A Comparison of Several Definitions Of Oil and Gas Reserves

A Learned Discourse into those Matters of Law And of Common Usage which Influence the Assignment of Volume and Value to Differing Classes of Oil and Gas Reserves

Item the First: What are Reserves? and Why do they Need to be Defined?

Before delving into a comparison and analysis of the several forms of reserves definitions, it may be useful to consider the concept of "reserves" and to examine the necessity for definition of the term. Irrespective of which of several definitions is used, "reserves" are expressed as a volume of oil, gas, or other produce (hereafter "oil") which is a function of the expected future production of oil and of certain expected economic conditions. It is not a physical volume in the sense that it can be examined, measured and moved from place to place. "Reserves" do not connote a physical entity in the way that "building" connotes a 3-dimensional structure which one can see and feel, and walk into and out of if one so desires. Or in the sense that "rock" connotes a hard object that has an obvious tactile presence, size, shape, color and direct use as a tool. "Reserves" is an abstract concept that describes the total volume of future oil production that could be expected to be recovered, assuming that certain physical and economic conditions exist and continue to prevail for however long is required to obtain the production. A comparison to an office building is illustrative: an office building retains the same physical size and character whether the rents for the building go up or down. Reserves, on the other hand, may increase or decline with changes in oil price.

The primary objective of oil production is the income to be derived from the sales of the produced oil, not the oil itself. However, potential total income is difficult to compare among properties in any useful manner. Therefore, "reserves" is used as a euphemism for the future income and provides a means of keeping track of that future income and of comparing one property or company to another. Reserves are also used as a commonly accepted repository of the value of a property, even though the value is derived from the income resulting from production and sale of the oil that makes up the "reserve." Unfortunately, both expected income and the related "reserves" are transitory and neither is entirely satisfactory as a measure.

Since "reserves" depend upon the expectation of future production and sales of oil, and since different persons can have differing expectations for production and sales from a property, the "reserves" of that property can never be a fixed volume but can and do change from observer to observer and from time to time, or both. For that reason, "reserves" as such cannot have value, but can only represent value, and then only in an abstract sense. For example, if all conditions are identical, a property with greater reserves can be construed to have a greater value. But all conditions are never identical.

The "reserves" concept becomes even more abstract when the number of conditions used to define "reserves" are expanded to include risk. In this case, the "reserves" can be sub-divided into categories such as Proved and Unproved based on the relative risk of recovery of the reserves in each category. Here again, the risk is not in the reserves per se but in the likelihood that the expectations for future production and economic conditions will be met. The risk is accounted for by assigning the anticipated future volume of oil production to a certain category of reserve based upon that risk.

If "reserves" are a function of the interaction of a set of expectations for future production and economic conditions, and if those expected conditions are variable in both time and space, then "reserves" are relative. In order to avoid a situation where "reserves" lose all meaning as a comparative measure, a definition for "reserves" is necessary in order to provide some broadly accepted constraints on the conditions that would result in the estimation of a particular volume of "reserves." Without a definition as a guideline or reference, a volume labeled as "reserves" could be anything but would have no meaning to anyone.

Historical Development

There was a time when "reserves" and the measurement of "reserves" was not considered necessary. In the early days of the oil industry, properties were classified by production rates, and the practice was to produce as much as possible as quickly as possible. The growth of integrated companies, with their need to plan sources of supply for refining operations, resulted in the need to measure the ability of a property to produce over a (long) period of time. This led to the development of methods to quantify producible volumes, oil-in-place in the ground, future productions rates and other matters that come under the heading of petroleum engineering. It was only a matter of time before economic conditions were added into the analysis, which resulted in discounted cash flow evaluation methods and the first legal/financial issues of value and "reserves." One item of fallout from this short history was the acknowledged necessity for a uniform procedure, system or method of defining "reserves."

Industry folklore gives credit to the American Petroleum Institute (API) for the first definition of reserves in the mid - 1930's:

> "From 1936 to 1964, the American Petroleum Institute (API) set the standards for definitions of Proved Reserves. This effort was joined by the American Gas Association (AGA) in 1946 with the joint API-AGA annual publication of "Proved Reserves of Crude Oil, Natural Gas Liquids and Natural Gas." In 1964, the Society of Petroleum Engineers (SPE) issued reserve definitions, which agreed closely with revised API definitions."[1]

1 "Guidelines for Application of the Definitions for Oil and Gas Reserves," Monograph I, Society of Petroleum Evaluation Engineers, Houston TX, 1988

As noted by SPEE:

> "The continuing process of updating and revising reserve definitions is a reflection of both the changing nature of the petroleum industry with time and the difficulty of writing a comprehensive definition of reserves and guidelines that will serve the broad needs of industry without excess complexity."

The events of the 1970's and resulting changes in the oil industry led to the issuance of definitions by the Security and Exchange Commission (SEC) in 1979, by SPE in 1981 and by the World Petroleum Congress (WPC) in 1983. SPE revised its definitions in 1987 and, in cooperation with WPC, again in 1997. Until 1983 all reserves definitions, at least those issued by recognized authorities such as API and SPE, were for Proved Reserves only. The WPC definitions of 1983 included categories ranging from Proved to "speculative" reserves. The 1987 SPE definitions were the first to formally define Proved, Probable and Possible. This does not mean that the terms were not in use or that Probable and Possible reserves had not been calculated and reported. Producing companies, consulting firms, banks and government agencies developed their own criteria for UnProved reserves and used them.

