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AN ANALYSIS OF AUDIT RISK IN ASSOCIATING
WITH RESERVE INFORMATION OF OIL
AND GAS COMPANIES

DISSERTATION

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By

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This research was designed to investigate the relationship between audit risk and the conduct of the audit engagement in the specific context of an oil and gas audit. Because reserve estimates are in the financial reports of oil and gas entities (in the depreciation, depletion and amortization calculation, the limitation on capitalized costs for companies using the full-cost method, and the required supplementary disclosure for companies subject to Securities and Exchange Commission requirements) and because the reserve estimation process is considerably affected by numerous factors, there is a chance that a material error could be incorporated into the financial statement representations with which the auditor is associated. The objective of the research was to (1) identify conditions which are important in an assessment of audit risk in associating with reserve estimates, and (2) determine the impact of some of these conditions on the conduct of the audit.

In order to achieve the research objective, a two-phase approach was used. In the first phase, audit risk indicators specific to an oil and gas engagement were accumulated through research and consultation with practitioners. A questionnaire was developed asking participants

to evaluate the relative importance of each indicator in risk assessment. An analysis of the responses provided confirmation and reduction of the audit risk indicators into a small number for further study. In the second phase, several levels of risk were described for certain of the audit risk indicators identified in the first phase. Ways in which auditors could change the conduct of the audit were also described. The audit risk, the risk levels, and the possible changes were formulated into a questionnaire in which respondents were asked to indicate the likelihood of making each specific change at each risk level.

The questionnaire responses were analyzed using both nonparametric statistics and categoric regression techniques. The results of the questionnaire strongly support the research hypothesis that "in the context of an oil and gas audit, as risk increases an auditor will change the conduct of the audit." The major implications of this research to the auditing profession are in the areas of planning audit programs, training personnel and formulating firm policy on audit risk.

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CHAPTER I

INTRODUCTION

History of Financial Accounting Requirements for Oil and Gas Producing Companies

The development of oil and gas financial accounting is replete with studies, pronouncements, and suspensions of pronouncements. The first participation by an authoritative accounting rule-making body in the evolution of financial accounting for oil and gas producing activities occurred in 1964 when the Accounting Principles Board (APB) of the American Institute of Certified Public Accountants (AICPA) commissioned a study to be performed by Robert E. Field. At that time, there was a diversity of accounting methods being used, with most methods being varieties of either successful-efforts accounting or full-cost accounting. While Field's effort resulted in Accounting Research Study No. 11 (1969)¹, its recommendation that full cost be abandoned in favor of successful efforts was never adopted by the APB.

The issue of consistent financial accounting in the oil and gas industry did not receive authoritative concern

¹Robert E. Field, "Financial Reporting in the Extractive Industries," Accounting Research Study No. 11, (New York, American Institute of Certified Public Accountants, 1969).

again until 1975 at which time the Financial Accounting Standards Board (FASB) instituted a project to study the topic. The result of this effort was Statement of Financial Accounting Standards No. 19 (Statement No. 19) entitled "Financial Accounting and Reporting for Oil and Gas Producing Companies." This statement supported a successful-efforts method of accounting.²

Before Statement No. 19 went into effect, the Securities and Exchange Commission (SEC) decided that neither successful efforts nor full cost adequately presented the operating results or the financial position of an oil and gas company. As presented in Accounting Series Release No. 253 (ASR 253), "Adoption of Requirements for Financial Accounting and Reporting Practices for Oil and Gas Producing Activities," they argued that neither method reflected the major activity of oil and gas companies-- finding proved reserves--nor satisfactorily reflected the major asset--reserves.³ Therefore, the SEC announced that they would seek to develop a new accounting method which would be called Reserve Recognition Accounting (RRA).

²Financial Accounting Standards Board, "Financial Accounting and Reporting by Oil and Gas Producing Companies," Statement of Financial Accounting Standards No. 19, (Stamford, Conn., FASB, December 1977).

³Securities and Exchange Commission, "Adoption of Requirements for Financial Accounting and Reporting Practices for Oil and Gas Producing Activities," Release Nos. 33-5966; 34-15108; 35-20688; IC-10383; AS-253, (Washington, Government Printing Office, August 31, 1978).

Until RRA could be developed, companies could continue to use either successful efforts [following the rules specified in Accounting Series Release No. 257 (ASR 257), "Requirements for Financial Accounting and Reporting Practices for Oil and Gas Producing Activities," which were basically the same as those in Statement No. 19] or full cost [following a method subsequently prescribed by the SEC in Accounting Series Release No. 258 (ASR 258), "Oil and Gas Producers--Full Cost Accounting Practices"] in reports filed with the SEC.

In 1981, Accounting Series Release No. 289 (ASR 289), "Financial Reporting by Oil and Gas Producers," was issued with the summary that

The Commission is announcing that it no longer considers Reserve Recognition Accounting to be a potential method of accounting in the primary financial statements of oil and gas producers. In addition, the Commission is announcing its support of an undertaking by the Financial Accounting Standards Board to develop a comprehensive package of disclosures for those engaged in oil and gas producing activities.⁴

Pursuant to the SEC's announcement that the FASB would undertake a project to develop supplemental disclosure requirements for oil and gas companies, the FASB issued an Exposure Draft in March, 1982, of a Proposed Statement of Financial Accounting Standards specifying disclosures about

⁴Securities and Exchange Commission, "Financial Reporting by Oil and Gas Producers," Release Nos. 33-6294; 34-17581; 35-21936; IC-11650; AS-289, (Washington, Government Printing Office, February 26, 1981), p. 1.

oil and gas producing activities. The FASB indicated that among the disclosures for public enterprises, there should be information on proved oil and gas reserve quantities and standardized estimates of discounted net cash flows relating to proved oil and gas reserves.⁵ This Exposure Draft was accepted and became Statement of Financial Accounting Standards No. 69, "Disclosures About Oil and Gas Producing Activities."

Definition of Oil and Gas Reserves

Prior to any discussion of the usage of reserve data in financial reports, it is necessary to define reserves and to differentiate among the types of reserves. (The determination and calculation of reserves will be discussed in a subsequent section.)

Reserves are those quantities of crude oil, natural gas, and natural gas liquid which, upon analysis of geologic and engineering data, appear with reasonable certainty to be recoverable in the future from oil and gas reservoirs.⁶ There are different categories of reserves used in financial accounting. These categories and their definitions are:

⁵Financial Accounting Standards Board, "Disclosures About Oil and Gas Producing Activities," Exposure Draft, Proposed Statement of Financial Accounting Standards, (Stamford, Conn., FASB, April 15, 1982).

⁶Statement No. 19, Par. 271.

Proved reserves. Those quantities of crude oil, natural gas and natural gas liquids which, upon analysis of geologic and engineering data, appear with reasonable certainty to be recoverable in the future from known oil and gas reservoirs under existing economic and operating conditions. Proved reserves are limited to those quantities of oil and gas which can be expected, with little doubt, to be recoverable commercially at current prices and costs, under existing regulatory practices and with existing conventional equipment and operation methods. Depending upon their status of development, such proved reserves are subdivided into "proved developed reserves" and "proved undeveloped reserves."

Proved developed reserves. Reserves which can be expected to be recovered through existing wells with existing equipment and operating methods. Proved developed reserves include both (a) proved developed producing reserves (those that are expected to be produced from existing completion intervals now open for production in existing wells) and (b) proved developed nonproducing reserves (those that exist behind the casing of existing wells, or at minor depths below the present bottom of such wells, which are expected to be produced through these wells in the predicted future, where the cost of making such oil and gas available for production should be relatively small compared to the cost of a new well). Additional oil and gas expected to be obtained through the application of fluid injection or other improved recovery techniques for supplementing the natural forces and mechanisms of primary recovery should be included as "proved developed reserves" only after testing by a pilot project or after the operation of an installed program has confirmed through production response that increased recovery will be achieved.

Proved undeveloped reserves. Reserves which are expected to be recovered from new wells on undrilled acreage, or from existing wells where a relatively major expenditure is required for re-completion. Reserves on undrilled acreage shall be limited to those drilling units offsetting productive units, which are reasonably certain of production when drilled. Proved reserves for other undrilled units can be claimed only where it can be demonstrated with certainty that there

is continuity of production from the existing productive formation. Under no circumstances should estimates for proved undeveloped reserves be attributable to any acreage for which an application of fluid injection or other improved recovery technique is contemplated, unless such techniques have been proved defective by actual tests in the area and in the same reservoir.⁷

Use of Reserve Information in Financial Reports

Oil and gas reserve information may be used in three ways in financial reports of oil and gas companies: in the calculation of depreciation, depletion and amortization (DD&A); in the ceiling test (limitation on capitalized costs) for full-cost companies; and as required supplementary information for publicly-owned enterprises.

DD&A Calculation

Depreciation, depletion and amortization is calculated in order to charge to expense the capitalized costs of acquisition, exploration and development activities. Prior to Statement No. 19 there was no standard method of calculating DD&A. With the adoption of Statement No. 19 the units-of-production method became the generally accepted method for successful-efforts companies (with certain exceptions for "passive" investors).⁸ The DD&A computation for full-cost companies as specified in Accounting Series

⁷Ibid.

⁸Ibid., Par. 38.

Release No. 258 (ASR 258) is also a units-of-production method.⁹ The costs to be capitalized and the calculation of DD&A differ for full-cost and successful-efforts companies. However, in DD&A calculations for both full-cost and successful-efforts companies, the unit cost is computed on the basis of total estimated units of oil and gas reserves. For full-cost companies, the reserves used in the DD&A calculation are total proved reserves, while for successful-efforts companies the reserves used are either total proved reserves or proved developed reserves only, depending on the nature of the capitalized costs.

Full-Cost Ceiling Test

The authoritative requirement of a ceiling test for full-cost companies originated with the SEC. While many full-cost companies used some form of a ceiling test, one was not specified until the SEC issued ASR 258. The requirements of the SEC ceiling test are limited to publicly-held oil and gas companies. The test or limitation is such that

- (i) For each cost center, capitalized costs, less accumulated amortization and related deferred income taxes, shall not exceed an amount (the cost center ceiling) equal to the sum of (A) the present value of future net revenues from estimated production of

⁹Securities and Exchange Commission, "Oil and Gas Producers--Full Cost Accounting Practices," Release Nos. 33-6007; 34-15417; 35-20837; IC-10531; AS-258, (Washington, Government Printing Office, December 19, 1978).

proved oil and gas reserves. . . , plus (B) the cost of properties not being amortized . . . ; plus (C) the lower of cost or estimated fair value of unproved properties included in the costs being amortized; less (D) income tax effects related to differences between the book and tax basis of the properties involved.

- (ii) If unamortized costs, capitalized within a cost center, less related deferred income taxes, exceed the cost center ceiling, the excess shall be charged to expense and separately disclosed during the period in which the excess occurs. Amounts thus required to be written off shall not be reinstated for any subsequent increase in the cost center ceiling.¹⁰

As specified, proved reserve data is integral input into this limitation calculation.

Required Supplementary Disclosure

The final use of reserve data is as required disclosure as supplementary information accompanying the financial statements of publicly-held oil and gas companies. This required disclosure is the culmination of several years' consideration regarding the proper placement of reserve disclosures. One of the first authoritative requirements was set forth in Statement No. 19. In Statement No. 19's Appendix B, "Basis for Conclusions," the Board explained why the inclusion of reserve data was of importance

Most of the respondents to the Discussion Memorandum and most of the interviewees in the research effort. . . said that information about

¹⁰Ibid.

quantities of oil and gas reserves is essential to understand and interpret the financial statements of an oil and gas producing company. Many felt that reserve information is the single most important type of disclosure that could be required of an oil and gas producing company. They said that discovery of reserves is the critical event in the oil and gas production cycle and that reserves and change in reserves are key indicators of the success of a company. In general, the Board agrees with those views.¹¹

As originally issued, these disclosures were to have been "made within the body of the financial statements, in the notes thereto, or in a separate schedule that is an integral part of the financial statements."¹² The original effective date of Statement No. 19 was for fiscal years beginning after December 15, 1978. This requirement placed reserve data directly in the audited financial statements, but curiously there was little reaction by accountants or users at the time. As speculated by Alan May, Jr., then Chairman of the Oil and Gas Reserve Data Committee of the American Institute of Certified Public Accountants

Interestingly, few focused on the requirement of the FASB to put reserves in footnotes when the full cost successful efforts debate was going on. The emotional issue was so great at that time that not many noticed that reserves would be included, and there was not much protest about their inclusion in the audited financial statements.¹³

¹¹Statement No. 19, Par. 235.

¹²Ibid., Par. 48.

¹³Alan May, Jr., "Public Reporting of Oil and Gas Reserves--Auditing Oil and Gas Reserve Information (Part I)," Institute on Oil and Gas Accounting 15th Southwestern Legal Foundation, 1979 Proceedings, (New York, 1980), p. 4.

Regarding the placement of reserve information, the Board explained

The Board does not agree with the view, expressed by some, that mineral reserve information is not accounting information and, if disclosed at all, should not be included in financial statements. Those who take the position argue that while reserve information may indeed be important, it is too subjective, too frequently revised, too unreliable, too "soft" to be reported in financial statements. In the Board's judgment, however, certain reserve information has the qualities of verifiability, reliability, freedom from bias, comparability, and the like to a sufficiently reasonable degree to warrant its inclusion in financial statements. Accordingly, the Board concluded that reserve information is so helpful and essential to an understanding of the financial position, results of operations, and changes in financial position of an oil and gas producing company that the added relevance of the financial statements from including the information more than compensates for the lack of precision of estimates of reserves.¹⁴

In summary, Statement No. 19 required that reserve information be presented within the audited portion of the financial statements. It was the Board's opinion that this data had an information value which sufficiently offset its lack of precision.

