

U.S. uranium mining: An industry in transition

By Susan Gallier

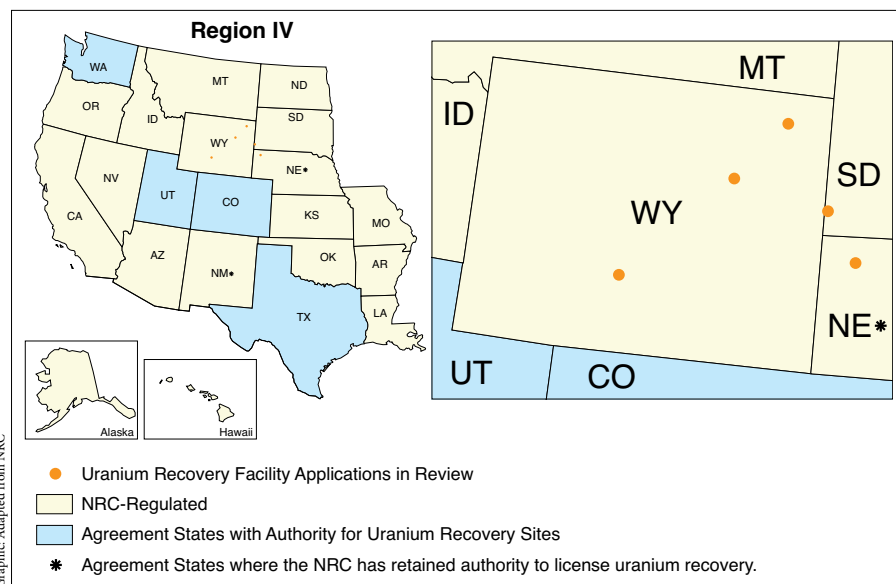
The uranium mining industry in the United States is in a state of flux. The price of uranium isn't budging, and as a result, companies are taking action—selling assets, merging, downsizing, and making strategic development decisions. Meanwhile, the industry is seeking high-grade deposits that can be mined using low-cost methods, and the Nuclear Regulatory Commission is trying to keep pace with rulemakings and licensing. As the industry adapts and prepares for a potential market rebound, all eyes are on the price of uranium.

In July 2007, the industry's prospects were very different. The NRC published a notice of intent to prepare a generic environmental impact statement (EIS) for the licensing of *in situ* recovery (ISR) uranium mining projects. "The U.S. Nuclear Regulatory Commission expects numerous license applications for new *in situ* leach uranium recovery facilities in 2008 through 2010," read an announcement on the NRC website. In anticipation of those applications, the NRC staff developed NUREG-1910, *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities*, to address environmental issues—including construction, operation, eventual decommissioning, and groundwater restoration—for ISR facilities in four specified regions of the western United States.

When the NRC started work on the generic EIS in July 2007, the spot price of uranium was peaking at \$138/lb. By the time the final generic EIS was issued in May 2009, the bubble had burst, and the spot price stood at \$45/lb. The years since have seen small price swings—including a drop below \$30/lb in the summer of 2014—but no sustained recovery despite some optimistic predictions.

According to the Energy Information Administration's (EIA) latest quarterly report on domestic uranium production, released on October 27, U.S. production of uranium concentrate in the third quarter of 2015 totaled just 774,541 lb U₃O₈, down 2

Several years after uranium prices dropped from their peak in 2007, developers and regulators are making their way through a changing regulatory landscape and a seemingly stagnant market.



Locations of projected new uranium recovery facilities, expansions, restarts, and renewals

percent from the second quarter, and down 47 percent from the third quarter of 2014.

"The 33 percent reduction in the third-quarter production compared with the 1,154,408 lb U₃O₈ produced in the first quarter of 2015 may be attributed to the continued low market price of uranium for some U.S. uranium producers," the report states, adding that the third-quarter 2015 production level was the lowest quarterly U.S. production level since the fourth quarter of 2005.

U.S. producers may be waiting out the market, but U.S. nuclear plants still need fuel, and international suppliers are happy to oblige. In 2014, according to the EIA, about 94 percent of the uranium purchased originated outside of the United States.

While the NRC may not have ended up

with the number of applications it expected when NUREG-1910 was developed, the generic EIS has been put to use in a few licensing proceedings, namely, the Ross, Dewey Burdock, Lost Creek, Nichols Ranch, and Moore Ranch ISR projects.