As noted by SPEE:

> "The Definitions for Oil and Gas Reserves were designed to address many of these problems. Until now, there has been no industry standard for Probable and Possible reserves. The need to categorize such reserves has long been recognized. The many definitions that have been advanced for Probable and Possible reserves have contributed to the confusion of those attempting to use these higher-risk reserves estimates.
>
> In addition, there has been a need to re-examine and expand definitions used for improved recovery reserves where technology has expanded rapidly. Supplemental recovery methods include both conventional methods (waterflooding and gas injection) and enhanced methods (steam injection, in situ combustion, polymer and miscible flooding)."

<u>Item the Second: Sources of Reserves Definitions</u>

Despite the efforts of SPE/WPC and SEC to standardize reserves, multiple reserve definitions remain in use. Many companies and agencies retain their own definitions which, while close to the SPE standard, have certain idiosyncrasies resulting from law and regulatory requirements, corporate policy decisions and/or ingrained habit. This is particularly true regarding the boundary between Proved and Unproved and, to a lesser extent, the sub-categories within Proved.

In this discourse we will examine and compare four sources of definitions of Reserves:

1. The SPE definitions of 1965, 1981, 1987 and 1997.
2. The SPEE expansions of the SPE 1987 and 1997 definitions.

3. The SEC definition of 1979.
4. The California State Board of Equalization (SBOE) definition contained in rule 468 of the California R&T Code.

The purpose of this exercise is to compare and contrast the terms and conditions of the Rule 468 definition to the other definitions in order to determine whether reserves reported under one set of definitions are the same as, or to what degree they are different from, reserves reported under one or more of the other sets of definitions. The issue really boils down to whether the Rule 468 definition allows the expansion of the reserves of a property as the result of the precedent conditions contained in the Rule 468 definition as compared to the "industry" definition.

Each of the four sources noted above serve a somewhat different purpose. The SPE and SPE/WPC definitions are intended to provide industry and observers of the industry, consultants and the financial (lending) community with a standard to which all evaluators should conform. The 1981 and 1987 SPE definitions succeeded in providing that standard for domestic use, and the 1997 SPE/WPC collaboration attempted to provide an international standard. In any case, SPE is considered to be the industry standard.

The SEC definitions are the response of government to the perceived need for a benchmark by which producing companies could be compared to each other. The primary beneficiary of this effort is the equity financial community and consulting firms. The Rule 468 definition is the recognition by SBOE of the need for a regulatory standard that should be followed by assessors in appraising oil properties. The SPEE expansion of the SPE definitions is included because of the extensive explanation of the SPE definitions rendered by SPEE and the historical context for these definitions provided by SPEE.

The historical context is of some importance in this analysis. Rule 468 was adopted, as amended, in July, 1979, and there has been no amendment since that time. The rule has gained reference in one or more published opinions by California courts, but none have issued judgements or findings that would alter the language of the rule. The SBOE has not made any modification to the language of Rule 468 since it was last amended. In 1996, SBOE issued Assessors Handbook Section 566, "Assessment of Petroleum Properties," in which Chapter 4 includes a section titled, *Definitions of Reserves*. This section provides a discussion of some aspects of reserves and reserves definitions, which is very useful in positioning the Rule 468 definition among the industry and other definitions.

At the time that Rule 468 was adopted, and last amended, the 1965 SPE definitions were the existing standard along with the APE definitions. Assessors Handbook Section 566, *Valuation of Oil and Gas Producing Properties*, originally issued in 1972 and last amended in 1999, specifically adopted the API definition of Proved reserves as the working definition of reserves for assessment appraisal. This was prior to the drafting and issuance of either the 1981 SPE or the 1983 WPC definitions. As noted above, these pre-1983 definitions referred to only Proved reserves. This might suggest that, in writing Rule 468, there was no overt consideration of Probable and Possible reserves as taxable assets and, further, that the only sources available to SBOE in writing Rule 468 were the existing SPE/API standards and possibly the proposed SEC definitions.

Item the Third: The SPE Definitions

The 1964 SPE/API [2] Definition

The first SPE definitions were succinct and fit on one typewritten page (Attachment 1), wherein Proved reserves are defined as:

> "The quantities of crude oil, natural gas and natural gas liquids which geological and engineering data demonstrate with reasonable certainty to be recoverable in the future from known oil and gas reservoirs under existing economic and operating conditions. They represent strictly technical judgments, and are not knowingly influenced by attitudes of conservatism or optimism." (Emphasis added)

It is readily apparent that the SPE and API definitions are the same. SPE goes on to add some explanation:

> "When evaluating an individual property in an existing oil or gas field, the proved reserves within the framework of the above definition are those quantities indicated to be recoverable commercially from the subject property at current prices and costs, under existing regulatory practices, and with conventional methods and equipment." (Emphasis added)

Proved reserves were further categorized as Proved Developed Producing (PDP), Proved Developed Non-Producing (PDNP) and Proved Undeveloped (PUD) with the latter two categories deriving from the scale of expected investment necessary to obtain the production.

