

**CSA STAFF NOTICE 51-327****OIL AND GAS DISCLOSURE:  
RESOURCES OTHER THAN RESERVES DATA****February 27, 2009****1. Introduction**

National Instrument 51-101 *Standards of Disclosure for Oil and Gas Activities (NI 51-101)* mandates the disclosure of “reserves data”, which is defined in NI 51-101 to include “an estimate of proved reserves and probable reserves”. Disclosure of “resources” not included in reserves data is not required under NI 51-101. Although this disclosure is optional, staff of the Canadian Securities Administrators (the **CSA**) have seen a significant increase in the disclosure of possible reserves and other resource classes, especially for unconventional resources.

The disclosure of resources other than reserves data must be consistent with all applicable securities laws including, but not limited to, the principles and specific requirements and restrictions of NI 51-101. For example, a reporting issuer must not make misleading or untrue statements, or omit any fact from its disclosure that would prevent a statement from being misleading.

This CSA Staff Notice (this **Notice**) provides guidance on recurring issues that we have found in our review of reporting issuers’ disclosure of resources other than reserves data.

Specifically, we provide guidance in this Notice about:

- disclosure of stand-alone possible reserves;
- disclosure of high and low case category estimates;
- adding together resources of different classes;
- partially risked prospective resources;
- use of the term “best estimate”;
- technology under development for contingent resources;
- classification to the most specific class and category of resource; and
- criteria for classification of unconventional hydrocarbons as discovered petroleum initially-in-place.

We think that it may be misleading for reporting issuers to disclose resources other than reserves data without providing some context to that data. We recommend cautionary statements throughout this Notice to assist reporting issuers in providing that context. A reporting issuer may use cautionary language other than that recommended by this Notice.

**Notes on Terminology**

Please refer to section 5 (*Definitions of Resources and Reserves*) of the *Canadian Oil and Gas Evaluation Handbook (COGEH)*, Volume 1<sup>1</sup>, for terminology, notably Figure 5-1.

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<sup>1</sup> Available on the Alberta Securities Commission website at:  
<http://www.albertasecurities.com/securitieslaw/Regulatory%20Instruments/5/2232/COGEHs.5DefinitionsOfOilandGasResourcesandReserves.pdf>

This Notice also uses other terminology that has been adopted in the Petroleum Resource Management System (**PRMS**), namely:

**Class** describes the chance of commerciality (reserves, contingent resources, etc.)

**Category** describes the range of uncertainty within a class:

for reserves: proved, probable, possible

for other classes: low, best, high case estimates

In colloquial usage, the term “resources” may or may not include reserves volumes. CSA Staff Notice 51-324 *Glossary to NI 51-101 Standards of Disclosure for Oil and Gas Activities* defines “resources” as “a general term that may refer to all or a portion of total resources”, where “total resources” is equivalent to total petroleum initially-in-place, as defined in COGEH.

In this Notice, “reserves data” is used as defined in NI 51-101, namely “an estimate of proved reserves and probable reserves”. A phrase such as “resources other than reserves data” refers to all other classes of resource, including possible reserves.

## 2. Stand-alone Possible Reserves

Stand-alone possible reserves are possible reserves that are assigned to a property for which no proved or probable reserves volumes have been assigned. We think that it is potentially misleading to disclose possible reserves on a stand-alone basis. Situations in which it might be appropriate to disclose possible reserves on a stand-alone basis are rare, but could include the following:

- Project economics are such that no proved or probable reserves can be assigned, but on a proved + probable + possible reserves basis the project is economically viable, and a development decision has been made (e.g., adding compression, expanding facilities, offshore development of a structure delineated mainly with seismic with only limited well control).
- Only minor expenditure is required to develop the possible reserves and development is likely to proceed in the near future (e.g., behind-pipe zones in a well which has proved or probable reserves in another zone).
- Possible reserves may be assigned to that part of an accumulation for which a reporting issuer has the rights, when proved or probable reserves have been assigned to adjacent parts of the same accumulation for which the reporting issuer does not have rights.

In all of these situations, there should be an intent to develop the stand-alone possible reserves within a reasonable time.

In these situations, a reporting issuer that discloses stand-alone possible reserves should also disclose that there are no proved and probable reserves and provide a clear explanation as to why the possible reserves have been disclosed on a stand-alone basis.

