APPEALS INDUSTRY SPECIALIZATION PROGRAM
SETTLEMENT GUIDELINES

INDUSTRY:	Petroleum
ISSUE:	Cost Depletion - Recoverable Reserves
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APPEALS SETTLEMENT GUIDELINES
PETROLEUM INDUSTRY

COST DEPLETION - RECOVERABLE RESERVES

ISSUES

A. Whether a taxpayer is required to include proved reserves and "probable or prospective" reserves in its original and subsequent reserve estimates when computing cost depletion under IRC § 611(a).

B. Whether a taxpayer is permitted to revise the original reserve estimate based solely on changes in economic factors, without operations or development work indicating the physical existence of a materially different quantity of reserves than originally estimated.

EXAMINATION DIVISION POSITION

A. Proved developed, proved undeveloped and "probable or prospective" reserves are regularly estimated using methods current in the industry. For purposes of computing cost depletion, the taxpayer is required to include all recoverable units of minerals in the total number of recoverable units at the end of the year. Recoverable units include both proved reserves (developed and undeveloped) and, under appropriate circumstances, additional reserves.

B. For purposes of cost depletion, the taxpayer is not permitted to revise its reserve estimate based solely on changes in economic factors, without operations or development work indicating the physical existence of a materially different quantity of reserves than originally estimated to purchase the property or develop the property. In Martin Marietta Corp. v. United States, 7 Cl. Ct. 586, 85-1 USTC 9284 (Cl. Ct. 1985), the Court concluded that I.R.C. § 611(a) and Treas. Reg. § 1.611-2(c)(2) preclude re-estimates of mineral reserves when essential geological facts remained unchanged.

INDUSTRY/TAXPAYER POSITION

1. That the evidence indicating the existence of Probable Reserves does not reach the degree of certainty necessary for those reserves to be included in the cost depletion computation.

2. That only Proved Reserves are required or permitted to be reported for SEC and

Financial Statement purposes. The standards and methods required there should suffice for tax purposes.

3. That the phrase in Treas. Reg. § 611-2(c) which states ". . .may be estimated. . .As to quantity. . ." makes inclusion of Probable Reserves permissive, not a requirement.

4. The method current in the industry is, for the most part, to re-estimate reserves at the end of each year. Each estimate or appraisal will include the economic environment of the appraisal date. Therefore, estimates will necessarily change as industry economics change.

This short listing does not purport to be exhaustive nor all-inclusive; it represents a synopsis of the industry viewpoint.

DISCUSSION

ISSUE A.

LAW

IRC § 611(a) provides that:

> In the case of mines, oil and gas wells, other natural deposits, and timber, there shall be allowed as a deduction in computing taxable income a reasonable allowance for depletion . . . according to the peculiar conditions in each case; such reasonable allowance in all cases to be made under regulations prescribed by the Secretary."

Treas. Reg. § 1.611-2(a)(1) then defines:

Cost Depletion = (Basis/"the number of units remaining as of the taxable year") X units-sold.

Obviously that which is described as "the number of units remaining as of the taxable year" has been shortened in common usage to "Reserves". "Basis" is depletable basis remaining in the minerals-in-place at the beginning of the year.

"The number of units of mineral remaining as of the taxable year" is defined in Treas. Reg. § 1.611-2(a)(3):

> ". . .the number of units of mineral remaining at the end of the period to be recovered from the property (including units recovered but not sold) plus the "number of units sold within the taxable year" as defined in this section."

Further, Treas. Reg. § 1.611-2(c)(1) indicates the deposits which are to be included in depletion computations:

> If it is necessary to estimate or determine with respect to any mineral deposit as of any specific date the total recoverable units (tons, pounds, ounces, barrels, thousands of cubic feet, or other measure) of mineral products reasonably known, or on good evidence believed, to have existed in place as of that date, the estimate or determination must be made according to the method current in the industry and in light of the most accurate and reliable information obtainable. In the selection of a unit of estimate, preference shall be given to the principal unit (or units) paid for in the product marketed. The estimate of the recoverable units of the mineral products in the deposit for the purposes of valuation and depletion shall include as to both quantity and grade:
>
> (i) The ores and minerals "in sight", "blocked out", "developed", or "assured", in the usual or conventional meaning of these terms with respect to the type of the deposits, and
>
> (ii) "Probable" or "Prospective" ores or minerals (in the corresponding sense), that is, ores or minerals that are believed to exist on the basis of good evidence although not actually known to occur on the basis of existing development. Such "probable" or "prospective" ores may be estimated:
> (a) As to quantity, only in case they are extensions of known deposits or are new bodies or masses whose existence is indicated by geological surveys or other evidence to a high degree of probability, and
> (b) As to grade, only in accordance with the best indications available as to richness.

