

Estimating and Auditing Standards for Reserves

At its June 2001 meeting, the SPE Board of Directors endorsed recommendations of the Society's Oil and Gas Reserves Committee for revisions to the 1977 Reserves document. The changes make the SPE voluntary standard compatible with the 1997 joint SPE/World Petroleum Council (formerly World Petroleum Congresses) definitions for petroleum reserves (resources).

Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserve Information

Article I - The Basis and Purpose of Developing Standards Pertaining to the Estimating and Auditing of Reserve Information [1]

1.1 The Nature and Purpose of Estimating and Auditing Reserve Information

Estimates of Reserve Information are made by or for Entities as a part of their normal business practices. Such Reserve Information typically may include, among other things, estimates of (i) the reserve quantities, (ii) the future producing rates from such reserves, (iii) the future net revenue from such reserves and (iv) the present value of such future net revenue. The exact type and extent of Reserve Information must necessarily take into account the purpose for which such Reserve Information is being prepared and, correspondingly, statutory and regulatory provisions, if any, that are applicable to such intended use of the Reserve Information.

1.2 Estimating and Auditing Reserve Information in Accordance With Generally Accepted Engineering and Evaluation Principles

The estimating and auditing of Reserve Information is predicated upon certain historically developed principles of petroleum engineering and evaluation, which are in turn based on principles of physical science, mathematics and economics. Although these generally accepted petroleum engineering and evaluation principles are predicated on established scientific concepts, the application of such principles involves extensive judgments and is subject to changes in (i) existing knowledge and technology, (ii) economic conditions, (iii) applicable statutory and regulatory provisions and (iv) the purposes for which the Reserve information is to be used.

1.3 The Inherently Imprecise Nature of Reserve Information

The reliability of Reserve Information is considerably affected by several factors. Initially, it should be noted that Reserve Information is imprecise due to the inherent uncertainties in, and the limited nature of, the database upon which the estimating and auditing of Reserve Information is predicated. Moreover, the methods and data used in estimating Reserve Information are often necessarily indirect or analogical in character rather than direct or deductive. Furthermore, the persons estimating and auditing Reserve Information are required, in applying generally accepted petroleum engineering and evaluation principles, to make numerous judgments based upon their educational background, professional training and professional experience. The extent and significance of the judgments to be made are, in themselves, sufficient to render Reserve Information inherently imprecise.

1.4 The Need for Standards Governing the Estimating and Auditing of Reserve Information

The Society of Petroleum Engineers (the "Society") has determined that the Society should adopt these Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserve Information (the "Standards"). The adoption of these Standards by the Society fulfills at least three useful objectives.

First, although some users of Reserve Information are cognizant of the general principles that are applied to databases in determining Reserve Information, the judgments required in estimating and auditing Reserve Information and the inherently imprecise nature of Reserve Information, it has become increasingly apparent in recent years that many users of Reserve Information do not fully understand such matters. The adoption, publication and distribution of these Standards should enable users of Reserve Information to understand these matters more fully and therefore avoid placing undue reliance on Reserve Information.

Secondly, the wider dissemination of Reserve Information through public financial reporting, such as that required by various governmental authorities, makes it imperative that the users of Reserve Information have a general understanding of the methods of, and limitations on, estimating and auditing Reserve Information.

Thirdly, as Reserve Information proliferates in terms of the types of information available and the broader dissemination thereof, it becomes increasingly important that Reserve Information be estimated and audited on a consistent basis. Compliance with these Standards is a method of facilitating evaluation and comparisons of Reserve Information by the users thereof.

In order to accomplish the three above-discussed objectives, the Society has included in these Standards (i) definitions of selected terms pertaining to the estimation and evaluation of Reserve Information, (ii) qualifications for persons estimating and auditing Reserve Information, (iii) standards of independence and objectivity for such persons, (iv) standards for estimating reserves and other Reserve Information and (v) standards for auditing reserves and other Reserve Information. Although these Standards are predicated on generally accepted petroleum engineering and evaluation principles, it may in the future become necessary, for the reasons set forth in Section 1.2, to clarify or amend certain of these Standards. Consequently, the Society may, in appropriate future circumstances, determine to amend these Standards or publish clarifying statements.

Article II - Definitions of Selected Terms

2.1 Applicability of Definitions

In preparing a report or opinion, persons estimating and auditing Reserve Information shall ascribe, to reserves and other significant terms used therein, the definitions promulgated by the Society or such other definitions as he or she may reasonably consider appropriate in accordance with generally accepted petroleum engineering and evaluation principles; provided, however, that (i) such report or opinion should define, or make reference to a definition of, each significant term that is used therein and (ii) the definitions used in any report or opinion must be consistent with statutory and regulatory provisions, if any, that apply to such report or opinion in accordance with its intended use.

2.2 Defined Terms

The definitions set forth in this Section are applicable for all purposes of these Standards:

(a) Entity. An Entity is a corporation, joint venture, partnership, trust, individual or other person engaged in (i) the exploration for, or production of, oil and gas; (ii) the acquisition of properties or interests therein for the purpose of conducting such exploration or production; or (iii) the

ownership of properties or interests therein with respect to which such exploration or production is being, or will be, conducted.

