RESERVOIR SOLUTIONS

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Reservoir Solutions add-ins grow to 12

Ryder Scott has posted two new Reservoir Solutions Excel add-ins to the webpage at www.ryderscott.com/software/reservoir-solutions/. They are the Lognormal Probability Tool and the Exponential Calculator.

More than 20 years ago, Ryder Scott released its first Reservoir Solutions freeware program and by 2006, the number of petroleum engineering and geoscience applications had grown to 10. Today, the Excel add-ins are used by thousands in the industry the world over.

Bob Royce, petroleum engineer, said, "Right now, I am using the Log Wizard software to do a Simandoux shaley sand analysis. It works well and gives me the answers I need very quickly. I have also used the volumetrics and P/Z add-ins."

To request a password to enable the Reservoir Solutions downloads, please go to www.ryderscott.com/software/reservoir-solutions/rs-freeware-password-request-form/.

The latest version of the software family is compatible with the following versions of Excel: 2007, 2010, 2013, 2016 and 2019. In addition, Ryder Scott developed a fix for Office 365 users, who earlier this year reported that the engineering menu did not load or appear on the add-ins tab of the Excel ribbon after installation.

Please go to www.ryderscott.com/software/reservoir-solutions/ for further information on how to solve the loading problem.

Starting with the two new programs, the following summaries describe the capabilities and functions of each add-in.

Ryder Scott designed the **Lognormal Probability Tool** to assist the experienced petroleum professional in developing assessments of undeveloped reserves and resources quantities in resource plays. The tool is based on the methodology outlined in Monograph 3, "Guidelines for the Practical Evaluation of Undeveloped Reserves in Resource Plays (2010)," published by the Society of Petroleum Evaluation Engineers. The template displays a probit plot with up to three lognormal distributions, each containing as many as 4,000 data points. The **Lognormal Probability Tool** features utilities for sorting data series. It also offers options to select the data interval over which the linear regression will be conducted. The logarithmic scale has a range of adjustments. With the preparation of the probit plot itself, the program will also determine and display the results of the analysis to include P10, P50 and

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Data Analytics

Ryder Scott has posted Well Collator -- a fully automated, web-based application that takes surface and bottom-hole coordinates for a group of wells in a CSV file. Then the tool makes use of a pad-branch-stem hierarchy that enables the user to estimate spacing in a cluster (pad) of wells. The free application is at www.ryderscott.com/software/well-collator/.

Adam Cagle, data science coordinator, said Ryder Scott plans to introduce a spacing-vs.-time calculation. "The enhancement will show how the well's spacing has changed over time and return this information as a time-series variable," he said.

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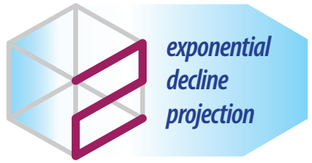
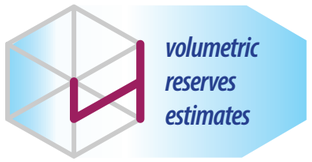
P90 distributions; lognormal series mean; arithmetic mean; and Swanson's mean. Also provided are Monograph 3 metrics P10/P90 and $\hat{p}$. Finally, the tabulation will display the count of data points included in the linear regression and indicate the conformance of the analysis to the criterion presented in Monograph 3, namely, whether the analyzed sample size meets the minimum recommended size.



Using **Exponential Calculator**, evaluators can enter any three valid exponential decline projection variables into the template and click "Calculate." The simple-to-use utility then calculates and displays the remaining two variables. For example, if the user enters initial and final rates for an exponential decline as well as an annual decline rate, **Exponential Calculator** will display remaining reserves and life of the projection. Of critical importance, the evaluator must enter parameters from a valid projection. Entering variables that are not physically or mathematically possible will generate invalid results.

TruVert 2-D provides a sophisticated calculation procedure to determine true vertical thickness (TVT) and net pay in deviated wellbores that penetrate dipping reservoirs. While the computation procedures are relatively simple, manual TVT calculations can be time consuming and often confusing. With **TruVert 2-D**, the user enters measured-depth log data, either measured or subsea contact depths and standard directional survey data for rapid, accurate calculation results.

TruVert 2-D enables the advanced user to emulate heterogeneous reservoir stratigraphy, providing net pay calculations by phase. As a bonus, **TruVert 2-D** incorporates Excel's versatile graphics-handling capabilities to provide the energy professional with printer-friendly, hard-copy output of individual reservoir geometry.



