Up, up and away: Helium prices soar, interest in Saskatchewan heightens

Marlon McDougall is restless these days. The president of North American Helium (NAH) Inc. is ready to hook up the first of 10 wells to surface facilities and a gas plant to produce Helium, which, at $300 per Mcf, is 100 times more valuable than natural gas.

"We expect to have a single-well purifier in place the second quarter of 2020 and a larger-scale plant on stream by the third quarter of 2021," he said. "As we build and commission plants, we would expect each plant to have a production profile of between 50 to 100 MMcf per year of helium."

NAH has completed 10 of the 13 wells it drilled at a cost of $1.2 million per well. The wells in southwestern Saskatchewan penetrate conventional reservoirs with stratigraphic intervals in the western Williston basin from 6,900 to 7,900 ft deep.

"The reservoirs have significant porosity and permeability, so well density for pool development is very efficient," said McDougall.

Rather than expanding a known discovery, NAH drilled into an untapped reservoir in Saskatchewan and discovered helium in that area for the first time since the 1960s, the *Northern Miner* newsletter reported in August of last year.

Geologists learned about the potential for helium in southwestern Saskatchewan while searching for oil and gas in the late 1950s and 1960s. "The discovery of the helium resulted in steady production in Saskatchewan from 1963 to 1977," stated *Professional Edge* magazine, published by the Association of Professional Engineers and Geoscientists of Saskatchewan (APEGS). "However, when the price of helium dropped, well producers quietly shut the doors and walked away. Now, with the price of helium rising, these old wells have been rediscovered."

Please see article at https://www.apegs.ca/e-edge/Archive/Edge167/helium.html.

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A 2016 report from the Saskatchewan Geological Survey concluded that the most viable model for exploration targets seems to be closed structures created by Cambrian to Cretaceous sediments. Please see report at https://pubsaskdev.blob.core.windows.net/pubsask-prod/94157/94157-Open_File_Report_2016-1_Yurkowski.pdf.

"At this early stage of exploration and development of helium resources in Saskatchewan, the most obvious and easiest targets to suggest for exploration are structural traps characterized by sedimentary rocks …draped over Precambrian monadnocks," stated **Melinda M. Yurkowski**, SGS petroleum geologist, in the report.

Monadnocks are isolated, underground hills of bedrock. Gas-trapping Paleozoic sedimentary rocks are an effective seal that entraps the small, lighter-than-air helium molecules.

"Monadnocks are easily identified in seismic surveys," the report stated. NAH is acquiring seismic data over its four major prospect areas and has correlated logs with seismic data where possible, considering the few Cambrian penetrations in the basin.

"It has taken a significant investment to shoot new seismic, interpret it and drill wells to test our theories," said McDougall.

The Upper Cambrian Deadwood conventional formation has the highest concentration of helium, according to the SGS study. Helium discoveries in the 1950s, including Battle Creek in 1952, also helped delineate this target basal sand in the formation.

Naturally occurring, radioactive uranium and thorium have disintegrated over half a billion years to form Helium in southwestern Saskatchewan and elsewhere in the earth's crust. During the early evolution of earth, heavier air displaced primordial helium from the sun and the gas dispersed into space.

For NAH, helium will represent about 0.5 to 0.9 percent of the gas stream while nitrogen will serve as the "carrier gas" at 98 percent of the stream. Trace-gas components comprise the remaining 1 to 2 percent.

"Because nitrogen is inert and makes up 78 percent of the atmosphere, all carrier gas will be vented," said McDougall. "Significant capital investment would be required to commercialize other gas streams. However, we continue to explore opportunities to use the carrier gas (N2) for agricultural applications."

Under a reasonably escalated sales price scenario, NAH expects that the wells will pay out within one to two years.

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Well 6-30-3-27W3M drilled in southwestern Saskatchewan by North American Helium looks like any other gas well, except it is poised to produce helium. The gas can be up to 100 times more valuable than methane, but only makes up about 1- to 2-percent of the produced gas stream.

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Demand and prices

"The search for new sources of helium is of paramount importance as a combination of declining production and increasing demand have made helium prices soar. This follows a century in which the United States had a near monopoly on helium reserves and U.S. production met global demand," states an introduction in the "History of Helium Exploration, Part 2," published by the American Association of Petroleum Geologists this year.

The U.S. government sold off its strategic stockpile of helium in the mid-1990s, which accelerated the shortfall. At the latest auction of the U.S. Bureau of Land Management (BLM) more than a year ago, shortages boosted spot market prices to multiples of 2 to 4 times the average price to $280 per Mcf of raw, unprocessed helium. Ten years ago, the price was $50 per Mcf.