(b) Reserve Estimator. A Reserve Estimator is a person who is designated to be in responsible charge for estimating and evaluating reserves and other Reserve Information. A Reserve Estimator either may personally make the estimates and evaluations of Reserve Information or may supervise and approve the estimation and evaluation thereof by others.

(c) Reserve Auditor. A Reserve Auditor is a person who is designated to be in responsible charge for the conduct of an audit with respect to Reserve Information estimated by others. A Reserve Auditor either may personally conduct an audit of Reserve Information or may supervise and approve the conduct of an audit thereof by others.

(d) Reserve Information. Reserve Information consists of various estimates pertaining to the extent and value of oil and gas properties. Reserve Information may, but will not necessarily, include estimates of (i) reserves, (ii) the future production rates from such reserves, (iii) the future net revenue from such reserves and (iv) the present value of such future net revenue.

Article III - Professional Qualifications of Reserve Estimators and Reserve Auditors

3.1 The Importance of Professionally Qualified Reserve Estimators and Reserve Auditors

Reserve Information is prepared and audited, respectively, by Reserve Estimators and Reserve Auditors, who are often assisted by other professionals and by paraprofessionals and clerical personnel. Reserve Estimators and Reserve Auditors may be (i) employees of an Entity itself or (ii) stockholders, proprietors, partners or employees of an independent firm of petroleum consultants with which an arrangement has been made for the estimating or auditing of Reserve Information. Irrespective of the nature of their employment, however, Reserve Estimators and Reserve Auditors must (i) examine the database necessary to estimate or audit Reserve Information; (ii) perform such tests, and consider such matters, as may be necessary to evaluate the sufficiency of the database; and (iii) make such calculations and estimations, and apply such tests and standards, as may be necessary to estimate or audit reserves and other Reserve Information. For the reasons discussed in Section 1.3, the proper determination of these matters is highly dependent upon the numerous judgments Reserve Estimators and Reserve Auditors are required to make based upon their educational background, professional training and professional experience. Consequently, in order to assure that Reserve Information will be as reliable as possible given the limitations inherent in the estimating and auditing process, it is essential that those in responsible charge for estimating and auditing Reserve Information have adequate professional qualifications such as those set forth in this Article III.

3.2 Professional Qualifications of Reserve Estimators

A Reserve Estimator shall be considered professionally qualified in such capacity if he or she has sufficient educational background, professional training and professional experience to enable him or her to exercise prudent professional judgment and to be in responsible charge in connection with the estimating of reserves and other Reserve Information. The determination of whether a Reserve Estimator is professionally qualified should be made on an individual-by-individual basis. A Reserve Estimator would normally be considered to be qualified if he or she (i) has a minimum of three years' practical experience in petroleum engineering or petroleum production geology, with at least one year of such experience being in the estimation and evaluation of Reserve Information; and (ii) either (A) has obtained, from a college or university of recognized stature, a bachelor's or advanced degree in petroleum engineering, geology or other discipline of engineering or physical science or (B) has received, and is maintaining in

good standing, a registered or certified professional engineer's license or a registered or certified professional geologist's license, or the equivalent thereof, from an appropriate governmental authority or professional organization.

3.3 Professional Qualifications of Reserve Auditors

A Reserve Auditor shall be considered professionally qualified in such capacity if he or she has sufficient educational background, professional training and professional experience to enable him or her to exercise prudent professional judgment while acting in responsible charge for the conduct of an audit of Reserve Information estimated by others. The determination of whether a Reserve Auditor is professionally qualified should be made on an individual-by-individual basis. A Reserve Auditor would normally be considered to be qualified if he or she (i) has a minimum of ten years' practical experience in petroleum engineering or petroleum production geology, with at least five years of such experience being in the estimation and evaluation of Reserve Information; and (ii) either (A) has obtained, from a college or university of recognized stature, a bachelor's or advanced degree in petroleum engineering, geology or other discipline of engineering or physical science or (B) has received, and is maintaining in good standing, a registered or certified professional engineer's license or a registered or certified professional geologist's license, or the equivalent thereof, from an appropriate governmental authority or professional organization.

Article IV - Standards of Independence, Objectivity and Confidentiality for Reserve Estimators and Reserve Auditors

4.1 The Importance of Independent or Objective Reserve Estimators and Reserve Auditors

In order that users of Reserve Information may be assured that the Reserve Information was estimated or audited in an unbiased and objective manner, it is important that Reserve Estimators and Reserve Auditors maintain, respectively, the levels of independence and objectivity set forth in this Article IV. The determination of the independence and objectivity of Reserve Estimators and Reserve Auditors should be made on a case-by-case basis. To facilitate such determination, the Society has adopted (i) standards of independence for consulting Reserve Estimators and consulting Reserve Auditors and (ii) standards of objectivity for Reserve Auditors internally employed by Entities to which the Reserve Information relates. To the extent that the applicable standards of independence and objectivity set forth in this Article IV are not met by Reserve Estimators and Reserve Auditors in estimating and auditing Reserve Information, such lack of conformity with this Article IV shall be set forth in any report or opinion relating to Reserve Information which purports to have been estimated or audited in accordance with these Standards.

