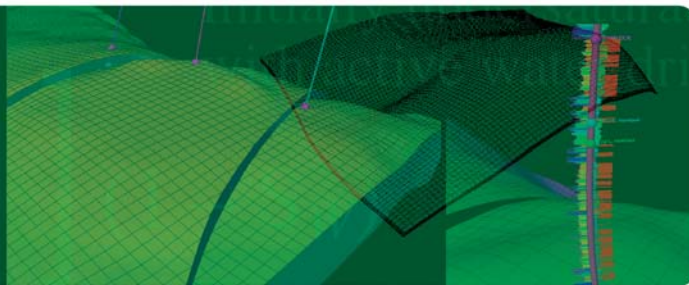


RESERVOIR SOLUTIONS



A quarterly publication of Ryder Scott Petroleum Consultants

June–August 2005/Vol. 8, No. 2

OTC panelists call for changes in U.S. reserves reporting and accounting disclosure regulations



Panelists at the Offshore Technology Conference in May took aim at U.S. rules on reserves accounting and estimating while offering other, newer models.

Those include a year-old reserves reporting system in Canada and a United Nations classification system proposed as a world standard last year.

Addressing regulations created by the Financial Accounting and Standards Board, **Ron Harrell**, chairman at Ryder Scott, said that “virtually every client ... resents using year-end prices for reserves and future cash flows. They believe that it leads to distortions in volumes and values.” As an example, he cited the seasonality of year-end gas prices that are traditionally higher than the rest of the year.

While saying that consulting firms should not weigh into the debate between producers and regulators, Harrell suggested that if the U.S. Securities and Exchange Commission provided an estimated year-end price in October, perhaps from the U.S. Energy Information Administration, then the industry would have more time to prepare for year-end filings.

Harrell also characterized the industry as “struggling” to apply the one-offset rule, which is based on legal well-spacing requirements in the United States, to provinces such as offshore Angola.



Flanked by fellow panelists, **Ron Harrell**, chairman at Ryder Scott, speaks to attendees of the 2005 OTC this May.

“This concept is virtually unknown today outside North America and, coupled with today’s technology, is seen as a severe limitation in the recognition of proved undeveloped reserves located more than an arbitrary distance from a commercial well,” he said.

Harrell also said that the industry often relies on good pressure gradient data from wells in a common reservoir to calculate a water contact. SEC engineers consider this method as unreliable, reversing their former position. “Most evaluators

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AAPG, SPEE to decide on certification program in 3rd-4th Q



The American Association of Petroleum Geologists and Society of Petroleum

Evaluation Engineers are scheduled to decide later this year whether to give their support in sponsoring a voluntary program to certify

petroleum reserves evaluators.

“The program to train and test petroleum engineers and geologists will be modeled to some degree after the one for certified public accountants,” said **Dan Tearpock**, who is leading the initiative for AAPG.

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consider this good science," he remarked.

Harrell pointed out that the SEC engineers will not accept the booking of improved-recovery reserves, including from pressure maintenance, without a nearby analog, roughly 25 to 50 miles. "This is somewhat restrictive when reservoirs have sufficiently positive parameters so improved recovery is 'reasonably certain,'" he said.

Ronald J. Gajdica, Atlantic development manager for BHP Billiton Plc, said that earnings and SMOG disclosures based on SEC proved developed reserves quantities can mislead the public in understanding how a company makes field investment decisions. He showed problems in matching expenditures to revenues early in the lives of six fields with differing development schemes. All examples cited overly conservative initial proved reserves estimates and correspondingly high DD&A (depletion, depreciation and amortization) negatively affecting earnings. As field life progressed, DD&A dropped and

earnings rose more in line with producers' internal forecasts.

Gajdica recommended that the U.S. develop standard reserves definitions for a P50 reserves volume and allow it to be reported. When questioned about greater tax liabilities in reporting P50s, he said, "Lowering DD&A early in life would increase earnings and book taxes. However, this would be offset by higher DD&A later in life causing lower earnings and lower taxes. So, the general effect would not be more taxes, just an acceleration of taxes."

He added that "from a present worth perspective, acceleration of tax payments hurts" so he suggested that the use of P50 be optional.