RyVOL facilitates the preparation of volumetric reserves estimates for oil and gas wells and reservoirs. The menu-driven program provides templates for either oil or gas reservoirs and allows the user to determine such fluid and reservoir properties as gas deviation factors, pseudocritical temperatures and pressures, oil- and gas-formation volume factors and calculated solution gas-oil ratios.

Volumetric in-place and recoverable reserves are based on user input for reservoir volumes and recovery factors. Secondary product recovery is calculated either as a percentage of product in-place or as a ratio relative to primary product. **RyVOL** works with the **Reservoir Solutions Modules 1.0**.

Reservoir Solutions Modules 1.0 gives reservoir engineers the capabilities to solve common problems requiring the calculation of oil and fluid properties, such as pseudocritical properties, compressibilities and formation-volume factors. Included in the program are functions for calculating Tc (pseudocritical temperature), Pc (pseudocritical pressure), Z factor (real gas deviation), shut-in bottomhole pressure, Cg (gas isothermal compressibility), Cw (water isothermal compressibility), Co (oil isothermal compressibility), Bo (oil formation volume factor) and Bg (gas formation volume factor).

Reservoir Gas Analysis Software (ResGAS) computes critical pressures and temperatures and specific gravities and heating values of a gas stream. The application works with the **Reservoir Solutions Modules** program.

The computation of gas properties includes corrections for contaminants and adjustments for condensate content. **ResGAS** also calculates wet gas in place and recoverable wet-, dry- and sales-gas volumes as well as recoverable condensate volumes.

ResGAS computes the estimated recovery of propane, butane and sulfur and approximates the BTU content of separator and gas sales. A user must enter separator-gas component percentages derived from laboratory analysis and other data input, including well and reservoir parameters and recovery factors.

QuickLook economics evaluation software gives the user a simple, fast tool to compute screening economics for prospects, evaluate workovers and recompletions and run preliminary lending economics. The user can run complete reserves and cash flow projections for individual wells or properties.

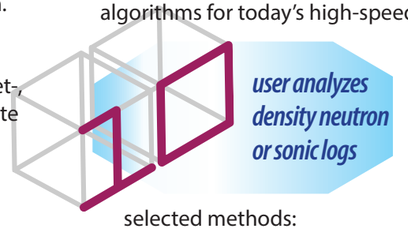
QuickLook computes up to four distinct product streams, two oil and two gas, and secondary product streams based on gas-oil ratios or condensate yields. The program provides options for exponential, hyperbolic, harmonic and manual product projections. A user can also subtract or add together streams.

QuickLook also has multiple expense, tax and investment-parameter options as well as a provision for abandonment costs.

The **Material Balance application** automatically calculates original gas in place (OGIP), estimated ultimate recovery (EUR), BHP/Z vs. cumulative gas production and Tc and Pc properties from gas gravity while adjusting for contaminants. Using the popular Cullender-Smith (1956) method as modified by Ryder Scott, the utility software also predicts shut-in bottomhole pressures from tubing pressures in gas wells.

With the **Flowing Pressure Analysis** program, a user can evaluate the performance of producing gas or gas-injection wells. The program enables the user to calculate flowing bottomhole pressures (FBHP) for gas wells. The application also automatically computes associated backpressure equation parameters and displays a traditional log-log backpressure curve at the user's option.

For producing wells, absolute open flow (AOF) potential is also calculated. Static bottomhole pressure (SIBHP) can be determined from shut-in tubing pressure (SITP). The application integrates techniques derived from Cullender-Smith and Turner, Hubbard and Dukler (1969). Ryder Scott modified those algorithms for today's high-speed computers.

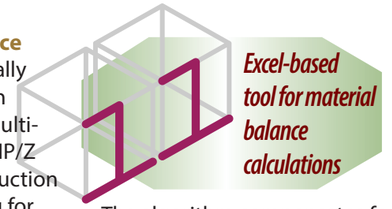


With **LogWizard**, a user analyzes density neutron or sonic logs using either of two templates and calculates the following petrophysical values based on user selected methods:

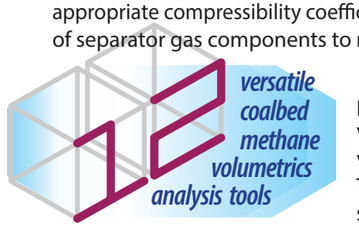
- Shale content—Applicable to consolidated and unconsolidated formations
- Total porosity—Uses arithmetic-average or sum-of-squares method
- Effective porosity—Uses arithmetic-average or sum-of-squares method
- Formation water saturation—Solves using Archie or modified Simandoux algorithms

For sonic logs, the program template uses interval transit time to calculate uncorrected sonic and effective porosities. For water-saturation and shale-content computations, **LogWizard** includes visual basic functions that can be exported or linked to other Excel applications.