4.2 Requirement of Independence for Consulting Reserve Estimators and Consulting Reserve Auditors

Consulting Reserve Estimators and consulting Reserve Auditors, or any firm of petroleum consultants of which such individuals are stockholders, proprietors, partners or employees, should be independent from any Entity with respect to which such Reserve Estimators, Reserve Auditors or consulting firm estimate or audit Reserve Information which purports to have been estimated or audited in accordance with these Standards.

4.3 Standards of Independence for Consulting Reserve Estimators and Consulting Reserve Auditors[2]

Consulting Reserve Estimators and consulting Reserve Auditors, and any firm of petroleum consultants of which such individuals are stockholders, proprietors, partners or employees, would not normally be considered independent with respect to an Entity if, during the term of their professional engagement, such Reserve Estimators, Reserve Auditors or consulting firm:

- (a) Investments. Either owned or acquired, or were committed to acquire, directly or indirectly, any material financial interest in (i) such Entity or any corporation or other person affiliated therewith or (ii) any property with respect to which Reserve Information is to be estimated or audited;
- (b) Joint Business Venture. Either owned or acquired, or were committed to acquire, directly or indirectly, any material joint business investment with such Entity or any officer, director, principal stockholder or other person affiliated therewith;
- (c) Borrowings. Were indebted to such Entity or any officer, director, principal stockholder or other person affiliated therewith; provided, however, that retainers, advances against work-in-progress and trade accounts payable arising from the purchase of goods and services in the ordinary course of business shall not constitute indebtedness within the meaning of this Section 4.3(c);
- (d) Guarantees of Borrowings. Were indebted to any individual, corporation or other person under circumstances where the payment of such indebtedness was guaranteed by such Entity or any officer, director, principal stockholder or other person affiliated therewith;
- (e) Loans to Clients. Extended credit to (i) such Entity or any officer, director, principal stockholder or other person affiliated therewith or (ii) any person having a material interest in any property with respect to which Reserve Information was estimated or audited; provided, however, that trade accounts receivable arising in the ordinary course of business from the performance of petroleum engineering and related services shall not constitute the extension of credit within the meaning of this Section 4.3(e);
- (f) Guarantees for Clients. Guaranteed any indebtedness (i) owed by such Entity or any officer, director, principal stockholder or other person affiliated therewith or (ii) payable to any individual, corporation, entity or other person having a material interest in the Reserve Information pertaining to such Entity;
- (g) Purchases and Sales of Assets. Purchased any material asset from, or sold any material asset to, such Entity or any officer, director, principal stockholder or other person affiliated therewith;
- (h) Certain Relationships With Client. Were directly or indirectly connected with such Entity as a promoter, underwriter, officer, director or principal stockholder, or in any capacity equivalent thereto, or were otherwise not separate and independent from the operating and investment decision-making process of such Entity;
- (i) Trusts and Estates. Were trustees of any trust, or executors or administrators of any estate, if such trust or estate had any direct or indirect interest material to it in such Entity or in any property with respect to which Reserve Information was estimated or audited; or
- (j) Contingent Fee. Were engaged by such Entity to estimate or audit Reserve Information pursuant to any agreement, arrangement or understanding whereby the remuneration or fee

paid by such Entity was contingent upon, or related to, the results or conclusions reached in estimating or auditing such Reserve Information.

The independence of consulting Reserve Estimators and consulting Reserve Auditors, and the independence of any firm of petroleum consultants of which such individuals are stockholders, proprietors, partners or employees, shall not be considered impaired merely because other petroleum engineering and related services were performed (i) for such Entity or any officer, director, principal stockholder or other person affiliated therewith or (ii) in regard to any property with respect to which Reserve Information was estimated or audited; provided, however, such other services must have been of a type normally rendered by the petroleum engineering profession.

4.4 Requirement of Objectivity for Reserve Auditors Internally Employed by Entities

Reserve Auditors who are internally employed by an Entity should be objective with respect to such Entity if such Reserve Auditors audit Reserve Information relating to such Entity which purports to have been estimated or audited in accordance with these Standards.

4.5 Standards of Objectivity for Reserve Auditors Internally Employed by Entities

Reserve Auditors internally employed by an Entity would normally be considered to be in a position of objectivity with respect to such Entity if, during the time period in which Reserve Information was audited, such Reserve Auditors

(a) Accountability to Management. Were assigned to a staff group which was (i) accountable to upper level management of such Entity and (ii) separate and independent from the operating and investment decision-making process of such Entity; and

(b) Freedom to Report Irregularities. Were granted complete and unrestricted freedom to report, to the principal executives and board of directors of such Entity, any substantive or procedural irregularities of which such Reserve Auditors became aware during their audit of Reserve Information pertaining to such Entity.