As noted in the review of the history of financial accounting for oil and gas production companies, the SEC intervened before Statement No. 19 was to have gone into effect. Since the SEC desired the creation of a method of accounting which would be based on reserve data, they did

¹⁴Statement No. 19, Par. 236.

not support the successful-efforts method advocated in Statement No. 19. Until RRA could be perfected, however, the SEC would require disclosure of certain reserve data. The original requirement was that this disclosure be in the audited financial statements for fiscal years ending after December 25, 1979. However, prior to that time the SEC changed this requirement to allow the presentation of this information as an unaudited note or schedule accompanying the financial statements.¹⁵

Pursuant to the SEC's issuance of ASR 253, the FASB issued Statement of Financial Accounting Standards No. 25 (Statement No. 25), "Suspension of Certain Accounting Requirements for Oil and Gas Producing Companies," in which they suspended most of the portions of Statement No. 19 related to rules under successful-efforts accounting. The reserve disclosure portions of Statement No. 19 were not suspended. However, Statement No. 25 changed the location of reserve disclosures from the body or footnotes of the statements to supplementary information. In explaining why this information was moved to supplementary information, the Board stated

In view of the evolutionary and experimental nature of deciding where information should be

¹⁵Securities and Exchange Commission, "Oil and Gas Reserve Information--Postponement of Audit Requirement," Release Nos. 33-6207; 34-16752; 35-21526; IC-11133; AS-277, (Washington, Government Printing Office, April 17, 1980), p. 2.

disclosed and the degree of independent verification, the Board believes that, for the present, permitting the required disclosure of reserve quantities to be made outside the financial statements will ensure the provision of this essential information without excessive burden.¹⁶

The Board's decision was tempered by input from respondents who had "concerns generally related to the cost, time, or difficulty of obtaining an independent verification of reserve quantity information."¹⁷ A further item which should be noted is the fact that the auditing profession was "in the process of developing standards that establish an independent accountant's responsibility to review and verify compliance with a required disclosure permitted to be made outside the financial statements."¹⁸ Prior to that time, there had been no such authoritative guidance. The development of a statement of responsibility in this area would clarify that the extent of audit work required in a review of supplementary information was less than that required in a full audit. This decrease would result in time and cost savings.

The most recent impact on supplemental disclosure of reserve information resulted from the agreement between the SEC and the FASB that the latter would develop a

¹⁶Financial Accounting Standards Board, "Suspension of Certain Accounting Requirements for Oil and Gas Producing Companies," Statement of Financial Accounting Standards No. 25, (Stamford, Conn., FASB, February 1979), Par. 28.

¹⁷Ibid.

¹⁸Ibid.

comprehensive package of disclosures. The FASB responded with an Exposure Draft (March 1982) requiring the disclosure of information about proved developed and undeveloped reserves including (but not limited to) beginning of the year information, revisions, changes due to improved recovery, purchases, discoveries, production and sales. Information is also to be disclosed on proved developed reserves. The Exposure Draft was adopted as Statement No. 69, and the format of the required disclosures is presented in Appendix A.

Association of Auditors with Reserve Information

Nature of Auditors' Association with Reserve Information

An auditor is considered to be associated with reserve information when the auditor's name is associated with financial statements which include oil and gas reserve data. Of the three uses of reserve information, the first two--the DD&A calculation and the ceiling test for full-cost companies--are used in the determination of actual financial statement numbers. For these and any other financial statement representations, the auditor must obtain sufficient, competent evidential matter to afford a reasonable basis for an opinion on their fairness. As detailed in the

¹⁹American Institute of Certified Public Accountants, "Evidential Matter," Statements on Auditing Standards No. 31, (New York, AICPA, August 1980), Par. 03.

explanatory material supporting the third standard of field work, "assertions are representations by management that are embodied in financial statement components."¹⁹ Among the categories of assertions are those about valuation or allocation which "deal with whether asset, liability, revenue and expense components have been included in the financial statements at appropriate amounts."²⁰ The DD&A calculation and ceiling test would be classified in this category of assertions. Therefore, the auditor of an oil and gas entity would need to obtain sufficient, competent, evidential matter to support an opinion on the fairness of the DD&A calculation for all companies and the application of the cost ceiling for full-cost companies.

Materiality is implicit in the concept of fair presentation.²¹ Therefore, the relative materiality of a representation would temper the extent of any audit effort. As noted by Robert Kelley, Vice President for Finance of Samedan Oil Corporation, the DD&A expense is "one of the largest expense items of an oil and gas producing company."²² Logically its determination would be considered of material importance.

²⁰Ibid., Par. 09.

²¹SAS 31, Par. 11.

²²Robert Kelley, "Accounting for the Effects of Reserve Changes on Interim Results," Journal of Extractive Industries Accounting, Vol. 1 No. 3 (Fall 1982).

The limitation on capitalized cost is an essential feature of full-cost accounting. While this method basically capitalizes all costs incurred in acquiring, exploring and developing properties within a cost center, the accounting convention of conservatism requires that the asset not be on the books in an amount which exceeds its realizable value. The ceiling test determines this dollar limitation. The use of reserve data in this calculation is, therefore, materially important. (This application has taken on even greater significance because of recent declines in prices of oil and gas.)

The use of reserve data as supplemental information imposes a lighter burden on the auditor than the two uses discussed earlier. "The auditor has no responsibility to examine information outside the basic financial statement in accordance with generally accepted auditing standards."²³ The auditor's basic responsibility with regard to supplementary information is such that the auditor is charged with applying certain limited procedures and should report deficiencies in, or the omission of, information required by the FASB. The true limits of the auditor's

²³American Institute of Certified Public Accountants, "Supplementary Information Required by the Financial Accounting Standards Board," Statements on Auditing Standards No. 27, (New York, AICPA, December 1979), Par. 04.

responsibility may not be known until litigation serves to establish parameters in this heretofore uncertain area.

Further discussion of the auditor's responsibility, authoritative guidance and the auditor's risk of association with reserve information is presented in subsequent sections of this chapter.

The Nature of Reserve Information

To appreciate the essence of the responsibility of an auditor's association (at any level) with reserve data, the derivation of reserve numbers must be understood. In the publication, "Estimation and Valuation of Underground Oil and Gas Reserves," the American Petroleum Institute discusses the methodology of reserve estimation and valuation. In the introduction to the paper, they state,

Because of the varying degrees of expertise, technical assumptions, data availability, and human judgment applied in reserve estimation and valuation, there can be considerable variations in the comparability of data between companies.²⁴

Related to the varying degrees of expertise referred to, the Society of Petroleum Engineers published "Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserve Information" which established professional qualifications for reserve estimators and reserve auditors. As explained by the Society of Petroleum Engineers

²⁴American Petroleum Institute, "Estimation and Valuation of Underground Oil and Gas Reserves," (1971), p. 1.

The reliability of Reserve Information is considerably affected by several factors. Initially, it should be noted that Reserve Information is imprecise due to the inherent uncertainties in, and the limited nature of, the data base upon which the estimating and auditing of Reserve Information is predicated. Moreover, the methods and data used in estimating Reserve Information are often necessarily indirect or analogical in character rather than direct or deductive. Furthermore, the persons estimating and auditing Reserve Information are required, in applying generally accepted petroleum engineering and evaluation principles, to make numerous judgments based upon their educational background, professional training and professional experience. The extent and significance of the judgments to be made are, in themselves, sufficient to render Reserve Information inherently imprecise.²⁵

While the standards established could serve to control or limit the variable of degree of expertise, other variables still remain. An overview of the methodology of reserve estimation expands on several of these other variables.

The effort to establish reserve estimates has two major components: (1) reserve quantity estimation and (2) reserve valuation. This discussion is limited to reserve quantity estimation which also has two components: (a) the determination of hydrocarbons in place and (b) the determination of the economic recovery factor. A listing of the variables involved in determining the hydrocarbons in place emphasizes the potential for miscalculations in the process.

²⁵Society of Petroleum Engineers, "Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserve Information," Journal of Petroleum Technology (December 1979), p. 1559.

$$\text{Hydrocarbons in Place} = \text{Area} \times \text{Thickness} \times \text{Porosity} \times \text{Hydrocarbon Saturation} \times \text{Shrinkage or Expansion}^{26}$$

What must be realized is that each factor in the formula also requires estimations. However, it is noted that

although significant errors can be introduced by the lack of data for determination of hydrocarbons in place, considerably more latitude for judgment and corresponding possibilities for error is introduced in the determination of the economic recovery factor.²⁷

The economic recovery factor depends on three variables:

(i) the natural producing mechanism; (ii) net value of hydrocarbons; and (iii) additional recovery potential.

The basic equation (hydrocarbons in place multiplied by the economic recovery factor) is used in five general methods of computing petroleum reserves. These methods are: volumetric estimation; material balances; production decline curves; estimating reserves using production and recovery characteristics from other reservoirs which have similar geological and reservoir conditions; and estimating reserves using production and recovery characteristics from the same reservoir as though it were in other fields.²⁸

Among conclusions which can be reached in the study of reserve estimation are the following.

²⁶American Petroleum Institute, p. 5.

²⁷Ibid., p. 9.

²⁸Alan D. Bell, "The Petroleum Reserve Estimation Process--An Introduction For Accountants," Journal of Extractive Industries Accounting, Vol. 2 (Spring 1983), p. 75.

- (1) The method used to estimate the petroleum reserves is dictated by the amount of information available about the characteristics of the reservoir.
- (2) With the passage of time from the early exploratory stage through the production stage, the error rate in reserve estimation decreases.
- (3) A combination of methods for computing reserve estimates can be used.
- (4) Fluctuations in petroleum prices will affect the economic limit of a well or field and therefore the amount of recoverable reserves.²⁹

Professional Standards Guidance for Auditors
Associated with Reserve Information

While an auditor of an oil and gas producing entity will find support and guidance for the conduct of the audit throughout the Professional Standards, some standards are of particular importance in this audit environment. During the period that the authoritative literature was leaning towards inclusion of reserve data in the audited financial statements, the Oil and Gas Committee of the AICPA developed an "Audit and Accounting Guide for Oil and Gas Reserve Information." The Exposure Draft was issued in April, 1979, but the change of reserve data to supplementary information reduced the necessity for immediate adoption of the guide, and it has never been issued in final form.

²⁹Ibid., pp. 15-16.

The proposed guide established an approach to the audit which drew from Statements on Auditing Standards No. 11 (SAS 11), "Using the Work of a Specialist." As expressed by Alan May, member of the Audit Guide Committee,

We felt that the auditor has insufficient expertise to investigate the oil and gas reserve information himself, particularly new discoveries where there is no production history. We believe the auditor could be fooled by thousands of percent and would be foolish to rely on his own expertise to investigate reserves, which, in some cases, will certainly require material adjustments. When we deal with oil and gas reserves, it is not a matter of getting them right because that is never possible. It is a matter of getting the best answer possible from the information at hand. And it is not possible to get a perfect answer. Therefore, there will be material adjustments, and when that happens, the auditor will be called upon to justify that what he did was adequate in the circumstances.

The only choice left, then, was to use an expert who could get into the reserves and get behind the calculations to the extent necessary to help the auditor.³⁰

Paragraph 11 of SAS 11, referring to the work of the specialist in the auditor's report, states

When expressing an unqualified opinion, the auditor should not refer to the work or findings of the specialist. Such a reference in an unqualified opinion might be misunderstood to be a qualification of the auditor's opinion or a division of responsibility, neither of which is intended.³¹

³⁰May, p. 5.

³¹American Institute of Certified Public Accountants, "Using the Work of a Specialist," Statement on Auditing Standards No. 11, (New York, AICPA, December 1975), Par. 11.

This paragraph is important because it emphasizes that the auditor's reliance on the work of a specialist does not result in a sharing of the auditor's responsibility. The auditor remains responsible for his opinion. Again quoting May

The work of an expert, therefore, is the competent evidential matter. As long as this language remains, the auditor is not going to be able to duck liability with respect to giving assurances on the reserves if he uses the work of an improper outside expert. So the auditor's work is in determining which consulting engineer is acceptable.³²

Two authoritative statements have been issued by the Auditing Standards Board that specify the auditor's responsibility for supplementary information and suggest procedures to be applied in an audit of an oil and gas entity presenting this supplemental information. They are Statements on Auditing Standards No. 27 (SAS 27), "Supplementary Information Required by the Financial Accounting Standards Board" and Statements on Auditing Standards No. 33 (SAS 33), "Supplementary Oil and Gas Reserve Information."

SAS 27 outlines the auditor's basic responsibilities with regard to all supplementary information. This SAS charges the auditor with applying certain limited procedures to supplementary information required by the FASB and requires the auditor to report any deficiencies in, or the omission of, such information.³³ Toward this end, the

³²May, p. 8. ³³SAS 27, Par. 07.

auditor should

- (1) consider whether supplementary information is required by the FASB in the circumstances, and
- (2) if such information is required, ascertain that the information has been measured and presented in a manner that does not depart materially from guidelines prescribed by the FASB.

