



SEARCH



- NUCLEAR REACTORS
- NUCLEAR MATERIALS
- RADIOACTIVE WASTE
- NUCLEAR SECURITY
- PUBLIC MEETINGS & INVOLVEMENT
- NRC LIBRARY
- ABOUT NRC

PRINT

Home > Nuclear Materials > Uranium Recovery > Extraction Methods > **Conventional Uranium Mills**

URANIUM RECOVERY (EXTRACTION) METHODS

- Conventional Uranium Mills**
- In Situ Recovery Facilities
- Heap Leach and Ion-Exchange Facilities
- Comparison of Conventional Mill, Heap Leach, and ISR Facilities

Conventional Uranium Mills

Conventional milling is one of the two primary [recovery methods](#) that are currently used to extract [uranium](#) from mined ore. A conventional uranium mill is a chemical plant that extracts uranium using the following process:

1. Trucks deliver uranium ore to the mill, where it is crushed into smaller particles before being extracted (or leached). In most cases, sulfuric acid is the leaching agent, but alkaline solutions can also be used to leach the uranium from the ore. (In addition to extracting 90 to 95 percent of the uranium from the ore, the leaching agent also extracts several other "heavy metal" constituents, including molybdenum, vanadium, selenium, iron, lead, and arsenic.)
2. The mill then concentrates the extracted uranium to produce a material, which is called "yellowcake" because of its yellowish color.
3. Finally, the yellowcake is transported to a [uranium conversion](#) facility, where it is processed through the [stages of the nuclear fuel cycle](#) to produce fuel for use in nuclear power reactors.

Conventional mills are typically located in areas of low population density, and they process ore from mines within a geographic radius of 50 kilometers (30 miles). Most conventional mills in the United States are in [decommissioning](#) or have already been decommissioned. (For more detail, see [Uranium Recovery Sites Undergoing Decommissioning](#).)

Although mining operations are regulated by the Office of Surface Mining, the U.S. Department of the Interior, and the individual States where the mines are located, the U.S. Nuclear Regulatory Commission (NRC) regulates conventional milling operations under Title 10, Part 40, of the *Code of Federal Regulations* (10 CFR Part 40), "Domestic Licensing of Source Material." As defined in that regulation, uranium milling is any activity that produces [byproduct material](#). Like Section 11e(2) of the *Atomic Energy Act*, 10 CFR Part 40 defines byproduct material as "...the [tailings](#) or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its [source material](#) content." However, 10 CFR Part 40 expands upon this definition by adding, "...including discrete surface wastes resulting from uranium solution extraction processes." [In situ recovery facilities](#) perform uranium milling under this expanded definition.

At the heart of the NRC's regulatory definition of uranium milling, is the concept of the mill tailings produced by the extraction and concentration of uranium. Mill tailings are the fine-grained, sandy waste byproduct material that remains after the milling process has extracted and concentrated the uranium from the ore. Mill tailings are typically created in slurry form during processing, and are then deposited in an impoundment or "mill tailings pile," which must be carefully regulated, monitored, and controlled. This is because the mill tailings contain the heavy metal ore constituents, as well as a residual amount of radium, which is produced during the radioactive [decay](#) of uranium. The radium, in turn, decays to produce a radioactive gas, known as [radon](#), which may then be released to the environment. Because this radon is a radioactive gas, which may be inhaled and deposited in the respiratory tract, some researchers have suggested that its presence in confined areas (such as mines or homes) may be associated with an increased risk of lung cancer. (For additional information, see [Uranium Mill Tailings](#) and the [Backgrounder on Uranium Mill Tailings](#).)

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[DIGITAL GOVERNMENT](#)

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