NI 51-101 AND RESERVES CLASSIFICATIONS

SPE Breakfast Series -
Business Acumen

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Outline

Part 1:
» Brief history of time

Part 2:
» Reserves Governance: Guidelines vs. Legislation
» Non-compliance

Part 3:
» Reserve and Resource categories

Part 4:
» NI 51-101 Amendments -> recent changes
» ROTR
A BRIEF HISTORY OF TIME
The Early Days

The Early Days

Exciting time
» Multitude of prospective ventures
» Increasing equity investment
» Independent firms engaged to verify value of assets
The Early Days

Regulations

» Rules for oil and gas disclosure – National Policy 2B (Canada, late 1970s)

» Limited guidance and no Board oversight

» Challenge for investors
And then in 1998....

Blue Range Resource Corp.

» Hostile takeover by Big Bear Exploration Ltd. in 1998

» Financial statements were:
  > severely misrepresented and did not undergo a proper audit
  > materially understated long-term debt

» Production and reserves:
  > Added 9-14% extra volume onto reserves and production
  > Claimed no industry standard for reporting raw vs. sales gas
  > Did not disclose the manner in which the numbers were reported (i.e.: units)
  > Did not update target estimates – deceived public

» Overstated reserves, double-counted undeveloped acreage, reported production using raw gas not sales gas, unpaid bills, deficient book-keeping, overdrawn credit lines, created the impression that the value of the company was far greater than it actually was.
Fast forward to 2006...

ASC decision in December 2006:

» Consequences – Corporate
  > Company forced into bankruptcy
  > Executive team lost financial stake, reputation destroyed/shattered

» Consequences – CEO
  > Could not act as a director or officer of any issuer permanently
  > Pay a penalty of $180,000 and an additional $675,000 to cover the costs of the hearing

» Consequences – CFO
  > Could not act as a director or officer of any issuer for 10 years
  > Pay a penalty of $50,000 and an additional $175,000 to cover the costs of the hearing
In 2009...

The Court of Appeal of Alberta

» Upheld the ruling of the ASC against Blue Range Resources and it’s former CEO and CFO

» Found the sanctions against the officers “lenient” given the scale of the events

Integrity and Credibility of the Alberta Securities market place heavily tarnished

» Loss of investor confidence

» Led to the creation of new standardized regulations
Today

Regulations:
» Public company oil and gas asset assessment and discloser governed by NI 51-101 (circa 2003)
» Additional discloser requirements and guidance
» Strive for consistency and comparability
» Adopted by most private companies
» Goal is to regain and increase investor confidence
Who uses reserves reports?

Internal Stakeholders:
» Board of Directors
» Management
» Area Teams
  > Engineering
  > Geology
  > Accounting

External Stakeholders:
» Regulatory Agencies
» Investors
» Financial Institutions
Internal Stakeholders

- Board of Directors (Reserve Audit Committee)
- Auditors
- Reserves & Resources
- Qualified Reserves Evaluator (QRE)
- Executive & Management
- Area Teams (Engineering, Geology, Accounting, etc.)
- Assets
- The Public
  - Annual Information Form
  - COGEH (SPEE)
  - NI 51-101 (ASC)
  - S-X, S-K (SEC)
External Stakeholders

ABC Corporation (Reserves and Resources Evaluation)

Annual Information Form (AIF)

- ASC
- SEC

- Banks
- Analysts
- Shareholders
- The Public
RESERVES GOVERNANCE – GUIDELINES VS. LEGISLATION
Securities Regulators – Relating to Reserves

Canada

CSA (Canadian Securities Administrators)

Individual Provincial Securities Commission

ASC (Alberta Securities Commission)

Year-End Proved Plus Probable Reserves

NI 51-101 COGEH

United States of America

SEC (U.S. Securities and Exchange Commission)

Year-End Proved Reserves

Regulation S-K Regulation S-X Sarbanes Oxely (SOX)

McDaniel & Associates Consultants Ltd.
Securities Regulators – Relating to Reserves

Canada

CSA (Canadian Securities Administrators)

Individual Provincial Securities Commission

ASC (Alberta Securities Commission)

Year-End Proved Plus Probable Reserves

NI 51-101 COGEH

United States of America

SEC (U.S. Securities and Exchange Commission)

Year-End Proved Reserves

Regulation S-K

Regulation S-X

Sarbanes Oxely (SOX)
Canadian Securities Administrators (CSA)

» Not a federal entity, but a collaboration of regulators from 10 provinces and 3 territories.
» Purpose is protect investors and foster an environment of fair and efficient capital markets.
» Is the primary regulator for a majority of the oil and gas companies listed in Canada.
Securities Regulators – Relating to Reserves

Canada

CSA
(Canadian Securities Administrators)

Individual Provincial Securities Commission

ASC
(Alberta Securities Commission)

Year-End Proved Plus Probable Reserves

NI 51-101

COGEH

United States of America

SEC
(U.S. Securities and Exchange Commission)