In SAS 33, the general procedures of SAS 27 are made more specific through suggested topics for inquiry and application of analytical methods. These procedures are directed toward obtaining a sense of management's understanding of and compliance with the specifications for reserve information disclosure. Among the suggested procedures are

- a. Inquire about whether the person who estimated the entity's reserve quantity information has appropriate qualifications;
- b. Compare the entity's recent production with its reserve estimates for properties that have significant production or significant reserve quantities and inquire about disproportionate ratios;
- c. Compare the entity's reserve quantity information with the corresponding information used for depletion and amortization, and make inquiries when differences exist;
- d. Inquire about the methods and bases used to calculate the reserve value information. These inquiries might include matters such as
 - (i) The prices used to develop future gross revenues from estimated production of the proved reserves are comparable to

- prices received at the end of the entity's fiscal year, and whether the calculation of future gross revenues appropriately reflects the terms of sales contracts and applicable governmental laws and regulations.
- (ii) The entity's estimate of the nature and timing of future development of the proved reserves and the future rates of production are consistent with available development plans.
 - (iii) The entity's estimates of future development and production costs are based on costs prevailing at the end of the entity's fiscal year.
 - (iv) The future gross revenues and costs have been appropriately discounted to present value.
 - (v) With respect to full-cost companies, the estimated future development costs are consistent with the corresponding amounts used for depletion and amortization purposes.
 - (vi) With respect to entities that present a summary of oil and gas producing activities and a summary of changes in present value of estimated future net revenues, pursuant to the requirements of the SEC, the entity has
 - (a) prepared and presented the data included in the summaries in conformity with the regulations of the SEC;
 - (b) included data in the summaries that are consistent with related data included in the audited financial statements and other supplementary oil and gas reserve information; and
 - (c) included appropriate explanations in the presentations.

- e. Inquire about whether the methods and bases for estimating the entity's reserve information are documented and whether the information is current.³⁴

In addition to these authoritative pronouncements, the Oil and Gas Committee of the AICPA has recently completed a project entitled "Proposed Audit Guide; Audits of Oil and Gas Producing Companies." This guide offers the following advice

As a result of the pervasive effect of reserve classification and volume estimates upon the financial statements of oil and gas producing companies, the auditor should understand the origin and accumulation of oil and gas deposits and the means by which the volumes of known deposits are estimated.³⁵

The guide then proceeds with an eight page review of oil and gas reserves, including reserve classifications, definitional problems, determination of reserves, preparation of estimates, revision of estimates and reports (of reserve estimates).

In the chapter entitled "Auditing" of the proposed guide, the topic of supplementary disclosure of reserve information is addressed. It is noted that "although this supplementary information is not required to be audited,

³⁴American Institute of Certified Public Accountants, "Supplementary Oil and Gas Reserve Information," Statement on Auditing Standards No. 33, (New York, AICPA, October 1980), Par. 05.

³⁵Oil and Gas Committee of the American Institute of Certified Public Accountants, "Proposed Audit Guide--Audits of Oil and Gas Producing Companies," (New York, AICPA, 1982), p. 34.

the FASB considers the information an essential part of financial reporting."³⁶ The proposed guide summarizes the auditor's objectives with regard to the supplementary disclosures as

- to determine that the supplementary information prepared by the company is in conformity with prescribed guidelines and is presented in a manner consistent with prior year presentations.
- to determine that reserve quantity estimates are prepared by reservoir engineers qualified to make such estimates.
- to determine that the reserve information is consistent with the information in the underlying financial statements.³⁷

To meet these objectives, the proposed guide specifies application of the audit procedures of SAS 27 and SAS 33, suggests procedures to determine that the reservoir engineer's information is complete and, finally, calls for an evaluation of the reasonableness of supplementary information based on the performance of these limited procedures.³⁸

Audit Risk

According to the Exposure Draft for the Proposed Statement on Auditing Standards on Materiality and Audit Risk in Conducting An Audit³⁹

³⁶Ibid., p. 97. ³⁷Ibid., p. 98. ³⁸Ibid., pp. 98-99.

³⁹American Institute of Certified Public Accountants, "Materiality and Audit Risk in Conducting An Audit," Exposure Draft, Proposed Statement on Auditing Standards, (New York, AICPA, December 6, 1982), Par. 13.

Audit risk as it relates to an account balance or class of transactions is a combination of three component risks, namely the risk (consisting of inherent risk and control risk) that the balance or class contains error exceeding tolerable error and the risk (detection risk) that the auditor will not detect such error.³⁹

Therefore, the auditor's risk in being associated with oil and gas reserve information could be considered twofold. The first risk is that there are material errors in the reserve data incorporated in the financial statement representations. In previous sections of this chapter, both the procedure by which reserve quantities are estimated and the uses of reserve data were detailed. Because the process is one of estimation and because there are many uses of the resulting information, there is the chance that a material error could be incorporated into the financial statement representations with which the auditor is associated. The second risk is that the auditor will not detect the occurrence of such a material error. It is the first risk of material errors in the financial statement representations, consisting of inherent risk and control risk, which is the focus of this research.

In the past, the authoritative literature has considered inherent and control risk together and has suggested that "the auditor may rely on internal accounting control to reduce the [first] risk . . ."⁴⁰ While the research

⁴⁰Ibid.

will focus on the risk of material errors, the consideration of factors related to it will not be limited to internal control. In his doctoral dissertation, Carl William Brewer stated

Looking only at internal control, however, severely limits the view of risk. Audit risk manifests itself in forms other than just internal control. We accept the statements in the SAS as part of our definition of audit risk but reject weak internal control as the only risk indicator.⁴¹

Others have also expanded the list of determinants of the risk of material error risk to include items other than internal control. One auditing authority, Carl Warren, specifies the three major determinants of this risk to be

- (1) the integrity of management
- (2) the strength of the client's system of internal accounting control, and
- (3) the economic condition of the entity.⁴²

In their auditing textbook, Alvin A. Arens and James K. Loebbecke list the following major factors of risk⁴³

- system of internal control
- materiality
- population size and makeup
- initial versus repeat engagement

⁴¹Carl William Brewer, "The Nature of Audit Risk Indicators and Their Effect on the Audit Work Performed," (unpublished dissertation, University of Houston, 1981), p. 3.

⁴²Carl S. Warren, "Audit Risk," The Journal of Accountancy, Vol. 148 (August 1979), p. 68.

⁴³Alvin A. Arens and James K. Loebbecke, Auditing--An Integrated Approach, 2nd Edition, (Prentice Hall, Inc., Englewood Cliffs, New Jersey, 1980), p. 148.

- results of current and previous audits
- integrity of management
- others

Whether the list of determinants is limited to internal control or expanded to include numerous other factors, it is usually conceded that these factors are not subject to the direct control of the auditor, unlike detection risk's determinants which are basically tied to the auditor's examination. Yet, as Warren points out, "although they are uncontrollable, it is important to accurately assess the impact of these determinants in planning the audit."⁴⁴ Arens and Loebbecke state,

At the time the audit starts, there is not much that can be done about changing this risk. Instead, the auditor must assess the factors making up the risk and modify his audit evidence to take them into consideration. If the auditor believes the risk of error is high, the amount of evidence collected must be increased to accomplish the desired overall risk."⁴⁵

In summary, the aspect of audit risk which will be considered in the research is limited to the risk that material errors will occur (this is a combination of inherent and control risks). While this risk cannot be controlled by the auditor, there are factors or determinants of the risk, and as expressed by Brewer "audit work will vary depending on the existence of risky conditions."⁴⁶

⁴⁴Warren, p. 72. ⁴⁵Arens and Loebbecke, pp. 147-148.

⁴⁶Brewer, p. 5.

The research will use some of the terminology introduced by Brewer in his dissertation. He elaborated upon the definition of risk stating,

. . . risk is not the error, but rather, the possibility of the error. Possibility can be expressed in terms of probability, which represents the likelihood of occurrence of the event under consideration.⁴⁷

When Brewer applied the "likelihood concept" to audit risk, he noted that risk would vary with the presence or absence of these specified conditions. He termed the conditions "audit risk indicators (ARIs)"⁴⁸ and the variance in the level of audit work performed, dependent on the existence of these conditions, "audit intensity."⁴⁹

Purpose of the Study

While it is generally accepted that there is a relationship between audit risk and the intensity of the audit effort, there has been little empirical research in the area. In the context of an oil and gas audit, it can be hypothesized that there is a relationship between the risk in associating with reserve estimates and the conduct of the audit engagement. The purpose of this research was to (1) identify conditions which are important in an assessment of audit risk in associating with reserve estimates and (2) determine the impact of some of these identified conditions on the conduct of the audit.

⁴⁷Ibid., p. 3. ⁴⁸Ibid., p. 4. ⁴⁹Ibid., p. 5.

The findings of this research should prove to be useful to practitioners and professional standard-setting organizations. While practitioners are aware of the existence of the risk in associating with reserve information, identification and classification of the risk factors could aid in their assimilation of risk factors into the overall audit risk model.

Standard setting bodies within the profession have given little recognition to the risk in associating with reserve information. Perhaps the results of this research could be used in formulating guides to assist practitioners.

Research Methodology

The methodology used in this research was similar in approach and sequence to that used by Carl William Brewer in his doctoral dissertation research. Despite these similarities, the focus of this research was much more specific in that it concentrated on the auditor's association with oil and gas reserve data.

A two-phase approach was used. In Phase I, a list of proposed audit risk indicators specific to oil and gas reserve estimation was accumulated and formulated into a questionnaire. A population of auditors was determined as participants in the survey and questionnaires were mailed to them. They were asked to indicate the relative

importance of each audit risk indicator in audit risk assessment. Responses were analyzed to confirm the previously identified audit risk indicators and to reduce them into a smaller number of factors for use in Phase II of the research.

In Phase II, the research hypothesis "in the context of an oil and gas audit as risk increases an auditor will change the conduct of the audit" was tested. For each audit risk factor emerging from Phase I several levels of risk were described. The audit risk factors, the risk levels and several specific audit changes were incorporated into a questionnaire to test the hypothesis.

Limitations and Assumptions of the Study

There are three major limitations and assumptions of this research. They are as follows.

1. In limiting the analysis of risk to that in associating with reserve data, many other risks in an oil and gas company audit are not being considered. This separation may not be natural or compatible with the respondent's own classifications of risk. If differences do exist, it may be difficult for respondents to give accurate responses to the questionnaires.
2. In the second phase of the research, respondents were asked to evaluate the likelihood of making

certain changes assuming differing levels of risk of specific audit risk factors. It must be noted that what respondents state they would do and what they would actually do might vary. Further, an audit is a dynamic situation in which many decisions are interdependent. A questionnaire cannot capture the interrelationship of decisions and contingencies, but rather imposes static conditions on the respondent. Therefore, participants are limited in potential responses which might render their answers inconsistent with what their actual performances would be.

3. While an effort will be made to include as many Audit Risk Indicators as reasonable, it is not possible to identify every risk in associating with reserve data.

Chapter Descriptions

Chapter I presents background information on the topic and introduces the study. Oil and gas reserves are described, a history of disclosure requirements is presented, the derivation of reserve numbers is explained, and the uses of reserve data in financial statements are reviewed. Audit risk is defined and discussed in the context of the study. The purpose of the research is presented and the research methodology outlined.

Chapter II is devoted to a review of prior research and related literature. It includes studies concerned with audit risk in a general sense, with particular emphasis on prior work identifying risk determinants and relating risk to audit intensity.

Chapter III presents a detailed description of research methodology. The method of data collection, data analysis and results of Phase I are presented, and the purpose and methodology of Phase II are explained.

Chapter IV presents the research findings of Phase II, including an analysis and interpretation of the statistical results.

In Chapter V the findings of the previous chapters are summarized. Implications and contributions of the study are discussed and recommendations for future research are presented.

CHAPTER II

STUDIES ON IDENTIFICATION OF AUDIT ENGAGEMENT RISK FACTORS

While there has been research on several aspects of audit risk, there exists no research on the specific topic of the audit risk in associating with oil and gas reserve data. Therefore, those works which have dealt with the identification of any audit engagement's risk factors, exclusive of internal control, and those efforts which have investigated the relationship between risk perception and audit intensity may be considered as pertinent.

Some items in this review are not considered to be research in the classic sense because they did not have a research methodology nor did they test hypotheses. Thus, this review will be in two parts, with the first part including empirical research and the second part including descriptive research.

Empirical Work

Arens¹

Arens' (1970) dissertation focused on the auditor's determination of the point at which sufficient competent

¹Alvin A. Arens, "The Adequacy of Audit Evidence Accumulation in Public Accounting," (unpublished dissertation, University of Minnesota, 1970).

evidential matter has been accumulated upon which an audit opinion can be based. In the two-part effort, Part 1 isolated the variables that should affect evidence accumulation while Part 2 investigated the extent to which evidence accumulation practices correspond to the identified variables and professional guidelines.

In his consideration of risk as a variable affecting evidence accumulation, Arens defined risk to be the possibility of sanctions being imposed on the auditor. He identified three broad categories of risk:

- (1) conditions which affect the probability that material misstatements will exist in the financial statements before the audit begins,
- (2) conditions which affect the probability of sanctions being imposed upon the auditor,
- (3) the probability that material misstatements will not be discovered and properly interpreted by the auditor.

The conditions included in the first broad category of risk were: the internal control system; the past errors found in the client's records; the size of the account; the motivations of management and employees; the susceptibility to fraud; the judgment required to record the transaction; and the routine versus nonroutine nature of the transaction.

The second category of risk included: the financial condition of the client; the types of users of the statements; the types of errors; and the type of business in which the client is engaged. The third category had only three items: the type of error; the type of audit procedures selected; and the extent to which the audit procedures are performed.

In the second part of the study, Arens analyzed procedures from workpapers of 28 clients to determine the extent to which the variables affected the evidence accumulation. He concluded that while there was a relatively uniform perception of what constitutes a minimum audit program within a firm, there were considerable differences among firms. Further, the variables identified in the first part of the study had a relatively minor impact on the accumulation of audit evidence among the practitioners he studied.

