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Uranium Mining Is Important for Securing America's Energy Future

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Burdensome regulation, politics, and bad policy hamper access to available energy resources in the United States. The nation can now add uranium to the list of energy resources that local, state, and federal bureaucrats have deemed off-limits, which includes oil in the Arctic, off-shore natural gas, coastal wind, and cellulosic ethanol.

The nation's largest known uranium deposit was discovered in the 1980s on a farm in southern Virginia. The owner of that land has recently explored the possibility of mining the approximately $10 billion worth of uranium believed to be on the site. Despite the fact that uranium has been mined safely around the world for decades, including in New Mexico, Nebraska, Utah, and Wyoming, Virginia bureaucrats have decided to prohibit land owners from even studying the viability of mining.

As the only proven power source that affordably provides large amounts of primarily domestic energy without atmospheric emissions, nuclear energy is a logical choice for a nation struggling to reconcile its energy policy with its economic, environmental, and security objectives. Like other large power generators, nuclear power plants need fuel. In the U.S., that fuel is uranium. As nuclear power expands, it will be critical that uranium resources are accessible when mining can be done in a safe and economical way.

Uranium: A Must-Have for Nuclear Power. To produce the same amount of electricity, nuclear power requires far less fuel than does coal, natural gas, petroleum and other energy sources. Still, some fuel is required.

Uranium is found throughout the world, but quantities sufficient to be mined economically are limited to a few known regions. Canada has the highest grade uranium while Australia has the most. Kazakhstan, South Africa, Niger, Namibia, and Brazil also have significant deposits. The U.S. has about 3 percent–4 percent of the world's known uranium and produces about 4.3 percent of the world's supply despite operating about one-quarter of the world's commercial power reactors.

Natural uranium is critical in the production of electricity through nuclear power. In its natural state, uranium consists of several isotopes. The isotope needed to conduct fission—the process that creates the heat necessary to produce power—is uranium-235 (U-235) and makes up 0.7 percent of naturally occurring uranium. The remainder is primarily uranium-238 (U-238).

However, for fission to be sustained in U.S. light water reactors, the uranium fuel must consist of approximately 3 percent–5 percent U-235. To reach this level, natural uranium must be enriched. Once the correct level of U-235 is attained, the uranium is manufactured into small pellets about the size of a pencil eraser. Each uranium pellet contains as much energy as 150 gallons of oil.[1]

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Increasing Demand for Uranium. Increasing production of nuclear power and higher production efficiency[2] (which results in more fuel usage) inevitably mean a higher demand for uranium. Uranium production from mines eclipsed 39,000 tons in 2006.[3] According to the World Nuclear Association, uranium requirements for fuel reactors could surpass 100,000 tons by 2020.[4] Given that more than half of the world's uranium production comes from three countries, the U.S. faces substantial incentives to increase access to domestic uranium mining.

A nuclear renaissance is emerging worldwide. Countries like the United Kingdom, China, India, and Russia are planning significant expansions of nuclear energy; other nations are also planning new reactors. Indeed, some 35 reactors are under construction today throughout the world. U.S companies are planning to build up to 30 new reactors—though none have actually started construction.

Building all of these reactors would likely put substantial pressure on current uranium supplies. This is one reason why the United States must consider tapping more of its own uranium reserves. One place where that could happen is in Pittsylvania County, Virginia, where a 200-acre farm sits on an estimated 110 million pounds of uranium. This could fuel each of America's 104 nuclear reactors, which provide the U.S. with 20 percent of its electricity, for two years.[5] Regrettably, Virginia banned uranium mining in 1982 and exhibits little inclination to reconsider this needless policy.

Access Denied. Despite rising energy prices, government at all levels continues to deny Americans access to significant portions of the nation's energy resources. These legislative, bureaucratic, and procedural barriers are even more bizarre considering growing calls for energy independence. This affects uranium mining as well as Alaskan oil drilling, off-shore gas exploration, and wind farms.

Ironically, Virginia has a rich history of supporting nuclear power and continues to depend on it today. Its ban on uranium mining demonstrates the impact that anti-nuclear propaganda has had on the population. Virginia gets 38 percent of its electricity from four nuclear reactors and will likely be among the first to build a new reactor in the United States. Beyond that, Virginia hosts a variety of other nuclear-related industries, including the nuclear qualified Newport News naval shipyard, which is one of the nation's only two with that capability.

Virginia will surely not be the only place in the U.S. that attempts to prohibit access to uranium reserves as rising demand spurs exploration activities. Three decades of anti-nuclear propaganda continues to influence the public perception of nuclear power.