David Elliott, senior petroleum evaluation geologist at the Alberta Securities Commission, said that the ASC is providing feedback to the industry on technical revisions to reserves after the first year of reporting under National Instrument 51-101. The "scorecard" showed average technical revisions ranged from a -0.4 percent for 2P conventional oil to a -19.7 percent for proved heavy oil estimates.

Also, nine companies with initial forecasts of production

from almost 2,400 wells varied after the first 10 months of 2004 — from a ratio of actual-to-forecast production of 97 percent for proved gas reserves to 85 percent for 2P oil reserves. Elliott recommended that those interested in ASC reserves disclosure information go to www.albertasecurities.com.

Thomas S. Ahlbrandt, world energy project chief at the U.S. Geological Survey, said that the United Nations has integrated petroleum reserves classifications from the Society of Petroleum Engineers, World Petroleum Congress and American Association of Petroleum Geologists into its reserves categories. The International Accounting Standards Board has referred to the U.N. Framework Classification for Energy and Mineral Resources and the SPE/WPC/AAPG effort as standard setting.

The U.N. has also "mapped" other systems, such as Norway's classification of oil and gas resources, to document definitions and terms common in both. The U.N. has adopted the SPE/WPC definitions for resources.

Presentations from the panel discussion were posted at <http://www.otcnet.org/2005/presentations/index.html> in May.

Publisher's Statement

Reservoir Solutions newsletter is published quarterly by Ryder Scott Company 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 100 employees, including 63 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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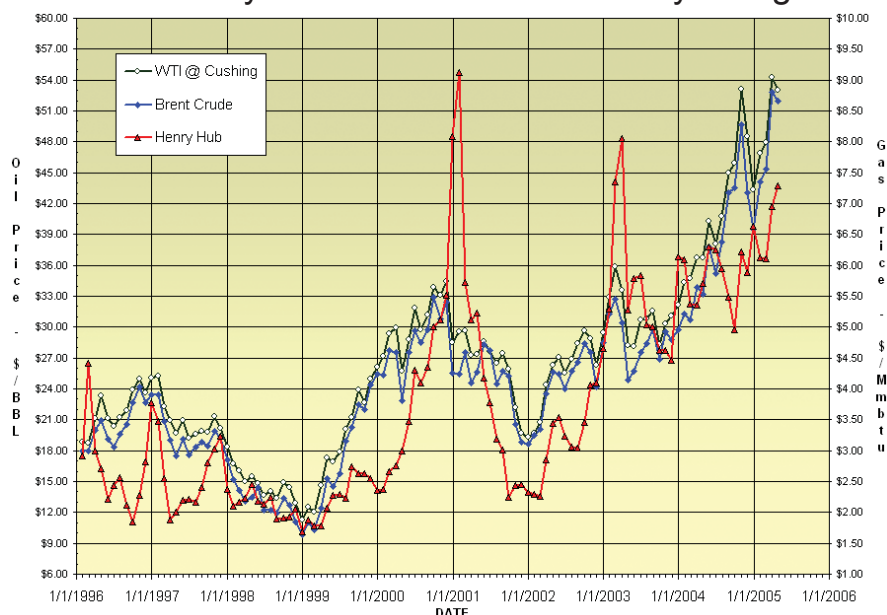
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Price history of benchmark oil and Henry Hub gas



The historical price chart shows published, monthly-average, cash market prices for WTI crude at Cushing (NYMEX), Brent crude and Henry Hub gas.

At Ryder Scott Reserves Conference, ex-SEC accountant who “penned” reserves disclosure rules gives “inside” view

A capacity audience at the May 6 Ryder Scott Reserves Conference heard **Richard Adkerson**, a staff member the U.S. Securities and Exchange Commission in the 1970s, give a firsthand account of how disclosures rules in petroleum reserves accounting originated. He is now co-chairman of McMoRan Exploration Co. and CEO at Freeport-McMoRan Copper & Gold Inc.

From 1976 to 1978, Adkerson was a Professional Accounting Fellow in the Office of the Chief Accountant at the SEC in Washington, D.C. “At the tip of Adkerson’s pen,” reporting regulations for reserves and standardized measure were written in 1978. Originally developed as SEC supplemental disclosure requirements and as RRA accounting rules, they were eventually adopted as part of FASB 69.

Adkerson said that the SEC proposed rules in 1977 that would have required oil and gas companies to use varying discount rates based on interest-rate changes and on the size and diversity of a company’s reserves portfolio. Fewer fields and less diversity in the property portfolio would trigger a higher rate and vice versa.

