RESERVOIR SOLUTIONS

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SPECIAL EDITION

2ND ANNUAL RYDER SCOTT CANADA RESERVES CONFERENCE

OCTOBER 2ND

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Calgary Conference registration opens

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A word from the editor

Over the past decade, the annual Ryder Scott Reserves Conference in Houston has evolved into a perennial event for evaluators and other professionals in a niche sector of the oil and gas industry. The goal has always been to present a speaker lineup of industry experts knowledgeable of various contemporary, compelling reserves issues. We have been honored to present speakers who in our industry are considered icons—from Professor **John Lee** to our own chairman emeritus, **Ron Harrell**.

Wunderkinds advancing new technical and mathematical approaches to reserves-estimating challenges have presented. Attorneys and accountants specializing in the oil and gas industry have spoken as well as the regulators themselves. Our petroleum engineers and geologists, considered experts in their own right, have presented. This year, for the first time, an expert from a competitor to Ryder Scott will present. We are truly committed to putting together the best speaker lineup regardless of company affiliations.

All speakers try to clarify technical, commercial and regulatory matters essential for evaluators, managers and other industry professionals to understand. Through the conference, Ryder Scott aims to benefit those in our audience, whether they are clients or non-clients. Many of the attendees make daily, hands-on decisions on reserves.

Last year, we added a new venue—the Ryder Scott Canada reserves conference, a one-day annual event styled after the Houston gathering. This year, we expect that together the conferences will attract more than 450 oil and gas professionals. Through the years, we have built up a big following while enriching our audience and our industry, we hope.

Ryder Scott underwrites the programs and is honored to give back to an industry which has given so much to us over 77 years. We hope you have a chance to attend one of the conferences.

Regards,

Mike Wysatta
Editor of *Reservoir Solutions* newsletter

CSA plans to respond to comments on proposed NI 51-101 later this year

The Canadian Securities Administration has reviewed all comments on proposed revisions to NI 51-101 and plans to respond in the late third or fourth quarter, said **Phillip Chan**, chief petroleum officer at the Alberta Securities Commission. The CSA has proposed amendments to National Instrument 51-101 on Resources Other Than Reserves (ROTR) and while some drew praise, others were criticized by the E&P companies and consultants that submitted comments.

The proposed amendments will allow disclosure of resources prepared under alternate resource evaluation systems, namely those of the U.S. Securities and Exchange Commission and the Society of Petroleum Engineers Petroleum Resources Management System.

Reporting NPVs proposed as mandatory

While reporting prospective and contingent resources in Canada is optional, if a proposed change to Form 51-101-F is finalized, then public issuers disclosing ROTR will be required to file associated net present values of future net revenue. Some commenters supported reporting NPVs of ROTR if done on some classifications and sub-classifications vs. all classes. For instance, several commenters questioned tabulating a negative value for sub-economic contingent resources, preferring to be allowed to disclose the future net revenue of economic contingent resources while reporting sub-economic separately and without FMVs.

Canada has more than 450 public oil and gas companies, but only 13 entities commented. With the low response rate, the comments do not necessarily reflect the views of overall Canadian industry. On the other hand, public issuers opting to report resources have grown to more than 120 over the past 10 annual reporting periods since Canada's new rules were introduced.