4.6 Requirement of Confidentiality

Reserve Estimators and Reserve Auditors, and any firm of petroleum consultants of which such individuals are stockholders, proprietors, partners or employees, should retain in strictest confidence Reserve Information and other data and information furnished by, or pertaining to, an Entity and such Reserve Information, data and information should not be disclosed to others without the prior consent of such Entity.

Article V - Standards for Estimating Reserves and Other Reserve Information

5.1 General Considerations in Estimating Reserve Information

Reserve Information may be estimated through the use of generally accepted geologic and engineering methods that are consistent with both these Standards and any statutory and regulatory provisions that are applicable to such Reserve Information in accordance with its intended use. In estimating Reserve Information for a property or group of properties, Reserve Estimators will determine the geologic and engineering methods to be used in estimating Reserve Information by considering (i) the sufficiency and reliability of the database; (ii) the stage of development; (iii) the performance history; (iv) their experience with respect to such property or group of properties, and with respect to similar properties; and (v) the significance of such property or group of properties to the aggregate oil and gas properties and interests being estimated or evaluated. The report as to Reserve Information should set forth information

regarding the manner in which, and the assumptions pursuant to which, such report was prepared. Such disclosure should include, where appropriate, definitions of the significant terms used in such report, the geologic and engineering methods and measurement base used in preparing the Reserve Information and the source of the data used with regard to ownership interests, oil and gas production and other performance data, costs of operation and development, product prices, and agreements relating to current and future operations and sales of production.

5.2 Adequacy of Database in Estimating Reserve Information

The sufficiency and reliability of the database is of primary importance in the estimation of reserves and other Reserve Information. The type and extent of the data required will necessarily vary in accordance with the methods employed to estimate reserves and other Reserve Information. In this regard, information must be available with respect to each property or group of properties as to operating interests, expense interests and revenue interests and future changes in any of such interests that, based on current circumstances, are expected to occur. Additionally, if future net revenue from reserves, or the present value of such future net revenue, is to be estimated, the database should include, with respect to each property or group of properties, costs of operation and development, if available, product prices and a description of any agreements relating to current and future operations and sales of production.

5.3 Estimating Reserves

The acceptable methods for estimating reserves include (i) the volumetric method; (ii) evaluation of the performance history, which evaluation may include an analysis and projection of producing ranges, reservoir pressures, oil-water ratios, gas-oil ratios and gas-liquid ratios; (iii) development of a mathematical model through consideration of material balance and computer simulation techniques; (iv) analogy to other reservoirs if geographic location, formation characteristics or similar factors render such analogy appropriate. In estimating reserves, Reserve Estimators should utilize the particular methods, and the number of methods, which in their professional judgment are most appropriate given (i) the geographic location, formation characteristics and nature of the property or group of properties with respect to which reserves are being estimated; (ii) the amount and quality of available data; and (iii) the significance of such property or group of properties in relation to the oil and gas properties with respect to which reserves are being estimated.

5.4 Estimating Reserves by the Volumetric Method

Estimating reserves in accordance with the volumetric method involves estimation of oil in place based upon review and analysis of such documents and information as (i) ownership and development maps; (ii) geologic maps; (iii) electric logs and formation tests; (iv) relevant reservoir and core data; and (v) information regarding the completion of oil and gas wells and any production performance thereof. An appropriate estimated recovery efficiency is applied to the resulting oil in place figure in order to derive estimated reserves.

5.5 Estimating Reserves by Analyzing Performance Data

For reservoirs with respect to which performance has disclosed reliable production trends, reserves may be estimated by analysis of performance histories and projections of such trends. These estimates may be primarily predicated on an analysis of the rates of decline in production and on appropriate consideration of other performance parameters such as reservoir pressures, oil-water ratios, gas-oil ratios and gas-liquid ratios.

5.6 Estimating Reserves by Using Mathematical Models

Reserves and future production performance can be estimated through a combination of detailed geologic and reservoir engineering studies and mathematical or computer simulation models. The validity of the mathematical simulation models is enhanced by the degree to which the calculated history matches the performance history. Where performance history is unavailable, special consideration should be given to determining the sensitivity of the calculated ultimate recoveries to the data that is the most uncertain. After making such sensitivity determination, the ultimate recovery should be based on computed results using a combination of input parameters appropriate for the class of reserves assigned.

5.7 Estimating Reserves by Analogy to Comparable Reservoirs

If performance trends have not been established with respect to oil and gas production, future production rates and reserves may be estimated by analogy to reservoirs in the same geographic area having similar characteristics and established performance trends.

5.8 Classification of Reserves

Reserves must be classified according to the level of certainty that they will be recovered. To guide the classification of reserves, Reserves Definitions have been promulgated by various regulatory bodies and professional organizations throughout the world. Most sets of Reserves Definitions allow for different classes of reserves depending on the level of certainty associated with the reserves estimate. The highest category of reserves in many systems are “proved reserves,” which require the highest degree of confidence. Lower classes of reserves such as “probable” or “possible” imply decreasing standards of certainty. When presenting a set of reserve quantities, the Reserve Estimator should always identify the set of Reserves Definitions under which those reserves were determined.

