

**SPE Oil and Gas Reserves Committee
Mapping Subcommittee Final Report – December 2005**

APPENDIX A

Detailed Description of Agencies' Classification/Definitions

Includes a description of each classification/ references utilized plus comparison to SPE definitions using:

- a) summary text/diagrams and*
- b) a table detailing position on key issues*

	Page
US Security and Exchange Commission (SEC-1978)	2
UK Statement of Recommended Practices (SORP-2001)	13
Canadian Security Administrators (CSA -2002)	23
Russian Ministry of Natural Resources (RF-2005)	35
China Petroleum Reserves Office (PRO–2005)	53
Norwegian Petroleum Directorate (NPD–2001)	67
United States Geological Survey (USGS-1980)	70
United Nations Framework Classification (UNFC–2004)	75

US Security and Exchange Commission (SEC-1978)

Oil and Gas Reserves disclosures by all companies (both US and foreign-based) quoted on the US Stock Exchange are governed by SEC Accounting Rules (S-X §210.4-10 and S-K) and two Statements of Financial Accounting Standards Board (FASB): *SFAS No.19* and *SFAS No.69*.

The S-X regulation, published in 1978, deals with the definitions of proved reserves (developed and undeveloped) to be used in determining quantities of oil and gas reserves to be reported in filings with the SEC. In 1997 (Oil and Gas Producing Activities – Topic 12) and 2001, (“Accounting and Financial Reporting Interpretations and Guidance”) the SEC published additional clarifications on selected reserves disclosure issues.

The regulation S-K defines the standard instructions for filing forms. This regulation prohibits disclosure of estimated quantities of probable or possible reserves of oil and gas. The *SFAS No.19* (“Financial Accounting and Reporting by Oil and Gas Producing Companies”), published in 1977, requires the disclosure of the standardized measure of discounted future net cash flows from production of proved oil and gas reserves, computed by applying year-end prices of oil and gas. The *SFAS No.69* (“Disclosures about Oil and Gas Producing Activities”) has been published in 1982. This Statement amends FASB Statement No.19.

The proved reserves are estimated using prices and costs as at the evaluation date (most companies use 31st December), without any escalation. The SEC does not require independent evaluations.

The SEC regulations and guidelines about reserves definitions can be accessed on the Internet at:

2004 Testing Requirements in Deep Water GOM

<http://www.sec.gov/divisions/corpfin/guidance/oilgasltr04152004.htm>

Guidance on Reserves Classification

http://www.sec.gov/divisions/corpfin/guidance/cfactfaq.htm#P279_57537

1997 Oil and Gas Producing Activities – Topic 12

<http://www.sec.gov/interps/account/sabcodet12.htm>

Regulation S-X (Reserves Definition)

<http://www.sec.gov/divisions/corpfin/forms/regsx.htm#gas>

Industry Guides (Disclosure of Oil and Gas Operations)

<http://www.sec.gov/divisions/corpfin/forms/industry.htm>

Regulation S-K

<http://www.sec.gov/divisions/corpfin/forms/regsk.htm>

FASB documents could be found at www.fasb.org.

The oil and gas industry is generally aware of additional interpretations based on SEC correspondence with individual companies and/or opinions expressed by SEC engineers in public forums. However, the guidance on SEC definitions contained herein is based solely on information published by the SEC and taken from the sources listed above.

Comparison to SPE Definitions

The SEC rules and guidelines address proved reserves only. The SEC prohibits additional disclosure of unproved reserves, i.e. probable and possible, as well as Contingent and Prospective Resources. While SPE and SEC proved reserve definitions are quite similar, SEC regulations are generally considered to be slightly more restrictive than associated SPE guidance. Key differences between SEC and SPE systems are:

- While both proved definitions apply “current economic conditions”, the SEC specifically requires use of year-end prices and costs while the SPE will, in some circumstances, allow use of average prices and costs
- SPE allows use of either deterministic or probabilistic methodologies. While the SEC does not forbid probabilistic analyses, the disclosed quantities must be demonstrated to meet the defined deterministic criteria.
- SPE generally requires a well test to classify reserves as proved but can be replaced if the estimate is fully supported by wireline formation tests, logs and cores. The SEC states that a well test is mandatory and can be only avoided in the Gulf of Mexico (GOM) deep water if the estimate is fully supported by seismic, wire line conveyed sampling, logs and cores.
- Both the SPE and the SEC limit proved reserves to those recovered above the lowest known occurrence of hydrocarbons. In the absence of data on fluid contacts, SPE states that the lowest known structural occurrence of hydrocarbons controls the proved limit unless otherwise indicated by definitive geological, engineering or performance data. In contrast, the SEC effectively rules out the use of conclusive technical data other than direct well observations and incremental proved can only be based on performance history.
- Regarding unconventional hydrocarbons, the SEC allows coal bed methane to be classified as proved reserves if the recovery is shown to be economic. While the SEC has ruled that bitumen recovered by mining is not petroleum reserves, there are no published guidelines for bitumen produced by in situ methods. The SPE definitions apply to both conventional and unconventional hydrocarbons
- The SPE guidelines define developed producing and non-producing status while SEC defines developed with no sub-categories.
- Both sets of definitions set similar criteria around commerciality to include not only economics but also commitment to proceed with development projects within a reasonable time frame. This includes confirmation of market, production and transportation facilities, and the required lease extensions. Neither set of definitions specifies the documentation to support these claims.
- The SEC requires a reasonable certainty of procurement of project financing; the SPE does not address financing requirements.

The SPE does not represent these analyses as being definitive guidance for those required to disclose reserves and resources under criteria set by these agencies; issuers should obtain guidelines documentation directly from each agency.

**Comparison of Reserves Definitions
Reserves Definition/Proved Criteria**

	SPE/WPC (1997)	U.S. SEC Reg. S-X (1987) Accounting Interpretation and Guidance (2001)
Intended purpose	General application – not country specific	Securities reporting
Qualitative description of certainty- proved	Reasonable certainty to be commercially recoverable	Reasonable certainty to be commercially recoverable
Qualitative description of certainty- probable	Not proved, but more likely than not to be recoverable	Not Defined
Qualitative description of certainty- possible	Less likely to be recovered than probable	Not Defined
Quantification of probabilities associated with estimates.	Proved \Rightarrow P90 2P \Rightarrow P50 3P \Rightarrow P10	Not Addressed
Proved reserves relative to lowest known hydrocarbon (LKH)	No proved reserves below LKH as defined by well logs, core analysis or formation testing	No proved reserves below LKH. Make positive revision if performance history indicates more reserves than estimated volumetrically to the LKH .
Proved reserve extensions on undrilled acreage	Directly offsetting DSU's and/or where reasonably certain of continuity and commercial recovery	Limited to directly offsetting DSU's except where continuity of production from the existing productive formation has been demonstrated with certainty. Seismic data cannot be the sole indicator of continuity.
Proved reserves – requirements for testing	Generally require actual production or a conclusive flowing well test. In certain cases, proved reserves can be based on logs and/or cores and is analogous to producing or tested reservoirs	In most cases, reservoirs require actual production or a conclusive flowing well test at economic rates For deep water GOM can be avoided if the estimate is fully supported by seismic, wire line conveyed sampling, logs and cores.
Classification of enhanced recovery mechanism as proved	Successful pilot or existing project in subject or analogous reservoir	Successful pilot or existing project in subject or poorer quality analogous reservoir Not required if the IOR technique has been verified by routine commercial use in the area

**Comparison of Reserves Definitions
Development Status**

Development and production status categories	Developed producing and non-producing. Undeveloped.	Developed Undeveloped
Developed	Reserves expected to be recovered from existing wells including reserves behind pipe. Improved recovery reserves require that necessary equipment has been installed or when costs to do so are relatively minor.	Reserves that can be expected to be recovered through existing wells with existing equipment and operating methods. Additional oil and gas expected to be obtained through the application of fluid injection or other improved recovery techniques should be included as “proved developed reserves” only after testing by a pilot project or after the operation of an installed program has confirmed through production response that increased recovery will be achieved.
Developed - Producing	Reserves expected to be recovered from completion intervals which are open and producing at the time of the estimate. Improved recovery reserves are considered developed producing only after the improved recovery project is operational.	Not Defined
Developed – Non-Producing	Includes shut-in (open but not producing, waiting on market/pipeline connections, or mechanical problems) and behind pipe (requires additional completion or future recompletion) reserves.	Not Defined
Undeveloped	Reserves to be recovered from additional drilling, deepening existing wells to a different reservoir or where a relatively large expenditure is required to complete an existing well or install production or transportation facilities.	Reserves that are expected to be recovered from new wells on undrilled acreage, or from existing wells where a relatively major expenditure is required for recompletion
Allocation in Multi-well Pools	Not Defined	Not Defined

**Comparison of Reserves Definitions
Unproved Reserves**

Unproved Reserves	Technical, contractual, economic, or regulatory uncertainties preclude reserves being classified as proved. Unproved reserves may be estimated assuming future economic conditions (and technological development) different from those prevailing at the time of the estimate.	Not Defined.
Probable Reserves	Includes: 1) step-out areas from proved 2) formations that appear productive on logs but lack core, definitive tests, or productive analogs 3) incremental reserves attributable to infill drilling 4) reserves attributable to improved recovery methods but lack pilot 5) adjacent fault blocks up-dip to proved 6) reserves attributable to future workover treatments or other procedures without successful analogs 7) incremental reserves in proved reservoirs through alternative interpretations.	Not Defined
Possible Reserves	Includes: 1) areas beyond probable potentially productive based on geological interpretations 2) formations that appear petroleum bearing in cores and logs but may not be commercially productive on tests 3) reserves attributable to infill drilling that are subject to technical uncertainty 4) improved recovery reserves where no pilot is operational and reservoir characteristics may not support commercial application 5) adjacent fault blocks down-dip to proved areas.	Not Defined

**Comparison of Reserves Definitions
Deterministic vs Probabilistic Methods**

<p>Deterministic vs Probabilistic Methods</p>	<p>Reserve estimates may be prepared using whether deterministic or probabilistic methods. Reserve numbers are generally defined within a range, not as one fixed quantity. The range may be described qualitatively by deterministic methods or quantitatively by probabilistic methods. (the probabilistic limits (e.g. Proved => P90) can only be specifically applied when the probabilistic method is applied)</p>	<p>Reserves estimates are prepared using mainly deterministic methodologies. If probabilistic methodologies are used, the limiting criteria in the SEC definitions, such as LKH, are still in effect and shall be honored.</p>
<p>Deterministic Method</p>	<p>Deterministic estimates do not address uncertainties in terms of probabilities; they require that volumes be described in terms of discrete estimates using defined criteria (e.g. LKH) including qualitative certainty.</p>	<p>Deterministic calculations are made with every input value singly determined. Reasonable certainty of these estimations can be made with a high degree of confidence. The best estimate of reserves is made on known geological, engineering and economical data.</p>
<p>Probabilistic Method</p>	<p>If probabilistic methods are used the defined quantitative limits (e.g. Proved => P90) apply at the entity level (<i>before aggregation</i>).</p>	<p>Not specified. SEC staff feels that it would be premature to issue any confidence criteria at this time.</p>
<p>Application of probability criteria and aggregation.</p>	<p>Numerical probabilities are only applied in probabilistic method and probability limits apply at the entity level. Probabilistic aggregation allowed to the field level only, then arithmetic summation to reporting level. Dependencies between entities and their distributions must be modeled in probabilistic aggregation.</p>	<p>Probabilistic aggregation of proved reserves can result in larger reserve estimates (due to decrease in uncertainty of recovery) than simple addition would yield. The SEC requires a straightforward reconciliation of this for financial reporting purposes.</p>

**Comparison of Reserves Definitions
Special Issues**

Treatment of Unconventional Hydrocarbons	Classification applies to all petroleum deposits.	Includes only conventional hydrocarbons. Mined bitumen is a mining reserve, not a petroleum reserve. However, coal bed methane gas can be classified as proved reserves if the recovery of such is shown to be economically feasible.
Fuel Gas Reserves Status	Issuers have the option to include gas volumes consumed in operations in production and reserves if an appropriate expense is allocated.	Issuers have the option to include gas volumes consumed in operations in reserves if produced from the lease and reduces the OPEX.
Natural Gas Injection	To include injection gas as reserves, the volumes would have to meet the normal criteria (economic when available for production, existence of a firm market, available pipeline or other export option, part of established development plan).	Injected gas should be omitted from the reported production. The reporting as reserves (i.e. when blow down is done) is not indicated.
Gas Sales Volumes	Reported gas reserves reflect the condition of the gas at the point of sale. If sold as wet gas, associate liquids reserves are not reported separately. If sold with a non-hydrocarbon gas content, the full volume as sold is included in reserves. The price received will reflect quality.	Gas volumes are reported on an "as sold" basis.
Infill Drilling	Not Defined	Not Defined
Compression	Not Defined	Not Defined

**Comparison of Reserves Definitions
Special Issues**

Net Profits Interests	Not Defined	Not Defined
Production-Sharing Contracts	Under a PSC the host government retains ownership, however the contractor receives a stipulated share of production remaining after cost recovery. Reported reserves are based on the economic interest held subject to the specific terms and time frame of the agreement. Being tied to economic interest, reserves must be re-calculated annually based on product price and operating costs and may vary considerably. Under SPE definitions, an average price over the term of the contact may be used to define reserves.	To calculate the reserves entitlement the economic interest method is preferred.
Contract Extensions	Where agreements allow extension through negotiation of renewed contract terms, exercise of options to extend or other means additional reserves (of various categories) or contingent resources may be assigned depending the level of certainty and commercial viability associated with the contract extension.	For purposes of determining proved reserves, a registrant's estimate of oil & gas reserves should be limited to quantities expected to be produced during the term of its leases or concessions. Renewals should not be assumed unless the registrant has a demonstrated history of obtaining renewals. Automatic renewal of such agreements cannot be expected if the regulatory body has the authority to end the agreement unless there is a long and clear track record which supports the conclusion that such approvals and renewal are a matter of course.
Product Categorization	NA	NA

**Comparison of Reserves Definitions
Economics/Commerciality**

Commerciality	In order to assign reserves of any category, a project needs to be defined in terms of a commercially viable development plan and there should be evidence of firm intent to proceed.	In frontier areas, issuers must demonstrate reasonable certainty of a market and the existence (or is likely to exist in the near future) of an economic method to extract, treat and transport the hydrocarbon
Commitment	If the degree of commitment is not such that an accumulation is expected to be developed and placed on production within a reasonable time frame (e.g. 5 years), the estimated recoverable volumes should be classified as contingent resources (not reserves).	In frontier areas a commitment by the company to develop the necessary production, treatment and transportation infrastructure is essential to the attribution of proved undeveloped reserves. Significant lack of progress on the development of such reserves may be evidence of a lack of such commitment. Affirmation of this commitment may take the form of signed sales contracts for the products; request for proposals to build facilities; signed acceptance of bid proposals; memos of understanding between the appropriate organizations and governments; firm plans and timetables established; approved authorization for expenditures to build facilities; approved loan documents to finance the required infrastructure; initiation of construction of facilities; approved environmental permits etc. Reasonable certainty of procurement of project financing by the company is a requirement for the attribution of proved reserves.
Economics	The underlying economic evaluation based on perception (best estimate) of future costs and prices together with best-estimate production profile expected to equate to a proved plus probable scenario. To limit downside exposure the “low case” scenario should be at least “break-even”, which is consistent with the requirement that proved reserve are viable under “current economic conditions”.	Economics has to be computed properly by property, applying year-end costs and prices and using only proved reserves. Future price changes shall be considered only to the extent provided by existing contractual arrangements. A positive cash flow is necessary to classify reserves as proved.
Development Plan Approvals	While some companies choose not to assign any proved reserves until the development plan has received all relevant formal approvals, SPE definitions require only a reasonable expectation that the necessary facilities to process and transport those reserves will be installed.	See the “Commitment” item.

**Comparison of Reserves Definitions
Economics/Disclosure Guidelines**

Prices & Costs for defining reserves "economic limit".	Proved: Existing economic conditions (year-end or appropriate period* average) (SPE *recommends prior 12 month period) Unproved: reserves may be based on forecast prices and costs	Prices and costs as of the last day of the company's fiscal year – no escalation
Abandonment Costs	Economic limit calculated including abandonment and reclamation costs.	Economic limit calculated including abandonment costs.
Net Present Value of Future Net Revenue (FNR).	Not Defined	The Standardized Measurement of Discounted Future Net Cash Flows have to be disclosed together with the future cash inflow, future development and production cost, future income tax expenses. A discount rate of 10 % is used.
Audit Requirements	No requirement for use of external evaluators. SPE "Standards Pertaining to the Estimating and Auditing of Oil and Gas Information" recommends standards for training, experience levels, and sets independence criteria for evaluators and auditors whether internal or external.	Not Required
Gross vs Net Reserves	See Note 1	See Note 1

Note 1:

SEC Net

FASB 69-10: "Net" quantities of reserves include those relating to the enterprise's operating and non-operating interests in properties as defined in paragraph 11(a) of Statement 19. Quantities of reserves relating to royalty interested owned shall be included in "net" quantities. "Net" quantities shall not include reserves relating to interests of others in properties owned by the enterprise.

FASB 69-13: Net quantities shall not include oil and gas subject to purchase under long-term supply, purchase, or similar agreements and contracts.

SPE Regards Royalty

Within the U.S., royalty volumes are strictly omitted from reported reserves (*that is, they are reported on a net basis*). In some cases outside the U.S., where royalty is paid in cash and the cash flow from the royalty is reflected in the company's accounts, the corresponding royalty may be included in reserves.

UK Statement of Recommended Practices (SORP-2001)

The Oil Industry Accounting Committee (OIAC) was established in 1984 to develop and promulgate guidance for the United Kingdom (UK) upstream oil and gas industry. The OIAC was authorized by the U.K. Accounting Standards Board (ASB) to develop a Statement of Recommended Practices (SORP) for the preparation of financial disclosures.

The first version was issued in 1986 and the last update was published in June 2001. For accounting periods beginning on or after 24 December 2001, Financial Reporting Standard 18, Accounting Policies, requires disclosure for entities falling within the scope of a SORP, whether the SORP has been followed and give details of and explanations for any departures.

The major feature is that the reserves may be disclosed, at company's choice, as either "Proved and probable oil and gas reserves" or "Proved developed and undeveloped oil and gas reserves". These alternatives are mutually exclusive and two different definitions are provided. Thus, the comparison with SPE definitions was made separating these two possible choices.

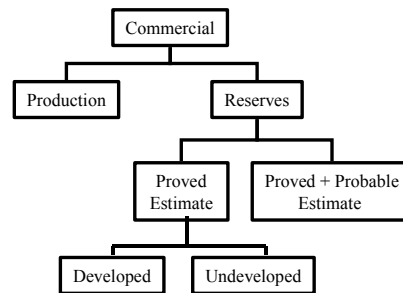
The degree of certainty of proven and probable reserves is given by a probabilistic definition (2P => P50) while proved developed and undeveloped use a deterministic definition ("reasonable certainty") almost equal to that defined by the SEC. In either submission, the key proved reserve boundaries (e.g. LKH and area extension) must be based on single-value deterministic estimates.

The proved developed and undeveloped reserves are defined with prices and costs as at the date the estimate is made. The proved and probable reserves definition does not address this aspect although such reserves quantification has to be based upon a reasonable assessment of the future economics of their production, a reasonable expectation of an available market, and evidence that the necessary production, transmission and transportation facilities are available or can be made available.

The SORP requires that the source of the estimate should be disclosed together with a description of the basis used to arrive at net quantities.

The SORP guidelines have a financial reporting purpose; methodological aspects are not contemplated. The SORP document can be accessed on the Internet at: www.oiac.co.uk/pronouncements.htm

Comparison to SPE Definitions



SORP is primarily an accounting standards document. It does not discuss the full reserves and resource classification system (no possible reserves, no contingent or prospective resources) nor does it supply detailed guidance on the recommended evaluation practices. Its reserves definitions are confined to the Proven and 2P estimate options defined above.

Its 2P definitions clearly require that “there should be a 50% statistical probability that the actual quantity of recoverable reserves will be more than the amount estimated as proven and probable and a 50% statistical probability that it will be less”. Further “the equivalent statistical probabilities for the proven component of proven and probable reserves are 90% and 10% respectively.