Year-End Proved Reserves

Regulation S-K

Regulation S-X

Sarbanes Oxely (SOX)
Alberta Securities Commission (ASC)

» Provincially legislated
» Is the principal regulator for Oil and Gas activities.
» ASC maintains an active disclosure review program
  > Compliance reviews of annual filings, news releases, websites, webcasts
  > Technical reviews / audits of reserves and resources evaluations
    (continuous disclosure reviews, prospectus filings)
  > Annual “Oil and Gas Review” report & continuous disclosure report
Securities Regulators – Relating to Reserves

- **Canada**
  - CSA (Canadian Securities Administrators)
  - Individual Provincial Securities Commission
  - ASC (Alberta Securities Commission)
  - Year-End Proved Plus Probable Reserves
  - NI 51-101
  - COGEH

- **United States of America**
  - SEC (U.S. Securities and Exchange Commission)
  - Year-End Proved Reserves
  - Regulation S-K
  - Regulation S-X
  - Sarbanes Oxely (SOX)
NI 51-101: Purpose

» To enable clear, consistent, accurate and comparable disclosure.

» To provide guidance on the type, form, quantity, value and timing of disclosure.

» To provide a comprehensive set of definitions to enable a common vocabulary and as a reference to COGEH for other terms not defined but used in the regulation.
NI 51-101: Pertinent Topics

» The requirement to report all Proved Plus Probable (2P) reserves and sub-categories
» 2P Reserves Reconciliation and PUD vintage
» The use of “reasonable” forecast prices and costs
» The recognition of COGEH to determine reserves and resources estimates
» Requirements for the calculation and disclosure of metrics
» Defined terms and forms for required disclosure of reserves and optional disclosure of resources
NI 51-101: Constituent Forms

The regulation for reserves & resources in Canada is National Instrument 51-101 Standards of Disclosure for Oil and Gas Activities (NI 51-101).

» NI 51-101 – Definitions, annual filing requirements, responsibilities and requirements for all disclosure

» Companion Policy 51-101CP – to assist in the interpretation and application of NI 51-101 and related forms

» Form 51-101F1 – Disclosure of reserves data, pricing, NPV’s, PUD vintage, reserves reconciliation etc.

» Form 51-101F2 – Report on reserves data for IQRE

» Form 51-101F3 – Report of management and directors

» Form 51-101F4 – Notice of public filing of Form 51-101F1

» Form 51-101F5 – Ceasing to engage in Oil & Gas Activities
Securities Regulators – Relating to Reserves

Canada

CSA
(Canadian Securities Administrators)

Individual Provincial Securities Commission

ASC
(Alberta Securities Commission)

Year-End Proved Plus Probable Reserves

NI 51-101

COGEH

United States of America

SEC
(U.S. Securities and Exchange Commission)

Year-End Proved Reserves

Regulation S-K

Regulation S-X

Sarbanes Oxley (SOX)
COGEH: Hey it’s the books
COGEH: Canadian Oil & Gas Evaluation Handbook

» Comprised of 3 volumes, which have been revised and tweaked as industry & technology evolved
» Developed by the Calgary Chapter of the SPEE with the Petroleum Chapter of the CIM.
» Was adopted by NI 51-101 to provide guidance on the determination of reserves and resources
» Includes similar concepts to PRMS
COGEH: The Volumes

» Volume 1
  > Uses of reserves evaluations
  > Definitions of reserves, contingent and prospective resources
  > Guidelines for resource classification and estimation
  > Financial analysis
  > Uncertainty and statistical analysis

» Volume 2
  > Dedicated to the procedures for estimating and classifying conventional reserves
  > Newly added July 2014 guidelines for the evaluation of “resources other than reserves (ROTR)”

» Volume 3
  > Dedicated to the procedures for estimating and classifying reserves and resources contained within certain unconventional reservoirs (i.e. CBM, Oil Sands)
  > Guidelines for the evaluation of international properties
ROTR: Resources other than Reserves

» Added to COGEH Volume 2 Section 2, in 2014
» Resource disclosure is **not mandatory** for year end filing.
» Annual disclosure concerning unproved properties and resource activities as described in Part 6 of Form 51-101F1.
» Additional disclosure beyond this is voluntary and must comply with section 5.9 of NI 51-101 if anticipated results from ROTR are voluntarily disclosed.
» For prospectuses, ROTR that are material to the issuer is required, even if the disclosure is not mandated by NI 51-101.
Securities Regulators – Relating to Reserves

Canada

CSA
(Canadian Securities Administrators)

Individual Provincial Securities Commission

ASC
(Alberta Securities Commission)

Year-End Proved Plus Probable Reserves

NI 51-101

COGEH

United States of America

SEC
(U.S. Securities and Exchange Commission)

Year-End Proved Reserves

Regulation S-K

Regulation S-X

Sarbanes Oxley (SOX)
Securities and Exchange Commission (SEC)

