RED OIL
Resisting Environmental Destruction On Indigenous Lands
An Alaska Native Grassroots Network

ACAT
Alaska Community Action on Toxics

Uranium Mining

Introduction

Uranium is a naturally occurring, unstable element that continually breaks down into other elements called "decay products," or "radionuclides." As uranium breaks down, it releases a type of radiation known to cause cancer.[1] There are many decay products of uranium, and it can take billions of years for it to fully breakdown into a non-radioactive substance. Uranium is mined for several reasons, but most uranium is used for nuclear energy or weapons, while small amounts are used to create dyes and inks and as a component of some industrial processes.

Uranium mining

Most uranium mining utilizes conventional open pit, or underground methods depending on the location and quality of the ore. As with other forms of mining, significant amounts of waste rock are created during the mining operation. Typically this waste rock has elevated concentrations of uranium and therefore radiation contamination. Large areas are disturbed during open pit mining operations; hundreds of acres can be covered with waste rock from mining. Less common methods of uranium mining include directly leaching uranium from rock without removing it, called *in situ leaching*. In this case uranium is released from rock into the ground water using a solvent, and then pumped to the surface.[2]

Once uranium has been removed from the ground as ore, it must be milled and extracted from the ore. This process uses multiple toxic chemicals including industrial solvents and strong acids and bases. The result of this process yields a collection of uranium compounds known as "yellow cake uranium" as well as significant amounts of mine tailings and contaminated waste water. Mine tailings can contain numerous radioactive elements and continue to contaminate the environment long after the mine has been closed.[3] It is estimated that mine tailing retain 85% of their original radioactive energy.[4]

Milling and processing of uranium ore have been associated with contamination of the environment as well. Contamination can be found at levels that are dangerous to humans, wildlife, and agricultural animals.[5] Uses of refined uranium include nuclear energy and weapons, both of which have significant environmental impacts of their own. Nuclear weapons produce catastrophic environmental damage, and release large amounts of radionuclides that can disperse globally.[6] Nuclear power produces radioactive waste material that must be stored indefinitely. The United States still has no comprehensive plan for permanent disposal of nuclear waste.[7]

Health Effects of Uranium

The primary health concern of Uranium mining is exposure to cancer-causing radiation. In addition to causing cancer, radiation may cause genetic damage, disrupt hormone levels, and reduce blood cell counts.[8] One of the most troublesome aspects of radiation exposure during mining is that symptoms of diseases may not arise until decades after exposure.[9]

Historically, uranium miners have had significantly greater chances of developing cancer. A review of literature on uranium mining and cancer revealed that uranium workers' risk of developing lung cancer is 2-5 times greater than average. Even living in close proximity to uranium mining operations has been known to cause an increase in negative health effects. The cancer rate among Navajo increased dramatically during the period when uranium mining was allowed on Native lands. The Navajo have since banned uranium mining due to its adverse effects on the environment and human health.[10]

Uranium is known to cause kidney disease in animal studies, although it is not clear whether chronic low level exposures can cause this effect in humans.[11] High levels of uranium in drinking water (approximately 1,000 µg/L) have been shown to cause kidney damage in people.[12]

Routes of Exposure

There are several ways in which people can be exposed to radiation associated with uranium: through radioactive radon gas in the air, through inhalation of contaminated dust, or through ingestion of water, dust, plants and animals containing radionuclides.

One of the decay products of uranium is radon, a radioactive gas that causes cancer (as do other uranium decay products). Radon concentrations are likely to be higher near uranium deposits. Radon is an especially serious health hazard because it can accumulate in residential buildings or enclosed spaces such as mine shafts.[13] According to the National Cancer Institute radon is the second leading cause of lung cancer in the U.S.[14] The majority of historical lung cancer cases among uranium miners are thought to have been caused by breathing radon.

In addition to air contamination, another major concern is the presence of radioactive substances in water. After uranium is exposed to oxygen, whether in water or air, it easily dissolves in water. Radium and radon, radioactive breakdown products of uranium, are highly soluble in water. Uranium is mobile in water of any pH, and acid mine drainage doesn't need to be present in order for uranium to contaminate local waters. According to the EPA, "Waters affected by uranium mining may be on, adjacent to, or at some distance from a mine or mines" and "the periods of high precipitation...may be sufficient to result in eventual migration of radionuclides into groundwater or surface water bodies, soils, and make them available for uptake in vegetation." Radioactive contamination of water increases the likelihood that contamination will extend beyond just a mining site because radionuclides may be transported in surface waters. In 2008, 21 drinking water wells within the Navajo Nation were found to be contaminated with unsafe levels of radioactive contamination that resulted from uranium mining.[15]

Direct exposure to radioactive substances including ingestion or inhalation of dusts is another serious concern. As with other forms of mining, dust is a significant source of toxic contamination. Dust particles may contain numerous toxic substances including radioactive elements.[16] Uranium in dust may travel away from the mine site and later be incorporated into local vegetation or deposited in waterways and soils.[17,18]

As with other mines, there is the potential for acid mine drainage during or after uranium mining.[19] In addition to the threat of radionuclide contamination, acid mine drainage would present additional environmental problems including destruction of wetlands and releasing toxic metals into the environment.