The commercial and technical criteria for the 2P case are very similar to those set by the SPE definitions. Specific criteria include:

- Reserves may only be considered proven and probable if producibility is supported by either actual production or conclusive formation test.
- 2P includes immediately adjoining undrilled portions beyond proved which can be reasonable judged as economically productive based on available geophysical, geological and engineering data.
- Improved recovery 2P reserves can be defined based on successful pilots or operation of an installed program in the reservoir or other reasonable evidence (successful analogs or reservoir simulation studies).
- Reserves may be considered commercially producible if management has the intention of developing and producing them.

The Proved Developed and Undeveloped definitions duplicate those of the basic SEC guidance and estimates would meet all SPE guidelines. SORP does not subdivide Proved Developed into Producing and Non-Producing. *(It is noted that some issuers interpret that while the words duplicate the SEC proved definitions, there is no obligation to consider the supplemental guidance issued by SEC staff and thus the reported proved reserves under SORP may not equal those estimated for SEC disclosures).*

Regarding non-conventional hydrocarbons, the Proved definition is taken from the SEC and the 2P definition does not address the issue.

**Comparison of Reserves Definitions
Reserves Definitions/Proved Criteria**

	SPE/WPC (1997)	U.K. SORP (2001)	
		Disclosure of Proved and Probable	Disclosure of Proved Developed and Undeveloped
Intended purpose	General application – not country specific	Financial statements reporting in UK	
Qualitative description of certainty- proved	Reasonable certainty to be commercially recoverable	Not defined	Reasonable certainty to be commercially recoverable
Qualitative description of certainty- probable	Not proved, but more likely than not to be recoverable	Not defined	-
Qualitative description of certainty- possible	Less likely to be recovered than probable	-	-
Quantification of probabilities associated with estimates.	Proved \Rightarrow P90 2P \Rightarrow P50 3P \Rightarrow P10	Proved \Rightarrow P90 2P \Rightarrow P50	Not defined
Proved reserves relative to lowest known hydrocarbon (LKH)	No proved reserves below LKH as defined by well logs, core analysis or formation testing.	No proved reserves below LKH (no detailed criteria)	No proved reserves below LKH (no detailed criteria)
Proved reserve extensions on undrilled acreage	Directly offsetting DSU's and/or where reasonably certain of continuity and commercial recovery.	Limited to immediately adjoining portions not yet drilled, but which can be reasonably judged as economically productive based on geological, geophysical and engineering data.	Limited to immediately adjoining portions not yet drilled, but which can be reasonably judged as economically productive based on geological and engineering data.
Proved reserves – requirements for testing	Generally require actual production or a conclusive flowing well test. In certain cases, proved reserves can be based on logs and/or cores and is analogous to producing or tested reservoirs.	Producibility is supported by either actual production or conclusive formation test	Economic producibility is supported by either actual production or conclusive formation test
Classification of enhanced recovery mechanism as proved	Successful pilot or existing project in subject or analogous reservoir.	Successful pilot or existing project in subject or other reasonable evidence (analogous reservoirs, reservoir simulation studies).	Successful pilot or existing project in subject.

**Comparison of Reserves Definitions
Development Status**

Development and production status categories	Developed producing and non-producing. Undeveloped.	Not defined	Developed and Undeveloped
Developed	Reserves expected to be recovered from existing wells including reserves behind pipe. Improved recovery reserves require that necessary equipment has been installed or when costs to do so are relatively minor.	Not defined	Proved reserves that can be expected to be recovered from existing wells, equipment and operating methods. Improved recovery reserves included only after testing by a pilot project or after operation confirms increased recovery.
Developed - Producing	Reserves expected to be recovered from completion intervals that are open and producing at the time of the estimate. Improved recovery reserves are considered developed producing only after the improved recovery project is operational.	Not defined	Not defined
Developed – Non-Producing	Includes shut-in (open but not producing, waiting on market/pipeline connections, or mechanical problems) and behind pipe (requires additional completion or future re-completion) reserves	Not defined	Not defined
Undeveloped	Reserves to be recovered from additional drilling, deepening existing wells to a different reservoir or where a relatively large expenditure is required to complete an existing well or install production or transportation facilities	Not Defined	Proved undeveloped reserves are all other proved reserves that do not meet the proved developed definition.
Allocation in Multi-well Pools	Not Defined	Not Defined	Not Defined

**Comparison of Reserves Definitions
Unproved Reserves**

Unproved Reserves	Technical, contractual, economic, or regulatory uncertainties preclude reserves being classified as proved. Unproved reserves may be estimated assuming future economic conditions (and technological development) different from those prevailing at the time of the estimate.	A qualitative characterization of unproved reserves is not indicated	Estimates of proved reserves do not include: volumes classified as indicated additional reserves or where recovery is uncertain. -
Probable Reserves	Includes: 1) step-out areas from proved 2) formations that appear productive on logs but lack core, definitive tests, or productive analogs 3) incremental reserves attributable to infill drilling 4) reserves attributable to improved recovery methods but lack pilot 5) adjacent fault blocks up-dip to proved 6) reserves attributable to future workover treatments or other procedures without successful analogs 7) incremental reserves in proved reservoirs through alternative interpretations.	No qualitative criteria given-	
Possible Reserves	Includes: 1) areas beyond probable potentially productive based on geological interpretations 2) formations that appear petroleum bearing in cores and logs but may not be commercially productive on tests 3) reserves attributable to infill drilling that are subject to technical uncertainty, 4) improved recovery reserves where no pilot is operational and reservoir characteristics may not support commercial application 5) adjacent fault blocks down-dip to proved areas.	NA-	-

**Comparison of Reserves Definitions
Deterministic vs Probabilistic Methods**

Deterministic vs Probabilistic Methods	Reserve estimates may be prepared using either deterministic or probabilistic methods. Reserve numbers are generally defined within a range, not as one fixed quantity. The range may be described qualitatively by deterministic methods or quantitatively by probabilistic methods. (the probabilistic limits (e.g. Proved => P90) can only be specifically applied when the probabilistic method is applied)	Reserve estimates are prepared using a probabilistic approach with deterministic constraints. (i.e. LKH).	Reserve estimates have to be prepared using only deterministic methods
Deterministic Method	Deterministic estimates do not address uncertainties in terms of probabilities; they require that volumes be described in terms of discrete estimates using defined criteria (e.g. LKH) including qualitative certainty.	Methods are not addressed in SORP	Methods are not addressed in SORP
Probabilistic Method	If probabilistic methods are used the defined quantitative limits (e.g. Proved => P90) apply at the entity level (<i>before aggregation</i>).	Methods are not addressed in SORP	-
Application of probability criteria and aggregation.	Numerical probabilities are only applied in probabilistic method and probability limits apply at the entity level. Probabilistic aggregation allowed to the field level only, then arithmetic summation to reporting level. Dependencies between entities and their distributions must be modeled in probabilistic aggregation.	Application of probability criteria and aggregation are not addressed in SORP.	-

**Comparison of Reserves Definitions
Special Issues**

Treatment of Unconventional Hydrocarbons	Classification applies to all petroleum deposits.	Classification applies to crude oil, natural gas and natural gas liquids. (unconventional hydrocarbons not addressed)	Estimates do not include crude oil, natural gas and natural gas liquids hydrocarbons that may be recovered from oil shales, coal, gilsonite and other such sources.
Fuel Gas Reserves Status	Issuers have the option to include gas volumes consumed in operations in production and reserves if an appropriate expense is allocated.	The figures both for production and commercial reserves should consistently either include or exclude any quantities of oil and gas consumed in operations.	See Proved and Probable.
Natural Gas Injection	To include injection gas as reserves, the volumes would have to meet the normal criteria (economic when available for production, existence of a firm market, available pipeline or other export option, part of established development plan).	Not defined	Not defined
Gas Sales Volumes	Reported gas reserves reflect the condition of the gas at the point of sale. If sold as wet gas, associate liquids reserves are not reported separately. If sold with a non-hydrocarbon gas content, the full volume as sold is included in reserves. The price received will reflect quality.	Not defined	Not defined
Infill Drilling	Not Defined	Not defined	Not defined
Compression	Not Defined	Not defined	Not defined

**Comparison of Reserves Definitions
Special Issues**

Net Profits Interests	Not defined	P.164 Where a purchaser's entitlement is represented by a specific proportion of future net revenue (such as in a net profits interest) the owner retains the primary interest in the underlying reserves. The 'purchaser', is not considered to hold a direct interest in the underlying reserves.	See Proved and Probable
Production-Sharing Contracts	Under a PSC the host government retains ownership, however the contractor receives a stipulated share of production remaining after cost recovery. Reported reserves are based on the economic interest held subject to the specific terms and time frame of the agreement. Being tied to economic interest, reserves must be re-calculated annually based on product price and operating costs and may vary considerably. Under SPE definitions, an average price over the term of the contact may be used to define reserves.	P.157-161 If there is production, the contractor receives a share of the production for recovery of its costs ('cost oil'). The remainder of the production ('profit oil') is shared between the contractor and the government in agreed ratios, the share of the profit oil taken by the government representing a form of taxation. The contractor's anticipated production revenues, from both the "cost oil" and the "profit oil" elements, are combined in their evaluation of the project economics	See Proved and Probable It appears that SORP would allow reporting of reserves based on economic interests. No guidance on the use of average prices is given.
Contract Extensions	Where agreements allow extension through negotiation of renewed contract terms, exercise of options to extend or other means additional reserves (of various categories) or contingent resources may be assigned depending the level of certainty and commercial viability associated with the contract extension.	Not defined	Not defined

**Comparison of Reserves Definitions
Economics/Commerciality**

Commerciality	In order to assign reserves of any category, a project needs to be defined in terms of a commercially viable development plan and there should be evidence of firm intent to proceed.	Based on a reasonable assessment of future economics, a reasonable expectation that there is a market and the evidence that necessary production, transmission and transportation facilities are available or can be in the future are required.	Not defined
Commitment	If the degree of commitment is not such that an accumulation is expected to be developed and placed on production within a reasonable time frame (e.g. 5 years), the estimated recoverable volumes should be classified as contingent resources (not reserves).	Reserves may be considered commercially producible if management has the intention of developing and producing them.	Not defined
Economics	The underlying economic evaluation based on perception (best estimate) of future costs and prices together with best-estimate production profile expected to equate to a proved plus probable scenario. To limit downside exposure the “low case” scenario should be at least “break-even” which is consistent with the requirement that proved reserves are viable under “current economic conditions”.	A reasonable assessment of future economics is required.	Not defined
Development Plan Approvals	While some companies choose not to assign any proved reserves until the development plan has received all relevant formal approvals, SPE definitions require only a reasonable expectation that the necessary facilities to process and transport those reserves will be installed.	Not defined	Not defined

**Comparison of Reserves Definitions
Economics/Disclosure Guidelines**

Prices & Costs for defining reserves "economic limit".	Proved: Existing economic conditions (year-end or appropriate period* average) (*SPE recommends prior 12 month period). Unproved: reserves may be based on forecast prices and costs.	Not defined. Associated costs may be accumulated in a cost pool. The source of estimates should be disclosed together with a description of the basis used to arrive at net quantities.	Prices and cost as the date the estimate is made. The source of estimates should be disclosed together with a description of the basis used to arrive at net quantities.
Abandonment Costs	Economic limit calculated including abandonment and reclamation costs.	FRS 12 specifically relates this concept to oil installations by examples, requiring provision for decommissioning costs.	See Proved and Probable
Net Present Value of Future Net Revenue (FNR).	Not defined	Not defined	Not defined
Audit Requirements	No requirement for use of external evaluators. SPE "Standards Pertaining to the Estimating and Auditing of Oil and Gas Information" recommends standards for training, experience levels, and sets independence criteria for evaluators and auditors whether internal or external.	P.248 Although the determination of the reserve quantities disclosed will be the responsibility of the directors, the source of the estimates should be disclosed together with a description of the basis used to arrive at net quantities. <i>(No audit requirements)</i>	Not required

SPE Regards Royalty

Within the U.S., royalty volumes are strictly omitted from reported reserves (*that is, they are reported on a net basis*). In some cases outside the U.S., where royalty is paid in cash and the cash flow from the royalty is reflected in the company's accounts, the corresponding royalty may be included in reserves

SORP Regards Royalties:

P. 111 Government and other royalties payable are sometimes excluded from both the value of reported turnover and cost of sales on the basis that the reporting company has no legal right to the royalty oil or gas. In other cases all invoiced quantities are included in turnover, and royalty payments are charged to cost of sales. Variations in treatment render comparisons difficult, not only as regards turnover but also as regards the relationship between turnover, production and net oil and gas reserve quantity movements

P.247 Net quantities should only include amounts that may be taken by Governments as royalties-in-kind where it is the company's policy (see paragraph 198) to record as turnover the value of production taken as royalty-in-kind.

Canadian Security Administrators (CSA -2002)

Effective September 30, 2003, annual and ongoing oil and gas reserves disclosures by Canadian companies are governed by National Instrument (NI) 51-101 as issued by the Canadian Securities Administrators (CSA). The disclosure regulations reference guidelines as contained in the Canadian Oil and Gas Evaluation Handbook (COGEH) Volume 1 "Reserves Definitions and Evaluation Practices and Procedures" co-authored by the Society of Petroleum Evaluation Engineers (Calgary Chapter) and the Canadian Institute of Mining, Metallurgy, and Petroleum (CIM Petroleum Society) published in June 2002. The contained reserves definitions are referred to as "CIM 2002".

For purposes of this comparison, the "Canadian definitions" are those stated in CIM 2002 with additional criteria taken from the Canadian Oil and Gas Evaluation Handbook Volume 1 and referred to hereafter as the "CIM definitions". The base reserve and resource definitions are designed to be applicable independent of the regulatory disclosure rules applied, that is, they can be used whether filing under SEC or CSA regulations. While COGEH supplies "standards to be used within the Canadian oil and gas industry in evaluating reserves and resources", the actual reporting requirements are contained in the NI 51-101 regulations; several key features of these rules are supplied as background.

Under NI 5101, the statement of reserves data must include proved, proved plus probable (proved plus probable plus possible is optional) and the accompanying future net revenue at multiple defined discount rates. Issuers also have the option to disclose Contingent and Prospective Resources. The proved (developed producing and non-producing, undeveloped, and total) reserves are defined under both evaluation date (that is year-end/constant) and defined forecast cost/price scenarios; the proved plus probable estimates use forecast cost/prices schedules only. Reserve impairment [ceiling test and depletion] is calculated using the 2P/forecast case. Reserves in each certainty class must be reported by product type and country; price and costs schedules for each product type must be disclosed. NI 51-101 reserves disclosures include both conventional and unconventional hydrocarbons (including mined bitumen).

CSA regulations require that, for non-exempt Canadian issuers, independent qualified evaluators (external consultants) be employed to evaluate or audit, annually, at least 75% of each company's properties based on proved plus probable future net revenue. The remaining 25% must be independently reviewed. NI-51-101 recommends (but does not require) that each issuer's board should appoint a "Reserves Committee" to coordinate interaction between the directors, management and the independent evaluators. Exemption from independent evaluation is only available to companies with more than 100,000 boe per day production, and must be applied for, but is neither certain, nor in perpetuity. Separate exemptions, to be able to report using US requirements (FASB/SEC) are also available, but there is no production threshold. None of these exemptions provide an exemption from CSA review.

CSA NI 51-101 regulations and the CIM reserves definitions can be accessed on the internet at: <http://www.albertasecurities.com/index.php?currentPage=3954>

Dr. David Elliott with the Alberta Securities Commission reviewed this summary and provided assistance in completing a detailed comparison to the SPE definitions.

Comparison to SPE Definitions

CIM has adopted the overall 2001 SPE/WPC/AAPG reserves and resource classification; as illustrated in figure 1; it is identical with one exception. The CIM classification allows the subdivision into Developed (separated into Developed Producing and Developed Non-producing) and Undeveloped at all reserves certainty levels whereas the current SPE definitions apply these status categories only to proved reserves but has developed their own reserve definitions and assessment guidelines. The sum of prior production and reserves is defined as the “ultimate reserves”. Reserves by definition must be remaining, recoverable with established technology under specified economic conditions, which are reasonable and disclosed. Note the quantitative certainty terms applied to 1P, 2P and 3P reserves are identical to those applied to low, best and high estimate for Contingent and Prospective Resources. It is emphasized that allocation to a resource category is based on information available as of the date of the evaluation.

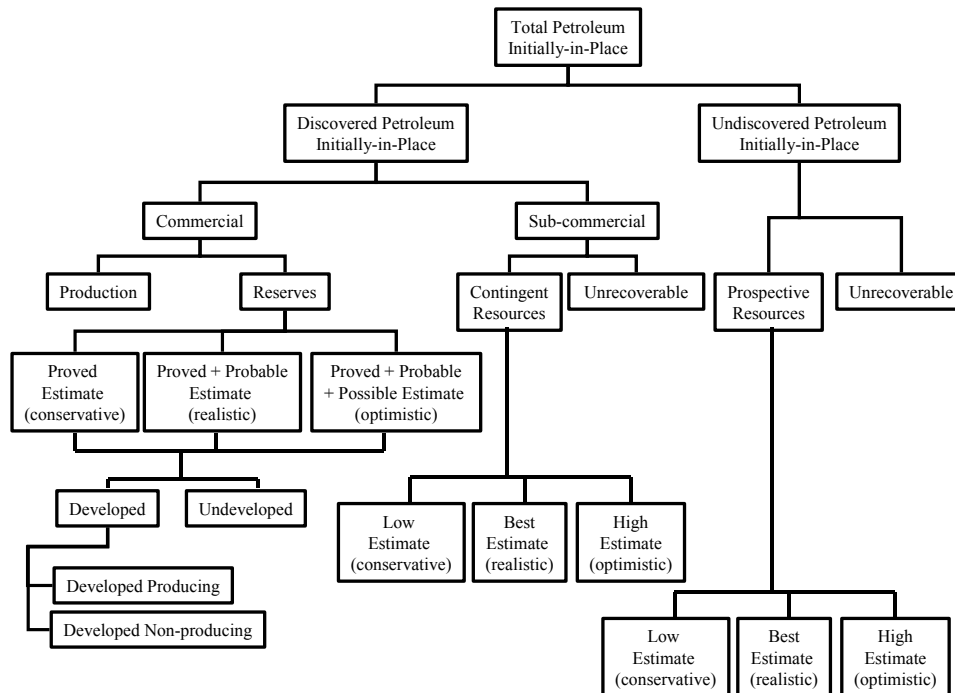


Figure 1: Canadian CIM Classification

While the reserves definitions are very similar to those of the SPE, the following issues are noted:

- For proved reserves, the CIM definitions use the quantitative term “high degree of certainty to be recoverable” versus the SPE term “reasonable certainty” (although the SPE defines reasonable certainty as “expressing a high degree of confidence that the quantities will be recovered”).
- The CIM defines Probable reserves are “those additional reserves that are less certain to be recovered than proved reserves”. Some users interpret that this implies that no probable reserves can be estimated without associated proved reserves. This may be contradicted with separate CIM guidance that “in the

absence of production or formation testing, probable and/or possible reserves may be assigned to an accumulation based on well logs and/or cores that support an analogy to other reservoirs in the area” that have produced or been tested. *(There is still debate on this issue)*

- The CIM definitions state that “the qualitative certainty levels are applicable to both individual Reserve Entities and to Reported Reserves being the sum of entity level estimates used in disclosures. While defining the same probability targets (P90, P50, P10) as the SPE, the CIM apply these at the reporting level (country or corporation) while the SPE applies them at the entity level (field, property or project). In large portfolios the central limit theorem would allow lower confidence targets at the entity level. *(although COGEH still requires a “high degree of certainty” at the entity level)*. Both SPE and CIM guidance prohibits fully probabilistic aggregation beyond the field/project level. However, since the CIM claims that even deterministic estimates have an inferred confidence level, the same portfolio effect may be reflected in their deterministic estimates. While acknowledging the use of fully probabilistic analyses, the CIM expects that most Canadian assessments will use deterministic methods.
- SPE guidelines are designed to incorporate both conventional and unconventional reserves, but do not specifically list bitumen as a hydrocarbon type nor do they address in situ versus mining extraction methods. Although NI 51-101 does specifically include bitumen (including mined bitumen) as reserves, the CIM definitions do not address the issue and COGEH guidelines do not include bitumen or synthetic oil as product types.
- Similar to the SPE approach, under the CIM guidelines undeveloped recoverable volumes must have a sufficient return on investment to justify the associated capital expenditure in order to be classified as reserves as opposed to Contingent Resources. The CIM definitions further state that reserves may be assigned only in instances where production or development of these reserves is not prohibited by government regulations (e.g. where environmental conditions can not be satisfied).
- The CIM reserves definitions state that, “the fiscal conditions under which reserve estimates are prepared should generally be those which are considered to be a reasonable outlook on the future. Security regulators or other agencies may require that constant or other prices and costs be used in the determination of reserves and value. In such circumstances, the estimated reserve quantities must be recoverable under those conditions and should also be recoverable under fiscal conditions considered to be a reasonable outlook on the future. In any event, the fiscal assumptions used in the preparation of reserves estimates must be disclosed”. As opposed to the SPE definitions, the same fiscal conditions are assumed for proven and unproven reserves.