» Agent of the United States federal government.
» SEC conducts some level of review every three years for each reporting issuer. Any perceived deficiencies are communicated through comment letters.
» Some of the regulatory “guidelines” are not legislated. Information is disseminated in comment letters.
» If the Company is a “foreign private issuer”, for reserves & resources disclosure, it must satisfy both U.S. and Canadian disclosure obligations
Securities Regulators – Relating to Reserves

Canada

CSA
(Canadian Securities Administrators)

Individual Provincial Securities Commission

ASC
(Alberta Securities Commission)

Year-End Proved Plus Probable Reserves

NI 51-101
COGEH

United States of America

SEC
(U.S. Securities and Exchange Commission)

Year-End Proved Reserves

Regulation S-K
Regulation S-X
Sarbanes Oxley (SOX)
Regulation S-X and S-K

» S-X
  > The regulation includes the “Form” and “Content” requirements for financial statements
  > Provides definitions of reserves, products, categories
  > Does not instruct on how to determine reserves

» S-K
  > Lists the reporting requirements for various SEC filings used by public companies
  > Includes ongoing required documents such as the forms 10-K and 8-K

» Some of the rules that oil and gas filers have become accustomed to in their annual filings are not legislated in the two regulations above. Only through comments letters from the SEC do Companies realize that they were offside!
SOX: Sarbanes Oxley Act

» The Sarbanes Oxley Act of 2002 (SOX) is a U.S. law that was enacted to restore investor confidence in the integrity of public reporting

  > In particular, SOX 404 deals with the effectiveness of internal controls over financial reporting including reserves disclosure

» To ensure the integrity of the reserves, disclosures must include the following:

  > Review of the independent qualified reserves evaluator’s (IQREs) final reserves estimates and assumptions
  > Representation letter signed-off by senior management validating the reserves data supplied to the IQREs
  > Comparison of internal and IQRE reserves information and sign-off
  > Review by Reserves Committee of final reserves data outlined in the final IQRE report
Differences between US (SEC) and Canadian reporting (NI 51-101)

» Price Schedule
  > Reasonable outlook on future prices (CAD) - forecast
  > 12 month average price held constant (US)

» Reserves Disclosure Requirement
  > Proved plus Probable required (CAD)
  > Based on before and after royalties (CAD)
  > Proved only required (US)
  > Based on after royalties (US)

» Proved Undeveloped Rules
  > No specific limit on years of PUDs (CAD)
  > 5 year limit from first booking unless “specific circumstances” (US)

» Ability to Fund Future Development
  > Assume unlimited funds (CAD)
  > Need to demonstrate ability and intent to fund (US)
How do regulations drive the evaluation process?
COGEH is the principal guidance tool for the reserves evaluation

» Terminology and definitions  ➔ COGEH and NI 51-101
» Evaluation standards and guidelines ➔ COGEH
» Qualification: QREs do the work ➔ NI 51-101
» External Involvement: IQRE audit ➔ NI 51-101
» Governance ➔ NI 51-101 and/or SOX
  > Option to establish a reserves committee or equivalent
  > Committee reviews results and disclosure and recommendations for Board to approve
  > Asset Teams & Reserves governance verify accuracy of IQRE evaluation; reserves & resources data conveyance and results sign-offs

» Public disclosure requirements ➔ NI 51-101 and NI 51-102
RISKS/CONSEQUENCES OF NON-COMPLIANCE
Risks/Consequences

"I'VE BEEN HERE SO LONG I DON'T REMEMBER WHAT I DID, BUT IT HAD SOMETHING TO DO WITH NON-COMPLIANCE."

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Risks/Consequences

HAVE YOU FINISHED MY BILLION DOLLAR BUSINESS PLAN YET?
ALMOST.

I'M UP TO THE PART WHERE THE S.E.C. INVESTIGATES YOU FOR SECURITIES FRAUD.

I CAN'T DECIDE WHAT THE EMPLOYEES WILL BE SINGING WHEN YOU GET HANDCUFFED.
## Non-compliance case studies

<table>
<thead>
<tr>
<th></th>
<th>Shell</th>
<th>El Paso Corp</th>
<th>Stone Energy Corp</th>
<th>Repsol</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size</strong></td>
<td>4.5 billion BOE</td>
<td>1.8 Tcf</td>
<td>171 Bcfe</td>
<td>1.25 MMBoe</td>
</tr>
<tr>
<td></td>
<td>~23% of TP</td>
<td>~40% of TP</td>
<td>~20% of TP</td>
<td>~25% of TP</td>
</tr>
<tr>
<td><strong>Announced</strong></td>
<td>Jan 9, 2004</td>
<td>Feb 2004</td>
<td>Nov 8, 2005</td>
<td>Jan 2006</td>
</tr>
<tr>
<td><strong>Settlements</strong></td>
<td>~ US$ 600MM</td>
<td>US$ 235M paid by 5 employees US$273MM class action</td>
<td>~$10.5MM class action</td>
<td>US$8MM</td>
</tr>
<tr>
<td><strong>Casualties</strong></td>
<td>Group Chairman, CFO, E&amp;P CEO</td>
<td>Leadership team (top + 2 levels down) 7 BOD members</td>
<td>CEO, VP Exploitation Mgr Reservoir Engineering</td>
<td>CEO, CFO</td>
</tr>
<tr>
<td><strong>Financial Statements</strong></td>
<td>Restated back to 1999</td>
<td>Restated back to 2001</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Area involved</strong></td>
<td>Australia, Nigeria, Oman</td>
<td>South Texas, Rockies</td>
<td>GOM, Rockies, Williston Basin</td>
<td>Bolivia, Argentina</td>
</tr>
<tr>
<td><strong>Affect on share price</strong></td>
<td>-7%</td>
<td>-18%</td>
<td>-30%</td>
<td>-7%</td>
</tr>
</tbody>
</table>
Reserves overstatements