Based on user-selected criteria, **LogWizard** calculates gross reservoir sand thickness and net pay thickness as well as average porosities and water saturations for pay sections. The program incorporates an Rw calculator to assist users in computing formation water resistivity from log data. The template also contains areas for entering core data or notes.



RamBal is an easy-to-use, Excel-based tool for material balance calculations to help predict future performance of abnormally pressured, unconventional gas fields. The algorithm compensates for reservoir rock and water compressibility in determining both OGIP and recoverable reserves and accounts for finite downdip free water expansion. The program requires only commonly available reservoir pressures, temperature data and gas properties and includes "calculators" and tips to help experienced petroleum professionals assess appropriate compressibility coefficients as well as the conversion of separator gas components to reservoir (wet gas) conditions.



The **rscCBM** program provides the user with versatile coalbed methane volumetrics analysis tools. The program incorporates standard Langmuir parameters obtained from laboratory analysis of coalbed core samples and has a feature-rich set of calculation procedures to provide useful, reliable results.

The volumetrics program presents a graphical representation of results for each zone, seam or well, which can be printed. Data validation and enhanced navigation are used extensively. In each case where calculated results are anticipated in the program, the user may optionally override such calculations. Those changes will be evident to the user by a change in background color. That is especially important when no lab data is available and calculations are entered manually rather than basing them on Langmuir parameters.

The templates in **rscCBM** are large by design and use "frozen panes" to facilitate data entry and visualization of graphical results. That could create difficulties for users with low-resolution graphics displays. To compensate, the program automatically detects the user's display settings to set or eliminate frozen panes.

Reservoir Solutions user manuals are included in the Excel files accessible from the engineering menu. All posted freeware programs produce presentation-quality, on-screen views and printer-friendly, hard-copy output.

Ryder Scott also distributes USB drives with the freeware from its booth at the SPE-ATCE and NAPE events.

Editor's Note: *Ryder Scott does not guarantee or warrant the accuracy or reliability of the Reservoir Solutions software and disclaims its fitness for any particular purpose.*

Acuña adds resources classification for some companies to consider

-- **Herman Acuña**, executive vice president

Herman Acuña

In this article, we explore the difficulties that some E&P companies face when maturing volumes from exploration to development – especially those companies trying to expedite declarations of commerciality to satisfy the demands of management, board members and stakeholders.

We all have seen the headlines proclaiming large discovery volumes, sometimes expressed as "reserves." In some cases, those announcements fall short of the stricter, higher classification standards of the SPE-PRMS (Society of Petroleum Engineers Petroleum Resources Management System).

The root of this over-optimism starts with maturation procedures that encourage exploration departments to regularly hand over opportunities to those in field development soon after the discoveries. In some cases, those exploration units limit delineation to maintain lower finding costs. That, in turn, keeps other key performance indicators (KPIs) for exploration at optimum levels.

However, curtailing delineation causes problems with the maturation of an opportunity, in part, because generally, a development department operates differently from an exploration unit.

E&P companies approve development budgets based on internal costs to evaluate their portfolios of opportunities. The premature handover of a discovery, not yet matured or in the portfolio, may result in a stopping point in the workflow.

Typically, companies do not design development budgets for further delineation and maturation. Furthermore, those in field development apply the rigor of the SPE-PRMS definitions to volumes handed over by exploration. That generally results in significant downward revisions to resources and reserves categorizations and classifications. Please see Fig. 1 on this page.

To keep those project opportunities from falling into "no-man's land," I recommend that instead of the traditional exploration-to-development handover, companies create opportunity maturation teams (OMTs) to do the following:

- **Focus on advancing the opportunity without the KPIs for exploration and/or development.**
- **Incorporate expertise from both exploration and development teams.**
- **Facilitate continuity of analysis.**
- **Designate an opportunity maturation budget.**
- **Achieve a unified handover to development and clearly define the "sponsor" responsible for the progression.**

Please see that approach schematically in Fig. 2 on the right.