This regulation is legislative (see Internal Revenue Code § 611(a), quoted above) and long-standing (this portion has been unchanged since adoption in 1960).

ANALYSIS OF TAX DEPLETION.

Probability. The argument has been presented by taxpayers in the industry that the phrase from Treas. Reg. § 1.611-2(c):

> (a) As to quantity, only in case they are extensions of known deposits or are new bodies or masses whose existence is indicated by geological surveys or other evidence to a high degree of probability,

should be read to mean that any probable reserve is to be included in the cost depletion computation **only** if its existence is indicated "to a high degree of probability". That appears to be incorrect. If the "probable" is an "extension of a known deposit", then the modifier "to a high degree of probability" does not appear to apply. This is a reasonable interpretation of the regulation: extensions of known deposits should **already** have a reasonably high degree of probability of existence. However, as the regulation notes, if we are dealing with new bodies or masses, then the quantity must be indicated by "geological surveys or other evidence" to the required high degree of probability. "Step-outs" or "infills" of known reservoirs always provide the greatest degree of certainty (compared to

any other exploratory effort) of success. The taxpayer's interpretation of the regulation would equate "extensions of known deposits" with "new bodies or masses" relative to probable success in developing a property, an interpretation inconsistent with real world findings.

SEC & Financial Accounting. Securities and Exchange Commission Regulation §210.4-10 prescribes appropriate accounting for Oil & Gas producing activities. Of particular interest is subsection (e), which requires the use of proved oil & gas reserves to amortize property acquisition costs, if the successful efforts method of accounting is used. If the full cost method is used, subsection (i) also requires the use of proved reserves to amortize (deplete) such costs. Whatever accounting method is used, there are also provisions which permit/require the allocation of acquisition costs between proved properties and those which are neither proved nor yet determined to be "impaired".

AICPA Statement of Financial Accounting Standards No. 69, amending a number of earlier FASB Statements, also describes "Disclosures about Oil and Gas Producing Activities." Briefly stated, FASB No. 69 also dictates that only Proved reserves should be disclosed in financial statements; requirements pretty much parallel to those of the SEC.

"Reserves" for the cost depletion computation for Federal Income Tax purposes is not precisely the same as "Reserves" for financial statement or SEC purposes. This is just one of a multitude of situations where tax accounting differs from financial accounting. SEC and FASB guidelines require that **only** Proved reserves be included in the "amortization" of property costs. Treas. Reg. § 1.611-2, as quoted above, clearly states that probable reserves are to be included in the depletion computation in certain circumstances. A close reading of the seven sub-categories of Probable reserves as defined by the Industry (Society of Petroleum Engineers & World Petroleum Congress, see Exhibit I), makes it clear that some probable reserves can be a part of or an extension of known, proved reserves, and, therefore, clearly fitting such Probable reserves within the tax depletion computation pursuant to § 1.611-2, even though they would not be included for financial statement and SEC purposes.

Permissive. Another argument occasionally put forth in tax controversies is that the phrase from Treas. Reg.§ 1.611-2(c)(1) which states that "Such 'probable' or 'prospective' ores may be estimated:. . ." makes the use of the Probable Reserves in the cost depletion computation permissive, not a requirement. This ignores the clear statement earlier in that subsection that "The estimate. . .shall include. . .'Probable' or 'Prospective' ores or minerals. . ." The subsection then goes on to describe the circumstances in which such estimation is to be done; i.e., when "they are extensions of known deposits. . .", and so on. Inclusion is not permissive; it is required when the circumstances are as described in § 1.611-2(c)(1)(ii)(a). It is illogical, bordering on absurd, to think that inclusion or exclusion of some reserves would be optional. Such an interpretation would introduce additional

uncertainty into the tax computations and would be an option unlikely to be used: why would anyone reduce the depletion deduction by including additional reserves not required to be included?

INDUSTRY PRACTICES AND TERMINOLOGY.