Mining Is Expanding Around the World. As noted, uranium is mined safely all over the world, including in several U.S. states. Although existing stocks are meeting current demand along with secondary sources[6], the uranium market could tighten significantly unless additional mines are explored. As new power plants are brought on-line, the U.S. could play a key role in meeting future demand with state and federal policies that allow entrepreneurs to invest in accessing uranium reserves. Of

1. "Power Generation—San Onofre Nuclear Generating Station, FAQs" Southern California Edison, at *www.eia.doe.gov/kids/energyfacts/sources/non-renewable/nuclear.html#Nuclear%20Fuelhttp://www.sce.com/PowerandEnvironment/PowerGeneration/SanOnofreNuclearGeneratingStation/FAQs.htm* (March 19, 2008).
2. Efficiency in this case is in reference to capacity factor, which is a measurement of a reactor's actual power production versus its theoretical maximum capacity.
3. "World Uranium Mining, Nuclear Issues Briefing Paper 41," Australian Uranium Association, July 2007 at *www.uic.com.au/nip41.htm* (March 19, 2008).
4. "The Global Nuclear Fuel Market: Supply and Demand 2005-2030," World Nuclear Association, p. 8, 2005.
5. Anita Kumar, "Uranium Lode in VA is Feared, Coveted," *Washington Post*, January 2, 2008, p. B01, at *www.washingtonpost.com/wp-dyn/content/article/2008/01/01/AR2008010101811.html* (March 19, 2008).
6. In addition to freshly mined uranium, U.S. reactors also run on what are known as secondary fuel sources. This usually consists of highly enriched uranium from Russian warheads that has been diluted to low-enriched levels through a process called downblending. This downblended uranium has provided about one-half of America's nuclear fuel, or 10 percent of all electricity produced, in recent years.

course, federal oversight agencies would still play an important role in protecting public safety.

In 2006, more than half of the world's uranium supply came from Canada, Australia and Kazakhstan, with Canada supplying one-fourth on its own. The U.S. accounted for only 4.24 percent of all uranium production.[7] A decade ago, U.S. mines produced 2,400 tons of uranium and provided 1,100 jobs for American workers; these numbers dropped to as low as 1,100 tons and 321 jobs in 2003.[8] Although production has increased steadily since then, the extent of proven reserves, especially in Wyoming and New Mexico, indicates that the U.S. could greatly contribute significantly to the forthcoming increase in demand for uranium.

Ultimately, estimates of the world's proven reserves are not 100-percent accurate, but figures indicate that Australia (35 percent) and Canada (13 percent) have considerably higher percentages of total world reserves than the United States (3-4 percent). According to the World Nuclear Association, most of the uranium in the United States is categorized as low-cost mining, which is an assessment based on the ease with which it can be mined and the quality of the ore.[9]

Other former uranium mining countries are also considering the possibility of reentering the market; for instance, Finland, which has not mined the ore in 45 years.[10] Finland currently receives 28 percent of its electricity from nuclear power and has a new plant under construction. The country is also implementing a comprehensive program to support its nuclear activities.[11]

Mining Methods. Uranium is mined in one of three ways. Deposits up to 100 meters below the surface are generally mined through open-pit mining. Deeper reserves are normally accessed through underground mining. These underground mines are heavily ventilated to protect workers from radiation exposure. When the ore is of a high enough grade, it is sometimes partially processed underground to further protect workers from radiation exposure.

When conditions are right, a third method called in-situ leaching (ISL) can be very advantageous. This is the method most often used in the U.S. ISL entails dissolving the below-surface uranium into a low-acidic solution and then pumping it to the surface. This permits the extraction of uranium with minimal ground-level disturbance. Groundwater is then cleanly restored after the removal of uranium.[12] Even as the U.S. imports approximately 80 percent of its uranium requirements, technological advancements in ISL have substantially lowered the costs of domestic mining.

Once the ore is mined, it must be milled: the process by which the uranium is separated from other substances. These facilities are sometimes located near the mines.

The milling process depends on the state of the uranium when it is removed from the ground. Unless it was already leached, the ore must be crushed and treated with an acid solution to separate out the uranium. It is then further purified through a number of chemical processes. The resulting uranium-rich liquid is then dried into a powder called uranium oxide concentrate (U3O8), also known as yellow-cake. After further refinement, the yellow-cake is ready for the next steps in the fuel production process, which are separate from the mining/milling processes.[13]