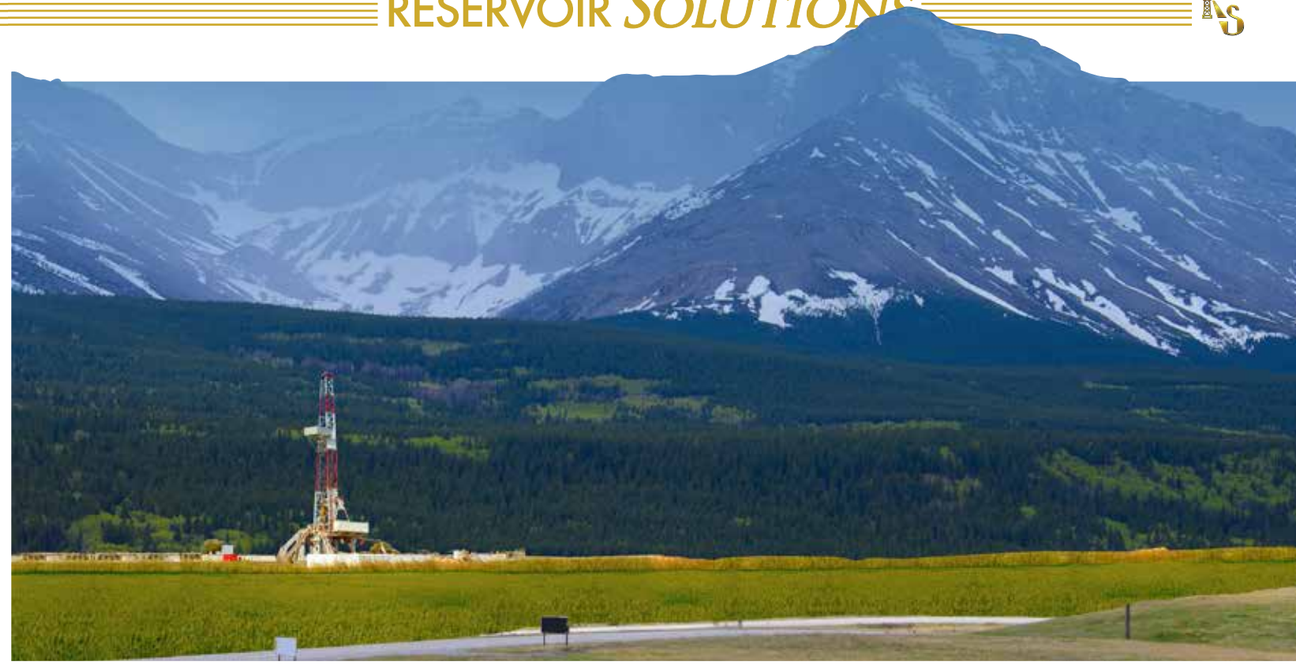
None of the commenters fully supported disclosing NPVs for all classes and subclasses of ROTR. Several companies opposed the proposed measure in its entirety.

Talisman Energy Inc. said that resources are not required to be economic and ascribing economic value could result in "misleading and confusing disclosures caused by issuers ascribing vastly different economic values."

Imperial Oil Ltd. commented that it does not support reporting NPVs of resources. "Given the … uncertainty in the assumptions necessary to determine value for …resources, we believe the proposed amendment may reduce comparability between issuers, heighten the potential for misleading data and detrimentally impact the integrity of disclosures."

Canadian Oil Sands Ltd. also said no to reporting future net revenue from ROTR. "We believe that requiring (that) provides little, if any, benefit to investors and, in fact, implies a greater level of precision than appropriate…" **Cenovus Energy Inc.** said, "We strongly disagree with the CSA proposal… We believe that disclosure … would be difficult to verify," adding that "significant uncertainties (are) involved in the long-term forecasts required to calculate this information." Cenovus also criticized valuing resources "given the unreliability of those estimates."

Husky Energy Inc. agreed with the other commenting oil and gas companies, saying it was against requiring NPVs for resources. "These projects are immature compared to reserves projects. …It is probable that different companies will use widely different assumptions, and if there is not consistency…, then there will be no comparability in net present values."



Canadian Natural Resources Ltd. also urged the CSA to drop the requirement to value ROTR, saying that "determining value for contingent and prospective resources is dependent on many different assumptions, including recovery technology, market access, development plans, capital costs, product prices and corporate priorities."

IQREs

The CSA also proposed that issuers be required to use independent qualified reserves evaluators (IQREs) to audit or evaluate resources. Two of three commenting consulting firms agreed with the proposed amendment; the other did not comment. Some oil and gas companies supported the required use of IQREs. Cenovus remarked that it discloses prospective and contingent resources prepared by an IQRE.

"We believe (the proposed requirement) is highly desirable since it will improve the reliability of disclosure(s)," the company said.

CNRL also supported the required use of IQREs to prepare ROTR disclosures. "This requirement would ensure that the resource information contained in Form 51-101F1 is of the same quality, reliability and consistency as the reserves estimates."

Talisman obtained a NI 51-101 exemption order in 2010 permitting it to continue to rely on internally-generated reserves interpretations. The company asked the CSA to "confirm that … (the proposed amendment) would not result in any termination or change to the IQRE exemption…"

Imperial supported the proposition requiring an IQRE, except for itself and other issuers which have internally generated reserves data that the company said is at least as reliable as independently generated reserves data. The company expects to be exempted.

Itemizing reclamation costs

CSA recommendations call for separating abandonment and reclamation costs in a future net revenue disclosure for ROTR. Talisman said, "The value of such disclosure is disproportionate to the amount of work required to separate them."