Conventional uranium mining has not kept up with the continued, although slow-paced, licensing of ISR projects. Only one conventional uranium mill is currently operating in the United States—the White Mesa Mill, in San Juan County, Utah—while two other mills are currently on standby awaiting a market upturn. Applications for two new conventional mining properties, Uranium Resources' Juan Tafoya and Rio Grande Resources' Mt. Taylor, were forecast in letters of intent submitted in 2012, but at this writing they have yet to be submitted.

NRC regulation

A uranium recovery license is valid for 10 years from the date the NRC first authorizes construction and operation at a facility and can be renewed for 10 years at a time. For both new licenses and renewals, the applicant's qualifications, design safety, environmental impacts, operational programs, and site safety are reviewed for compliance with the Atomic Energy Act, NRC regulations, and the National Environmental Policy Act.

NRC regulations pertaining to uranium mining are found in 10 CFR Part 20, *Standards for Protection Against Radiation*; 10 CFR Part 40, *Domestic Licensing of Source Material*; and Appendix A to 10 CFR Part 40, *Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content*.

NUREG-1569, *Standard Review Plan for In Situ Leach Uranium Extraction License Applications*, was published in June 2003 to guide the work of staff reviewers in the Office of Nuclear Material Safety and Safeguards. Reviewers can emphasize particular aspects of each section of the standard review plan for individual applications.

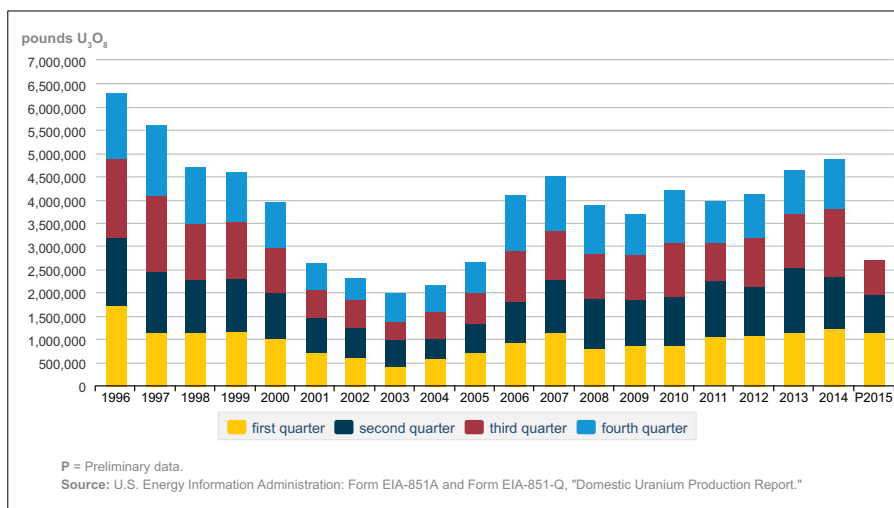
NRC regulations are backed by regulatory guides issued in 10 broad divisions, three of which—Fuels and Materials Facilities, Environmental and Siting, and Occupational Health—apply in part to the licensing of uranium mines and mills.

The NRC currently regulates operating uranium recovery facilities in Nebraska, New Mexico, and Wyoming. Some agreement states—Colorado, Texas, and Utah—also host and regulate operating mining facilities. But regardless of whether a license is granted by the NRC or by a state agency, all licensees are subject to Environmental Protection Agency regulations.

EPA 40 CFR Part 192

The majority of uranium produced in the United States today (and, according to the OECD Nuclear Energy Agency, about half of the uranium produced worldwide) is extracted through *in situ* leach mining. ISR can be less costly than conventional underground or heap leach mining and has the potential to extract uranium from permeable deposits with minimal surface disturbance.

The ISR process begins with the injection of a groundwater solution—with added oxygen, carbon dioxide, or caustic soda yielding a slightly elevated pH—into a deposit that contains uranium. Uranium dissolves into the water, which is then pumped to a facility where it is circulated through a resin bed to extract the uranium. The uranium is concentrated into yellowcake (U_3O_8), the clean water is returned to the ground, and the mining process is repeated.



Uranium concentrate production in the United States, 1996-3rd quarter 2015

In January 2015, the EPA proposed the development of new groundwater protection standards for ISR facilities in 40 CFR Part 192, *Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings and Uranium In Situ Leaching Processing Facilities*. The rule was last revised in 1995, before ISR became the most common method of uranium extraction in the United States. The EPA took comments on the proposal through May 27 and is now evaluating those comments, with a target of April 2016 for the issuance of a final rule.