### 3. Disclosure of High and Low Case Category Estimates

#### **(a) Individual Property Estimates**

Disclosure of proved + probable + possible reserves (high estimate) or of a high estimate of other resource classes, without disclosure of a best estimate and low estimate, is potentially misleading because investors may not appreciate that a high estimate does not represent the best estimate of the volume of resources that will actually be recovered by the reporting issuer.

Disclosure of reserves data in annual filings is required by NI 51-101. Disclosure of reserves estimates outside of annual filings that does not also include disclosure of probable reserves, when probable reserves are material, is likely to be misleading.

Disclosure by reporting issuers of resource classes other than reserves data that deviates from the guidance provided in section 5.5 of Companion Policy 51-101CP *Standards of Disclosure for Oil and Gas Activities (51-101CP)* is likely to be misleading. In particular, disclosing only a high case estimate without also disclosing the best case estimate is likely to be misleading; omission of the low case estimate will often also result in misleading disclosure. In most instances, disclosure of all three types of estimates will be necessary to avoid misleading readers.

In general, to ensure that disclosure is balanced and not misleading:

- If a reporting issuer discloses a proved + probable + possible reserves estimate, the proved and proved + probable estimates should also be disclosed.
- If a reporting issuer discloses a high case estimate of other classes, the best and low case estimates should also be disclosed.

#### **Example**

Contingent resources	
Low case estimate	1 Bcf
Best case estimate	10 Bcf
High case estimate	40 Bcf

In this example, 75% of the estimate of contingent resources lies above the best estimate; disclosure of the high case estimate alone would thus be misleading.

#### **(b) Aggregation of Resource Category Estimates for Several Properties**

Current guidance on the aggregation of resource estimates is provided in section 5.2(4) (*Probabilistic and Deterministic Evaluation Methods*) of 51-101CP and in section 9.6 (*Reserves Aggregation*) in COGEH, Volume 1. Although the general principles discussed there are relevant to the aggregation of all resource classes, the guidance in 51-101CP and COGEH was written primarily to address the aggregation of reserves data, (i.e., of proved and of proved + probable reserves). We provide additional guidance here on the disclosure of aggregated estimates that include resources other than reserves data.

##### *(i) Probabilistic Aggregation of Resource Estimates for Several Properties*

The guidance in 51-101CP on the probabilistic aggregation of reserves (section 5.2(4) (*Probabilistic and Deterministic Evaluation Methods*) of 51-101CP and section 5.5.3

(*Aggregation of Reserves Estimates*) of COGEH, Volume 1) is also applicable to disclosure of estimates of resources other than reserves data.

(ii) *Arithmetic Aggregation of Resource Estimates for Several Properties*

Proved, proved + probable and proved + probable + possible reserves estimates and high, best, and low estimates of other resource classes are measures of the probability that the disclosed volumes will be exceeded. Disclosure of the arithmetic sum of low estimates or high estimates of multiple properties may be misleading.

Proved + probable reserves, and best estimates of other resource classes, are generally considered to be approximations to a mean estimate<sup>2</sup> and, as such, their summation provides meaningful information and may be disclosed without misleading readers.

However, when other estimates are aggregated (e.g., multiple estimates of proved + probable + possible reserves or multiple high estimates of other resource classes) statistical principles indicate that the resulting sums will lie beyond a reasonable range of expected actual outcomes and, therefore, will potentially mislead readers.

Accordingly, where an arithmetic aggregation of several proved + probable + possible reserves estimates or of several high estimates of other resource classes is disclosed, the reporting issuer should (in addition to applying the guidance set out in section 5.2(4) of 51-101CP) accompany the disclosure with a clear cautionary statement to the following effect:

*This volume is an arithmetic sum of multiple estimates of [identify reserves or resource classes], which statistical principles indicate may be misleading as to volumes that may actually be recovered. Readers should give attention to the estimates of individual classes of [reserves or resources] and appreciate the differing probabilities of recovery associated with each class as explained [indicate where disclosed and explained].*

**Example: Arithmetic Aggregation**

Reserves in Bcf	Proved (circa P90)	Proved + Probable (circa P50)	Proved + Probable + Possible (circa P10)
Property 1	10	20	50
Property 2	12	18	30
Property 3	5	12	25
Property 4	25	40	75
Property 5	32	50	80
Total	84	140	260

Probability of getting:

More than	84 Bcf	>> 90% (much greater than 90%)
About	140 Bcf	≈ 50% (equal likelihood of getting more or less)
More than	260 Bcf	<< 10% (much less than 10%)

<sup>2</sup> This will not always be the case, especially for estimates made for frontier areas or for unconventional hydrocarbons. The implications of this should be considered when adding estimates of this nature.