Booker²

In his doctoral dissertation, Jon A. Booker hypothesized that prior to each audit engagement there is an evaluation of relative risk which serves as one of the determinants of the quantity and quality of evidence to be gathered. To test his hypothesis, Booker identified risk factors by reviewing accounting and auditing literature

²Jon Booker, "A Study of Risk Evaluation in the Audit Function of Public Accounting Firms," (unpublished dissertation, North Texas State University, 1971).

including litigation and disciplinary actions against accounting firms and by reviewing literature from the field of insurance and risk. He then developed a risk function which included the following factors:

- reputation and stability of client's management
- the nature of a client's business
- independence of the auditor
- client's system of internal control
- types of financing used by client
- client's rate of growth
- longevity of the audit engagement

In the second part of his research, Booker interviewed accounting practitioners to determine the extent to which the risk evaluation process had been rationalized by the profession. As a result of the interviews, Booker concluded that his hypothesis was confirmed--there is a process of risk evaluation conducted prior to an audit. However, this process is informal and is, to a great extent, left to the professional judgment of the practitioner. Because the risk evaluation process was found to be incomplete and unstructured, Booker developed a relative risk evaluation program which he hoped would be modified and improved and eventually included in the audit process.

Brewer³

The research done by Carl William Brewer (1981) for his doctoral dissertation serves as the pattern for this research. Brewer explored the relationship of audit risk to evidence gathering by identifying and classifying Audit Risk Indicators (ARIs) into Audit Risk Factors (ARFs). Brewer hypothesized that there were audit risks, other than internal control, which are incorporated into an auditor's decisions about audit intensity. In the second phase of his work, he tested the impact of the previously identified audit risk factors on audit intensity. His results revealed many elements of audit risk in addition to internal control. Of his list of 60 ARIs, 47 were judged to have a moderate or greater risk level.

For the ARFs which were included in the second phase of the research, the results indicated that the presence of the factor called for significantly more audit work even in the presence of good internal control. Brewer concluded that studies which consider internal control to be essentially the only risk indicator are incomplete.

³Carl William Brewer, "The Nature of Audit Risk Indicators and Their Effect on the Intensity of Audit Work Performed," (unpublished doctoral dissertation, College of Business Administration, The University of Houston, Houston, Texas, 1981).

Kissinger⁴

In his three-part effort, Kissinger (1974) examined the auditor's decision process with regard to questions of evidence accumulation. The first section of the study developed a normative framework for audit evidence accumulation decisions. In the second section, Kissinger discussed three groups of factors identified in the first section. Of the three, only the third relates to this research: factors which would influence the probability that the auditor would incur sanctions for failing to detect material errors in the client's records. The items Kissinger included in this category drew from the work of Anderson, Giese and Booker and were as follows:

1. the nature of the specific error involved.
2. the degree of exposure the client's statements receive as indicated by:
 - a. client's size,
 - b. nature of the client's operations,
 - c. distribution of the client's ownership,
 - d. loan covenants which require the client to maintain specified account balances or ratios,

⁴John N. Kissinger, "A Study of Factors Which Affect Audit Evidence Accumulation," (unpublished dissertation, Michigan State University, 1974).

3. the probability that the client will file bankruptcy subsequent to the audit as indicated by:
 - a. factors which affect or indicate the degree and types of financial crisis the client can understand, e.g.:
 - (1) factors which indicate the client's financial position. . .
 - (2) economic conditions related to the availability of external capital
 - (3) the client's rate and method of growth,
 - b. factors which affect or indicate the probability that the client will face a financial crisis which exceeds its capabilities, e.g.:
 - (1) the nature of the client's operations,
 - (2) economic conditions relevant to the client's marketplace,
 - (3) the client's method of financing operations.

In the third portion of this research, Kissinger conducted an empirical study of the influence of some of the factors previously identified on evidence accumulation decisions in specific areas of an audit. Kissinger concluded that Generally Accepted Auditing Standards (GAAS) and individual firm policy were the primary determinants of procedure selection in one area of the audit studied (sales) while in another area studied (accounts receivable)

GAAS was the primary determinant. Other determinants of importance were internal control as related to the auditor's timing decisions and client size, internal control and client's ownership as related to sample size decisions. Kissinger's research did not reveal audit risk as a significant determinant in evidence accumulation.

Morris and Anderson⁵

In their research reported in 1976, Morris and Anderson analyzed fourteen audits over a period of four years in an effort to observe the correlation between changes in internal control and modifications in the conduct of the audit. As their findings did not disclose a close relationship between the amount of evidence required in the conduct of an audit and the internal control evaluation, they proposed that there were numerous other factors that determined the amount of evidence gathered. The two primary factors were (1) what the authors referred to as inherent risk or exposure and (2) changes in the size of the client's operations.

Morris and Anderson identified the following to be factors affecting inherent risk:

- size and nature of the business

⁵William Morris and Hershel Anderson, "Audit Scope Adjustments for Internal Control?" CPA Journal, Vol. 46 (July 1976), pp. 15-20.

- reputation and stability of management
- type of financing and financial structure
- profitability, including stability and quality of earnings
- stability of business, including rate of growth
- internal control

As a result of their research, Morris and Anderson concluded that the profession should give recognition to risk evaluation as a major determinant of the sufficiency of evidence and that risk evaluation should be incorporated into official standards.

Descriptive Work

Anderson, Giese and Booker⁶

In their work on the nature of the auditing propositions, Anderson, Giese and Booker (1970) focused on the relationship between graded opinions and the evidence gathered to sustain the various opinions. The authors specified the following as factors which determine the kind and amount of evidence required: custom and authoritative pronouncements; the nature and size of the client's

⁶H. M. Anderson, J. W. Giese, and Jon Booker, "Some Propositions About Auditing," The Accounting Review, Vol. 45 (July 1970), pp. 524-531.

operations; the system of internal control; the relative risk in the engagement; the auditing team; and the fee restraints.

The authors maintained that internal control is only one of the variables influencing relative risk, with other factors being

- (1) size of client
- (2) rate of growth
- (3) nature of client's business
- (4) financing used by client
- (5) longevity of engagement
- (6) independence
- (7) general economic conditions

Additionally, the authors contended that risk estimation should be a continuous process throughout the engagement, and that the profession should develop a program for risk evaluation.

Warren⁷

In a 1979 article, Warren defined audit risk as the likelihood of rendering an inappropriate audit opinion because material errors or irregularities, if they existed, would not be detected. With the intention of promoting an understanding of audit risk so informed audit risk decisions can be made, Warren segregated the risk into

⁷Warren, pp. 66-74.

determinants and analyzed the controllable and noncontrollable components of the determinants.

Warren identified the following determinants of the two major components of audit risk:

1. the likelihood of material error
 - A. the integrity of management
 - B. the strength of the client's system of internal control
 - C. The economic condition of the entity.
2. the likelihood of failure to detect a material error
 - A. sampling risk
 - B. nonsampling risk
 - (1) nonauditor specific
 - (2) auditor specific
 - a. inadequate planning and supervision
 - b. lack of staff integrity
 - c. lack of competence
 - d. lack of willingness to consult with others
 - e. oversight errors

With regard to controlling the risks, Warren considered the determinants of the likelihood of material errors to be outside of the control of the auditor while the

determinants of the likelihood of failure to detect material errors are directly controllable by the auditor. Although the determinants of the first risk cannot be directly controlled by the auditor, Warren noted the importance of assessing the impact of these determinants in planning the audit.

Summary of Literature

As stated in the beginning of this chapter, there exists no research on the specific topic of the audit risk in associating with oil and gas reserve data. The literature which was reviewed was related to audit risk in more general applications. With the exception of the research done by Brewer which serves as the pattern for this work, the reviewed works have recognized that there are elements of risk other than internal control, yet have not confirmed these risk factors nor tied their presence to the nature and extent of subsequent audit work. Brewer's research both empirically identified audit risk factors other than internal control and related these factors to audit intensity.

The current research moves from the general concept of Brewer's work into a specific context, that of an audit of oil and gas reserves. In this research, audit risks are identified, and the impact of these risks on the conduct of the audit is investigated.

CHAPTER III

RESEARCH METHODOLOGY

The research consisted of two phases. Since the results of Phase I served as input into Phase II, this chapter will present an explanation of the data collection, data analysis and results of Phase I and the purpose and methodology of Phase II. The Phase II results will be presented in Chapter IV.

Phase I

The objective of Phase I was to identify and confirm factors of importance in assessing the audit risk resulting from associating with oil and gas reserve estimates. To accomplish this goal, Phase I was organized into the following sequence:

1. Development of a list of Audit Risk Indicators (ARIs);
2. Construction of a questionnaire to obtain auditors' opinions on the relative riskiness of each ARI;
3. Definition and selection of a population of auditors to participate in the survey;

4. Analysis of the responses for confirmation of ARIs and reduction into a smaller number of Audit Risk Factors for use in Phase II.

Audit Risk Indicators

To initially identify Audit Risk Indicators (ARIs) specific to the auditor's association with oil and gas reserve information, pertinent literature was reviewed and practicing accountants were consulted. The literature review was not limited to auditing topics, but also included technical writings on the derivation of reserve numbers and the qualifications of reserve estimators. The practitioners consulted were partners and managers with several of the "Big Eight" public accounting firms in the Dallas-Fort Worth area. They were individuals with experience in auditing oil and gas companies. Their suggestions coupled with the results of the literature review were compiled into a master list of ARIs. This list was then pretested for clarity and completeness with selected practitioners.

Questionnaire

After pretesting, a final list of 37 ARIs was established. (This list is reproduced in Table I.) From this list, a questionnaire was constructed which requested the respondent to evaluate each item's relative importance in assessing the audit risk encountered in associating with

reserve estimates in a specific assumed case. (A copy of this questionnaire is reproduced as Appendix B.) The basic case context was a hypothetical engagement involving an annual audit of a corporation for the year ended December 31, 1983, with all the client's oil and gas interests being domestic. The respondents were instructed to include in their consideration all uses of reserve estimates, such as the depletion, depreciation and amortization calculation; the full-cost ceiling test; and supplementary disclosure. The respondents were allowed separate responses for assumptions of public and private ownership of the client company. If the respondents felt that the form of ownership made no difference to their response, they were allowed to so indicate.

In evaluating the relative importance of each item in an assessment of the audit risk, participants gave responses on a scale ranging from 1 to 5, with the following meanings:

- 1 - very little or no importance in the assessment of risk
- 2 - of little importance in the assessment of risk
- 3 - of moderate importance in the assessment of risk
- 4 - of great importance in the assessment of risk
- 5 - of maximum importance in the assessment of risk

Since there were 37 variables, it was feared that respondents might become tired while progressing through

the list and answer the last part of the questionnaire less carefully than the first part. In an attempt to offset the possible impact of respondent fatigue on the results, three versions of the questionnaire were created presenting the variables in different sequences. The list of the Phase I population was randomly divided into three groups with each group receiving a different version of the questionnaire.

Population

It was decided that the questionnaire should be completed by auditors who had fairly extensive experience in auditing oil and gas clients. To obtain the names of such practitioners, a partner or manager of each of fourteen public accounting firms was asked to compile a list of ten to fifteen of their firm's oil and gas audit specialists at the manager and partner level throughout the nation. Thirteen firms participated. They were seven of the "Big Eight" firms and six other large, national public accounting firms. One participating firm did not supply a list, but rather typed the names and addresses on the cover letters and mailed the questionnaires to specialists in their firm. This procedure was followed because the firm did not want a list of its oil and gas audit specialists to be made available outside the firm. The master list of names was interfirm randomly divided into two parts, with

the second half of the list of names being reserved for use in Phase II. The Phase I questionnaire was mailed with an explanatory cover letter to 109 practitioners.

Data Analysis

Sixty-eight questionnaires were returned by respondents. However, only 67 responses were used in the data analysis because one respondent did not complete the questionnaire, but instead took issue with the premise of the research. Thus, the response rate was in excess of 61 per cent. Second requests on the Phase I questionnaire were not considered necessary.

Using the Statistical Analysis System (SAS) computer package, means and standard deviations were calculated for each ARI to provide a measure of relative riskiness. The results of this procedure are shown in Table I.

While the responses were accumulated for audits of both publicly held and privately held firms, the overall research design was focused on audits of publicly held companies since only publicly held firms are required to have independent audits. Therefore, no further analysis was performed on the responses related to privately held companies.

Although the primary objective of Phase I was to identify and confirm certain ARIs, a second objective was to condense the original 37 variables into a smaller number of

factors for use in Phase II. At the planning stage, it was intended that factor analysis would be used to achieve this objective. Although factor analysis is not a statistical test, it is a way to describe how variables relate to each other, and it generally results in grouping variables into a smaller number of factors.