Not limited to:
» Particular company size
» Stock exchange
» Asset geography
» Product type
» Reserves category

Can be avoided by:
» More training/education regarding disclosure requirements
» Strong internal controls
» Strong emphasis on ethics
CLASSIFICATION OF TOTAL PETROLEUM INITIALLY-IN-PLACE
Fig. 2.1—Resources classification framework.
## COGEH and SPE – PRMS Table

<table>
<thead>
<tr>
<th>Total Petroleum Initially-In-Place (PIIP)</th>
<th>Production</th>
<th>Project Maturity Sub-classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>RESERVES</td>
<td>On Production</td>
</tr>
<tr>
<td>Sub-Commercial</td>
<td>CONTINGENT RESOURCES</td>
<td>Approved for Development</td>
</tr>
<tr>
<td>Undiscovered PIIP (UPIIP)</td>
<td>PROSPECTIVE RESOURCES</td>
<td>Justified for Development</td>
</tr>
<tr>
<td>Undiscovered PIIP (UPIIP)</td>
<td>UNRECOVERABLE</td>
<td>Development Pending</td>
</tr>
<tr>
<td>Undiscovered PIIP (UPIIP)</td>
<td>UNRECOVERABLE</td>
<td>Development on Hold</td>
</tr>
<tr>
<td>Undiscovered PIIP (UPIIP)</td>
<td>UNRECOVERABLE</td>
<td>Development Unclarified</td>
</tr>
<tr>
<td>Undiscovered PIIP (UPIIP)</td>
<td>UNRECOVERABLE</td>
<td>Development not Viable</td>
</tr>
</tbody>
</table>

**Range of Uncertainty**

- Prospect
- Lead
- Play

**Not to Scale**
Total Petroleum Initially In Place (PIIP) (equivalent to “Total Resources”) is that quantity of petroleum that is estimated, as of a given date, to be contained in known accumulations plus those estimated quantities in accumulations yet to be discovered.
Discovered Petroleum Initially-In-Place (equivalent to “Discovered Resources”) is that quantity of petroleum that is estimated, as of a given date, to be contained in known accumulations prior to production. The recoverable portion of discovered petroleum initially-in-place includes production, reserves, and contingent resources.
Reserves

» Reserves are estimated remaining quantities of oil and natural gas and related substances anticipated to be recoverable from known accumulations.

» Reserves must further satisfy four criteria: they must be discovered, recoverable, commercial, and remaining (as of the evaluation date).

» Reserves are categorized by the level of certainty associated with the estimates:
  > Proved
  > Proved + Probable
  > Proved + Probable + Possible

Fig. 2.1—Resources classification framework.
Contingent Resources

Contingent Resources are those quantities of petroleum estimated, as of a given date, to be potentially recoverable from known accumulations using established technology or technology under development, but which are not currently considered to be commercially recoverable due to one or more contingencies.

Contingent Resources are further classified in accordance with the level of certainty associated with the estimates (low-1C, best-2C, high-3C).

Fig. 2.1—Resources classification framework.
Undiscovered Petroleum Initially-In-Place (equivalent to “Undiscovered Resources”) is that quantity of petroleum that is estimated, as of a given date, to be contained in accumulations yet to be discovered. The recoverable portion of undiscovered petroleum initially-in-place is referred to as “Prospective Resources”.

Fig. 2.1—Resources classification framework.
Prospective Resources

Prospective Resources are those quantities of petroleum estimated, as of a given date, to be potentially recoverable from undiscovered accumulations by application of future development projects. Prospective Resources have both an associated chance of discovery and a chance of development. Prospective Resources are further classified in accordance with the level of certainty associated with the estimates (low, best, high).
RESERVES
Development and Production Status - Canada

» Developed Producing: Reserves expected to be recovered from completion intervals open at the time of the estimate.

» Developed Non-Producing: Reserves that either have not been on production, or have previously been on production, but are shut-in, and the date of resumption of production is unknown. Usually, minor capital required to put on production.

» Undeveloped: Reserves expected to be recovered from known accumulations where a significant expenditure is required to render them capable of production.
Developed non-producing wells (PNP) should require a short well tie-in, recompletion, or small capital requirements. Costs should be less than 50 percent of the cost of drilling and casing a new well.