The following chart compares in more detail SPE /WPC reserves and resource definitions (including 2001 clarifications) to the Canadian “CIM Definitions”.

**Comparison of Reserves Definitions
Reserves Definitions/Proved Criteria**

	SPE/WPC (1997)	Canadian CIM (2002)
Intended purpose	General application – not country specific	General application and securities reporting in Canada
Qualitative description of certainty- proved	Reasonable certainty to be commercially recoverable	High degree of certainty to be recoverable [target for Entity]
Qualitative description of certainty- probable	Not proved, but more likely than not to be recoverable	Additional reserves less certain to be recovered than proved. Equally likely that remaining reserves will be higher or lower than 2P [target for Entity]
Qualitative description of certainty- possible	Less likely to be recovered than probable	Additional to 2P. Unlikely that the actual recovery will exceed the 3P estimate [target for Entity]
Quantification of probabilities associated with estimates.	Proved \geq P90 2P \geq P50 3P \geq P10 (target at field/property level)	Proved \geq P90 2P \geq P50 3P \geq P10 (target for reported reserves)
Proved reserves relative to lowest known hydrocarbon (LKH)	No proved reserves below LKH as defined by well logs, core analysis or formation testing.	No proved reserves below LKH as defined by well logs, core analysis or formation testing.
Proved reserve extensions on undrilled acreage	Directly offsetting DSU's and/or where reasonably certain of continuity and commercial recovery.	Generally limited to directly offsetting spacing units (DSU's) with a high degree of geologic continuity.
Proved reserves – requirements for testing	Generally require actual production or a conclusive flowing well test. In certain cases, proved reserves can be based on logs and/or cores and is analogous to producing or tested reservoirs.	Confirmation of commercial productivity of an accumulation by production or formation testing is required for classification of reserves as proved.
Classification of enhanced recovery mechanism as proved	Successful pilot or existing project in subject or analogous reservoir.	Successful pilot or existing project in subject or analogous reservoir. Commitment demonstrated by project funding, regulatory approvals.

**Comparison of Reserves Definitions
Development Status**

Development and production status categories	Developed producing and non-producing. Undeveloped.	Developed producing and non-producing. Undeveloped. Development status can also be applied to probable and possible.
Developed	Reserves expected to be recovered from existing wells including reserves behind pipe. Improved recovery reserves require that necessary equipment has been installed or when costs to do so are relatively minor.	Reserves that are expected to be recovered from existing wells and installed facilities or if facilities have not been installed, that would involve a relatively low expenditure.
Developed - Producing	Reserves expected to be recovered from completion intervals which are open and producing at the time of the estimate. Improved recovery reserves are considered developed producing only after the improved recovery project is operational.	Reserves expected to be recovered from completion intervals open at the time of the estimate. May be currently producing or if shut-in, must have been previously on production and the date of resumption of production must be known with certainty,
Developed – Non-Producing	Includes shut-in (open but not producing, waiting on market/pipeline connections, or mechanical problems) and behind pipe (requires additional completion or future recompletion) reserves	Reserves that either have not been on production or have previously been on production but are shut-in and the date of resumption of production is unknown.
Undeveloped	Reserves to be recovered from additional drilling, deepening existing wells to a different reservoir or where a relatively large expenditure is required to complete an existing well or install production or transportation facilities.	Reserves expected to be recovered from known accumulations where a significant expenditure (when compared to the cost of drilling a well) is required to render them capable of production. <i>(NI 51-101 requires reasons that a property will not be developed within 2 years)</i>
Allocation in Multi-well Pools	Not Defined	If appropriate, allocate total pool reserves between developed (producing and non-producing) and undeveloped categories based on recoverable estimates from specific wells, facilities and completion intervals in the pool.

**Comparison of Reserves Definitions
Unproved Reserves**

Unproved Reserves	Technical, contractual, economic, or regulatory uncertainties preclude reserves being classified as proved. Unproved reserves may be estimated assuming future economic conditions (and technological development) different from those prevailing at the time of the estimate.	In the absence of production or formation testing, probable and/or possible reserves may be assigned on the basis of well log and/or core analysis which indicates that the zone is hydrocarbon bearing and is analogous to productive reservoirs in the immediate area.
Probable Reserves	Includes: 1) step-out areas from proved 2) formations that appear productive on logs but lack core, definitive tests, or productive analogs 3) incremental reserves attributable to infill drilling 4) reserves attributable to improved recovery methods but lack pilot 5) adjacent fault blocks up-dip to proved 6) reserves attributable to future workover treatments or other procedures without successful analogs 7) incremental reserves in proved reservoirs through alternative interpretations.	Probable reserves may be assigned when a planned enhanced recovery project does not meet proved requirements but the project can be shown to be practically and technically reasonable, commercial success has been demonstrated in reservoirs with analogous rock and fluid properties and it is reasonably certain that the project will be implemented. <i>(COGEH does not detail requirements for assigning Probable to primary recovery projects)</i>
Possible Reserves	Includes: 1) areas beyond probable potentially productive based on geological interpretations 2) formations that appear petroleum bearing in cores and logs but may not be commercially productive on tests 3) reserves attributable to infill drilling that are subject to technical uncertainty 4) improved recovery reserves where no pilot is operational and reservoir characteristics may not support commercial application 5) adjacent fault blocks down-dip to proved areas.	Possible reserves may be assigned when a planned enhanced recovery project does not meet proved or probable requirements but the project can be shown to be practically and technically reasonable, commercial success has been demonstrated in reservoirs with analogous rock and fluid properties but there is some doubt of success in the subject reservoir, and it is reasonably certain that the project will be implemented. <i>(COGEH does not detail requirements for assigning Possible to primary recovery projects)</i>

**Comparison of Reserves Definitions
Deterministic vs Probabilistic Methods**

<p>Deterministic vs Probabilistic Methods</p>	<p>Reserve estimates may be prepared using either deterministic or probabilistic methods. Reserve numbers are generally defined within a range, not as one fixed quantity. The range may be described qualitatively by deterministic methods or quantitatively by probabilistic methods. (the probabilistic limits (e.g. Proved \geq P90) can only be specifically applied when the probabilistic method is applied)</p>	<p>Reserve estimates may be prepared using either deterministic or probabilistic methods; the methods are not distinct and separate. A deterministic estimate is a single value within a range of outcomes that could be derived from probabilistic analysis. There should be no material difference between Reported reserves prepared using deterministic and probabilistic methods. It is required that the guidelines (e.g. LKH) be met regardless of the analysis method used.</p>
<p>Deterministic Method</p>	<p>Deterministic estimates do not address uncertainties in terms of probabilities; they require that volumes be described in terms of discrete estimates using defined criteria (e.g. LKH) including qualitative certainty.</p>	<p>The discrete value for each parameter is selected based on the estimator's determination of the value that is most appropriate for the corresponding reserves category. <i>(all deterministic estimates have an inferred probability)</i></p>
<p>Probabilistic Method</p>	<p>If probabilistic methods are used the defined quantitative limits (e.g. Proved \geq P90) apply at the entity level <i>(before aggregation)</i>.</p>	<p>If probabilistic methods are used the defined quantitative limits (e.g. Proved \geq P90) apply at the Reporting Level <i>(after aggregation)</i>.</p>
<p>Application of probability criteria and aggregation.</p>	<p>Numerical probabilities are only applied in probabilistic method and probability limits apply at the entity level. Probabilistic aggregation allowed to the field level only, then arithmetic summation to reporting level. Dependencies between entities and their distributions must be modeled in probabilistic aggregation.</p>	<p>Since probability criteria target the aggregate reporting level, estimates of reserves and future net revenue for individual properties may not reflect the same confidence level as estimates for the aggregate. Fully probabilistic aggregation may not be applied beyond the field level. Dependencies between entities and their distributions must be modeled in probabilistic aggregation. <i>(each entity level proved estimate must still have a "high degree of certainty" although specific confidence levels are not quantified)</i></p>

**Comparison of Reserves Definitions
Special Issues**

Treatment of Unconventional Hydrocarbons	Classification applies to all petroleum deposits.	Not defined in CIM (<i>NI 51-101 includes all conventional and unconventional hydrocarbons including mined bitumen</i>)
Fuel Gas Reserves Status	Issuers have the option to include gas volumes consumed in operations in production and reserves if an appropriate expense is allocated.	Fuel gas consumed before the first point of sale is treated as production shrinkage and is not included in reserves.
Natural Gas Injection	To include injection gas as reserves, the volumes would have to meet the normal criteria (economic when available for production, existence of a firm market, available pipeline or other export option, part of established development plan).	Not Defined
Gas Sales Volumes	Reported gas reserves reflect the condition of the gas at the point of sale. If sold as wet gas, associate liquids reserves are not reported separately. If sold with a non-hydrocarbon gas content, the full volume as sold is included in reserves. The price received will reflect quality.	Oil, gas, and by-product reserves must be reported on a marketable basis. This refers to the volume of reserves that changes ownership at the custody transfer point, The composition or quality may vary considerably; however the price received reflects the quality of the product that is being sold.
Infill Drilling	Reserves assigned to infill drilling with low uncertainty are Probable, infill areas with technical uncertainty are Possible. (<i>acceleration issue not addressed</i>)	The estimator must quantify from well interference effects that portion which represents accelerated production and that portion which represents incremental recovery. (<i>Treated as improved recovery for annual reconciliations in NI 51-101</i>).
Compression	Not Defined	Not addressed in CIM definitions. (<i>NI 51-101 guidance: Installation of field facilities such as compression, line lopping, etc are treated as a form of improved recovery for annual reconciliations.</i>)

**Comparison of Reserves Definitions
Special Issues**

Net Profits Interests	Not defined	A net profits interest is an interest in production income only and not in production or reserves.
Production-Sharing Contracts	Under a PSC the host government retains ownership, however the contractor receives a stipulated share of production remaining after cost recovery. Reported reserves are based on the economic interest held subject to the specific terms and time frame of the agreement. Being tied to economic interest, reserves must be re-calculated annually based on product price and operating costs and may vary considerably. Under SPE definitions, an average price over the term of the contact may be used to define reserves.	Not Addressed in COGEH Vol 1 [Currently being addressed by a COGEH sub-committee]
Contract Extensions	Where agreements allow extension through negotiation of renewed contract terms, exercise of options to extend or other means additional reserves (of various categories) or contingent resources may be assigned depending on the level of certainty and commercial viability associated with the contract extension.	Not Addressed in COGEH Vol. 1 <i>(For securities disclosure, it would depend on the likelihood of contract extension. CSA would require a discussion of the issue so that an investor is aware of the pros and cons.)</i>
Product categorization	Not Defined	Reserves must be categorized according to their physical properties and their association with other products as the uses and values of the commodities will differ. See Note 2.

**Comparison of Reserves Definitions
Economics/Commerciality**

Commerciality	In order to assign reserves of any category, a project needs to be defined in terms of a commercially viable development plan and there should be evidence of firm intent to proceed.	Reserves may only be assigned to those volumes that are economically recoverable and where development is not prohibited by government regulation.
Commitment	If the degree of commitment is not such that an accumulation is expected to be developed and placed on production within a reasonable time frame (e.g. 5 years), the estimated recoverable volumes should be classified as contingent resources (not reserves).	In general, quantities must not be classified as reserves unless there is a reasonable expectation that the accumulation will be developed and placed on production within a reasonable timeframe. <i>(No time defined, but it depends on the area. A full discussion of the issue is required in securities disclosures).</i>
Economics	The underlying economic evaluation based on perception (best estimate) of future costs and prices together with best-estimate production profile expected to equate to a proved plus probable scenario. To limit downside exposure the “low case” scenario should be at least “break-even“, which is consistent with the requirement that proved reserves are viable under “current economic conditions”.	<p>The fiscal conditions under which reserve estimates are prepared should generally be a reasonable outlook on the future.</p> <p>Reserves are those volumes recovered before a project reaches its economic limit, that is, the production rate that provides revenues (net of royalties) equal to operating costs.</p>
Development Plan Approvals	While some companies choose not to assign any proved reserves until the development plan has received all relevant formal approvals, SPE definitions require only a reasonable expectation that the necessary facilities to process and transport those reserves will be installed.	Not Defined in COGEH <i>(Security regulators would apply the standard of a reasonable expectation of approval.)</i>

**Comparison of Reserves Definitions
Economics/Disclosure Guidelines**

Prices & Costs for defining reserves "economic limit".	<p>Proved: Existing economic conditions (year-end or appropriate period* average) (*SPE recommends prior 12 month period).</p> <p>Unproved: reserves may be based on forecast prices and costs.</p>	<p>"The fiscal conditions under which reserve estimates are prepared should generally be those which are considered to be a reasonable outlook on the future". <i>COGEH uses same forecast for proved & unproved. (NI 51-101 requires 2 disclosures: 1) proved at year-end costs & prices conditions 2) proved and probable (and 2P) using forecast case (if disclosed possible and 3P use forecast case)</i></p>
Abandonment Costs	Economic limit calculated including abandonment and reclamation costs.	Economic limit calculated including abandonment and reclamation costs.
Net Present Value of Future Net Revenue (FNR).	Not defined	<i>COGEH provides instruction on calculating cash flows and computing net present value but defers to the NI 51-101 to define required discount rates.</i>
Audit Requirements	No requirement for use of external evaluators. SPE "Standards Pertaining to the Estimating and Auditing of Oil and Gas Information" recommends standards for training, experience levels, and sets independence criteria for evaluators and auditors whether internal or external.	<p>COGEH recommends standards for training, experience levels, and sets independence criteria for evaluators and auditors whether internal or external. COGEH further describes levels of evaluations, audits and reviews.</p> <p><i>(NI 51-101 requires Canadian issuers to submit 75% of their properties based on 2P value for evaluation by external consultants)</i></p>
Gross vs Net Reserves	See Note 1	See Note 1

Note 1:

Gross vs Net from CIM

Gross: In relation to the reporting issuer's interest in production or reserves, company gross reserves are the issuer's working interest share before the deduction of royalties and without including any royalty interests of the reporting issuer.

Net: In relation to the reporting issuer's interest in production or reserves, company gross reserves are the issuer's working interest share after deduction of royalty obligations plus any royalty interests of the reporting issuer.

SPE Regards Royalty

Within the U.S., royalty volumes are strictly omitted from reported reserves (*that is, they are reported on a net basis*). In some cases outside the U.S., where royalty is paid in cash and the cash flow from the royalty is reflected in the company's accounts, the corresponding royalty may be included in reserves.

Note 2: Product Categorization (as used in COGEH)

Under COGEH guidelines, reserves must be categorized according to their physical properties and their association with other products as the uses and values of the commodities will differ. The recommended categories are:

- Oil
- a) Light, Medium
- b) Heavy (less than 25⁰ API)

- By-Products
- a) Ethane
- b) Butanes
- c) Propanes
- d) Pentanes Plus (Condensate)

- Natural Gas
- a) Associated
 - Gas Cap
 - Solution Gas
- b) Non-Associated

- Non-Hydrocarbons
- a) Sulphur
- b) Carbon Dioxide

NI 51-101 defines the following Production Groups and Product Types:

Conventional Production Groups

Light & Medium Oil

Heavy Oil

Associated and Non-Associated Gas

Non-Conventional Production Groups

In Situ Bitumen Recovery

Oil Sands Mining Projects

Coal Bed Methane

Product Types

Light and Medium Oil, Gas, Natural Gas Liquids and Sulphur

Heavy Oil , Solution Gas, Natural gas Liquids and Sulphur

Associated and Non-Associated Gas, Natural Gas Liquids, Sulphur and other by-products

Bitumen, Synthetic Oil

Bitumen, Synthetic Oil

Natural Gas

The SPE guidance does not address product categorization

Russian Ministry of Natural Resources (RF-2005)

Russian reserve guidelines are in a state of transition from the system utilized within Soviet state companies to a new system more closely aligned with the needs of private industry.).

Figure 1 illustrated the nomenclature in three vintages of Russian classifications and their approximate correlation:

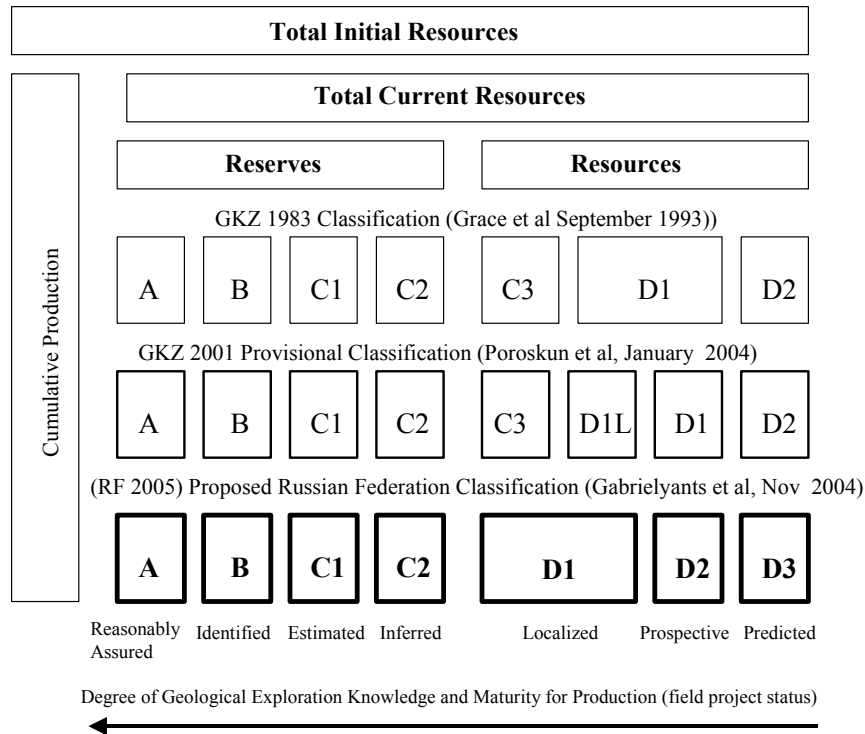


Figure 1: Russian Reserves Classifications

- GKZ 1983 being that applied within the former Soviet Union (FSU) and as described by Grace et al September 1993 article in the SPE Journal of Petroleum Technology “Comparative Reserves Definitions: U.S.A., Europe, and the Former Soviet Union”.
- GKZ 2001 being the “Provisional Classification of Oil and Gas Reserves” as adopted in 2001 and utilized by the State Committee for Reserves of the Russian Federation (GKZ) to certify discoveries and approve development plans within the Russian Federation as described in Poroskun et al “Reserves/Resource Classification Schemes Used in Russia and Western Countries: A Review and Comparison”, Journal of Petroleum Geology, Vol. 27 (1), January 2004.
- RF 2005 being the “Proposed New Russian Federation Classification” as described in a presentation made by G.A. Gabrielyants to the UNECE Ad Hoc Groups of Experts on Supply of Fossil Fuels in November 2004 plus a draft classification submitted by G. Malukhin to the SPE subcommittee on February 24, 2005.

GKZ 1983 provides background to the reserves and resource assessment approach historically applied in Russia. GKZ 2001 is a revised version and is that currently applied in the Russian Federation. RF 2005 is in advanced draft stages and we are advised that it will be implemented in the near future; thus it is this classification that we have utilized in this comparison to the current SPE reserves and resource classification.

RF 2005 Classification

RF 2005 establishes uniform principles for classification of reserves/resources of oil and natural combustible gas in the Russian Federation. Based on geological exploration knowledge and degree of maturity for economic development, oil and gas quantities found in the subsoil are divided into geological reserves (discovered) and geological resources (undiscovered). Geological Reserves are used in development planning including processing and transportation to forecast production and assess socio/economic impact. Geological Resources are estimated separately for oil and gas by province, region, districts, zones, areas and individual traps; such information is used in planning future exploration activities.