Once "discovered," some exploration departments with large discoveries reclassify prospective resources to 1C, 2C and 3C contingent resources based on analyses that more closely resemble exploration practices, not those of development. Hydrocarbon volumes can be classified incorrectly, particularly when considering the SPE-PRMS requirement that without additional technical data, there should be no change in distribution of technically recoverable volumes when projects are reclassified from contingent resources to reserves.

Accordingly, volumes that qualify as 1C, 2C or 3C also progress to 1P, 2P or 3P. The SPE-PRMS provides a tool to track the progression of those opportunities during the maturation process. However, in my opinion, the PRMS is missing a classification for large discovered volumes not qualified to be classified as contingent resources.

To assist E&P companies, I have proposed an additional classification defined as "scope for recovery" to bridge this gap. This classification allows for the recognition of large discoveries without having to declare them contingent resources. It provides flexibility for wider ranges of technical uncertainty.

The proposed OMTs can also organically operate within the organization with budgets separate from exploration and development. The following graph, Fig. 3, shows a modified SPE-PRMS framework as discussed in this article.

Editor's Note: *This editorial expresses the views of Herman Acuña, executive vice president, and are not necessarily those of Ryder Scott or its professionals. We have published his commentary to stimulate further open discussion in our industry.*

This editorial is based on a presentation from Acuña at the Ryder Scott Mexico Conference in Cancun, Mexico, in mid-May. The conference was the first one held by Ryder Scott outside of the U.S. and Canada. Attendees hailed from nine countries: Argentina, Brazil, Colombia, Ecuador, Italy, Mexico, Nigeria, Paraguay and the U.S. Over two days, 15 speakers made presentations. The audience enjoyed live simultaneous translations from English to Spanish and vice versa. Ryder Scott plans to hold a conference in Canada next year and further plans call for a conference outside North America in 2021.

