Western Uranium Development: The Next Boom?

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No other element on the periodic table elicits quite as strong a reaction as atomic number 92, uranium. It is the heaviest of all naturally occurring elements and is ubiquitous in nature. Uranium has been mined in the United States since the latter 19th century. Early on, it was used to color glass and ceramic glazes, and to obtain radium, a common byproduct of uranium processing, which was needed in the field of medicine. Development of the atomic bomb by the United States during World War II and growing energy demands following the war led to greatly increased production and use of uranium. In the late 1950s and early 1960s, uranium was in demand for use in nuclear weapons (Shawe and others, 1991). Uranium production in the United States again peaked in the 1970s, due to the increased development of nuclear power, then declined sharply after 1980 because of environmental concerns, health concerns for uranium miners, and the availability of cheaper foreign energy sources.

Currently we find ourselves in another uranium boom cycle driven by demand for nuclear power across Asia, Europe, and Africa, as well as North and South America. Uranium development is gathering momentum through the expansion of global distribution of reactor units (439 operating, 36 under construction, 93 in planning, and 218 proposed). The western United States used to be the world's leader in production of uranium. Now 95 percent of our uranium is imported from Canada, Australia, Kazakhstan, Namibia, Uzbekistan, and Russia.

The U.S. Bottleneck

Western U.S. uranium development is at a bottleneck that is continuing to tighten due to infrastructural impediments and conflicting opinions about its legacy versus current safety standards. But technology and the protection of both worker health and the environment in the U.S. uranium extraction industry have improved in the past decade. The United States will likely see an imminent increase in small-scale conventional (open-pit and underground) mining and processing in the Colorado Plateau, and the continued use of in-situ recovery (ISR, see pages 28 and 30) in the Rocky Mountain and Texas coastal plain regions. Both methods are now highly regulated and monitored by multiple state and federal agencies.

Current U.S. uranium production in the Colorado Plateau comes from conventional mining, but is limited by only one operating uranium mill in Utah. Additional mills are

How Bad Is It?

Uranium can be both chemically and radioactively toxic. Chemically, large amounts of uranium can cause kidney damage in humans. Long-term exposure to radiation from uranium's decay products, especially radium and radon, can cause cancer (uranium itself is not known to cause cancer). Uranium and its decay products enter humans and other mammals primarily by inhalation (such as radon gas or uranium dust in building materials) and ingestion (such as in drinking water).

planned, but permitting times are lengthy. ISR production currently occurs in Wyoming, Nebraska, and Texas; other mines are in the permitting stage in these states as well as Colorado and South Dakota.

No matter how we may feel about nuclear energy or other uses of uranium, the worldwide demand for it is high and uranium mining is going to increase in the Southwest.

Production in New Mexico, where tremendous uranium resources exist, is hampered by the lack of an operating mill and concerns related to groundwater protection, conflicting cultural beliefs, and perceived mine impacts. Even with expanded domestic uranium mining, the United States will continue to have a significant need to purchase uranium in the global market to fulfill current and projected energy requirements.

Then Versus Now

Why, as hydrologists and water managers, do we care about uranium mining? Because no matter how we may feel about nuclear energy or other uses of uranium, the worldwide demand for it is high and uranium mining is going to increase in the Southwest, presenting numerous hydrologic, water chemistry, and policy issues that are important to consider:

- How have regulations for protecting groundwater and remediating mined-out sites changed since the mining boom of the 1970s, when water quality standards for uranium were lacking? How do those differences impact water quality, the development of new mines, and the cleanup of old mines?
- What has happened to the old mining and milling operations that contaminated groundwater?
- How does in-situ mining and uranium recovery actually work from the standpoint of water chemistry, well mechanics, and aquifer properties? In-situ mining is becoming more prevalent because of the types of deposits that are being mined and because it does not generate the large amounts of tailings that conventional practices do. A saturated, confined aquifer with certain ranges of hydrologic properties is essential to making in-situ work, but how is containment of the uranium-bearing fluids ensured?
- How are background water quality levels determined? For old mines now being reclaimed, this is a particular challenge: background uranium data were not collected prior to the start of mining because uranium standards did not exist then. Mineralized areas generally have poor water quality before mining even begins, yet some argue that existing regulations may allow the "contaminated" zone to extend even further once the mines are developed.

These issues are addressed by the following articles, along with background about how uranium deposits are formed and extracted.

Reference

Shawe, D.R., J.T. Nash, and W.L. Chenoweth, 1991. Uranium and vanadium deposits, in The Geology of North America, Vol. P-2, Economic Geology, U.S., Geologic Society of America, pp 103-123.

2007 Uranium Production Statistics

World production

- Total production: 45,500 tons uranium
- 60% of production (27,258 tons) was from three countries:
  - Canada (23%)
  - Australia (21%)
  - Kazakhstan (16%)
- 4% was from the United States (1,800 tons)

Production method

- Conventional underground and open pit: 61%
- In-situ leach: 29%
- By-product: 10%

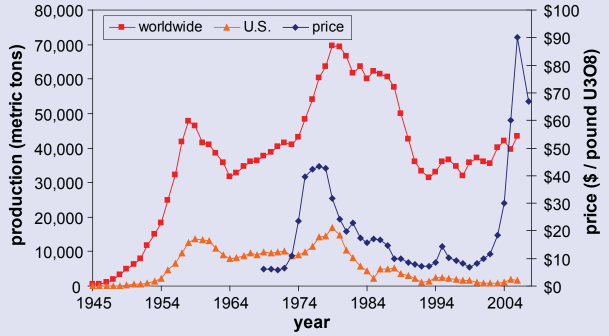
Top known recoverable sources of uranium (tons uranium, percent of world reserves)

- Australia (1.3 million, 23%)
- Kazakhstan (901,000, 15%)
- Russia (602,000, 10%)
- South Africa (480,000, 8%)
- Canada (466,000, 8%)
- United States (377,000, 6%)
- The world's known uranium resources increased 15% from 2005 due to increased mineral exploration.
- Seven companies marketed 85% of the world's uranium mine production.

In the United States

- Six underground and five in-situ leach mines operated, along with just one uranium mill (in White Mesa, Utah)
- 4,000 mines have a history of uranium production
- 104 nuclear reactors provided 19% of U.S. electricity
- Amount of uranium used for nuclear weapons: not published

Worldwide and U.S. Uranium Production Compared to Price
(source: OECD 2006 and 2008)



References

OECD (Organisation for Economic Co-operation and Development), 2006. Forty Years of Uranium Resources, Production and Demand in Perspective. OECD Publishing.

OECD and the Industrial Atomic Energy Agency, 2008. Uranium 2007: Resources, Production and Demand. http://213.253.134.43/oecd/pdfs/browseit/660831E.pdf.

U.S. Energy Information Administration (accessed August 2008): www.eia.doe.gov