Different grades of reserves are used for different purposes. In general, proved reserves are used for financial reporting and lending, where the need for certainty is the greatest. However in order to make intelligent business decisions in activities such as prioritization of capital spending and property acquisitions, it is also important to recognize and quantify the amount of probable and possible reserves.

The SPE/WPC (1997) definitions contains a general requirement that proved reserves have a “reasonable certainty” of being recovered. Other, more specific, criteria must also be met for reserves to be classified as proved. The definition for probable reserves is less stringent, requiring that a general test of “more likely than not” be satisfied. Possible reserves are those unproved reserves which analysis of geological and engineering data suggests are less likely to be recoverable than probable reserves.

5.9 Deterministic and Probabilistic Methods of Estimating Reserves

Under the SPE/WPC (1997) definitions, reserve estimates may be prepared using either deterministic or probabilistic methods. With the deterministic method, the Reserve Estimator selects a single value for each parameter to be used in the calculation of reserves. The discrete value for each parameter is selected based on the estimator’s opinion of the value that is most appropriate for the corresponding reserves classification.

With the probabilistic method, the full range of possible values is described for each parameter. A mathematical technique such as Monte Carlo Simulation is then employed to perform a large number of random, repetitive calculations to generate a range of possible outcomes for the reserves, and their associated probability of occurrence.

In principal, the two methods employ comparable calculation techniques. Conceptually, a deterministic estimate is a single value taken from a range of possible reserve values that can be expressed by a probabilistic analysis.

For proved reserves, the SPE/WPC (1997) Definitions specify that there should be at least a 90 percent probability that the quantities actually recovered will equal or exceed the estimate if probabilistic methods are used. Similarly, the definitions specify that there should be at least a 50 percent probability that the quantities actually recovered will equal or exceed the sum of estimated proved plus probable reserves. And finally, there should be at least a 10 percent probability that the quantities actually recovered will equal or exceed the sum of estimated proved plus probable plus possible reserves.

It should be noted that the probability distribution of reserve values associated with the aggregation of a number of individual entities may be different from the arithmetic sum of the probability distributions for those entities. As the number of entities increases, the spread between the tails of the aggregated probability distribution decreases with respect to the spread observed for the arithmetic sum. In general, however, the arithmetic sum of a set of mean estimates will equal the mean of a probabilistic sum of such estimates.

5.10 Estimated Future Rates of Production

Future rates of oil and gas production may be estimated by extrapolating production trends where such have been established. If production trends have not been established, future rates of production may be estimated by analogy to the respective rates of production of reservoirs in the same geographic area having similar geologic features, reservoir rock and fluid characteristics. If there is not available either (i) production trends from the property or group of properties with respect to which reserves are being estimated or (ii) rates of production from similar reservoirs, the estimation of future rates of production may be predicated on an assumed future decline rate that takes into proper consideration the cumulative oil and gas production that is estimated to occur prior to the predicted decline in such production in relation to the estimated ultimate production. Reservoir simulation is also an accepted method of estimating future rates of production. Irrespective of the method used, however, proper consideration should be given to (i) the producing capacities of the wells; (ii) the number of wells to be drilled in the future, together with the proposed times when such are to be drilled and the structural positions of such wells; (iii) the energy inherent in, or introduced to, the reservoir; (iv) the estimated ultimate recovery; (v) future remedial work to be performed; (vi) the scheduling of future well abandonments; (vii) normal downtime which may be anticipated; and (viii) artificial restriction of future production rates that is attributable to statutory and regulatory provisions, purchaser proration and other factors.

5.11 Estimating Other Reserve Information

A Reserve Estimator often estimates Reserve Information other than reserves and future rates of production in order to make his or her report more useful. Reserves net to the interests appraised are estimated using the Entity's net interest in the property or group of properties, or in the production therefrom, with respect to which reserves were estimated. The nature of the net interest of the Entity may be established or affected by any number of arrangements which the Reserve Estimator must take into account. Estimated future revenues are calculated from the estimated future rates of production by applying the appropriate sales prices furnished by the Entity or by using such other pricing levels as may be required by statutory and regulatory provisions that are applicable to such report in accordance with its intended use. Where appropriate, the Reserve Estimator deducts from such future revenues items such as (i) any existing production or severance taxes, (ii) taxes levied against property or production, (iii) estimates of future operating costs, (iv) estimates of any future development, equipment or

other significant capital expenditures required for the production of the reserves and (v) net costs of abandonment. Such deductions normally include various overhead and management charges. For some purposes, it is desirable to subtract income taxes and other governmental levies in estimating future net revenues.

In estimating future net revenues, the Reserve Estimator should consider, where appropriate, any likely changes (i) from historical operating costs, (ii) from current estimates of future capital expenditures and (iii) in other factors which may affect estimated limits of economic production.