These were the definitions in place when Rule 468 was drafted and adopted. There are five operative criteria for Proved reserves:

1. Known oil and gas reservoirs
2. Reasonable certainty to be recoverable
3. Existing economic and operating conditions
4. Existing regulatory practices
5. Conventional methods and equipment

No criteria are provided for defining "known oil and gas reservoirs" or for "reasonable certainty to be recoverable." The terms were assumed to be understood by users, which, at the time, were generally limited to industry evaluators and a few banks. The same is true of "conventional methods and equipment" which usually meant something that had been tried and tested for years and could be shown to work when appropriately applied – in other words, it had gained general acceptance. At the time "existing regulatory practices" meant (a) proration of

[2] The API definition of Proved reserves reads as follows: "These are the volumes of crude oil and natural gas which geological and engineering information indicate, beyond reasonable doubt, to be recoverable in the future from oil and gas reservoirs under existing economic and operation conditions. They represent strictly technical judgments and are not knowingly influenced by policies of conservatism or optimism. They are limited only by the definition of the term "proved." They do not include what are commonly referred to as "probable" or "possible reserves." AH566(1972), pg. 119.

production and (b) regulations regarding the operation of injection projects. The "existing economic and operating conditions" and "current prices and costs," however, require some discussion. Do they mean the same thing? If they do, what do they mean? If not; What is the difference?

"Existing economic and operating conditions" is a broader statement than "current prices and costs." The former could relate to the general economy for oil and gas production and operations including whether inflation or deflation is occurring, whether over supply or excess demand is prevalent, or whether labor is in tight supply and could even extend to the income tax structure and the investment climate. "Existing operating conditions" is more readily translated to mean the production mechanism(s) in use whether it be flowing wells, artificial lift, waterflood, or some other method. A change in expected production due to the introduction of new operating methods could result in the production being classed as Undeveloped. On the other hand, "current prices and costs" seems relatively limited. At the time (1965) this clearly meant (a) using the actual prices being paid for oil and gas and the actual operating costs being incurred and (b) carrying them forward in the evaluation. This was accepted at the time because oil prices were essentially fixed (that was the purpose of proration) and there was, as yet, no significant inflation. In fact, real oil prices were in decline. Proration would last until 1972, and inflation only became an issue in the early 1970's. There was no expectation of any other economic conditions.

The 1981 SPE Definitions

The 1981 definitions (Attachment 2) were a joint effort of SPE, AAPG and API in response to two events. First, the substantial combined impact on the industry and evaluation practices caused by the end of proration, the OPEC embargo, extreme price increases in 1973 and 1979, the decline in domestic production, and the introduction of enhanced recovery to old fields. Second, the adoption by the SEC and FASB of methods of reporting Proved reserves as part of the required reporting of public companies and the near-miss of Reserve Recognition Accounting. (See below: The SEC Definition).

In 1981, SPE/API/AAPG said:

> "Proved reserves of crude oil, natural gas, or natural gas liquids are estimated quantities that geological and engineering data demonstrate with reasonable certainty to be recoverable in the future from known reservoirs under existing economic conditions."

This definition is not only shorter than the 1965 language but leaves out any reference to existing regulatory practices and known oil and gas reservoirs. And, while it refers to "existing economic conditions," there is no mention of "current prices and costs." The complete text of the 1981 definitions is much more concerned with defining and explaining the petrophysical and operational criteria for Proved reserves and sub-categories of Proved reserves such as Proved Undeveloped.

At the time, existing economic conditions were that oil prices were at a peak and (in hindsight) had started to decline, but there was still substantial speculation that crude oil price would reach $100/Bbl.

The 1988 SPE Definition

On October 1, 1988 SPE approved and issued a revised set of definitions (Attachment 3) of reserves which improved on the 1981 definitions by adding definitions for Unproved (Probable and Possible) reserves and expanding the explanation and discussion of the nature of reserves in general and Proved reserves in particular. This definition said:

> "Reserves are estimated volumes of crude oil, condensate, natural gas, natural gas liquids, and associated substances anticipated to be commercially recoverable from known accumulations from a given date forward, under existing economic conditions, by established operating practices, and under current government regulations. Reserves estimates are based on interpretation of geologic and/or engineering data available at the time of the estimate."
>
> "Proved reserves can be estimated with reasonable certainty to be recoverable under current economic conditions. Current economic conditions include prices and costs prevailing at the time of the estimate. Proved reserves may be developed or undeveloped."

In the 1988 version, several phrases and terms from 1965 reappear such as "established operating practices" (conventional methods and equipment) and "known accumulations" (known oil and gas fields). Also reappearing is the use of "existing economic conditions" as a criteria for reserves generally, but "current economic conditions" for Proved reserves. In 1988, SPE makes the effort to state that, "Current economic conditions include prices and costs prevailing at the time of the estimate." This language is important in relation to the SPEE interpretation and the Rule 468 usage.