That is, the probability that the combined production from all properties will exceed 260 Bcf is much lower (perhaps 1%) than the criterion for proved + probable + possible reserves. Conversely, the probability that actual production will exceed 84 Bcf is considerably greater (perhaps 98%).

This example uses P90, P50, and P10<sup>3</sup> criteria, but the same argument applies for any estimates that are greater or less than a mean, whether they have been determined using deterministic or probabilistic methods.

#### 4. Adding Across Resource Classes

##### (a) Introduction

NI 51-101 is silent in respect of the disclosure of summations of different resource class estimates. Some guidance is provided in section 5.2 (*Definition of Resources*) of COGEH, Volume 1, where the sum of reserves and contingent and prospective resources is described as “remaining recoverable resources”, and section 9.6 (*Reserves Aggregation*) of COGEH, Volume 1.

Section 5.3.3 of COGEH, Volume 1, states that “reserves, contingent resources, and prospective resources involve different risks associated with achieving commerciality”. “Chance of commerciality” is the product of two components:

- *Chance of discovery* - This applies to prospective resources. Methods of determining this for exploration activities are well developed and we do not expect its estimation to present particular difficulties.
- *Chance of development* - This applies to both prospective resources and contingent resources. It is derived from a number of factors that may include, but are not necessarily limited to:
  - project economics;
  - recovery technology;
  - technology under development (refer to section 7 of this Notice for further discussion on technology under development);
  - regulatory (including environmental) approval;
  - market and facilities;
  - corporate commitment; and
  - political risk - the quantification of political risk is not within the usual practice of oil and gas evaluators, but organizations exist that provide this information (e.g., The Economist’s *Global Political Risk Index*, produced by the Eurasia Group).

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<sup>3</sup> See section 5.3.5 of COGEH, Volume 1 regarding uncertainty categories and the use of P90, P50 and P10 criteria

The Chance of Commerciality for:

Reserves	= 100%
Contingent Resources	= Chance of Development
Prospective Resources	= Chance of Discovery x Chance of Development

	Chance of	
	Discovery	Development
Reserves	100%	100%
Contingent Resources	100%	< 100%
Prospective Resources	< 100%	<100%

Failure to account for these different chances of commerciality when adding different resource class estimates can result in highly misleading information. This should be avoided. In the exceptional circumstance in which the chance of discovery (prospective resources) and the chance of development (prospective and contingent resources) approach 100%, disclosure of the unrisks<sup>4</sup> arithmetic sum<sup>5</sup> of different resources may not be misleading if accompanied with additional cautionary language.

If a reporting issuer chooses to add across resource classes, in order to avoid potentially misleading disclosure the reporting issuer should only disclose summed resource classes as described below.

**(b) Addition of Unrisks Resource Classes**

NI 51-101 does not explicitly prohibit the disclosure of an unrisks arithmetic sum of different resource classes. However, this type of disclosure, especially the summation of high case estimates, will almost always be misleading.

In the exceptional circumstance in which the chance of discovery (prospective resources) and chance of development (prospective and contingent resources) approaches 100%, if a reporting issuer wishes to disclose such a sum, it should be described as “remaining recoverable resources (unrisks)”, and should be accompanied by a proximate cautionary statement that addresses the classes included in the summation that is to the following effect:

If only contingent resources are included in the summation:

*This estimate of remaining recoverable resources (unrisks) includes contingent resources that have not been adjusted for risk based on the chance of development. It is not an estimate of volumes that may be recovered. Actual recovery may be less.*

If only prospective resources are included in the summation:

*This estimate of remaining recoverable resources (unrisks) includes prospective resources that have not been adjusted for risk based on the*

<sup>4</sup> See section 9.2.2 of COGEH, Volume 1, where “risk” is defined as referring to “a likelihood of loss”. The term “unrisks” is used to indicate that the likelihood of loss has not been accounted for. The term “risks” is used to indicate that the likelihood of loss has been accounted for.

