



Uranium Mines and Mills

Uranium is used as nuclear fuel for electric power generation.

- U.S. mining industries can obtain uranium in two ways: mining or milling.
- Mining waste and mill tailings can contaminate water, soil and air if not disposed of properly.

About Uranium Mines and Mills

Uranium is a natural mineral and has been mined and used for its chemical properties for thousands of years. The U.S. mining industry can retrieve uranium in two ways: by mining rock that contains uranium or by using strong chemicals to dissolve uranium from the rock that is still in the ground. When uranium is near the surface, miners dig the rock out of open pits. Open-pit mining strips away the topsoil and rock that lie above the uranium ore. When uranium is found deep underground, miners must dig underground mines to reach it. The rock is then removed through underground tunnels.

There are three methods for extracting the uranium from the ore: heap-leaching, in-situ leaching and milling.

- **Heap-leaching** is the process of dissolving a chemical by pouring a liquid on it. One example of this type of process is making coffee. Uranium heap-leaching is done by spraying chemicals over piles of crushed rock that contain uranium. Underground drains below the heap collect the uranium-bearing liquid. Once the liquid is collected, it is sent for additional processing to extract the uranium. U.S. miners currently do not use this method.
- **In-situ leaching** (also known as in-situ uranium recovery) is Latin for “in place.” Some uranium is found in rocks that are porous and completely soaked with water underneath the ground. In-situ leaching of uranium is done by pumping chemicals into the groundwater to dissolve uranium from the surrounding rock. The liquid containing uranium is pumped to the surface through wells. The liquid solution is then processed to recover the uranium. Currently, this is the most commonly used mining method in the United States.
- **Milling** is a process that removes uranium from the rock that contains it. Uranium ore is removed from open-pit and underground mines. Once at the mill, the ore is crushed and ground up. Chemicals are added to dissolve the uranium. The uranium is then recovered from the chemical solution. Tailings are the radioactive wastes that are left over from the milling processes. They can contain uranium, thorium,



Uranium Ore.



Aerial view of the Midnite Mine in Washington State. This uranium mine is no longer operating.

radium, polonium, lead, radon and chemical wastes like arsenic and organics. Mill tailings are stored in specially designed ponds called impoundments.

Uranium eventually decays to radium. Radium decays to release a radioactive gas called radon. Open pit uranium milling and in-situ mining sites do not pose a significant radon risk to the public or to miners; the radon disperses into the atmosphere. However, underground mines are a greater radiation hazard to miners. Without precautions, radon can collect in the mineshafts where it is inhaled by miners. The operators of uranium mines must take special precautions to protect miners, such as pumping radon gas out of the mine and replacing it with fresh air. Radon gas vented from uranium mines must not exceed certain limits to protect the public near the mines. It is also necessary for miners to wear respirators that protect their lungs from radioactive dust and radon gas.

In the past, the waste rock produced by underground and open-pit mining was piled up outside the mine. This practice has caused problems on Navajo lands in particular, where more than half of the many small, abandoned uranium mines from the middle of the 20th century and their wastes remain. Wind can blow radioactive dust from the wastes into populated areas and the wastes can contaminate drinking water.

Previously, waste rock and mill tailings were used in some Western mining areas as building materials for homes, schools, roads and other construction. Structures built with waste rock and mill tailings were radon and radiation hazards to anyone spending time in them. People traveling on roads made with waste rock were in danger of breathing radioactive dust. In response to these issues, the 1978 Uranium Mill Tailings Radiation Control Act (UMTRCA) stopped the use of mill tailings in building and construction projects. EPA, Navajo EPA and individual states continue to work together to identify and cleanup or rebuild contaminated buildings and roads.

Rules and Guidance

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

The Uranium Mill Tailings Radiation Control Act (UMTRCA)ⁱ enables EPA to set limits on radiation from mill tailings. The Clean Air Actⁱⁱ also limits the amount of radon that can be released from tailings impoundments and underground uranium mines. Runoff from mines, mills and ore piles is regulated under the Clean Water Actⁱⁱⁱ. The Safe Drinking Water Act^{iv} sets limits for radionuclides in drinking water. Uranium mining and milling sites are cleaned up under the EPA Superfund program.



An abandoned underground uranium mine.



Mine wastes outside the abandoned Davis Uranium Mine in Colorado.

U.S. NUCLEAR REGULATORY COMMISSION (NRC)

NRC licenses and oversees the operations of mills, heaps and in-situ leaching mines. NRC rules for tailings impoundments are based on EPA limits.

THE STATES

Many states have signed formal agreements with NRC to get authority over the licensing and operations at mills and in-situ leaching mines. These states are known as Agreement States.

U.S. DEPARTMENT OF LABOR (DOL), MINE SAFETY AND HEALTH ADMINISTRATION (MSHA)

MSHA enforces safety and health rules at mines and mills. These rules help reduce health hazards and prevent accidents in the nation's mines and mills.

U.S. DEPARTMENT OF ENERGY (DOE)

DOE takes control of closed and reclaimed mills. At the direction of Congress, DOE cleans up mill sites.

U.S. DEPARTMENT OF THE INTERIOR (DOI), BUREAU OF LAND MANAGEMENT (BLM)

BLM manages 262 million acres of land - about one-eighth of the land in the United States. The Bureau manages about 700 million more acres of underground minerals, including uranium mines. The Office of Surface Mining provides funds to many state and tribal agencies for cleaning up uranium mines on their land.

U.S. ARMY CORPS OF ENGINEERS (USACE)

The U.S. Army Corps of Engineers operates the Formerly Utilized Site Remedial Action Program (FUSRAP). Its job is to identify and clean up old, contaminated facilities that supported the federal government in the early years of the nation's atomic energy program. Some of these sites have radioactivity levels above today's regulatory limits. Through the FUSRAP, federal agencies, state and local governments and property owners work together to keep radioactive material on these sites under control. The Corps of Engineers has also assisted EPA and tribes in cleaning up abandoned mines on Native American properties.

What you can do

EPA and other agencies work to protect people and the environment from the uranium mining wastes. You can contact your state geological survey or radiation control office to learn if there are mining wastes in your area.

- **Avoid** mining sites and their abandoned equipment.
- **Do not handle**, dispose of or reuse old equipment or materials from uranium mining sites.

You should never:

- **Swim** in or drink the water from open pit mine lakes.
- **Drink** the water from streams and springs near abandoned uranium mines.
- **Remove** rock or soil from a uranium mine to reuse or as souvenirs.

Where to learn more

You can learn more about radioactive material from uranium mines and mills by visiting the resources available on the following webpage: <http://www3.epa.gov/radtown/uranium-mines-mills.html#learn-more>.

ⁱ http://www.epa.gov/radiation/laws/laws_sum.html#umtrca

ⁱⁱ <http://www.epa.gov/air/caa/peg/>

ⁱⁱⁱ <http://www2.epa.gov/laws-regulations/summary-clean-water-act>

^{iv} <http://water.epa.gov/lawsregs/rulesregs/sdwa/>