

The Nuclear Review

April 2017 | Number 584

Nuclear Electricity
Generation in 2016

Spotlight on Mining—
Azarga Uranium



The Nuclear Review

April 2017 Number 584

Departments

- 2 Market Review
Market Values Summary / March Market Review / Current Market Data
- 26 Nuclear Industry Calendar
- 27 Historical Market Data
- 33 Government Statistics
- 37 Uranium Market Statistics

Features

- 16 **Nuclear Electricity Generation in 2016**
Worldwide installed nuclear capacity increased in 2016 to 391 GWe, as nuclear-generated electricity remained part of the energy mix in 30 countries. A total of 448 reactors were in commercial operation throughout the world last year and estimated global nuclear generation climbed to approximately 2.3 million GWh—15 percent more than total generation of about 2.0 million GWh in 2015. Ten new reactors were connected to the grid, while construction began on three new units last year.
- 20 **Spotlight on Mining—Azarga Uranium**
Denver-based uranium developer Azarga Uranium is advancing its Dewey Burdock Project in South Dakota, which received a US Nuclear Regulatory Commission license in April 2014. The company is in the process of completing other regulatory permit approvals needed for development of the high-grade, *in-situ* recovery project. In this article, TradeTech presents a conversation with Azarga Uranium President and Chief Financial Officer Blake Steele.

Published by:

TradeTech

Denver Tech Center
7887 E. Belleview Avenue, Suite 888
Englewood, Colorado 80111, USA
Phone +1 (303) 573-3530
Fax +1 (303) 573-3531
www.uranium.info
review@tradetech.com
tradetechU3O8@gmail.com

Managing Editor

Treva E. Klingbiel

Editor

Gail J. Fox

Editorial Assistant

Hanh T. Do

©2017 TradeTech

This Review is prepared especially for subscribers and is furnished to them for their use only. Except for internal use by subscribers, no part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior written permission of TradeTech. Neither this Review, nor copies of any portion thereof, may be lent, sold or given to non-subscribers.

The information in this Review was gathered from sources TradeTech believes to be accurate. However, TradeTech makes no warranty, express or implied, and assumes no legal liability or responsibility for the accuracy, completeness or usefulness of any information contained herein.

ISSN: 1090-6797

ISBN: 978-1-934933-98-8

On the Cover

The Dewey Burdock *In-Situ* Recovery Project site in southwestern South Dakota.

Photo courtesy of Azarga Uranium

Spotlight on Mining— Azarga Uranium



Denver-based uranium developer Azarga Uranium is advancing its Dewey Burdock Project in South Dakota, which received a US Nuclear Regulatory Commission license in April 2014. The company is in the process of completing other regulatory permit approvals needed for development of the high-grade, in-situ recovery (ISR) project.

The TSX-listed company recently achieved a major milestone when the US Environmental Protection Agency (EPA) granted two draft permits for the Dewey Burdock Project, which pertain to the planned Class III and Class V Underground Injection Control activities and address all outstanding permit applications filed with the EPA for the project.

The company also owns the Centennial Uranium Project in Colorado and the Aladdin Deposit in Wyoming, as well as a majority interest in the Kyzyl Ompul deposit in Kyrgyzstan. In this article, TradeTech presents a conversation with Azarga Uranium President and Chief Financial Officer Blake Steele.

TNR: What is the history of Azarga Uranium and its mineral properties?

Steele: Azarga Uranium Corp. was incorporated in British Columbia, Canada, and is listed on the Toronto Stock Exchange (TSX: AZZ) and the Frankfurt Stock Exchange (FRA: P8AA). The Dewey Burdock Project is the company’s initial development priority and is solely controlled by Powertech USA Inc., a wholly owned subsidiary of Azarga Uranium.

The Dewey Burdock Project is located in southwest South Dakota and forms part of the northwestern extension of the Edgemont Uranium Mining District (**Figure 2**). The Dewey Burdock Project is composed of 13,160 surface acres and 17,340 net mineral acres. Exploration programs have resulted

in a NI 43-101 compliant resource estimate comprising 8.6 million pounds of Measured and Indicated resources and 3.5 million pounds of Inferred resources (**Figure 1**).

