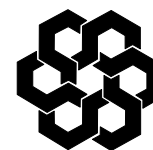


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**International
Accounting Standards
Board**

*This document is provided as a convenience to observers at IASB meetings, to assist them in following the Board's discussion. It does not represent an official position of the IASB. Board positions are set out in Standards.
Note: These notes are a summary of the staff papers prepared for the IASB.*

INFORMATION FOR OBSERVERS

Board meeting: July 2005, London
Project: Extractive Activities research project, Education session
Comparison of various reserve and resource definitions (A summary of agenda papers 5B and 5C)

Comparison between minerals and oil & gas reserves and resources definitions (Agenda Paper 5B)

1. Agenda paper 5B compares what are generally considered to be the dominant industry-based definitions of reserves and resources in the minerals and oil & gas industries – that is, the 2004 Australasian Joint Ore Reserves Committee (JORC)¹ Code (for minerals) and the Society of Petroleum Engineers (SPE) / World Petroleum Congress (WPC) / American Association of Petroleum Geologists (AAPG) definitions² (for oil & gas, and for simplicity hereafter referred to as the “SPE Code”).³ These “industry” definitions of reserves and resources have been developed over a long time, and they have been developed independently and in isolation of each other. Therefore, although both sets of definitions share some similar nomenclature and underlying concepts (e.g. reserves are the economically recoverable part of a deposit), it is understandable that some of the content and assumptions incorporated into the

¹ Prepared by the Joint Ore Reserves Committee of the Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and Minerals Council of Australia.

² These definitions are the *Petroleum Reserves Definitions* issued by the SPE and the WPC and the *Petroleum Resources Classification System and Definitions* issued by the SPE/WPC/AAPG.

³ Comparisons between the “industry” definitions and the SEC definitions follows in agenda paper 5C.

definitions are different. These differences are explained in the comparison. The core JORC and SPE definitions are provided at Appendix A to this paper.

2. The following aspects of the JORC Code and the SPE Code are compared:

- (a) the definitions of proved reserves;
- (b) the definitions of probable reserves;
- (c) the definitions of possible reserves and resources; and
- (d) the preparation of reserve and resource estimates.

A. Proved reserves – key components of the definition

3. The key components of the JORC and SPE definitions of ‘proved reserve’ are outlined in the table below together with a short comment on whether or not those components have a comparable meaning.

Key components of the definitions of Proved Reserves		
JORC (minerals)	SPE (oil & gas)	Observations
1. economically mineable	commercially recoverable	Both terms have a comparable meaning
2. a high level of confidence relating to the level of confidence with estimating resource characteristics (i.e. tonnage, densities, shape, physical characteristics, grade and mineral content)	reasonable certainty relating to the level of confidence with estimating the quantities of petroleum that may be commercially recoverable	The degree of certainty to be demonstrated for proved reserves is broadly comparable
3. realistically assumed economic factors	current economic conditions	Different economic assumptions apply (e.g. future versus current price, exchange rate, and operating cost assumptions)
4. <u>other</u> realistically assumed variables/inputs specifically, realistically assumed mining, metallurgical, marketing, legal, environmental, social	<u>other</u> current variables/inputs specifically, under current operating methods and government regulations	Different assumptions apply – assumptions can be based on future expectations only in the case of minerals ⁴

⁴ The JORC Code (minerals) also explicitly lists additional factors to those present in the SPE Code (oil & gas) although, practically, it is likely that the same factors are considered under both.

Key components of the definitions of Proved Reserves		
JORC (minerals)	SPE (oil & gas)	Observations
<i>and governmental factors</i>		
5. <ul style="list-style-type: none"> reasonable prospects for eventual economic extraction; and at the time of reporting extraction must be capable of being reasonably justified⁵ 	the accumulation is expected to be developed and placed on production within a reasonable time frame	In practice, the timeframe for commencing development is expected to be broadly comparable

Observations on the differences between mineral and oil & gas proved reserves

4. The major difference in the definitions of proved reserves under the JORC Code and the SPE Code relates to the economic and operating assumptions used. JORC allows mineral proved reserves to be estimated using realistically assumed future economic and operating conditions. In contrast, the SPE Code requires current conditions to be reflected in oil & gas proved reserves. Even though the assumptions used may not be dissimilar in some cases (e.g. if the historical price average is proximate to the forecast price, or operating costs have not inflated), the use of future versus current conditions is considered to be a significant difference between the Codes.

B. Probable reserves – key components of the definition

5. The above table identified and compared the five core components of the definitions of ‘proved reserves’ under the JORC and SPE codes. The table below identifies and compares the components of the definitions of ‘probable reserves’ under both codes to the extent they are different from each other and also different from the definitions of ‘proved reserves’.