However, in response to industry criticisms, the then chief accountant at the SEC, **Clarence Sampson**, told the 30-year-old Adkerson to “pick a rate.” Without hesitating, the young accountant replied, “Prime plus one percent.” The prime lending rate then was 9 percent, so the discount rate became a standardized measure at 10 percent.

For the past 25 years, all reserves evaluators have factored that rate into the calculation of discounted net present values for the cash flow from future



Dean Rietz (background), managing senior vice president at Ryder Scott, was one of four presenters at the Ryder Scott Reserves Conference held during OTC week. The presentations are posted at www.ryderscott.com/presentations.htm.

production.

“Since then, a number of professors have written detailed, theoretical papers about how the rate was justified based on interest rates and industry risk analyses,” Adkerson mused.

Ryder Scott professionals **John Hodgkin**, **Dean Rietz** and **Bob Wagner** also presented during the one-day conference in Houston. All presentations are posted at www.ryderscott.com/presentations.htm.

Harrell to participate in IQPC event in London, June 29-30

Ron Harrell, chairman at Ryder Scott, will conduct a June 29 workshop on compliance in reporting reserves under the U.S. Sarbanes-Oxley Act at The Selfridge Hotel in London. While there, he will also make a presentation on transparency in reserves disclosures June 30. The Corporate Governance for Oil & Gas event is sponsored by International Quality & Productivity Centre.

The June 29 pre-conference workshop runs from 8:30 a.m. to 12:30 p.m. and will focus on the following:

- U.S. Securities and Exchange Commission reserves definitions
- Qualified reserves evaluators
- Adequate and timely reserves data
- Independence from inappropriate influences
- Maintenance of well-documented work papers

The workshop will investigate the roles of the independent auditor and of management and their commitment to transparent and competent estimation

and reporting of proved reserves to SEC standards.

The June 30 presentation will begin at 5 p.m. and will address corporate accountability and financial reporting transparency. Harrell will address the challenges faced by the industry in achieving transparency across operations, particularly in relation to SEC and SPE guidelines.

The presentation will also cover estimating and auditing oil and gas reserves information based on 1997 SPE guidelines. Harrell will assess the proposal to certify reserves evaluators.

For more information, send an e-mail to enquire@oilandgasIQ.com. Also, Harrell will present in Tunis on Sept. 20. See Page 7.



Harrell at recent OTC event

LNG and Underground Storage: Cold Gas, Hot Topic

— Scott Rouze, petroleum engineer



Rouze

Lately, with the strength of gas prices, the U.S. industry has intensified its focus on importing and storing liquefied natural gas. The U.S.

Energy Information Administration has said that to meet the country's growing energy needs, an additional 8 Tcf per year of supply will be required by 2025.

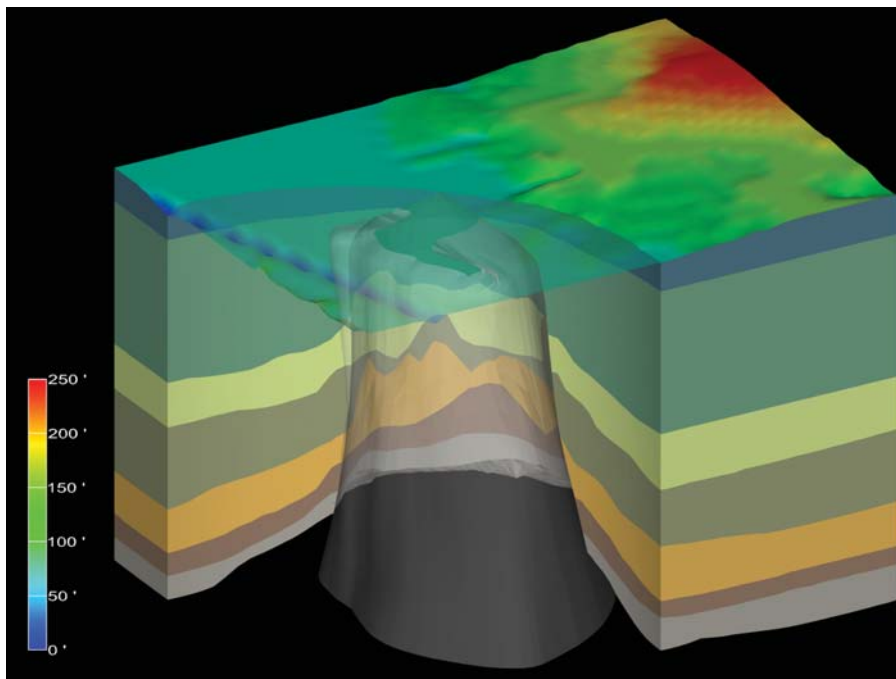
While Canadian gas remains the predominant source for imported supply, much of the growth in supply is expected to come from LNG imports, increasing substantially from 0.5 Tcf per year in 2004 to 6.4 Tcf per year by 2025. The LNG industry believes it will meet that forecast by monetizing "stranded" reserves, bringing previously inaccessible gas fields to the market.