Helium is transported as gas or liquid to distributors worldwide, and like oil, prices rise and fall in a world market.

"We have participated in BLM auctions and have bought and sold helium into the market," said McDougall. "Because it is trucked, you can sell to the full spectrum of companies -- end users, distributors, large industrial gas companies and others." While prices are confidential and for the most part, not shared within the industry, NAH believes it is reasonable to expect "term" Helium deals to be above $300 per Mcf in the future.

While the prices are high, the market is diverse. An August special report from *Stockhead*, which publishes news on emerging markets in the Alberta Stock Exchange, cited business sectors that depend on helium -- space exploration, rocketry, high-level science, medical industry for MRI machines, fiber optics, electronics, telecommunications, superconductivity, underwater breathing, welding and nuclear power stations. Please see *Stockhead* article at https://stockhead.com.au/energy/a-helium-boom-is-fast-approaching-and-there-arent-many-stocks-to-choose-from/.

Because of its low boiling point, liquid helium is used in industrial cryogenic systems when extremely low temperatures below the boiling point of nitrogen are needed.

On the supply side, Canada has the fifth- or sixth-largest helium resource in the world, behind the U.S., Qatar, Algeria, Russia and possibly Tanzania, states APEGS.

The role of Ryder Scott Canada

Building capital-intensive gas separating facilities and plants to refine the raw gas stream into purified helium involves significant outlays, and is an economic barrier.

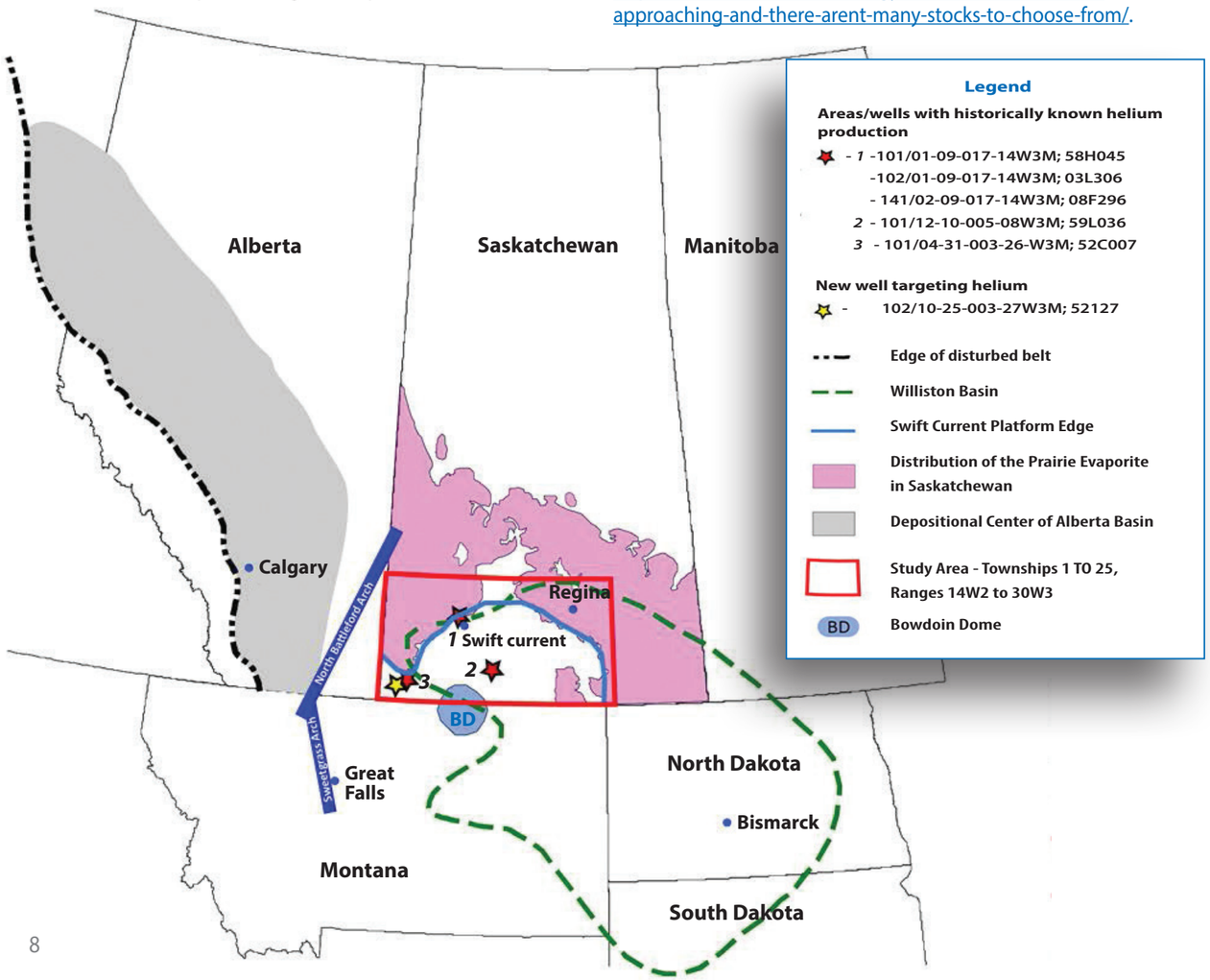
McDougall said that NAH is pursuing financing based on reserves and resources quantities supported by independent reports from Ryder Scott Canada. "Those reports, also used for marketing, have allowed us to demonstrate that there is a significant helium business to be developed in Saskatchewan," he remarked.