Additionally, mine tailings and waste rock that remain at the mine site will continue to release toxic substances. Radioactive elements and toxic chemicals are more easily dispersed into water and air from mine tailings than from the original underground ore. Mine tailings also continually release radioactive radon gas into the air.

Not only are radionuclides a direct threat to people exposed to them during mining, but they are also known to accumulate in Arctic food chains. This is especially troublesome for Alaska Natives who rely on local plants and animals for subsistence. Traditional Native foods such as caribou and moose have elevated levels of radionuclides.[20] Uranium mining could increase the risk of exposure to cancer-causing radiation for Alaska Native populations who are already at risk.[21] Additionally, disruption of the environment by mining operations could decrease the availability of traditional subsistence foods. Lack of access to traditional food sources can have drastic effects on the health and cultural prosperity of Alaska Natives.[22]

Due to ongoing environmental degradation and adverse human health effects caused by historic uranium mining, in 2005 the Navajo Nation enacted a law to ban all uranium mining or processes on Navajo lands. The law was the first of its kind.

Proposed mines in Alaska

Bokan Mountain

U-core Uranium proposes to develop the Bokan Mountain uranium mine on the southern edge of the Alaska panhandle, approximately 38 miles from Ketchikan and even closer to the village of Kassan.[23] If permitted, U-core would develop 19 square miles within the Tongass National Forest on Prince of Wales Island, including the area of the abandoned Ross Adams uranium mine. The proposed mine area has widespread, highly radioactive veins. Although the veins themselves tend to be small, they have high concentrations of uranium and thorium, a decay product of uranium. At present, the mine site is contaminated from previous uranium mining that occurred between 1957 and 1971. Radiation levels on the site range up to 100 times the average for the region, and surface water contamination includes radon, arsenic and lead.[24] It clear that Uranium mining has already contaminated the landscape around the proposed Bokan Mountain mine, further uranium mining would release more toxic metals and radionuclides into the Arctic environment.

Boulder Creek

Triex Minerals proposes to develop the Boulder Creek uranium mine approximately 31 miles north of the Native village of Elim. The area is composed of 143 state mining claims totaling more than 22,490 acres of land. The uranium deposit is associated with molybdenum and arsenic.[25] Both uranium and arsenic are easily leached from rock by water, and disturbing the environment with a large scale mining operation could potentially release these toxics materials. The soils in the region are already contaminated with uranium—concentrations as high as 145 ppm uranium have been found. Mining activities are likely to increase the area and the amount of uranium contamination. If permitted the mine would be in close proximity to the Tubutulik River. Residents of Elim and other local villages are heavily dependent upon subsistence resources,[26] many of which are from the watershed that would be affected by development. Environmental destruction associated with mining activities could have significant effects on the health of people and safety of local traditional food sources.

Uranium mining in Alaska poses direct threats to the environment and local people. The environmental impacts of uranium mining are especially important in light of the subsistence way of life of many Alaskan Natives. The environmental degradation associated with uranium mining can impact not only the immediate ecosystems, but also the health of individuals and the cultural prosperity of villages. The uranium mining industry has a long history of degrading Native lands, resources, and the health of Native people. Because of these factors, Alaskan Natives should be involved in all aspects of mine scoping, analysis, planning, development, and reclamation.

REDOIL
PO Box 74667
Fairbanks, AK 99707
Tel: (907) 750-0188
www.ienearth.org/redoil.html

ACAT
505 W. Northern Lights, Suite 205
Anchorage, AK 99503
Phone: (907) 222-7714
Fax: (907) 222-7715
www.akaction.org