Article VI - Standards for Auditing Reserves and Other Reserve Information

6.1 The Concept of Auditing Reserves and Other Reserve Information

An audit is an examination of Reserve Information that is conducted for the purpose of expressing an opinion as to whether such Reserve Information, in the aggregate, is reasonable and has been estimated and presented in conformity with generally accepted petroleum engineering and evaluation principles.

As discussed in Section 1.3, the estimation of reserves and other Reserve Information is an imprecise science due to the many unknown geologic and reservoir factors that can only be estimated through sampling techniques. Since reserves are therefore only estimates, such cannot be audited for the purpose of verifying exactness. Instead, Reserve Information is audited for the purpose of reviewing in sufficient detail the policies, procedures and methods used by an Entity in estimating its Reserve Information so that the Reserve Auditors may express an opinion as to whether, in the aggregate, the Reserve Information furnished by such Entity is reasonable and has been estimated and presented in conformity with generally accepted petroleum engineering and evaluation principles.

The methods and procedures used by an Entity, and the Reserve Information it furnishes, must be reviewed in sufficient detail to permit the Reserve Auditor, in his or her professional judgment, to express an opinion as to the reasonableness of such Entity's Reserve Information. In some cases the auditing procedure may require independent estimates of Reserve Information for particular properties. The desirability of such re-estimation will be determined by the Reserve Auditor exercising his or her professional judgment in arriving at an opinion as to the reasonableness of the Entity's Reserve Information.

6.2 Limitations on Responsibility of Reserve Auditors

Since the primary responsibility for estimating and presenting Reserve Information pertaining to an Entity is with the management of such Entity, the responsibility of Reserve Auditors is necessarily limited to any opinion they express with respect to such Reserve Information. In discharging such responsibility, Reserve Auditors may accept, generally without independent verification, information and data furnished by the Entity with respect to ownership interests, oil and gas production, historical costs of operation and development, product prices, agreements relating to current and future operations and sales of production, and other specified matters. If during the course of the audit, however, questions arise as to the accuracy or sufficiency of any information or data furnished by the Entity, the Reserve Auditor should not rely on such information or data unless such questions are resolved or the information or data is independently verified. If Reserve Information is used for financial accounting purposes, certain basic data would ordinarily be tested by an Entity's independent public accountants in connection with their examination of the Entity's financial statements. Such basic data would include information such as the property interests owned by the Entity, historical production data and the prices, costs and discount factors used in valuations of reserves. Reserve Auditors

should, however, review estimates of major expenditures for development and equipment and any major differences between historical operating costs and estimated future operating costs.

6.3 Understanding Among an Entity, Its Independent Public Accountants and the Reserve Auditors

An understanding should exist among an Entity, its independent public accountants and the Reserve Auditors with respect to the nature of the work to be performed by the Reserve Auditors. Irrespective of whether the Reserve Auditors are consultants or internally employed by the Entity, the understanding between the Entity and the Reserve Auditors should include at least the following:

(a) Availability of Reserve Information. The Entity will provide the Reserve Auditors with (i) all Reserve Information prepared by such Entity, (ii) access to all basic data and documentation pertaining to the oil and gas properties of such Entity, and (iii) access to all personnel of such Entity who might have information relevant to the audit of such Reserve Information.

(b) Performance of Audit. The Reserve Auditors will (i) study and evaluate the methods and procedures used by the Entity in estimating and documenting its Reserve Information; (ii) review the reserve definitions and classifications used by such Entity; (iii) test and evaluate the Reserve Information of such Entity to the extent considered necessary by the Reserve Auditors; and (iv) express an opinion as to the reasonableness, in the aggregate, of such Entity's Reserve Information.

(c) Availability of Audit Report to Independent Public Accountants. The Reserve Auditors will (i) permit their audit report to be provided to the independent public accountants of the Entity for use in their examination of its financial statements and (ii) be available to discuss their audit report with such independent public accountants.

(d) Coordination Between Reserve Auditors and Independent Public Accountants. The Reserve Auditors and the Entity's independent public accountants will coordinate their efforts and agree on the records and data of the Entity to be reviewed by each.

In the case of an audit to be conducted by consulting Reserve Auditors, it is preferable that such understanding be documented, such as through an engagement letter between the Entity and the consulting Reserve Auditors.

6.4 Procedures for Auditing Reserve Information

Irrespective of whether the Reserve Information pertaining to an Entity is being audited by consulting Reserve Auditors or Reserve Auditors internally employed by such Entity, the audit should be conducted in accordance with the following procedures:

(a) Proper Planning and Supervision. The audit should be adequately planned and assistants, if any, should be properly supervised.

(b) Early Appointment of Reserve Auditors. Where appropriate, early appointment of Reserve Auditors is advantageous to both the Entity and the Reserve Auditors. Early appointment enables the Reserve Auditors to plan their work so that it may be done expeditiously and to determine the extent to which such can be completed prior to the balance sheet date. Preliminary work by the Reserve Auditors benefits the Entity by facilitating the efficient and expeditious completion of the audit of such Entity's Reserve Information.

