

Summary of USGS Contamination Findings

[USGS Report](#) - Hydrological, Geological, and Biological Site Characterization of Breccia Pipe Uranium Deposits in Northern Arizona (February 2010)

The USGS found elevated radioactivity at every mining site they visited relative to a nearby un-mined watershed with similar geology. Groundwater samples from many of those mines also exhibited uranium concentrations above EPA standards, whereas the natural background for dissolved uranium in Grand Canyon's watershed is far below EPA standards.

The USGS consistently found elevated radioactivity and uranium where mining had occurred in the past.

1. The Orphan Mine

“Uranium concentrations in samples from Salt Creek Spring (average, 30.6 µg/L) exceeded U.S. Environmental Protection Agency (USEPA) PMCL of 30 µg/L (fig. 9). One sample from Horn Creek had a concentration only slightly lower than the PMCL (29.2 µg/L). Previous studies have found high gross-alpha-particle activity in samples from Salt Creek Spring and Horn Creek (Monroe and others, 2005; Bills and others, 2007). An abandoned uranium and copper mine (Orphan Lode Mine) in the vicinity of Salt Creek and Horn Creek is the likely source of this high activity (plate 1) (Monroe and others, 2005; Grand Canyon National Park, 2006; Bills and others, 2007).” (Hydrology chapter at 156).

“Horn Creek and Horn Spring were sampled three times in 1994–95; concentrations ranged from 18.9 to 67.8 µg/L (appendix 4). The Horn Up site was sampled four times in June and July 2002; concentrations ranged from 312 to 400 µg/L (appendix 4). Two samples from the Horn West site, both collected in July 2002, had uranium concentrations of 135 and 202 µg/L. (Id. at 181.)

“Horn Creek Spring is located in the same drainage and downgradient from the Orphan Mine. Several investigators have linked the elevated dissolved uranium in Horn Creek with mining activity in the area (Monroe and others 2004; Grand Canyon National Park, 2006; and Bills and others, 2007). (Id. at 184.)

2. The Canyon Mine

“A small number of water samples from wells also had elevated uranium concentrations. The highest is from the Canyon Mine Well (appendix 4, figs. 9B, 12, 14, table 8). Eleven samples reported from this well had concentrations ranging from 4.1 µg/L in 1987 to 309 µg/L in 1989.”

3. The Hermit Mine

“Water samples collected in the Hermit Mine shaft for the Arizona Department of Environmental Quality in 1988 and 1989 range from 20 to 42 µg/L (Energy Fuels Nuclear, 1995b)... the Hermit Mine sump concentrations ranged from 3,310 to 36,600 µg/L (the highest reported value of any sample type in this study) in 1989–90 (figs. 9A, 13). These high concentration mine shaft and sump waters may be sources of dissolved uranium for nearby sites if mine water is capable of entering the regional groundwater flow system.” (Id. at 184.)

4. The Pigeon Mine

“The Pigeon Mine sump had a single reported value of 170 µg/L in 1986.” (Id. at 184.)

5. The Kanab North Mine

“Mined waste rock, uranium ore, pond sludge, and local wind- and water-dispersed fine particles on the unreclaimed mine site (all of which contained high concentrations of uranium and other trace element constituents such as arsenic) were exposed to the ambient environment for about 20 years at the Kanab North partially mined site. Offsite, only one soil sample approximated background uranium concentrations, suggesting that dispersion extends beyond the limit of sampling, about 420 feet. Soil samples (n=20) collected within about 420 feet outside of the fenced mine site had an average uranium concentration of 27.8 parts per million (more than 10 times background concentration) and arsenic concentration of 12 parts per million. Wind appears to be the dominant process dispersing material offsite.” (Effects chapter at 7.)

6. All sites

In total, the report found a total of 41 water samples exceeding EPA water quality standards.

“Fifteen springs and 5 wells in the region contain concentrations of dissolved uranium that exceed the U.S. Environmental Protection Agency maximum contaminant level for drinking water and are related to mining processes.” (Hydrology chapter at 194).

“Elevated radioactivity is evident at all sites (except the Jumpup Canyon background area). The highest microR measurements were found at the Kanab North Mine (a partially mined site with abundant mined waste rock at the surface inside a fenced site perimeter), followed by the Pigeon site and then the Hack Mine complex (within a half mile downstream of Hack 1 Mine). Much lower microR measurements were recorded at the Hermit site. Very little radiation above background concentrations was found at the unmined Kanab South site, except at a weakly uraniferous limonite-stained outcrop. Radioactivity rapidly decreases within 400 feet outside of the fenced area of the Kanab North site. Similarly, radioactivity notably decreased within a few feet of anomalous point sources (ore and waste-rock fragments) at reclaimed Pigeon, and Hack 1, 2, and 3 sites.” (Effects chapter at 8).