The cryogenic technology for LNG, while constantly advancing, is well understood and no longer presents any unique technical challenge. Stored in non-pressurized tanks, LNG has been safely handled for decades.

In fact, the U.S. Department of Energy Sandia National Laboratory recently reported that "...during the past 40 years, more than 80,000 LNG carrier voyages have taken place, covering more than 100 million miles, without major accidents or safety problems, either in port or on the high seas."

Also, the cost of LNG components has dropped significantly. The EIA reports that "...between 1996 and 2000, the cost of a new (LNG) tanker dropped by approximately 30 percent and ...construction costs for regasification terminals have seen similar decreases."

With this focus on LNG, questions surrounding how the projected increase in LNG usage will affect the U.S. gas-transmission infrastructure are also being



The U.S. Strategic Petroleum Reserves' Bayou Choctaw cavern storage facility is typical of salt domes that will increasingly be used to store revaporized, LNG-sourced gas. Image courtesy of C Tech Development Corp., Huntington Beach, CA.

vigorously studied. Does the existing gas pipeline system have the capacity to handle the increase in LNG? What facilities in addition to new long-haul pipelines will be needed? For new terminals, what locations have the best prospects of meeting all the citing requirements of the numerous stakeholders?

The energy industry is working hard to answer these important questions.

Specifically, one important link in the supply chain receiving much attention is underground gas storage in salt caverns. The high deliverability of salt storage is a perfect fit for storing and marketing LNG-sourced gas.

Withdrawal rates from a cavern far out perform the send-out rates available from traditional LNG plant vaporizers. A cavern can be developed to cycle its capacity several times a year. In contrast, an LNG storage and a vaporization plant requires most of the off season to refill its capacity.

Gas quality mixing and interchangeability are enhanced by storing LNG-sourced gas in a

cavern. A cavern can be built at a lower cost than an above-ground cryogenic tank and in less time.

Additionally, many believe gas stored in a cavern has increased physical security over that of an above-ground tank.

LNG and salt cavern storage individually represent efficient, effective components of the U.S. natural gas supply chain. Together, they will provide a key service to meet increasing energy needs.

For additional discussion on these items, feel free to contact me at scott_rouze@ryderscott.com or at 713-651-9191.

Editor's Note: As a petroleum engineer, Rouze has worked on the Williams Companies Inc. three LNG plants and on the United States' largest salt dome storage facility at Eminence, Mississippi. During that time, he had a first-hand opportunity to see the synergies created when a company has both LNG and cavern-storage assets.

Rouze recently joined Ryder Scott. Please see next page.

Two engineers join RSC

With latest staff additions, professional petroleum engineers and geoscientists total 63



Dobbs

John Dobbs, petroleum engineer, recently joined Ryder Scott. He worked at ExxonMobil Production Co. from 1998 to 2004 as a senior reservoir engineer and expert in probabilistic evaluation techniques.

He ensured technical quality of drillwell proposals and developed processes to assess large-scale field developments.

Dobbs has evaluated a wide variety of fields in Texas and Louisiana, including offshore sub-salt plays; high-temperature, high-pressure gas fields; deep, low-pressure gas fields and CO₂ floods.

Dobbs has a BS degree in chemical engineering, Magna Cum Laude, from Brigham Young University and an MBA degree in finance from Tulane University. He is a member of the Society of Petroleum Engineers.

Scott Rouze, petroleum engineer, joined the reservoir simulation group at Ryder Scott and will conduct gas storage property simulations and evaluations and evaluate and model reservoir and surface facilities for expansion and integrity studies.

