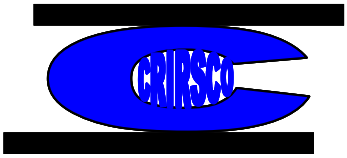

Committee for Mineral Reserves International Reporting Standards

Mapping of Petroleum and Minerals Reserves and Resources Classification Systems

A Joint Report submitted by:

Committee for Mineral Reserves International Reporting Standards (CRIRSCO)

and

Society of Petroleum Engineers (SPE) – Oil & Gas Reserves Committee

to the:

International Accounting Standards Board Extractive Activities Working Group

September 2007

Introduction

This report documents findings of a SPE-CRIRSCO joint study team regarding a comparison of current classification and guidelines for reporting reserves and resources associated with petroleum and minerals projects. While this report is primarily designed to assist the International Accounting Standards Board (IASB) in drafting International Financial Reporting Standards (IFRS) applicable to these extractive activities, it is also intended to provide background to other interested parties in order to promote better understanding of cross-industry reserves and resources assessment processes.

Background

Minerals and petroleum are naturally occurring materials that are non-renewable and thus subject to depletion.

Minerals (sometimes referred to as solid minerals) are naturally occurring materials in or on the earth's crust that include metallic ores, other industrial minerals (non-metallic minerals, aggregates), gemstones, uranium, and fossilized organic material (coal).

Petroleum is defined as a naturally occurring mixture consisting of hydrocarbons in the gaseous, liquid or solid phase (such as tar sands or oil shale). Petroleum may also contain non-hydrocarbons, common examples of which are carbon dioxide, nitrogen, hydrogen sulfide, and sulphur. In rare cases, non-hydrocarbon content could be greater than 50%.

The minerals and petroleum industries have independently developed classification systems and terminology to categorize the estimated quantities of material that exist in nature based on the level of knowledge available to develop the estimates and the risk and uncertainty implicit in any estimation process. Consideration is also given to the extent to which quantities can be technically and economically recovered based on the application of available extraction and processing technologies.

Several classification systems have been developed to support technical and commercial analyses. Moreover, individual regulatory agencies have defined rules for public disclosure of the estimated extractable and/or marketable quantities and their associated value; in most cases separate disclosure rules apply to minerals and petroleum.

The dominant international classification system for minerals is the International Reporting Template for the public reporting of Exploration Results, Mineral Resources and Mineral Reserves (hereinafter referred to as the Template) published by CRIRSCO in 2006. The primary objective of the system is to establish international best-practice standards for regulatory and public disclosures. The system combines the basic components of a number of national reporting codes and guidelines that have been adopted in similar forms by all the major agencies outside of the United States Securities and Exchange Commission (SEC). The classification is applied, with small modifications or extensions, by most mining companies for the purpose of internal resources and reserves management.

The dominant classification system for petroleum is that jointly published in March 2007 by the Society of Petroleum Engineers, the World Petroleum Council, the American Association of Petroleum Geologists, and the Society of Petroleum Evaluation Engineers, hereinafter referred to as the Petroleum Resource

Management System (PRMS). These are technical guidelines that are adopted in slightly modified form for internal resource management by most oil and gas companies. Most of the major regulatory agencies have developed disclosure guidelines that impose classification rules similar to, but not directly linked to, PRMS. Regulatory agencies typically mandate disclosure of only a subset of the total reserves and resources defined in PRMS; for example, the SEC currently specifies that only Proved Reserves should be disclosed.

The SPE-CRIRSCO study team critically examined the potential to introduce changes in terminology in one or both industries to improve the understanding when a common set of financial criteria are applied; however, given the long history of each industry wherein these terms and approaches have become embedded in practice and, in some cases, in legal documents, such a convergence would be extremely difficult.

The recommended approach is a “mapping” of the current systems and terminology such that the financial standards may be applied equally to either industry where appropriate, but the mapping also considers those areas where modified applications could be required.

Appendix A provides a correlation of the classes and categories as defined in PRMS for petroleum and the CRIRSCO Template for minerals.

Appendix B provides a glossary to compare selected terms as commonly utilized in the two industries.

Comparison of Reserves and Resources Classification Systems

Petroleum and Minerals have developed similar, but somewhat different, classification systems. The current petroleum and minerals classification and guidelines are maintained on the SPE (www.spe.org) and CRIRSCO (www.crirsco.com) websites.

The following section provides a high level overview of the two classification systems and the comparability of resulting reserves and resources estimates.

Petroleum

Figure 1 summarizes the current PRMS classification.

In this two-dimensional matrix, the vertical axis relates to the chance that a project applied to an accumulation will result in a commercial development. The horizontal axis relates to the uncertainty in estimates of quantities of sales products that will be associated with a specific development project. These estimated quantities may be characterized as Reserves if the accumulation is “discovered” (a significant quantity has been identified), and a development project is deemed commercial. To be commercial, a project must generally meet the evaluator’s economic criteria; there should be no significant contingencies (e.g. legal right to develop or obtaining an environmental permit is still questionable) that would prevent development, and the owners must commit to initiate development within a reasonable time frame.

Where an accumulation has been discovered, but no commercial project has been defined, the potentially recoverable sales quantities are classified as Contingent Resources with an associated chance of development. Where an accumulation is predicted but not yet discovered, the potential recoverable sales quantities are

classified as Prospective Resources with an associated chance of discovery and a conditional chance of development.

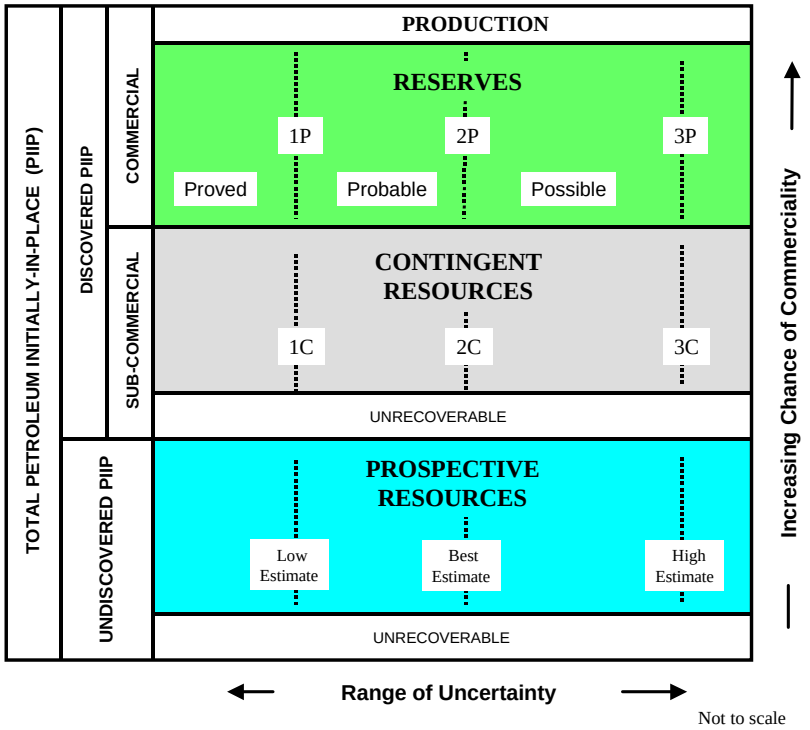

Figure 1: SPE/WPC/AAPG/SPEE 2007 Petroleum Resource Management System (PRMS)

In all cases, the estimates of recoverable quantities, or potentially recoverable quantities assuming a successful development plan, are categorized according to the relative certainty or confidence that the estimated quantities will actually be recovered and delivered for sale at a defined transfer point. The uncertainty in reserves estimates may be characterized in two formats:

1) Discrete increments: Proved, Probable, and Possible Reserves where Proved has a high confidence, the Probable increment is less likely than Proved but more likely than Possible, and the Possible increment would only be recovered based on optimistic estimates of in-place volume and recovery efficiency.
2) Cumulative scenarios: 1P (Proved), 2P (Proved plus Probable) and 3P (Proved plus Probable plus Possible). In this approach, the evaluator integrates geoscientific and engineering information to make a judgment on low/best/high outcome scenarios. Such estimates may be based on deterministic or probabilistic methods or combinations thereof.