(Note that the Russian term “Geological Reserves (Resources)” refers to in-place volumes. “Recoverable Reserves” would match Western usage of the term “reserves”).

A subject of reserves calculation is normally an accumulation of oil and/or gas (or a part of it) for which commercial hydrocarbon content has been proved (thus the “reserves entity level” is a reservoir, field, or project).

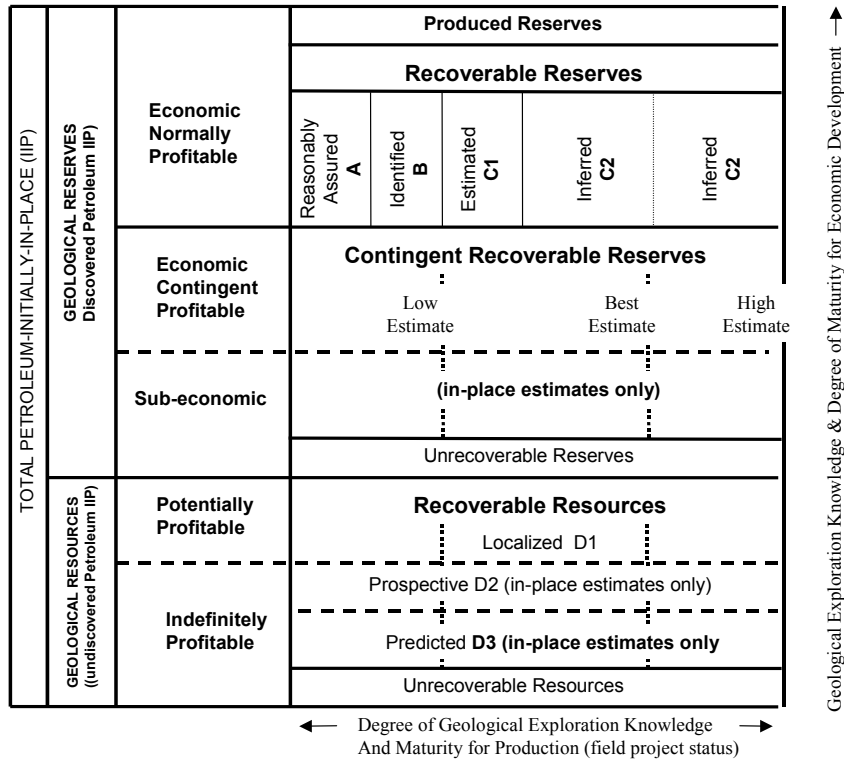


Figure 2: Proposed New Russian Federation Classification (RF 2005)

Referring to Figure 2, reserves are subdivided according two main aspects: commercial and geologic uncertainty/project status:

Commercial Producibility and Economic Efficiency – based on level of commercial producibility of a deposit and future net discounted cash flow (NPV) based on predicted performance indicators and fixed discount rates. Resources are grouped by Expected Monetary Value (EMV). Reserves are separated into three groups:

- **Economic Normally Profitable** are reserves which according to technical/economic calculations have been assessed, on a given date, to be commercially recoverable if brought to production under competitive market conditions, with use of equipment and technology of recovery and treatment ensuring that the requirements for rational use of the subsoil and environmental protection are observed.
- **Economic Contingent Profitable** are reserves not considered, on a given date, to ensure viability under competitive market conditions due to low performance characteristics but the development of which may be feasible through changing prices, new markets, or new technologies.
- **Sub-economic** are reserves the development of which, on a given date, is not considered feasible for economic, technical, or technological reasons. This includes not only non-commercial accumulations also those shut-in within the limits of water protection zones, populated areas, national parks, historical/cultural monuments, and deposits located far from transportation lines and producing infrastructure.

In economic deposits, on the basis of technological and technical/economic assessments, **recoverable reserves** are calculated and booked. Recoverable reserve is that portion of geological reserves which, on a date of calculation, proves commercially efficient for recovery under competitive market conditions with up-to-date equipment and technologies rationally applied and subsoil and environmental protection requirements are observed.

In sub-economic deposits geologic reserves (*in-place*) are calculated and booked but no estimates of recoverable reserves are made.

Petroleum Resources are subdivided into Potentially Profitable (positive EMV) and Indefinitely Profitable (insufficient information to compute EMV). Recoverable resources are only calculated for Potentially Profitable.

Degree of Geological Knowledge (geological structure and petroleum content) **and Maturity For Production** (field project status = degree to which a reservoir has been developed and prepared to become producing) is used to subdivide reserves into 4 categories:

- **Category A** (reasonable assured) includes actually producing reserves of a petroleum accumulation (or its portion) drilled on the basis of exploitation grid of wells in compliance with the appropriate production design document. All geology, rock and fluid characteristics (including fluid contacts) confirmed by drilling, sampling and well logging sufficient for building multidimensional simulation models. Profitable

exploitation is determined by an appropriate technological design document and confirmed by actual recovery operations. Category A includes:

- reserves in commercially developed reservoirs being drained by production wells with the use of established recovery technologies
 - reserves in commercially developed reservoirs which for various reasons are not being drained at the date of calculation for which bringing to production is economically justified and will not require any essential additional expenditure
 - incremental reserves which can be profitably recovered from geological reserves (*in-place*) through the application of established improved recovery methods
 - incremental reserves which can be profitably recovered from geological reserves (*in-place*) through infill drilling within the primary grid of production wells
- **Category B** (identified) includes reserves of a petroleum accumulation which have been explored and matured for development, studied by seismic and drilled by wildcat, appraisal, and production wells from which commercial flows were obtained. All geology, rock and fluid characteristics are known reasonably well and sufficient for building reliable simulation models. Commercial producibility of a reservoir has been confirmed by pilot production data, geophysical well logging and justified by a technological development design document. Category B includes reserves of the reservoir portions in drainage zones of wells from which commercial flows have been obtained by testing and/or trial production.
 - **Category C1** (estimated) includes reserves of a petroleum accumulation studied by seismic and adjacent to reserves of A and B categories provided that geological and geophysical information indicates with reasonable certainty that the objective formation is laterally continuous and there is a high degree of probability to commercial producibility from the objective formation in this portion of the reservoir. Production performance and profitability of development and production are determined/inferred by analogy with the explored portions of the reservoir. Category C1 includes reserves
 - in undrilled portion of the reservoir immediately adjacent to A and B categories at the distance equal to possible drainage zone (*one "spacing unit"*).
 - in portions of the reservoir in an area of unsampled wells in case producibility has been proved by sampling or production from other wells (*adjacent analogs*).
 - **Category (C2)** (inferred) includes reserves of undrilled portions of the reservoir beyond one drainage zone offset to wells where A and B reserves are established. Geological and reservoir performance parameters are assumed by analogy with the explored part of the same reservoir or other accumulations within the same region. The information available is sufficient for generating preliminary geological simulation models and reserve calculation. C2 includes reserves:

- in reservoir portions between its proved outlines and boundaries of blocks with higher category reserves if there is enough geological and geophysical evidence to confirm continuity of the objective formation.
- in formations with unproved producing capability but explored with well logs in intervening wells that indicate productivity
- in undrilled tectonic blocks of productive reservoirs provided geological information is indicative of similar potentially productive formations.

Reserves estimated with categories A, B, and C1 should not be aggregated with those estimated as C2.

- **Category (D1)** (localized) includes petroleum resources in potentially producible formations confined to traps matured for drilling. Outlines, size and structure have been determined from geological and geophysical studies. Formation thickness, hydrocarbon pore volume of the reservoir, composition of oil and gas are assumed by analogy with explored deposits.
- **Category D2** (prospective) includes petroleum resources of lithological/stratigraphic complexes and horizons with proved commercial hydrocarbon content confined to large regional structures (*proven petroleum system*). Quantitative estimation of prospective resources is based on results of regional studies and analogies to discovered accumulations in the region.
- **Category D3** (predicted) includes petroleum resources of lithological/stratigraphic complexes and horizons for which commercial hydrocarbon content has not yet been established (*unproven petroleum system*). Quantitative estimation of predicted resources is based on presumed reservoir parameters from regional analogies and conceptual geologic interpretations.

RF 2005 reporting requires additional subdivisions of reserves and resources by:

- **Types of Oil and Natural Gas Deposits by Phase Relationship** using the following classification for petroleum deposits (accumulations)
 - Oil - with dissolved gas to saturation (no gas cap)
 - Oil and Gas –with a gas cap not exceeding 50% on a fuel equivalent basis
 - Gas and Oil - with oil fringe less than 50% by volume of equivalent fuel
 - Gas – containing only gas (*dry gas*)
 - Gas Condensate – gas with condensate further subdivided by C_{5+b} content (from low (below 25 g/m³) to unique (over 500 g/m³) condensate
 - Oil-Gas-Condensate
- **By Size of Recoverable Reserves** subdivided according to:
 - Unique – over 300 Mt (2.1 billion bbls) oil or 500 BCM gas (17.5 tcf)
 - Large – 30 (210 mmb) to 300Mt oil, 30 (1.1 tcf) to 500 BCM gas
 - Medium – 3 (21 mmb) to 30 Mt oil, 3 (105 bcf) to 30 BCM gas
 - Small – 1 (7 mmb) to 3 Mt oil, 1 (35 bcf) to 3 BCM gas
 - Very Small – below 1 MT (7 mmb) oil, less than 1 BCM (35 bcf) gas
- **By Complexity of Geologic Structure** subdivided according to:

- Simple – one phase accumulations associated with weakly deformed structures; productive formation continuous (thickness, porosity, permeability) areally and vertically
- Complicated – one and two phase accumulations; productive formation discontinuous (thickness, porosity, permeability) areally and vertically with intervening seals (or tectonic dislocations)
- Very complicated - one and two phase accumulations; both productive formation discontinuous (thickness, porosity, permeability) areally and vertically and intervening seals (or tectonic dislocations), also includes heavy oils

RF 2005 specifies that calculation of reserves and estimation of resources may be carried out by deterministic or probabilistic methods. If deterministic methods are used, it is suggested to evaluate an associated error based on the accuracy of determining calculation parameters. When probabilistic methods are used, the following estimates of reserves/resources may be derived:

- a low estimate (P90) with 0.9 probability of being confirmed
- a best (or basic) estimate (P50) with a 0.5 probability of being confirmed
- a high estimate (P10) with a 0.1 probability of being confirmed

(At this time, the probabilistic method is not routinely applied in Russia, and if applied is most often confined to resource estimates. However, it is expected its use will increase throughout all phases of exploration and exploitation.)

The following url accesses the slides used by Gabrielyants in his 2004 presentation to the UNECE on the new Russian Federation Classification:

http://www.unece.org/ie/se/pdfs/adclass/day2/GabrielyantsRussianFed_UNFC.pdf

Mr. Grigoriy Malukhin provided extensive support in our understanding of the Russian Federation's classification and its detailed comparison to the SPE definitions. He was assisted by a national group consisting of Y. Podturkin, M. Zykin, V. Poroskun, I Gutman and K. Kavun.

The SPE does not represent the above summary as being definitive guidance for those required to report reserves and resources under criteria set by the Russian Federation. Analysts should obtain guidelines documentation directly from the appropriate agencies.

Comparison of SPE to Russian Federation Classification Scheme (RF 2005)

Comparisons of the new Russian Federation and SPE/WPC/AAPG classifications can be best approached by first examining separation into categories based on the commercial axis” (figure 3):

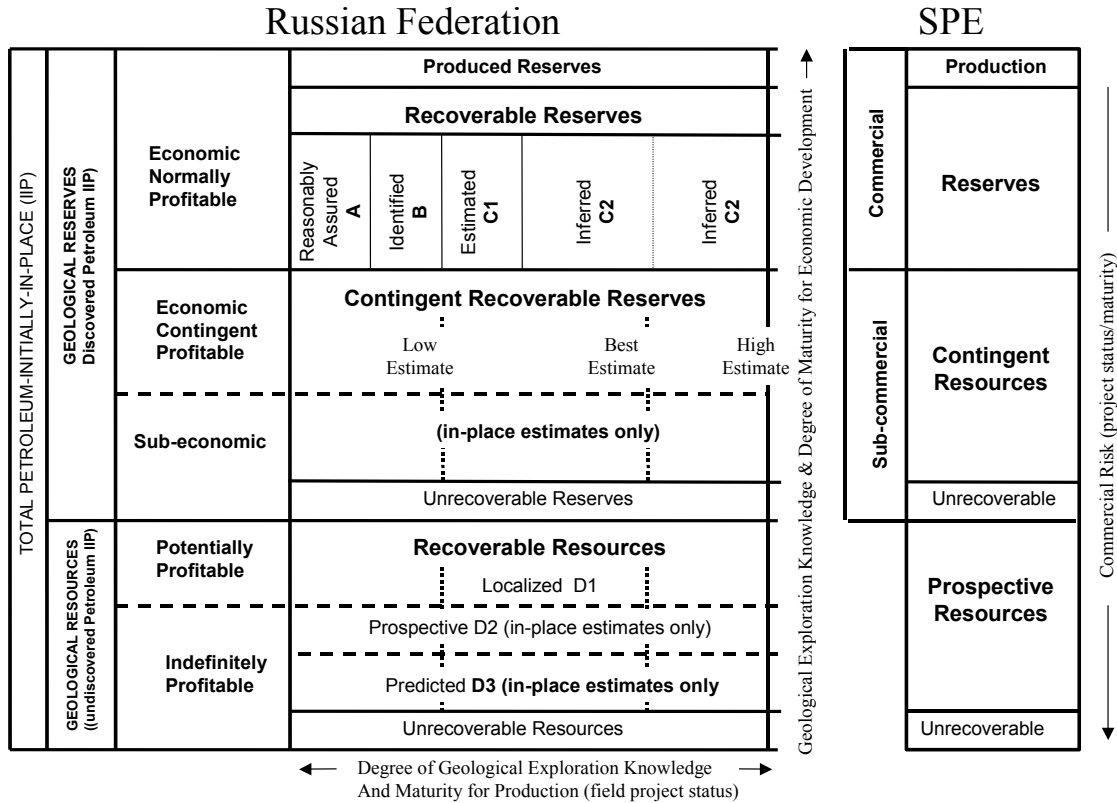


Figure 3: Comparison of New Russian Federation (RF 2005) and SPE Categories

There is overall alignment at major boundaries. The Russians split the undiscovered into 3 categories that can be roughly described as prospects (D1), leads (D2), and plays (D3). Other organizations such as the NPD apply a project maturity axis to describe a similar approach.

While the SPE classification refers to recoverable volume throughout, the Russians estimate only in-place volumes for their D3 and D2 classes and the sub-economic portion of their Contingent Recoverable Reserves. The logic is that lacking sufficient definition for computing development plan economics, it is not feasible to forecast recovery to an economic limit. In the SPE approach, analogous developments would be used to estimate recovery efficiency.

The overall intent of the Contingent Recoverable Reserves category is similar to the SPE's Contingent Resources, that is, these are discovered volumes that because of some contingency (economics and/or technology), it is not currently feasible to proceed with development. Those volumes categorized as sub-economic by RF 2005 due to access constraints such as under parks, cities, or in water protection zones (environmental) or lack of local pipelines and/or infrastructure may still have economic potential and

would not be segregated in the SPE classification. The RF 2005 proposal also includes shut-in wells in their sub-economic Contingent category; without further clarification it is not obvious why this is not classified as developed but non-producing.

Gabrielyants presentation infers that a portion of volumes classified as possible reserves under SPE guidelines may fall in the Russian Contingent category. This may refer to volumes in adjacent undrilled fault blocks and satellite features that are often included in Possible reserves.

Figure 3 also highlights some terminology differences. The Russians use the term “reserves” for all types of discovered volumes (in-place, economic, sub-economic) whereas the SPE uses the term reserves only for the remaining, commercially recoverable portions of discovered volumes. *(This may be typical of linguistic difficulties that are encountered internationally when technical terms are translated using their general meaning.)*

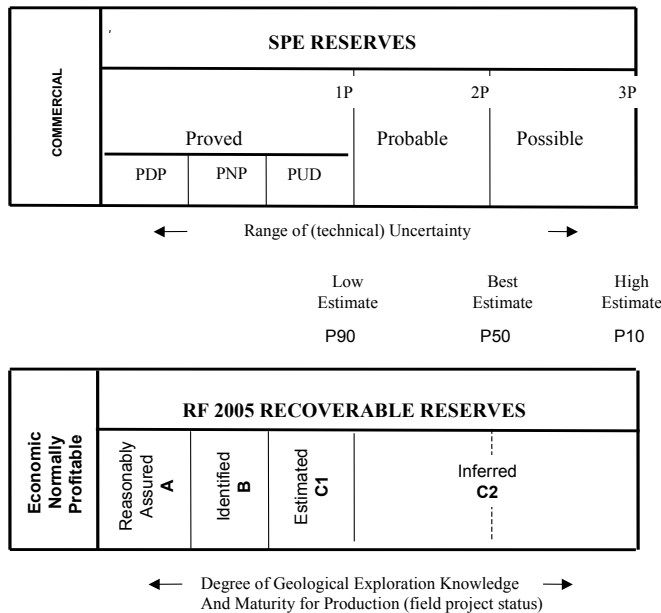


Figure 4: Comparison of New Russian Federation (RF 2005) and SPE Reserve Classes

Figure 4 shows that the Russian reserves classes A, B, and C1 grossly correlate to SPE Proved Developed Producing (PDP), Proved Developed Non-Producing (PNP) and Proved Undeveloped (PUD), respectively.

Recoverable estimates in their Category B have all the certainty of Category A but are not on production for some reason. It is not explicitly stated that the capital required to reach production status is “not significant” and there is some confusion in that category A includes “reservoirs that are temporarily shut-in and can be reactivated with minimal expenditures”. Category B definitions probably include reserves existing behind pipe waiting future re-completions.

Category C1 correlates to SPE PUD in areas one drainage unit offset to Proved Developed but does not specifically address proved reserves in deeper reservoirs or the

case where a relatively large expenditure is required to a) re-complete an existing well or b) install production or transportation facilities for primary or improved recovery projects.

Category C2 encompasses SPE probable and possible (unproven) and can only be dissected by detailed examination of the information available. Although probabilistic methods are rarely applied in Russia, this could be used as a basis for defining a 2P (best) versus 3P (high) estimate. The RF 2005 requires reporting by field/reservoir and thereafter aggregations to various levels and ultimately total Russia; current aggregation is arithmetic by category based on the deterministic method. The Russian guidelines do not address the issue of portfolio effect in probabilistic aggregations.

RF 2005 classification applies to all reserves/resources of oil and natural combustible gas. It is not clear if the classification applies to unconventional hydrocarbons (tight gas, coal bed methane, bitumen). The only reference to unconventional hydrocarbons is that heavy oils should be classified as “very complicated” accumulations.

Significant differences versus SPE guidelines include:

- RF 2005 includes incremental reserves due to application of established improved recovery methods and infill drilling in Category A (equivalent to SPE PDP) without the requirement for a successful pilot in the subject reservoir or a commitment to proceed with the incremental development.
- In historical Russian classifications, one value of recovery ratio was established in the original development plan and there was no provision to forecast a range of resulting recovery efficiencies. This is still true, although incremental reserves from forecast application of a new recovery method can be included in category C1.
- The Russian classification does not provide for using a more conservative price forecast for proved versus unproved reserves. It appears as if all reserves are evaluated using the criteria “commercially recoverable if brought to production under competitive market conditions, with use of equipment and technology of recovery and treatment ensuring that the requirements for rational use of the subsoil and environmental protection are observed”.
- When reviewing their mapping to UNFC, Category B is considered contingent or undefined under project feasibility. Under SPE guidelines both B and C1 reserves can be brought to producing status without significant capital investment and thus there is no significant feasibility contingency.

Since the Russian classification is based on geologic certainty of in-place volumes, there is a much greater emphasis on volumetric analysis in all categories whereas most Western analysts would focus on production performance-based estimates (decline, material balance) in Proved and Probable estimations for mature properties.

The referenced Gabrielyants presentation to the UNECE (http://www.unece.org/ie/se/pdfs/adclass/day2/GabrielyantsRussianFed_UNFC.pdf) includes several examples that illustrate overall alignment of SPE and RF 2005 classifications.