Attached to this paper, as Exhibit I, is a two-page (in the original) article from the Journal of Petroleum Technology, May 1997 issue @ Page 527, entitled "SPE/WPC Reserves Definitions Approved." The importance that attaches to the adoption of uniform definitions within the industry cannot be overstated. Petroleum producers and independent consulting firms must use these definitions when preparing year-end reserve reports. Such reserve reports will then be the starting point for tax return preparation and for the Revenue Agent Engineer who may be examining such a tax return. The discussion which follows will be sprinkled with quotations from those definitions which will simply be referred to as Exhibit I, and the reader is invited to read said article closely. The August 1996 issue of the same Journal had presented the definitions to the Society of Petroleum Engineers in draft form for comment and the May 1997 article represents the final form.

The following caveat is noted in the first page of the article:

> *A conscious effort was made to keep the recommended terminology as close to current common usage as possible in order to minimize the impact of previously reported quantities and changes required to bring acceptance.*

In other words, the Reserves Definitions represent formal adoption of that which had been in general usage.

Proved Reserves are defined as those quantities of petroleum that can be estimated with reasonable certainty to be commercially recoverable (Ex. I gives the complete definition). Proved reserves can be developed or undeveloped. Any reserves which are not **Proved** are unproved. Unproved reserves are further divided into the two categories: Probable & Possible. Probable reserves are of such interest that the entire description is given herein:

> **Probable Reserves** are those unproved reserves which analysis of geological and engineering data suggest are more likely than not to be recoverable. In this context, when probabilistic methods are used, there should be at least a 50% probability that the quantities actually recovered will equal or exceed the sum of estimated proved plus probable reserves.
> In general, probable reserves may include (1) reserves anticipated to be proved by normal step-out drilling where sub-surface control is inadequate to classify those reserves as proved, (2) reserves in formations that appear to be productive based on well log characteristics but lack core data or definitive tests and which are not analogous to producing or proved reservoirs in the area, (3) incremental reserves attributable to infill drilling that could have been classified as proved if closer statutory spacing had been approved at the time of the estimate, (4) reserves attributable to improved recovery methods that have been established

> by repeated commercially successful applications when (a) a project is planned but not in operation and (b) rock, fluid, and reservoir characteristics appear favorable for commercial application, (5) reserves in an area of the formation that appears to be separated from the proved area by faulting and the geologic interpretation indicates the subject area is structurally higher than the proved area, (6) reserves attributable to a future workover, treatment, re-treatment, change of equipment, or other mechanical procedures, where such procedure has not been proved successful in wells which exhibit similar behavior in analogous reservoirs, and (7) incremental reserves in proved reservoirs where an alternative interpretation of performance or volumetric data indicates more reserves than can be classified as proved.

Petroleum reserves are generally re-estimated annually for financial statement and tax purposes. This has apparently become the industry practice as a result of changing reserve quantities; i.e., beginning reserves less production does not necessarily equal ending reserves. Probable reserves become proved reserves as production continues over time and a more accurate production-decline-curve can be established. The estimates can either be done internally, as many of the major petroleum producers do, or by a petroleum-consulting firm, as many less-than-major producers do.

Ultimate recovery almost always exceeds the initial estimated recovery for a reservoir. This phenomenon is discussed at technical length in an article in Energy Information Administration/Natural Gas Monthly for July, 1997, entitled "The Intricate Puzzle of Oil and Gas 'Reserves Growth'", p. vii, David F. Morehouse, author.

> . . . Estimates of proved reserves and ultimate recoveries during the early years of a field's or a reservoir's productive life span are, as a result, generally conservative. . . . Estimates of the volumes that will ultimately be produced from reservoirs and fields tend on average to increase substantially over time. . .

[*footnotes omitted*.]

The reader is referred to that article if an extensive look at "ultimate recovery appreciation" is deemed necessary or useful.

One could speculate for a long time regarding the genesis of this conservative bias . . . maybe a history of salted gold mines and overstated petroleum finds. Maybe the financial community just wants a "proved" reserve estimate with which it can feel comfortable. Whatever the cause, all industry literature makes it clear that reserve estimators who err will do so on the low side.

APPLICATION OF TAX DEPLETION REGULATIONS.