In regard to the distinction between Proved and Unproved, SPE says:

> "…reserves are considered proved if commercial producibility of the reservoir is supported by actual production or formation tests. The term proved refers to the estimated volume of reserves and not just of the productivity of the well or reservoir. In certain instances, proved reserves may be assigned on the basis of electrical and other type logs and/or core analysis that indicate subject reservoir is hydrocarbon bearing and is analogous to reservoirs in the same area that are producing, or have demonstrated the ability to produce on a formation test."

Further,

> "The area of a reservoir considered proved includes (1) the area delineated by drilling and defined by fluid contacts, if any, and (2) the undrilled areas that can be reasonably judged as commercially productive on the basis of available geologic and engineering data. In the absence of data on fluid contacts, the

lowest known structural occurrence of hydrocarbons controls the proved limit unless otherwise indicated by definitive engineering or performance data." and,

"…Proved undeveloped reserves are assigned to undrilled locations that satisfy the following conditions: (1) the locations are direct offsets to wells that have indicated commercial production in the objective formation, (2) it is reasonably certain that the locations are within the known proved productive limits of the objective formation, (3) the locations conform to existing well spacing regulations, if any, and (4) it is reasonably certain that the locations will be developed. Reserves for other undrilled locations are classified as proved undeveloped only in those cases where interpretations of data from wells indicate that the objective formation is laterally continuous and contains commercially recoverable hydrocarbons at locations beyond direct offsets." Finally,

"Reserves that can be produced through the application of established improved recovery methods are included in the proved classification when (1) successful testing by a pilot project or favorable production or pressure response of an installed program in that reservoir, or one in the immediate area with similar rock and fluid properties, provides support for the engineering analysis on which the project or program is based, and (2) it is reasonably certain the project will proceed."

In contrast, Unproved Reserves are defined as follows:

"Unproved reserves are based on geologic and/or engineering data similar to that used in estimates of proved reserves; but technical, contractual, economic, or regulatory uncertainties preclude such reserves being classified as proved. They may be estimated assuming future economic conditions different from those prevailing at the time of the estimate."

"Probable reserves are less certain than proved reserves and can be estimated with a degree of certainty sufficient to indicate they are more likely to be recovered than not."

Possible reserves are less than probable reserves and can be estimated with a low degree of certainty, insufficient to indicate whether they are more likely to be recovered than not."

The 1997 SPE/WPC Definitions

The 1997 definitions (Attachment 4) are, for the purpose of this discussion, the same as the 1988 SPE definitions, with two exceptions. The primary exception, from the industry standpoint, is that the SPE/WPC made an attempt to address the "reasonable certainty" issue. The definition states:

"Reserves are those quantities of petroleum which are anticipated to be commercially recovered from known accumulations from a given date forward. All reserve estimates involve some degree of uncertainty. The uncertainty

depends chiefly on the amount of reliable geologic and engineering data available at the time of the estimate and the interpretation of these data. The relative degree of uncertainty may be conveyed by placing reserves into one of two principal classifications, either proved or unproved. Unproved reserves are less certain to be recovered than proved reserves and may be further subclassified as probable and possible reserves to denote progressively increasing uncertainty in their recoverability."

"Proved reserves are those quantities of petroleum, which by analysis of geological and engineering data, can be estimated with reasonable certainty to be commercially recoverable, from a given date forward, from known reservoirs and under current economic conditions, operating methods, and government regulations. Proved reserves can be categorized as developed or undeveloped."

"If deterministic methods are used, the term reasonable certainty is intended to express a high degree of confidence that the quantities will be recovered. If probabilistic methods are used, there should be at least an 90% probability that the quantities actually recovered will equal or exceed the estimate."

"Establishment of current economic conditions should include relevant historical petroleum prices and associated costs and may involve an averaging period that is consistent with the purpose of the reserves estimate, appropriate contract obligations, corporate procedures, and government regulations involved in reporting these reserves."

The discussion of Proved reserves contains the terms "deterministic" and "probabilistic" which describe two different methods of estimating reserves. The distinction is beyond the scope of this discussion. Suffice to say that the language is a compromise between SPE (deterministic) and WPC (probabilistic) that will be revisited as "globalization" of the reserves estimation business proceeds.

There has been some effort on the part of SPE to blur the implied equality between "high degree of confidence" and "at least a 90% probability" but, in the end, the two approaches must produce the same result.

Probable reserves are "…more likely than not to be recoverable…" or, when using probabilistic methods, "…there should be at least 50% probability that the quantities actually recovered which will equal or exceed the sum of estimated proved plus probable reserves." This has been read by some to mean that Probable reserves have a 50% probability of recovery, but it is the ***sum*** of Proved plus Probable that must be at least 50%. If the volumes are equal and if Proved is 90%, then Probable must be less than 50%.

The second major exception is the treatment accorded to "current economic conditions" which now "…should include relevant historical…prices and …costs and may involve an averaging period that is consistent…" and "Unproved reserves may be estimated assuming future economic conditions different from those prevailing at the time of estimate." If the prevailing conditions are also "current economic conditions," then an evaluator has now been given some latitude to define economic conditions for himself, within reason, using relevant

historical data. This is a clear move away from the rigid SEC approach toward the more common industry approach.