TABLE I

AUDIT RISK INDICATOR MEANS
AND STANDARD DEVIATIONS

Audit Risk Indicator	Mean	Standard Deviation
1. Makeup of ownership of stock in the client company (i.e., many small investors/few large investors).	1.776	.902
2. Age of client company.	2.761	.986
3. Length of time client company has owned oil and gas interests.	3.015	.992
4. Size of client company.	2.776	1.085
5. Method of accounting used by client company (i.e., full cost/successful efforts/tax basis).	2.925	1.078
6. Length of time client company has been your client.	2.567	1.003
7. Extent to which the client's oil and gas reserves include interests in partnership or joint interests.	2.403	1.045
8. Current market conditions (e.g., price of oil and gas/supply-demand of oil and gas).	3.537	.876

TABLE I--Continued

Audit Risk Indicator	Mean	Standard Deviation
9. Extent to which asset values exceed book values (i.e., cost recoverability problems).	4.164	.828
10. Integrity and reliability of client's data base of reserve information.	4.149	.764
11. Quality of client's documentation of reserve estimation.	3.866	.833
12. Quality of client's established review procedures for reserve estimation.	3.985	.769
13. Frequency of field studies.	3.104	.819
14. Frequency of estimate revisions.	3.284	.884
15. Client's own use of reserve estimates (i.e., only as required in financial reports/ for budgeting and managerial purposes).	3.060	.952
16. Internal estimator's general record of accuracy in estimation.	3.687	.763
17. External estimator's general record of accuracy in estimation for this client.	3.866	.776
18. Internal estimator's professional qualifications (education, training, experience) as per Society of Petroleum Engineers' established standards.	3.657	.962
19. External estimator's professional qualifications (education, training, experience) as per Society of Petroleum Engineers' established standards.	4.000	.937

TABLE I--Continued

Audit Risk Indicator	Mean	Standard Deviation
20. Internal estimator's independence, objectivity and confidentiality as per Society of Petroleum Engineers' established standards.	3.448	1.077
21. External estimator's independence, objectivity and confidentiality as per Society of Petroleum Engineers' established standards.	4.075	.858
22. Internal estimator's experience in oil and gas fields in which the client operates.	3.657	.750
23. External estimator's experience in oil and gas fields in which the client operates.	3.716	.755
24. External estimator's approach (i.e., rely on internal estimator's work/do most of the estimate work themselves).	3.299	.888
25. External estimator's reputation (i.e., liberal/conservative in estimates).	3.642	.732
26. Auditor's experience with the external estimator.	3.329	.927
27. Methodology(ies) used to calculate reserve estimates (i.e., single method/combination of methods).	3.239	.854
28. Client's quantity of revisions as compared to production (historically).	3.478	.785
29. Client's quantity of revisions as compared to reserve quantities.	3.522	.823

TABLE I--Continued

Audit Risk Indicator	Mean	Standard Deviation
30. Auditor's use of analytical review as a checking procedure in estimate revisions.	3.507	.842
31. Relative extent of auditor's knowledge of reserve estimation process.	3.418	.838
32. Age of oil and gas fields involved.	3.612	.797
33. Recovery method(s) being used in the fields.	2.910	.848
34. Stage of development of fields (i.e., development wells drilled/not yet drilled).	3.806	.744
35. Availability of production history.	3.970	.738
36. Presence of other producing fields in the area.	3.194	.909
37. Source of reserve estimation (i.e., internal/external).	3.821	.833

The use of numerous types of factor extraction and rotation methods resulted in many different groups of factors. However, no one group of factors was found to be satisfactory in an intuitive sense. That is, the resultant factors did not share a commonality which was logical or realistic in the context of an audit. Such difficulty with the results of factor analysis is not unusual, and in this

case rendered the use of factor analysis for condensing the variable list undesirable.

To reduce the number of variables from the original 37 of Phase I to a smaller number for further study in Phase II, a minimum mean score of 3.80 on the 5.0 scaling was arbitrarily set as the selection criterion. This separation yielded ten variables, a list of which is reproduced as Table II. It was decided that these ten variables would be used in Phase II of the analysis.

Phase II

The purpose of Phase II was to test the hypothesis "in the context of an oil and gas audit as risk increases an auditor will change the conduct of the audit." In order to test the hypothesis several preliminary steps were required:

1. Identification of risk factors specific to an oil and gas audit engagement;
2. Description of varying levels of risk of the identified variables;
3. Definition of "change" in the context of an audit engagement;
4. Development of a questionnaire to effectively test the hypothesis;
5. Analysis of the responses.

TABLE II
AUDIT RISK INDICATORS USED IN PHASE II

Variable	Description	Mean
9	Extent to which asset values exceed book values (i.e., cost recoverability problems).	4.164
10	Integrity and reliability of client's data base of reserve information.	4.149
11	Quality of client's documentation of reserve estimation.	3.866
12	Quality of client's established review procedures for reserve estimation.	3.985
17	External estimator's general record of accuracy in estimation for this client.	3.866
19	External estimator's professional qualifications (education, training, experience) as per Society of Petroleum Engineers' established standards.	4.000
21	External estimator's independence, objectivity and confidentiality as per Society of Petroleum Engineers' established standards.	4.075
* 34	Stage of development of fields (i.e., development wells drilled/not yet drilled).	3.806
35	Availability of production history.	3.970
37	Source of reserve estimation (i.e., internal/external).	3.820

*Subsequently combined with variable 35; see page 57 for explanation.

Audit Risk Factors

Phase I of the research identified and confirmed certain audit risk indicators of which ten were retained for further study in Phase II. These ARIs are called Audit Risk Factors in Phase II in order to differentiate between the two phases. Of the ten Factors (listed in Table II), it was determined that items 34 and 35 were essentially the same in the context of an audit given certain of the case synopsis assumptions. Therefore, the two were combined into one Factor for use in the questionnaire.

Levels of Risk for Factors

To establish varying levels of risk for each of the nine Audit Risk Factors, selected practitioners were asked to define or describe some characteristics of the Factor at as many levels as necessary to complete a full spectrum of possible risk. The results were accumulated and four levels emerged, with level one being considered the base case for a hypothetical audit.

Change

Since the hypothesis involved an auditor changing the conduct of the audit, it was necessary to define change in an audit context. By referring to the literature and consulting with experts, the following list of possible changes in an auditor's conduct of an engagement was determined:

1. Change in the firm's personnel assigned to the audit engagement;
2. Reallocation of the budgeted time among the audit tasks;
3. Expansion of the total time budget on the engagement;
4. Employment of experts for consultation on the engagement;
5. Qualification of the audit opinion;
6. Withdrawal from the audit engagement.

Questionnaire

To test the hypothesis, a questionnaire was created which contained all nine Audit Risk Factors, each at four levels of risk, and each of the six possible changes. The questionnaire is reproduced as Appendix C. In addition to the questions, the respondents were given a case synopsis detailing the following items:

- Purpose of the audit engagement
- Prior audit experience
- The audit team
- The client
- Client's accounting practices
- Client's internal control.

Preceding the case context and the questions, the questionnaire explained the focus and objective of the

research and described the six possible changes that could be made in the conduct of the hypothetical audit engagement. The respondents were instructed to consider each Audit Risk Factor independently and to indicate the likelihood of making each particular change at each level of risk. The available response options were as follows.

- 0 = No, I would definitely NOT make this change.
- 1 = I would probably NOT make this change.
- 2 = I am neutral as to whether a change should be made.
- 3 = I would probably make this change.
- 4 = Yes, I would definitely make this change.

The questionnaire was sent to the 105 practitioners who comprised the second half of the population list obtained during Phase I of the research. Each member of the population was sent a cover letter, the questionnaire, and a stamped, addressed envelope to use in returning the questionnaire. After four weeks 39 responses had been received. A second request was sent to all nonrespondents. This mailing included a new cover letter, the questionnaire and a stamped, addressed envelope. The second request yielded 20 responses. Thus, the total response rate in Phase II was in excess of 56 per cent. Of the 59 responses, seven could not be used. One of these seven respondents disagreed with the approach taken to the

research, and the other six completed the questionnaires incorrectly. Therefore, the usable response rate was 49.5 per cent.

Data Analysis

The hypothesis for Phase II of this research was that in the context of an oil and gas audit as risk increases an auditor will change the conduct of the audit. To test this hypothesis two approaches were used: (1) an individual risk/ change approach and (2) a summary approach.

Individual Risk/Change Approach.--One of the variety of ways of looking at the Phase II questionnaire results was to view the response for each change type of each Audit Risk Factor separately to determine if as the risk increased the likelihood of making that specific change increased. Because of the nature of the data resulting from the questionnaire responses and because of a hesitancy to make certain assumptions about the normalcy of the population, it was decided that a nonparametric test would be most appropriate. The purpose of the selected test was to aid in drawing an inference as to whether the likelihood of change responses yielded differences which were outside the range of what could occur by chance.

The appropriate test for this type of data is the Friedman test which tests the general null hypothesis that

"k" samples have been drawn from the same population. Stated another way, the null hypothesis can be considered a test of whether responses are dependent on conditions. In this specific context, the Friedman test analyzed whether likelihood of change responses were dependent on risk conditions.

To perform a Friedman test, the data are set in a two-way table with "N" rows and "k" columns. The rows represent the score of each response under the "k" conditions. The questionnaire responses were arranged as follows.

	Columns = Levels of Risk			
	I	II	III	IV
Rows = Responses	1			
given for each	2			
change type of	3			
each Audit Risk	.	.	.	.
Factor	52			

The entries in each row are ranked 1 to 4 on the basis of size. Then the entries in each column are summed (R_j). The Friedman test determines whether the rank totals (R_j) differ significantly by computing the value of a statistic denoted as Xr^2 .

$$Xr^2 = \frac{12}{Nk(k+1)} \sum_{j=1}^k (R_j)^2 - 3N(k+1)$$

where

N	=	number of rows
k	=	number of columns
R_j	=	sum of ranks in the jth column

$$\sum_{j=1}^k$$
 directs one to sum the squares of the sums of ranks over all K conditions¹

If the general null hypothesis were true (that all the samples came from the same population) then the distribution of ranks in each column would be a matter of chance. If, however, the general null hypothesis were false, then the rank totals would vary from one column to another indicating that the likelihood of change responses were indeed dependent on the conditions (levels of risk).²

The Friedman test's general hypothesis may be restated in terms of this application as

H₀: As a factor's risk increases, the likelihood of making a change does not increase. Risk has no effect on the conduct of the audit.

and the alternative hypothesis:

H₁: As a factor's risk increases, the likelihood of making a change increases. Risk has an effect on the conduct of the audit.

Since there were nine Audit Risk Factors and six change types for each factor, the hypothesis was tested a total of 54 times. Because the first level of risk was considered the base case in the questionnaire, the participants were

¹Sidney Siegel, Nonparametric Statistics For The Behavioral Sciences, (McGraw-Hill Book Company, New York, 1956), p. 168.

²Ibid., p. 166.

not asked to supply responses. Rather, the response "0" was filled in across the level I risk for all change types of each Audit Risk Factor. In this test the 0's were given, they could have been treated as constants. This would have resulted in the loss of a degree of freedom. Although this might reduce the power of the methodology with an impact on the individual values, there should be no significant effect on the overall results.

The results of the Friedman Test indicated which of the risk increases elicited a significantly different likelihood of specific changes. While this satisfactorily tested the hypothesis, further analysis was performed to determine at which risk level progressions there were significant differences in the likelihood of making a change. As an example, for Audit Risk Factor 1, Change Type A, the Friedman Test addressed the likelihood of making a change over the total group of four risk levels. The next analysis performed, the Sign Test, tested for significance as the risk level progressed from level I to II, from II to III, and from III to IV. In the sign test, "the signs of the differences between the paired observations are analyzed. If the two variables share a common distribution, the number of positive and negative differences should be roughly the same."³ The null

³C. Hadlai Hull and Norman H. Nie, SPSS Update 7-9: New Procedures and Facilities for Releases 7-9, (McGraw-Hill Book Company, New York, 1981), p. 227.

hypothesis for the Sign Test is that

$$p (X_A > X_B) = p (X_A < X_B) = \frac{1}{2}$$

where X_A is the judgment or score under one of the conditions and X_B is the judgment or score under the other condition

Under the null hypothesis, it is expected that half the sign differences would be negative and half would be positive. H_0 is rejected if too few differences of one sign occur.⁴

In the terms of this application, the null hypothesis for the Sign Test is the same as for the Friedman Test, but it is applied at each risk level progression. Since there are three risk level progressions for each of six change types for nine Audit Risk Factors, the Sign Test would be performed a total of 162 times.

Summary Approach.--While the analysis previously described examined each change type of each Audit Risk Factor separately, the purpose of this portion of the analysis was to consider the research question in terms of groups of Audit Risk Factors, risk levels and change types. These groupings and the further analysis were not done for purposes of prediction, but rather to attempt to explain how well the variables of risk level, change type and Audit Risk Factor

⁴Siegel, p. 68.

together explained the decision to make a change in the conduct of the audit.

Because of the type of data accumulated in the questionnaire it was determined that the best analysis would be a Grizzle-Starmer-Koch (GSK) linear-models approach to the analysis of categorical data. The use of this analytical approach allowed investigation of the relationship between the decision to change the conduct of the audit and the variables of Audit Risk Factor, risk level, and change type. By using the GSK approach ". . . questions regarding variable selection, model appropriateness, and interaction can be pursued in the same spirit as that used in analysis of variance and stepwise-regression procedures for quantitative data."⁵

The GSK linear-models approach is based on the application of general weighted-least-squares regression techniques to estimates of appropriate functions of the cell proportions in complex categorical data layouts. The FUNCAT procedure of the Statistical Analysis System (SAS) which uses weighted least squares to produce minimum chi-square estimates according to the GSK method was utilized.⁶ To use the FUNCAT procedure, the responses were reorganized to accumulate frequency counts for each change type at each

⁵David G. Kleinbaum and Lawrence L. Kupper, Applied Regression Analysis and Other Multivariable Methods, (Duxbury Press, North Scituate, Mass., 1978), p. 458.