**Comparison of Reserves Definitions
Reserves Definitions/Proved Criteria**

	SPE/WPC (1997)	New Russian Proposed (RF 2005)
Intended purpose	General application – not country specific	Government reporting in Russia
Qualitative description of certainty- proved	Reasonable certainty to be commercially recoverable	A - reasonably assured + B- identified + C1- Estimated
Qualitative description of certainty- probable	Not proved, but more likely than not to be recoverable	Part of C2- inferred
Qualitative description of certainty- possible	Less likely to be recovered than probable	Part of C2- inferred
Quantification of probabilities associated with estimates.	Proved \Rightarrow P90 2P \Rightarrow P50 3P \Rightarrow P10 (target at field/property level)	Low Est \Rightarrow P90 Basic Est \Rightarrow P50 High Est \Rightarrow P10 (levels not clearly defined)
Proved reserves relative to lowest known hydrocarbon (LKH)	No proved reserves below LKH as defined by well logs, core analysis or formation testing.	Category A has fluid contacts delimited by drilling, sampling and well logging.
Proved reserve extensions on undrilled acreage	Directly offsetting DSU's and/or where reasonably certain of continuity and commercial recovery.	C1 - geological and geophysical information indicates reasonable certainty that the objective formation is laterally continuous. Includes undrilled portion of the reservoir immediately adjoining the reserves of A+B categories at the distance equal to possible drainage zone.
Proved reserves – requirements for testing	Generally require actual production or a conclusive flowing well test. In certain cases, proved reserves can be based on logs and/or cores and is analogous to producing or tested reservoirs.	Attributed to drainage area and offsets for wells from which commercial flows have been obtained by testing and/or trial production.
Classification of enhanced recovery mechanism as proved	Successful pilot or existing project in subject or analogous reservoir.	Included in Category A based on original development plan – no pilot required for established methods (e.g. waterfloods).

**Comparison of Reserves Definitions
Development Status**

Development and production status categories	Developed producing and non-producing. Undeveloped.	Category A - producing, category B - non-producing, category C1- undeveloped
Developed	Reserves expected to be recovered from existing wells including reserves behind pipe. Improved recovery reserves require that necessary equipment has been installed or when costs to do so are relatively minor.	Category A represents developed producing (<i>and some non-producing</i>) and includes incremental reserves from established improved recovery methods as contained in the original development plan.
Developed - Producing	Reserves expected to be recovered from completion intervals which are open and producing at the time of the estimate. Improved recovery reserves are considered developed producing only after the improved recovery project is operational.	A - includes incremental reserves from established improved recovery.
Developed – Non-Producing	Includes shut-in (open but not producing, waiting on market/pipeline connections, or mechanical problems) and behind pipe (requires additional completion or future re-completion) reserves.	B - includes reserves in drainage zones of wells from which commercial flows have been obtained.
Undeveloped	Reserves to be recovered from additional drilling, deepening existing wells to a different reservoir or where a relatively large expenditure is required to complete an existing well or install production or transportation facilities	C1- assigned undrilled portions immediately adjoining the reserves of category A+B categories at a distance equal to possible drainage zone
Allocation in Multi-well Pools	Not Defined	Not Defined

**Comparison of Reserves Definitions
Unproved Reserves**

Unproved Reserves	Technical, contractual, economic, or regulatory uncertainties preclude reserves being classified as proved. Unproved reserves may be estimated assuming future economic conditions (and technological development) different from those prevailing at the time of the estimate.	Category C2 (inferred) includes all portions between accumulation outline and blocks with higher categories, untested formations with continuity to producing wells based on seismic and untested fault blocks deemed productive when compared to productive areas
Probable Reserves	Includes: 1) step-out areas from proved 2) formations that appear productive on logs but lack core, definitive tests, or productive analogs 3) incremental reserves attributable to infill drilling 4) reserves attributable to improved recovery methods but lack pilot 5) adjacent fault blocks up-dip to proved 6) reserves attributable to future workover treatments or other procedures without successful analogs 7) incremental reserves in proved reservoirs through alternative interpretations.	Not defined – that portion of C2 with less uncertainty.
Possible Reserves	Includes: 1) areas beyond probable potentially productive based on geological interpretations 2) formations that appear petroleum bearing in cores and logs but may not be commercially productive on tests 3) reserves attributable to infill drilling that are subject to technical uncertainty 4) improved recovery reserves where no pilot is operational and reservoir characteristics may not support commercial application 5) adjacent fault blocks down-dip to proved areas.	Not defined- that portion of C2 with more uncertainty.

**Comparison of Reserves Definitions
Deterministic vs Probabilistic Methods**

<p>Deterministic vs Probabilistic Methods</p>	<p>Reserve estimates may be prepared using either deterministic or probabilistic methods. Reserve numbers are generally defined within a range, not as one fixed quantity. The range may be described qualitatively by deterministic methods or quantitatively by probabilistic methods. (the probabilistic limits (e.g. Proved \geq P90) can only be specifically applied when the probabilistic method is applied)</p>	<p>Calculations/estimations may use either deterministic or probabilistic methods. (probabilistic methods are currently rarely applied).</p>
<p>Deterministic Method</p>	<p>Deterministic estimates do not address uncertainties in terms of probabilities; they require that volumes be described in terms of discrete estimates using defined criteria (e.g. LKH) including qualitative certainty.</p>	<p>If deterministic methods are used it is suggested to evaluate an error based on accuracy of determining calculation parameters.</p>
<p>Probabilistic Method</p>	<p>If probabilistic methods are used the defined quantitative limits (e.g. Proved \geq P90) apply at the entity level (<i>before aggregation</i>).</p>	<p>For probabilistic methods use targets (see above). (Level not defined)</p>
<p>Application of probability criteria and aggregation.</p>	<p>Numerical probabilities are only applied in probabilistic method and probability limits apply at the entity level. Probabilistic aggregation allowed to the field level only, then arithmetic summation to reporting level. Dependencies between entities and their distributions must be modeled in probabilistic aggregation.</p>	<p>Aggregation not specifically addressed. However, calculation and booking of reserves of oil and gas having commercial significance shall be implemented separately for each individual accumulation and the deposit as a whole in terms of quantities in-place, with no account taken of possible losses at the production stage.</p>

**Comparison of Reserves Definitions
Special Issues**

Treatment of Unconventional Hydrocarbons	Classification applies to all petroleum deposits.	Not clear if reserve definitions include unconventional deposits beyond heavy oil.
Fuel Gas Reserves Status	Issuers have the option to include gas volumes consumed in operations in production and reserves if an appropriate expense is allocated.	Classification includes all production and losses for mass balance. Not clear if fuel gas is included in recoverable reserves
Natural Gas Injection	To include injection gas as reserves, the volumes would have to meet the normal criteria (economic when available for production, existence of a firm market, available pipeline or other export option, part of established development plan).	Not Defined
Gas Sales Volumes	Reported gas reserves reflect the condition of the gas at the point of sale. If sold as wet gas, associate liquids reserves are not reported separately. If sold with a non-hydrocarbon gas content, the full volume as sold is included in reserves. The price received will reflect quality.	Natural gas and helium reserves are calculated in terms of volumes adjusted to standard conditions (pressure 0.1 uPa, temperature 20° C).
Infill Drilling	Reserves assigned to infill drilling with low uncertainty are Probable, infill areas with technical uncertainty are possible (<i>acceleration issue not addressed</i>)	Incremental reserves associated with infill drilling are included in Category A.
Compression	Not Defined	Not Defined

**Comparison of Reserves Definitions
Special Issues**

Net Profits Interests	Not defined	Not defined
Production-Sharing Contracts	Under a PSC the host government retains ownership, however the contractor receives a stipulated share of production remaining after cost recovery. Reported reserves are based on the economic interest held subject to the specific terms and time frame of the agreement. Being tied to economic interest, reserves must be re-calculated annually based on product price and operating costs and may vary considerably. Under SPE definitions, an average price over the term of the contact may be used to define reserves.	Not defined
Contract Extensions	Where agreements allow extension through negotiation of renewed contract terms, exercise of options to extend or other means additional reserves (of various categories) or contingent resources may be assigned depending the level of certainty and commercial viability associated with the contract extension.	Not defined
Product categorization	NA	See Note 2.

**Comparison of Reserves Definitions
Economics/Commerciality**

Commerciality	In order to assign reserves of any category, a project needs to be defined in terms of a commercially viable development plan and there should be evidence of firm intent to proceed.	Recoverable reserves must prove commercially efficient for recovery under competitive market conditions, with up to date equipment and technologies rationally applied.
Commitment	If the degree of commitment is not such that an accumulation is expected to be developed and placed on production within a reasonable time frame (e.g. 5 years), the estimated recoverable volumes should be classified as contingent resources (not reserves).	Not defined
Economics	The underlying economic evaluation based on perception (best estimate) of future costs and prices together with best-estimate production profile expected to equate to a proved plus probable scenario. To limit downside exposure the "low case" scenario should be at least "break-even" which is consistent with the requirement that proved reserves are viable under "current economic conditions".	Economic Normally Profitable are reserves assessed on a given date according to be commercially recoverable if brought to production under competitive market conditions with use of equipment and technology of recovery and treatment ensuring that the requirements for rational use of subsoil and environmental protection are observed.
Development Plan Approvals	While some companies choose not to assign any proved reserves until the development plan has received all relevant formal approvals, SPE definitions require only a reasonable expectation that the necessary facilities to process and transport those reserves will be installed.	Not defined

**Comparison of Reserves Definitions
Economics/Disclosure Guidelines**

Prices & Costs for defining reserves "economic limit".	<p>Proved: Existing economic conditions (year-end or appropriate period* average) (*SPE recommends prior 12 month period).</p> <p>Unproved: reserves may be based on forecast prices and costs.</p>	Pricing not specifically addressed but reserves are as assessed on a given date to be commercial under competitive market conditions. Appear to use same assumptions for all reserves categories
Abandonment Costs	Economic limit calculated including abandonment and reclamation costs.	Not defined
Net Present Value of Future Net Revenue (FNR).	Not defined	Future Net Discounted cash flow (NPV) based upon predicted performance indicators and fixed discount rates.
Audit Requirements	No requirement for use of external evaluators. SPE "Standards Pertaining to the Estimating and Auditing of Oil and Gas Information" recommends standards for training, experience levels, and sets independence criteria for evaluators and auditors whether internal or external.	<u>To be addressed in final version</u>
Gross vs Net Reserves	See Note 1	See Note 1

Note 1:

Gross vs Net: Not addressed in Russian classification

SPE Regards Royalty

Within the U.S., royalty volumes are strictly omitted from reported reserves (*that is, they are reported on a net basis*). In some cases outside the U.S., where royalty is paid in cash and the cash flow from the royalty is reflected in the company's accounts, the corresponding royalty may be included in reserves.

Note 2: Product Categorization Reporting Required in RF 2005

Categorize Types of Oil and Natural Gas Deposits by Phase Relationship using the following classification for petroleum deposits (accumulations)

- Oil - with dissolved gas to saturation (no gas cap)
- Oil and Gas –with a gas cap not exceeding 50% on a fuel equivalent basis
- Gas and Oil - with oil fringe less than 50% by volume of equivalent fuel
- Gas – containing only gas (*dry gas*)
- Gas Condensate –further subdivided by C_{5+b} content
 - Low by condensate contained (below 25 g/m³)
 - Medium by condensate contained (25 -100 g/m³)
 - High by condensate contained (100 - 500 g/m³)
 - Unique by condensate contained (over 500 g/m³)
- Oil-Gas-Condensate

The SPE has no requirements for product categorization.

China Petroleum Reserves Office (PRO–2005)

The current classification system was approved and issued in 2004 by the General Administration of Quality Supervision, Inspection and Quarantine of the Peoples Republic of China with implementation to be effective in 2005. Reserves and resource reporting is administered by the Petroleum Reserves Office of the Ministry of Land and Resources. Each Chinese company must report annually detailed volumes (by field, block, and reservoir) under this classification that are associated with new discoveries, extensions and changes in development plans on properties within the borders of China.

China began developing a modern oil and gas industry in the 1950's and utilized the petroleum classification system from the former Soviet Union (FSU). Several revisions of the classification and guidelines culminated in the adoption of the China National Reserves Committee recommendations in 1988. In this classification, discovered oil and gas resources are referred to as "Discovered Geological Reserves" and the assignment of oil and/or gas in-place volumes to reserves classes is based on the phase of exploration or development and the amount of information available. The three classes are:

Inferred	Early Exploration and discovery
Indicated	Exploration Well Test with <u>Industrial Flows</u>
Measured	End of Exploration to Development

In the Chinese 1988 definition of reserves, economic viability was not emphasized or lacked clarification. However, an element of economics was included through the "industrial flows" criteria are defined in the following table relating well test/production rate to reservoir depth:

Reservoir Depth (meters)	Well Test Production	
	Oil (tonne/d)	Gas (10 ⁴ m ³ /d)
<500	0.3	0.05
500 - 1000	0.5	0.1
1000 – 2000	1.0	0.3
2000 – 3000	3.0	0.5
3000 – 4000	5.0	1.0
>4000	10.0	2.0

The classes of recoverable reserves are the same as the corresponding "geologic reserves" (in-place). Estimated Ultimate Recoverable (EUR) volumes are computed as the product of estimated in-place volumes times the estimated recovery efficiency. This volumetric approach is continued even into the production decline phase.

In 1998, the Ministry of Land and Resources was set up with mineral resources/reserves management as one of its main responsibilities. The current classification (hereafter referred to as the China 2005 definitions) is the result of work by their Petroleum Reserves Office and takes into consideration criteria contained in the SPE/WPC/AAPG and the United Nations Framework Classification (UNFC) systems. It keeps the basic features of the 1988 classification but incorporates SPE terminology. Figure 1 illustrates the overall classification and the category names and acronyms.

In general, discovered in-place volumes are first classified as measured, indicated or inferred “geologic reserves” based on the phase of exploration and development. That portion that is estimated to be theoretically recoverable under given technological conditions is termed “technically EUR (estimated ultimate recoveries)” or “TEUR”. The equivalent recoverable reserve categories are defined as Proved, Probable and Possible based on the degree of geological confidence. Economic initially recoverable reserves (EIRR) are those quantities of petroleum that are anticipated to be economically recoverable under existing economic conditions and under current executed or planned to be established technical operating conditions.

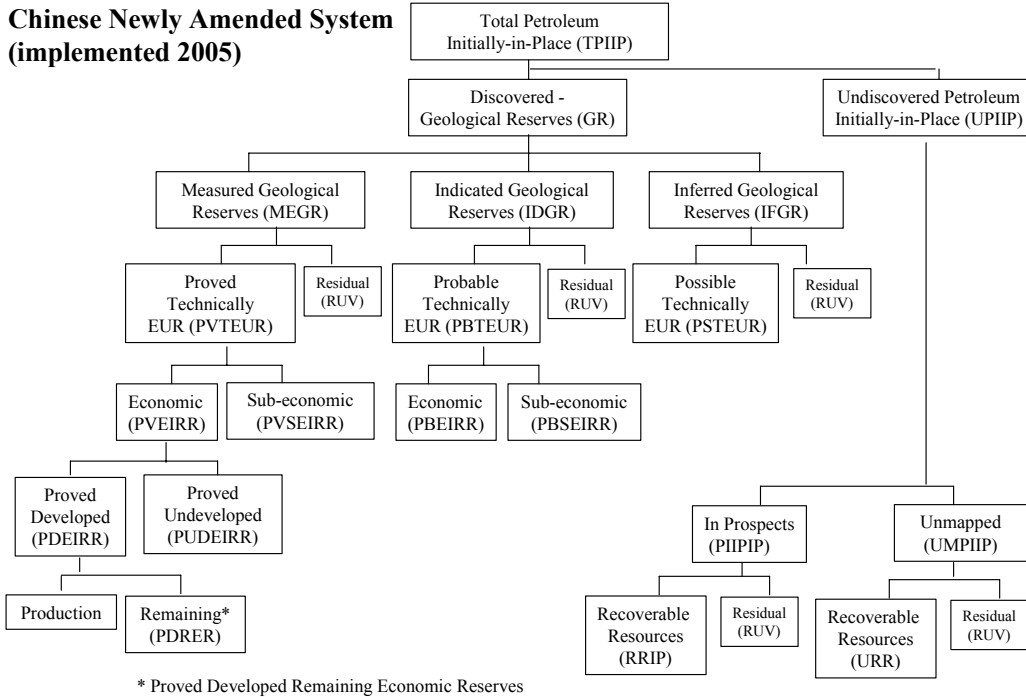


Figure 1: Classification Framework of Chinese Petroleum Resources/Reserves

Measured Geological Reserves are estimated with a high level of confidence after the reservoirs have been proved economically recoverable by appraisal drilling. A reasonable well spacing should be used in the delineation of measured limits. All parameters in the volumetric approach should have a high degree of certainty.

That portion of Measured Geological Reserves that can be technically recovered is termed proved technically EUR (PVTEUR); these ultimate recoveries are based on:

- primary and improved recovery technologies that have been operated or are planned to be operated in the near future
- already have a development plan in progress or to be carried out in the near future
- are economic based on existing being recent average prices and costs.

This category has an economic and sub-economic component. For proved economic initially recoverable reserves (PVEIRR):

- use unescalated prices and costs from the date of the evaluation
- the technology is operational or has been demonstrated by a pilot or is successful in an analogous field and is assured to be installed

- the development plan will be carried out in the near future (for gas, there should be existing or contracted pipelines and firm sales contacts).
- reserve boundaries are based on fluid contacts or reliable pressure data, or the lowest known hydrocarbons encountered in a well; confined to an area with reasonable well control
- economic productivity is confirmed by actual production or conclusive test or such evidence in the same formation in offset wells or similar formations in the same well
- feasibility studies show the development is economic
- there should be at least 80% probability that the quantities actually recovered in the future will equal or exceed the estimated initially recoverable reserves

The economic portion can be split into Proved Undeveloped and Proved Developed with the latter composed of cumulative production and remaining economically recoverable reserves. *(Thus, once adjusted for prior production, the economic recoverable measured is generally equivalent to SPE proved.)*

The sub-economic portion is defined as the difference between the proved technically estimated ultimate recoveries (PVTEUR) and the proved economic initially recoverable reserves (PVEIRR) and includes two parts:

- sub-economic PVTEUR volumes
- those PVTEUR volumes anticipated to be economic but the uncertainties of contractual and/or technical recoveries preclude such volumes being classified as PVEIRR.

(These “sub-economic/technically proved” volumes thus correlate closely to SPE low estimate Contingent Resources and part of SPE Probable Reserves.)