"His background in porous media, cavern storage and LNG operations will add to our experience base," said **Dean Rietz**, managing senior vice president and manager of the simulation group.

Before joining Ryder Scott, Rouze worked at Williams Gas Pipelines for 10 years as a petroleum engineer, managing gas-storage activities. He moved over to Williams from Transcontinental Gas Pipeline (Transco) after it merged with Williams.

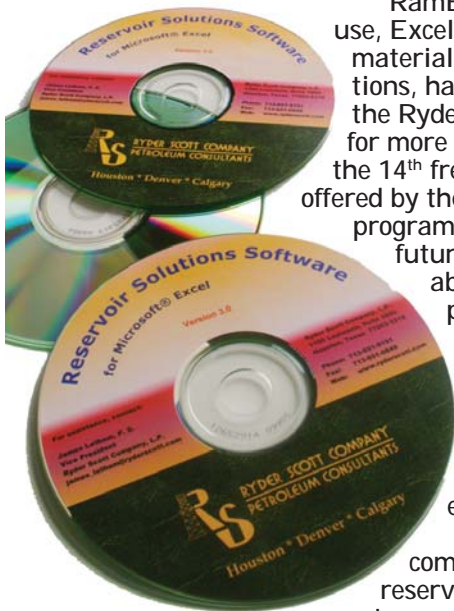
In his 10 years at Transco, beginning in 1985, he was a reservoir engineer in gas supply, deliverability and storage. He began his career at Getty Oil Co. in 1983 as a production engineer.

Rouze has a BS degree in petroleum engineering from the University of Texas. He is a member of SPE.



Rouze

RamBal is 14th freeware product offered by RSC



RamBal, an easy-to-use, Excel-based tool for material balance calculations, has been posted on the Ryder Scott Web site for more than a year as the 14th freeware product offered by the firm. "The program helps predict

future performance of abnormally pressured, unconventional gas fields," said developer **James Latham**, senior vice president and petroleum engineer.

The algorithm compensates for reservoir rock and water compressibility in determining both original gas in place and recoverable reserves and accounts for finite down dip free water expansion. The program requires only the

commonly available reservoir pressures, temperature data and gas properties and includes "calculators" and tips to help the experienced petroleum professional assess the appropriate compressibility coefficients as well as the conversion of separator gas components to reservoir (wet gas) conditions.

A user's manual is included in an Excel file accessible from the engineering menu. As is the case with all posted freeware, the new material balance application produces presentation-quality on-screen views and printer-friendly, hard-copy output.

Ryder Scott offers nine Reservoir Solutions programs and five SOS programs on its Web site. They are used by thousands in the industry the world over.

Go to www.ryderscott.com to download all programs. The most recent versions are maintained on the Web site.

Ryder Scott distributes the Reservoir Solutions install disks at the SPE Annual Technical Conference and at the North American Prospect Expo. Reservoir Solutions programs are available to those who fill out and submit the password request form on the Web site.

That is the only requirement to receive those programs. The SOS programs, developed in part by **Scott Wilson**, vice president and petroleum engineer, are available only to clients and potential clients.

Technical challenges in estimating reserves Part 3: Isopachous maps and attic volumes

Editor's Note: This is a revised excerpt from "Oil and Gas Reserves Estimates: Recurring Mistakes and Errors," (SPE Paper No. 91069). To order a copy of the full paper, go to www.spe.org and access the e-library.



Ryder Scott personnel see a wide variety of internally produced petroleum reserves estimates and most of them are well prepared. However, the firm has noticed common technical errors in reserves

estimates.

This multipart article offers guidelines to help reduce the chance of errors in geoscientific and engineering analysis. This third newsletter article focuses on isopachous maps (Cont. from Part 2, March 2005 *Reservoir Solutions*) and attic volumes.

Net pay isopach maps—Downdip wedge zone (Cont. from Part 2)—The use of an average net-to-gross ratio in a reservoir where the net-pay distribution varies over the vertical interval will likely lead to misstating reserves. The following three figures illustrate the relationship between net-to-gross ratios and reservoir volumes.

The net-to-gross ratio for the well illustrated in Figure 8 is 0.50. However, most of the net pay occurs in the upper 20 ft of the 80-ft gross interval.