Suncor Energy Inc. said, "The estimation of reclamation costs is not currently an area of expertise for independent reserves evaluators. Evaluators will therefore not likely be able to render an independent opinion in this regard and will need to rely on information provided by the reporting issuer or hire environmental experts, further increasing costs."

Bitumen and heavy oil classifications

Based on the Canadian Oil and Gas Evaluation Handbook (COGEH), the CSA proposed to continue to define bitumen and heavy crude based on viscosity with a threshold of 10,000 mille Pascal seconds while the American Petroleum Institute defines both based on gravity. Cenovus said, "We are aware where some heavier oils could fit into both definitions," and request a clear distinction between the two.

CNRL argued that the extraction of bitumen requires thermal in-situ technology and tertiary recovery processes for deep deposits or mining methods for shallow deposits while heavy oil can be recovered through primary recovery methods. "We recommend that the definition of heavy crude be changed to include the words, 'that can be produced under primary recovery methods' to be clear and comparable," the company said.

Some commenters recommended that the definition be based on the SPE-PRMS definition of bitumen, which states that "in its natural viscous state, it (bitumen) is not normally recoverable at commercial rates through a well and requires the implementation of improved recovery methods such as steam injection."

Please see CSA on Page 10

2nd Annual Ryder Scott Canada Reserves Conference

RS Canada accepting requests to attend reserves conference in Calgary

Ryder Scott Canada is taking online registrations for the 2nd Annual Ryder Scott Canada Reserves Conference to be held in the Kensington Ballroom at the Marriott Downtown Hotel in Calgary on Thursday, Oct. 2. Seating is limited.

North American experts will discuss petroleum reserves issues at this one-day oil and gas conference. The speaker lineup includes professionals in geology/ engineering, government regulation, research and consulting.

To request a reservation, go to CVENT at https://RSCanada.cvent.com and use the code, calgaryoil. Generally, Ryder Scott will confirm your request with a reservation. Exceptions are based on seating limitations. For instance, in some cases, Ryder Scott has to limit the number of attendees from a given company in fairness to all companies. Those not initially accepted may be accepted at a later date if they request that their names be put on a wait list. Ryder Scott will try to fill all cancellations. The agenda is targeted to oil and gas professionals in geology, reservoir engineering, finance and government. "We expect that up to 100 executives, managers and technical professionals will attend," said **Lynn Kis**, managing senior vice president who manages the conference. The event is underwritten by Ryder Scott Canada.

Those requesting reservations can also do so by phone by calling 403-705-1050 or by email. Use the subject, Calgary Conference, and email your business card information to ConferencesCalgary@ryderscott.com.

Registration deadline is Sept 18. Late registrations will be considered for reservations depending on available seating. To attend, registrants have to receive affirmative confirmations from Ryder Scott. Those with confirmed reservations will check in. No hard-copy confirmations or tickets are required.

Other details: Attendees will receive all presentations on flash drives. APEGA-licensed geologists and engineers will earn up to eight Continuing Professional Development hours. Meals, accompaniments, hors d'oeuvres, deserts and beverages, including those at the evening cocktail reception, will be catered by the Marriott and are complimentary. Networking will occur throughout the day at breaks and the reception.

The hotel address is 110 9th Ave. SE, Calgary, Alberta T2G 5A6 Canada. The phone number is 1-403-266-7331.

Schedule of Events

"Evaluation Challenges in a Changing North America"

