How Is Uranium Mined in Texas?

The two uranium mining techniques used in Texas are open pit mining and in-situ leaching (ISL). Shallow uranium deposits that occurred above groundwater at depths typically no deeper than 300 feet in Karnes County were mined simply by digging open pits. Most of the open pit mining for uranium occurred in Karnes County, although some occurred in Gonzales, Atascosa, Live Oak, and McMullen counties. Deeper deposits in Brooks, Kleberg, Jim Hogg, Duval, Webb, Bee, Live Oak, and Karnes counties have been mined using ISL techniques.

In-situ leaching (ISL) involves injecting fluids into the ground to dissolve minerals, then pumping the fluids to the surface where they are processed to recover the minerals. ISL for uranium reverses the process by which nature formed the uranium deposits. A leaching solution is injected into the uranium-bearing zone through injection wells arranged in a pattern designed to efficiently recover the uranium. The leaching solution circulates through the uranium-bearing zone and dissolves the uranium. The uranium-bearing solution is then recovered through production wells (see Figure 1). Heap leach mining operators used low concentration sulfuric acid during the 1960's to the mid 1980's. Uranium in-situ miners tried low concentration sulfuric acid at South Texas in-situ recovery sites, but it did not work well because of the high ion exchange clays and carbonate in uranium bearing formations. In-situ miners such as IEC and USX added ammonium carbonate to oxygen or hydrogen peroxide solutions in the 1970s and early 1980's in South Texas. Most uranium miners stopped using ammonium in the early to mid-1980's in favor of sodium carbonate for uranium complexing because ammonium carbonate was too costly for aquifer restoration. More recently, the leaching solution typically consists of groundwater supplemented with oxygen and bicarbonate ions, which is safer and better for the environment. At the surface, this solution is processed to remove the uranium. The water is then refortified with oxygen and bicarbonate ions and reused for more ISL.

Exploration drilling and open pit mining of uranium are regulated by the Railroad Commission of Texas (RRC). There are no longer any active open pit uranium mines in Texas. Most of the old open pit mines and mill sites have been reclaimed through a program managed by the RRC.

ISR and uranium processing plants are regulated by the Texas Commission on Environmental Quality (TCEQ).

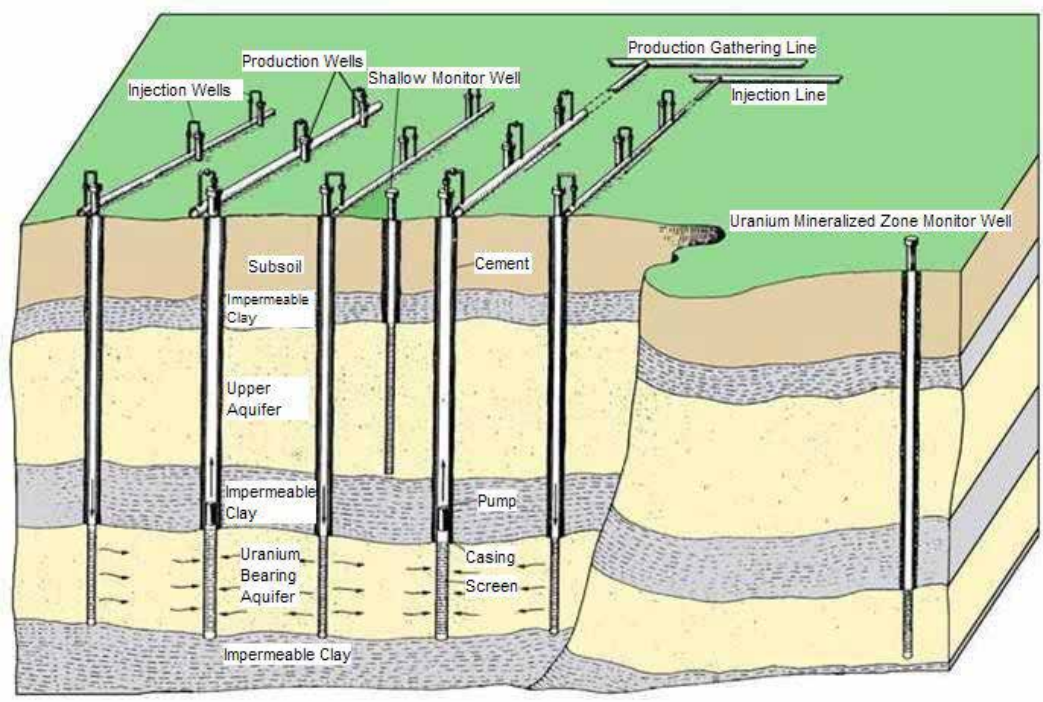

Figure 1. In-Situ Uranium Recovery Mining Operation

Resources and Useful Links

- TCEQ Source Material Recovery and By-Product Material Disposal, https://www.tceq.texas.gov/permitting/radmat/uranium/uranium.html
- TCEQ In-Situ Leach and Conventional Uranium-Recovery Methods, https://www.tceq.texas.gov/permitting/radmat/uranium/process.html
- TCEQ Regulations for Class III Wells, https://www.tceq.texas.gov/permitting/radmat/uic_permits/UIC_Guidance_Class_3.htmlhttps://texreg.sos.state.tx.us/public/readtac%24ext.ViewTAC?tac_view=5&ti=30&pt=1&ch=331&sch=E&rl=Y
- U.S. Environmental Protection Agency Class III Injection Wells for Solution Mining, https://www.epa.gov/uic/class-iii-injection-wells-solution-mining
- U.S. Nuclear Regulatory Commission (NRC) NUREG 1569: *Standard Review Plan for In Situ Leach Uranium Extraction License Applications,* https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1569/sr1569.pdf
- U.S. NRC NUREG 6870: *Consideration of Geochemical Issues in Groundwater Restoration at Uranium In-Situ Leach Mining Facilities,* https://www.nrc.gov/reading-rm/doc-collections/nuregs/contract/cr6870/index.html

· Texas A&M AgriLife Extension Service (TAES) *Drinking Water Problems: Radionuclides* (B-6192), https://twon.tamu.edu/wp-content/uploads/sites/3/2021/06/drinking-water-problems-radionuclides.pdf

· Texas Mining and Reclamation Association, https://www.tmra.com/

· RRC: *Information and Statistical Facts on Coal and Uranium Mining in Texas*, 1991, https://www.rrc.texas.gov/media/pmpdhdah/information-and-statistical-facts-on-coal-and-uranium-mining-in-texas-june-1991.pdf

· RRC Surface Mining and Reclamation Division (SMRD), https://www.rrc.texas.gov/surface-mining/

· Smith, Gary, TCEQ Underground Injection Control (UIC) Team, personal communication, June 2009

Other Frequently Asked Questions (FAQs)

For additional FAQs visit the Texas Groundwater Protection Committee's FAQ webpage at https://tgpc.texas.gov/frequently-asked-questions-faqs.