<sup>5</sup> A sum in which the chance of discovery and/or the chance of development is unaccounted for.

*chance of discovery or the chance of development. It is not an estimate of volumes that may be recovered. Actual recovery is likely to be less and may be substantially less or zero.*

If prospective resources and contingent resources are included in the summation:

*This estimate of remaining recoverable resources (unrisked) includes prospective resources that have not been adjusted for risk based on the chance of discovery or the chance of development and contingent resources that have not been adjusted for risk based on the chance of development. It is not an estimate of volumes that may be recovered. Actual recovery is likely to be less and may be substantially less or zero.*

Also, paragraph 5.9(1)(d) of NI 51-101 requires reporting issuers to disclose the risks and uncertainties associated with the chance of discovery and chance of development. This disclosure may be in the form of a percentage probability or a discussion that provides meaningful information.

We think that, almost invariably, an unrisked summation of proved + probable + possible reserves and high estimates of contingent and prospective resources would lie beyond a reasonable range of expectation and disclosure of that sum would be misleading. This should be avoided.

**(c) Risked Addition of Resource Classes**

It is uncommon to see a risked addition of resource classes but if such disclosure is made, reporting issuers should describe the disclosure as “remaining recoverable resources (risked)”, and the guidelines below should be followed.

*(i) Probabilistically Risked Addition of Resource Classes*

Disclosure should always include the P50 estimate. If other estimates are disclosed, the corresponding higher and lower estimates and the probabilities that they represent should also be disclosed (e.g., if a P10 estimate is disclosed, the P90 estimate should also be disclosed).

The disclosure should be accompanied by a proximate statement to the following effect:

*These remaining recoverable resources (risked) were adjusted for risk using statistical probabilistic methods.*

Also, the disclosure should be accompanied by a proximate statement that explains the specific form of the disclosure, such as:

*The P10 risked remaining recoverable resources estimate is a volume for which there is only a 10% probability that actual recovery will be greater.*

*(ii) Deterministically Risked Addition of Resource Classes*

Disclosure should always include the best estimate and, if other estimates are disclosed, the corresponding higher and lower estimates. The disclosure should be accompanied by a proximate statement to the following effect:

*These remaining recoverable resources (risked) were adjusted for risk using deterministic methods, which are an arithmetic weighting of the different resource classes, with weights representing the chance of commerciality.*

Also, subparagraph 5.9(2)(c)(iii) of NI 51-101 requires disclosure of the significant positive and negative factors relevant to the estimate. In satisfaction of this requirement, either one of the following may form part of the required disclosure:

- the numerical values of the weights assigned to chance of discovery and chance of development; or
- when a large number of estimates in the sum would result in a lengthy list, a meaningful discussion of the factors that have been considered in developing the weights.

### **5. Partially Risked Prospective Resources**

We have seen reporting issuers disclose prospective resources which are risked for the chance of discovery but not for the chance of development, typically where there is an exploration program that includes several wells. We have seen calculation errors with this procedure. Reporting issuers that disclose the results of such calculations should accompany the disclosure with a proximate statement to the following effect:

*These are partially risked prospective resources that have been risked for chance of discovery, but have not been risked for chance of development. If a discovery is made, there is no certainty that it will be developed or, if it is developed, there is no certainty as to the timing of such development.*

The chance of development should be discussed, with meaningful comment on the risks, uncertainties, and timing of development.

### **6. Use of the Term “Best Estimate”**

The term “best estimate” is defined in Appendix A of COGEH, Volume 1 with respect to entity-level estimates, as:

...the value derived by an evaluator using deterministic methods that best represents the expected outcome with no optimism or conservatism... If probabilistic methods are used, there should be at least a 50 percent probability ( $P_{50}$ ) that the quantities actually recovered will equal or exceed the best estimate.

The term “best estimate” should not be used to describe the results of arithmetic or probabilistic aggregation of resource estimates, unless these are risked in the aggregation process in such a manner that the aggregated value is strictly in accord with the definition of “best estimate”.

### **7. Technology Under Development for Contingent Resources**

When an evaluation cannot be carried out on the basis of established technology, contingent resources may be assigned on the basis of “technology under development”. Section 5.3.3 (*Commercial Risk*) of COGEH, Volume 1 defines “technology under development” as follows:

... technology that has been developed and verified by testing as feasible for future commercial applications to the subject reservoir.