Time	Speaker	Topic
7:30 a.m. – 8:30 a.m.		Conference Check In and Light Breakfast
8:30 a.m. – 8:40 a.m.	**Larry Connor**, managing senior vice president at Ryder Scott Petroleum Consultants	**Welcome and Introduction**
8:40 a.m. – 9:20 a.m.	**Randy Freeborn**, chief research engineer at Energy Navigator Inc.	*Probabilistic Analysis vs. Deterministic*
9:20 a.m. – 10 a.m.	**Eleazar Benedetto-Padron**, vice president, technical specialist at Ryder Scott Petroleum Consultants	*Volumetric Challenges in Unconventional Reservoirs*
10 a.m. – 10:30 a.m.		**Coffee Break**
10:30 a.m. – 11:10 a.m.	**Phillip Chan**, chief petroleum officer at the Alberta Securities Commission	*New Amendments for NI 51-101 Regulations*
11:10 a.m. – 11:50 a.m.	**John Harper**, technical advisor at Geo-Reservoir Solutions Ltd.	*Reservoir Characterization and the Maverick Hypothesis*
11:50 a.m. – 1:30 p.m.		**Buffet Luncheon**
1:30 p.m. – 2:10 p.m.	**Stuart Filler**, senior petroleum engineer at Ryder Scott Petroleum Consultants	*Production Forecasting in Ultra-Low Permeability Reservoirs—Proposed Methodology*
2:10 p.m. – 2:50 p.m.	**Peter Howard**, president and CEO at the Canadian Energy Research Institute	*Unlocking Incremental Reserve Value in Canadian Oil and Gas by Accessing European and Asian Markets*
2:50 p.m. – 3:20 p.m.		**Coffee Break**
3:20 p.m. – 4 p.m.	**John Etherington**, managing director at PRA International Ltd.	*Comparison of PRMS and COGEH and Plans to Merge*
4 p.m. – 4:40 p.m.	**David C. Elliott**, former chief advisor at the Alberta Securities Commission	*New COGEH Guidelines on ROTR*
4:40 p.m. – 4:50 p.m.		**Adjourn Conference**
4:50 p.m. – 6:30 p.m.		*Cocktail Reception*

10th Annual Ryder Scott Reserves Conference on Sept. 17

The 10th Annual Ryder Scott Reserves Conference will be held on Wednesday, Sept. 17 from 7 a.m. to 4 p.m. at the Hyatt Regency hotel in downtown Houston. True to its theme, "Evaluation Challenges in a Changing World," the day-long event is essential for those wanting to keep in step with the latest issues in estimating and reporting oil and gas reserves.

The conference attracts more than 300 oil and gas professionals, making it the single largest gathering of reserves evaluators in the world.

Ryder Scott will email invitations in August. The email will have a link for an invitee to easily register online. Registrants will receive emailed confirmation notices.

Taking a paper-saving approach, Ryder Scott is discontinuing printed versions of the presentations traditionally distributed at check-in. Instead, attendees will receive digital versions (PDF files) on USB drives. Attendees will also receive padfolios embossed with 10th anniversary artwork on the front cover and with writing tablet paper to take notes. Logo pens will also be provided. All presentations, except any withheld by the speakers, will be posted on the Ryder Scott's website at www.ryderscott.com

Larry Connor, managing senior vice president, manages the event. Email requests, questions or comments to RSCConfHouston@ryderscott.com.

Attending licensed petroleum engineers will receive six to eight hours of CEUs (Continuing Education Units). State-licensed engineers are required annually to maintain their licensing through continuing education.

For instance, the Texas Board of Professional Engineers requires that licensed engineers earn 15 professional development hours (PDHs) per year and at least one hour must be in professional ethics, roles and responsibilities of professional engineering or review of the Texas Engineering Practice Act and board rules. Those who attend the ethics presentation at the reserves conference will receive one PDH, which fulfills the one-hour annual requirement.

When

Wednesday, Sept. 17, 7 a.m. to 4 p.m.
Ethics Hour: 4 p.m. to 5 p.m.
Cocktail Reception: 5 p.m. to 7 p.m.

Where

Hyatt Regency Hotel, Imperial Ballroom, 1200 Louisiana St., Houston, Texas 77002

Schedule of Events

"Evaluation Challenges in a Changing World"

Time	Speaker	Topic
7 a.m. – 8 a.m.		Conference Check In and Light Breakfast
8 a.m. – 8:30 a.m.	**Don Roesle**, CEO at Ryder Scott Petroleum Consultants	Welcome and Introduction
8:30 a.m. – 9:15 a.m.	**Ray Flumerfelt**, senior reservoir manager–southern Wolfcamp shale at Pioneer Natural Resources Co.	*What is the Outlook for the Wolfcamp Trend in the Permian Basin?*
9:15 a.m. – 10 a.m.	**Ali Daneshy**, president at Daneshy Consultants Intl.	*New Trends and Technology for Fracing Unconventional Reservoirs*
10 a.m. – 10:30 a.m.		Break
10:30 a.m. – 11:15 a.m.	**John Lee**, professor at University of Houston	*Advances in Shale Analysis*
11:15 a.m. – 12:15 p.m.		Buffet Luncheon
12:15 p.m. – 1 p.m.	**John Seidle**, vice president at MHA Petroleum Consultants LLC	*Monograph 4: Developed Reserves in Unconventional Reservoirs*
1 p.m. – 1:45 p.m.	**Randy Lafollette**, manager–applied reservoir technology at Baker Hughes Inc.	*Drilling Challenges in Shale Plays: An Emerging Technology to Overcome*
1:45 p.m. – 2:15 p.m.		Break
2:15 p.m. – 3 p.m.	**Marc Folladori**, partner, retired, Mayer Brown LLP	*SEC Reserves Hot Button Topics*
3 p.m. – 3:45 p.m.	**Stuart Filler**, senior petroleum engineer, Ryder Scott Petroleum Consultants	*Proper Use and Construction of Type Curve Analysis*
3:45 p.m. – 4 p.m.		Adjourn Conference
4 p.m. – 5 p.m.	**Joe Stowers**, petroleum engineer, Ryder Scott Petroleum Consultants	*Ethics Hour*
5 p.m. – 7 p.m.		Cocktail Reception