⁶SAS User's Guide: Statistics, 1982 Edition (SAS Institute Inc., Cary, North Carolina, 1982), p. 257.

risk level for each Audit Risk Factor. A response of 0, 1, or 2 was considered to be equivalent to a neutral or "no change" preference and a response of 3 or 4 was considered to be a "change" preference. To recap the response options

- | | | |
|---------------------------------------------------------|---|-------------|
| 0 = No, I would definitely NOT make this change. | } | "no change" |
| 1 = I would probably NOT make this change. | | |
| 2 = I am neutral as to whether a change should be made. | | |
| 3 = I would probably make this change. | } | "change" |
| 4 = Yes, I would definitely make this change. | | |

In this way, the possible responses were dichotomized. The primary purpose of establishing this dichotomy was related to the statistical test being performed. In the FUNCAT procedure there are cells in which the frequency of response counts are accumulated. For the procedure to work properly, there should be as few cells with zero counts as possible. By reducing the number of cells from five to two through the dichotomizing procedure described above, the proportion of zero count cells was greatly reduced. Further the procedure is designed for dichotomous dependent variables. The negative aspect of this dichotomization is very minor because in this phase the research question is as well addressed with

a Yes or No response as it is with a graduated yes to no response.

The approach taken to apply the FUNCAT program to this research was to begin with a fully saturated model. This is a model which includes as independent (explanatory) variables all main effect variables (Audit Risk Factor, risk level, change type) and all interaction variables (factor/level, factor/change type, level/change type, factor/level/change type). Each explanatory variable was then examined for significance (a P value greater than 0.05 indicates nonsignificant effects), and the insignificant variables were dropped.

Other models were run in an attempt to determine the one which could be considered as a "best fit." The measures used in the evaluation of the models were the P values of the variables, the P value of the residual and the overall compatibility with the premise of the research.⁷

Summary

In this chapter the two phases of the research were described. The method of data collection, the data analysis and the results of Phase I were all presented since the Phase I results served as input into the remainder of the research. The Phase II purpose and methodology were explained including presentation of the research hypothesis

⁷Kleinbaum and Kupper, pp. 475-478.

and description of statistical techniques which were used.
The Phase II results are presented in Chapter IV.

CHAPTER IV

RESULTS OF THE STUDY

This chapter presents the results of the statistical tests used to evaluate the research hypothesis stated in the preceding chapter. The first section contains the results of the Phase II approach which focused on each individual risk level and change type while the second section details the findings of the Phase II summary approach.

Results of Individual Risk/Change Approach

As explained in Chapter III, the Friedman Test was used to test the hypothesis

H₀: As a factor's risk increases, the likelihood of making a change does not increase. Risk has no effect on the conduct of the audit.

Each of the six change types was tested for each of nine Audit Risk Factors. Therefore, the hypothesis was tested 54 times. The results of these tests are presented in Table III.

The scores presented in Table III are the Chi-Square and the level of significance. As explained in Chapter III in the Friedman Test, a statistic X_p^2 is computed which

approximates a chi-square. This statistic is reported in the column labeled Chi-Square. If the value of the calculated X_r^2 is equal to or larger than values given in a table of critical values of Chi-Square, then the implication is that at least one of the sums of ranks for various columns is significantly different (i.e., the size of the scores were dependent on the conditions), and the null hypothesis can be rejected at the level of significance indicated in the table. That level of significance is the second value shown in Table III.

As can be seen by the values in Table III, the null hypothesis was rejected at a level of significance of .009 or better for each change type of each factor except

Factor One	Change A
Factor Two	Changes A and F
Factor Three	Change A
Factor Four	Change A
Factor Five	Change F
Factor Six	Changes A and F
Factor Eight	Changes A and F
Factor Nine	Changes A and F

This means that for every change type of every Audit Risk Factor, except those noted above, the null hypothesis was rejected. The Friedman Test does not test for the direction of change, therefore, the results of the technique

only address differences, which are not necessarily increases. However, the results of the Friedman Test along with a visual examination of the data indicated that all the significant differences were indeed increases. Thus there can be acceptance (except as noted above) of the alternative hypothesis "as a factor's risk increases, the likelihood of making a change increases. Risk has an effect on the conduct of the audit." These results are also presented in Appendix D along with other information superimposed over the Phase II questionnaire to allow the results to be viewed in the context of the questionnaire.

TABLE III
FRIEDMAN TEST RESULTS

Factor	Change Type	Chi-Square	Level of Significance
One	A	7.783	.051 *
	B	58.921	.000
	C	110.983	.000
	D	99.288	.000
	E	54.906	.000
	F	13.448	.004
Two	A	9.796	.020 *
	B	37.442	.000
	C	69.115	.000
	D	67.310	.000
	E	24.565	.000
	F	.917	.821 *

TABLE III--Continued

Factor	Change Type	Chi-Square	Level of Significance
Three	A	8.510	.037 *
	B	37.194	.000
	C	72.744	.000
	D	117.663	.000
	E	58.396	.000
	F	17.608	.001
Four	A	5.602	.133 *
	B	36.779	.000
	C	65.377	.000
	D	111.790	.000
	E	56.244	.000
	F	15.098	.002
Five	A	12.963	.005
	B	45.658	.000
	C	103.529	.000
	D	74.186	.000
	E	38.671	.000
	F	8.740	.033 *
Six	A	10.113	.018 *
	B	41.833	.000
	C	105.352	.000
	D	78.185	.000
	E	44.948	.000
	F	10.044	.018 *
Seven	A	11.994	.007
	B	39.710	.000
	C	102.000	.000
	D	103.731	.000
	E	77.821	.000
	F	24.110	.000

TABLE III--Continued

Factor	Change Type	Chi-Square	Level of Significance
Eight	A	4.811	.186 *
	B	23.856	.000
	C	74.613	.000
	D	67.506	.000
	E	15.006	.002
	F	4.725	.193 *
Nine	A	8.619	.035 *
	B	34.183	.000
	C	71.960	.000
	D	38.775	.000
	E	40.488	.000
	F	1.575	.665 *

*Cannot reject the null hypothesis.

As can be noted by reviewing Table III, there were only two change types for which the null hypothesis was not rejected. They were change types A (for which the null hypothesis was rejected only once, in Audit Risk Factor Seven) and F (for which the null hypothesis was rejected only four times, in Audit Risk Factors one, three, four and seven). Change type A was described to participants as "change in your firm's personnel assigned to the audit engagement." Change F was described to the participants as "withdrawal from the audit engagement."

The other test performed in this approach to the Phase II analysis was the Sign Test. This technique was used to determine at which risk level progressions (i.e., from I to

II, II to III, and/or III to IV) there were significant differences in the likelihood of making each specific change. This test was performed only on those change types which, according to the Friedman Test, had a .009 or better level of significance since if there were no overall increased likelihood of making a change as risk increased (from level I to IV), there would be none for individual risk level progressions (from I to II, II to III, III to IV).

TABLE IV
SIGN TEST RESULTS

Factor	Change Type	Risk Level		
		I to II	II to III	III to IV
One**	B	.000	1.000 *	.000
	C	.000	.078 *	.000
	D	.000	.700 *	.000
	E	.000	.109 *	.000
	F	.031	.125 *	.000
Two**	B	.000	.727 *	.118 *
	C	.000	.006	.000
	D	.000	.002	.000
	E	.000	.375 *	.000
Three**	B	.000	.039	.022
	C	.000	.000	.000
	D	.000	.000	.000
	E	.000	.000	.000
	F	.002	.063 *	.000

TABLE IV--Continued

Factor	Change Type	Risk Level		
		I to II	II to III	III to IV
Four**	B	.000	.000	.057 *
	C	.000	.000	.001
	D	.000	.000	.000
	E	.000	.000	.000
	F	.004	.001	.039
	Five**	A	.000	1.000 *	.006
B		.000	1.226 *	.031
C		.000	.065 *	.000
D		.000	.607 *	.000
E		.000	.344 *	.000
Six**	B	.000	.267 *	.012
	C	.000	.000	.000
	D	.000	.000	.000
	E	.000	.000	.000
Seven	A	.002	.021	.012
	B	.000	.011	.003
	C	.000	.000	.002
	D	.000	.000	.000
	E	.000	.000	.000
	F	.000	.002	.000
Eight**	B	.000	.227 *	.000
	C	.000	.004	.000
	D	.000	.039	.000
	E	.004	.625 *	.000

TABLE IV--Continued

Factor	Change Type	Risk Level		
		I to II	II to III	III to IV
Nine**	B	.000	.002	.180 *
	C	.000	.000	.008
	D	.000	.000	.002
	E	.000	.004	.000

*Failure to reject the null hypothesis.

**The following Factor/Change types were omitted from this analysis as their Friedman Test level of significance exceeded .009.

Factor One-Change A	Factor Five-Change F
Factor Two-Changes A and F	Factor Six-Changes A and F
Factor Three-Change A	Factor Eight-Changes A and F
Factor Four-Change A	Factor Nine-Changes A and F

The results of the 126 tests (presented in Table IV) show that failure to reject the Sign Test's null hypothesis (that the samples came from the same population) occurred only nineteen times (using the .05 significance level as the cut off point). The 107 rejections of the null hypothesis can be considered to indicate that the level to level risk progressions were individually significant; that is, the respondents perceived as different the two levels of risk tested.

Ten of the nineteen failures to reject the null hypothesis were accounted for in two Audit Risk Factors: One (the level II to III progression) and Five (the level II to

III progression). These two Audit Risk Factors and the risk level progression are presented in Table V. Of the other nine, three were in Audit Risk Factor Two, one in Three, one in Four, one in Six, two in Eight and one in Nine. The results of the Sign Test are also presented in Appendix D with the Friedman Test results.

TABLE V
AUDIT RISK FACTORS ONE AND FIVE
RISK LEVEL PROGRESSION II TO III

Factor One:	Estimator's record of accuracy.
	II. The revisions appear to be the result of estimators being overly optimistic in the selection of assumptions.
	III. The estimator's assumptions are reasonable, but the production information was not used effectively.

Factor Five:	Quality of client's established review procedures for reserve estimation.
	II. The review procedures have been established, but are not followed.
	III. There are no established procedures, but several engineers are involved in making and compiling estimates.

Results of Summary Approach

The purpose of this approach to the research was to achieve an overview which would essentially answer the question: was the change/no change decision a function of the

variables Audit Risk Factor, risk level and change type? The procedure utilized was the G-S-K program, and the starting point was the fully saturated model in which all main effect variables and all interaction variables were included. As with all models subsequently run, the P value was considered the measure of significance of the variable. Any variable with a P value greater than 0.05 was considered nonsignificant in its contribution toward explaining the dependent variable. Such nonsignificance indicated the variable should be removed from the model. The results of the fully saturated model are presented in Table VI.

TABLE VI
FULLY SATURATED G-S-K Model

Source	DF	Chi-Square	P Value
Intercept	1	1031.42	0.0001
Audit Risk Factor	8	69.20	0.0001
Risk Level	2	171.87	0.0001
Change Type	5	825.69	0.0001
Factor * Level	16	31.25	0.0125
Factor * Change Type	40	208.81	0.0001
Level * Change Type	10	37.46	0.0001
Factor * Level * Change Type	80	58.18	0.9684
Residual	0	0.00	1.0000

*Includes all main effects and all interaction effects.

There was one variable in this model with a nonsignificant P value. This was the three way interaction term,

factor * level * change type. Five of the variables were highly significant (P values less than .001), and the remaining variable, factor * level, was neither nonsignificant nor highly significant.

Manipulation of the model beyond the fully saturated Model 1 was two-fold. One technique of seeking the best specified model was to drop the insignificant variables from the fully saturated model. The resultant model is Model 2, a summary of which is presented in Table VII along with the results of other models.

The second tact in an attempt to obtain the model with the best fit was to begin with a model which contained only the three main effects. This was Model 3. While each of the three variables had a highly significant P value, the residual P-value of .0001 meant this model was not well specified. However, since the three main effects were each highly significant individually, they were used as a base in an attempt to construct the best fitting model. The next models, Model 4, Model 5, and Model 6, each added one interaction term to the three main effects with the same results: each variable was individually significant, but the overall model was not. Models 7, 8 and 9 included the main effects and two interaction terms. Again, all variables were individually significant, but the P value of the residual was still not sufficiently significant.

TABLE VII
SUMMARY OF P VALUES IN
G-S-K MODELS

Source of Variation	Model Number								
	1	2	3	4	5	6	7	8	9
Intercept	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
Factor	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
Level	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
Change Type	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
Factor * Level	.0125	.0001	. . .	.0001	. . .	. . .	.0001	. . .	.0001
Factor * Change Type	.0001	.0001	. . .	. . .	.0001	. . .	.0001	.0001	. . .
Level * Change Type	.0001	.0001	. . .	. . .	. . .	.0001	. . .	.0001	.0001
Factor * Level * Change Type	.9684	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Residual (Goodness of Fit)	1.0000	.9684	.0001	.0001	.0001	.0001	.1668	.0197	.0001

The next logical step in this building procedure was a model which included all three main effects and all three of the two way interaction terms. This was the same model that resulted when the fully saturated model dropped the non-significant variable, Model 2. On this model all the variables were highly significant, and the residual (goodness of fit) P value was very close to 1.0. Model 2 is more fully detailed in Table VIII.

TABLE VIII
G-S-K MODEL 2

Source	DF	Chi-Square	P Value
Intercept	1	1132.08	0.0001
Audit Risk Factor	8	88.58	0.0001
Risk Level	2	193.91	0.0001
Change Type	5	904.63	0.0001
Factor * Level	16	68.46	0.0001
Factor * Change Type	40	241.23	0.0001
Level * Change Type	10	44.70	0.0001
Residual	80	58.18	.9684

The final point of evaluation of the model was in terms of its interpretability and relevance--was the resultant model consistent with the hypothesis of the research? Since the model of best fit included all of the main effects and each of the two way interactions, it is highly compatible with the underlying theory.

Summary

This chapter has presented and evaluated the results of the non-parametric tests utilized in the individual risk/change approach to the research and the results of the summary approach. The conclusions from the research are presented in Chapter V.