(c) Disclosure of the possibility of a Qualified Audit Opinion. Before accepting an engagement, Reserve Auditors should ascertain whether circumstances are likely to permit an unqualified

opinion with respect to an Entity's Reserve Information and, if such will not, they should discuss with such Entity (i) the possible necessity of their rendering a qualified opinion and (ii) the possible remedies to the circumstances giving rise to the potential qualification of such opinion.

(d) Interim Audit Procedures. Many audit tests can be conducted at almost any time during the year. In the course of interim work, the Reserve Auditors make tests of the Entity's methods, procedures and controls to determine the extent to which such are reliable. It is acceptable practice for the Reserve Auditors to complete substantial parts of an audit examination at interim dates.

When a significant part of an audit is completed during the year and the Entity's methods, procedures and controls are found to be effective, the year-end audit procedure may primarily consist of an evaluation of the impact of new data. The Reserve Auditors must nevertheless be satisfied that the procedures and controls are still effective at the year end and that new discoveries, recent oil and gas production and other recent information and data have been taken into account. Reserve Auditors would not be required to retest the database pertaining to an Entity's properties and interests unless their inquiries and observations indicate that conditions have changed significantly.

(e) General Matters To Be Reviewed With Respect to Reserve Information. An audit of the Reserve Information pertaining to an Entity should include a review of (i) the policies, procedures, documentation and guidelines of such Entity with respect to the estimation, review and approval of its Reserve Information; (ii) the qualifications of Reserve Estimators internally employed by such Entity; (iii) ratios of such Entity's reserves to annual production for, respectively, oil, gas and natural gas liquids; (iv) historical reserve and revision trends with respect to the oil and gas properties and interests of such Entity; (v) the ranking by size of properties or groups of properties with respect to estimates of reserves or the future net revenue from such reserves; (vi) the percentages of reserves estimated by each of the various methods set forth in Section 5.3 for estimating reserves; and (vii) the significant changes occurring in such Entity's reserves, other than from production, during the year with respect to which the audit is being prepared.

(f) Evaluation of Internal Policies, Procedures and Documentation. Reserve Auditors should review and evaluate the internal policies, procedures and documentation of an Entity to establish a basis for reliance thereon in determining the nature, extent and timing of the audit tests to be applied in the examination of such Entity's Reserve Information and other data and matters. The internal policies, procedures and documentation to be reviewed with respect to an Entity should include (i) reserve definitions and classifications used by such Entity; (ii) such Entity's policies pertaining to, and management involvement in, the review and approval of Reserve Information and changes therein; (iii) the frequency with which such Entity reviews existing Reserve Information; (iv) the form, content and documentation of the Reserve Information of such Entity, together with such Entity's internal distribution thereof; and (v) the flow of data to and from such Entity's reserve inventory system.

(g) Testing for Compliance. Reserve Auditors should conduct tests and spot checks to confirm that (i) there is adherence on the part of an Entity's internal Reserve Estimators and other employees to the policies and procedures established by such Entity; and (ii) the data flowing into the reserve inventory system of such Entity is complete and consistent with other available records.

(h) Substantive Testing. In conducting substantive tests, Reserve Auditors should give priority to each property or group of properties of an Entity having (i) a large reserve value in relation to the aggregate properties of such Entity; (ii) a relatively large reserve value and major changes during the audit year in the Reserve Information pertaining to such property or group of

properties; and (iii) a relatively large reserve value and a high degree of uncertainty in the Reserve Information pertaining thereto. The selection of properties for substantive testing shall be made independently by the Reserves Auditors. The amount of substantive testing performed with respect to particular Reserve Information of an Entity should depend on the assessment of (i) the general degree of uncertainty with respect to such Reserve Information, (ii) the evaluation of the internal policies, procedures and documentation of such Entity and (iii) the results of the compliance testing with respect to such Entity. Such substantive testing could therefore appropriately range from a limited number of tests selected by the Reserve Auditor to the complete estimation of Reserve Information with respect to a majority of an Entity's reserves.

6.5 Records and Documentation With Respect to Audit

Reserve Auditor should document, and maintain records with respect to, each audit of the Reserve Information of an Entity. Such documentation and records should include, among other things, a description of (i) the Reserve Information audited; (ii) the review and evaluation of such Entity's policies, procedures and documentation; (iii) the compliance testing performed with respect to such Entity; and (iv) the substantive tests performed in the course of such audit.

6.6 Forms of Unqualified Audit Opinions

Acceptable forms of unqualified audit opinions for consulting Reserve Auditors and Reserve Auditors internally employed by Entities are attached to these Standards as, respectively, Exhibits "A" and "B."

Exhibit “A” – Illustrative Unqualified Audit

Opinion of Consulting Reserve Auditor*

(Date)

Entity

[Address]

Independent Public Accountants of Entity

[Address]

Gentlemen:

At your request, we have examined the estimates as of [dates] set forth in the accompanying table with respect to (i) the proved reserves of Entity, (ii) changes in such proved reserves during the period indicated, (iii) the future net revenue from such proved reserves and (iv) the present value of such future net revenue. Our examination included such tests and procedures as we considered necessary under the circumstances to render the opinion set forth herein.