Technology under development may only be used where all conditions of the above definition have been met:

- *“technology that has been developed”* - This condition effectively limits the technology to existing technology that has been developed in analogous reservoirs.
- *“verified by testing as feasible for future commercial applications”* - This condition implies that there has been a successful pilot project in the reservoir of interest or a good, relevant analog. An evaluator should exercise considerable caution before accepting a lower level of evidence. For example, laboratory tests on cores alone, temporary stimulation (e.g., by hot water, cold solvent) of short term flow, or simulation alone, would not be adequate evidence for classification as a contingent resource.
- *“to the subject reservoir”* - This condition requires careful examination and comparative analysis of the reservoir characteristics to confirm that the technology is specifically applicable to that reservoir. It is not sufficient to consider that completion technology that has been successfully applied, for example, in one shale gas area, can also be applied to other shale gas areas without careful consideration of the specific relevant factors.

Technology that may be described generally as being “under development”, including experimental technology, but that does not satisfy the requirements specified above, cannot be used to justify a classification as contingent resources.

In addition to the requirements specified in COGEH, for disclosure to be consistent with NI 51-101 the reporting issuer should be committed to the development of the technology and the technology should be expected to be available within a reasonable time. Section 5.5.4.f (*Timing of Production and Development*) of COGEH, Volume 1, although addressing reserves provides appropriate guidance on the timeline in which “technology under development” should be expected to proceed to a decision.

Reporting issuers making this type of disclosure should ensure that they also satisfy the requirements of section 5.9 of NI 51-101 regarding disclosure of contingent resources. In particular, paragraph 5.9(2)(b) of NI 51-101 requires that resources other than reserves be classified to the most specific category of resources. Reporting issuers may further classify and disclose contingent resources as “economic”, “sub-economic”, or “economic status undetermined”, as described in section 5.3.4 of COGEH, Volume 1. In some instances, it may be misleading to fail to further refine the classification and disclosure of contingent resources in this manner.

### **8. Classification to the Most Specific Class and Category of Resource**

Paragraph 5.9(2)(b) of NI 51-101 requires classification of resources to the most specific category (i.e., reserves, contingent resources, prospective resources or unrecoverable resources). The inclusion of this provision in NI 51-101 addresses concerns about disclosure of large volumes of undiscovered and discovered petroleum initially-in-place (**PIIP**) without any meaningful indication that commerciality could be attained.

Section 5.3 of 51-101CP contemplates as “exceptional circumstances” a situation in which a reporting issuer is unable to classify a discovered resource into one of the subcategories of discovered resources. The guidance in 51-101CP reflects established mining practice, which requires a pre-feasibility or a feasibility study before reserves are assigned to mining operations.

In that case, the recovery technology is well established but commerciality has to be confirmed. The applicability of “exceptional circumstances” for recovery of hydrocarbons by means other than mining would be limited to situations in which it is not possible to define a project<sup>6</sup> for the recovery of a resource from a petroleum accumulation.

If projects can be developed using several recovery processes but no decision has been made among them, one or more of such possible processes may be reflected in an evaluation as the basis of disclosure, and the results disclosed in an appropriate class (most likely contingent resources) with relevant discussion.

The definition of discovered PIIP includes the statement “...the recoverable portion of discovered petroleum initially-in-place includes production, reserves, and contingent resources; the remainder is unrecoverable”. Therefore, any volume for which a project cannot be defined and evaluated for classification of production, reserves, contingent resources or, in the case of undiscovered PIIP, prospective resources, *at the evaluation date*, is by definition unrecoverable.

Reporting issuers with volumes currently classified as unrecoverable but who are developing recovery projects may describe their activities in the disclosure, provided it is accompanied by a discussion of significant positive and negative factors.

