# Uranium Mining Near Grand Canyon:
# IT’S DANGEROUS AND UNNECESSARY

ECOFLIGHT

## Pollution from uranium mines is costly for Americans

**$1.7 billion**—the minimum cost of uranium-mine assessment and cleanup on the Navajo Nation. That cleanup is far from finished with more than 500 abandoned mine sites remaining on Navajo lands.[1]

**$1.5 billion**—the amount the Department of Energy estimated in 2000 it had spent toward uranium-mill cleanup efforts since 1978. That figure exceeds the receipts for uranium extracted and sold from U.S. mines by more than 50 percent.[2] While contamination cleanup and control have continued in the nearly two decades since that figure was released, a more updated figure is difficult to pin down. But we do know that the cleanup of one Colorado Plateau mill site—the Atlas Mill in Moab, Utah—is expected to cost around $1 billion by itself by 2032.[3]

**$15 million**—the amount of taxpayer dollars spent so far on the ongoing cleanup of Orphan uranium mine,[4] located on the south rim of the Grand Canyon, near the South Rim village. Orphan Mine is the likely cause of serious contamination of Horn Creek. The National Park Service warns hikers not to drink the water unless “death by thirst is the only other option.”[5]

**Beyond Measure**—the complete past and present medical bills and trauma borne by Americans impacted by the trans-generational consequences of uranium contamination.

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.[6] The same study found equally high concentrations in Navajo newborns and noted they continued to be exposed to uranium during their first year of life.

## 1 Uranium mines near the Grand Canyon deplete and pollute groundwater

The shafts of both Pinenut (North Rim in 2009) and Canyon uranium mines (South Rim starting 2013 to present), have flooded with water, exposing the water to radioactive ore. At Canyon Mine, nearly 9 million gallons flooded the mine in 2017. That increased to nearly 10 million gallons in 2018, and exceeded 10 million gallons in 2019. Mine flooding means a company must dispose of millions of gallons of toxic and radioactive water. Not only did regulators assume flooding like this wouldn't occur when Canyon Mine was permitted, but mine flooding introduces a significant hazard for the spread of contamination and underscores the danger of allowing mining in this region. Importantly, flooding is not guaranteed to cease in perpetuity post-closure. Any man-made plug of groundwater flow will eventually fail.

- Water from Pinenut Mine's mine shaft was contaminated with uranium at 80 times the EPA standard for drinking water (2,410 micrograms per liter (ug/L). The EPA drinking-water standard is 30 ug/L.
- Water from Canyon Mine's shaft was found to contain uranium levels at three times (90 ug/L) the EPA standard.
- Groundwater connectivity and flow in the region is especially difficult to predict, effectively eliminating guarantees against contamination.

## 2 Groundwater pollution could harm the Grand Canyon's springs and be impossible to clean up

- The geology around the Grand Canyon is highly fractured and the region's groundwater flow is difficult to predict. Underscoring this reality, preliminary research north of the Grand Canyon found that an injected test dye travelled more than 6000 vertical feet and nearly 22 horizontal miles in less than a month.[7] So whether a mine is on the rim or several miles from it, the potential for serious and lasting impacts is real.
- Mines near the Grand Canyon are not required to install sufficient groundwater monitoring systems to detect contamination if it occurs or to know where that contamination is traveling. This also makes it easy for a company to claim there's no evidence of mine contamination.

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- Cleaning up deep aquifer pollution thousands of feet underground would be, at best, extraordinarily expensive, but most likely impossible.

## 3 Soil contamination near mines

- USGS research[8] revealed that mean concentrations of uranium and other trace element contaminants in surface soils, both inside and outside Grand Canyon-area mine perimeters, were higher in mined areas than in unmined areas in the region. According to USGS: "Risk to wildlife posed by inorganic constituents was not eliminated regardless of the reclamation status of the formerly mined areas. . . Concentrations of arsenic, cadmium, copper, lead, nickel, thallium, uranium, and zinc were increased in weathered mine wastes."
- In December 2015, contaminated soils 2–3 times above normal background (5.33-8.52 parts per billion) were discovered around Pinenut Mine.
- A 1984 flash flood washed uranium ore from the Hack Canyon mines into Kanab Creek,[9] a major tributary of the Colorado River within the Grand Canyon.
- USGS research published in 2017[10] revealed that wind is transporting dust contaminated with uranium, thallium, lead, nickel, copper, and arsenic downwind to vegetation outside the Canyon Mine perimeter. The mineshaft was drilled to the level of the target ore in 2016,[11] but actual mining still has yet to commence.

## 4 The Grand Canyon's uranium deposits aren't needed for domestic energy security or defense use

- The Grand Canyon region holds less than 1% of the hundreds of millions of pounds of known, unmined uranium reserves in the U.S.[12]

- U.S. uranium reserves as a whole are simply fewer and of far lower quality than reserves in other countries. The U.S. ranks 15th out of the top 16 uranium-producing countries in the world, with roughly 1% of global uranium reserves.[13]

- If Russia or China cut off uranium supplies, the reality of uranium reserve quality in the U.S. means demand would increase for the far higher-quality uranium in Canada and Australia.[14]

- The U.S. already has enough enriched uranium stockpiled to meet military needs for decades to come; improving technology only strengthens that outlook.