The uranium deposits that form the Dewey Burdock Project are classic roll-front type deposits occurring in subsurface sandstone channels. These fronts are known to extend throughout an area covering more than 16 square miles and having a total length of over 24 miles.

Uranium was first discovered in the vicinity of the Dewey Burdock Project as early

as 1952. Soon thereafter, uranium deposits were being developed into producing mines. During the uranium boom of the 1970s, several companies returned to the Dewey Burdock area. During this period, exploration companies discovered much larger, roll-front type uranium mineralization.

TNR: What are the mineral resources at Azarga’s Dewey Burdock Uranium Project and what is the company’s development plan for the property?

Steele: The NI 43-101-compliant resource estimate contains 8.6 million pounds of Measured and Indicated resources at 0.25% U₃O₈ and 3.5 million pounds of Inferred resources at 0.05% U₃O₈. The U₃O₈ grade of Dewey Burdock’s Measured and Indicated resources is the highest among its peer group. Additional trends have also been identified at the Dewey Burdock Project and we believe that the overall resource can be increased with additional exploratory and delineation efforts.

Resources ¹	Avg Grade (% U ₃ O ₈)	U ₃ O ₈ (in million lbs)
Dewey Burdock Project		
Measured Resource	0.330%	4.122
Indicated Resource	0.210%	4.460
Measured & Indicated Resource	0.250%	8.582
Inferred Resource	0.050%	3.528
¹ Estimated		

Figure 1 Resources Summary, Dewey Burdock Project
Source: Azarga Uranium

The company’s immediate objective is to obtain the necessary permits and licenses to advance the Dewey Burdock Project to the construction phase. The company has also embarked on a process to investigate project financing options for the Dewey Burdock Project, with a view to having a funding solution in place prior to or concurrent with the finalization of permits.

Once the permitting process has completed and project financing is in place, the company plans to execute a phased development plan that maximizes the project economics. This plan will involve a systematic ramp-up in production to peak output of 1 million pounds per annum, while also deferring a substantial portion of the capital expenditures for the project to future years of the mine plan. A phased development approach requires only US\$27 million of capital expenditures to bring the Dewey Burdock Project to initial production. It also provides more operational flexibility to allow the business to nimbly react to changes in the market environment.

TNR: *What is the status of the project today in the development schedule? Are there any recent developments in permitting?*

Steele: Yes, the US Environmental Protection Agency (EPA) issued two draft permits for the Dewey Burdock Uranium Project in March 2017. The issuance of the draft EPA Class III and Class V Underground Injection Control permits represents the completion of a major regulatory milestone for the company and the project.

In terms of the development schedule for the project, the company continues

to progress the Dewey Burdock Project toward construction. There are three major regulatory approvals required for the development of the Dewey Burdock Project:

- 1) US Nuclear Regulatory Commission (NRC) License – In April 2014, the company received a Source and Byproduct Materials License from the NRC and the license continues to remain in good standing;
- 2) EPA Permits – As noted above, in March 2017, the company received its draft EPA Class III and Class V Underground Injection Control permits. The EPA issuance of the draft permits is a significant step toward another major federal regulatory

approval for the project. The receipt of these draft permits is the result of years of hard work by the company, and we are pleased to see those efforts moving the Dewey Burdock Project closer to development. The EPA’s final permit decision will evaluate all public comments submitted up to May 19, 2017; and

3) South Dakota Permits – The South Dakota Department of Environment and Natural Resources staff has recommended approval of the major state permits. The hearings to finalize the state permitting process won’t be completed though until the federal permits, namely those pertaining to the NRC and EPA, have been issued.