Item the Fourth: The SPEE "Definitions"

The Society of Petroleum Evaluation Engineers (SPEE) is an organization composed of petroleum engineers, largely independent consultants, who are engaged in the evaluation of oil properties, primarily estimation of reserves and economic evaluation. SPEE is not a part of SPE but maintains a separate existence and does not always conform to SPE. Nor does SPEE issue separate reserves definitions, but generally attempts to work with SPE and similar organizations in formulating reserves definitions and in other areas of evaluation practice. SPEE is included in this discourse for two reasons. First, SPEE has generally taken the lead in prompting the reconsideration of definitions. Second, in 1988 and in 1998 SPEE published a volume entitled, "Guidelines for Application of the Definitions for Oil and Gas Reserves," known as Monograph I (as referred to hereafter). Both the 1988 and 1998 editions of Monograph I are expanded discussions of the way in which the SPE definitions should be construed and applied. Both editions contain extensive discussion of various reserve determination methodologies and how those methods may relate to the category or sub-category of "reserves" that is applied to a particular property or project. Both editions contain considerable discussion of the meaning of certain parts of the SPE definitions in the context of actual property valuation. In many areas this expanded discussion amounts to interpretation of the SPE definitions that goes beyond the wording of the actual definitions. This is of no particular concern to the present issue except in the area of price and cost assumptions.

The Escalated/Un-escalated Issue

As noted above, the 1987 definition of Reserves includes the phrase "…under existing economic conditions [where]…" and for Proved reserves says, "…current economic conditions" [where] "…current economic conditions include prices and costs prevailing at the time of the estimate." SPE provides no further elaboration of the intent of the terms "existing," or "current," or "economic conditions" as used in the definitions and gives no guidance as to the selection of initial prices and/or estimation of operating costs.

The SPE language has often led to debates among evaluators regarding the treatment of future prices and costs. Why are two different terms used? Are reserves to be established only by using the price and cost in effect on the date of evaluation or can reserves be established by projecting prices and costs which change over time from the initial values? The former is generally referred to as the un-escalated case while the latter is referred as the escalated case. Further, there tends to be an assumption that escalated always means increasing rather than simply a change from the initial value.

The debate is usually framed as follows:

One side of the debate says that existing economic conditions are the totality of the conditions that may affect the value of a property and/or influence the future operation of a project. The evaluator may start with the price(s) and cost(s) occurring on the date of evaluation, but if the prevailing economic conditions are such that the price and/or costs can reasonably be

expected to change in some particular manner, then the evaluator should incorporate those anticipated changes into the estimation of future cash flow.

The other side of the debate takes the position that using "current economic conditions," which include prices and costs prevailing at the time of the estimate, allows no change in those prices or costs over the life of the evaluation. This latter construction ignores the inclusive interpretation of the term "include" and makes the term an absolute.

This issue has far more to do with cash flow and the valuation of income than with reserves. Reserves are influenced in only two ways. First, changing prices and costs over the life of the projection may result in a different economic limit of production for the property/project than would be obtained using a flat price/cost projection; reserves are added at the end of the life when the economic limit is reduced and the life is extended. On the other hand, when economic limit is increased and producing life is shortened, reserves are reduced. Second, capital investment in workovers or remedial work or new drilling that would not be economically justified at "current prices" might be justified if prices were escalated (increased). In this latter case, new reserves might be added through increased production.

In Monograph I (1988 edition), SPEE takes the position that "existing economic conditions" and "current economic condition" mean the same thing, which is that the prices and costs in effect at the time of the evaluation are carried forward with no changes. SPEE goes farther and states (pg. 45):

> "If the reserves are increased by escalating product prices and costs, then the change in the reserves should be shown separately in the engineer's report as Unproved Reserves."

SPEE advises that the evaluator can avoid this by using the same economic limit (the un-escalated one) for both cases thereby assuring that no reserves are added at the end of life. This, of course, ignores the fact that many operators will continue to produce beyond this artificial limit.

The position taken in Monograph I (both 1988 and 1998) is the only serious flaw in an otherwise excellent document. The position is untenable as a practical matter and has some very serious logical loopholes. In practice, it is often ignored. It is quite common for evaluators to cite the SPE definition in their reports and then escalate (de-escalate) prices and/or costs and include all the reserves as Proved. Within SPEE, the subject is often warmly debated, and the issue of escalation or non-escalation is far from a unanimous agreement.

Three major areas of failure of the SPEE proposition are as follows:

1. In periods of changing prices and costs an evaluation done of Property A in October might have one reserve estimate, while an evaluation done in November could have a second (higher or lower) reserve estimate. Both would be considered correct, but which one is really correct? If the same evaluator had estimated the reserves in October by projecting the October price to change to the November price, the change in reserves would be Unproved while the same volume in the November evaluation is considered Proved. In all other respects, a change in reserves category is a function

of risk derived from the likelihood of recovery (See SPE Definitions for examples that illustrate Proved, Probably and Possible). In the SPEE Interpretation, however, a major change in reserves categorization occurs due solely to the treatment of prices and costs.