Fig. 1

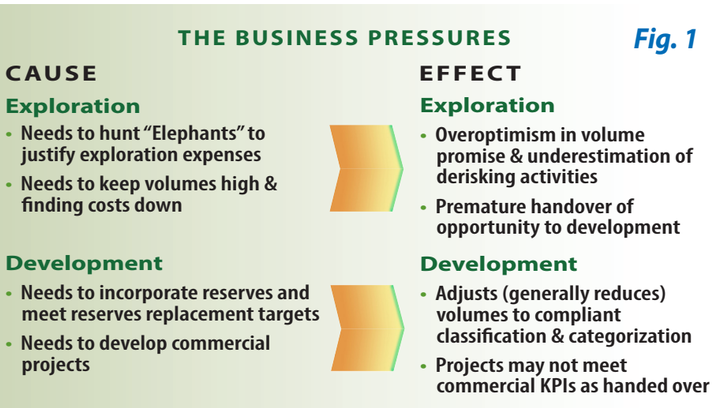


Fig. 2

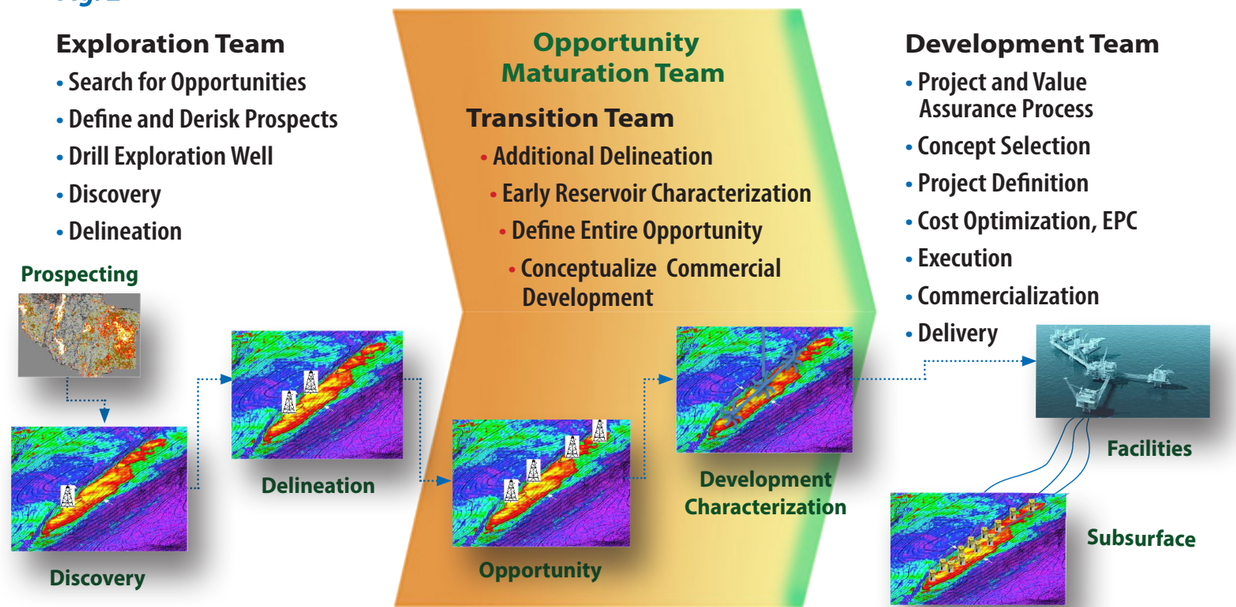
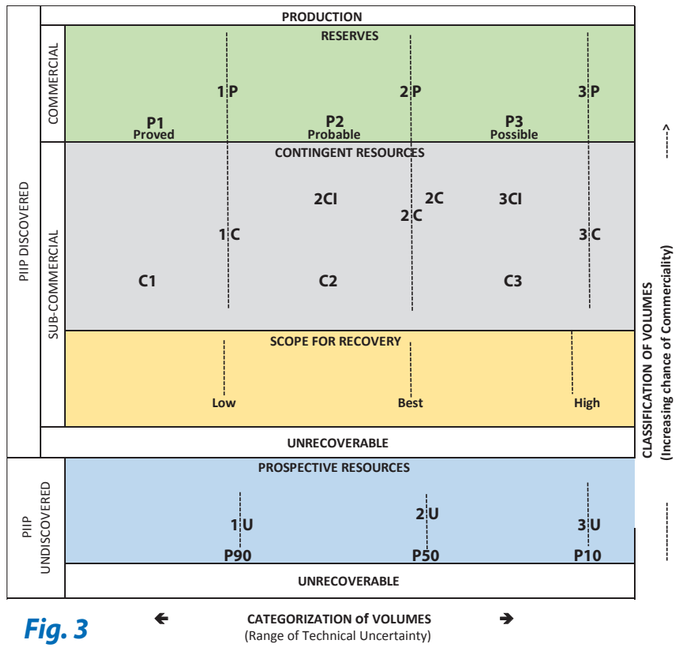


Fig. 3



SPE-PRMS offers flexibility to industry

-- **Dan Olds**, managing senior vice president and incoming SPE-OGRC chairman

The SPE-PRMS preamble notes that the guidelines "allow flexibility for entities, governments and regulators to tailor applications for their particular needs." Perhaps the most common example is where oil and gas companies customize the PRMS matrix.

They often add new subclasses for detail and closer alignment with internal decision-making processes. Additional detail can be useful in transitioning from potential to contingent resources.

In theory, the transition should be straightforward. In practice, it may take several wells over an extended period to determine the extent of the discovery. During that time, each new well can cause large swings in resources estimates.

The introduction of an intermediate class between prospective and contingent resources is an example of a customization that provides clarity during the process of maturing a discovery to contingent resources.

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.

G&G

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.