CHAPTER V

SUMMARY AND CONCLUSIONS

This chapter includes a summary of the study followed by a presentation of the conclusions. Recommendations for future research are also included.

Overview of the Study

The Problem

Oil and gas reserve estimates are part of the financial statements of companies with oil and gas holdings. These estimates are used in the calculation of the depreciation, depletion and amortization (DD&A)--a material item of expense, the full-cost ceiling test (for companies which account for their holdings using the full-cost method) and in required supplementary disclosures (for companies subject to SEC requirements). Of these three uses of reserve information, the first two--the DD&A calculation and the ceiling test for full-cost companies--are used in the determination of actual financial statement numbers for which the independent auditor must obtain sufficient, competent evidential matter to afford a reasonable basis for an opinion on their fairness. The third use of reserve data as supplemental information ostensibly imposes a lighter

burden on the auditor as it entails applying only limited procedures, yet the true limits of the auditor's responsibility in this area may not be known until litigation serves to establish parameters in this heretofore uncertain area.

The difficulty with the auditor's association with reserve information (at any level of responsibility) is that the reserve numbers are estimates which are considerably affected by several factors. Because of this estimation process and because of the various uses of the reserve estimates, there is a chance that a material error could be incorporated into the financial statement representations with which the auditor is associated. This is a form of audit risk; one over which the auditor has no direct control.

While the authoritative literature sets out certain guidelines and procedures for auditors to follow in the conduct of the audit of an oil and gas entity (both in general and in specific), these do not remove the risk. Therefore, the auditor is faced with a dilemma.

Objective of the Study

While it is generally accepted that there is a relationship between audit risk and the intensity of the audit effort, there has been little empirical research in the area. In the context of an oil and gas audit, it can

be hypothesized that there is a relationship between the risk in associating with reserve estimates and the conduct of the audit engagement. The objective of this research was to

- (1) identify conditions which were important in an assessment of audit risk in associating with reserve estimates and
- (2) determine the impact of some of these conditions on the conduct of the audit.

Research Methodology

A two phase approach to the research was used. In Phase I a questionnaire was developed using Audit Risk Indicators (ARIs) specific to an oil and gas engagement. These ARIs were accumulated by research through the literature and consulting with auditors experienced in oil and gas audits. Participants were asked to indicate the relative importance of the 37 ARIs. An analysis of the responses provided confirmation of the ARIs and reduction of the 37 into a smaller number for use in Phase II.

In Phase II, the research hypothesis was tested. The hypothesis was that "in the context of an oil and gas audit, as risk increases an auditor will change the conduct of the audit." For some of the ARIs confirmed in Phase I (referred to as Audit Risk Factors in Phase II) several levels of risk were described. These Audit Risk Factors,

and risk levels were combined with several specific types of audit changes and developed into a questionnaire. The participants were asked to indicate the likelihood of making the specific changes at each risk level for each Audit Risk Factor.

The Phase II responses were analyzed in two ways. Using non-parametric statistics, each change type of each Audit Risk Factor was evaluated to determine if as the audit risk increased, the likelihood of making that specific change increased. Still using non-parametric statistics, risk level progressions of each Audit Risk Factor were tested for significance. The second form of analysis took a summary approach by evaluating how well the variables Audit Risk Factor, risk level and change type explained the respondents' decisions to change the conduct of the audit.

Results

The results of the individual risk/change approach were as follows.

- (1) As the risk increased in each Audit Risk Factor, the likelihood of respondents making a change in the audit did increase for four of the six types of change.

- (2) The two change types for which there were not increased likelihoods as risk increased were the first and the last of the change types.
- (3) A large portion of the risk level progressions were significant.
- (4) Of those risk level progressions which were not significant, more than half were related to two specific risk level progressions.

The result of the summary approach to the Phase II analysis was a model which was both well specified (in terms of goodness of fit) and satisfactory in terms of relevance to the research.

Conclusions

Any conclusions about this research must be made within the context of the limitations set forth in Chapter I. However, in consideration of the results of the research, it is appropriate to conclude that as audit risk increases an auditor changes the conduct of the audit. This statement has many implications to the auditing profession. These implications can be presented in three groups: planning audit programs; training personnel; and formulating firm policy.

Based on the research conclusion that "as audit risk increases, an auditor changes the conduct of the audit," there should be a phase in planning an audit engagement in

which there is a formal risk analysis. Items recognized as audit risk indicators should be considered for any changes since the previous audit. The changes should be evaluated and the programs should be altered as required.

The professional training of auditors should recognize the impact of risk on the conduct of the audit. Auditors should be made aware of risk indicators and instructed on the firms' policies in dealing with changing risk.

Finally, with regard to firm policy, the responses to this questionnaire can be evaluated in terms of the reactions to risk level increases. A firm could evaluate the respondent's choices in the context of their firm's philosophy and develop some guidelines for their firm's personnel.

While this research dealt with the specific context of an oil and gas audit, other aspects of the audit could be studied and analyzed in a similar risk-reaction format for input into more general audit program risk analysis, personnel training and policy formulation.

Recommendations for Future Research

The recommendations for future research are organized into three categories: considerations in refining this survey instrument, suggestions of other research formats; and thoughts on broader applications.

Survey Instrument

While this research focused on a question of interest to auditors of oil and gas entities, the topic had not been empirically analyzed. Therefore, this work was not of a refining nor confirming nature, but rather was an initial effort in a complex area. As such, much of its contribution is that it highlights some problem areas which should be considered if future research in the area is pursued.

The questionnaire responses which were inconsistent with the overall research findings offer insights into ways in which the survey instrument might be refined. That the response for two of the change types did not indicate an increased likelihood of change as the risk level increased can be explained, to a great extent, by examining the specific changes. The first change allowed for a change in the firm's personnel assigned to the engagement which, given the highly specific nature of the risky situations, probably seemed too weak a change to be effective. The other change dealt with withdrawal from the audit engagement. While the first change was too weak to be effective, this change was probably too extreme a choice given the limited information of the case context. Rather than being considered as disconfirming of the research hypothesis, the test results of these two change types speak more to the instrument design.

Possible conclusions about the results of the risk level progressions tests also relate more to instrument design than the research question. Since these tests were performed only on the situations already deemed significant by the previous test, the results should not be interpreted negatively. If the individual audit risk progressions within a significant change type and Audit Risk Factor were insignificant, the logical conclusion is that the risk level progressions were poorly delineated.

Improvements in these two specific areas would enhance this survey instrument. Also, further use of the questionnaire would possibly reveal other weaknesses which could be corrected.

Other Formats

The static format of a questionnaire cannot hope to cover all of the interrelationships and contingencies an auditor actually faces. Future research might result in more detailed and accurate information if an interview technique is used. Time constraints would force a smaller absolute number of participants, and data analysis might be more difficult; but the trade-off would be for a higher quality of information.

A more nearly complete picture of the impact of risk increases on the conduct of the audit of an oil and gas entity might be obtained by development of an interactive

instrument. A computer simulation programmed with if-then contingencies would be more consistent with the dynamic nature of this type of change decision. It would be difficult to create such a simulation model, but the usefulness to both research and training might warrant the expenditure of time and expense.

A totally different approach to this research question is the case study approach. A public accounting firm's records and working papers could be analyzed for cases in which some of the audit risk indicators are present. By tracking the client over a period of years, the auditors' reaction to changes in the audit risk indicators could be noted and analyzed. Since there is great concern for client confidentiality, access to this type of data would probably be limited to personnel of the firm. Even though the accumulation of the data might be limited, the results could be generalized and shared with other firms through publication in professional journals.

Broader Applications

The other recommendations have dealt with future research in the oil and gas audit context. This research has implications outside of an oil and gas context.

Risk is present in all audit engagements. The conduct and result of this research and that performed by Carl Brewer indicate that research which attempts to identify

risk and gauge the reactions of auditors to these risks can be successfully conducted. Future research should be pursued which will build on these efforts in order to learn more about auditors and risk.

APPENDIX A

FORMAT FOR PRESENTATION OF SUPPLEMENTARY
RESERVE INFORMATION

Source: FASB, "Disclosures About Oil and Gas Producing
Activities," Statement of Financial Accounting
Standards No. 69 (Stamford, Conn., FASB,
November, 1982)

**STANDARDIZED MEASURE OF DISCOUNTED FUTURE NET CASH FLOWS AND
CHANGES THEREIN RELATING TO PROVED OIL AND GAS RESERVES
AT DECEMBER 31, 19XX**

	<u>Total</u>	<u>United States</u>	<u>Foreign Geographic Area A</u>	<u>Foreign Geographic Area B</u>	<u>Other Foreign Geographic Areas</u>
Future cash inflows*	\$ X	\$ X	\$ X	\$ X	\$ X
Future production and development costs*	(X)	(X)	(X)	(X)	(X)
Future income tax expenses*	(X)	(X)	(X)	(X)	(X)
Future net cash flows	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>
10% annual discount for estimated timing of cash flows	(X)	(X)	(X)	(X)	(X)
Standardized measure of discounted future net cash flows	<u>\$ X†</u>	<u>\$ X</u>	<u>\$ X</u>	<u>\$ X</u>	<u>\$ X</u>
Enterprise's share of equity method investees' standardized measure of discounted future net cash flows	<u>\$ X</u>	<u>\$ X</u>	<u>\$ X</u>	<u>\$ X</u>	<u>\$ X</u>

The following are the principal sources of change in the standardized measure of discounted future net cash flows during 19XX:

Sales and transfers of oil and gas produced, net of production costs	\$(X)
Net changes in prices and production costs	X
Extensions, discoveries, and improved recovery, less related costs	X
Development costs incurred during the period	(X)
Revisions of previous quantity estimates	X
Accretion of discount	X
Net change in income taxes	X
Other	X

*Future net cash flows were computed using year-end prices and costs, and year-end statutory tax rates (adjusted for permanent differences) that relate to existing proved oil and gas reserves in which the enterprise has mineral interests, including those mineral interests related to long-term supply agreements with governments for which the enterprise serves as the producer of the reserves
†Includes \$X attributable to a consolidated subsidiary in which there is an X-percent minority interest.

RESERVE QUANTITY INFORMATION*
FOR THE YEAR ENDED DECEMBER 31, 19XX

	<u>Total</u>		<u>United States</u>		<u>Foreign Geographic Area A</u>		<u>Foreign Geographic Area B</u>		<u>Other Foreign Geographic Areas</u>	
	<u>Oil</u>	<u>Gas</u>	<u>Oil</u>	<u>Gas</u>	<u>Oil</u>	<u>Gas</u>	<u>Oil</u>	<u>Gas</u>	<u>Oil</u>	<u>Gas</u>
Proved developed and undeveloped reserves:										
Beginning of year	X	X	X	X	X	X	X	X	X	X
Revisions of previous estimates	X	X	X	X	X	X	X	X	X	X
Improved recovery	X	X	X	X	X	X	X	X	X	X
Purchases of minerals in place	X	X	X	X	X	X	X	X	X	X
Extensions and discoveries	X	X	X	X	X	X	X	X	X	X
Production	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)
Sales of minerals in place	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)
End of year	<u>X†</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>
Proved developed reserves:										
Beginning of year	X	X	X	X	X	X	X	X	X	X
End of year	X	X	X	X	X	X	X	X	X	X
Oil and gas applicable to long-term supply agreements with governments or authorities in which the enterprise acts as producer:										
Proved reserves—										
end of year	X	X			X	X				
Received during the year	X	X			X	X				
Enterprise's proportional interest in reserves of investees accounted for by the equity method—										
end of year	X	X	X	X	X	X	X	X	X	X

*Oil reserves stated in barrels; gas reserves stated in cubic feet.

†Includes reserves of X barrels attributable to a consolidated subsidiary in which there is an X-percent minority interest.

APPENDIX B

PHASE I QUESTIONNAIRE

Part 1: Evaluation of Factors That May Affect Risk

The purpose of this questionnaire is to obtain opinions and perceptions of the audit risk in associating with oil and gas reserve quantity and value estimates. As used in this survey, audit risk can be considered to consist of two parts:

- the risk that material errors will occur in the accounting process used to develop the financial reports
- the risk that any material errors that occur will not be detected by the auditor.

This study will focus on the first risk as it applies to oil and gas reserve estimation. Therefore, the first risk could be restated as:

- the risk that material errors will occur in financial reports as a result of the fact that oil and gas reserve quantities cannot be measured directly but must be estimated.

You should include in your consideration all uses of reserve estimates, such as depletion, depreciation and amortization calculations; full-cost ceiling test; and supplementary disclosures.

Instructions: Following are a number of statements describing types of information that could be available in an audit engagement. Please indicate the relative importance of each item (considered independently) in an assessment of the audit risk in associating with reserve estimates.

There are no right or wrong answers; please give the answer most indicative of your thoughts on each item by placing a check (✓) in the appropriate space.

Your response options are on a scale as follows:

- very little or no importance in the assessment of risk
- of little importance in the assessment of risk
- of moderate importance in the assessment of risk
- of great importance in the assessment of risk
- of maximum importance in the assessment of risk

You are allowed separate responses for public and private ownership of the client company. If the form of ownership makes no difference to your response, check here _____ and place answers in the public column only.

Case Context: You should assume that the engagement is the annual audit of a corporation for the year ended 12/31/83. The company's oil and gas interests are all domestic.

	PUBLIC					PRIVATE				
	very little or no importance	little importance	moderate importance	great importance	maximum importance	very little or no importance	little importance	moderate importance	great importance	maximum importance
1. makeup of ownership of stock in the client company (i.e., many small investors/few large investors).										
2. age of client company.										
3. length of time client company has owned oil and gas interests.										
4. size of client company.										
5. method of accounting used by client company (i.e., full cost/successful efforts/tax basis).										