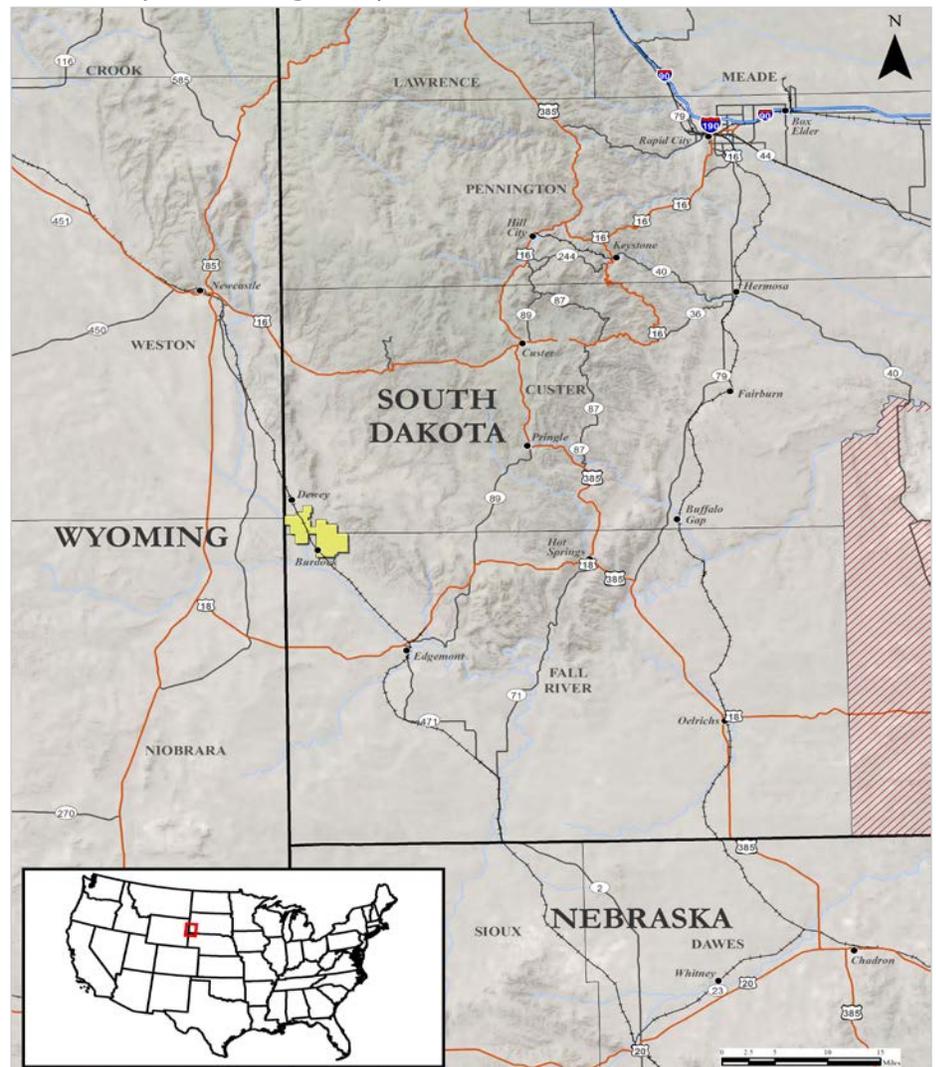


Figure 2 Dewey Burdock Uranium Project, South Dakota
 Source: Azarga Uranium

Once the necessary permits and licenses have been obtained and construction has commenced, initial production is forecast to occur after just one year. The one-year construction timetable to initial production provides us with the ability to more readily assess market conditions and determine the right time to move forward, as opposed to having to commit to a multi-year development plan, which introduces more risk. This is a significant advantage that few development companies in the industry have. Our team has also been involved in the construction and operation of *in-situ* recovery (ISR) projects in the United States, providing unique insights and expertise that can be directly applied to Dewey Burdock.

TNR: *What are some key characteristics and challenges associated with the Dewey Burdock Project, and how has the project's unique profile informed the company's operational strategy?*

Steele: The most significant challenge currently facing the Dewey Burdock Project is the current state of the uranium market. Although the company believes that a uranium sector turnaround will eventuate sooner, rather than later, and uranium prices in the first quarter of 2017 have started to recover, uncertainty with respect to the timing and scale of the recovery remains.