A Ryder Scott Canada volumetric study for the private Calgary-based explorer is helping to support an early-stage, in-progress material balance study by the NAH technical staff, said McDougall.

Mike Lam, vice president - technical specialist at Ryder Scott Canada, analyzed the geology of the NAH properties, understanding that helium is very similar to conventional gas in that the evaluator is looking for structural/stratigraphic entrapment with a good top seal.

"A big difference between conventional hydrocarbon and helium is the source. Most helium is thought to form from radioactive decay of uranium and thorium in granitoid rocks. It's no surprise then that many helium reservoirs we have observed start in reservoirs that drape over identified basement highs," he said. "That doesn't mean there aren't accumulations in younger rock, but it's certainly understandable to start near the source."

Ryder Scott Canada has prepared reports for other helium producers in Canada and elsewhere. The firm estimates reserves and resources under COGEH guidelines and NI 51-101 regulations for clients in and outside of Canada. For more information, please contact Dave Haugen, manager of the Calgary office, at dave_haugen@ryderscott.com.



Map showing the SGS study area, Williston basin, center of the Alberta basin (Wright et al., 1994) and well locations published in 2016. See legend. Two years later, NAH, the most active driller in the area, had six wells completed, with one planned and one abandoned. Royal Helium Corp., Weil Group Resources LLC, Canadian Helium Inc. and the City of Medicine Hat were also drilling.

Credit: *Yurkowski, M.M. (2016): Helium in southwestern Saskatchewan: accumulation and geological setting; Saskatchewan Ministry of the Economy, Saskatchewan Geological Survey, Open File Report 2016-1, 20p. and Microsoft Excel file.*

Spy in the sky finds less Permian efficiency than reported

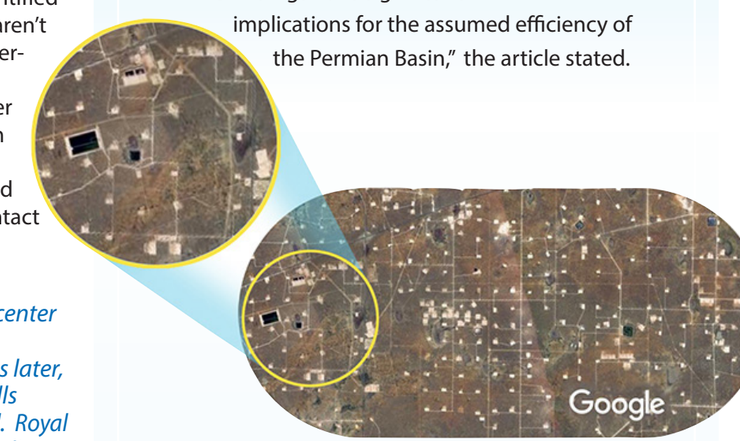
Kayrros Inc., a consulting firm with the tag line, "Disruptive Analytics for Energy Markets," claims that satellite observations show that operators underreported fracing by more than 20 percent in the Permian Basin. The article is at https://www.kayrros.com/media.

The significance of this is "it took many more wells to account for production in 2018 than were reported (to state commissions or FracFocus, a public repository). Assuming a cost of $5 million per horizontal completion, 2018 operator capex is also underestimated by as much as $4.1 billion," stated the article.

"Further, the sand and water intensity of Permian tight oil production in 2018 was 23 percent greater than previously recorded with sand demand being underestimated by 9.2 billion pounds and water by 12.5 billion gallons."

Kayrros also said that the backlog of drilled uncompleted (DUC) wells is considerably smaller than thought.

"The findings have significant implications for the assumed efficiency of the Permian Basin," the article stated.



This image, attributed properly, shows wells in the Permian Basin, but is not a Kayrros image.