The starting point for the Revenue Agent Engineer, and later for the Appeals Officer, will be the taxpayer's reserve report. Those reserve reports will have been prepared pursuant to industry standards; i.e., the Society of Petroleum Engineers/World Petroleum Congress definitions shown at Exhibit I. The focus of contention will be those reserves listed as

"Probable" within those reports. It will be the job of the examiner to overlay the Treasury Regulation definitions of "Probable" reserves onto the various sub-categories within the industry standards to determine which are "Probable" within tax definitions; that is, which are known to exist with a high degree of probability or are extensions of known deposits? The issue is mostly one of fact.

WITH REGARD TO ISSUE B.

Treas. Reg. § 1.611-2(c)(2) provides:

> If the number of recoverable units of mineral in the deposit has been previously estimated for the prior year or years, and if there has been no known change in the facts upon which the prior estimate was based, the number of recoverable units of mineral in the deposit as of the taxable year will be the number remaining from the prior estimate. However, for any taxable year for which it is ascertained either by the taxpayer or the district director from any source, such as operations or development work prior to the close of the taxable year, that the remaining recoverable mineral units as of the taxable year are materially greater or less than the number remaining from the prior estimate, then the estimate of the remaining recoverable units shall be revised, and the annual cost depletion allowance with respect to the property for the taxable year and for subsequent taxable years will be based upon the revised estimate until a change in facts requires another revision. Such revised estimate will not, however, change the adjusted basis for depletion.

In Martin Marietta Corp. v. U. S., the Court determined that the statute and the regulation were intended to remedy mistakes of geological fact, that is, situations where the actual size of the mineral deposit in place, as originally estimated, is later determined, on the basis of more complete exploratory studies, for example, to be greater or less than earlier information indicated.

In a telling paragraph at p. 87,660 of 85-1 USTC 9284, the Court compares (as requested by the taxpayer) depreciation to depletion:

> . . .By contrast, if a depletable mineral property is idled, it is, by definition, no longer being exhausted because the mineral remains in place and may be recovered at a later time. The allowance for depletion recognizes this fact, for it applies only to the amount of mineral actually extracted from the property. . .

See also West Virginia Coal Co. v. Comm., 16 B.T.A. 378 (1929), Wylie v. U.S., 281 F. Supp. 180 (N.D. Tex. 1968) and Rev. Rul. 67-157, 1967-1 C. B. 154, for additional examples that discuss adjustments to mineral reserves because of price or demand changes.

The concern with this issue, as articulated in Examination's Coordinated Issue Paper, is that the producer would attempt to revise mineral reserve estimates based solely on price

fluctuations. In reality, economics will rarely be easily distinguishable in the reservoir reserve report. Production and/or development throughout the year will, in all likelihood, clarify the production decline curve and be blended with price assumptions in the reserve report. The appraiser/estimator is required to take into account ". . .current economic conditions, operating methods, and government regulations." (See the definition of Proved Reserves at Exhibit I.). Treas. Reg. § 1.611-2(a)(3) effectively defines beginning inventory ("number of units of mineral remaining as of the taxable year") as ending inventory plus production during the year; see Discussion, Law, above. So it is understood, within the Regulations and within the industry, that last year's-end reserve estimate minus production will only approximate this year's-end reserve estimate.

At least to some degree, "commercially recoverable" (see Exhibit I) will depend on current oil (or gas) prices. The plain language of Exhibit I indicates that the estimator will have taken price levels into consideration when the estimates were made. It might seem, though it is less than perfectly clear, that year's-end estimates might drop or pick up reserves, *vis a vis* the prior year's-end estimate, if there has been a major price change during the year. Rev. Rul. 67-157, supra, and the cited case law make it clear, however, that reserves are not to be revised solely because of market fluctuations.

SETTLEMENT GUIDELINES

ISSUE A.

At this point, it should be apparent that the issue will be heavily factual. Most taxpayers will offer some variation of the arguments listed above, but for the reasons detailed, those legal contentions are essentially non-starters. Most taxpayers will concede that Proved, undeveloped reserves must be included in the depletion computation; even FASB & SEC require that all proved reserves be disclosed. The issue will focus on the Probable Reserves (or whatever internal terminology the taxpayer may use).

