifically identifies land designations like national parks and national monuments, as well as mining bans like the one around the Grand Canyon, for review, revision, and/or removal in order to allow access for uranium mining. Presidential executive orders have resulted in the Forest Service listing the Grand Canyon mining ban as an action for review to enhance domestic energy development. Uranium was also added to the list of "critical" minerals for the first time in history, wrongfully giving new uranium mining a priority status as having "significant consequences for our economy and national security."

The temporary mining ban is a political target. If contamination occurs, it's sure to be extremely expensive to manage, if not completely irreversible. Between hydrological uncertainty, research that is impossible to complete, and risk of irreversible contamination that endangers Grand Canyon ecosystems and the people and economies that depend upon them today and for generations to come, it's clear that uranium mining does not have a place near the Grand Canyon.

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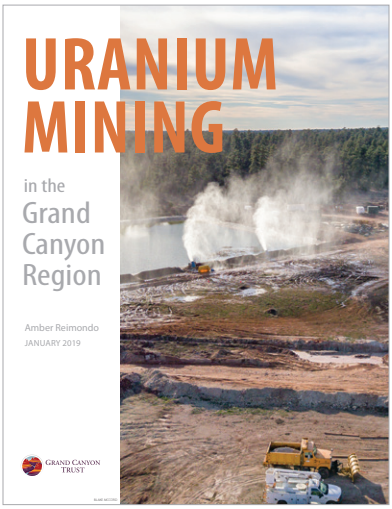
Learn more

Too Precious to Mine (9:36).
Watch this short film for free on Vimeo:
https://vimeo.com/241576331



Read more about the issue in a comprehensive report at:
grandcanyontrust.org/uranium-mining-grand-canyon-region

[1]Environmental Protection Agency. "Cleaning Up Abandoned Uranium Mines." https://www.epa.gov/navajo-nation-uranium-cleanup/cleaning-abandoned-uranium-mines. Accessed 16 December 2019.

[2]Environmental Protection Agency. "Uranium and Radiation on the Navajo Nation." December 2014. https://www.epa.gov/sites/production/files/2016-06/documents/atsdr_uranium_and_radiation_health_dec_2014.pdf. Accessed 16 December 2019.

[3]National Cancer Institute. "Radon and Cancer." https://www.cancer.gov/about-cancer/causes-prevention/risk/substances/radon/radon-fact-sheet. Accessed 16 December 2019.

[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 16 December 2019.

[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 16 December 2019.

[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 16 December 2019.

[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 16 December 2019.

[8]Hudetz, Mary. The Associated Press. "US official: Research Finds Uranium in Navajo Women, Babies." Oct. 7, 2019. https://apnews.com/334124280ace4b36beb6b8d58c328ae3. Accessed 16 December 2019.

[9]U.S. Department of Commerce. "A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals." June 4, 2019. https://www.commerce.gov/news/reports/2019/06/federal-strategy-ensure-secure-and-reliable-supplies-critical-minerals. Accessed 16 December 2019.