Where probabilistic methods are used, the definitions (Appendix A) provide the specific cumulative probability of exceeding identified targets. PRMS further states that: "*While deterministic estimates may have broadly inferred confidence levels, they do not have associated quantitatively defined probabilities. Nevertheless, the ranges of the probability guidelines established for the probabilistic method influence the amount of uncertainty generally inferred in the estimate derived from the deterministic method.*"

The same categorization logic is applied to projects classified as Contingent Resources (conditional on development) where the equivalent cumulative scenario terms are 1C/2C/3C. *While PRMS does not provide specific labels, increments within Contingent Resources can be informally identified as C1, C2, and C3.* The cumulative scenarios for Prospective Resources (conditional upon discovery and

development) are low, best and high estimate: no discrete increment terms are used in pre-discovery assessments.

PRMS provides evaluators several options to further characterize projects to improve communication and better support portfolio analysis (Figure 2).

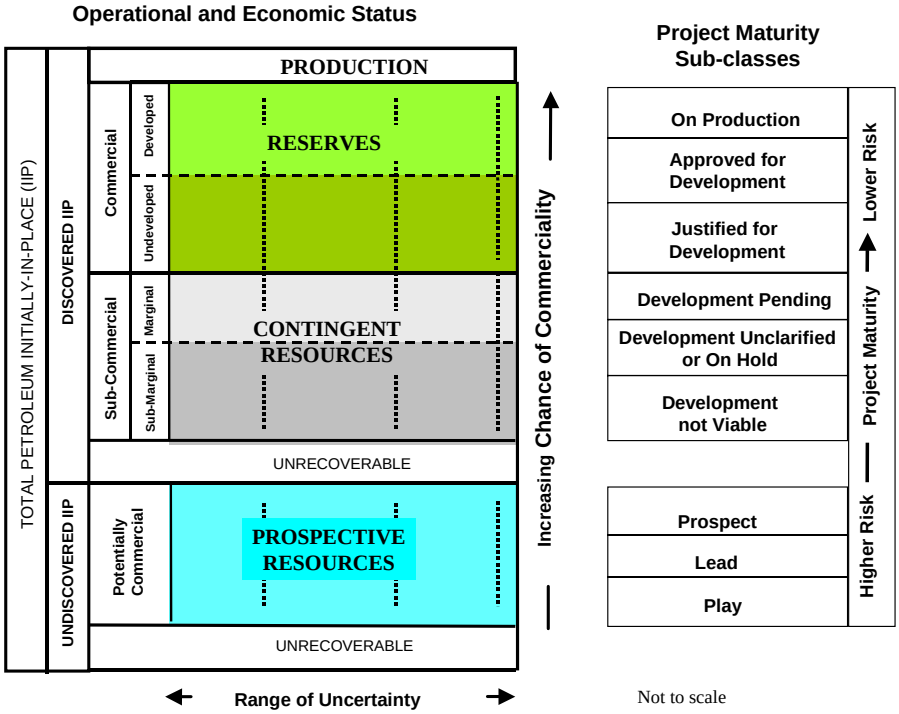

Figure 2: Sub-classification and Project Modifier Options in PRMS

The Project Maturity sub-classes align with the decision gates used internally as projects mature towards the ultimate “on production” status. A project constitutes an “investment opportunity” and is defined at the level at which the decision is made to proceed with capital investment that will move the project to a higher level of maturity. Such subdivisions are primarily designed to support internal project and portfolio analyses. Once projects satisfy commercial risk criteria, the associated quantities are classified as Reserves. These quantities may be allocated to Reserves Status subdivisions (Developed/Undeveloped) based on the funding and operational status of wells and associated facilities within the reservoir development plan.

Petroleum projects may be further characterized by their Economic Status. All projects classified as Reserves generally must be economic under defined conditions. Based on assumptions regarding future conditions and their impact on ultimate economic viability, projects classified as Contingent Resources may be broadly divided into two groups:

- Marginal Contingent Resources are those quantities associated with technically feasible projects that are either currently economic or projected to be economic under reasonably forecasted improvements in commercial conditions but are not committed for development because of one or more contingencies.

- Sub-Marginal Contingent Resources are those quantities associated with discoveries for which analysis indicates that technically feasible development projects would not be economic and/or other contingencies would not be satisfied under current or reasonably forecasted improvements in commercial conditions.

These projects nonetheless should be retained in the inventory of discovered resources pending unforeseen major changes in commercial conditions.

Where evaluations are incomplete such that it is premature to clearly define ultimate chance of commerciality, the economic status may be identified as “undetermined”.

Minerals

Figure 3, as taken from the CRIRSCO Template, sets out the framework for classifying tonnage and grade estimates to reflect different levels of geological confidence and different degrees of technical and economic evaluation.

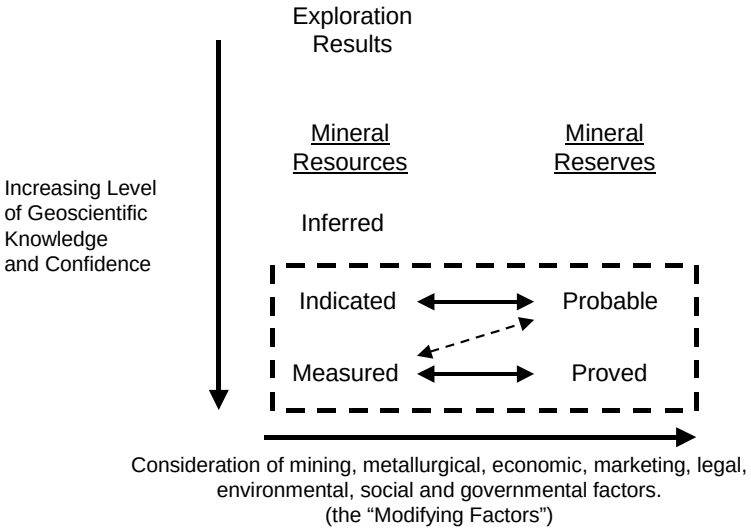

Figure 3: CRIRSCO-standard Mineral Reserves and Resource Classification

Mineral Resources must have reasonable prospects for eventual economic extraction. Sufficient geoscientific data must be available to permit estimation of tonnage and grade (concentration of valuable mineral commodity). Mineral Resources are subdivided into three categories with increasing degree of confidence: Inferred (low level of confidence, reasonably assumed but not verified), Indicated (reasonable level of confidence) and Measured (high level of confidence). Measured and Indicated Mineral Resources may be converted to Mineral Reserves by the application of economic and other criteria. Mineral Reserves are subdivided into two categories, with increasing degree of confidence and economic evaluation: Probable and Proved.

While Mineral Resources can be estimated based on predominantly geoscientific information, Mineral Reserves are also dependent on the consideration of Modifying Factors. The double-headed arrows indicate that resources can be converted into reserves and vice versa between the categories shown.

The dashed line between Measured Resources and Probable Reserves indicates that this conversion is possible in situations where the collective effect of the Modifying Factors provides additional uncertainties that have the consequence of reducing the confidence in the quantity of material that is expected to be economically recoverable. It follows also that an Indicated Mineral Resource could never be converted directly (i.e. without first being upgraded to a Measured Resource) to a Proved Reserve since there would not be the requisite level of geological confidence. Mineral Reserves contain no equivalent of Inferred Resources

(i.e. Possible Reserves); Inferred Resources must first be upgraded to at least Indicated Resources prior to conversion to reserves, so that there is sufficient knowledge of the geometry, grade and continuity to permit appropriate application of the Modifying Factors.

While similar decision-gates as described for petroleum may be applied by individual mining companies as part of their internal business processes, they are not part of the classification criteria for reporting purposes because the criteria used vary from company to company, and there are as yet no agreed industry-wide definitions.

Petroleum to Minerals Classification Mapping

Based on SPE-CRIRSCO study team findings, Figure 4 graphically illustrates the alignment between the current minerals and petroleum classification systems.