Please see Up, Up and Away on page 8

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

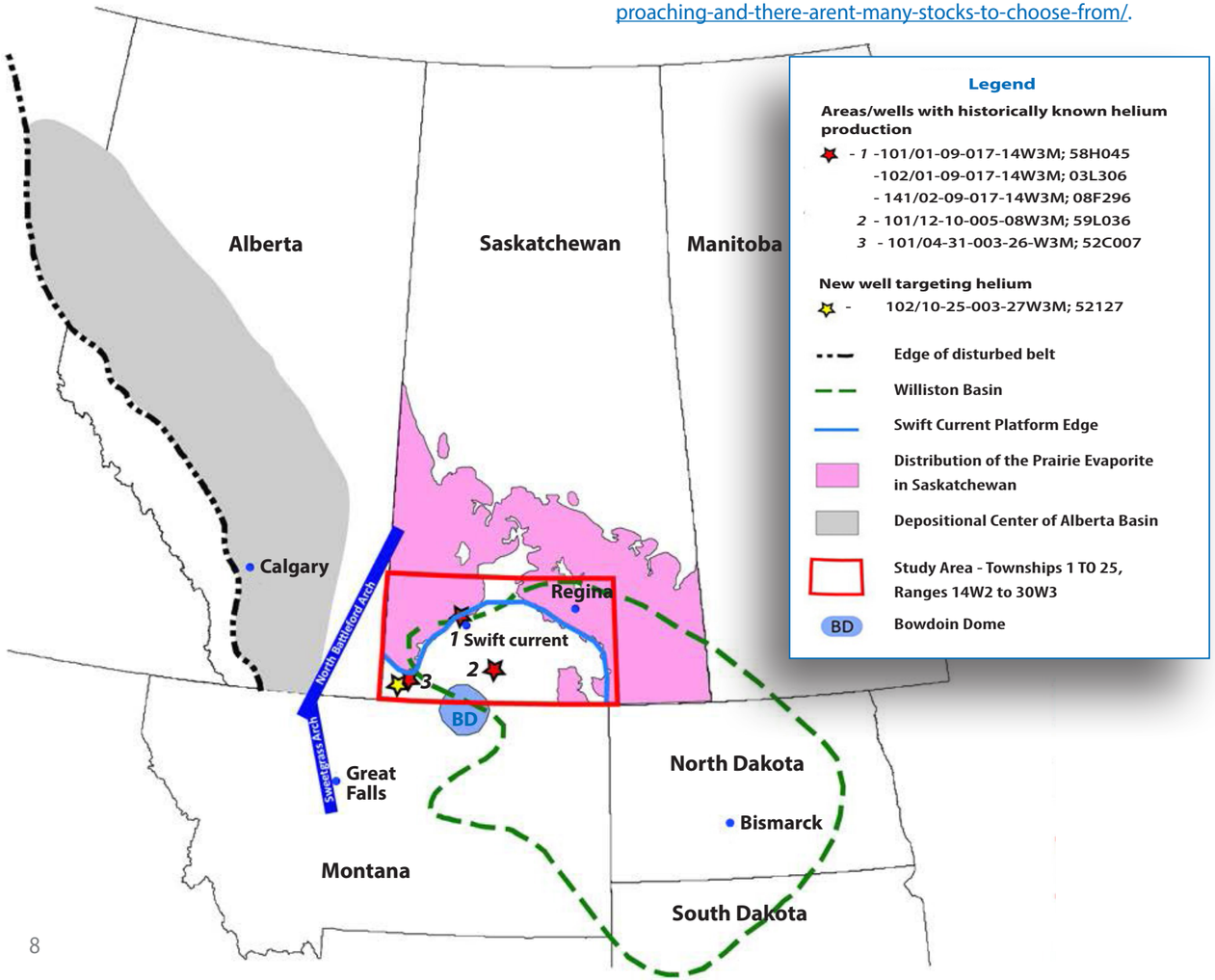
"The search for new sources of helium is of paramount importance as a combination of declining production and increasing demand have made helium prices soar. This follows a century in which the United States had a near monopoly on helium reserves and U.S. production met global demand," states an introduction 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/.



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.*

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.

Spy in the sky finds less Permian efficiency than reported

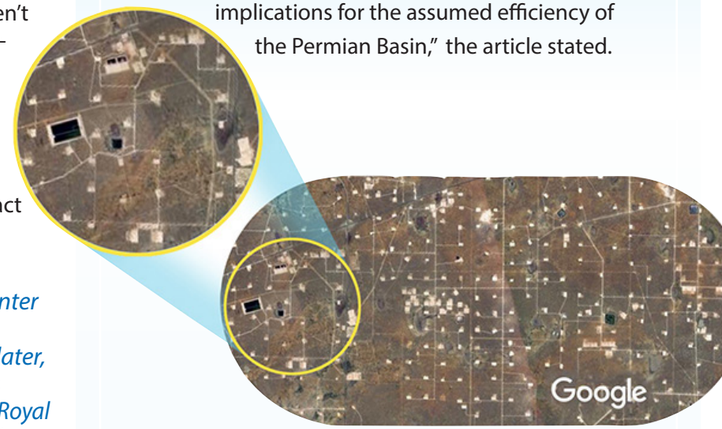
Kayrros Inc., a consulting firm with the tag line, "Disruptive Analytics for Energy Markets," claims that satellite observations show that operators underreported fracing by more than 20 percent in the Permian Basin. The article is at https://www.kayrros.com/media.