A re-reading of the seven categories defined into Probable Reserves by the SPE/WPC will make it obvious that some of those categories are also defined into Treas. Reg. § 1.611-2(c)(1), such as number (7). Category (3) would require an inquiry regarding statutory spacing; for Category (1) the RA Engineer should have had an extensive discussion with the estimator as to exactly why these "step-outs" are not an extension of the Proved reserves in the same field or reservoir. Categories (4) & (6) may well be excludible from the depletion computation, depending on the taxpayer's stage of implementing any enhanced recovery methods; they also may be includible, if the facts warrant. Inclusion or exclusion of Category (2) will depend on whether the "high degree of probability" test of § 1.611-2(c)(1) is met, unless these are extensions of proved reserves (unlikely).

The immediately preceding is not intended to be an exhaustive listing of all possible factual situations that can be present in a particular case. It is clear that the examiner or RA Engineer will be required to give his/her examination the proper depth and thoroughness to determine whether Probable Reserves have been properly treated.

WITH REGARD TO ISSUE B.

Adverse economic circumstances (a price drop), taken alone, should not result in an increased depletion expense or some other sort of write-off. In most cases, a temporary price change, even if a large change, will not cause producers to abandon long-term plans to develop known productive reserves, only to defer such plans. As the Martin Marietta Court, supra, notes, idled depletable assets are not being exhausted nor necessarily abandoned; they are simply idled. Cyclical price swings will not affect total petroleum product to be recovered in the long term. These two factors create an internal tension in this sub-issue: 1. Economic conditions do not affect the volume of petroleum available to be recovered; but 2. Economic conditions will determine whether an effort will be made to recover marginal reserves.

It is uncertain when or whether estimators/appraisers delete or add large chunks of reserves based on drastic changes in price levels in a particular year. The examiner, and in turn the Appeals Officer, should be alert to this possibility and take proper exception thereto. Large changes in reserve estimates from one year to the next, on a particular property, may be the product of something as innocuous as the abandonment of a pay zone due to excessive saltwater production, rather than drastic changes in the price of petroleum. Nonetheless, as noted above, the engineer who estimates year's-end reserves will have taken the price of crude oil or natural gas into account in calculating the reserve estimate. Therefore, price levels will transparently find their way into the recoverable depletion reserves estimate (and depletion computations) by having been taken into account at the time the estimate is made.

EXHIBIT I
Reprinted from The Journal of Petroleum Technology, May 1997, p. 527, with the Permission of the Society of Petroleum Engineers.

"SPE/WPC Reserves Definitions Approved"

The SPE Board of Directors recently approved the revised reserves definitions submitted by the SPE Oil and Gas Reserves Committee. The revised definitions, drafted by the Society of Petroleum Engineers/ World Petroleum Congresses (WPC) Task Force on Petroleum** Reserves Definitions, are the result of several years of collaboration among task force members from both organizations, with input from outside organizations, companies, and individuals.

SPE and WPC emphasize that these new definitions are intended to establish standard, general guidelines for petroleum reserves classification that will allow for proper comparison of quantities on a worldwide basis. The definitions, with the exception of portions of the Preamble, are presented here.

Preamble

The terminology used in classifying petroleum substances and the various categories of reserves have been the subject of much study and discussion for many years. Attempts to standardize reserves terminology began in the mid 1930's when the American Petroleum Institute considered classification for petroleum and definitions or various reserves categories. Since then, the evolution of technology has yielded more precise engineering methods to determine reserves and has intensified the need for an improved nomenclature to achieve consistency among professionals working with reserves terminology. Working entirely separately, the Society of Petroleum Engineers and the World Petroleum Congress produced strikingly similar sets of petroleum reserve definitions for known accumulations which were introduced in early 1987. These have become the preferred standards for reserves classification across the industry. Soon after, it became apparent to both organizations that these could be combined into a single set of definitions which could be used by the industry worldwide. Contacts between representatives of the two organizations started in 1987, shortly after the publication of the initial sets of definitions. During the World Petroleum Congress in June 1994, it was recognized that while any revisions to the current definitions would require the approval of the respective Boards of Directors, the effort to establish a worldwide nomenclature should be increased. A common nomenclature would present an enhanced opportunity for acceptance and would signify a common and unique stance on an essential technical and professional issue facing the international petroleum industry.

As a first step in the process, the organizations issued a joint statement which presented a broad

**Petroleum: For the purpose of these definitions, the term petroleum refers to naturally occurring liquids and gases which are predominately comprised of hydrocarbon compounds. Petroleum may also contain non-hydrocarbon compounds in which sulphur, oxygen, and/or nitrogen atoms are combined with carbon and hydrogen. Common examples of non-hydrocarbons found in petroleum are nitrogen, carbon dioxide, and hydrogen sulfide. A task force was established by the Boards of SPE and WPC to develop a common set of definitions based on this statement of principles.