Early research shows strongest correlation in Wolfcamp is between EUR levels and operator

The Wolfcamp tight-sand formation in the Midland basin of the Permian in west Texas has emerged as a world-class horizontal play four years after the boom started.

Some industry executives, including **Scott Sheffield**, CEO at Pioneer Natural Resources Co., say that Wolfcamp could possibly become the largest oil and gas discovery in the world. Vertical wells have been successful in Wolfcamp but Pioneer and others are getting maximum recoveries and returns by shifting to new horizontal drilling and multi-stage hydraulic fracturing techniques.

The *Oil & Gas Investor* magazine said in its May edition that more than 100 horizontal wells have been drilled over the past two years in the Midland basin to derisk the Wolfcamp intervals. The basin has multiple stacked pay zones so Pioneer is drilling stacked laterals and fracing not only in the Spraberry, a shallower, productive trend, and Wolfcamp zones but in the layers between them, including the Dean. Wolfcamp in the Midland basin alone has four zones—Wolfcamp A, B, C and D, which some call the Cline shale. Spraberry has upper, middle and lower intervals.

Pioneer drilled 30 to 40 wells from the same pad site to different depths before turning them horizontally through six different strata, **Tim Dove**, president and COO, told the *Dallas Business Journal* last year. In June, Dove reiterated in the *Oil & Gas Journal* that "[Last year] we accomplished quite a lot in terms of our understanding of the various zones in the Wolfcamp basin."

At an earnings conference call in May, Sheffield said, "the big change is increasing our lower Spraberry (production) … and continuing to see the same type returns on the Wolfcamp A, B and D."

The smaller independents are also turning to horizontals in multiple intervals. RSP Permian acquired 40,000 net acres in the Midland basin in 2010 to drill successful verticals in the Wolfberry play. (Wolfberry is a blend and refers to the Wolfcamp and Spraberry trends.) *O&G Investor* reported that the independent switched to horizontals in Spraberry and in Wolfcamp in its southern acreage with more success and discovered that Wolfcamp horizontal well performance improved as it drilled northward. RSP has identified six zones and plans to drill stacked laterals this year, convinced that the higher D&C costs pay out sooner than the verticals, the article stated.

Pioneer is the largest acreage holder in Spraberry Wolfcamp near Midland, TX, and Sheffield has the bragging rights to a play that may prove that everything is bigger in Texas, including oil fields. Pioneer estimated recoverable oil in Spraberry/Wolfcamp field at 50 billion BOE last year. This year estimates swelled to 75 billion BOE, which would make it the second largest field in the world behind the Ghawar field in Saudia Arabia, said Pioneer. Ghawar boasts from 70 to 100 billion barrels of oil reserves.

> **"…Wolfcamp could possibly become the largest oil and gas discovery in the world."**
>
> ***– Pioneer Natural Resources Co.***

In an earlier *OGJ* article, Sheffield said the Pioneer will test 13 zones by 2016. *Oil & Gas Financial Journal* reported that 5,000 wells are expected to be drilled in the Permian basin this year to develop the various unconventional plays and by 2020, the Permian will have the highest tight oil production rate in North America at 1.8 million BOPD.

Wolfcamp rocks

Pioneer said the petrophysics are superior to the Bakken or Eagle Ford shale plays, according to *O&G Investor*. Total organic carbon (TOC) is in the excellent range. Vitrinite Reflectance (RO values), porosity and rock composition are all favorable.

Chris Cheatwood, executive vice president of business development and geosciences at Pioneer, told the *O&G Investor*, "I call them Goldilocks rocks. Everything is better out here."