2. The SPEE proposition assumes that escalated prices are increasing prices and does not consider the impact of pricing cycles and/or decreasing prices or costs. Further, it fails to consider the effect of differing escalations of prices as compared to costs. If decreasing prices are projected with flat or increasing costs, the economic limit would be increased and the reserves may be decreased. The amount of reserves "lost," as it were, cannot be classified as Unproved since they do not exist as reserves. In that case, they are simply deducted from Proved reserves. Reserves that were measurable, by definition, when prices were increasing, become no longer measurable when prices go down.

3. Finally, SPEE is not consistent on this issue. While being specific about prices for oil, Monograph I also says: "Determining current gas price would be more difficult…common sense and good judgement are called for…" This is true of the entire evaluation process and applies equally to production projections and price projections.

This issue would not be of overwhelming importance were it not for the fact that the SPEE interpretation of the SPE definitions is often cited as being the correct interpretation and as the point of distinction between the "industry" definition of Proved reserves and the Rule 468 definitions.

The SEC Definition

In 1975, as part of the knee-jerk reaction to the so-called "energy crisis," the federal government, along with creating artificial shortages of oil, gasoline and other things, decided to get into the business of regulating reserves reporting and passed the Energy Policy and Conservation Act of 1975. As an outgrowth of the Act, the SEC, after several scary forays into Reserves Recognition Accounting and other bad ideas, issued SEC SX Rule 4-10 (Attachment 5) which, among other things, included definitions for Proved and Unproved reserves.

> *"Proved oil and gas reserves*. Proved oil and gas reserves are the estimated quantities of crude oil, natural gas, and natural gas liquids which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions, i.e.,
> prices and costs as of the date the estimate is made. Prices include consideration of changes in existing prices provided only by contractual arrangements, but not on escalations based upon future conditions."

This is virtually identical to the then existing SPE (1965) definition except for the addition of the phrase, "i.e., prices and costs as of the date the estimate is made." and the final sentence.

The intent of Rule 4-10 was very simple. Having decided that reserves would be reported by public companies as notes to the financial statements (thankfully not as part of the Balance Sheet), a standard and unambiguous definition was required. So-called "SEC reserves" serve only one purpose, which is to allow a comparison of public companies by providing some information regarding a company's reserves of oil and gas. This was to be done by estimating the volume of reserves on the last day of the company's fiscal year using the prices (and costs) in effect on that date with no escalation (increase or decrease) from those prices and costs. The company also reports a dollar value of these reserves using the fixed price/cost projection discounted at a standard 10% before income tax.

The purpose of including this information in the financial report of a company was ostensibly to provide investors with data with which to compare companies. In that context, the fixed price/cost and the 10% discount rate are appropriate to providing a relative comparison. It may not be accurate or emulate the real world, and it certainly does not represent market value, but it does allow a reasonably informed investor to compare Company A to Company B, particularly over time. As a happy circumstance, it created a lot of work for consulting firms who gain far more benefit than do investors.

The SEC regulations are probably, at least partially, responsible for the interpretation of the SPE definition regarding price/cost escalation. Note that, for SEC purposes, only Proved reserves are reported.[3] Since the SEC language is identical to the 1965 SPE language, with the exception of the additional language to define "existing economic conditions", evaluators began to apply the same non-escalation criteria to the SPE definition. A classic case of the tail wagging the dog.

It is of interest, then, that in 1981 SPE issued definitions which still used "existing economic conditions" to define Proved reserves, with no further elaboration or description. One is left to wonder if SPE intended "existing" or "current" economic conditions to mean the same thing as the SEC definition and, if so, why they did not also include the same or a similar, descriptive phrase. In fact, none of the SPE definitions subsequent to the SEC definitions, even the far more wordy 1987 and 1998 versions, go that far but only refer to inclusion of "prices and costs prevailing at the time of the estimate," a substantially less demanding criteria.

The Rule 468 Definition

Differing Interpretations

According to SBOE Rule 468(b):

> "The market value of an oil and gas mineral property interest is determined by estimating the value of the volumes of proved reserves. Proved reserves are those reserves which geological and engineering information indicate with reasonable certainty to be recoverable in the future, taking into account reasonably projected physical and economic operating conditions. Present and projected economic conditions shall be determined by reference to all economic factors considered by

[3] "Unproved properties. Properties with no proved reserves." See also Financial Accounting Standards Board Release No. 257 re: Unproved Properties.

knowledgeable and informed persons engaged in the operation and buying or selling of such properties, e.g., capitalization rates, product prices and operation expenses."

The first sentence is very clear that the market value of an appraised property is a function of Proved reserves only. There is no discussion of Probable, Possible or Unproved reserves. This is entirely consistent with the industry (SPE/API) definitions of the period (1970's) which did not recognize any other class of reserves and with government regulations (SEC) which likewise gave no reference to Unproved reserves. The second sentence is taken from the 1965 SPE definition with three modifications. Where SPE says, "The quantities of crude oil, natural gas and natural gas liquids…," SBOE says, "Proved reserves are those reserves…" Where SPE says, "…information indicate…," SBOE says, "…data demonstrate…" Lastly, SBOE replaces "…under existing economic and operating conditions" with "…taking into account reasonably projected physical and economic operating conditions."