A conscious effort was made to keep the recommended terminology as close to current common

usage as possible in order to minimize the impact of previously reported quantities and changes required to bring about wide acceptance. The proposed terminology in not intended as a precise system of definitions and evaluation procedures to satisfy all situations. Due to the many forms of occurrence of petroleum, the wide range of characteristics, the uncertainty associated with the geological environment, and the constant evolution of evaluation technologies, a precise classification system is not practical. Furthermore, the complexity required for a precise system would detract from its understanding by those involved in petroleum matters. As a result, the recommended definitions do not represent a major change from the current SPE and WPC definitions which have become the standards across the industry. It is hoped that the recommended terminology will integrate the two sets of definitions and achieve better consistency in reserves data across the international industry.

Reserves derived under these definitions rely on the integrity, skill, and judgment of the evaluator and are affected by the geological complexity, stage of development, degree of depletion of the reservoirs, and amount of available data. Use of these definitions should sharpen the distinction between the various classifications and provide more consistent reserves reporting.

Definitions

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 sub-classified as probable and possible reserves to denote progressively increasing uncertainty in their recoverability.

The intent of the SPE and WPC in approving additional classifications beyond proved reserves is to facilitate consistency among professionals using such terms. In presenting these definitions, neither organization is recommending public disclosure of reserves classified as unproved. Public disclosure of the quantities classified as unproved reserves is left to the discretion of the countries or companies involved.

Estimation of reserves is done under conditions of uncertainty. The method of estimation is called deterministic if a single best estimate of reserves is made based on known geological, engineering, and economic data. The method of estimation is called probabilistic when the known geological, engineering, and economic data are used to generate a range of estimates and their associated probabilities. Identifying reserves as proved, probable, and possible has been the most frequent classification method and gives an indication of the probability of recovery. Because of potential differences in uncertainty, caution should be exercised when aggregating reserves of different classifications.

Reserves estimates will generally be revised as additional geologic or engineering data becomes available or as economic conditions change. Reserves do not include quantities of petroleum being held in inventory, and may be reduced for usage or processing losses if required for financial reporting.

Reserves may he attributed to either natural energy or improved recovery methods. Improved recovery methods include all methods for supplementing natural energy or altering natural forces

in the reservoir to increase ultimate recovery. Examples of such methods are pressure maintenance, cycling, waterflooding, thermal methods, chemical flooding, and the use of miscible and immiscible displacement fluids. Other improved recovery methods may be developed in the future as petroleum technology continues to evolve.

Proved Reserves. 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 a 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 reserve estimate, appropriate contract obligations, corporate procedures, and government regulations involved in reporting these reserves.

In general, reserves are considered proved if the commercial producibility of the reservoir is supported by actual production or formation tests. In this context, the term proved refers to the actual quantities of petroleum reserves and not just the productivity of the well or reservoir. In certain cases, proved reserves may be assigned on the basis of well logs and/or core analysis that indicate the subject reservoir is hydrocarbon bearing and is analogous to reservoirs in the some area that are producing or have demonstrated the ability to produce on formation tests.

The area of the reservoir considered as proved includes (1) the area delineated by drilling and defined by fluid contacts, if any, and (2) the undrilled portions of the reservoir that can reasonably be judged as commercially productive on the basis of available geological and engineering data. In the absence of data on fluid contacts, the lowest known occurrence of hydrocarbons controls the proved limit unless otherwise indicated by definitive geological, engineering or performance data.

Reserves may be classified as proved if facilities to process and transport those reserves to market are operational at the time of the estimate or there is a reasonable expectation that such facilities will be installed. Reserves in undeveloped locations may bc classified as proved undeveloped provided (1) the locations are direct offsets to wells that have indicated commercial production in the objective formation, (2) it is reasonably certain such locations are within the known proved productive limits of the objective formation, (3) the locations conform to existing well spacing regulations where applicable, and (4) it is reasonably certain the locations will be developed. Reserves from other locations are categorized as proved undeveloped only where interpretations of geological and engineering data from wells indicate with reasonable certainty that the objective formation is laterally continuous and contains commercially recoverable petroleum at locations beyond direct offsets.