The Wolfcamp formation is thicker than the other unconventional plays in the U.S. and varies from 1,500 to 2,600 ft thick, said the IPAA (Independent Petroleum Association of America). "Wolfcamp is reasonably consistent over distances much greater than typical well spacing. Geologic certainty is often more easily established," said **Jeff Wilson**, managing senior vice president at Ryder Scott.

Ryder Scott insights

Wilson and **Rick Robinson**, senior vice president, evaluate Wolfcamp for various clients and are building a database with aggregated public and client information. Despite thick, reasonably consistent upper, middle and lower sections in Wolfcamp, drilling results are not consistent. To look deeper at the disparate results, the Ryder Scott research involved generating correlations between recoveries and several variables.

"Generally, correlations of well performance to geologic elements have been unreliable to date, causing evaluators to use analogy-based bookings, using statistical or stochastic methods," said Wilson.

Operators use various horizontal drilling-and-completion approaches with varying levels of success, making this a technology play. Some, such as lateral lengths, frac intervals, number of frac stages, frac pressure, pounds of proppant, etc., may be known," said Wilson. "Other completion details may also be important but are not always available to the evaluator."

The Wolfcamp database shows that the strongest correlations are between recovery levels and operator. "That logically addresses the cumulative knowledge and operational practices of each operator," said Wilson. "This means that evaluators must use care when assigning recoverable volumes by analogy based

Please see Wolfcamp on Page 11

Wolfcamp extends into the Delaware basin where this well is operated by Arabella Exploration Inc. The company specializes in accessing all zones of the play using multi-lateral completions. Photo courtesy of Shale Experts at www.shaleexperts.com.

CSA – Cont. from Page 3

COGEH, SPE-PRMS and NI 51-101

The Society of Petroleum Evaluation Engineers Calgary section and the SPE Canada chapter, formerly the Petroleum Society of CIM, co-wrote the three COGEH volumes. COGEH and SPE-PRMS classification systems are similar. One minor difference is sub-classification of contingent resources. In response, the societies have strived to improve consistency between the two systems with a focus on how COGEH treats the estimation of ROTR. The final revisions will augment other guidelines in COGEH Volumes 1 to 3.

In its comment letter, Suncor said that the adoption of a sub-classification system for contingent resources similar to that in the SPE-PRMS is being contemplated for COGEH. "It may be more important to wait until the proposed changes to the COGE handbook are issued before amending NI 51-101 with respect to ROTR," said Suncor. Months later, the CSA has done that. SPEE Calgary finished preparing COGEH guidelines on ROTR in a new chapter, "Evaluation and Classification of Resources Other Than Reserves" (Chapter 2 in Volume 2 of the handbook) June 30 and it is being reviewed by regulators.

The CSA also has reset the NI 51-101 amendments proposed effective date from Dec. 31, 2014 to July 1, 2015. **David Elliott**, a former chief advisor at the ASC, plans to present the new COGEH guidelines at the Ryder Scott Canada reserves conference on Oct. 2.

Suncor also said, "There is an initiative underway to merge COGEH and the PRMS, increasing the likelihood that the … (PRMS application guidelines for subclasses of contingent resources) will be adopted in Canada." The anticipated merger is at an early proposal stage and efforts between SPE and SPEE Canadian section may take as long as five years to conclude, say those involved.