This last addition is explained by the third sentence which says: "Present and projected economic conditions shall be determined by reference to all economic factors considered by knowledgeable and informed persons engaged in the operation and buying or selling of such properties, e.g., capitalization rates, product prices and operating expenses." This last sentence has been correctly interpreted to mean the use of market derived information, or at least information obtained from knowledgeable and informed persons, and has been used as the rationale for requiring that operators and buyers of properties provide extensive amounts of data to assessors.

The definition of Proved reserves in paragraph (b) is quite rational in not imposing a set of criteria for projecting prices and costs or operating conditions. It simply requires the appraiser to assess the market and solicit or derive information from which to make projections.

Assessors and their representatives have often argued that Proved reserves, as defined by Rule 468, are a broader category of reserves than the reserves defined by industry because Rule 468 allows escalation of prices and costs, whereas industry (SPE) definitions do not and, further, that appraisals or evaluations or reports that refer to SPE definitions should not be allowed or given weight because the SPE definition differs from the SBOE definition. The crux of this argument has always lain in the supposed difference between the Rule 468 "projected economic conditions" and the flat pricing interpretation of the SPE definitions. It has been the practice of assessors to use this erstwhile difference in the definitions to argue that industry definitions should be ignored and a broader definition of reserves, based on their interpretation of Rule 468, should be allowed.

In past occurrences, the attempt to broaden the Rule 468 reserve interpretation has not extended to include Probable or Possible reserves along with Proved. The argument against the SPE definitions has most often been raised to prevent introduction of discussion of the various classes of Proved reserves. This latter point is important since discount rates have been shown to be related to reserves class as an expression of risk.

The argument regarding interpretation of Rule 468, as it relates to Proved reserves, is one that would not occur among appraisers familiar with oil properties. It is only raised in an

adversarial context, more often by attorneys than appraisers. Having said that, the argument has several flaws.

Does "…reasonably projected physical and economic operating conditions…" mean escalated prices and costs?

As noted, the interpretation favored by assessors is that (1) "projected" means "escalated" prices and costs, and (2) escalated always means increasing. There is, of course, no language in paragraph (b) or any other part of Rule 468 to support that assertion. The simplest interpretation of "projected" is just what it says – an extension of physical and economic conditions into the future based on some reasonable information obtained from the marketplace. All income approach evaluations are projections of oil and gas production, well count, product prices, capital investment and operating costs. Oil and gas production can be projected to go down with natural decline; to go up due to new drilling or improved recovery; or to remain relatively flat supported by workover and remedial programs and/or pressure maintenance. Well count can go up, down, or flat as can capital investment. Operating costs can go up with inflation or down as fluid volumes and well counts decline. Oil and gas prices, as we all know, can go any direction over any period of time. In Rule 468(b), the term "projected" is applied to all physical and economic conditions. No direction to the projection is implied. As used in the rule, "projected" simply reflects the reality of doing an income approach appraisal. No appraiser would be foolish enough to value an oil property solely on the production, prices and costs on the date of appraisal. A projection is accepted practice, and Rule 468 simply incorporates that accepted practice.

The "reasonably projected" phrase is contrasted with the "existing economic and operating conditions" phrase of the SPE definitions to say that the latter means flat prices and costs while Rule 468(b) means escalated. But, as noted above, "existing" or "current" conditions are not defined by SPE as flat or without change – only SPEE makes that assertion. And, based on practical experience, it is an incorrect interpretation.

It could be argued that, given the time frame in which Rule 468 was written, the only definitions of Proved reserves were the SPE/API definitions and that in looking for a model SBOE adapted the SPE/API definitions which, if the assessors are correct, would mean that Proved reserves can only be derived using flat prices and costs. But it is also true that by the late 1970's (Rule 468 was adopted in 1979) oil and gas price projections were based on extreme (even embarrassingly) high escalations that in hind-sight were ludicrous but nonetheless in common usage. Therefore, SBOE may very well have taken note of what was being done by "knowledgeable and informed persons" and concluded that a "reasonable" projection based on market data was appropriate for assessment appraisal purposes. Market transactions for the period and later suggest that this was a correct interpretation.

As noted above, the SPE definitions issued in 1981, 1987 and 1998 add no illumination to the issue and continue to use essentially the same language. And there the issue sat from 1979 until 1996.

Assessors Handbook Section 566

In August, 1996 SBOE issued Assessors Handbook 566 (AH566) which includes a discussion of Proved Reserves on pages 4-1 through 4-3. After quoting Rule 468(b), AH566 states:

> "In this definition, future expectations about prices and expenses are specifically considered, because in determining market value, operators, sellers, and purchasers will carefully consider the variation of product prices from their current levels in order to determine the effect on the profitability of the property. The significant difference between the Rule definition of proved reserves and the SPE or SPEE definition is that Rule 468(b) allows inclusion of reserves derived from future expectations for product prices and operating costs. Rule 468 authorizes subtraction from taxable value for deletions in proved reserves and increases in the taxable value of the petroleum property where there are additions to proved reserves. A history and analysis of this definition of proved reserves is further explained in *Lynch v. State Bd. of Equalization*, p. 105."
>
> And elaborates by adding the following:
>
> "The Society of Petroleum Evaluation Engineers (SPEE) maintains, as does the SPE, that 'proved reserves' do not include reserves that are the result of projected increases in prices."