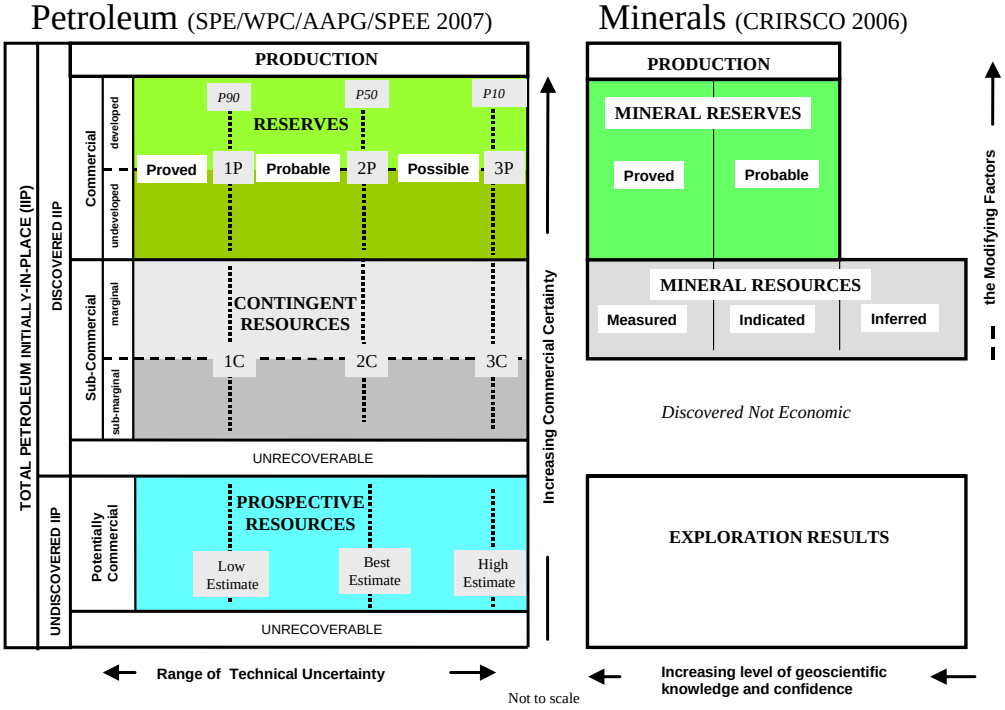

Figure 4: Comparison of Petroleum and Minerals Classification Systems

Note that the minerals classification matrix has been rotated to align with the petroleum presentation format in which Modifying Factors are generally equivalent to the contingencies that impact a petroleum project's chance of commerciality. For those categories of mineralization where it is possible to establish direct equivalents, the graphic and the associated class and category definitions (Appendix A) demonstrate close alignment.

Underlying this comparison are several key observations jointly agreed by the SPE-CRIRSCO team:

1. Both systems recognize a two dimensional matrix wherein classification is by commercial certainty (vertical axis in Figure 4) and categorization by technical certainty (horizontal axis in Figure 4). "Commercial" in this sense includes all of the minerals 'Modifying Factors', including economic.

2. SPE-PRMS provides classes for all hydrocarbons (discovered or undiscovered, commercial or sub-commercial) and their associated projects as typically

managed within an oil and gas company, whereas the current CRIRSCO schema focuses only on those classes deemed to be economic or reasonably assured of becoming economic and thus suitable to be included in public disclosures of Mineral Reserves and Mineral Resources.

3. Under SPE-PRMS, all estimates of reserves and resources refer to the "sales quantities" delivered at a custody transfer point according to product delivery specifications. Under CRIRSCO, Mineral Reserves estimates refer to run-of-mine tonnage and grade (% of the ultimate refined product). CRIRSCO requires disclosure of recovery factors which permit the reader to compute "sales quantities", and best practice is to report sales quantities of product.

4. SPE's Contingent Resources class encompasses a total inventory of all hydrocarbons that meet the discovery criteria. CRIRSCO's Mineral Resources are a subset and include only those deposits that have reasonable prospects for eventual economic extraction. Under PRMS, petroleum Marginal Contingent Resources are considered equivalent to Mineral Resources. CRIRSCO provides no class labels for "Discovered Not Economic" deposits. Petroleum's Contingent Resources estimates refer to sales volumes that would be derived by application of a defined project; Mineral Resources are estimated as in situ tonnage and grade based on defined cut-offs, since a specific extraction plan has not yet been defined.

5. The concept of classifying and measuring "Not Recoverable" (discovered and undiscovered) quantities as used by the SPE system does not exist in the current CRIRSCO schema. Exploration Results are insufficient to permit estimation of Mineral Resources, and are limited to disclosure of thicknesses and grade of mineralized intercepts.

6. CRIRSCO's use of Modifying Factors in feasibility studies to define Mineral Reserves is similar to the SPE's use of contingencies in development planning studies. CRIRSCO's Mineral Reserves and SPE's Petroleum Reserves classes show a similar high level of commercial certainty. *Reserves are those portions of resource quantities that can be recovered by projects that satisfy specified commercial conditions* using validated technology. SPE's classification of reserves for new projects anticipates initiation of development within five-years (with some documented exceptions); CRIRSCO's definitions require reserves to be economic, but time to anticipated production for new projects is not specified. Best practice is for unproduced reserves to be periodically validated by updated feasibility studies.

7. Proved and Probable Mineral Reserves have the same general level of associated confidence as SPE's Proved and Probable petroleum Reserves. However, the mining industry applies these confidence limits on a local scale, and PRMS applies these limits on a project scale. The sum of Proved and Probable Reserves under defined conditions is considered the best estimate of remaining recoverable quantities in both industries. CRIRSCO has no equivalent to SPE's Possible Reserves category; quantities related to deposits with similar low confidence levels remain as Inferred Mineral Resources.

8. Petroleum reserves and resources estimates are typically expressed on a net working interest (entitlement) basis after reduction for royalties and production owing to others. Mineral Reserves and Mineral Resources are typically reported on a 100% basis with the share attributable to the company shown separately.

9. Measured and Indicated Mineral Resources have the same geological confidence levels as Proved and Probable Mineral Reserves. SPE's Proved, Probable, and Possible Reserves categories have the same general technical confidence levels as their C1, C2, and C3 Contingent Resources categories. SPE's C1, C2 and C3 categories have similar associated confidence levels to CRIRSCO's Measured, Indicated and Inferred categories but with the caveat that the SPE categories refer to sales quantities while the CRIRSCO categories are based on in situ geological uncertainty.

10. The concept of cumulative scenarios as expressed by SPE's low/best/high estimates (and equivalent 1P/2P/3P in Reserves and 1C/2C/3C in Contingent Resources) is not utilized in the CRIRSCO classification model.

11. Underlying quantitative cumulative probability targets and derived average confidence factors used by SPE to guide placement of uncertainty category boundaries (when probabilistic methods are used) are not part of the CRIRSCO assessment system. Nonetheless, mineral evaluations take account of volatility of incremental cash flows related to uncertainty in incremental tonnage and grade produced over relevant time periods in assigning resources and reserves categories. Probabilistic methods can be used to assist in evaluating the uncertainty of tonnage and grade produced.

12. Production in the CRIRSCO system can be derived directly from reserves categorized as only Probable or from deposits with both Proved and Probable Reserves. Production in the SPE system can only be derived from Proved Developed Reserves. CRIRSCO does not separate Developed from Undeveloped reserves based on status of facilities and associated capital requirements, although regulators may require this for public reporting, and some mining companies do this for internal planning.

Regarding the underlying assumptions for economic analysis *(for purposes of defining project life and associated recoveries)* CRIRSCO and SPE agree that:

1. The base case for project evaluations assumes a production and cash flow schedule generally associated with the sum of Proved plus Probable reserves.

2. The base case assumes forecast cost and price schedules as developed internally by the entity making the investment decision (and need not be disclosed).

3. The economic criteria for commitment to implementing a project are specific to the entity making the project investment decision.

4. Typically the entity making the investment decision will conduct various sensitivity analyses and/or develop several scenarios based on the underlying forecasts of costs and prices (and other Modifying Factors). These may or may not include a scenario where costs and prices remain constant as of the date of the assessment, the end of the fiscal year, or some historical average.

Common Principles

Regardless of the commodity, be it derived from petroleum accumulations or mineral deposits, the following principles apply to reserves and resources evaluations:

- Resources and reserves are estimated by Competent Persons (minerals) or Qualified Evaluators (petroleum), who have demonstrated experience in estimation of resources and reserves for the deposit type.

- Reserves are estimates of an entity's entitlement to marketable/extractable quantities derived from a reservoir/deposit by applying a development plan taken to its economic, technical or contractual limit. Mineral Reserves must be stated in terms of run-of-mine tonnage and grade from which an estimate of the ultimate marketable product can be derived using disclosed recovery factors. Best practice is to disclose sales quantities in the reserve statement.