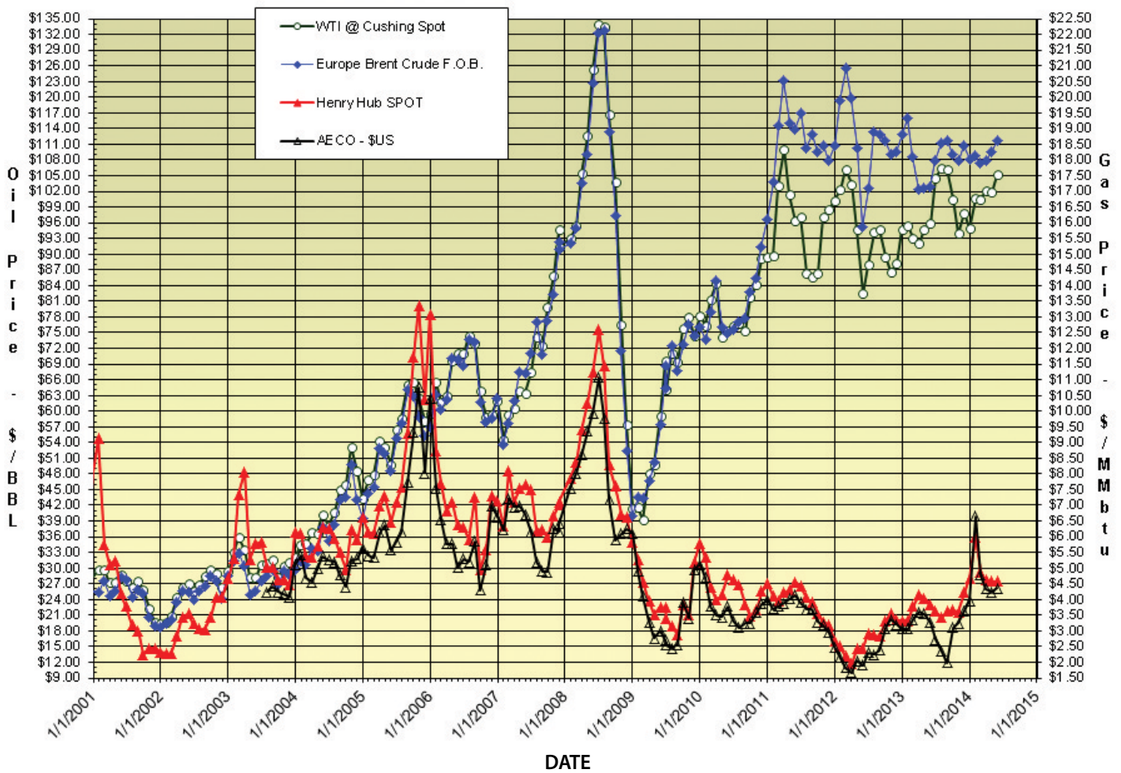
Suncor also said, "If the CSA adopts NPVs for contingent and prospective resources, they will not likely align with… the revised COGEH."

Low, medium and high cases

Imperial did not support the CSA proposition to require public issuers to annually provide low, medium and high estimates of volumes and NPVs of future net revenue for contingent and prospective resources. "Disclosure of the medium or 'best' estimate of volume is sufficient," the company said.

Suncor agreed. "Due to the relative immaturity of many projects classified as contingent resources, low (1C) and high (3C) estimates may vary widely due to limited information. Suncor maintains that the most meaningful and useful estimate of contingent resources is the best (2C) estimate," the company said. "We recommend that only best-estimate contingent resources be required to be reported."

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.

Wolfcamp – Cont. from Page 9

fully or partially on different operators' results."

He added that Ryder Scott assigns reserves to some locations in Wolfcamp that are significantly lower than what the firm estimates for reserves in adjacent locations. "Clients ask about the differences," said Wilson, who attributes them, in part, to differing D&C techniques.

Wood Mackenzie has confirmed the clear-cut relationship among well locations, recovery levels, operators and their D&C techniques.

Benjamin Shattuck, an analyst with the energy research firm, told the *Houston Chronicle* in June, at an energy briefing, "It's not based on location. It boiled down to attention to the Permian: How long have these operators been operating in the Permian and, if they hadn't been operating in the Permian for long, how focused are they?"

Operators in the Wolfcamp shale that have focused on the field tend to perform much better in the region than companies that have recently moved in or only spend a fraction of their drilling budgets in the play, Shattuck told the *Chronicle*.

Wolfcamp operators have not established a consortium to share information on D&C techniques and results. "We cannot disclose what technology a client is using because of confidentiality agreements," said Wilson.

Other findings from the Ryder Scott research include the following:

- Recoverable volumes are much harder to correlate over significant distances.
- Some portions of Wolfcamp are better developed with sufficient history allowing for statistical or stochastic methodologies.
- Some areas are sparsely developed and typically include wells with very limited history.
- Final well spacing and potential interference are problematic when establishing levels of certainty for various reserves classifications. In the early development stages, wells are typically not drilled at their final spacing; wells are drilled in wide-ranging locations to hold leases or establish geologic consistency. In more mature areas, where wells have been drilled at their final spacing intervals, interference with other wells would not be anticipated for many years because of the nature of the reservoirs and the completions. Evaluators must remain conscious of those potential issues when booking reserves volumes.
- Final well spacing is complicated by the thickness of Wolfcamp. Many operators are exploring staggered well spacings with wells in the upper, middle and lower sections of Wolfcamp. This complicates the interference questions and can make the establishment of analogous areas more problematic because of different development strategies in the basin.