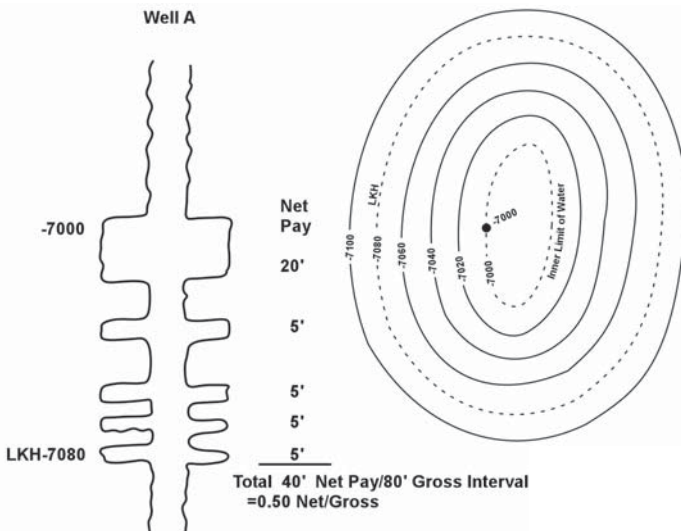


Figure 8. Example of a well log from a reservoir where most of the net pay occurs near the top. Structure map with well locations also shown.

Figure 9 illustrates a net pay isopach map constructed using the average net-to-gross ratio of 0.50 in the wedge zone.

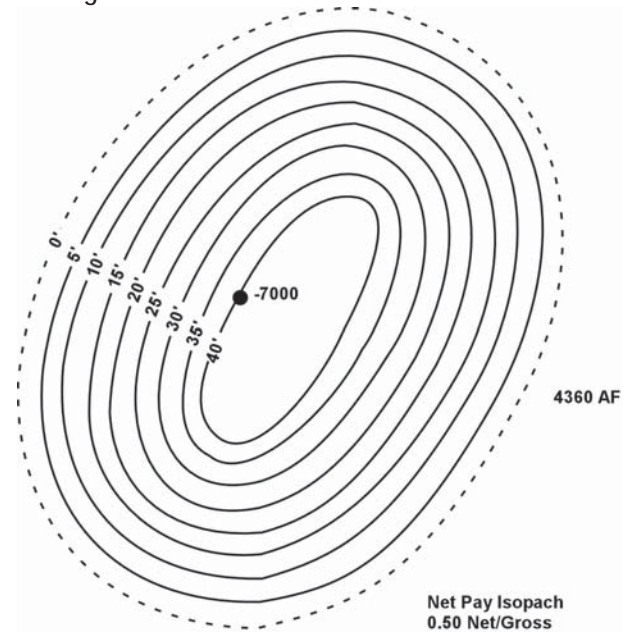


Figure 9. Illustration of net pay isopach with a wedge zone mapped using average net-to-gross approach.

Figure 10 illustrates a net pay isopach map constructed using the relationship of net pay thickness to height above the downdip fluid contact. In this example, the net pay isopach volume in Figure 9 is 18 percent smaller than the volume in the correct map from Figure 10.

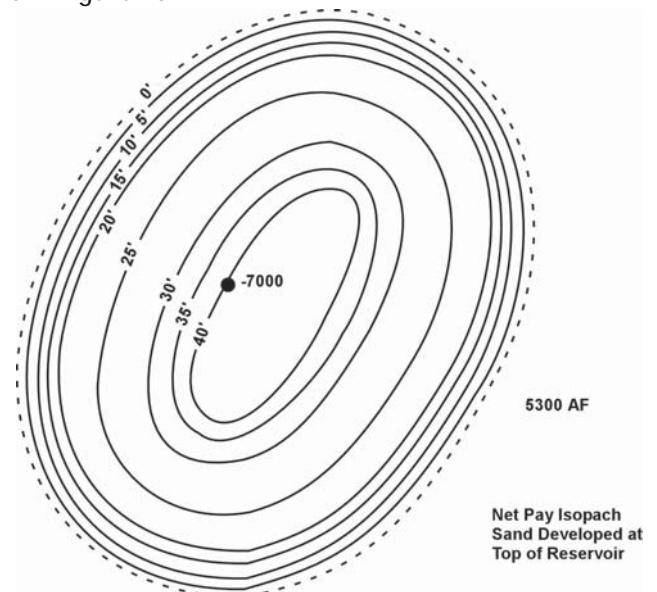


Figure 10. Same data mapped with wedge zone based on correct application of a vertical net-to-gross ratio.