The scope of 40 CFR Part 192 encompasses standards for the protection of public health and safety and the environment from radiological and nonradiological hazards associated with the processing of uranium and thorium ore and the disposal of associated wastes. According to the EPA's proposal, "These cross-media standards, which apply to pollutant emissions and site restoration, must be adopted by the Nuclear Regulatory Commission, [its] agreement states, and the Department of Energy. We propose to review the standards in the existing rule and to revise the regulations, taking into particular account the significant changes in uranium industry extraction technologies and their potential impacts to groundwater. In addition, new facilities being proposed in states from Virginia to Alaska add to the importance of this effort."

In 2006, the NRC staff was directed by the commissioners to begin a rulemaking on the regulation of groundwater protection at *in situ* leach uranium extraction facilities, but those plans, originally designed to help eliminate dual NRC/EPA regulation, were put on hold. After the EPA issues its 40 CFR Part 192 final rule, the NRC will revise NUREG-1569 accordingly.

Section 106

Section 106 of the National Historic Preservation Act requires federal agencies to take into account the effects of their ac-

tions on historic properties and to give the Advisory Council on Historic Preservation an opportunity to comment. In the western United States, host to many potentially profitable uranium deposits, evaluating property for historical significance requires consultation with Native American tribes in the surrounding area. According to the council, "Consultation with an Indian tribe must respect tribal sovereignty and the government-to-government relationship between the federal government and Indian tribes."

The NRC states on its website, "The NRC has developed a proactive approach to promote government-to-government relations between itself and federally recognized Indian tribes that have a known interest in, or may be potentially affected by, the NRC's regulation of uranium recovery facilities." This approach, when applied to a licensing proceeding, typically results in a programmatic agreement spelling out responsibilities for the protection of identified properties. In practice, the adequacy of a completed programmatic agreement may be called into question, as those involved in the licensing of the Dewey Burdock ISR project have learned.

An undated NRC document titled *U.S. Nuclear Regulatory Commission Strategy for Outreach and Communication with Indian Tribes Potentially Affected by Uranium Recovery Sites* emphasizes the importance of communication early in the review of a licensing action. At several stages of the license application review, the NRC staff is to go beyond the basic *Federal Register* notice.

"This outreach will begin with an applicant's first indication of an interest in submitting a future major proposed licensing action to the NRC for review and processing and continue through the processing and review of a licensing submittal all the way through to the completion of that review," the document reads. "It is the NRC's goal to provide outreach and communication during the various steps of the process



Photo: Crow Butte Resources

Crow Butte, in northeast Nebraska, has operated since 1991.

by a variety of means, including phone calls and e-mails to tribal officials, meetings with tribal leaders and other public meetings, presentations to tribes on subjects of interest, consultation letters for selected aspects of licensing reviews, and copies of correspondence on matters of interest. . . . These efforts will provide American Indian tribes with ample opportunity to participate in the licensing process and with information that is timely and complete on matters of interest related to NRC's authority and oversight of sites associated with uranium recovery facilities."

Focus on licensing

A closer look at three projects that have recently gone through the NRC licensing process—one ISR license renewal and two new ISR projects—will illustrate some of the issues that can arise in contentious proceedings.

Crow Butte

Crow Butte Resources (CBR), a Cameco subsidiary, filed a license renewal application for its Crow Butte ISR facility in Crawford, Neb., in December 2007, just three months before the license was to expire. Because the license was considered to be in "timely renewal," operation was allowed to continue while the NRC staff conducted its review. The review progressed so slowly, however, that in October 2011, the Atomic Safety and Licensing Board charged with conducting a hearing on the proceeding sent a memorandum to the NRC commissioners expressing concern about the slow pace of the NRC staff's review and CBR's responses, suggesting that the slowness of the proceedings infringed on the intervenors' right to a hearing. The commissioners determined

that the staff's review of the Crow Butte license renewal request was proceeding appropriately and declined to take action.

The license for Crow Butte, Nebraska's first uranium mine, was first issued in 1988 for a 10-year term and then renewed in 1998 for an additional 10 years. Since operations began in 1991, the mine has produced 11.2 million lb U_3O_8 , and it contains additional proven and probable reserves of 1.7 million lb.

On November 6, 2014, nearly seven years after CBR filed the second license renewal application, Crow Butte's license was renewed for another 10 years. But the story doesn't end there.

Intervenors—a group of local residents and the Western Nebraska Resources Council, known collectively as Consolidated Intervenors, and the Oglala Sioux Tribe—were permitted to file new contentions on an environmental assessment released in October 2014. In March 2015, the ASLB ruled that four contentions to the license renewal application could "migrate" to become challenges to the environmental assessment, while eight new contentions were admitted in part (in some cases merged with other contentions) or as presented by the intervenors.