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.

Russian alliance partner translates SPE-PRMS

Dmitri Zabrodin, center, stands with his students showing training certificates after completing the three-day SPE-PRMS training session in Almaty in March. Classroom participants were geologists and petroleum engineers from oil and gas producers in Kazakhstan.

Long-time Ryder Scott alliance partner, **Dmitri Zabrodin**, vice president at FDP Engineering LLP, has finished translating the 2018 SPE-PRMS into Russian. It is available at https://www.spe.org/industry/docs/PRMgmtSystem_V1.01_RUS-FINAL.pdf

He donated more than 150 hours of his own time to SPE to translate the 67-page document.

The PRMS (Petroleum Reserves Management System) comprises guidelines for evaluating hydrocarbon reserves and resources. It has become the de-facto international standard for classifying recoverable petroleum quantities. Moscow-based FDP and Ryder Scott work together on resources and reserves studies across the FSU.

Latest project part of ongoing efforts

The project not only required the language skills of a translator, but a deep knowledge of reservoir engineering, production forecasting, economics and the PRMS itself. Zabrodin delivered the translation to SPE by the target date in September. Ryder Scott and FDP professionals assisted Zabrodin in drafting the translated text, which was peer-reviewed by both Russian and international SPE-designated experts.

One of the first attempts to map the Russian system to the PRMS was done by Zabrodin and **John Hodgin**, then president at Ryder Scott. They presented their work at the International Geoscience Conference in Tyumen, Russia, in late 2007. On that project, they reviewed the 2005 SPE mapping work and, at that time, the new 2007 SPE-PRMS to remap those guidelines to what was then newly drafted Russian RF-2005 reserves standards.

As a speaker and instructor in the FSU, Zabrodin has helped bridge differences between the PRMS and the Russian classification and categorical standards for reserves and resources.

At the Russian O&G Summit E&P in 2015, Zabrodin delivered a presentation that compared the recently enforced RF-2013 classification system in Russia to the 2007 SPE-PRMS. Please see the July-September 2015 *Reservoir Solutions* article, "New Russian reserves classification system introduces economic limits," on Page 8 at https://www.ryderscott.com/wp-content/uploads/July-2015-Newsletter.pdf?r=false.

In 2016, Zabrodin presented a three-day training course on the application of the SPE-PRMS definitions and classifications to reserves evaluations. He designed the course agenda for various specialists in major oil and gas producing companies in the Republic of Kazakhstan.

After that, Zabrodin regularly presented the three-day course to several producing companies and scientific organizations in Kazakhstan. In addition, he conducted an online SPE-PRMS class to reach other audiences in the country. This year, he presented the SPE-PRMS class in Almaty and Atyrau.

Through his continuing training sessions, Zabrodin has been instrumental in helping to guide Kazakh management and reserves-evaluation professionals in their transition from the obsolete Soviet reserves booking system to the modern, universally accepted SPE-PRMS.

Earlier this year, the chairman of the SPE Oil and Gas

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U.K. shale gas reserves are 80 percent smaller than estimated, study claims

U.K. shale gas reserves are at least 80 percent smaller than thought, concluded a University of Nottingham report last August. The study is at www.nature.com/articles/s41467-019-11653-4.