A similar but inverse error occurs if the vertical net pay distribution is inverted from that shown in Figure 8. In this case, a map constructed using the average net-to-gross ratio overstates the productive reservoir volume.

In both examples, the “average” net-to-gross approach results in mechanically equal-spaced thickness contours in the wedge zone which do not represent the vertical distribution of net pay in the well.

Net pay isopach maps—Thickness within area of maximum fill-up—The area of maximum fill-up as illustrated in Figure 7 (in March 2005, *Reservoir Solutions* newsletter, Page 6) is the region updip from the intersection of the fluid contact and the structure on the base of the effective reservoir unit. Above this inner limit of fluid, the placement of net pay thickness contours is governed by the lateral change in the net effective reservoir thickness.

A common shortcut used in computer-aided mapping calculates the gross rock volume from the vertical difference between the top and base of the reservoir. Net pay thickness is generated by applying a net-to-gross ratio to the gross rock volume. A few of the potential inherent errors are as follows:

- Use of an arithmetic average of the net-to-gross ratio from multiple well penetrations may not represent lateral variation from well to well. A more rigorous approach is to represent the lateral variation by contouring the net-to-gross ratio from well data. The resulting interpolated distribution of net pay thickness should tie or be adjusted to match the well-data points. Evaluators should consider the validity of estimates of interpolated net-to-gross ratios greater than the maximum value obtained from well data.

- As previously noted, errors in the selection of the top or base of the contributing reservoir unit will result in overestimating the gross interval thickness and gross rock volume. The interpolated lateral distribution of the gross reservoir thickness should tie to or be adjusted to match actual well-data points. When the top or base of the reservoir unit is based on seismic data, the evaluator should consider the quality and resolution of seismic data. The evaluator should also consider the validity of estimates of interpolated gross reservoir thickness greater than the maximum value obtained from well data.

- Similarly, consideration should be given to the validity of lateral variations in interpolated net pay thickness derived from uncalibrated seismic amplitudes that result in values greater than indicated by the actual well-data points.

Attic volumes

Frequently, evaluators assign reserves to volumes updip to the last well penetration point in a reservoir. The level of confidence in the structural and stratigraphic continuity of the reservoir and recognition of the appropriate drive mechanism are critical to correctly attributing reserves.

Figure 11 shows net pay thickness projected in association with structural gain only and exceeding the maximum net effective sand thickness updip to the wedge zone from the downdip well penetration.

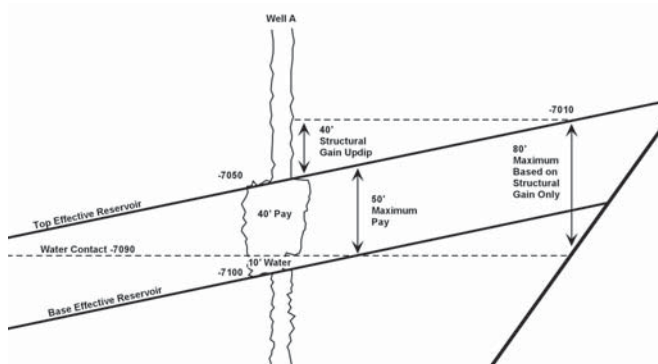


Figure 11. Potential error in estimating attic volumes based on projecting structural gain greater than maximum sand thickness.

Evaluators must consider the level of confidence in the position of faults and stratigraphic conditions away from the existing subsurface well control. Seismic fault placement should be corroborated by subsurface well control. Stratigraphic continuity verified in zones above or below the interval in question increases the level of confidence for the attribution of reserves.

Though not necessarily a geoscience issue, evaluators must consider the possibility of a gas-saturated attic above a highest-known oil limit. They must also consider that in a water-drive reservoir, the attic volume may not be recovered from existing wells.

Harrell at ATW in Tunis, Sept. 20

Ron Harrell, chairman at Ryder Scott, will be a keynote speaker at the Society of Petroleum Engineers Applied Technology Workshop on estimating and reporting reserves at the Residence hotel in Tunis on Sept. 20. He will speak at Session 3, Aggregation of Reserves and Resources, which will focus on deterministic and probabilistic approaches and aggregation practices. The session runs from 8:30 a.m. to 12:30 p.m.