However, current conditions favor ISR projects, such as the Dewey Burdock Project, as they have a number of advantages over conventional mines. ISR projects operate at approximately two-thirds the cost of conventional mines and the average capital expenditures

associated with constructing ISR projects is less than 15 percent of a conventional mine, which generally means lower comparable risk. ISR projects also provide greater operational flexibility and scalable development profiles which provides owners of these type of projects with the ability to more easily adapt to changes in the uranium market. The environmental impact is also manageable with minimal noise pollution, minimal dust, and no waste rock tailings.

But what sets the Dewey Burdock Project apart from other ISR projects? The grade. The 0.25% U₃O₈ grade of Dewey Burdock's Measured and Indicated resources is the highest among its peer group. The high-grade nature of the Dewey Burdock Project, when considered with other geological factors, such as expected well flow rates, translates into forecast C1 uranium cash costs in the lowest quartile. This excellent operating cost profile allows projects like Dewey Burdock to advance toward development, despite the current market environment.

Additionally, the Dewey Burdock Project is well serviced by infrastructure. The project is located 16 miles from the town of Edgemont and access is provided via a two-lane, all-weather gravel road. Major power lines are located across the project and can be accessed for electrical services to support the first two years of operations, at which point additional power lines will need to be constructed to support increased operations. A major rail line cuts diagonally across the project area and a major railroad siding is located in the town of Edgemont (**Figure 3**).

TNR: *What are the expected capital and operational costs with respect to Azarga's development plan for the Dewey Burdock Project?*

Steele: Capital expenditures are forecast at \$27 million to bring the project into production—this is “sector leading” for a project of this size. Sustaining capital expenditures over the project's life of mine are forecast to be \$14.00 per pound of production. C1 cash costs over the project's life of mine are forecast to



Figure 3 Dewey Burdock Uranium Project Site, South Dakota
Source: Azarga Uranium

be \$12.53 per pound of production, which are first quartile on the uranium cost curve.

TNR: *Azarga has indicated the Dewey Burdock Project has relatively low capital expense requirements and will have low cash costs during initial production. Can you describe the inherent efficiencies in the post-licensing phase of development that support Azarga's cost estimates?*

Steele: The cost efficiencies are largely driven by the mining methodology. The Dewey Burdock Project will be mined using ISR, which is typically cheaper from an operating cost perspective than conventional mining and substantially cheaper from a capital expenditure perspective. Further operating cost efficiencies are forecast to be achieved due to the high-grade nature of the Dewey Burdock Project.

Our cost estimates are supported by an independent NI 43-101 Preliminary Economic Assessment (PEA) prepared by TREC, Inc. and Roughstock Mining Services (TREC, Inc. is a leading US engineering firm in design and construction management of ISR facilities in North America).

TNR: *In 2015, Azarga began engaging with potential customers for future uranium production offtake in parallel with the advancement of the Dewey Burdock Project. Has Azarga found an appetite for supporting emerging production in the course of these discussions?*

Steele: The United States consumes in excess of 50 million pounds of

uranium annually and produces less than 10 percent of this amount in country, so a natural market exists for future production from the Dewey Burdock Project. An appetite certainly exists for US-based production. Though we continue to engage in offtake discussions in parallel with the advancement of the Dewey Burdock Project, maintaining our leverage to the uranium price in the current market is important given the company's stage of development.

"The United States consumes in excess of 50 million pounds of uranium annually and produces less than 10 percent of this amount in country, so a natural market exists for future production from the Dewey Burdock Project. An appetite certainly exists for US-based production."

—Blake Steele
President & Chief Financial Officer
Azarga Uranium

TNR: *Azarga owns a number of mineral properties. Has the company's geographically diverse asset portfolio been advantageous in attracting financing?*

Steele: Our asset suite includes mineral properties at various stages of development, which provides us with a pipeline for continued growth and that has helped attract financing.