- Reserves are derived from a time integration of a project's production profile.

- Each project has a parallel cash flow schedule, and the project future net revenue is derived from a time integration of that cash flow schedule. Net operating cash flow is impacted by both production costs (including fiscal terms) and commodity price at the time of production. Different commodities have different price forecasts.

- When an appropriate discount rate is applied to the cash flow schedule, the net present value is dependent on the project timing - the earlier the production, the greater the net present value. A greenfields (no prior infrastructure) project typically involves major pre-production investment that requires a higher quality/quantity reserve than a brownfields expansion of an existing project.

- More than one project may be applied to the same accumulation/district (sequentially or in parallel).

- All projects involve risk and uncertainty:
    - Risk that the project may not proceed to "on production" status
    - Uncertainty in project timing
    - Uncertainty in the in-place quantities (tonnage and grade for minerals or initial volume and quality for petroleum)
    - Uncertainty in the recovery efficiency associated with a project
    - Uncertainty in costs and prices over the life of the project
    - Uncertainty in abandonment costs/mine closures

Summary

All of the above indicates that there is a high degree of compatibility in the classification logic that petroleum and minerals evaluators apply in determining quantities of their respective materials that reside in a field or a deposit and can be extracted and marketed. Nonetheless, each industry has developed separate classification and categorization logic. In many cases, this logic is related to the physical in situ differences in the material, the assessment techniques, and the appropriate extraction and processing methods. Appendix A (attached) provides a correlation of the classes and categories as defined in the CRIRSCO Template for minerals and PRMS for petroleum.

In some cases, similar terms are used with slightly different meanings; in other cases, similar concepts are described using different terms. Appendix B (attached) provides a comparative glossary of selected terms utilized in resource assessment and reporting in the two industries.

Appendix A: SPE_CRISCO Classification and Guidelines Mapping

SPE/WPC/AAPG/SPEE 2007 PRMS	CRIRSCO 2006 Template	Comments
Reserves – those quantities of petroleum anticipated to be commercially recoverable by application of development projects to known accumulations from a given date forward under defined conditions. Reserves must satisfy four criteria: they must be discovered, recoverable, commercial, and remaining based on the development project(s) applied. Reserves are further subdivided in accordance with the level of certainty associated with the estimates and may be sub-classified based on project maturity and/or characterized by their development and production status. To be included in the Reserves class, a project must be sufficiently defined to establish its commercial viability. There must be a reasonable expectation that all required internal and external approvals will be forthcoming, and there is evidence of firm intention to proceed with development within a reasonable time frame. A reasonable time frame for the initiation of development depends on the specific circumstances and varies according to the scope of the project. While five years is recommended as a benchmark, a longer time frame could be applied where, for example, development of economic projects are deferred at the option of the producer for, among other things, market-related reasons, or to meet contractual or strategic objectives. In all cases, the justification for classification as Reserves should be clearly documented. To be included in the Reserves class, there must be a high confidence in the commercial producibility of the reservoir as supported by actual production or formation tests. In certain cases, Reserves may be assigned on the basis of well logs and/or core analysis that indicate that the subject reservoir is hydrocarbon bearing and is analogous to reservoirs in the same area that are producing or have demonstrated the ability to produce on formation tests.	A **'Mineral Reserve'** is the economically mineable 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 (the Modifying Factors). These assessments demonstrate at the time of reporting that extraction could reasonably be justified. Mineral Reserves are sub-divided in order of increasing confidence into Probable Mineral Reserves and Proved Mineral Reserves.	Mineral and Petroleum reserves are essentially the same in that they have been discovered; remain available for extraction (i.e. not already extracted), and they are recoverable, meaning that the technology is available and validated to extract the useful mineral from the ground and by subsequent processing, where necessary, yield a marketable product. The difference between 'economically mineable' and 'commercial' is one of timing and intent, with the petroleum guidelines requiring firm commitment to initiate development within a "reasonable" timeframe (e.g. 5 years); minerals guidelines do not explicitly set a time constraint. To be designated as economic or commercial, and thus reserves, projects in both industries must satisfy a series of conditions regarding their technical, economic and legal status, for example, obtaining, or having a reasonable expectation of obtaining, environmental and other permits. In mining these are called the Modifying Factors, in petroleum these are called contingencies. Mineral Reserves are derived from Mineral Resources: Mineral Resources minus losses (e.g. pillars) + dilution (e.g. material below cut-off grade) = Mineral Reserves. Mineral Reserves are typically estimated in terms of tonnage of ore delivered from the mine with an associated grade being the concentration of the economic product (e.g. copper) which can be recovered after smelting/refining. Disclosures of Mineral Reserves must include a discussion of the Modifying Factors and in particular recovery factors that can be applied to reserves to obtain Sales Quantities. Best practice is to include Sales Quantities in the reserve statement. Petroleum is typically delivered as a more refined product (e.g. dry methane gas with very minor non-hydrocarbons), and this delivery specification becomes the basis of Reserves.

SPE/WPC/AAPG/SPEE 2007 PRMS	CRIRSCO 2006 Template	Comments
Proved Reserves – those quantities of petroleum, which by analysis of geoscientific and engineering data, can be estimated with reasonable certainty to be commercially recoverable, from a given date forward, from known reservoirs and under defined economic conditions, operating methods, and government regulations. If deterministic methods are used, the term reasonable certainty is intended to express a high degree of confidence that the quantities will be recovered. If probabilistic methods are used, there should be at least a 90% probability that the quantities actually recovered will equal or exceed the estimate.	A **'Proved Mineral Reserve'** is the economically mineable part of a Measured Mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined. Studies to at least Pre-Feasibility level will have been carried out, including consideration of, and modification by, realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors (the Modifying Factors). These studies demonstrate at the time of reporting that extraction is justified.	Proved Mineral Reserves can only be derived from Measured Mineral Resources, which represent material in the ground with the highest degree of geological confidence. Petroleum Proved Reserves represent the recoverable volumes of greatest geological and engineering (recovery efficiency) certainty. Minerals are generally solid and must be explored (drilled) in greater detail to determine available quantities and grades on a local basis, whereas conventional oil and gas are mobile and will flow towards an extraction well and thus require less dense sampling. Mineral Reserves estimators tend to rely on deterministic methods more than probabilistic (see Appendix B). Notwithstanding this difference in assessment methods, when all of the Modifying Factors or contingencies have been satisfied, the resulting Proved and Probable Reserves represent essentially same level of confidence in both industries.
Probable Reserves – those additional Reserves which analysis of geoscientific and engineering data indicate are less likely to be recovered than Proved Reserves but more certain to be recovered than Possible Reserves. It is equally likely that actual remaining quantities recovered will be greater than or less than the sum of the estimated Proved plus Probable Reserves (2P). In this context, when probabilistic methods are used, there should be at least a 50% probability that the actual quantities recovered will equal or exceed the 2P estimate.	A **'Probable Mineral Reserve'** is the economically mineable part of an Indicated, and in some circumstances, a Measured Mineral Resource, where the Modifying Factors (see below) are uncertain. It includes diluting materials and allowances for losses which may occur when the material is mined. Studies to at least Pre-Feasibility level will have been carried out, including consideration of and modification by realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors (the Modifying Factors). The results of the studies demonstrate at the time of reporting that extraction could reasonably be justified.	Probable Mineral Reserves are derived from Indicated Mineral Resources, which are generally geologically well defined but to a lesser degree than Measured. This lower level of confidence; which mining describes as 'reasonable' as opposed to high, cannot be changed when the material is converted to a Mineral Reserve. Petroleum Probable Reserves similarly have a lower level of confidence than Proved due primarily to technical uncertainties (in-place quantities and recovery efficiency) but may also be influenced by commercial issues. In both industries the sum of Proved plus Probable is considered the evaluator's best estimate of the remaining recoverable quantities using the information available at the time the estimate is made.