A quick reading of these passages in AH566 would suggest the SBOE accepts the idea of Proved reserves based on escalation of prices and costs, but the tone of the language is interesting, and a second reading is more informative. The second sentence regarding the "…significant difference…" between the Rule 468 and SPE/SPEE definitions[4] is that Rule 468 "…allows inclusion of reserves derived from future expectations for product prices and operating costs."

This language used by SBOE, in the section of AH566 that is quoted above this paragraph, is consistent with Rule 468 and in no way requires or suggests that escalation is necessary or even preferred. The only criterion is the "reasonable" projection required by Rule 468. The "reasonable projection" concept is reinforced by the third sentence which refers to increases and decreases in reserves which, despite the misplaced direct connection of reserves and value, is a correct analysis of the evaluation process. The assertion by SBOE that SPE maintains that "…reserves that are the
result of projected increases in prices…" are not Proved reserves is unfortunate and not entirely accurate. During the mark-up of AH566, SBOE could not be moved off this argument, and there were larger issues at stake.

AH566 seems to assert the difference between SPE and Rule 468 in order to put SPE in context and then goes on to discuss the SPE non-economic criteria for Proved reserves and the sub-classes of Proved reserves. AH566 clearly states, in two places, that: "Only reserves as defined by Rule 468(b) are subject to assessment." And, referring to the SPE/SPEE sub-

[4] The SPE/SPEE definitions are not quoted in AH566.

classifications of Proved reserves, states, "These are all taxable under Rule 468." There is no discussion of Unproved, Probable or Possible and no suggestion that they are assessable.

Lynch v. State Bd. of Equalization

The reference in AH566 to *Lynch v. State Bd. of Equalization* is particularly useful in this regard in that the January, 1985 *Lynch* opinion clearly states in reference to assessable reserves:

> "They are limited only by the definition of the term "proved". They do not include what are *commonly* referred to as "probable" or "possible" reserves." (Emphasis added)

It is also interesting to note that the court further states:

> "The capitalization method of valuation utilizes the concept of "proved reserves," for which purpose the definition of the American Petroleum Institute was adopted. Under this definition, proved reserves are the volumes of crude oil and natural gas which geological and engineering information indicate, beyond a reasonable doubt, to be recoverable in the future from oil and gas reservoirs under existing economic and operating conditions. They represent strictly technical judgments and are not knowingly influenced by policies of conservatism or optimism."

As previously noted, the API definition is, for all intents and purposes, identical to the 1965 SPE definition of Proved reserves. The subsequent discussion in *Lynch* is a well-considered and lucid exposition of the reserves and valuation issue. It is interesting that while the court includes Rule 468 as a footnote, it refers to the API definition in the body of the opinion and makes no suggestion that there is any difference between the two. While affirming Rule 468 as appropriate for valuation of oil and gas properties, there is no suggestion that the Rule 468 definition encompasses a significant change in the concept of Proved reserves. And, while acknowledging that economic conditions can and do change, the Court seems to view the "existing" economic conditions criteria with greater flexibility than is attributed to that phrase by AH566.

Taken together, AH566, *Lynch* and Rule 468 indicate that the definition of Proved reserves in Rule 468 has far more in common with the SPE (industry) definition(s) of Proved reserves than it has differences. The only significant difference between Rule 468 and industry usage is in the interpretation of the "existing" or "current" economic conditions presented by SPEE, which may or may not be a correct or, perhaps more important, practical interpretation.

<u>Why the Debate?</u>

Based on the above paragraph, it seems clear that any differences which exist between the definition of Proved reserves in Rule 468 and the definitions in common usage in industry and represented by the SPE/WPC issue of 1997 and prior are semantic rather that substantive, resulting from (a) the observation of the marketplace and economic and other conditions in the oil producing industry in the late 1970's and (b) the desire to capture those conditions by way of

the authorship of new regulatory language. There is no language in the rule that suggests any difference between the conditions specified in the rule and those of common usage. In fact, the assessor is specifically directed to avail himself of those knowledgeable and informed persons in the marketplace and elsewhere to obtain the information necessary to value oil properties under California Law.

Conclusions

1. The definition of Proved reserves contained in Rule 468, as amplified by *Lynch* and AH566, is a rational and correct interpretation of Proved reserves and is consistent with the industry (SPE) definition of Proved reserves in practical usage.

2. Rule 468 does not require, suggest, presume, or assume that escalating (meaning increasing) prices and costs are a necessary component of assessment appraisal.

3. Rule 468, AH566, and Lynch allow only Proved reserves to be assessed. In Lynch the
reference to Proved reserves is the API (industry) definition.

4. The SPEE Monograph I provides only one interpretation of the SPE definitions and does not constitute an alternative set of definitions.

5. The SEC definitions have no relation or relevance to ad valorem tax appraisal.