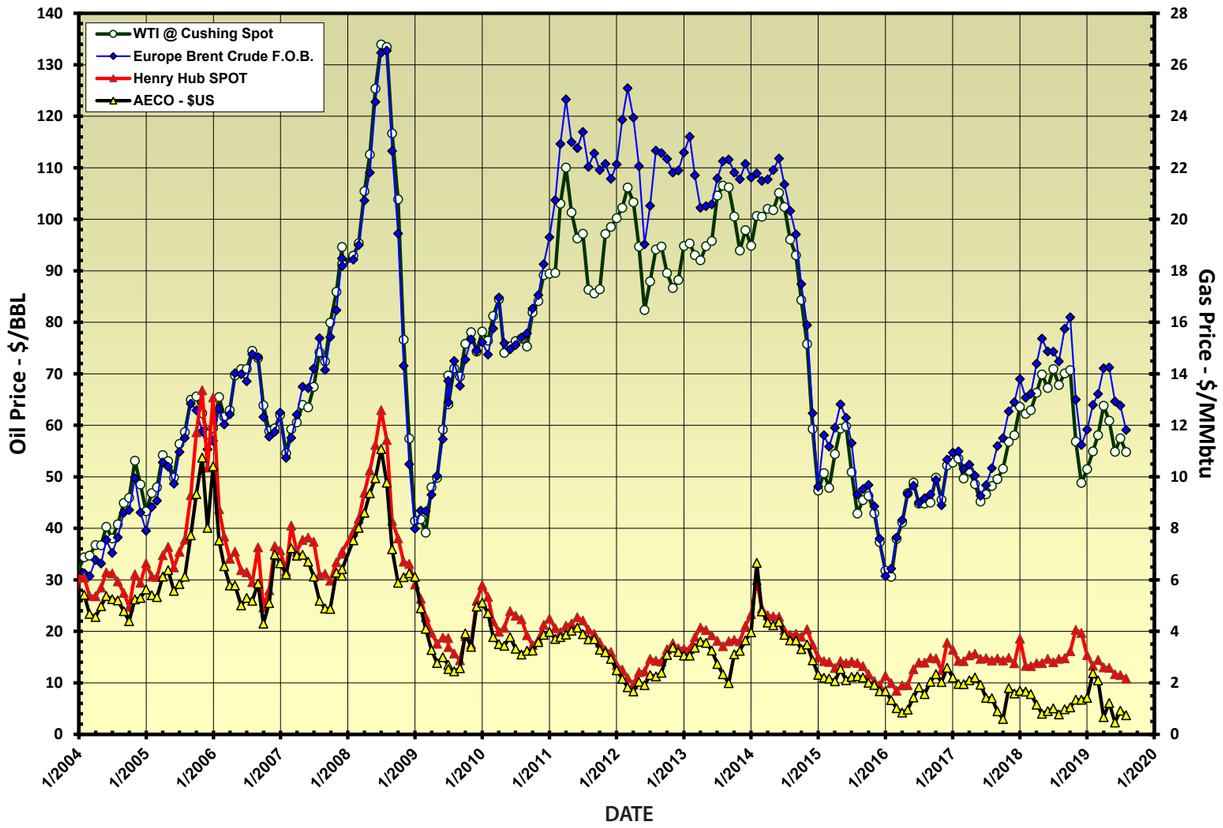
Web-based media outlet *The Conversation* detangled some of the convoluted, scientific language in the report at http://theconversation.com/how-we-discovered-uk-shale-gas-reserves-are-at-least-80-smaller-than-thought-122076.

In 2013, scientists conducting a U.K. government study estimated the in-place gas volumes in the Bowland shale with models developed for shales in the U.S. They did not take into account key differences between shale gas in the two countries.

The Conversation reported, "Initial estimates of this gas-holding capacity may have been inflated as they overlooked the effect of moisture, which is known to reduce the amount of gas held within the shale."

The scientists estimated that the Bowland shale play contained 1,300 Tcf of gas and could provide the U.K. with up to 50 years of gas at current demand. Revised estimates, assuming a "fairly optimistic" 10-percent recovery factor, yielded 200 Tcf of gas or a 10-year supply.

Price history of benchmark oil and gas in U.S. dollars



Published, monthly-average, cash market prices for WTI crude at Cushing (NYMEX), Brent crude and Henry Hub and AECO gas.

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Reserves Committee (OGRC) asked Zabrodin to "lead the effort to translate the 2018 PRMS into Russian" after considering recommendations of support. SPE said it selected Zabrodin because of his expertise.

"He has been granted the freedom to manage the translation that he deems most effective," the OGRC said then.

The committee is the most influential decision-making body for establishing and revising petroleum reserves definitions used by the industry worldwide. The 2018 SPE-PRMS was jointly approved by the boards of SPE, Society of Petroleum Evaluation Engineers, World Petroleum Congress, American Association of Petroleum Geologists, Society of Petrophysicists and Well Log Analysts and European Association of Geoscientists & Engineers.

Zabrodin is an author of several articles published in Russian industry magazines. He has BS and MS degrees in petroleum engineering from the Gubkin Russian State University of Oil and Gas and a PhD degree in petroleum engineering from VNIIneft. He has written more than 60 research papers, conference proceedings and technical reports and penned a book on tertiary oil recovery.

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Publisher's Statement

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