SPE/WPC/AAPG/SPEE 2007 PRMS	CRIRSCO 2006 Template	Comments
Possible Reserves – those additional reserves which analysis of geoscientific and engineering data indicate are less likely to be recoverable than Probable Reserves. The total quantities ultimately recovered from the project have a low probability to exceed the sum of Proved plus Probable plus Possible (3P) which is equivalent to the high estimate scenario. When probabilistic methods are used, there should be at least a 10% probability that the actual quantities recovered will equal or exceed the 3P estimate.	There is no direct equivalent of Possible Reserves in the CRIRSCO classification.	The Minerals industry does not have a category of Possible Reserves. This follows from the notes above on the confidence of the underlying geological information. The nearest equivalent to Possible Reserves is Inferred Resources, where the geological certainty is inadequate to apply the Modifying Factors and arrive at a meaningful reserve estimate. In Petroleum, 3P Reserves are the upside potential of quantities recovered by a defined project that satisfies Reserves class criteria, in particular economic, recoverable and commercial at the time of estimation.
Contingent Resources – Those quantities of petroleum estimated, as of a given date, to be potentially recoverable from known accumulations by application of development projects, but which are not currently considered to be commercially recoverable due to one or more contingencies. Contingent Resources may include, for example, projects for which there are currently no viable markets, or where commercial recovery is dependent on technology under development, or where evaluation of the accumulation is insufficient to clearly assess commerciality. Contingent Resources are further categorized in accordance with the level of certainty associated with the estimates and may be sub-classified based on project maturity and/or characterized by their economic status.		Mineral Resources are essentially similar to Marginal Contingent Resources (see below) in that they are waiting for something to happen before they can be converted into reserves. This may simply mean that studies of the Modifying Factors have not been undertaken or completed, or it may mean that economic conditions have to change to some extent to enable the conversion to take place. In general there will be a realistic expectation that these conditions will eventually be met. Petroleum Contingent Resources include all discovered quantities but are subsequently subdivided according to commercial status (marginal, sub-marginal) and project maturity. There is no CRIRSCO Template equivalent to Sub-marginal Contingent Resources, although companies often maintain internal non-reportable mineral inventories of material for which the conversion to reserves is currently deemed unlikely.

SPE/WPC/AAPG/SPEE 2007 PRMS	CRIRSCO 2006 Template	Comments
Marginal Contingent Resources – Those quantities associated with technically feasible projects that are either currently economic or projected to be economic under reasonably forecasted improvements in commercial conditions but are not committed for development because of one or more contingencies.	A **'Mineral Resource'** is a concentration or occurrence of material of 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, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence, sampling and knowledge. Mineral Resources are subdivided, in order of increasing geological confidence into Inferred, Indicated and Measured categories.	Mineral Resources are estimates of the tonnage and grade of mineralization in the ground before mining and processing adjustments are made. Petroleum resources are always considered as saleable product, i.e. what is sold to customers after extraction from the ground and any processing to make a product or products. Apart from this distinction, the concepts are similar, with Contingent Resources being a precursor to Reserves dependent, or contingent, upon addressing the factors required for the conversion to take place. Contingent Resources are subdivided into Marginal and Sub-Marginal. Marginal implies that the material has, in minerals terminology, "reasonable prospects for eventual economic extraction".
Sub-Marginal Contingent Resources – Those quantities associated with discoveries for which analysis indicates that technically feasible development projects would not be economic and/or other contingencies would not be satisfied under current or reasonably forecasted improvements in commercial conditions. These projects nonetheless should be retained in the inventory of discovered resources pending unforeseen major changes in commercial conditions.	No formalized direct equivalent class, or sub-class, is defined by CRIRSCO. Informally these are referred to as "Discovered Not Economic".	CRIRSCO's classification does not include provision for the public reporting of mineralization that does not have reasonable prospects for eventual economic extraction, even though it may be discovered. In order to become economic, a significant shift might be needed in the price, or new technology may be needed to viably process the material. In such cases where there is little likelihood of this happening in the foreseeable future, then the material is maintained in an internal inventory of opportunities but not publicly disclosed.
C1 – Category criteria are identical to those of Proved Reserves conditional on meeting Reserves class criteria. If deterministic methods are used, there should be a high degree of confidence that the C1 quantities will be recovered. If probabilistic methods are used, there should be at least a 90% probability that the quantities actually recovered will equal or exceed the 1C estimate.	A **'Measured Mineral Resource'** is 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.	Measured Mineral Resources meet the criteria of a high degree of confidence in the geologic characteristics of the mineralization, with the continuity of both ore-body geometry and grade being demonstrated by detailed exploration. Both Measured Mineral Resources and C1 Contingent Resources require conditions to be favourable before conversion to Proved Reserves. In the case of minerals these are the successful application of the Modifying Factors (including adjustments for losses and dilution); in the case of C1 resources, it is satisfying the contingencies.

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C2 – Category criteria are identical to those of Probable Reserves conditional on meeting Reserves class criteria. It is equally likely that actual remaining quantities recovered will be greater than or less than the 2C estimate. In this context, when probabilistic methods are used, there should be at least a 50% probability that the actual quantities recovered will equal or exceed the 2C estimate.	An **'Indicated Mineral Resource'** is 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.	In the terminology used by CRIRSCO, Indicated Mineral Resources can be converted to Probable Mineral Reserves conditional on meeting Reserves class criteria, which means successful application of the Modifying Factors (including adjustments for losses and dilution). The contingencies that must be satisfied to convert Petroleum's C2 Contingent Resources to Probable Reserves are broadly similar to the Mineral's Modifying Factors.
C3 – Category criteria are identical to those of Possible Reserves conditional on meeting Reserves class criteria. The total quantities ultimately recovered from the project have a low probability to exceed the 3C estimate which is equivalent to the high estimate scenario. When probabilistic methods are used, there should be at least a 10% probability that the actual quantities recovered will equal or exceed the 3C estimate**.**	An **'Inferred Mineral Resource'** is 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, sampling 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 is limited or of uncertain quality and reliability.	The Petroleum class C3 is based on the upside potential of an identified reservoir, where additional oil or gas may be recovered. The likelihood of this happening is given a low but quantifiable probability. This is essentially the same as an Inferred Mineral Resource although the relationship of Inferred to the next confidence level of Indicated is different. Inferred Mineral Resources generally represent the first point at which data are adequate to describe a mineralised volume, tonnage and grade. In order to become a reserve, Inferred Resources must first be upgraded to Indicated Resources by more sampling (drilling). This is because the ore body geometry, grade and continuity of Inferred Mineral Resources is inadequate to permit application of the Modifying Factors. However, Petroleum C3 Contingent Resources can be converted to Possible Reserves when a project satisfies the contingent conditions and the level of confidence remains low, consistent with the lack of input data.

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Prospective Resources - Those quantities of petroleum which are estimated, as of a given date, to be potentially recoverable from undiscovered accumulations. Potential accumulations are evaluated according to their chance of discovery and, assuming a discovery, the estimated quantities that would be recoverable under defined development projects. It is recognized that the development programs will be of significantly less detail and depend more heavily on analog developments in the earlier phases of exploration.	Exploration Results include data and information generated by exploration programmes that may be of use to investors but which may not be part of a formal declaration of Minerals Resources or Mineral Reserves. It should be made clear in public reports that contain Minerals Exploration results that it is inappropriate to use such information to derive estimates of tonnage and grade.	Mineral Exploration Results generally consist of 'points' of data; for example mineralized intersection in an isolated drill hole or a sample taken from a surface rock exposure. The information may be encouraging but is insufficient to enable a geological model to be constructed or for a resource volume (tonnage) and grade to be estimated. Exploration Results are the nearest equivalent in the CRIRSCO classification to the petroleum industry's “undiscovered accumulations”. The petroleum industry goes beyond what minerals would normally do (at least in public) in assessing the likelihood of discovery and the potential recoverable quantities conditional on discovery and development. These forecasts by petroleum companies, in common with any made by minerals companies, are likely to guide further exploration rather than form a fundamental part of the business valuation.

Appendix B: Petroleum and Minerals Terminology Mapping

The following compares terms commonly used in reserves and resources assessment and reporting by the petroleum and minerals industry.