After the EPA announced its proposed revisions to 40 CFR Part 192 in January, the intervenors immediately filed 11 contentions on the basis of the potential new health and environmental protection standards in the proposed rulemaking. The ASLB rejected those contentions in an April 28 memorandum and order, stating that "all 11 proposed contentions are inadmissible because, *inter alia*, Consolidated Intervenors' new contentions either mistakenly assume that EPA's proposed rules are enforceable at this time, are based on EPA's tentative policy determinations, or are untimely filed."

An ASLB hearing was held August 24–28 in Crawford, Neb., on nine contentions—of which four were technical and five were related to the NRC's environmental review—and drew the attention of opponents and supporters of the facility. The contentions questioned the adequacy of the evaluation and protection of historical resources at the site and the facility's impact on surface water, groundwater, and the local ecosystem. During the hearing, the ASLB asked the parties for additional exhibits and testimony on groundwater flow and hydrogeologi-



Photo: Azarga Uranium

The licensed, but undeveloped, Dewey Burdock site in South Dakota.

cal formations, and a supplemental hearing was held on October 23 in Rockville, Md. The ASLB has 90 days from the conclusion of the supplemental hearing to issue an initial decision.

In addition to the Crow Butte license renewal, two other applications from Crow Butte Resources are on the NRC's docket. An application for the North Trend ISR expansion was submitted in 2007 and currently awaits a draft environmental assessment, with the issuance of a record of decision targeted for November 2016. CBR's Marsland ISR expansion application is a relative newcomer, having been submitted in 2012, and most of the review schedule for the application is yet to be determined. Both applications will be subject to a hearing process.

Dewey Burdock

Powertech (USA) Inc., a subsidiary of Azarga Uranium, applied in 2009 for a license for its proposed Dewey Burdock ISR facility in Custer and Fall River Counties in South Dakota. Powertech expects the mine to produce 9.7 million lb U₃O₈ over a 16-year mine life. Following the release of a final supplemental environmental impact statement (SEIS) in January 2014 and a Section 106 programmatic agreement between the NRC, the U.S. Bureau of Land Management, the South Dakota State Historic Preservation Office, Powertech, and the Advisory Council on Historic Preservation in March 2014, the NRC issued a license for Dewey Burdock in April 2014.

Just weeks after the license was issued, an ASLB ruled on contentions related to the final SEIS and a motion to stay the effectiveness of the license that were filed by the Oglala Sioux Tribe and other intervenors. A temporary stay was ordered by the ASLB but was soon lifted, and an evidentiary hearing was scheduled for August.

The ASLB's initial decision on seven contentions concerning the protection of historical and cultural resources and the final SEIS was issued in April of this year. Dewey Burdock's license was upheld, but the ASLB imposed additional license conditions.

Five contentions related to groundwater usage, groundwater quality, fluid migration, and mitigation measures were resolved in favor of the NRC staff and Powertech. In a decision on two contentions related to historic and cultural resources, the ASLB found that the NRC staff had not met the burden of demonstrating that its final SEIS complies with the National Environmental Policy Act and with 10 CFR Part 40. According to the ASLB, "The environmental documents do not satisfy the requirements of the NEPA, as they do not adequately address Sioux tribal cultural, historic, and religious resources." The ASLB also found that the NRC staff had not engaged in "meaningful consultation" with the tribe as required by statute.



Photo: Peninsula Energy Limited

Crew members inspected ion exchange system valves and instrumentation at Strata Energy's Lance central processing plant in October.

The NRC staff and Powertech submitted an appeal to the ASLB, arguing against the board's conclusion that the NRC staff had not adequately consulted with the Oglala Sioux Tribe or addressed potential environmental impacts on significant historic sites.

According to an Azarga Uranium press release issued on May 27, "Azarga's position references a record including NRC effort over five years consulting with 23 Native American tribes. All of these tribes were provided the opportunity to identify historic properties of religious and cultural significance and invited to participate in developing mitigation measures to protect or avoid such properties under the terms of a programmatic agreement. The agreement provides ongoing opportunity for tribal participation throughout the life of the project."

Communication between the NRC and the Oglala Sioux Tribe is ongoing as ASLB decisions on appeals are awaited. The NRC will use any additional information it receives from the Oglala Sioux Tribe to supplement its reviews. Meanwhile, Powertech is working to obtain other regulatory permit approvals that are necessary for the operation of the project, including those from the EPA and the South Dakota Department of Natural Resources.