» **Example 1:** Glauc oil horizontal well in southern Alberta. If the well is waiting for completion, it can be assigned non-producing reserves.

» **Example 2:** NE BC Montney horizontal well. If the well is waiting for completion, it cannot be assigned non-producing reserves. Undeveloped reserves appropriate.
Development and Production Status - Canada

Montney Horizontal Well
- Drilling: 4 MM$
- Completions: 4.5 MM$
- Equip.: 0.5 MM$

Glauc Horizontal Well
- Drilling: 0.6 MM$
- Completions: 0.15 MM$
- Equip.: 0.15 MM$
» Developed Reserves: Can be expected to be recovered through existing wells with existing equipment and operating methods.

» Undeveloped Reserves: Expected to be recovered from new wells on undrilled acreage, or from existing wells where a relatively major expenditure is required for recompletion.
Levels of Certainty

» 1P/1C/Low Estimate:
   > Likely that actual remaining quantities recovered will exceed this estimate.
   > Probabilistic method -> P90
   > *Future revisions should be mostly positive*

» 2P/2C/Best Estimate:
   > Equally likely that actual remaining quantities recovered will be greater or less than this estimate.
   > Probabilistic method -> P50
   > *Future revisions should be close to zero*

» 3P/3C/High Estimate:
   > Unlikely that the actual remaining quantities recovered will exceed this estimate.
   > Probabilistic method -> P10
   > *Future revisions should be mostly negative*
Levels of Certainty

![Diagram showing levels of certainty for reserves estimates over time. The diagram includes lines representing proved, proved probable, and proved possible reserves, with the mean and maximum limits. The x-axis represents time, and the y-axis represents reserves estimates. The economic limit is also shown.]
Reserves Are Like Fish Example

» Popular example from the web prior to current rules.

» Proved Developed:
  > The fish is in your boat.
  > You have weighed it, you can smell it and you will eat it.

» Proved Undeveloped:
  > The fish is on your hook in the water by your boat and you are ready to net it.
  > You can tell how big it looks (they always look bigger in the water).

» Probable
  > There are fish in the lake and you may have caught some yesterday.
  > You may even be able to see them, but you have not caught any today (yet).

» Possible
  > There is water in the lake and someone may have told you that there are fish in the lake.
  > You have your boat on the trailer but you may go golfing instead.

» Contingent Resources
  > Has all the same physical certainty categories as Reserves but can’t catch, sell, or eat the fish because:
    + Market/Infrastructure: The whole country is totally vegetarian. There are no refrigerated trucks to get the fish to market.
    + Political: You don’t have a fishing license.
    + Environmental: The fish is an endangered species.
    + Technological: The fish is poisonous and processing is dangerous, difficult, and very costly. The fish has so many bones that filleting is technically difficult.
RESERVES REQUIREMENTS
General Reserves Requirements

General requirements for classification of reserves include:

» Ownership

» Drilling - Known accumulations

» Testing – commercial productivity

» Regulatory approval

» Infrastructure – get it from wellhead to market

» Market considerations – have a market to sell to

» Timing of production and development

» Economics
Reserve Requirements

» **Ownership:** Company must own the mineral rights or the contractual right to exploit and produce. The interest must permit the company to participate in the sale of future production.
  > Company gross reserves are defined as the working interest share of reserves prior to the deduction of interests owned by others. Royalty interest reserves are not included in the company gross reserves.
  > Company net reserves are defined as the working, net carried, and royalty interest reserves after deduction of all applicable burdens.

» **Drilling:** Reserves can only be assigned to known accumulations.
  > Reserves should not be assigned to areas that are separated from a known accumulation by non-productive reservoir
    + Example: geological model indicates that the top of the reservoir is below the water contact between the productive well and the undrilled lands.
    + Certainty that the exploitable reservoir is consistent from your known point of productivity to your location is necessary. In the Montney, where the areal extent of the reservoir is large, undeveloped reserves can be assigned at a much larger distance than certain channelized oil reservoirs in SW Saskatchewan as an example.
Reserve Requirements

» Drilling requirement: Extrapolation from a control point

> An understanding of the relevant geological and engineering factors which should be described in the reserve report.
> To extrapolate, should be able to prove the following:
  + Presence of the geological unit of interest
  + Contains petroleum
  + The petroleum is potentially recoverable
> Consider the following:
  + Depositional environment and depositional trends
  + Diagenesis, the post-depositional alteration of sediment can’t destroy or create porosity or permeability
  + Faults, can be barriers
  + Consistency of well logs
  + Consistency of production
  + Changes in pressure
  + Changes in fluid property
Reserve Requirements

» Drilling example 1: Fault isolates portion of reservoir

» Productivity cannot be assumed on the other side of a fault
Reserve Requirements

» Drilling example 2: Depositional environment

» Example of depositional environment that lends to broad contour mapping. Viking gas or Horn River.
Drilling example 3: Analogies

> Use must be based on analysis and comparison of reservoirs as well as explained and justified.
> Reservoir analog: similar rock, fluid, reservoir conditions and drive mechanisms
  + Presence of geological unit with comparable reservoir properties
  + Presence of hydrocarbons with comparable properties
  + Producibility using a particular recovery process
> Recovery process analogue: recovery process that is an established technology
  + Must be for the same reservoir or resource type
  + Take into account completion details
  + Spacing
Testing: Known accumulations requires that at least one well in that accumulation clearly demonstrates the existence of recoverable hydrocarbons.