TERM	SPE (Petroleum) Definition	TERM	CRIRSCO (Minerals) Definition	Comments
Accumulation	An individual body of naturally occurring petroleum in a reservoir. (also called a deposit)			See Mineralization
Aggregation	The process of summing reservoir (or project) level estimates of resource quantities to higher levels or combinations such as field, country or company totals. Arithmetic summation of incremental categories may yield different results from probabilistic aggregation of distributions. Reserves in different categories and/or classes should not be aggregated without due consideration of their associated confidence levels and the varying degrees of technical and commercial risk involved in their classification.			Mineral Reserves and Resources are reported on a mine-by-mine basis. If aggregated, categories would be arithmetically summed by category. Mineral Resources are separately stated from Mineral Reserves. In some jurisdictions, Inferred Mineral Resources must be stated separately (and not added to) Measured + Indicated Mineral Resources.
		Beneficiation	Physical and/or chemical separation of constituents of interest from a larger mass of material. Examples include screening, flotation, magnetic separation, leaching, washing, roasting etc.	Equivalent in petroleum would be processing to remove non-hydrocarbons.
		Beneficiation Plant	Treatment facility that removes gangue and waste rock from run-of-mine ore, to produce a saleable product or a concentrate that will be purified in a smelter/refinery.	Except for some coal and industrial minerals projects, most mines have beneficiation plants.
Best Estimate	With respect to resource categorization, this is considered to be the best estimate of the quantity that will actually be recovered from the accumulation by the project. It is the most realistic assessment of recoverable quantities if only a single result were reported. If probabilistic methods are used, there should be at least a 50% probability (P50) that the quantities actually recovered will equal or exceed the best estimate.			While the term is not commonly used in the mineral industry, there is a similar concept that the sum of Proved and Probable Mineral Reserves represents the best estimate of the remaining recoverable run-of-mine quantities from a mining project based on the data available to make the estimate and Life-of-Mine plan.

TERM	SPE (Petroleum) Definition	TERM	CRIRSCO (Minerals) Definition	Comments
Commercial	When a project is commercial, this implies that the essential social, environmental and economic conditions are met, including political, legal, regulatory and contractual conditions. In addition a project is commercial if the degree of commitment is such that the accumulation is expected to be developed and placed on production within a reasonable time frame.		.	Generally equivalent to "economic" in minerals. Concept in the minerals industry would be a combination of meeting economic hurdles and satisfying other Modifying Factors. Commitment (intent to mine) is not required to declare Mineral Reserves, although there is an expectation that a company could make a commitment to develop a mine if it wished to do so.
Contingencies	The economic, marketing, legal, environmental, social, and governmental factors forecast to exist and impact the project during the time period being evaluated.			Generally the petroleum industry's contingencies are equivalent to the mineral industry's "Modifying Factors".
Conventional Resources	Conventional resources exist in discrete petroleum accumulations related to localized geological structural features and/or stratigraphic conditions, typically with each accumulation bounded by a down-dip contact with an aquifer, and which is significantly affected by hydrodynamic influences such as buoyancy of petroleum in water**.**			There is no equivalent terminology used in the minerals industry.
Current Economic Conditions	Establishment of current economic conditions should include relevant historical petroleum prices and associated costs and may involve a defined averaging period. The SPE guidelines recommend that a one-year historical average of costs and prices should be used as the default basis of "constant case" resources estimates and associated project cash flows. Regulatory agencies may apply alternative definitions.			As utilized in reporting of Mineral Reserves under SEC Industry Guide 7, SEC staff opinion has defined current conditions as based on a three-year historical average. In other jurisdictions, appropriate economic conditions are determined by the Competent Person and may involve forward-looking assumptions on process, costs and exchange rates.

TERM	SPE (Petroleum) Definition	TERM	CRIRSCO (Minerals) Definition	Comments
		Cut off Grade	The lowest grade, or quality, of mineralized material that qualifies as economically mineable and available in a given deposit. May be defined on the basis of economic evaluation, or on physical or chemical attributes that define an acceptable product specification. The cut-off grade may vary with the time period or location within the mineral deposit.	As part of the evaluation process, petroleum teams may also apply cut offs in terms of gross reservoir thickness, net to gross ratio, porosity/permeability, hydrocarbon saturation, etc. to isolate zones that can be commercially developed.
		Competent Person	Must have at least five years experience in deposit type or applicable related deposit type and be a member of a professional self-regulating organization with a code of ethics and disciplinary powers.	Petroleum uses the term Qualified Reserves Evaluator (QRE) (refer to SPE "Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserve Information"). A Competent Person must be a member of a Self-Regulating Organization (SRO); while this is not a requirement for a QRE, many evaluators are licensed by government agencies.
Deterministic Estimate	The method of estimation of Reserves or Resources is called deterministic if a discrete estimate(s) is made based on known geoscientific, engineering, and economic data.			Similar concept in minerals evaluations.
Developed	Developed Reserves are expected quantities to be recovered from existing wells and facilities.			Petroleum facility capital costs are depreciated based on Developed Reserves. Some mining companies categorize reserves as Undeveloped, Partly Developed, or Fully Developed for internal planning purposes (e.g. Zambian Copperbelt).

TERM	SPE (Petroleum) Definition	TERM	CRIRSCO (Minerals) Definition	Comments
Development Plan	The design specifications, timing and cost estimates of the development project including, but not limited to, well locations, completion techniques, drilling methods, processing facilities, transportation and marketing.			Also termed Plan of Development (POD). Generally equivalent to a Pre-feasibility or Feasibility Study in the minerals industry.
		Dilution	Those portions of ore below cut off grade and waste rock that are included in run-of-mine tonnage that can not be segregated because of irregularities in contacts (planned dilution) or through failure to follow ore control limits or stope boundaries during extraction (unplanned dilution).	The term is not used in petroleum for reserves estimates; the closest analogy would be the water-cut in raw production. Note that a similar term “diluent” refers to condensate or other light hydrocarbons used to dilute heavy oil to decrease viscosity for pipeline transport.
Economic	In relation to petroleum Reserves and Resources, economic refers to the situation where the income from an operation exceeds the expenses involved in, or attributable to, that operation.	Economically Mineable	Extraction of the Mineral Reserve has been demonstrated to be viable under reasonably assumed financial assumptions.	In both industries, at a minimum, exploitation of reserves must result in positive cash flow; for new projects NPV, IRR, payback period etc. hurdles must be met.
Economic Limit	Economic limit is defined as the production rate beyond which the net operating cash flows (after royalties or share of production owing to others) from a project, which may be an individual well, lease, or entire field, are negative.			In the minerals industry broadly equivalent to end of Life-of-Mine plan to exploit Mineral Reserves.
Entitlement	That portion of future production (and thus resources) legally accruing to a lessee or contractor under the terms of the development and production contract with a lessor.			Similar concept used in minerals industry.
Evaluation	The geoscientific, engineering, and associated studies, including economic analyses, conducted on a petroleum exploration, development or producing project resulting in estimates of the quantities that can be recovered and sold and the associated cash flow under defined forward conditions.			Generally equivalent to a Pre-Feasibility or Feasibility Study in the minerals industry.

TERM	SPE (Petroleum) Definition	TERM	CRIRSCO (Minerals) Definition	Comments
		Feasibility Study	A Feasibility Study is a comprehensive study of a mineral deposit in which all geological, engineering, legal, operating, economic, social, environmental and other relevant factors are considered in sufficient detail that it could reasonably serve as the basis for a final decision by a financial institution to finance the development of the deposit for mineral production.	In petroleum, this is generally referred to as a development plan and associated evaluation where the detail is appropriate to the project maturity.
Field	An area consisting of a single reservoir or multiple reservoirs all grouped on, or related to, the same individual geological structural feature and/or stratigraphic condition. There may be two or more reservoirs in a field that are separated vertically by intervening impermeable rock, laterally by local geologic barriers, or both. The term may be defined differently by individual regulatory authorities.			Generally equivalent to a mine. One or multiple projects may be applied to a field or area of mineralization to recover quantities of economic interest.
Forecast Case	Modifier applied to project resources estimates and associated cash flow when such estimates are based on those conditions (including costs and product price schedules) forecast by the evaluator to reasonably exist throughout the life of the project. Inflation or deflation adjustments are made to costs and revenues over the evaluation period.			In most jurisdictions, appropriate economic conditions in minerals evaluations are determined by the Competent Person and typically involve forward-looking assumptions on prices, costs and exchange rates.
		Gangue	Material that is intimately mixed with minerals of commercial interest.	In most cases, gangue is removed in beneficiation plants after mining.
		Grade	Any physical or chemical measurement of the characteristics of the material of interest in samples or product. Note that the term quality has special meaning for diamonds and other gemstones. (also termed quality, assay or analysis value).	In mining this is typically expressed as an estimated concentration of valued product (e.g. % Cu, g/t Au, cts/t diamonds) in the reported tonnage. Petroleum quantities are reported assuming 100% grade (according to sales product specifications).