Reserves which are to 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 response of an installed program in the same or an analogous reservoir with similar rock and fluid properties provides support for the analysis on which the project was based, and, (2) it is

reasonably certain that the project will proceed. Reserves to be recovered by improved recovery methods that have yet to be established through commercially successful applications are included in the proved classification only (1) after a favorable production response from the subject reservoir from either (a) a representative pilot or (b) an installed program where the response provides support for the analysis on which the project is based and (2) it is reasonably certain the project will proceed.

Unproved Reserves. 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. Unproved reserves may be further classified as probable reserves and possible reserves.

Unproved reserves may be estimated assuming future economic conditions different from those prevailing at the time of the estimate. The effect of possible future improvements in economic conditions and technological developments can be expressed by allocating appropriate quantities of reserves to the probable and possible classifications.

Probable Reserves. Probable reserves are those unproved reserves which analysis of geological and engineering data suggests are more likely than not to be recoverable. In this context, when probabilistic methods are used, there should be at least a 50% probability that the quantities actually recovered will equal or exceed the sum of estimated proved plus probable reserves.

In general, probable reserves may include (1) reserves anticipated to be proved by normal step-out drilling where sub-surface control is inadequate to classify these reserves as proved, (2) reserves in formations that appear to be productive based on well log characteristics but lack core data or definitive tests and which are not analogous to producing or proved reservoirs in the area, (3) incremental reserves attributable to infill drilling that could have been classified as proved if closer statutory spacing had been approved at the time of the estimate, (4) reserves attributable to improved recovery methods that have been established by repeated commercially successful applications when (a) a project or pilot is planned but not in operation and (b) rock, fluid, and reservoir characteristics appear favorable for commercial application, (5) reserves in an area of the formation that appears to bc separated from the proved area by faulting and the geologic interpretation indicates the subject area is structurally higher than the proved area, (6) reserves attributable to a future workover, treatment, re-treatment, change of equipment, or other mechanical procedures, where such procedure has not been proved successful in wells which exhibit similar behavior in analogous reservoirs, and (7) incremental reserves in proved reservoirs where an alternative interpretation of performance or volumetric data indicates more reserves than can be classified as proved.

Possible Reserves. Possible reserves are those unproved reserves which analysis of geological and engineering data suggests are less likely to be recoverable than probable reserves. In this context, when probabilistic methods are used, there should be at least a 10% probability that the quantities actually recovered will equal or exceed thee sum of estimated proved plus probable plus possible reserves.

In general, possible reserves may include, (1) reserves which, based on geological interpretation, could possibly exist beyond areas classified as probable, (2) reserves in formations that appear to be petroleum bearing based on log and core analysis but may not be productive at commercial rates, (3) incremental reserves attributed to infill drilling that are subject to technical

uncertainty, (4) reserves attributable to improved recovery methods when (a) a project or pilot is planned but not in operation and (b) rock, fluid, and reservoir characteristics are such that a reasonable doubt exists that the project will be commercial, and (5) reserves in an area of the formation that appears to be separated from the proved area by faulting and geological interpretation indicates the subject area is structurally lower than the proved area.

Reserve Status Categories. Reserve status categories define the development and producing status of wells and reservoirs.

Developed. Developed reserves are expected to be recovered from existing wells including reserves behind pipe. Improved recovery reserves are considered developed only after the necessary equipment has been installed, or when the costs to do so are relatively minor. Developed reserves may be sub-categorized as producing or non-producing.

Producing. Reserves subcategorized as producing are expected to be recovered from completion intervals which are open and producing at the time of the estimate. Improved recovery reserves are considered producing only after the improved recovery project is in operation.

Non-producing. Reserves subcategorized as non-producing include shut-in and behind-pipe reserves. Shut-in reserves are expected to be recovered from (1) completion intervals which are open at the time of the estimate but which have not started producing, (2) wells which were shut-in for market conditions or pipeline connections, or (3) wells not capable of production for mechanical reasons. Behind-pipe reserves are expected to be recovered from zones in existing wells, which will require additional completion work or future recompletion prior to the start of production.

Undeveloped Reserves. Undeveloped reserves are expected to be recovered: (1) from new wells on undrilled acreage, (2) from deepening existing wells to a different reservoir, or (3) where a relatively large expenditure is required to (a) recomplete an existing well or (b) install production or transportation facilities for primary or improved recovery projects.

END

* * * Journal of Petroleum Technology.