The Dewey Burdock Project and the Centennial Project (located in Colorado) are our most advanced projects with PEAs completed for both. The combined pre-tax net present value of these projects is in excess of \$200 million. The Centennial Project NI 43-101-compliant resource estimate includes 10.4 million pounds of Indicated resources at 0.09% U₃O₈

and 2.3 million pounds of Inferred resources at 0.09% U₃O₈.

In addition to our two development stage projects, we also have two exploration projects with NI 43-101-compliant resource estimates: the Aladdin Project in Wyoming and the Kyzyl Ompul Project in the Kyrgyz Republic, as well as two greenfield exploration projects, the Dewey Terrace Project and the Savageton Project, both located in Wyoming.

The projects located in Wyoming have the potential to form satellite deposits to the Dewey Burdock Project, which could create some interesting synergies in the future.

TNR: *Azarga raised capital in 2016, primarily through private placements and the sale of redundant assets. What are its plans for financing in 2017?*

Steele: Like any well-managed company at our stage of development, we continually evaluate opportunities to strengthen our financial position and improve our shareholder register. The issuance of the draft EPA permits represents a significant milestone event for us and should help provide access to additional financing channels. That said, we have a supportive existing shareholder base, which consists of significant insider ownership, and we expect this support to continue as the Dewey Burdock Project advances toward development.

We will also continue to investigate project financing options for the

Dewey Burdock Project, with the aim of having a funding solution in place prior to or concurrent with the finalization of permits.

TNR: *With respect to the uranium market, how does Azarga's development plan for the Dewey Burdock Project align with current market conditions, and looking forward, what are the company's expectations?*

Steele: In 2015, when the company revised its PEA for the Dewey Burdock Project, a phased development plan was adopted. As a result, only \$27 million of capital expenditures will be required to bring the Dewey Burdock Project to initial production. In the current market environment, only projects with low initial capital expenditures and first quartile C1 cash costs, such as Dewey Burdock, are able to progress toward development.

"Current [market] conditions favor ISR projects, such as the Dewey Burdock Project, as they have a number of advantages over conventional mines. ISR projects operate at approximately two-thirds the cost of conventional mines and the average capital expenditures associated with constructing ISR projects is less than 15 percent of a conventional mine, which generally means lower comparable risk."

**—Blake Steele
President & Chief Financial Officer
Azarga Uranium**

Looking forward, we are of the opinion that a uranium sector turnaround will eventuate sooner, rather than later. Today's global reactor pipeline exceeds the pre-Fukushima pipeline and 223 nuclear reactors are under construction or planned, representing approximately 50 percent of the current operating reactor fleet. China, Russia, and India lead the world in terms of the number of nuclear power plants under construction, with 21, seven, and five, respectively. On the supply side, low prices are forcing companies to curtail mining, development, and exploration. Cameco and Kazatomprom have both announced supply reductions for 2017.

TNR: *ISR operations are essentially a balancing act between flow rate capacity and resource grade while aligning production forecasts with sequential development of the ore body. How is Azarga Uranium planning the installation of its wellfield infrastructure at Dewey Burdock to ensure it can respond quickly to a rapid change in the uranium price?*

Steele: Shorter lead times for wellfield expansion and scalable development provide ISR projects, such as Dewey Burdock, the ability to quickly adapt to changes in

the uranium price. The phased development plan contemplated in our 2015 preliminary economic assessment provides us with greater operational flexibility, as we can ramp-up production rapidly through increased wellfield development and additional ion exchange capacity. Supporting this, the draft Class III EPA permit and the NRC license encompass nearly all of the proposed wellfields for the Dewey Burdock Project.

TNR: *The mineral resource estimate for Dewey Burdock includes an additional 940,000 pounds of non-ISR Inferred resources, which are located in dry rock above the water table. How receptive*

is Azarga Uranium to utilizing new mining technologies to recover "dry rock" resources (i.e. borehole mining or artificially raising the water table)?