⁵ “At the time of reporting” is intended to refer to the point in time when the reasonable justification must exist. That is, the assessment of extraction prospects can take into account, for example, future operating conditions and environments provided those forecasts can be reasonably justified at the time of reporting. The meaning of “at the time of reporting” is not intended to require that extraction must be justified according to the operating conditions and environment that exists as at the reporting date.

Key components of the definitions of Probable Reserves		
JORC (minerals)	SPE (oil & gas)	Observations
1. (typically) a reasonable level of confidence <i>relating to the level of confidence with estimating resource characteristics (i.e. tonnage, densities, shape, physical characteristics, grade and mineral content)</i>	<ul style="list-style-type: none"> • more likely than not to be recoverable; or • at least a 50% probability that the quantities actually recovered will equal or exceed the estimate <i>relating to the level of confidence with estimating quantities of petroleum that may be recoverable</i>	The degree of certainty to be demonstrated for probable reserves is much higher in the case of minerals.
2. realistically assumed variables/inputs <i>specifically, realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors</i>	future economic conditions <i>specifically, may assume future economic conditions different from those prevailing at the time of the estimate</i>	<p>Future assumptions about economic conditions can be made for both minerals and oil & gas – therefore, considered to be comparable</p> <p>(Comparability of the assumptions relating to some other modifying factors is unclear)</p>

Observations on the differences between mineral and oil & gas probable reserves

6. The major differences between mineral and oil & gas probable reserves relate to:
- (a) the level of confidence in the estimate – a probable reserve under the JORC Code requires a much higher level of confidence than a probable reserve under the SPE Code; and
 - (b) the scope of a probable reserve – a probable reserve under the JORC Code is a separate estimate to a proved reserve whereas under the SPE Code a probable reserve is the sum of the proved and probable reserve.

C. Possible reserves & resources

Relevance of possible reserves & resources to financial reporting

7. While the reserve/resource information most frequently used in financial reporting concerns the estimates of proved and probable reserves, estimates of lower categories of reserves and resources are relevant for some financial reporting purposes – for instance, in the calculation of fair value and in impairment testing of mining assets.⁶

Possible reserves

8. Included in the scope of the SPE Code is the concept of a ‘possible reserve’. The only difference between a probable and a possible reserve relates to the degree of uncertainty in their recoverability. For possible reserves, the SPE Code sets the threshold for recovery of quantities of petroleum (or gas) at:
 - (a) *less likely (than more likely)* to be recoverable; or
 - (b) at least a *10% probability* that the quantities actually recovered will equal or exceed the sum of estimated proved + probable + possible reserves.
9. There is no direct equivalent to a possible reserve in the JORC Code. If the JORC Code had a similar concept, it would most likely represent the economically mineable component of an inferred resource.

Resource definitions

10. The JORC Code uses mineral resources (and especially the measured and indicated categories) to form the basis of its reserves definitions. Broadly speaking, a mineral resource is the estimated tonnes and grade of an identified mineral deposit of a form, quality and quantity that has reasonable prospects for eventual economic extraction. The three categories of mineral resources (the third being inferred) are determined by the level of geological confidence in the deposit (which depends in part on the spacings) between drilling locations, and/or in confidence in the exploration data. A measured resource has the highest level of confidence of the three categories and inferred resource

⁶ See EITF 04-3: *Mining Assets: Impairment and Business Combinations*, which concluded that an entity should take into account the ‘value beyond proved and probable reserves’ in the estimates of future cash

has the lowest. To satisfy the definition of any category of mineral resource there must be a preliminary assessment of the economics of any eventual development and extraction.

11. 'Contingent resources' are defined by the SPE as:

... those quantities of petroleum which are estimated, on a given date, to be potentially recoverable from known accumulations, but which are not currently considered to be commercially recoverable.

12. Contingent resources are classified into a low, best and high estimate in the same manner as for reserves. SPE provides examples of contingent resources, which include "accumulations for which there is currently no viable market, or where commercial recovery is dependent on the development of new technology, or where evaluation of the accumulation is still at an early stage".

13. In addition to contingent resources are prospective resources. Broadly speaking, prospective resources are undiscovered petroleum that is expected to be potentially recoverable. Prospective resources is a concept that is usually used by governments in accounting for their national inventory.

Reporting of resources

14. JORC requires one or more categories of mineral resources to be reported. They may be reported inclusive or exclusive of resources converted to reserves, and an accompanying statement must make it clear which form of reporting has been adopted.