- Flow test preferable
- Good log and/or core data may suffice
- Flow test must show commercial level of productivity
- Known accumulation: an accumulation that has been penetrated by a well. In general, the well must have demonstrated the existence of hydrocarbons by flow testing in order for the accumulation to be classified as “known”. However, where log and/or core data exist and there is a good analogy to a nearby and geologically comparable known accumulation, this may suffice.
Reserve Requirements

- **Testing example 1**: sub commercial rates – does not constitute productivity for the area with existing technology
Reserve Requirements

» Testing example 2: extrapolating vertical well data to horizontal wells

Vertical Well 1,300 mcf/d
Reserve Requirements

» Testing example 2: horizontals, same section 2-4 times peak rate of vertical well

Horizontal Well 2,500 mcf/d

Horizontal Well 5,000 mcf/d
» **Testing example 3: Lower vs Upper Montney**

» **Upper and Middle Montney:**

  > The geological properties within the middle and upper Montney are usually quite consistent
  > No significant barrier for flow or fracture exists between the upper and middle
  > More than one well is often required to fully exploit the reservoir because of the thickness of the deposit – there is enough gas in-place to economically produce from 2+ intervals

» **Lower Montney:**

  > Geological properties of the lower are different
  > The non-reservoir between the middle and the lower would allow little if any flow between them
  > Considered separate and would usually require productivity tests to qualify for reserves.
Reserve Requirements

» Regulatory: If regulatory approval has not been received, it must be virtually certain for the assignment of proved reserves. For probable reserves, approval should be highly likely.

» Infrastructure and Market: Usually there is identifiable transportation infrastructure and a market to sell the production in order to assign reserves.
   > Marketing contracts Key
Regulatory example: application has not been approved for a major capital project but the likelihood of approval high.

In Saskatchewan, thermal SAGD projects have been consistently approved in 2-3 months. In Alberta, applications have taken 1 year plus and approval not guaranteed. For a thermal project in Saskatchewan, proved reserves could be assigned given that regulatory approval is virtually certain.
Reserve Requirements

» **Timing of Production and Development**: Practical time limit for reserves is 50 years, additional volume should be classified as contingent resources.
   > Non-producing reserves should normally be developed within a 2 year period (non-producing reserves awaiting depletion of another producing zone can be assigned many more years out).
   > For large projects, significant capital expenditure should begin within 3 years for proved reserves.
   > For probable reserves, spending should begin within 5 years.

» In large resource type plays undeveloped reserves:
   > in the 1P category are scheduled within 5 years
   > In the 2P category are scheduled within 8-10 years
Reserve Requirements

» Timing example: facility constrained
Reserve Requirements

- **Economics**: Only marketable quantities that are economically recoverable can be classified as reserves
  - Include future costs only
  - Canada based on forecast prices and costs. Usual threshold for inclusion of undeveloped locations is positive economics at a discount rate of 10%.
  - US based on constant prices and costs. Usual threshold for inclusion of undeveloped locations is positive economics at a discount rate of 0%.

**US = +0%**  
**Constant case**  
**CAD = +10%**  
**Forecast case**
» Forecast price decks assume prices will recover
  > Locations sometimes have better economics if drilled several years out. In certain cases, will make economics positive and there is often pressure to adjust timing to make locations economic.
Reserves Determination Methods

General methods for determining reserves include:

» Analogy
  > Similar developed reservoir

» Volumetric*
  > Defining Rock volume and associated parameters (Sw, porosity, pool size, etc.)
  > Recovery Factor

» Decline Curve*
  > Sufficient production available
  > Most common method in plays with lots of production data

» Material Balance
  > Less common in an unconventional resource play

» Reservoir Simulation
  > History matching
Reserves Determination Methods

Method(s) used for reserve determination depend on where you are in the life cycle of a play.

![Diagram showing methods at different stages of well life: Pre-Prod., Early, Mid-Life, Late. Methods include Analogy, Volumetric, Decline Curve, Material Balance, Reservoir Simulation.]

*Figure 6-8 Use and Reliability of Reserves Estimation Methods with Time.*

COGEH Vol.2 – Figure 6-8
CONTINGENT RESOURCES
Contingent Resources

“Are those quantities of petroleum estimated, as of a given date, to be potentially recoverable from known accumulations using established technology or technology under development, but which are not currently considered to be commercially recoverable due to one or more contingencies.”