Steele: We are open to evaluating all mining technologies to determine the most economical way to potentially extract the non-ISR inferred resources. These resources are primarily located at or near surface; therefore, several conventional alternatives are being considered and are likely to benefit from the relatively shallow depth of the mineralization. Historically, similar deposits in this area were mined using

conventional methods. Although these resources are within the NRC license boundary, another set of regulatory approvals is required to extract these resources and the company has not applied for these regulatory approvals to date.

TNR: *Have there been advantages (regulatory, geologic, or otherwise) specific to South Dakota*

that sets that state apart from developments in other states? What about Colorado or Wyoming?

Steele: The Edgemont Uranium Mining District in South Dakota has a long history of uranium mining, dating back to the 1950s. Many residents in the Edgemont area are supportive of the project and many have had family members or relatives who have worked in the uranium industry at some point in time.

South Dakota, unlike Wyoming or Colorado, is not an agreement state, meaning that the NRC and EPA have primary regulatory responsibility for radiation protection

and underground injection control requirements. The Dewey Burdock Project is the first ISR uranium project with Underground Injection Control permits issued under the direct regulation of the EPA. Taking the lead always presents unique challenges, but the company continues to advance the Dewey Burdock Project toward development.

TNR: *What separates the Dewey Burdock project from other ISR operations in the USA, specifically?*

Steele: In addition to the project's higher grade, the geological and hydrogeological conditions that exist at the Dewey Burdock Project are highly favorable to ISR. Flowing artesian conditions prevail over much of the project area. This results in improved conditions for well flow rates and enhances the ability to dissolve larger amounts of oxygen in the lixiviant (liquid medium used in hydrometallurgy).

In comparison to the nearby deposits in the Powder River Basin, where the

water table is usually a few hundred feet below surface, the water table at the Dewey Burdock Project is commonly at or near surface. Oxygen solubility increases roughly 1ppm per each additional foot of water depth, indicating that substantially larger amounts of oxygen should be able to be injected into the lixiviant at the Dewey Burdock Project. This hydrogeology is similar to that of many large ISR projects in Kazakhstan. Further, the mineralization at the Dewey Burdock Project is situated within excellent "confinement zones" and is isolated above and below by large, impermeable shale units which are one of the reasons for the flowing artesian conditions. All of these factors contribute to Dewey Burdock's forecast first quartile C1 cash costs.

TNR: *What are the key points that potential investors should know about Azarga Uranium Corp. today?*

Steele: We believe that a unique opportunity exists for investors to build a position in Azarga Uranium. The company's initial development

priority, the Dewey Burdock Project, is a high-grade undeveloped ISR project with attractive economics—forecast C1 cash costs of \$12.53 (lowest quartile) and \$27 million of capital expenditures required to bring the project into production, with a pre-tax Internal Rate of Return of 67 percent. We also believe that uranium prices have to move higher due to the factors previously discussed, such as the current reactor fleet expansion and the resultant increased demand for uranium that will eventuate. Current prices do not provide the required incentives to deliver the additional production needed.

Azarga's asset suite provides a pipeline for continued growth and the company's management and board have extensive experience in uranium, the broader mining sector, and financial markets. We are hopeful for a bright future for our employees and our investors.



Denver, Colorado USA

Denver Tech Center
7887 E. Belleview Avenue, Suite 888
Englewood, Colorado 80111
Phone +1 (303) 573-3530
Fax +1 (303) 573-3531
review@tradetech.com
tradetechU308@gmail.com
www.uranium.info

Dallas, Texas USA

Phone +1 (972) 503-3931
Fax +1 (972) 503-3936
editor@tradetech.com

Charlotte, North Carolina USA

Phone +1 (704) 574-0009

London, England

Phone +44 (0) 20-8798-0336

Tokyo, Japan

Phone +81 (0) 3-5443-2779
Fax +81 (0) 3-5443-4081

Shanghai, China

Phone +86 (135) 2456-7757