Indicated Geological Reserves are estimated with a moderate level of confidence when economic flow is obtained from a prospect well at the general exploration phase. That portion yielding technically estimated ultimate recoveries is called Probable (PBTEUR) and presumes the probably executed operation technology. Similar to the preceding, these estimates are split into economic and sub-economic. Economic may be based on recent average prices and costs or given forecast prices and costs. For the economic portion, there should be at least 50% probability that the quantities actually recovered in the future will equal or exceed the estimated initially recoverable reserves (EIRR). *(This category is grossly similar to SPE Probable reserves. The uneconomic portion is the difference between the Probable TEUR and EIRR and may be generally correlated to that portion of SPE Contingent Resources between the low and best estimate.)*

Inferred Geological Reserves are estimated with a rather low level of confidence characteristic of an early discovery phase or in the case where interpretations indicate that additional oil and/or gas layers exist. That portion yielding technically estimated ultimate recoveries is called Possible (PSTEUR) and optimistically presumes the probably adopted operation technology. There should be at least a 10% probability that the quantities actually recovered in the future will equal or exceed the estimated initially recoverable reserves (EIRR). The Chinese classification considers that Inferred reserves have undetermined economics and thus, it is not possible to define economic and sub-economic categories of Possible. *(Thus this category may correlate to SPE Possible reserves or high minus best estimate Contingent Resources, or some combination of the two.)*

Comparison to SPE Definitions

As illustrated in figure 2, there is a broad general agreement between the new Chinese (2005) and the SPE classification systems. However, there are some interpretational differences:

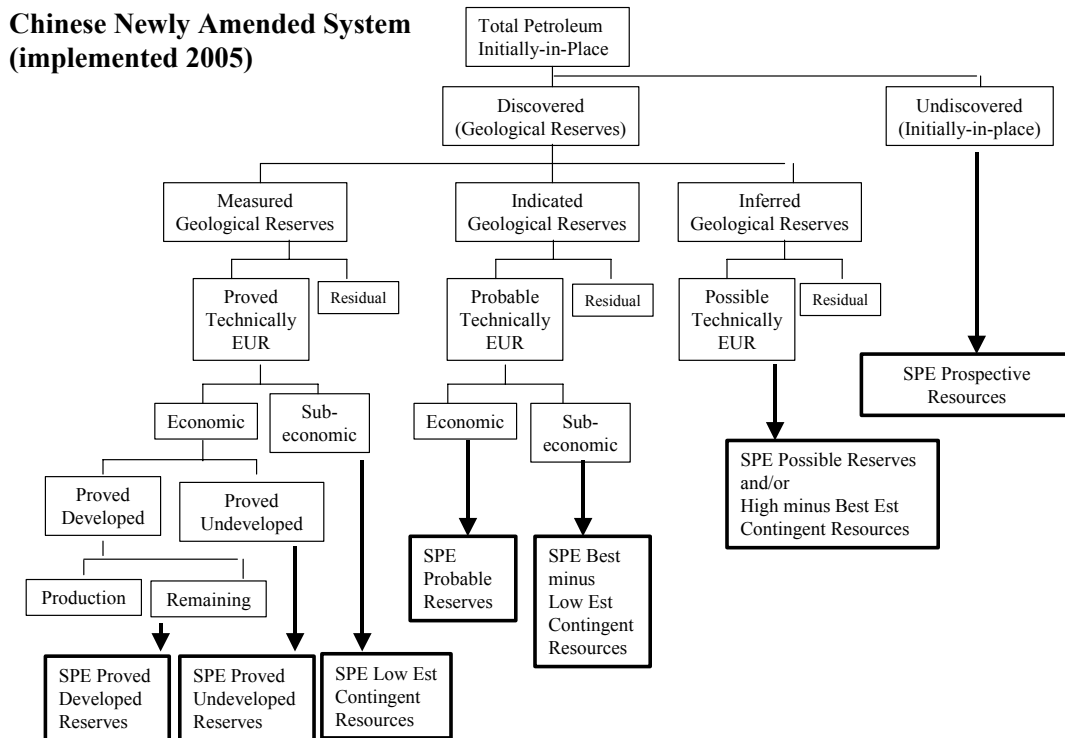


Figure 2: Comparison of Chinese (2005) and SPE Classifications

- a) It is key to remember that under the Chinese classification system:
- 1) The term “reserves” is used for both discovered in-place volumes and technically recoverable volumes in addition to economically recoverable volumes.
 - 2) Further, all certainty criteria are assigned to estimated in-place volumes and ultimate recoverable volumes, not restricted to remaining volumes.
 - 3) The Chinese Proved and subset Proved Developed Estimated Initially Recoverable Reserves must be reduced by prior cumulative production before comparison to SPE reserves.

b) The Chinese have retained their industrial flows criteria as a reference to define a commercial discovery but staff are encouraged to estimate local or field-wide criteria as well. In general, a commercial rate would allow recovery of the cost of drilling a producing well (excluding abandonment costs).

c) For Proved Technical Estimated Ultimate Recovery (PTEUR), the feasibility studies assume recent average prices and costs but for Proved Economic Initially Recoverable Reserves (PVEIRR), more stringent criteria include use of prices and costs as of the assessment date. *(In practice, Chinese companies may apply their internal forecast prices in feasibility studies to define PTEUR.)*

d) For PBEIRR/Probable, Chinese guidelines allow use of either historical average or forecast costs and prices whereas the SPE Probable and Possible apply forecast costs and prices.

e) Although not discussed above, the Chinese subdivide the undiscovered resources (comparable to SPE/WPC/AAPG Prospective Resource) into two categories: Petroleum Initially-in-place in Prospects at early stages of exploration and Unmapped Petroleum Initially-in-place that is based on regional reconnaissance mapping only.

f) While the China classification makes reference to probability targets, their post-discovery assessments are usually based on deterministic scenarios and it is rare that probabilistic analyses are used. While 2P and 3P match SPE guidance at P50 and P10, the Chinese definitions for Proved reference a target of P80 versus the SPE P90. The Chinese documents include phrases such as “indicated geological reserves are estimates with a moderate level of confidence with a relative error not more than +/- 50%”. This does not relate to actual probabilistic targets and is supplied as a general guide. It would appear that this implies a higher degree of uncertainty than normally associated with SPE probable estimates.

g) In the detailed definition of LKH, there is an indication that the Chinese specifically state that they would accept reliable pressure data as a primary criteria; the SPE requires a lowest penetration “unless otherwise indicated by definitive geological, engineering or performance data”.

The Chinese expect that there should be no material difference between SPE Proved Ultimate and their PVEIRR. However, it should be noted that it is common for the feasibility studies to include waterflood in the initial plans for oil reservoir development and improved recovery volumes may not be uniquely identified.

The Proved Reserves of the three major national oil companies that are disclosed to investors are in compliance with SEC guidelines since the estimations were performed by independent consulting firms. These quantities may not be equivalent to those reported by the same companies to the government under the above Chinese 2005 classification system.

The issue of combining a range of recovery efficiencies in combination with in-place uncertainties to define proved versus probable and possible recoverable volumes is problematical in the Chinese system. In practice, the probable (indicated) and possible (inferred) in-place volumes are estimated by exploration geologists using volumetric methods. When data meet the requirements of “Measured”, the property is turned over to a production company who define Measured In-place and associated Proved recoverable based on a development plan and debook the appropriate area of prior Probable in-place reserves. Typically the production company does not concern itself with probable and possible reserves estimates.

Once on production, the production company staff typically uses decline and/or material balance methods to estimate recoverable reserves but do not usually go back and revise the original in-place volume estimates. If the development drilling demonstrates that the original estimates of in-place volumes exceed the error limits (20% Of Measured in-place volumes), it is referred to the Ministry (Petroleum Reserves Office) for review (audit) and changes.

Regarding non-conventional hydrocarbons, the same classification is applied to Coal Bed Methane reserves. The Chinese have not yet developed regulations for bitumen or oil sands.

Information on the Chinese classification system was supplied courtesy of Hu Yundong, China Petroleum Reserves Office, Ministry of Land and Resources. For a complete description of this classification and associated guidelines, contact the China Petroleum Reserves Office directly.

**Comparison of Reserves Definitions
Reserves Definitions/Proved Criteria**

	SPE/WPC (1997)	China (2005)
Intended purpose	General application – not country specific	Government reporting
Qualitative description of certainty- proved	Reasonable certainty to be commercially recoverable	High level of confidence and relative error not more than +/- 20%
Qualitative description of certainty- probable	Not proved, but more likely than not to be recoverable	Presumes the probably executed operational technology. Feasibility study shows development is economic.
Qualitative description of certainty- possible	Less likely to be recovered than probable	Optimistically presume the probably adopted operation technology. (No economic qualification.)
Quantification of probabilities associated with estimates.	Proved => P90 2P => P50 3P =>P10	EIRR=> P80 EIRR=> P50 EIRR=>P10 (EIRR = economical initially recoverable reserves).
Proved reserves relative to lowest known hydrocarbon (LKH)	No proved reserves below LKH as defined by well logs, core analysis or formation testing.	No proved reserves below LKH as defined by well logs, core analysis formation testing, or pressure data.
Proved reserve extensions on undrilled acreage	Directly offsetting DSU's and/or where reasonably certain of continuity and commercial recovery.	A reasonable well spacing should be used in the delineation of measured limits.
Proved reserves – requirements for testing	Generally require actual production or a conclusive flowing well test. In certain cases, proved reserves can be based on logs and/or cores and is analogous to producing or tested reservoirs.	Confirmation of economic productivity in the objective formation by actual production or a conclusive test. Or is similar to the same formation in an offset or similar formation in the same well with economic production.
Classification of enhanced recovery mechanism as proved	Successful pilot or existing project in subject or analogous reservoir.	Technology has been operated or demonstrated favorable by pilot or is successful in analogous field. Project assured to be installed.

**Comparison of Reserves Definitions
Development Status**

Development and production status categories	Developed producing and non-producing. Undeveloped.	Developed and Undeveloped. (no sub-categories of developed)
Developed	Reserves expected to be recovered from existing wells including reserves behind pipe. Improved recovery reserves require that necessary equipment has been installed or when costs to do so are relatively minor.	Reserves fully put into production after completing development well pattern drilling and associated facility installment. Improved recovery reserves require that necessary equipment is operational. <i>Must subtract prior production to get remaining.</i>
Developed - Producing	Reserves expected to be recovered from completion intervals which are open and producing at the time of the estimate. Improved recovery reserves are considered developed producing only after the improved recovery project is operational.	Not Defined (same as Developed)
Developed – Non-Producing	Includes shut-in (open but not producing, waiting on market/pipeline connections, or mechanical problems) and behind pipe (requires additional completion or future recompletion) reserves.	Not Defined
Undeveloped	Reserves to be recovered from additional drilling, deepening existing wells to a different reservoir or where a relatively large expenditure is required to complete an existing well or install production or transportation facilities.	Recoverable reserves in oil and/or gas reservoirs which have completed appraisal drilling or have a pilot project but the production pattern is not fulfilled.
Allocation in Multi-well Pools	Not Defined	Not Defined

**Comparison of Reserves Definitions
Unproved Reserves**

Unproved Reserves	Technical, contractual, economic, or regulatory uncertainties preclude reserves being classified as proved. Unproved reserves may be estimated assuming future economic conditions (and technological development) different from those prevailing at the time of the estimate.	Discovered recoverable portions of Indicated or Inferred Geological Reserves.
Probable Reserves	Includes: 1) step-out areas from proved 2) formations that appear productive on logs but lack core, definitive tests, or productive analogs 3) incremental reserves attributable to infill drilling 4) reserves attributable to improved recovery methods but lack pilot 5) adjacent fault blocks up-dip to proved 6) reserves attributable to future workover treatments or other procedures without successful analogs 7) incremental reserves in proved reservoirs through alternative interpretations.	Only the recoverable portion of Indicated in-place volumes and the recovery efficiency may be estimated assuming probably operation technology different from those prevailing at the time of the estimate.
Possible Reserves	Includes: 1) areas beyond probable potentially productive based on geological interpretations 2) formations that appear petroleum bearing in cores and logs but may not be commercially productive on tests 3) reserves attributable to infill drilling that are subject to technical uncertainty 4) improved recovery reserves where no pilot is operational and reservoir characteristics may not support commercial application 5) adjacent fault blocks down-dip to proved areas.	Only the recoverable portion of Inferred in-place volumes and the recovery efficiency may be estimated optimistically assuming possible operation technology different from those prevailing at the time of the estimate.

**Comparison of Reserves Definitions
Deterministic vs Probabilistic Methods**

Deterministic vs Probabilistic Methods	Reserve estimates may be prepared using either deterministic or probabilistic methods. Reserve numbers are generally defined within a range, not as one fixed quantity. The range may be described qualitatively by deterministic methods or quantitatively by probabilistic methods. (the probabilistic limits (e.g. Proved \geq P90) can only be specifically applied when the probabilistic method is applied)	<i>(Although probability targets are defined, Chinese post-discovery estimates are almost entirely based on the deterministic methods. There is nothing in the definitions that would prevent probabilistic analyses)</i>
Deterministic Method	Deterministic estimates do not address uncertainties in terms of probabilities; they require that volumes be described in terms of discrete estimates using defined criteria (e.g. LKH) including qualitative certainty.	Not Defined
Probabilistic Method	If probabilistic methods are used the defined quantitative limits (e.g. Proved \geq P90) apply at the entity level <i>(before aggregation)</i> .	Not Defined
Application of probability criteria and aggregation.	Numerical probabilities are only applied in probabilistic method and probability limits apply at the entity level. Probabilistic aggregation allowed to the field level only, then arithmetic summation to reporting level. Dependencies between entities and their distributions must be modeled in probabilistic aggregation.	Not Defined

Comparison of Reserves Definitions (draft version Mar 7-05)
Special Issues

Treatment of Unconventional Hydrocarbons	Classification applies to all petroleum deposits.	Classification applies to all petroleum deposits.
Fuel Gas Reserves Status	Issuers have the option to include gas volumes consumed in operations in production and reserves if an appropriate expense is allocated.	Not Defined
Natural Gas Injection	To include injection gas as reserves, the volumes would have to meet the normal criteria (economic when available for production, existence of a firm market, available pipeline or other export option, part of established development plan).	Not Defined
Gas Sales Volumes	Reported gas reserves reflect the condition of the gas at the point of sale. If sold as wet gas, associate liquids reserves are not reported separately. If sold with a non-hydrocarbon gas content, the full volume as sold is included in reserves. The price received will reflect quality.	Not Defined
Infill Drilling	Not Defined	Not Defined
Compression	Not Defined	Not Defined

**Comparison of Reserves Definitions
Special Issues**

Net Profits Interests	Not Defined	Not Defined
Production-Sharing Contracts	Under a PSC the host government retains ownership, however the contractor receives a stipulated share of production remaining after cost recovery. Reported reserves are based on the economic interest held subject to the specific terms and time frame of the agreement. Being tied to economic interest, reserves must be re-calculated annually based on product price and operating costs and may vary considerably. Under SPE definitions, an average price over the term of the contact may be used to define reserves.	Not Defined
Contract Extensions	Where agreements allow extension through negotiation of renewed contract terms, exercise of options to extend or other means additional reserves (of various categories) or contingent resources may be assigned depending the level of certainty and commercial viability associated with the contract extension.	Not Defined
Product Categorization	Not Defined	Not Defined

**Comparison of Reserves Definitions
Economics/Commerciality**

Commerciality	In order to assign reserves of any category, a project needs to be defined in terms of a commercially viable development plan and there should be evidence of firm intent to proceed.	The feasibility study indicates that the development is economic.
Commitment	If the degree of commitment is not such that an accumulation is expected to be developed and placed on production within a reasonable time frame (e.g. 5 years), the estimated recoverable volumes should be classified as contingent resources (not reserves).	Program assured to be installed
Economics	The underlying economic evaluation based on perception (best estimate) of future costs and prices together with best-estimate production profile expected to equate to a proved plus probable scenario. To limit downside exposure the “low case” scenario should be at least “break-even“ which is consistent with the requirement that proved reserves are viable under “current economic conditions”.	Based on market conditions of the time, i.e. oil and /or gas prices and development costs at the time of reserve estimation, oil and gas production is believed technically feasible with the other conditions allowable, such as environment, etc. The economic viability refers to the reserves revenue being able to return the investment.
Development Plan Approvals	While some companies choose not to assign any proved reserves until the development plan has received all relevant formal approvals, SPE definitions require only a reasonable expectation that the necessary facilities to process and transport those reserves will be installed.	Not Defined

**Comparison of Reserves Definitions
Economics/Disclosure Guidelines**

Prices & Costs for defining reserves "economic limit".	Proved: Existing economic conditions (year-end or appropriate period* average) (SPE *recommends prior 12 month period). Unproved: reserves may be based on forecast prices and costs.	To be classified as economic, both Proved and Probable must be economic under current conditions of prices and costs. Current may be defined by recent average prices and costs. <i>(no provisions for escalation noted)</i> <i>(Unproved my use historical averages or defined forecasts prices and costs)</i>
Abandonment Costs	Economic limit calculated including abandonment and reclamation costs.	Not Defined
Net Present Value of Future Net Revenue (FNR).	Not Defined	Not Defined
Audit Requirements	No requirement for use of external evaluators. SPE "Standards Pertaining to the Estimating and Auditing of Oil and Gas Information" recommends standards for training, experience levels, and sets independence criteria for evaluators and auditors whether internal or external.	Not Defined
Gross vs Net	Note 1	Note 1

Note 1:

Gross vs Net Gross: The Chinese definitions do not address the issue of royalties.

SPE Regards Royalty

Within the U.S., royalty volumes are strictly omitted from reported reserves (*that is, they are reported on a net basis*). In some cases outside the U.S., where royalty is paid in cash and the cash flow from the royalty is reflected in the company's accounts, the corresponding royalty may be included in reserves.

Norwegian Petroleum Directorate (NPD–2001)

One of the principal tasks of the Norwegian Petroleum Directorate (NPD) is to maintain an overview of petroleum resources so that authorities can have the best possible basis for planning measures to ensure that they are well managed, and to forecast future production and activity.

The NPD’s annual updating of the resource account for expected recoverable resources focuses on classification by maturity. This system was developed in 1997. Based on experience gained in using the system and in cooperation with several oil companies, the NPD developed and published its current revised system in 2001. The current system builds on the SPE/WPC/AAPG 2000 classification but expands on the project maturity aspect.

The main principal in the NPD classification system is that originally recoverable resources in a field or discovery must be classified according to their position in the development chain, either from a discovery being made, or a new opportunity to increase recoverable resources in a field being identified, until production of the resources is complete. The system is designed to allow a single field or discovery being able to contain resources in different project status categories, i.e. resources at different stages of maturity in the development chain.

All resources must, as far as possible, be reported with a high and a low estimate in addition to the “base estimate”. This allows an opportunity to describe the uncertainty in the resource quantities in both the individual fields and the full resource account (total portfolio).

The resources are divided into ten different project status categories (Figure 1).

		Resource class	Project status category	
TOTAL RECOVERABLE PETROLEUM RESOURCES	Discovered	Historical Production [S]	0	Sold and delivered petroleum
		RESERVES [R]	1	Reserves in production
			2 F/A	Reserves with an approved plan for development and operation
			3 F/A	Reserves which the licensees have decided to recover
		CONTINGENT RESOURCES [C]	4 F/A	Resources in the planning phase
			5 F/A	Resources where recovery is likely but not clarified
			6	Resources whose recovery is not very likely
	7F/A		Resources that have not yet been evaluated	
	Undiscovered	UNDISCOVERED RESOURCES [P]	8	Resources in Prospects
			9	Resources in leads, and unmapped resources.

F= First oil/gas
A = Additional oil/gas

Figure 1: Norwegian Petroleum Directorate Classification

Categories 0 to 7 cover the discovered, recoverable resources, Possible future measures to improve the recovery factor are placed in category 7 along with discoveries that have not yet been evaluated. Categories 6 and 9 cover undiscovered resources.

The “F” label identifies quantities linked to the initial recovery project while “A” are additional quantities from improved recovery projects. There are cases where “A” can be negative; for example, oil recovery improvements may involve gas consumption.

All companies operating in Norway must annually submit resource information according to this classification. Moreover, the major Norwegian-based oil and gas companies have adopted the same or similar system for internal resource management.

A complete description of the NPD classification can be found on their website at: http://www.npd.no/regelverk/r2002/frame_e.htm

Comparison to SPE Definitions

The Norwegian Petroleum Directorate classification (NPD 2001) is based on the SPE/WPC/AAPG 2000 classification (figure 2) with a modification to utilize project status categories to differentiate projects based on their commerciality, that is, their maturity towards full producing status. These categories can also be viewed as qualitative measures of commercial risk or chance of commerciality.

		SPE/WPC/AAPG	NPD		
TOTAL PETROLEUM-INITIALLY-IN-PLACE	DISCOVERED PETROLEUM-INITIALLY-IN-PLACE	PRODUCTION	0	Sold and Delivered	
			P90 P50 P10	1	On Production
			RESERVES	2 F/A	Under Development
		1P 2P 3P	3 F/A	Development Committed	
		CONTINGENT RESOURCES	4 F/A	Resources in Planning	
			5 F/A	Development Likely	
	6		Development Unlikely		
	7F/A		Being Evaluated		
	UNRECOVERABLE				
	UNDISCOVERED PETROLEUM-INITIALLY-IN-PLACE	PROSPECTIVE RESOURCES	8	Prospect	
			9	Play and Lead	
		UNRECOVERABLE			

← Range of Uncertainty →

F= First recovery
A = Advanced recovery

Figure 2: Comparison of SPE and NPD Classifications

The NPD classification is a good example of a modified application of the SPE 2000 classification. It adheres to the guidelines provided, in that it is project status based. This means in principle that the uncertainty on the horizontal axis relates to the outcomes of specified recovery projects, and that there is one line for each project.

While the project status categories follow the illustrative example provided in the SPE guidelines (shown above) to a great extent, they have been adapted to match the requirements of the Norwegian legal and regulatory system.

It follows from the project status approach that there may be several projects recovering oil and gas from the same accumulation, and these may be in different stages of maturity, and thus in different categories. The NPD has found it to be convenient to distinguish between the first (F) project and additional (A) projects.

Probabilistic quantification is provided for, following the SPE scheme, but also allowing other legacy fractile to be used, in order not to unnecessarily burden companies who were using P80 and P20 when the existing classification was introduced. With time, P90, best estimates and P10 have prevailed and the P80 and P20 fractiles are no longer used as standards.