Contingencies can include:
- Economic
- Environmental
- Political
- Regulatory
- Lack of markets

Chance of development:
- Estimated probability that, once discovered, a known accumulation will be commercially developed.
- Chance of commerciality = chance of development

Subject to the same certainty levels as reserves
- Should convert to corresponding certainty level in reserves once contingencies have been removed.
Contingent Resources

- **Production Project Maturity Sub-classes**
  - On Production
  - Approved for Development
  - Justified for Development

- **Subclasses of Reserves**
  - Development Pending
  - Development on Hold
  - Development Unclarified
  - Development not Viable

- **TOTAL PETROLEUM INITIALLY-IN-PLACE (PIIP)**
  - DISCOVERED PIIP (DPIIP)
  - SUB-COMMERCIAL
  - COMMERCIAL
  - RESERVES
  - CONTINGENT RESOURCES
  - UNRECOVERABLE

- **PROSPECTIVE RESOURCES**
  - UNDISCOVERED PIIP (UPIIP)
  - PROSPECT
  - LEAD
  - PLAY

- **UNRECOVERABLE**

- **Range of Uncertainty**

- **Increasing Chance of Commerciality**

- **Not to Scale**
Contingent Resources

» Development Pending

» Development On Hold

» Development Unclarified

» Development Not Viable
  > No plans to pursue development or take on any data acquisition
» Project activities ongoing to justify commercial viability in the near future

» Critical contingencies identified and expected to be solved within reasonable timeframe

» Projects classified as development pending have a high chance of commerciality
Development On Hold

» Reasonable chance of commerciality

» Major non-technical contingencies (ie. environmental issues) preventing project from moving forward

» Factors preventing the project from moving forward are usually beyond the control of the operator
Development Unclarified

» Chance of commerciality difficult to assess

» Project is still under evaluation, or requires significant further appraisal to clarify potential for development

» If there is no current or planned activity, project should be reclassified as ‘development on hold’ OR ‘not viable’
Development Not Viable

» Sounds like the nail in the coffin.... BUT
» Not viable with respect to the conditions prevailing at the effective date
» Changes in conditions, such as fiscal conditions or technical developments, could result in a project maturity status being re-classified as viable.
Contingent Resources - Risking

» Contingent resource estimates should include a quantitative risk factor associated with:
  > Chance of development - estimated from associated development risk factors
    (ie: development plan, production forecasts, markets, etc.)

» Discussion is also required around how the risk factor was selected
PROSPECTIVE RESOURCES
Prospective Resources

“Are those quantities of petroleum estimated, as of a given date, to be potentially recoverable from undiscovered accumulations by application of future development projects. Prospective resource have both an associated chance of discovery and a chance of development.”

Subject to the same certainty levels as reserves

Chance of discovery:
- Estimated probability that exploration activities will confirm the existence of a significant accumulation of potentially recoverable petroleum.
- Usually bigger risk factor associated with conventional reservoirs.

Chance of development:
- Estimated probability that, once discovered, a known accumulation will be commercially developed.
- Usually a bigger risk factor associated with unconventional reservoirs.

Chance of commerciality:
- The product of the chance of discovery and the chance of development.
**PRODUCTION Project Maturity**

- **On Production**
- **Justified for Development**
- **Development Pending**
- **Development on Hold**
- **Development Undeclared**
- **Not to Scale**
- **UNRECOVERABLE**
- **SUB-COMMERCIAL**
- **COMMERCIAL**

**TOTAL PETROLEUM INITIALLY-IN-PLACE (PIIP)**

**UNDISCOVERED PIIP (UPIIP)**

- **UNRECOVERABLE**
- **PROSPECTIVE RESOURCES**

**DISCOVERED PIIP (DPIIP)**

- **RESERVES**
- **PROSPECTIVE RESOURCES**

**Increasing Chance of Commerciality**

**Range of Uncertainty**

- **Project Maturity Sub-classes**
  - Approved for Development
  - On Production
  - Development not Viable
  - Development on Hold
  - Development Pending
  - Development Undeclared
  - Not to Scale
  - UNRECOVERABLE
  - SUB-COMMERCIAL
  - COMMERCIAL
Prospective Resources

- **Prospect**: potential accumulation within a play that is sufficiently well defined to represent a viable drilling target

- **Lead**: potential accumulation within a play requiring more data acquisition and/or evaluation to be classified as a prospect

- **Play**: family of geologically similar fields, discoveries, prospects and leads
Prospective Resources - Risking

» Prospective resource estimates should include a quantitative risk factor associated with each of the following:

  > Chance of discovery -> estimated from associated geological risk factors (ie: source, reservoir, trap, timing)

  > Chance of development -> estimated from associated development risk factors (ie: development plan, production forecasts, markets, etc.)