TERM	SPE (Petroleum) Definition	TERM	CRIRSCO (Minerals) Definition	Comments
		High Level of Confidence	In the minerals industry high level of confidence is restricted to Measured Resources/Proved Reserves. The Competent Person is encouraged to discuss and to quantify risk to the extent possible.	"High level of confidence" as used in the CRIRSCO guidelines is considered to (broadly) equate with "Reasonable certainty" as used in the petroleum industry.
		Life-of-Mine (LOM) Plan	A plan showing the spatial location of development (underground access), ore and waste (open-pit stripping) production increments (typically annual). The plan should include a description of all the human resources and equipment resources required and cash flow statements demonstrating the project or operation to be economic. Typically the plan will be accompanied by design criteria in terms of applicable Modifying Factors and a risk analysis including measures to be taken to mitigate risk. Pre-feasibility and Feasibility studies will include life-of-mine plans. The Life-of-Mine planned tonnages and grades should constitute the Mineral Reserve.	Generally equivalent to petroleum's Plan of Development – see Development Plan. In some jurisdictions, Inferred Mineral Resources may be included in Life-of-Mine plans, but these Inferred Resources may not be included in Mineral Reserves.
		Losses	That ore that meets economic cut offs but is not recovered in run-of-mine tonnage due to mine design versus irregularities in mineralization; may include pillars in underground mines, and allowances for incomplete extraction of material within ore control limits or stope boundaries.	If the pillars can be recovered through subsequent mining, they may remain classed as Mineral Resources. In petroleum losses typically refers to oil or gas that is produced but subsequently lost in surface processing (see Non-sales Quantities).
Measurement	The process of establishing quantity (volume or mass) and quality of petroleum products delivered to a reference point under conditions defined by delivery contract or regulatory authorities.			Equivalent in mining industry to tonnage and grade estimation.

TERM	SPE (Petroleum) Definition	TERM	CRIRSCO (Minerals) Definition	Comments
		Mine	An industrial facility at which minerals are removed from the ground. Includes a means of access to the minerals in situ.	May exploit single or multiple ore bodies or deposits of mineralization. Usually accompanied by treatment plants, although a single treatment plant may serve more than one mine, and a mine may deliver production to more than one treatment plant. Broadly equivalent to field in petroleum industry.
		Minerals	Minerals (sometimes referred to as solid minerals) are naturally occurring materials in or on the earth's crust that include metallic ores, other industrial minerals (non-metallic minerals, aggregates), gemstones, uranium, and fossilized organic material (coal).	In this context, Mineral Resources and Mineral Reserves are valuable commodities that can be extracted from the earth's crust, processed if necessary, and sold. Oil shale and oil (bitumen) sands are sometimes treated as minerals and sometimes treated as petroleum depending on the jurisdiction in which they occur.
		Mineralization	Any single mineral or combination of minerals occurring in a mass, or deposit, of economic interest. The term is intended to cover all forms in which mineralization might occur, whether by class of deposit, mode of occurrence, genesis or composition.	The term does not imply any measure of volume or tonnage, grade or quality and is thus not part of a Mineral Resource under the CRIRSCO Template. In petroleum, the equivalent term may be a prospect or lead.
		Mining	All activities related to extraction of metals, minerals and gemstones from the earth, whether surface or underground, and by any method (e.g. quarries, open cast, open cut, solution mining, dredging etc.); also referred to as quarrying.	In petroleum would be referred to as a development project consisting of wells and related facilities, or mines in case of oil shale or oil sands project if applicable.

TERM	SPE (Petroleum) Definition	TERM	CRIRSCO (Minerals) Definition	Comments
		Modifying Factors	The term 'Modifying Factors' is defined to include mining, metallurgical, economic, marketing, legal, environmental, social and governmental considerations.	Generally equivalent to the term "Contingencies" in petroleum evaluations.
Non-sales Quantities	Those quantities that have been, or are expected to be produced but not sold. This may include quantities that either have been or are expected to be used in the production process, such as fuel gas, plus those quantities that are removed or lost during the production process.			Generally equivalent to metallurgical losses in the minerals industry.
		Ore	Mixture of minerals containing valuable commodity and gangue or waste; must meet cut off grade for Mineral Reserves.	Also equivalent to run-of-mine material that will be beneficiated or sold (industrial minerals, coal).
Petroleum	Petroleum is defined as a naturally occurring mixture consisting of hydrocarbons in the gaseous, liquid, or solid phase.			Petroleum may also contain non-hydrocarbon compounds, common examples of which are carbon dioxide, nitrogen, hydrogen sulphide, or sulphur. In rare cases non-hydrocarbon content could be greater than 50%.
Petroleum Initially-in-Place	Petroleum Initially-in-Place is the total quantity of petroleum that is estimated to exist originally in naturally occurring reservoirs. Crude Oil-in-place, Natural Gas-in-place and Natural Bitumen-in-place, are defined in the same manner. (also referred as Total Resource Base or Hydrocarbon Endowment).			Minerals equivalent would be the Resource Base of USGS. However Resource Base is a superset of the CRIRSCO reporting Template, i.e. it includes mineralization for which there are no reasonable prospects for eventual extraction.

TERM	SPE (Petroleum) Definition	TERM	CRIRSCO (Minerals) Definition	Comments
		Pre-Feasibility Study	A Pre-Feasibility Study is a comprehensive study of the viability of a mineral project that has advanced to a stage where the mining method, in the case of underground mining, or the pit configuration, in the case of an open pit, has been established, where an effective method of mineral processing has been determined, and includes a financial analysis based on reasonable assumptions of technical, engineering, legal, operating and economic factors and evaluation of other relevant factors which are sufficient for a Competent Person, acting reasonably, to determine if all or part of the Mineral resource may be classified as a Mineral Reserve.	In petroleum, this is generally referred to as a development plan (or Plan of Development) where the detail is appropriate for the project maturity.
Probabilistic Estimate	The method of estimation of Resources is called probabilistic when the known geoscientific, engineering, and economic data are used to generate a continuous range of estimates and their associated probabilities.		Not formally recognized by CRIRSCO	Can be applied at the local scale in minerals to estimate the frequency distribution of tonnage and grade within a local area. Tonnages and grades above cut off can be accumulated to estimate Mineral Resources and Reserves. The tonnages present at specified probability thresholds are not estimated.
Production	Production is the cumulative quantity of petroleum that has been actually recovered over a defined time period. While all recoverable resource estimates and production are reported in terms of the sales product specifications, raw production quantities (sales and non-sales, including non-hydrocarbons) are also measured to support engineering analyses requiring reservoir voidage calculations.			Equivalent to Sales Quantities in the minerals industry being the quantity and quality (if applicable) of valuable mineral commodity sold to the customer.

TERM	SPE (Petroleum) Definition	TERM	CRIRSCO (Minerals) Definition	Comments
Project	Represents the link between the petroleum accumulation and the decision-making process, including budget allocation. A project may, for example, constitute the development of a single reservoir or field, or an incremental development in a producing field, or the integrated development of a group of several fields and associated facilities with a common ownership. In general, an individual project will represent a specific maturity level at which a decision is made on whether or not to proceed (i.e. spend money), and there should be an associated range of estimated recoverable resources for that project.	Project	A mine or group of mines, treatment plants and associated infrastructure for which pre-feasibility and feasibility studies are prepared including integrated life-of-mine plans, and for which a decision is made to raise and spend capital for development.	Generally equivalent concept.
		Product tonnage and grade determination	Weight and chemical analysis of product delivered to the customer.	Equivalent to production measurement as used in petroleum industry.
Property	A volume of the earth's crust wherein a corporate entity or individual has contractual rights to extract, process, and market a defined portion of specified in-place minerals (including petroleum). Defined in general as an area but may have depth and/or stratigraphic constraints. May also be termed a lease, concession, or license.			Similar concept applies in minerals industry. In some jurisdictions, extensions of dipping ore bodies in depth may be included, even if outside the surface boundaries, called the doctrine of extralateral rights.
Range of Uncertainty	The range of uncertainty of the recoverable and/or potentially recoverable volumes may be represented by either deterministic scenarios or by a probability distribution.			Similar concept in minerals provided as a sensitivity analysis; appropriate range analysis set by Competent Person.
Reasonable Certainty	If deterministic methods for estimating recoverable resource quantities are used, then reasonable certainty is intended to express a high degree of confidence that the estimated quantities will be recovered.			CRIRSCO uses the term "high level of confidence". The term "reasonable certainty" is not used in the minerals industry, "High level of confidence" is considered to (broadly) equate with "Reasonable certainty" in the petroleum industry.