15. In contrast, the SPE does not specifically comment on the public reporting of contingent resources. Instead, the SPE leave the decision to report unproved reserves, and presumably resources, to the discretion of the entity or any jurisdiction that requires public reporting in accordance with the SPE Code.

Observations

16. The concept of resources is broader under the SPE Code than under the JORC Code. All resources reported in accordance with the JORC Code must be implicitly economic

flows used for impairment testing and in the value allocated to mining assets in a purchase price allocation.

whereas ‘contingent resources’ as defined by SPE will include resources that are implicitly economic as well as other resources that are either sub-economic or the likelihood of economic recovery is subject to considerable uncertainty. JORC has no equivalent to prospective resources (i.e. undiscovered resources) but does permit, subject to strict limits, the reporting of exploration targets that may be conceptual in nature.

D. Preparation of reserves estimates

17. Neither the JORC Code nor the SPE definitions contain mandatory prescriptive guidance on how to estimate reserves and resources. However both JORC and the SPE have published non-mandatory guidance on the evaluation of reserves and resources.
18. The JORC Code relies on a ‘competent person’ concept to provide some assurance in the estimates being reported. That assurance is provided by requiring the:
 - (a) reserve and resource estimates to be prepared by, or under the direction of, the competent person (they may be a full-time employee or a consultant);
 - (b) name of the competent person to be disclosed; and
 - (c) competent person to have a minimum of 5 years relevant experience in the style of mineralisation, type of deposit and activity involved and be a member of a specified professional society that has enforceable professional and ethical standards.
19. The SPE, in its *Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserve Information*, sets its expectations for the ‘reserve estimator’, which is a broadly comparable concept to that of the competent person. Like a competent person, they may be an employee or a consultant; they have the responsibility for estimating reserves (by either preparing, or supervising the preparation of, the estimates); and they must have the requisite experience – normally a minimum of three years practical experience in petroleum engineering or petroleum production geology, with at least one year of experience in estimating and evaluating reserve information – and qualifications. In contrast with the JORC Code, the SPE does not require the name of the reserves estimator to be disclosed with any reported reserve estimate, although it does emphasise that the reserve estimator must be independent or, if not independent, objective.

Further, unlike the JORC Code, the SPE requirements for a reserve estimator are not enforced.

Comparison between the industry-based and SEC definitions of reserves and resources (Agenda Paper 5C)

20. Agenda paper 5C compares the dominant industry-based definitions of minerals and oil & gas reserves and resources with the corresponding definitions used by the US Securities and Exchange (SEC).

Minerals – comparison between JORC Code and SEC Industry Guide 7

21. The table below specifies five key differences between the (Australasian) Joint Ore Reserves Committee (JORC) Code⁷ (and its international contemporary codes, hereafter referred to as “JORC-style codes”) and the SEC’s definitions, as specified in SEC Industry Guide 7 *Description of property by issuers engaged or to be engaged in significant mining operations* or as otherwise interpreted by the SEC staff.

JORC Code	SEC
1. Resources (measured, indicated and inferred) are defined and permitted to be disclosed	Resources are not defined, and generally cannot be disclosed
2. Price assumptions – reasonable and supportable short and long-term forecasts	Price assumptions – typically, a 3 year historical average
3. A feasibility study is <i>not</i> (necessarily) a prerequisite to the recognition of a reserve	A feasibility study is a prerequisite to the recognition of a reserve for an undeveloped project
4. Legal rights/permits – a reasonable expectation that permits will be granted and mining will occur	Legal rights/permits – implicitly requires all permits to be in place prior to reserves determination
5. Estimates to be prepared and reported by a competent person	No equivalent concept exists

⁷ *Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves – The JORC Code – 2004 Edition*, prepared by the Joint Ore Reserves Committee of The Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and Minerals Council of Australia.

Oil & gas – comparison between SPE Code and SEC Regulation S-X

22. The table below specifies key differences between the oil & gas reserves definitions of the Society of Petroleum Engineers (SPE) / World Petroleum Congress (WPC) / American Association of Petroleum Geologists (AAPG) definitions⁸ (hereafter referred to as the “SPE Code”) and the SEC, as specified in SEC Regulation S-X, Rule 4-10 *Financial accounting and reporting for oil and gas producing activities pursuant to the Federal Securities Laws and the Energy Policy and Conservation Act of 1975*. Interestingly, the SEC definition of ‘proved reserves’, which was introduced in 1978, was originally based on the SPE’s definition. However there are now a number of differences between the interpretation and application of the definitions.