---

[1] Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological profile for uranium. Available: http://www.atsdr.cdc.gov/toxprofiles/tp150.html
[2] U.S. Environmental Protection Agency. 2008. Technical Report on Technologically Enhanced Naturally Occurring Radioactive Materials from Uranium Mining. Volume 1: Mining and Reclamation Background. Available: http://www.epa.gov/rpdweb00/docs/tenorm/402-r-08-005-voli/402-r-08-005-v1.pdf
[3] Au WW, McConnell MA, Wilkinson GS, Ramanujam VMS, Alcock N. 1998. Population monitoring: experience with residents exposed to uranium mining /milling waste. *Mutation Research* 405:237–245
[4] AMAP. 2009. Arctic Pollution. Arctic Monitoring and Assessment Program. Olso Norway. Available: http://www.amap.no/
[5] Human Health and Environment Damages from Mining and Mineral Processing Wastes. 1995. Office of Solid Waste, U.S. Environmental Protection Agency. Available: http://www.epa.gov/osw/nonhaz/industrial/special/mining/minedock/damage/index.htm
[6] Simon SL, Bouville A, Beck HL. 2004. The geographic distribution of radionuclide deposition across the continental US from atmospheric nuclear testing. *Journal of Environmental Radioactivity* 74:91–105
[7] United States Nuclear Waste Technical Review. 2009. Board Survey of National Programs for Managing High-Level Radioactive Waste and Spent Nuclear Fuel A Report to Congress and the Secretary of Energy. Available: http://www.nwtrb.gov/reports/FINAL_NWTRB_110609.pdf
[8] C. Stephens and M. Ahern, 2001. "Worker and Community Health Impacts Related to Mining Operations Internationally: A Rapid Review of the Literature. Available: http://www.iied.org /mmsd/mmsd_pdfs/worker_community_health_impacts _literature_review.pdf.
[9] Stephens C, Ahern M. 2001. Worker and Community Health Impacts Related to Mining Operations Internationally A Rapid Review of the Literature. *Mining, Minerals and Sustainable Development* No. 25:1-59
[10] Brugge D, Goble R. 2002. The History of Uranium Mining and the Navajo People. *American Journal of Public Health* 92(9):1410-1419
[11] Kurttio P, Harmoinen A, Saha H, Salonen L, Karpas Z, Komulainen H, Auvinen A. 2006. Kidney toxicity of ingested uranium from drinking water. *Am J Kidney Dis* 47(6):972-82.
[12] Magdo HS, Forman J, Graber N, Newman B, Klein K, Satlin L, Amler RW, Winston JA, Landrigan PJ. 2007. Grand rounds: nephrotoxicity in a young child exposed to uranium from contaminated well water. *Environmental Health Perspectives* 115(8):1237-41
[13] Environmental Studies of Mineral Deposits in Alaska. 1996. United States Geological Survey bulletin 2156. Available: http://pubs.usgs.gov/bul/b2156/b2156.pdf
[14]National Cancer Insitute, National Institutes of Health. 2004. Radon and Cancer: Questions and Answers. Available: http://www.cancer.gov/templates/doc.aspx?viewid=9F80B377-3962-4898-BD71-D1EBCEE2D32D
[15] U.S. EPA. 2009. Addressing Uranium Contamination in the Navajo Nation. Available: http://www.epa.gov/region09/superfund/navajo-nation/index.html
[16] Petavratzi E, Kingman S. Lowndes I. 2005. Particulates from mining operations: A review of sources, effects and regulations. *Minerals Engineering* 18:1183–1199
[17] Bollhöfer A, Honeybun R, Rosman K, Martin P. 2006. The lead isotopic composition of dust in the vicinity of a uranium mine in northern Australia and its use for radiation dose assessment. *Science of the Total Environment* 366:579–589
[18] Marguí E, Iglesias M, Queralt I, Hidalgo M. 2006. Lead isotope ratio measurements by ICP-QMS to identify metal accumulation in vegetation specimens growing in mining environments. *Science of the Total Environment* 367:988–998

[19] Fernandes HM, Franklin MR, Veiga LH. 1998. Acid rock drainage and radiological environmental impacts. A study case of the Uranium mining and milling facilities at Pocos de Caldas. *Waste Management* 18:169-181

[20] Stranda P, Howard BJ, Aarkrog A, Balonov M, Tsaturov Y, Bewers JM, Salo A, Sickel M, Bergman R, Rissanen K. 2002. Radioactive contamination in the Arctic-sources, dose assessment and potential risks. *Environmental Radioactivity* 60:5–21

[21] Thomas P, Gates T. 1999. Radionuclides in the Lichen–Caribou–Human Food Chain near Uranium Mining Operations in Northern Saskatchewan, Canada. *Environmental Health Perspectives* 107:527–537.

[22] Kuhnlein HV, Chan HM. 2000. Environment and Contaminants in Traditional Food Systems of Northern Indigenous Peoples. *Annu Rev Nutr* 20:595–626

[23] Ucore Uranium: Bokan Mountain. Available: http://www.ucoreuranium.com/bokan.asp

[24] Kent and Sullivan. 2004. "2004 Preliminary Assessment/Site Inspection Report: Ross Adams Uranium Mine, Prince of Wales Island, Alaska." Prepared for USDA Forest Service, Alaska Region.

[25] Triex minerals. Boulder Creek Property. Available: http://www.triexminerals.com/s/BoulderCreek.asp

[26] Ahmasuk A, Trigg EW, Magdanz JS, Robbins B. 2007. North Pacific Research Board Project Final Report Project #643 Bering Strait Region Local and Traditional Knowledge Pilot Project A Comprehensive Subsistence Use Study of the Bering Strait Region.