Ray Flumerfelt, senior reservoir manager–southern Wolfcamp shale at Pioneer, will present, "What is the Outlook for the Wolfcamp Trend in the Permian Basin?" at the annual Ryder Scott Reserves Conference in Houston on Wednesday, Sept. 17. See details on the conference on Page 6.

For more information on Ryder Scott's qualifications to evaluate Wolfcamp, please contact Wilson at jeff_wilson@ryderscott.com or Robinson at rick_robinson@ryderscott.com.

Wolfcamp in Delaware basin also multi-layered

The Wolfcamp formation is also in the Delaware basin west of Spraberry/Wolfcamp. Development is in an earlier stage, because operators initially targeted the shallower, productive Bone Spring play. Like the Midland basin, the Delaware has several sandwiched pay zones, including four Bone Spring layers, one of which is the Avalon shale, the shallowest target and distinct from the other three sand intervals.

Horizontal drilling in Delaware Wolfcamp has shown early successes. Howard Weil this year said that the trend provides the strongest growth opportunities because it is still in the early stages of development when compared with Bone Spring.

"During the first quarter, Concho Resources drilled 55 wells in the Delaware Basin portion of the Permian with a focus on multiple zones," the *Motley Fool* website reported. "The prime focus was the Bone Spring with 41 wells and the Wolfcamp with 11 wells. The company is using these stacked plays to drive production growth up over 20% in 2014."

Ryder Scott personnel promoted

Ryder Scott has promoted the following personnel: **Claudia Oramas** and **Adam Cagle** to petroleum engineer; **Manuel Amaro**, **Christine Neylon** and **Dainee Hurtado** to senior petroleum engineer; **Brett Gray, Phillip Jankowski** and **Tiffany Kallus** to senior petroleum geologist; **Timour Baichev** to vice president project coordinator; **Michael Lam, Eleazar Benedetto-Padron** and **Marylena Garcia** to vice president technical specialist; **Tosin Famurewa, Steve Gardner** and **Ray Yee** to senior vice president group coordinator; **Robert Walters** to senior vice president technical advisor; **Ryan Wilson** to senior vice president technical advisor–management consulting services; **Miles Palke** to managing senior vice president group leader; **Brenda Mayes** to vice president controller and **Tony DiNoia** to senior engineering technician.

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Erratum to binomial distribution formula

In the June *Reservoir Solutions* newsletter, Ryder Scott inadvertently misprinted the binomial distribution formula. The formula has been corrected and is included in the following section of that article as follows:

Here is a basic example of how the binomial calculation works. In a binomial experiment, the probability of exactly x successes in n trials is the following:

$$P\ (X)= \frac{n!}{(n-x)!\ x!}\cdot p^{x}\cdot q^{(n-x)}$$

Notation for the Binomial Distribution
P(S) — Probability of success
P(F) — Probability of failure
p — Numerical probability of a success
q — Numerical probability of a failure
P(S) = p and P(F) = 1 - p = q
n — Number of trials
x — Number of successes
Note: 0 ≤ x ≤ n

Example

Three wells are drilled. Find the probability of getting exactly two successful (economic) wells. Looking at the problem in the previous example from the standpoint of a binomial experiment, one can show that it meets the four requirements.

1. There are only two outcomes for each trial: Successful well or failure, e.g., dry hole.
2. There is a fixed number of trials which is three wells.
3. The outcomes are independent of each other (the outcome of one well in no way affects the outcome of another one).
4. The probability of a success is 1/2 in each case (COS = 50%). In this case, n = 3, X = 2, p = 1/2, and q = 1/2. Hence, substituting in the formula gives the following:

$$P(2\ successful\ wells)= \frac{3!}{(3\text{-}2)!\,2!}\cdot\left(\frac{1}{2}\right)^{2}\left(\frac{1}{2}\right)^{1}=\frac{3}{8}=0.375$$

The answer is 37.5 percent probability of getting two successful wells.

Publisher's Statement

Reservoir Solutions newsletter is published quarterly by Ryder Scott Co. LP. Established in 1937, the reservoir evaluation consulting firm performs hundreds of studies a year. Ryder Scott multidisciplinary studies incorporate geophysics, petrophysics, geology, petroleum engineering, reservoir simulation and economics. With 130 employees, including 90 engineers and geoscientists, Ryder Scott has the capability to complete the largest, most complex reservoir-evaluation projects in a timely manner.

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