[A detailed description of the audit should be set forth.]

We are independent with respect to Entity as provided in the Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserve Information promulgated by the Society of Petroleum Engineers.

It should be understood that our above-described audit does not constitute a complete reserve study of the oil and gas properties of Entity. In the conduct of our report, we have not independently verified the accuracy and completeness of information and data furnished by Entity with respect to ownership interests, oil and gas production, historical costs of operation and development, product prices, agreements relating to current and future operations and sales of production, and (specify other information, data and matters upon which reliance was placed). We have, however, specifically identified to you the information and data upon which we so relied so that you may subject such to those procedures that you consider necessary. Furthermore, if in the course of our examination something came to our attention which brought into question the validity or sufficiency of any of such information or data, we did not rely on such information or data until we had satisfactorily resolved our questions relating thereto or independently verified such information or data.

Please be advised that, based upon the foregoing, in our opinion the above-described estimates of Entity’s proved reserves and other Reserve Information are, in the aggregate, reasonable and have been prepared in accordance with generally accepted petroleum engineering and evaluation principles as set forth in the Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserve Information promulgated by the Society of Petroleum Engineers.

(Insert, where appropriate and to the extent warranted by the Reserve Auditor’s examination, whether the Reserve Information is in conformity with specified governmental regulations.)

(Optional: This letter is solely for the information of Entity and for the information and assistance of its independent public accountants in connection with their review of, and report upon, the financial statements of Entity. This letter should not be used, circulated or quoted for any other purpose without the express written consent of the undersigned or except as required by law.)

Very truly yours,

RESERVE AUDITOR

By _____

Exhibit “B” – Illustrative Unqualified Audit

Opinion of Reserve Auditor Internally

Employed by an Entity*

(Date)

Entity

[Address]

Independent Public Accountants of Entity

[Address]

Gentlemen:

I have examined the estimates as of [dates] set forth in the accompanying table with respect to (i) the proved reserves of Entity, (ii) changes in such proved reserves during the period indicated, (iii) the future net revenue from such proved reserves and (iv) the present value of such future net revenue. My examination included such tests and procedures as I considered necessary under the circumstances to render the opinion set forth herein.

[A detailed description of the audit tests and procedures may be set forth.]

I meet the requirements of objectivity for Reserve Auditors internally employed by Entities as set forth in the Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserve Information promulgated by the Society of Petroleum Engineers.

It should be understood that my above-described audit does not constitute a complete reserve study of the oil and gas properties of Entity. In the conduct of my report, I have not independently verified the accuracy and completeness of information and data furnished by other employees of Entity with respect to ownership interests, oil and gas production, historical costs of operation and development, development, product prices, agreements relating to current and future operations and sales of production, and [specify other information, data and matters upon which reliance was placed]. I have, however, specifically identified to you the information and data upon which I so relied so that you may subject such to those procedures that you consider necessary. Furthermore, if in the course of my examination something came to my attention which brought into question the validity or sufficiency of any of such information or data, I did not rely on such information or data until I had satisfactorily resolved my questions relating thereto or independently verified such information or data.

Please be advised that, based upon the foregoing, in my opinion the above-described estimates of Entity’s proved reserves and other Reserve Information are, in the aggregate, reasonable and have been prepared in accordance with generally accepted petroleum engineering and evaluation principles as set forth in the Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserve Information promulgated by the Society of Petroleum Engineers.

[Insert, where appropriate and to the extent warranted by the Reserve Auditor’s examination, whether the Reserve Information is in conformity with specified governmental regulations.]

Very truly yours,

RESERVE AUDITOR

By _____

* If a Reserve Auditor is unable to give an unqualified opinion as to an Entity's Reserve Information, the Reserve Auditor should set forth in his or her opinion the nature and extent of the qualifications to such opinion and the reasons therefor.

Footnotes

[1] These Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserve Information (the “Standards”) are not intended to bind the members of the Society of Petroleum Engineers (the “Society”) or anyone else, and the Society imposes no sanctions for the nonuse of these Standards. Each person estimating and auditing oil and gas Reserve Information is encouraged to exercise his or her own judgment concerning the matters set forth in these Standards. The Society welcomes comments and suggested changes in regard to these Standards.

[2] For purposes of this Section 4.3, the term “affiliated” shall, with respect to an Entity, describe the relationship of a person to such Entity under circumstances in which such person directly, or indirectly through one or more intermediaries, controls or is controlled by, or is under common control with, such Entity; provided, however, that commercial banks and other bona fide financial institutions shall not be considered to be affiliated with the Entity to which the Reserve Information relates unless such banks or institutions actively participate in the management of the properties of such Entity.

Unless the context requires otherwise, the term “material” shall, for purposes of this Section 4.3, be interpreted with reference to the net worth of the consulting Reserve Estimators or the consulting Reserve Auditors, or any firm of petroleum consultants of which such individuals are stockholders, proprietors, partners or employees.