Ross

The Ross ISR project is the first permit area within Strata Energy's Lance projects to be developed. Strata, a subsidiary of Peninsula Energy Limited, submitted a license application for the Lance central processing plant and the Ross permit area in Wyoming's Powder River Basin in January

2011. Only a portion of the Lance projects has been explored to date, but Strata estimates that the entire project could contain the equivalent of 157.7 million–217 million lb U₃O₈.

In February 2012, an ASLB granted standing to two intervenors in the licensing proceeding, the Natural Resources Defense Council and the Powder River Basin Resource Defense Council. Standing was granted on the basis of two potential harms: traffic-generated dust and light pollution. The ASLB also admitted four contentions that challenged environmental aspects of Strata's license application. Three of the four contentions dealt with groundwater, not with traffic-generated dust or light pollution, the nominal bases for the intervenors' standing in the proceeding.

The fourth contention claimed that the NRC staff's reviews failed to adequately assess the cumulative impacts of the proposed action and the planned Lance district expansion project. As the NRC staff's review progressed and more information became available in the draft SEIS and the final SEIS, some of the intervenors' contentions were permitted to migrate to the new documents.

The NRC issued a license for the Lance central processing plant and Ross permit area on April 24, 2014. The ASLB heard evidence during a hearing held September 28–October 1, 2014, and in January 2015 ruled in favor of Peninsula and Strata on the remaining contentions, terminating the proceeding.

Strata began preparing the Ross site to host the processing plant in October 2013, including the fabrication of long-lead-time equipment and the construction of access roads and other infrastructure. Peninsula

reported on November 10 that the facility was ready to enter stage one of production. During stage one, the central processing plant, which is fully permitted to produce 3 million lb U_3O_8 per year, will produce at a rate of only 600,000–800,000 lb per year. With pressure testing and commissioning ongoing and a final preproduction inspection having been conducted by the NRC in early November, production was expected before the end of the year.

Just months after receiving its license, Strata Energy filed a letter of intent to submit an application to amend the license to include the Kendrick expansion area, which is contiguous to Ross. The license amendment application was submitted to the NRC in April 2015.

On the horizon

Crow Butte, Dewey Burdock, and Ross have all been granted licenses, but Crow Butte and Dewey Burdock still await final ASLB decisions that will be watched with interest.

The only other new mining application on the NRC's docket is for Reno Creek, an ISR site located in Campbell County, Wyo. AUC LLC applied for a license for Reno Creek in October 2012, and according to the NRC's application review schedule, a license could be issued as early as November 2016. The project is currently awaiting a fi-

nal safety evaluation report (targeted for April 2016) and a draft SEIS (targeted for February 2016).

Wyoming hosts seven of 10 operable uranium recovery facilities licensed by the NRC and seven of 10 sites that are the subject of currently docketed applications for new facilities, expansions, restarts, or renewals. During the third quarter of 2015, only seven U.S. uranium mills or plants produced uranium, according to the EIA, and four of the seven are located in Wyoming.

If all goes according to the plans of Gov. Matt Mead, Wyoming will become an NRC agreement state, and the responsibility for the regulation of "source materials from uranium mining and milling and the wastes associated with the recovery, mining, and milling of such source materials" will be in the hands of the Wyoming Department of Environmental Quality. In February, Mead signed legislation to begin the process and notified the NRC of the state's intent.

In contrast to Wyoming, Virginia has been under a moratorium on uranium mining for more than 33 years. Since 2007, however, when Virginia Uranium Inc. was granted an exploration permit for the Coles Hill uranium project, owned by Virginia Energy Resources and located in south central Virginia, the companies and other supporters have been fighting an uphill battle to overturn the moratorium.

On August 5, Virginia Uranium joined three other companies in filing a lawsuit in federal court against the Commonwealth of Virginia, asking the court to declare the state's ban on uranium mining to be null and void. The suit argues that the ban is invalid because it is based on environmental and safety concerns that are under the jurisdiction of the NRC. Arguments on the state's motion to dismiss the suit were heard on November 6, and a bench trial was scheduled for December 14.

A preliminary economic assessment for Coles Hill, dated August 2013, evaluated indicated mineral resources of 64.2 million lb U_3O_8 using a cutoff grade of 0.06 percent U_3O_8 equivalent—certainly a prospect worth pursuing. Still, even companies that are holding fully licensed properties may hesitate to develop them in the current market. Which brings us back to the price of uranium.

At this writing in mid-November, the U_3O_8 spot price was \$36/lb. Many uranium exploration and mining companies continue to wait out the market, trimming costs wherever possible while planning for the day when prices will rise. If the market fails to rebound, more changes can be anticipated. But whether the price of uranium falls or rises, those companies that can produce uranium economically are likely to come out ahead. **■**