TERM	SPE (Petroleum) Definition	TERM	CRIRSCO (Minerals) Definition	Comments
		Reasonable Level of Confidence	In the minerals industry reasonable degree of confidence is restricted to Indicated Resources/Probable Reserves. The Competent Person is encouraged to discuss and to quantify risk to the extent possible.	In minerals, a reasonable level of confidence would typically indicate a 50% or higher probability on a local scale. On a global (project) scale the probability would be higher. In petroleum this would broadly equate to the confidence level for Probable Reserves and C2 Contingent Resources.
Reasonable Expectation	Indicates a high degree of confidence (low risk of failure) that the project will proceed with commercial development or the referenced event will occur. There must be a reasonable expectation that all required internal and external approvals will be forthcoming, and there is evidence of firm intention to proceed with development within a "reasonable time frame."	Extraction could be Reasonably Justified	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*.	These terms relate to Reserves. In both industries there must be a high degree of confidence that the project could proceed through to producing status.
		Reasonable prospects for eventual economic extraction	Must take into account time period, which is commodity dependent. Although not prescribed, "reasonable" would typically imply greater than 50 % chance.	Applies to Mineral Resources and Marginal Contingent Resources (petroleum).
Recovery Efficiency	A numeric expression of that portion of in-place quantities of petroleum estimated to be recoverable by specific processes or projects, most often represented as a percentage.	Recovery (Yield)	The percentage of material of initial interest that is extracted during mining and/or processing. A measure of mining or processing efficiency.	Same concept applies for both mining and petroleum industries; in the minerals industry has a more general meaning which implies a comparison between material present at the beginning or end of a process, such as mining, treatment by a specified plant, etc. Does not imply conversion of in situ resources to saleable product unless specified or customary, e.g. Yield in the coal industry represents percentage of Run-of-mine coal converted to saleable products at a wash plant.

TERM	SPE (Petroleum) Definition	TERM	CRIRSCO (Minerals) Definition	Comments
Reference Point	A defined location within a petroleum extraction and processing operation where quantities of produced product are measured under defined conditions prior to custody transfer (or consumption). Also called Point of Sale or Custody Transfer Point.			Referred to as Point of Sale or Transfer in the minerals industry.
Reservoir	A subsurface rock formation containing an individual and separate natural accumulation of moveable petroleum that is confined by impermeable rocks/formations and is characterized by a single-pressure system.			A field is composed of one or more reservoirs. A mine may be composed of one or more mineralized zones (generally less continuous than a reservoir).
Resources Categories	Subdivisions of estimates of resources to be recovered by a project(s) to indicate the associated degrees of uncertainty. Categories reflect uncertainties in the total petroleum remaining within the accumulation (in-place resources), that portion of the in-place petroleum that can be recovered by applying a defined development project or projects, and variations in the conditions that may impact commercial development (e.g., market availability, contractual changes, etc.).			In mining, generally defined by incremental terms: Proved, Probable Mineral Reserves or Measured, Indicated, Inferred Mineral Resources. In petroleum may be defined by incremental terms (Proved, Probable, Possible Reserves; C1, C2, C3 Contingent Resources) or cumulative terms (1P, 2P, 2P reserves; 1C, 2C, 3C Contingent Resources).
Resources Classes	Subdivisions of Resources that indicate the relative maturity of the development projects being applied to yield the recoverable quantity estimates. Project maturity may be indicated qualitatively by allocation to classes and sub-classes and/or quantitatively by associating a project's estimated chance of reaching producing status.			In the minerals industry there are three classes (more often referred to as categories): Mineral Reserves, Mineral Resources, and Exploration Results (for which estimation of tonnages and grades is not possible). The CRIRSCO Template does not explicitly classify on project maturity although this is implied by the project development process (exploration, pre-feasibility, feasibility).

TERM	SPE (Petroleum) Definition	TERM	CRIRSCO (Minerals) Definition	Comments
Risk	The probability of loss or failure. As “risk” is generally associated with the negative outcome, the term “chance” is preferred for general usage to describe the probability of a discrete event occurring.			In the minerals industry, could include probabilities for upside and downside cases.
Royalty	Royalty refers to payments that are due to the host government or mineral owner (lessor) in return for depletion of the reservoirs and the producer (lessee/contractor) for having access to the petroleum resources. Many agreements allow for the producer to lift the royalty volumes, sell them on behalf of the royalty owner, and pay the proceeds to the owner. Some agreements provide for the royalty to be taken only in kind by the royalty owner.			Equivalent term used in mineral industry. May be in form of net profits interest or based on a percentage of sales proceeds (net smelter return is term often used, even though material may not be smelted). Less commonly may be in terms of value per ton or percentage of gross value of recovered product before deductions for treatment and other charges.
		Run-of-Mine (ROM)	Mixture of valuable minerals and waste (gangue) at the shaft collar or pit rim. The tonnage may be more or less than the (in situ) Mineral Resources depleted; the grade will generally be less than the grade of (in situ) Mineral Resources depleted.	Equivalent term in petroleum would be raw wellhead production before separation or processing.
Sales Quantities	The quantity of petroleum product delivered at the custody transfer (reference point) with specifications and measurement conditions as defined in the sales contract and/or by regulatory authorities. All recoverable resources are estimated in terms of the product sales quantity measurements.			Can be used similarly to petroleum by some portions of mineral industry, e.g. Coal and industrial minerals. For metallics, Mineral Resources are estimated as in-situ quantities, and Mineral Reserves are estimated as tonnage, grade and contained metal delivered to a beneficiation plant (run-of-mine).

TERM	SPE (Petroleum) Definition	TERM	CRIRSCO (Minerals) Definition	Comments
Sub-Commercial	A project is Sub-commercial if the degree of commitment is such that the accumulation is not expected to be developed and placed on production within a reasonable time frame. While five years is recommended as a benchmark, a longer time frame could be applied where, for example, development of economic projects are deferred at the option of the producer for, among other things, market-related reasons, or to meet contractual or strategic objectives. Discovered sub-commercial projects are classified as Contingent Resources.			Not formally used in mineral industry. Longer time frames than five years are typical in the Mineral Industry, and projects would not necessarily be removed from reserves if start dates are uncertain or more than five years in the future.
		Tonnage	An expression of the amount of material of interest irrespective of the units of measurement (which should be stated when figures are reported)	The quantity or volume of material of interest (rock volume containing ore). The closest analogy in petroleum is gross reservoir volume used in resource calculations but is not usually reported.
Uncertainty	The range of possible outcomes in a series of estimates. For recoverable resource assessments, the range of uncertainty reflects a reasonable range of estimated potentially recoverable quantities for an individual accumulation or a project. May be expressed qualitatively or quantitatively.			In the minerals industry the meaning is similar, but the range of uncertainty is typically expressed qualitatively, or if quantitatively restricted to production increments.
Unconven-tional Resources	Unconventional resources exist in petroleum accumulations that are pervasive throughout a large area and that are not significantly affected by hydrodynamic influences (also called “continuous-type deposits”). Examples include coal bed methane (CBM), basin-centered gas, shale gas, gas hydrate, natural bitumen (tar sands), and oil shale deposits. (also termed “Non-Conventional” Resources and “Continuous Deposits”)			There is no equivalent terminology used in the minerals industry.

TERM	SPE (Petroleum) Definition	TERM	CRIRSCO (Minerals) Definition	Comments
Undeveloped Reserves	Undeveloped Reserves are quantities expected to be recovered through future investments:			Developed/Undeveloped modifiers typically not reported, by mining industry but may be used for internal planning.
		Waste	Material below cut-off grade; where must be mined to access ore, is segregated from ore as much as practical.	Some waste will become incorporated in run-of-mine material, and is then called dilution.
Working Interest	Gross Working Interest is a company's equity interest in a project before reduction for royalties or production share owed to others under the applicable fiscal terms. Net Working Interest is after reduction for royalties or share of production owing to others.			Similar concept used in the minerals industry and referred to as "Equity Participation of Portion/Share". May not be reduced by royalties because these are typically small and treated as costs. Typically Mineral Reserves are reported on a 100% basis, and that percentage attributable to the company is separately noted.