SPE	SEC
1. All categories of reserves (proved, probable, and possible) are defined (Disclosure of reserves categories is left to the discretion of the jurisdiction or entity applying the SPE Code)	Only proved reserves can be disclosed
2. Reasonable certainty can be worked out using either deterministic or probabilistic methods	Reasonable certainty can be worked out using only deterministic methods
3. Economic assumptions – averaged historical prices and costs	Economic assumptions – typically prices and costs as at the date the estimate is made
4. Technical assumptions (e.g. new technology and practices can be used to prove up reserves)	Technical assumptions (e.g. only in limited circumstances can new technology and practice be used to prove up reserves)
5. Scope – includes non-traditional oil & gas (e.g. tar sands)	Scope – does not include non-traditional oil & gas

⁸ These definitions are the *Petroleum Reserves Definitions* issued by the SPE and the WPC and the *Petroleum Resources Classification System and Definitions* issued by the SPE/WPC/AAPG.

Core definitions from JORC and SPE/WPC/AAPG

JORC	SPE/WPC/AAPG
<p>Ore Reserve – the economically minable part of a Measured and/or Indicated Mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined. Appropriate assessments and studies have been carried out, and include consideration of and modification by realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These assessments demonstrate at the time of reporting that extraction could reasonably be justified. Ore Reserves are sub-divided in order of increasing confidence into Probable Ore Reserves and Proved Ore Reserves.</p>	<p>Reserves – those quantities of petroleum which are anticipated to be commercially recovered from known accumulations from a given date forward.</p>
<p>Proved Ore Reserve – the economically minable part of a Measured Mineral Resource. It includes diluting materials and allowances for losses which may occur when the material is mined. Appropriate assessments and studies have been carried out, and include consideration of a modification by realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These assessments demonstrate at the time of reporting that extraction could reasonably be justified.</p>	<p>Proved Reserves – those quantities of petroleum which, by analysis of geological and engineering data, can be estimated with reasonable certainty to be commercially recoverable, from a given date forward, from known reservoirs and under current economic conditions, operating methods and government regulations. Proved reserves can be categorised as developed or undeveloped.</p>
<p>No direct equivalent category</p>	<p>Unproved Reserves – based on geological and/or engineering data similar to that used in estimates of proved reserves; but technical, contractual, economic or regulatory uncertainties preclude such reserves being classified as proved. Unproved reserves may be further classified as probable reserves and possible reserves.</p>
<p>Probable Ore Reserve – the economically minable part of an indicated, and in some circumstances, a Measured Mineral Resource. It includes diluting materials and allowances for losses which may occur when the material is mined. Appropriate assessments and studies have been carried out, and include consideration of a modification by realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These assessments demonstrate at the time of reporting that extraction could reasonably be justified.</p>	<p>Probable Reserves – those unproved reserves which analysis of geological and engineering data suggests are more likely than not to be recoverable. In this context, when probabilistic methods are used, there should be at least a 50% probability that the quantities actually recovered will equal or exceed the sum of estimated proved plus probable reserves.</p>

JORC	SPE/WPC/AAPG
No direct equivalent category	<p>Possible Reserves – those unproved reserves which analysis of geological and engineering data suggests are less likely to be recoverable than probable reserves. In this context, when probabilistic methods are used, there should be at least a 10% probability that the quantities actually recovered will equal or exceed the sum of estimated proved plus probable plus possible reserves.</p>
<p>Mineral Resource – a concentration or occurrence of material of intrinsic economic interest in or on the Earth’s crust in such form, quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade, geological characteristics and continuity of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge. Mineral Resources are sub-divided, in order of increasing geological confidence, into Inferred, Indicated and Measured categories.</p>	<p>Contingent Resources - Those quantities of petroleum which are estimated, on a given date, to be potentially recoverable from known accumulations but which are not currently considered to be commercially recoverable.</p> <p><i>Classified into low, best and high estimates</i></p>
<p>Inferred Mineral Resource – that part of a Mineral Resource for which tonnage, grade and mineral content can be estimated with a low level of confidence. It is inferred from geological evidence and assumed but not verified geological and/or grade continuity. It is based on information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes which may be limited or of uncertain quality and reliability.</p>	
<p>Indicated Mineral Resource – that part of a Mineral Resource for which tonnage, densities, shape, physical characteristics, grade and mineral content can be estimated with a reasonable level of confidence. It is based on exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes. The locations are too widely or inappropriately spaced to confirm geological and/or grade continuity but are spaced closely enough for continuity to be assumed.</p>	

JORC	SPE/WPC/AAPG
<p><i>Measured Mineral Resource</i> – that part of a Mineral Resource for which tonnage, densities, shape, physical characteristics, grade and mineral content can be estimated with a high level of confidence. It is based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes. The locations are spaced closely enough to confirm geological and grade continuity.</p>	