The NPD substitutes the term “base estimate” for “best estimate”. It reflects the current understanding of the extension, characteristics and recovery factor of the reservoir. The base estimate can be calculated deterministically or stochastically. If the base estimate is calculated by a stochastic method, it should correspond to the mean value (not the median/P50).

As the NPD classification is developed for the resource management needs of the Norwegian Government and the business process management needs of the Norwegian companies, emphasis has been more on reflecting relevant quantities that comparable ones. The latter is of course of the essence in financial reporting. As a consequence, the NPD classification is lacking in precision when it comes to technical and economic criteria defining reserves. The concept of proved reserves according to deterministic criteria is not recognized as we know it from the SEC or SPE definitions. P90 reserves are however both a reasonable and simple, well-defined substitute, remembering that future, uncommitted projects are not allowed to contribute to the 2P nor 3P reserves. While the terms Proved, Probable and Possible are not utilized, the definitions of low/1P, base/2P, and high/3P estimated quantities allow derivation of these entities if required (notwithstanding that the base is the mean and not P50).

The NPD defines a discovery as one petroleum deposit, or several petroleum deposits collectively, which have been discovered in the same wildcat well, in which through testing, sampling, or logging there has been established a probability of the existence of mobile hydrocarbons (includes both a commercial and a technical discovery).

The NPD does not give definitions of commercial/economic or sub-commercial/sub-economic but depends on the status categories to segregate Reserves from Contingent Resources. Contingent Resources are defined as petroleum resources that have been discovered but no decision has yet been taken regarding their development. It is noted that their category 3 (reserves which the licensees have decided to recover) may include projects for which the authorities have not yet approved a Plan of Development (PDO) or granted exemption therefrom. Thus the differentiation of Reserves from Contingent resources may seem to rest solely on the licensees' internal commitment to proceed with development. Under the petroleum law, the licensees are however given the right to produce the petroleum. The government approval of the PDO is an occasion to align interests in the way development will take place and not an occasion to remove a right already granted.

There being no further definitions of technical or commercial criteria for reserves or uncertainty classes, no detailed comparison table has been prepared.

United States Geological Survey (USGS - 1980)

The United States Geological Survey (USGS) was created by an act of congress in 1879 as an independent fact-finding agency that collects, monitors, analyzes, and provides scientific understanding about natural resource conditions, issues, and problems. The USGS stands as the sole science advisory agency for the U.S. Department of the Interior. Because it has no regulatory or management mandate, the USGS provides impartial science that serves the needs of our changing world.

As part of its mandate, the USGS periodically assesses both U.S. and worldwide petroleum resources. Their latest world survey was completed in 2000 (<http://pubs.usgs.gov/dds/dds-060/index.html#TOP>). The USGS has developed methodologies to estimate the total hydrocarbon volumes that will be available for production. This includes volumes projected to be associated with existing discoveries and future discoveries.

Volumes within existing discoveries are based on published information collated from vendors (NRG and IHS) or other government agencies (U.S. Department of Energy). The USGS does not change, process, alter, redefine, or systematically check the accuracy of this data. This known discovered volumetric data is accepted in the classification as presented. Most are classified using the general SPE definitions and are normally proved for the US and proved plus probable in other areas of the world. The focus of USGS reports is to forecast ultimate potential by assessment units which sum three resource elements:

- prior production and known reserves (from vendor data)
- projected field growth in these known/discovered accumulations
- predicted undiscovered potential in both proved and unproven plays.

USBM/USGS(1980) Classification

The current “official” classification scheme is that jointly developed by the USGS and the US Bureau of Mines and referred to as the USBM/USGS (1980) system (figure 1).

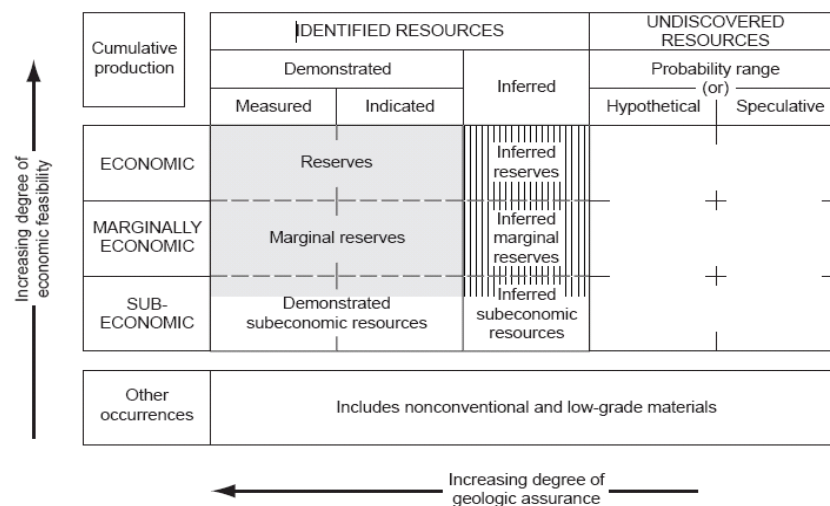


Figure 1: USBM/USGS (1980) Classification of Oil & Natural Gas Resources

This same classification is applied to both petroleum accumulations and mineral deposits. While the USGS does not actually apply this classification to discovered accumulations since they rely on vendor data (which generally use SPE definitions), the concepts contained are still useful as historical perspective and to explain their global assessment methodologies.

Resources include reserves and all other petroleum accumulations that may eventually become available - including known accumulations that are not recoverable under current economic conditions or current technology, or unknown accumulations of varying degrees of richness that may be inferred to exist, but not yet discovered. Therefore, resources can be classified in terms of geologic assurance as discovered (identified) and undiscovered.

According to the USBM/USGS (1980), "identified resources" are those whose location, grade, quality, and quantity are known or estimated from specific geologic evidence. Undiscovered resources are those whose existence are only postulated from geologic information and theory and comprise accumulations that are separate from identified resources [that is, existing outside of known oil and (or) natural gas accumulations].

Resources are also classified in terms of feasibility of economic recovery as economic, marginally economic and sub-economic (Fig. 1). "Marginal reserves" are defined as "that part of the reserve base which, at the time of determination, borders on being economically producible. Its essential characteristic is economic uncertainty. Included are resources that would be producible, given postulated changes in economic or technologic factors".

A degree of uncertainty is typically reported for the estimated quantities of discovered and undiscovered resources that are potentially recoverable. The uncertainty of estimated resource quantities may be expressed probabilistically, either as a range or single-value statistic such as a mean, mode, median (P_{50}), or some other percentile.

Discovered (identified) resources are divided according to geological (in-place) assurance into measured and indicated, and inferred classes defined as follows:

- Measured - Quantity is computed from dimensions revealed in outcrops, trenches, workings, or drill holes; grade and (or) quality are computed from the results of detailed sampling. The sites for inspection, sampling, and measurement are spaced so closely and the geologic character is so well-defined that size, shape, depth, and mineral content of the resource are well established.
- Indicated - Quantity and grade and (or) quality are computed from information similar to that used for measured resources, but the sites for inspection, sampling, and measurement are farther apart or are otherwise less adequately spaced. The degree of assurance, although lower than that for measured resources, is high enough to assume continuity between points of observation
- Inferred - Estimates are based on an assumed continuity beyond measured and (or) indicated resources, for which there is geologic evidence. *Inferred resources* may or may not be supported by samples or measurements.

Demonstrated resources are the sum of measured and indicated resources. The estimated economically recoverable portion of discovered (identified) is classified as reserves. These are the quantities that can be economically produced at the time of the determination. The part of the discovered (identified) from which reserves growth is estimated is called the “reserves base” (sum of shaded and hachured areas in fig 1).

Successive estimates of the total crude oil, natural gas, and natural gas liquids to be recovered in fields and reservoirs generally increase through time with continued development and production, the result commonly being additions of reserves. These additions are directly related to increases in the total size (cumulative production plus remaining reserves) of the field or reservoir. Reserve growth (*also called field growth, reserve appreciation, and ultimate recovery appreciation*) is therefore that part of the identified resources, over and above measured reserves, estimated to be added to existing fields and reservoirs within a defined timeframe (*usually 30 years*). Reserve growth occurs for a variety of geologic, engineering, operational, and economic reasons, including: (1) delineation of additional in-place hydrocarbons, including addition of new reservoirs and extensions (2) improved recovery efficiency, and (3) revisions resulting from recalculation of viable reserves under changing economic and operating conditions.

The USGS divides undiscovered resources into hypothetical and speculative classes to reflect geologic assurance. Hypothetical resources are undiscovered resources that may be reasonably expected to exist under geologic conditions analogous to those in known producing districts or regions. Speculative resources are undiscovered resources that may exist elsewhere, in districts or regions with no discovered.

Recent USGS assessments consider three types of technically recoverable resources: (1) undiscovered conventional accumulations of oil and natural gas, (2) additions of oil and natural gas from untested cells within continuous accumulations (unconventionals), and (3) the potential future additions to reserves of known conventional accumulations by reserve growth. Each of these resource types requires a different technique for evaluation and assessment. The oil and natural gas from undiscovered conventional accumulations clearly equate to the undiscovered resource classification, whereas oil and natural gas from development of continuous accumulations may equate to both discovered and undiscovered classes.

Although based on the best geologic and historical information and theory available, petroleum volumes assessed are unknown quantities, not measurements, and therefore should be expressed with probability distributions of uncertainty.

USGS assessment methodology is described within their World Assessment 2000 report available at their website: <http://pubs.usgs.gov/dds/dds-060/index.html#TOP>

Dr. Timonthy R. Klett assisted in our understanding of the USBM/USGS reserves and resource classification and further provided two key references:

U.S. Bureau of Mines and U.S. Geological Survey, 1976, Principles of the mineral resource classification system of the U.S. Bureau of Mines and U.S. Geological Survey: U.S. Geological Survey Bulletin 1450-A, 5p.

U.S. Bureau of Mines and U.S. Geological Survey, 1980, Principles of a reserve/resource classification for minerals: U.S. Geological Survey Circular 831, 5p.

Comparison to SPE Definitions

Figure 2 graphically illustrate the overall comparison of the USBM/USGS (1980) and the SPE/WPC/AAPG (2000) classifications for the discovered portion of total resources.

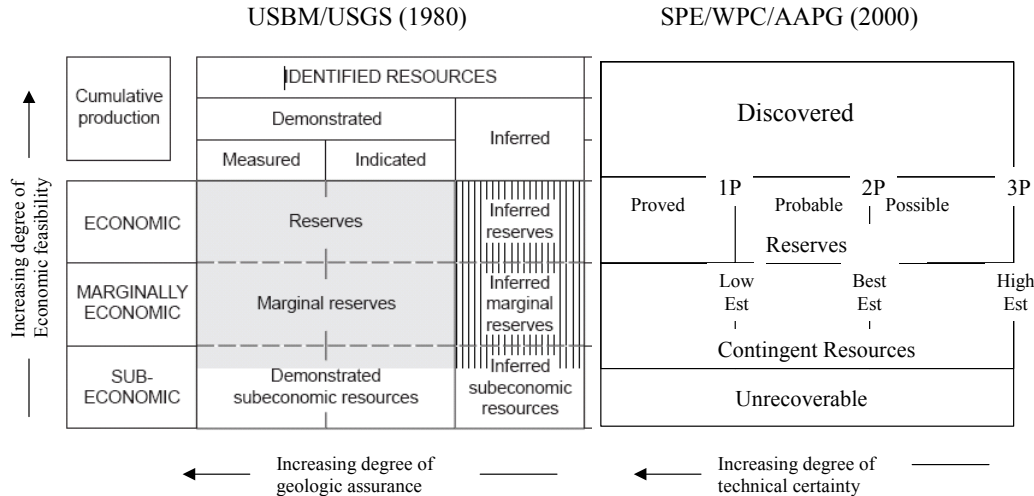


Figure 2: Comparison of USGS and SPE Classification (discovered portion)

The USGS classification is based on two parameters whereby resources are classified by feasibility of economic recovery and degree of geologic certainty. The SPE system classifies resources based on 3 parameters: feasibility of economic recovery (commerciality) in the y-axis and a combination of degree of geologic assurance and degree of recovery efficiency termed technical uncertainty on the x-axis. Although some differences exist, the classification schemes are comparable.

As shown in the previous figure 1, the USGS hypothetical and speculative undiscovered resources combined correlate to SPE Prospective Resources; they can be classified by technical uncertainty (low/best/high estimate or a probability distribution) but there is no attempt to segregate undiscovered volumes according to commercial certainty.

The shaded area in Figure 2 is termed the “reserves base”. It may encompass that part of the resources that has a reasonable potential for becoming economical within the planning horizons (30 years) beyond those that assume proven technology and current economics”. Thus, it appears that inferred reserves may be based on forecast conditions while demonstrated (measured and indicated) are based on current conditions. This contrasts with SPE guidance that proved is based on current conditions while probable and possible are based on forecast conditions.

Although the USGS measured, indicated, and inferred classes of reserves are assigned to reflect geologic assurance, these classes have been loosely interchanged with, respectively, the proved, probable, and possible classes. While measured and proved are comparable, probable and possible may not be directly interchangeable with indicated and inferred. Some earlier publications suggest that USGS inferred is not a high side estimate of indicated but refers to only unexplored deposits for which estimates of the quality and quantity are based on geologic evidence and projections and may not have any direct sampling or measurements. Later publications indicate closer alignment

with SPE possible reserves that may be a combination of high side estimates of drilled (sampled) areas and adjacent undrilled areas (fault blocks and satellite features).

Users should be aware of the “reserves” terminology used in current USGS reports as illustrated in figure 3:

World Excluding United States (conventional)

	<u>Oil - billion barrels</u>			
	<u>F95</u>	<u>F50</u>	<u>F5</u>	<u>Mean</u>
1- Cumulative Production				539
2 – Remaining Reserves				859
3 – Known Reserves (1+2)				1398
4 – Reserves Growth	192	612	1031	612
5 - Undiscovered	334	607	1107	649
6 – Future Volumes (2+5)				1508
7 – Future Grown Volumes (2+4+5)				2120
8 – Total Endowment (1+2+4+5)				2659

Figure 3: USGS World Petroleum Assessment 2000 – Results Summary

“Remaining reserves” are taken from NRG Associates and Petroconsultants (IHS) reports and may represent proved or proved plus probable reserves as defined in their data sources (typically using SPE definitions). “Reserves Growth” as discussed above is based on USGS projections of future (30 year) additions from new recovery methods, improved prices, satellite development, etc. using proprietary algorithms derived from analog fields of similar maturity. The volumes may include what would be currently classified under SPE guidelines as possible, contingent resources and even some portions of unrecoverable and speculative potential (for satellite accumulations). The USGS does not quote reserve growth for individual fields, it is only statistically meaningful for large aggregations; the 2000 report only quotes reserves growth on a total world basis. The SPE term “estimated ultimate recovery” may be applied to either USGS terms “known reserves” or “future endowment”.

The reserves growth and undiscovered resource aggregations use probabilistic models and will have portfolio effects. The USGS uses P95 for the lowside and P05 for the upside with two measures of central tendency being the median (P50) and the mean. Cumulative production and remaining reserves are aggregated arithmetically.

The 2000 USGS world assessment does not include unconventional hydrocarbons (continuous accumulations) from tight gas, coal bed methane, heavy oil (<15⁰ API), and tar sands but do recognize their potential. As extraction and processing technology develops, the geologic descriptions are matured and their recovery becomes economically feasible, and they will be assessed in the same manner as conventional hydrocarbons.

USGS “economic” implies that profitable extraction or production under defined investment assumptions has been established, analytically demonstrated, or assumed with reasonable certainty. This would not conflict with SPE guidance. The USGS definitions do not include more detailed guidance on such issues as pricing, discovery criteria and proved (measured) limits (e.g. LKH, DSU offsets).

Given that the USBM/USGS (1980) classification is only used as a concept reference, a detailed SPE/USGS comparison table is not appropriate.

United Nations Framework Classification (UNFC–2004)

The United Nations Framework Classification (UNFC) for Energy and Mineral Resources is a universally applicable scheme for classifying/evaluating energy and mineral reserves and resources.

The classification was originally focused on coal resources and was adopted by the United Nations Economic Commission for Europe (UNECE) in 1997. It was expanded to include all mineral reserves and resources in 1999. In 2001, the UNECE created an Intergovernmental Ad Hoc Group of Experts on the Harmonization of Energy Reserves/Resources Terminology to extend the principles of UNFC to other energy resources (oil, natural gas, and uranium). Regards petroleum, the group focused on full compatibility with the SPE/WPC/AAPG classification. In addition, several national classification systems played an important role in the harmonization process including the recently revised classification of the Russian Federation.

The current classification has been endorsed by the United Nations Economic and Social Council (ECSOC) and recommended for adoption as a worldwide standard. It has been reviewed and endorsed by the Organization of Petroleum Exporting Countries (OPEC), and is being considered for adoption as a reporting standard by the Committee of European Security Regulators (CESR) and the International Accounting Standards Board 's working group on extractive industries.

The classification is designed to allow incorporation of currently existing terms and definitions into this framework and thus make them comparable and compatible on an international basis. The approach has been simplified through the use of a three-digit code clearly indicating the essential characteristics of extractable energy and mineral commodities in market economies, notably (i) degree of economic/commercial viability (ii) field project status and feasibility, and (iii) level of geological knowledge. The three criteria are easily visualized in three dimensions as shown in Figure 1.

- E₁ Economic
- E₂ Potentially economic
- E₃ Intrinsically economic

- F₁ Mining report/Feasibility
- F₂ Pre-feasibility
- F₃ Geological Study

- G₁ Detailed Exploration
- G₂ General Exploration
- G₃ Prospecting
- G₄ Reconnaissance

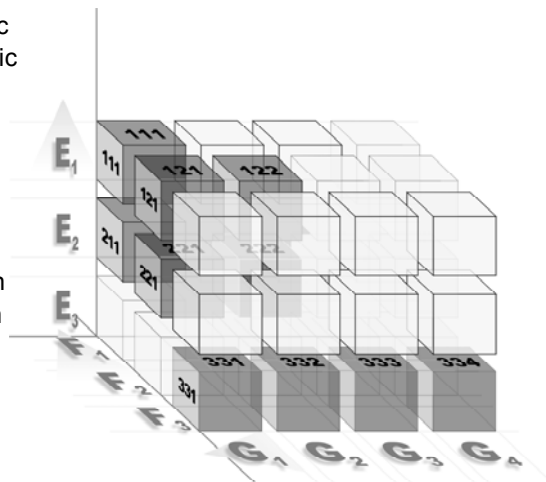


Figure 1: The UNFC for Solid Fuels and Mineral Commodities

To aid in understanding the numeric code sequence is always fixed, that is EFG and a quantity can be characterized numerically as 1:1:1: and the numeric value indicates the

degree of quality where “1” is the highest quality. Thus, 1:1:1 refers to quantities that are: economically and commercially recoverable (E1), have been justified by means of a feasibility study or actual production to be technically recoverable (F1) and are based on reasonably assured geology (G1).

Subcategories may be added under the main categories when required in the following format: 1.1;1;1 where a subcategory E1.1 has been defined. Semicolons now separate the main category codes. Figure 2 illustrates the codes and sub-codes as defined for petroleum classifications:

E1	Economic	F1	Justified Development and/or Production Project	G1	Reasonably Assured Geological Conditions
<i>E1.1</i>	<i>Normal Economic</i>	<i>F1.1</i>	<i>Project in Production</i>		
<i>E1.2</i>	<i>Exceptional Economic</i>	<i>F1.2</i>	<i>Committed Development Project</i>		
		<i>F1.3</i>	<i>Uncommitted Development Project</i>		
E2	Potentially Economic	F2	Contingent Development Project	G2	Estimated Geological Conditions
<i>E2.1</i>	<i>Marginal Economic</i>	<i>F2.1</i>	<i>Under Justification</i>		
<i>E2.2</i>	<i>Sub-marginal Economic</i>	<i>F2.2</i>	<i>Unclassified or On hold</i>		
		<i>F2.3</i>	<i>Not Viable</i>		
E3	Intrinsically Economic	F3	Project Undefined	G3	Inferred Geological Conditions
<i>E3.1</i>	<i>Non-sales</i>				
<i>E3.2</i>	<i>Undetermined</i>				
<i>E3.3</i>	<i>Unrecoverable</i>				
				G4	Potential Geological Conditions

Figure 2: UNFC Petroleum Categories and Sub-Categories

Assistance in promoting our detailed understanding of UNFC was provided by Sigurd Heiburg, Chairman of the UN Ad Hoc Group of Experts on the Harmonization of Energy Reserves/Resources Terminology

A complete description of the UNFC including definitions of the above terminology can be accessed at the following website address:
(<http://www.unece.org/ie/se/pdfs/UNFC/UNFCemr.pdf>)

Additional descriptions have been published in:
SPE 84124: The United Nations Framework Classification for World Petroleum Resources; T.S. Ahlbrandt et al, 2003
SPE 90839: Updated United Nations Framework Classification for Reserves and Resource of Extractive Industries; T.S. Ahlbrandt et al, 2004

UNFC is functional in its basic form. In defining key concepts, such as proved reserves, the more prescriptive requirements are left to be included in specifications/guidelines. Note that the Ad Hoc Group of Experts has been charged with developing application guidelines and that project is ongoing in liaison with the SPE Oil and Gas Reserves Committee.