When a reporting issuer discloses discovered PIIP without disclosure of reserves or contingent resources because a project for the evaluation of recoverable volumes has not been defined, the reporting issuer should supplement the cautionary statement required by clause 5.9(2)(c)(v)(A) of NI 51-101 with additional information to the effect of the underlined text as follows:

*A recovery project cannot be defined for this volume of discovered petroleum initially-in-place at this time. There is no certainty that it will be commercially viable to produce any portion of the resources.*

When a reporting issuer discloses undiscovered PIIP without disclosure of prospective resources because a project for the evaluation of recoverable volumes has not been defined, reporting issuers should supplement the cautionary statement required by clause 5.9(2)(c)(v)(B) of NI 51-101 with additional information to the effect of the underlined text as follows:

*There is no certainty that any portion of the resources will be discovered. A recovery project cannot be defined for this volume of undiscovered petroleum initially-in-place at this time. There is no certainty that it will be commercially viable to produce any portion of the resources.*

## **9. Criteria for Classification of Unconventional Hydrocarbons as Discovered Petroleum Initially-in-Place**

COGEH guidance for the classification of a hydrocarbon volume as discovered PIIP mainly addresses conventional hydrocarbons that exhibit primary flow. In this section we provide additional guidance for disclosure of unconventional hydrocarbons.

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<sup>6</sup> For this purpose, a project is a program of work that can be evaluated to demonstrate its commercial viability using current technology or technology under development (refer to section 7 of this Notice). The level of detail in a project and the sophistication of an evaluation will generally increase from prospective, to contingent resources, to reserves.

One of the criteria for classification of a volume of hydrocarbons as discovered PIIP is that the volume is in a “known accumulation”, which Appendix A of COGEH, Volume 1 defines as follows:

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 good analogy to a nearby and geologically comparable known accumulation, this may suffice.

Most unconventional hydrocarbons cannot be tested by primary flow and can require extensive pilot testing before flow may be demonstrated. Therefore, reliance has to be placed on log and core data, and on analogs to satisfy the known accumulation requirement.

- *Flow from temporary stimulation* - The requirement for flow testing for classification as discovered PIIP may be satisfied by a stimulation process, which results in temporary flow (e.g., stimulation by hot water, cold solvent). In the absence of further evidence, such a volume should be classified as unrecoverable and not as contingent resources or reserves.
- *Log and core data* - Unconventional hydrocarbon accumulations often have log and core data available from many sometimes hundreds of wells before flow has been demonstrated by pilot testing. On its own, log data from such wells would not satisfy the known accumulation requirement. Laboratory tests of cores that provide convincing evidence of the presence of significant (not trace or minimal) moveable oil would generally be sufficient to satisfy the known accumulation requirement and to assign discovered PIIP to an area around a well from which the core had been taken. In the absence of further evidence, such a volume should be classified as unrecoverable and not as contingent resources or reserves.
- *Analogs* - The known accumulation requirement may be satisfied by a “good analogy to a nearby and geologically comparable known accumulation”. Because in this case the analogy is a replacement for a flow test, it is not sufficient for individual reservoir parameters such as porosity or saturation to be comparable, but all aspects of the analog must support the expectation that the target reservoir will be able to flow in a similar manner, using the same recovery process.

Events that would not usually be considered to provide adequate evidence of flow for classification as discovered PIIP include desorption from cores, gas kicks, and mud log readings or minimal recovery (e.g., oil film) on tests.

The following points necessitate additional caution when evaluating unconventional resources:

- *Limited analogous information* - in comparison to the amount and quality of analog information on conventional oil and gas, the analogous information available on unconventional resources is limited. For example, only a few of the steam assisted gravity drainage well pairs with production have, at the date of this Notice, produced for any length of time.

- *Relevance of analogous information* - initial activity in any development tends to be in the best quality reservoir, and its use as an analog for later activity is likely to present an optimistic picture.
- *Analogs provide a best estimate* - analogs provide information on proved + probable reserves or best case estimate outcomes for resource classes other than reserves. Estimates of proved reserves or low case estimates should be adjusted accordingly.

Section 6.2 of COGEH, Volume 2 provides a discussion of the use of analogs for the assignment of reserves, much of which is generally relevant to other categories of resource. A paper by Hodgkin and Harrell<sup>7</sup> provides a useful approach to the use of analogous information for assigning reserves, although this approach does not necessarily meet specific requirements for regulatory disclosure.

A reporting issuer may be asked to demonstrate that an analogy is a good and relevant analogy and that geological comparability supports an expectation of flow.

### Questions

Please refer any questions you may have regarding this Notice to any of the following:

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<sup>7</sup> Hodgkin, J. E., Harrell, D. R., 2006, The Selection, Application, and Misapplication of Reservoir Analogs for the Estimation of Petroleum Reserves. SPE 102505

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