The SPE Tunisia section is sponsoring the ATW. For more information, contact Ross Davidson, SPE Middle East office in Dubai, UAE, at 971-4-390-3540 or at rdavidson@spe.org.

Errata

- The Alberta Securities Commission allowed public issuers to use an average price differential for bitumen, not an average price as published in March, to estimate year-end reserves. Producers applied that differential to year-end, constant pricing to establish economic limits governing reserves. The differential is calculated by accounting for historical adjustments for 2004 for transportation, gravity and other factors that create the difference in price between benchmark west Texas intermediate crude and bitumen.

- **Tom Talley**, as spelled here, joined Ryder Scott as a geologist.



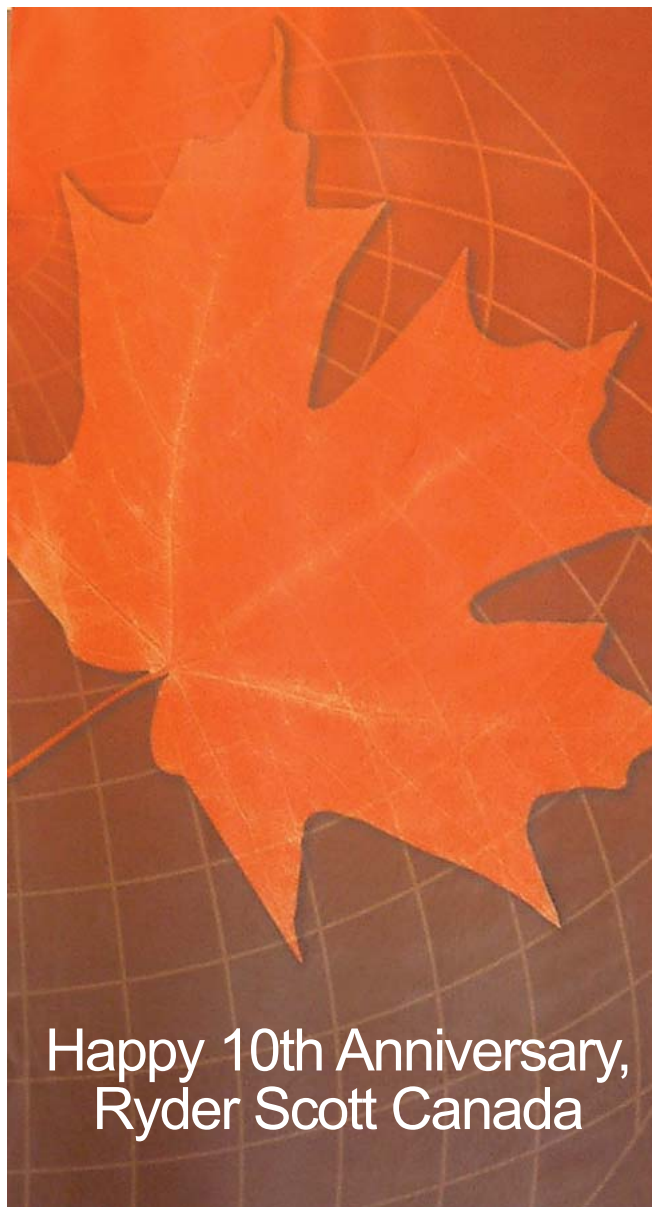
Ryder Scott personnel pose with the Houston Texans football team mascot Toro on April 23 at the Running of the Bulls 5K race benefitting the Houston Texans Foundation and the Greater YMCA of Houston. From left are Olga Basanko, petroleum engineer; Olga Borissova, technician; Toro; Elizabeth Lawson, petroleum engineer; John McLaughlin, petroleum engineer; and Anna Hardesty, contract petroleum engineer.

Certification—Cont. from Page 1

The organizations will consider a business plan and budgeting for the program after evaluating and deciding on its feasibility. Tearpock told *Reuters*, "One day, investors in oil projects might demand that reserves are verified by certified professionals before they commit any money."

Dan Olds, president of SPEE and a petroleum engineer at Ryder Scott, said that SPEE members will vote on the initiative during the third or fourth quarter. Tearpock told *Reuters* that the AAPG will decide in August.

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