Comparison to SPE Definitions

The SPE/WPC/AAPG (1997 and 2000) classification was initially developed independently of the UNFC pattern (1997). SPE and UNECE joined forces in 2001 through the UNECE Ad Hoc Group of Experts on the Harmonization of Energy Reserves/Resources Terminology where there was both formal and real representation of the SPE/WPC/AAPG Oil and Gas Reserves Committee. The result was the UN Framework Classification for Energy and Mineral Resources (UNFC), developed over the 1997 UNFC pattern.

The SPE classification and the UNFC differ in appearance in that economic, field project status and geologic criteria all are explicit in the UNFC, while the SPE is implicit on the field project status and explicit or verbal on the two others. Most importantly, the structure of the SPE classification reappears in the UNFC, primarily through the shared use of the field project status criterion and through identical design for the communication of uncertainty. Figure 3 illustrates mapping of the two classifications.

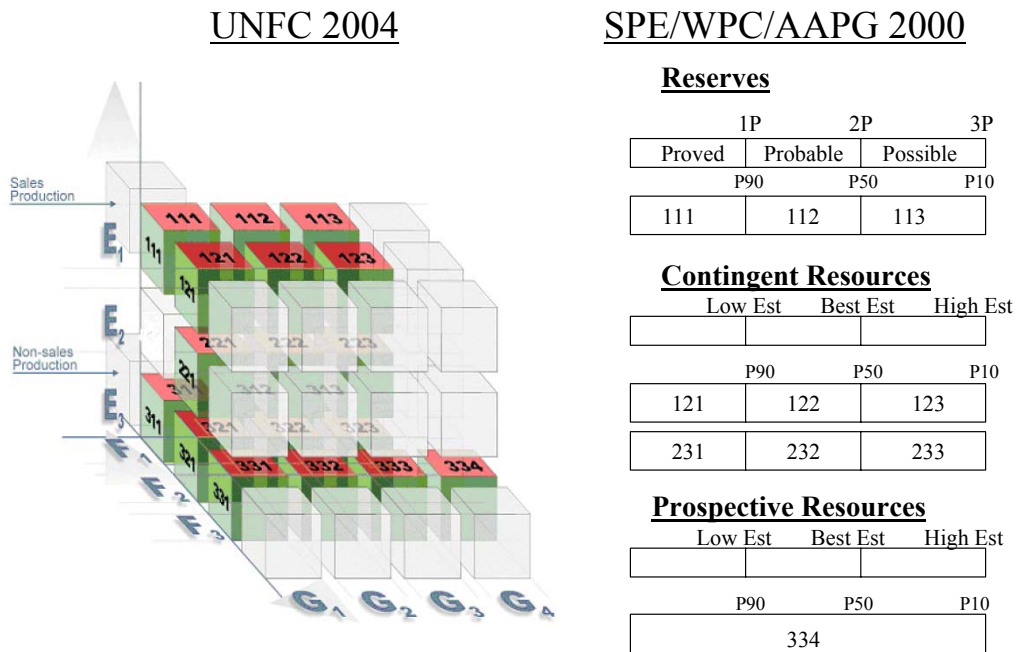


Figure 3: Comparison of UNFC and SPE/WPC/AAPG Classification

The graphical representation of the two classifications differs in that the UNFC is three-dimensional with three explicit criteria:

1. Economic
2. Field project status/Feasibility
3. Geological

This makes UNFC a more differentiated, and thus in some respects a stronger code, but also one that may appear to require complex routines in practical application. The strength of the UNFC is readily apparent when considering that it may be reduced by simply combining classes to nearly coincide with the SPE classification.

UNFC introduces the principle of a reserves reference point defining produced quantities and qualities, and thus value more precisely. This is not explicit in the SPE classification. UNFC introduces the principle of non-sales quantities both to make the material balance complete and to allow for the use of the UNFC in the management of important economical resources that are not traded commercially. In oil and gas, this will typically be fuel, flare and processing losses.

UNFC has taken the full consequence of the introduction by SPE of concept of contingent resources, and excludes such quantities from reserves. This prevents low probability future projects from influencing P90 Proved Reserves values. SPE has done the same, but in indirect ways, as there has not been an opportunity yet to revisit the reserves definitions.

UNFC has introduced the concept of justified, but not committed projects to define reserves, but excluded such projects from contributing to committed reserves. Committed reserves are foreseen as the primary basis for supplementing financial reports. This allows the identification of large recoverable quantities, such as those reported from the Middle East, as reserves and not as a high grade of contingent resources. While important from the point of view of communication, this action is of no consequence in the numerical treatment of classes in the UNFC.

Neither classification resolves the issue of ownership of reserves, and thus what quantities a stakeholder may be entitled to. When developing the UNFC, this dimension was left out on purpose. It was considered appropriate to elaborate ownership issues in other contexts, primarily that of international financial reporting standards.

An apparent weak point in both classifications (and in current SEC requirements) is the disconnect that appears when a project is committed and will go ahead, but where the geologically proved quantities alone are not the basis for the decision. In some cases, the project may not be economic on the basis of the quantities that are geologically proved or P90 alone.

One possible solution under the UNFC that should be discussed is the possibility of applying the subcategory E1.2 Exceptional economic. The initial justification for introducing this category was precisely to distinguish the production that will occur under subsidized conditions from normal profitable production. (Much of the strategic uranium production ended up in this category when the nuclear disarmament flooded the market). The scheme would be to place proved in E1.2 in those cases where the field itself (taking the probability distribution or some higher fractile than the P90 value into account) is economic and E1.1. From a distance, this would all be E1, meaning that production is committed to occur and will show up in the market.

SPE specifies proved reserves to be limited to those quantities that are commercial under current economic conditions. The above logic can therefore not be applied there.

The SPE classification maintains the same technical uncertainty classes (low/best/high estimates) from pre- to post-discovery with the only change being in field status or discovery risk. The UNFC classifies all undrilled resources as G4; any subdivision by technical uncertainty is given by non-numeric qualifications.

**Comparison of Reserves Definitions
Reserves Definitions/Proved Criteria**

	SPE/WPC (1997)	UNFC (2004)
Intended purpose	General application – not country specific.	General application – not country specific.
Qualitative description of certainty- proved	Reasonable certainty to be commercially recoverable.	G1 Quantities that are estimated to be recoverable from a known (drilled) accumulation, where sufficient technical data are available to establish the geological and reservoir production characteristics with a high level of confidence.
Qualitative description of certainty- probable	Not proved, but more likely than not to be recoverable	G2 Quantities that are estimated to be recoverable from a known (drilled) accumulation, where sufficient technical data are available to establish the geological and reservoir production characteristics with a reasonable level of confidence.
Qualitative description of certainty- possible	Less likely to be recovered than probable.	G3 Quantities that are estimated to be recoverable from a known (drilled) accumulation, where sufficient technical data are available to establish the geological and reservoir production characteristics with a low level of confidence.
Quantification of probabilities associated with estimates.	Proved \geq P90 2P \geq P50 3P \geq P10 (target at field/property level)	Low est \geq P90 Best Est \geq P50 or median or mean High Est \geq P10 (target level not defined)
Proved reserves relative to lowest known hydrocarbon (LKH)	No proved reserves below LKH as defined by well logs, core analysis or formation testing.	<i>To be defined in guidelines</i>
Proved reserve extensions on undrilled acreage	Directly offsetting DSU's and/or where reasonably certain of continuity and commercial recovery.	<i>To be defined in guidelines</i>
Proved reserves – requirements for testing	Generally require actual production or a conclusive flowing well test. In certain cases, proved reserves can be based on logs and/or cores and is analogous to producing or tested reservoirs.	Have been justified by means of a feasibility study or actual production to be technically recoverable (F1)
Classification of enhanced recovery mechanism as proved	Successful pilot or existing project in subject or analogous reservoir.	<i>(No specific criteria for enhanced recovery projects. To be defined in guidelines)</i>

**Comparison of Reserves Definitions
Development Status**

Development and production status categories	Developed producing and non-producing. Undeveloped.	Proved reserves can be categorized as developed or undeveloped.
Developed	Reserves expected to be recovered from existing wells including reserves behind pipe. Improved recovery reserves require that necessary equipment has been installed or when costs to do so are relatively minor.	Proved developed reserves are quantities of proved reserves that are estimated to be recovered from existing wells and will be processed and transported to market using facilities and infrastructure that exist at the date of the estimate.
Developed - Producing	Reserves expected to be recovered from completion intervals which are open and producing at the time of the estimate. Improved recovery reserves are considered developed producing only after the improved recovery project is operational.	F1.1 The development project is completed and the facilities are producing.
Developed – Non-Producing	Includes shut-in (open but not producing, waiting on market/pipeline connections, or mechanical problems) and behind pipe (requires additional completion or future recompletion) reserves	<i>To be defined in guidelines</i>
Undeveloped	Reserves to be recovered from additional drilling, deepening existing wells to a different reservoir or where a relatively large expenditure is required to complete an existing well or install production or transportation facilities.	See inverse of developed. Undeveloped projects are committed only when it can be demonstrated that there is intent to develop them and bring them to production.
Allocation in Multi-well Pools	Not Defined	Not defined

**Comparison of Reserves Definitions
Unproved Reserves**

Unproved Reserves	<p>Technical, contractual, economic, or regulatory uncertainties preclude reserves being classified as proved. Unproved reserves may be estimated assuming future economic conditions (and technological development) different from those prevailing at the time of the estimate.</p>	<p>Not specifically defined. Unproved reserves are total reserves minus proved reserves by implication</p> <p>In order to make full use of the precision offered by the UNFC, it is recommended not to use the broader, and somewhat ambiguous, terms, probable and possible reserves. Instead, the term slow, best and high estimate may be used stating precisely the classes of interest.</p>
Probable Reserves	<p>Includes: 1) step-out areas from proved 2) formations that appear productive on logs but lack core, definitive tests, or productive analogs 3) incremental reserves attributable to infill drilling 4) reserves attributable to improved recovery methods but lack pilot 5) adjacent fault blocks up-dip to proved 6) reserves attributable to future workover treatments or other procedures without successful analogs 7) incremental reserves in proved reservoirs through alternative interpretations.</p>	<p>1.1.2 economically and commercially recoverable (E1), have been justified by means of a feasibility study or actual production to be technically recoverable (F1) and are based on estimated geological conditions (G2).</p> <p><i>Additional deterministic criteria may be defined in guidelines</i></p>
Possible Reserves	<p>Includes: 1) areas beyond probable potentially productive based on geological interpretations 2) formations that appear petroleum bearing in cores and logs but may not be commercially productive on tests 3) reserves attributable to infill drilling that are subject to technical uncertainty 4) improved recovery reserves where no pilot is operational and reservoir characteristics may not support commercial application 5) adjacent fault blocks down-dip to proved areas.</p>	<p>1.1.3 economically and commercially recoverable (E1), have been justified by means of a feasibility study or actual production to be technically recoverable (F1) and are based on inferred geological conditions (G3).</p> <p><i>Additional deterministic criteria may be defined in guidelines</i></p>

**Comparison of Reserves Definitions
Deterministic vs Probabilistic Methods**

<p>Deterministic vs Probabilistic Methods</p>	<p>Reserve estimates may be prepared using either deterministic or probabilistic methods. Reserve numbers are generally defined within a range, not as one fixed quantity. The range may be described qualitatively by deterministic methods or quantitatively by probabilistic methods. (the probabilistic limits (e.g. Proved => P90) can only be specifically applied when the probabilistic method is applied)</p>	<p>Quantities in classes may be represented by one or more discrete estimates or by a probability distribution that reflects a range of uncertainty in the estimate of that quantity.</p> <p>Deterministic estimates shall reflect the same principles and approximately the same probabilities as would be associated with estimates derived from a probability distribution</p>
<p>Deterministic Method</p>	<p>Deterministic estimates do not address uncertainties in terms of probabilities; they require that volumes be described in terms of discrete estimates using defined criteria (e.g. LKH) including qualitative certainty.</p>	<p>When a quantity is represented by discrete estimates there shall be quoted as a minimum, a low, a best and a high estimate.</p>
<p>Probabilistic Method</p>	<p>If probabilistic methods are used the defined quantitative limits (e.g. Proved => P90) apply at the entity level (<i>before aggregation</i>).</p>	<p>When a quantity is represented by a probability distribution, a low, a best and a high estimate shall be quoted (see "Quantification of probabilities associated with estimates.") <i>Target level not defined.</i></p>
<p>Application of probability criteria and aggregation.</p>	<p>Numerical probabilities are only applied in probabilistic method and probability limits apply at the entity level. Probabilistic aggregation allowed to the field level only, then arithmetic summation to reporting level. Dependencies between entities and their distributions must be modeled in probabilistic aggregation.</p>	<p><i>Not addressed</i></p>

**Comparison of Reserves Definitions
Special Issues**

Treatment of Unconventional Hydrocarbons	Classification applies to all petroleum deposits.	<i>(Classification applies to all petroleum deposits?) To be addressed in guidelines</i>
Fuel Gas Reserves Status	Issuers have the option to include gas volumes consumed in operations in production and reserves if an appropriate expense is allocated.	Included in non-sales quantities produced but not sold (E3.1). <i>(Inclusion in reserves disclosures is based on regulatory guidelines.)</i>
Natural Gas Injection	To include injection gas as reserves, the volumes would have to meet the normal criteria (economic when available for production, existence of a firm market, available pipeline or other export option, part of established development plan).	Not Defined
Gas Sales Volumes	Reported gas reserves reflect the condition of the gas at the point of sale. If sold as wet gas, associate liquids reserves are not reported separately. If sold with a non-hydrocarbon gas content, the full volume as sold is included in reserves. The price received will reflect quality.	<i>Not addressed</i>
Infill Drilling	Reserves assigned to infill drilling with low uncertainty are Probable, infill areas with technical uncertainty are possible <i>(acceleration issue not addressed)</i>	<i>Not addressed.</i>
Compression	Not Defined	Not defined

**Comparison of Reserves Definitions
Special Issues**

Net Profits Interests	Not defined	Not defined
Production-Sharing Contracts	Under a PSC the host government retains ownership, however the contractor receives a stipulated share of production remaining after cost recovery. Reported reserves are based on the economic interest held subject to the specific terms and time frame of the agreement. Being tied to economic interest, reserves must be re-calculated annually based on product price and operating costs and may vary considerably. Under SPE definitions, an average price over the term of the contact may be used to define reserves.	Not defined
Contract Extensions	Where agreements allow extension through negotiation of renewed contract terms, exercise of options to extend or other means additional reserves (of various categories) or contingent resources may be assigned depending the level of certainty and commercial viability associated with the contract extension.	Not defined
Product categorization	Not Defined	Not defined

**Comparison of Reserves Definitions
Economics/Commerciality**

Commerciality	In order to assign reserves of any category, a project needs to be defined in terms of a commercially viable development plan and there should be evidence of firm intent to proceed.	Quantities in classes may be considered commercial if the reporting entity has the intention of developing and producing them and such intention is based upon: <ul style="list-style-type: none"> • a reasonable assessment of future production economics being satisfactory • a reasonable expectation of available market • evidence that production and transportation facilities can be made available • evidence that legal, contractual, environmental and other concerns will allow the recovery project to be realized.
Commitment	If the degree of commitment is not such that an accumulation is expected to be developed and placed on production within a reasonable time frame (e.g. 5 years), the estimated recoverable volumes should be classified as contingent resources (not reserves).	Development projects for recovery of a commodity are committed when firm commitments have been made for the expenditures and activities needed to bring a discovered accumulation to the production stage (<i>no time frame defined</i>).
Economics	The underlying economic evaluation based on perception (best estimate) of future costs and prices together with best-estimate production profile expected to equate to a proved plus probable scenario. To limit downside exposure the “low case” scenario should be at least “break-even” which is consistent with the requirement that proved reserves is viable under “current economic conditions”.	E.1 Production is justified under the technological, economic, environmental and other relevant commercial conditions, realistically assumed or specified at the time of the estimation. E1.1 Normal Economic – Production is justified under normal conditions. Assumptions regarding future economic conditions may be constrained by regulation. E1.2 Exceptional Economic quantities are at present not economic to produce under normal economic conditions– their production is made possible through government subsidies and/or other considerations
Development Plan Approvals	While some companies choose not to assign any proved reserves until the development plan has received all relevant formal approvals, SPE definitions require only a reasonable expectation that the necessary facilities to process and transport those reserves will be installed.	F1.3 Development plans have demonstrated production of the reported quantities to be justified but commitments to carry out the development works have not yet been made (<i>without an approved plan of development, legal/regulatory conditions for commerciality are not met and without commitment, no reserves are assigned</i>).

**Comparison of Reserves Definitions
Economics/Disclosure Guidelines**

Prices & Costs for defining reserves "economic limit".	<p>Proved: Existing economic conditions (year-end or appropriate period* average) (*SPE recommends prior 12 month period).</p> <p>Unproved: reserves may be based on forecast prices and costs.</p>	<p>Proved reserves are a specifically defined subset of Committed Reserves. Reasonably certain to be commercially recoverable under current economic conditions, operating methods and government regulations.</p> <p>Total Committed Reserves E1.F1 E1 – see economics F1 – Production is justified under technological, economic, environmental and other relevant commercial conditions, realistically assumed or specified at the time of estimation.</p>
Abandonment Costs	Economic limit calculated including abandonment and reclamation costs.	Commercial value of quantities includes estimated project abandonment costs Economic limit calculated including abandonment and reclamation costs.
Net Present Value of Future Net Revenue (FNR).	Not defined	<p>The commercial value of the quantities would generally be the present value of future cash flows obtainable as a result of production of the recoverable quantities.</p> <p>(See Note 1 for calculation guidelines)</p>
Audit Requirements	<p><i>No requirement for use of external evaluators.</i> SPE "Standards Pertaining to the Estimating and Auditing of Oil and Gas Information" recommends standards for training, experience levels, and sets independence criteria for evaluators and auditors whether internal or external.</p>	<p>The studies referred to in the UNFC must be under taken by a person(s) with the appropriate qualifications to assess resources/reserves of the type of commodity in question. The qualifications and experience required will vary from country to country. In certain circumstances licensing may be required. <i>(No requirement for use of external evaluators.)</i></p>
Gross vs Net Reserves	See Note 1	See Note 1

Note 1:

UNFC Regards Project Value Calculations

The calculation of commercial value shall reflect:

1. The expected quantities of production whose value is measured.
2. The estimated costs associated with the project to develop, recover and produce the quantities of production at its reference point, including environmental and abandonment costs charged to the project based on costs already incurred and the reporter's view of the costs expected to apply in future periods.
3. The estimated revenues from the quantities of production based on the reporter's view of the prices expected to apply to the respective commodities in future periods. Such prices are to be based on reliable data, the basis of which and reason why the reporter considers such price assumptions to be appropriate will be disclosed. Examples of such reliable data are agreed contract prices, the published forward price curve for the appropriate commodity, an average of a group of analysts' forecast prices and an average of historic achieved prices if this is considered to be a good estimate of the applicable future price.
4. The portion of costs and revenues accruing to the reporter.
5. Future production and revenue related taxes and royalties expected to be paid by the reporter.
6. The application of discount factors that reflect a specific risk or uncertainty associated with the estimated cash flows. Where risk is reflected in the discount rate, estimates of future revenues and costs should be discounted at a rate appropriate to that cash stream

SPE Regards Royalty

Within the U.S., royalty volumes are strictly omitted from reported reserves (*that is, they are reported on a net basis*). In some cases outside the U.S., where royalty is paid in cash and the cash flow from the royalty is reflected in the company's accounts, the corresponding royalty may be included in reserves.