» Discussion is also required around how each risk factor was selected
NI 51-101 AMENDMENTS AND ROTR
On October 17, 2013, the Canadian Securities Administrators (CSA) announced proposed amendments to NI 51-101 and published them for public comment

Public Comments were:

- reviewed by March 2014
- published on ASC Web site

Final proposed amendments were released on December 4, 2014 and came into effect on July 1, 2015
Production Group and Product Type

» Removes concept of “Production Group” – Light & Medium oil, Heavy oil, Natural gas

» Introduces concept of “Product Type” – Bitumen, CBM, Conventional gas, Shale Gas, etc.

» Reason:
  > Better define and classify varying resource potentials
  > Greater emphasis to sources and recovery processes
  > Consistency with other elements of reporting which are based on Product Type
## Production Group and Product Type

### Before:

<table>
<thead>
<tr>
<th>RESERVES CATEGORY</th>
<th>PRODUCTION GROUP</th>
<th>FUTURE NET REVENUE BEFORE INCOME TAXES (discounted at 10% per year) (M$)</th>
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</thead>
<tbody>
<tr>
<td>Proved Reserves</td>
<td>Light and Medium Crude Oil (including solution gas and other by-products)</td>
<td>XXX</td>
</tr>
<tr>
<td></td>
<td>Heavy Oil (including solution gas and other by-products)</td>
<td>XXX</td>
</tr>
<tr>
<td></td>
<td>Natural Gas (excluding by-products but excluding solution gas from oil wells)</td>
<td>XXX</td>
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<tr>
<td></td>
<td>Non-Conventional Oil and Gas Activities</td>
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<tr>
<td>Proved Plus Probable Reserves</td>
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<td>Natural Gas (excluding by-products but excluding solution gas from oil wells)</td>
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<td>Non-Conventional Oil and Gas Activities</td>
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</table>

Optional Supplementary: Reference: Item 2.2 of Form 51-101-F1

### After:

<table>
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<tr>
<th>RESERVES CATEGORY</th>
<th>PRODUCT TYPE</th>
<th>FUTURE NET REVENUE BEFORE INCOME TAXES (discounted at 10% per year) (M$)</th>
<th>UNIT VALUE ($/McF) ($/Bl)</th>
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</thead>
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<td>Proved Reserves</td>
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<td>Coal Bed Methane</td>
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<td>Conventional Natural Gas (including by-products but excluding solution gas and by-products from oil wells)</td>
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<td>Gas Hydrates</td>
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<td>Heavy Crude Oil (including solution gas and other by-products)</td>
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<td>Tight Oil</td>
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</tr>
<tr>
<td></td>
<td>Total</td>
<td>XXX</td>
<td>XXX</td>
</tr>
</tbody>
</table>
Abandonment and Reclamation Costs

» Prior to Amendment – inconsistency across industry in the “determination of what constitutes abandonment and reclamation costs for the purpose of the annual oil and gas disclosure”

» Amendment Clarifies:
  > Abandonment and reclamation costs may be disclosed together
  > Abandonment and reclamation applies to the area before the first point of sale or “property that has been disturbed by oil and gas activities”

» ARO (Asset Retirement Obligation) – legal obligation to abandon and reclaim existing activity; usually covered under accounting division
  > Much discussion among the ASC, Reserve Evaluators, and Corporations

» AER Directive 11 provides updated industry parameters and costs (unless provided directly by the Company)
Contingent and Prospective Resources

ROTR Amendments – Clearer guidance for disclosure of contingent and prospective resources data:

» Only required to disclose 2C Estimate (Contingent) or Best Case Estimate (Prospective)
  > However, if 3C/High Case is disclosed, 1C/Low Case must also be disclosed

» IQRE *not* required for resource evaluation if certain conditions met (QRE available)
  > If resources being reported in NI51-101F1, than a IQRE is required and all information must be available to IQRE (rep letter)

» When contingent and prospective resources are disclosed a quantification and explanation of risk must be identified
  > Quantification and method of arriving at the chance of discovery and chance of development is required
Contingent and Prospective Resources

» Reporting of contingent and prospective resources are optional for the annual filing of the NI51-101F1 form

» Disclosure of Risked net present value of future net revenue is required for contingent resources in the development pending sub-class only
  > Risked values are also suggested for other contingent classes and prospective resources, however, issuer must consider whether the level of uncertainty is sufficient to make that estimate misleading or not.

» Total CAPEX and general timeline (including first date of prod) must be disclosed for contingent/prospective resources

» Information regarding recovery technology, market access, development plans, costs and schedule are required to be included with disclosure of contingent/prospective resources.
  > Factors contributing to contingent/prospective subclass
Summary

» Regulations have progressed over time to bolster investor confidence
» Difference between Canada and US disclosure
» Consequences of non-compliance
» Reserves and resources are subdivided based on development status and levels of certainty
» Reserve requirements:
  > Ownership, drilling, testing, regulatory, infrastructure and markets, timing and economics
» Contingent & Prospective Resources
» Amendments to NI 51-101
  > Changes to resources, changes to product types, remove production groups, metrics descriptions, abandonment cost changes
QUESTIONS

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