7. Australian Uranium Association, "World Uranium Mining," Nuclear Issues Briefing Paper 41, July 2007, at *www.uic.com.au/nip41.htm* (March 19, 2008).
8. U.S. Department of Energy, Energy Information Agency, "Summary Production Statistics of the U.S. Uranium Industry," at *www.eia.doe.gov/cneaf/nuclear/dupr/usummary.html.*
9. World Nuclear Association, *The Global Nuclear Fuel Market: Supply and Demand 2005-2030*, p. 116.
10. "AREVA to Start Finnish Uranium Exploration in 2008," *Reuters*, February 20, 2008, at *www.reuters.com/article/rbssIndustryMaterialsUtilitiesNews/idUSL2059998520080220* (March 19, 2008).
11. Jack Spencer, "Finland's Rational Approach to Nuclear Power," Heritage Foundation *Backgrounder* No. 2117, March 19, 2008.
12. Kim Jones, Ph.D., P.E., Lee Clapp, Ph.D., and Venki Uddameri, Ph.D., "ISL Uranium Mining: Technological Advances and Challenges and a Proposed Center for In-situ Uranium Production Enhancement and Restoration (CIUPER)," PowerPoint Presentation, Environmental Engineering Texas A&M University-Kingsville, September 21, 2006, at *www.stei.org/Presentations/ISL%20Mining%20Tech%20Advances%20and%20Challenges%20Goliad%209-21-06.ppt#256* (March 19, 2008).

Mining Safety. Safety is and should be a paramount concern with uranium mining, especially in densely populated areas like Pittsylvania County. The reality is that the impact of uranium mining is not much different from the impact of other mining. For one thing, natural uranium is about as radioactive as granite. While there is often more dangerous radium or radon with uranium, these elements are safely managed to protect workers and the environment.[14]

The two global leaders in uranium mining, Australia and Canada, have set the standard in workers' safety. Both countries have implemented strict regulations to control dust, minimize radiation exposure, and control for any significant radon exposure. Radiation doses are well below regulatory limits, according to the World Nuclear Association:

> Radiation dose records compiled by mining companies under the scrutiny of regulatory authorities have shown consistently that mining company employees are not exposed to radiation doses in excess of the limits. The maximum dose received is about half of the 20 mSv/yr limit and the average is about one tenth of it.[15]

In the U.S., most environmental and operational oversight is conducted by the Environmental Protection Agency and the Nuclear Regulatory Commission. These agencies have found that both mining and ISL operations pose a low risk to the public.[16]

Mill tailings, the byproduct of the mining/milling process,[17] are often the focus of safety concerns despite stringent regulation. Like uranium ore itself, the tailings differ with regard to radioactivity. During operations, the tailings are usually stored underwater to protect the environment from danger. Upon the cessation of mining activities, the tailings are safely managed through a number of proven methods, which usually involves returning them underground. Regardless of the method, the outcome is that surface radiation is returned to pre-mining levels. Studies have demonstrated that the impact of tailings on humans is insignificant.[18]

Another point of contention is the environmental footprint that uranium mining can leave. The waste from conventional open-cut mining and milling creates radioactive solid products that could pose a danger. However, these byproducts are managed in a safe and reasonable way that protects public health and the environment. Regardless of the mining method, the sites are restored and revegitated. In the case of ISL, because the only surface disturbance is bore-hole drilling, the site is easily restored to its original condition.

Conclusion. Nuclear energy is becoming globally recognized as a safe, affordable, clean source of energy. Uranium is an important and necessary component of nuclear energy, and firms choosing to pursue uranium mining should not be unnecessarily burdened by fear and government overreach. Uranium mining occurs all over the world, and the United States should realize its potential to increase America's share of the uranium mining sector. It has proven to be safe for workers, the public, and the environment and is critical to the ability of the U.S. to enjoy all of the advantages that accrue from expansion of nuclear power.

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13. Cameco, "U101-Nuclear Energy," May 2006, at *www.cameco.com/common/pdfs/uranium_101/U101.pdf* (March 13, 2008).
14. World Nuclear Association, "Environmental Aspects of Uranium Mining," February 2006, at *www.world-nuclear.org/info/inf25.html* (March 14, 2008).
15. World Nuclear Association, "Occupational Safety in Uranium Mining," March 2006, at *www.world-nuclear.org/info/inf24.html* (March 19, 2008).
16. United States Environmental Protection Agency, "Uranium Mines," April 2006, at *www.epa.gov/radtown/docs/uranium-mines.pdf* (March 19, 2008).
17. U.S. Nuclear Regulatory Commission, *Fact Sheet on Uranium Mill Tailings*, August 2006, at *www.nrc.gov/reading-rm/doc-collections/fact-sheets/mill-tailings.html* (March 13, 2008).
18. Douglas B. Chambers, Leo M. Lowe and Ronald H. Stager, "Long Term Population Dose Due to Radon from Uranium Mill Tailings," The Uranium Institute, Twenty-Third Annual International Symposium 1998, at *www.world-nuclear.org/sym/1998/chambe.htm* (March 14, 2008).