    - An October 2015 Department of Energy report shows tritium supplies—a fuel for nuclear warheads partly derived from nuclear fission of uranium—are sufficient through at least 2040, while other defense uses may be sated until 2060.[15]

    - A more recent study shows that downblending (processing highly enriched uranium into any form of uranium product that contains less than 20% uranium-235) of excess weapons-grade uranium could supply enough low-enriched uranium for tritium production through at least 2060.[16]

    - The Union of Concerned Scientists said that the U.S. may never need additional uranium for military purposes if it continues to reduce its nuclear weapons stockpile and converts its naval reactors to use low-enriched, rather than highly enriched uranium.[17]

    - The former president of the World Nuclear Association has observed, "both Russia and the United States have stockpiles of highly enriched uranium from post-Cold War arms reductions. Neither country need ever fear a shortage of uranium, for weapons or electricity." [18]

## Uranium Resources by Country in 2017

| Country | tonnes U | percentage of world |
|---|---|---|
| Australia | 1,818,300 | 30% |
| Kazakhstan | 842,200 | 14% |
| Canada | 514,400 | 8% |
| Russia | 485,600 | 8% |
| Namibia | 442,100* | 7% |
| South Africa | 322,400 | 5% |
| China | 290,400 | 5% |
| Niger | 280,000* | 5% |
| Brazil | 276,800 | 5% |
| Uzbekistan | 139,200* | 2% |
| Ukraine | 114,100 | 2% |
| Mongolia | 113,500 | 2% |
| Botswana | 73,500* | 1% |
| Tanzania | 58,200* | 1% |
| USA | 47,200 | 1% |
| Jordan | 43,500 | 1% |
| Other | 280,600 | 4% |
| **WORLD TOTAL** | **6,142,600** | |

Source: World Nuclear Association. Identified resources recoverable (reasonably assured resources plus inferred resources), to US$ 130/kg U, 1/1/17, from OECD NEA & IAEA, *Uranium 2018: Resources, Production and Demand* ('Red Book'). The total recoverable identified sources to US$ 260/kg U is 7.989 million tonnes U.

# Footnotes

[1]$1.7 billion is the sum of settlements and other specific cleanup costs we were able to find ($985 million Kerr-McGee settlement in 2014, $600 million EPA settlement in 2017, $13.2 million EPA settlement in 2015, $85 million contract to assess 30 sites on Navajo nation in 2017, $15 million so far to clean up Orphan Mine in Grand Canyon National Park). Details about Navajo Nation cleanup can be found at: https://www.epa.gov/navajo-nation-uranium-cleanup/cleaning-abandoned-uranium-mines. Accessed 16 December 2019. Orphan Mine cleanup costs can be found at: http://www.intermountainhistories.org/items/show/62. Accessed 16 December 2019.
[2]"Reclaiming the Land: History of Uranium Mill Tailings Clean-up." *Southwest Research and Information* Center. http://www.sric.org/voices/2004/v5n3/umtrca.php. Accessed 16 December 2019.
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[4]Hearing on H.R. 644. Grand Canyon Watersheds Protection Act of 2009 before the House Subcommittee on National Parks, Forests, and Public Lands. July 21, 2009. 111th Cong. Testimony of David Kreamer, PhD, Dept. of Geoscience, University of Nevada, Las Vegas. Page 39. https://www.govinfo.gov/content/pkg/CHRG-111hhrg51143/pdf/CHRG-111hhrg51143.pdf. Accessed 16 December 2019.
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[10]Hinck, J.E., Cleveland, D., Brumbaugh, W.G. et al. "Pre-mining trace element and radiation exposure to biota from a breccia pipe uranium mine in the Grand Canyon (Arizona, USA) watershed." Environ Monit Assess 189: 56. 13 January 2017. https://doi.org/10.1007/s10661-017-5765-1. Accessed 16 December 2019.
[11]The Canyon Mine Plan of Operations states the ore level is between 900 and 1400 feet from the surface. According to Arizona Department of Environmental Quality Aquifer Protection Permit annual reports, the mine shaft, which is dug next to the breccia pipe, reached 900 feet in 2016. For ore level, see pages 8-9 of the plan of operations: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd475369.pdf. Accessed 16 December 2019.
[12]According to USGS (https://pubs.usgs.gov/sir/2010/5025/pdf/sir2010-5025_availability.pdf), reserves (versus not necessarily mineable "deposits" or "endowments") exist at nine mines within the withdrawal area. Of those nine mines, Canyon, Arizona 1, EZ 1, and EZ 2 could feasibly operate (the rest are undergoing reclamation). Those four mines contain 3,320,656 lbs of reserves. Divide that by the latest total domestic reserves estimated by EIA of 1,227 million lbs and that means 0.27% of nationwide reserves are present in the mining ban area. https://www.eia.gov/uranium/reserves/. Accessed 16 December 2019.
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