	PUBLIC					PRIVATE				
	very little or no importance	little importance	moderate importance	great importance	maximum importance	very little or no importance	little importance	moderate importance	great importance	maximum importance
6. length of time client company has been your client.										
7. extent to which the client's oil and gas reserves include interests in partnerships or joint interests.										
8. current market conditions (e.g., price of oil and gas/supply-demand of oil and gas).										
9. extent to which asset values exceed book values (i.e., cost recoverability problems).										
10. integrity and reliability of client's data base of reserve information.										
11. quality of client's documentation of reserve estimation.										
12. quality of client's established review procedures for reserve estimation.										
13. frequency of field studies.										
14. frequency of estimate revisions.										
15. client's own use of reserve estimates (i.e., only as required in financial reports/for budgeting and managerial purposes).										
16. internal estimator's general record of accuracy in estimation.										
17. external estimator's general record of accuracy in estimation for this client.										
18. internal estimator's professional qualifications (education, training, experience) as per Society of Petroleum Engineers' established standards.										
19. external estimator's professional qualifications (education, training, experience) as per Society of Petroleum Engineers' established standards.										
20. internal estimator's independence, objectivity and confidentiality as per Society of Petroleum Engineers' established standards.										
21. external estimator's independence, objectivity and confidentiality as per Society of Petroleum Engineers' established standards.										

	PUBLIC					PRIVATE				
	very little or no importance	little importance	moderate importance	great importance	maximum importance	very little or no importance	little importance	moderate importance	great importance	maximum importance
22. internal estimator's experience in oil and gas fields in which the client operates.										
23. external estimator's experience in oil and gas fields in which the client operates.										
24. external estimators' approach (i.e., rely on internal estimator's work/do most of the estimate work themselves).										
25. external estimator's reputation (i.e., liberal/conservative in estimates).										
26. auditor's experience with the external estimator.										
27. methodology(ies) used to calculate reserve estimates (i.e., single method/combination of methods).										
28. client's quantity of revisions as compared to production (historically).										
29. client's quantity of revisions as compared to reserve quantities.										
30. auditor's use of analytical review as a checking procedure in estimate revisions.										
31. relative extent of auditor's knowledge of reserve estimation process.										
32. age of oil and gas fields involved.										
33. recovery method(s) being used in the fields.										
34. stage of development of fields (i.e., development wells drilled/not yet drilled).										
35. availability of production history.										
36. presence of other producing fields in the area.										
37. source of reserve estimation (i.e., internal/external)										
38. other(s) _____										

Part 2: Demographic Questions

This demographic data is being accumulated for the sole purpose of classifying data in analyzing the results of the survey. It will not be associated or identified with individual questionnaire responses. All of your responses to these questions will be kept strictly confidential. Data will be reported only after it is aggregated.

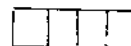
Instructions: Please circle or check the appropriate response.

1. How many years of auditing experience do you have?
1-5 6-10 11-15 16-20 21-25 26-30 31-35 36+
2. Which of the following best describes your present position?
(specialization in the sense that your firm considers oil and gas to be an area in which you have expertise)
 - partner with oil and gas industry specialization
 - partner without oil and gas industry specialization
 - manager with oil and gas industry specialization
 - manager without oil and gas industry specialization
 - other: _____
3. How many years have you been in the position described in 2 above?
1-5 6-10 11-15 16-20 21+
4. If you have work experience outside of public accounting, was it in the oil and gas industry?
yes _____ number of years _____ in what capacity _____
5. If you have a non-accounting degree, what was the field of study?
 - geology
 - petroleum engineering
 - other engineering
 - other: _____

Please send me a copy of the results of this research when completed.

Yes _____ Name & Address (this information will not be linked with your responses.)

No _____



APPENDIX C

PHASE II QUESTIONNAIRE

Part I: Evaluation of Relative Riskiness of Factors

Following is a case synopsis of an audit to be used as a base or reference point in responding to the subsequent questions. The focus of the questions is on some of the important factors (variables) in the reserve estimation process. The objective of the questions is the determination of the point at which a factor becomes sufficiently "risky" to warrant a change or variation in the auditor's performance of the audit program. You should include in your consideration all uses of reserve estimates, such as depletion, depreciation and amortization calculations; full-cost ceiling test; and supplementary disclosures.

For each of the nine independent factors identified in the reserve estimation section of the case synopsis, there is a chart describing the factor at four levels. Level I is the reference level which is descriptive of the nature of this factor on this audit for the past three years. Each of the other levels--II, III and IV--describe conditions of the factor different from level I.

In addition to the four levels for each factor, there are six possible changes which could be made in the conduct of this hypothetical audit engagement. These changes are:

- a. change in your firm's personnel assigned to the audit engagement
- b. reallocation of the budgeted time among the audit tasks
- c. expansion of the total time budget on the engagement
- d. employment of experts for consultation on the engagement
- e. qualification of the audit opinion
- f. withdrawal from the audit engagement

Instructions

For each factor consider the four levels, remembering that level I is the reference level or condition of the factor which has held true in the past. For each of levels II, III and IV determine the impact of the changed condition on your conduct of the audit. Decide if the different condition of the factor would cause you to make a change in the conduct of the audit. Then for each possible change, "a" through "f," mark the likelihood of your making that change. Your response options are:

- 0 = No, I would definitely NOT make this change
- 1 = I would probably NOT make this change
- 2 = I am neutral as to whether a change should be made
- 3 = I would probably make this change
- 4 = Yes, I would definitely make this change

You should consider each change separately. (That is, a response of "4" to one change option does not preclude your responding with "4" to another change option.) There are no right or wrong answers; please give the answer most indicative of your thoughts by placing a number 0, 1, 2, 3 or 4 in the allocated spaces.

CASE SYNOPSIS

General Information

PURPOSE OF AUDIT ENGAGEMENT: The purpose of the audit is a general examination, without any scope limitation, of the financial statements in accordance with generally accepted auditing standards.

PRIOR AUDIT EXPERIENCE: Your firm has audited the client for the past three years. Each year the client has received an unqualified opinion on its financial statements. You have worked on the audit for these past three years.

YOUR AUDIT TEAM: Personnel on your audit team are experienced at their respective levels (i.e., seniors/juniors have performed as seniors/juniors before this audit). All personnel are familiar with the client's industry. Other personnel in your firm do have greater expertise in oil and gas accounting.

THE CLIENT: The client is a publicly held, domestic oil and gas producing company. In recent years, the client has experienced a small but steady internal rate of growth resulting from exploration and drilling activities without any major acquisitions of producing properties.

CLIENT'S ACCOUNTING PRACTICES: The client has engaged in no unusual or complex transactions. All accounting practices are prescribed by existing authoritative pronouncements.

CLIENT'S INTERNAL CONTROLS: In general, internal control appears to be satisfactory.

Reserve Estimation Factors

FACTOR ONE: Estimator's record of accuracy.

FACTOR TWO: Availability of production history.

FACTOR THREE: External estimator's professional qualifications (education, training, experience) as per Society of Petroleum Engineers' established standards.

FACTOR FOUR: External estimator's independence, objectivity and confidentiality as per Society of Petroleum Engineers' established standards.

FACTOR FIVE: Quality of client's established review procedures for reserve estimation.

FACTOR SIX: Quality of client's documentation of reserve estimation.

FACTOR SEVEN: Integrity (reliability) of client's data base of reserve information.

FACTOR EIGHT: Source of reserve information.

FACTOR NINE: Extent to which proved reserve values exceed book values.

Please Note: Each factor is independent.

For each factor, the responses to the Reference Level I have been filled in with response option "0" because, as the base case, there is no need for a change in procedures.

- Response Options
- 0 = No, I would definitely NOT make this change
 - 1 = I would probably NOT make this change
 - 2 = I am neutral as to whether a change should be made
 - 3 = I would probably make this change
 - 4 = Yes, I would definitely make this change

	a change audit personnel	b reallocate budgeted time	c expand time budget	d use experts	e qualify audit opinion	f withdraw from engagement
<u>Factor One: Estimator's record of accuracy</u>						
I. The revisions are relatively small and appear to be mainly the result of new production data.	0	0	0	0	0	0
II. The revisions appear to be the result of estimators being overly optimistic in the selection of assumptions.						
III. The estimator's assumptions are reasonable, but the production information was not used effectively.						
IV. The revisions appear to be the result of faulty assumptions and incorrectly used production information.						
<u>Factor Two: Availability of production history</u>						
I. Most of the company's reserves are from a large number of established fields with production histories.	0	0	0	0	0	0
II. Half of the company's reserves are from a large number of established fields with production histories. The other half are from fairly new fields that have no histories.						
III. Half of the company's reserves are in a few large, new fields. The other half are in several older, well-established fields.						
IV. Most of the company's reserves are in new fields with no production history.						

Please Note: Each factor is independent.

For each factor, the responses to the Reference Level I have been filled in with response option "0" because, as the base case, there is no need for a change in procedures.

- Response Options
- 0 = No, I would definitely NOT make this change
 - 1 = I would probably NOT make this change
 - 2 = I am neutral as to whether a change should be made
 - 3 = I would probably make this change
 - 4 = Yes, I would definitely make this change

	a change audit personnel	b reallocate budgeted time	c expand time budget	d use experts	e qualify audit opinion	f withdraw from engagement
Factor Three: External estimator's professional qualifications (education, training, experience) as per Society of Petroleum Engineers' established standards (assume that client's estimation is done 100% externally)						
I. All of the qualifications are met.	0	0	0	0	0	0
II. The estimator has sufficient education and training, but the experience qualification is not met.						
III. The estimator has sufficient education, but the training and experience qualifications are not met.						
IV. None of the qualifications are met.						
Factor Four: External estimator's independence, objectivity and confidentiality as per Society of Petroleum Engineers' established standards (assume that client's estimation is done 100% externally)						
I. All of the qualifications are met.	0	0	0	0	0	0
II. The estimator meets the independence and objectivity qualifications, but not the confidentiality requirement.						
III. The estimator meets the independence requirement, but the objectivity and confidentiality qualifications are not met.						
IV. None of the qualifications are met.						

Please Note: Each factor is independent.

For each factor, the responses to the Reference Level I have been filled in with response option "0" because, as the base case, there is no need for a change in procedures.

- Response
Options
- 0 = No, I would definitely NOT make this change
 - 1 = I would probably NOT make this change
 - 2 = I am neutral as to whether a change should be made
 - 3 = I would probably make this change
 - 4 = Yes, I would definitely make this change

	a change audit personnel	b reallocate budgeted time	c expand time budget	d use experts	e qualify audit opinion	f withdraw from engagement
<u>Factor Five:</u> Quality of client's established review procedures for reserve estimation						
I. The review procedures are well established and adhered to.	0	0	0	0	0	0
II. The review procedures have been established, but are not followed.						
III. There are no established procedures, but several engineers are involved in making and compiling the estimates.						
IV. No one performs any review procedures.						
<u>Factor Six:</u> Quality of client's documentation of reserve estimation						
I. Client's documentation is complete and easily followed.	0	0	0	0	0	0
II. Client's documentation seems complete, but is difficult to follow.						
III. Client's documentation seems incomplete, but is easily followed.						
IV. Client's documentation seems incomplete and is difficult to follow.						

Please Note: Each factor is independent.

For each factor, the responses to the Reference Level I have been filled in with response option "0" because, as the base case, there is no need for a change in procedures.

- Response 0 = No, I would definitely NOT make this change
 1 = I would probably NOT make this change
 2 = I am neutral as to whether a change should be made
 3 = I would probably make this change
 4 = Yes, I would definitely make this change

	a change audit personnel	b reallocate budgeted time	c expand time budget	d use experts	e qualify audit opinion	f withdraw from engagement
Factor Seven: Integrity (reliability) of client's data base of reserve information						
I. A high degree of reliance can be placed on the data base of reserve information.	0	0	0	0	0	0
II. Some reliance can be placed on the data base of reserve information.						
III. Little reliance can be placed on the data base of reserve information.						
IV. No reliance can be placed on the data base of reserve information.						
Factor Eight: Source of reserve estimation						
I. Estimation is done internally and audited by external estimators.	0	0	0	0	0	0
II. Estimation is done externally with some review and verification by internal estimators.						
III. Estimation is done 100% externally.						
IV. Estimation is done 100% internally.						

Please Note: Each factor is independent.

For each factor, the responses to the Reference Level I have been filled in with response option "0" because, as the base case, there is no need for a change in procedures.

- Response
Options
- 0 = No, I would definitely NOT make this change
 - 1 = I would probably NOT make this change
 - 2 = I am neutral as to whether a change should be made
 - 3 = I would probably make this change
 - 4 = Yes, I would definitely make this change

Factor Nine: Extent to which proved reserve values exceed book values.	a change audit personnel	b reallocate budgeted time	c expand time budget	d use experts	e qualify audit opinion	f withdraw from engagement
I. Discounted net present value exceeds book value by 50%.	0	0	0	0	0	0
II. Discounted net present value exceeds book value by 5%.						
III. Discounted net present value is equal to book value.						
IV. Book value exceeds discounted net present value by 10%.						

Part 2: Demographic Questions

This demographic data is being accumulated for the sole purpose of classifying data in analyzing the results of the survey. It will not be associated or identified with individual questionnaire responses. All of your responses to these questions will be kept strictly confidential. Data will be reported only after it is aggregated. Please indicate your response below.

- How many years of auditing experience do you have?

1-5	6-10	11-15	16-20	21-25	26-30	31-35	36+
-----	------	-------	-------	-------	-------	-------	-----
- Which of the following best describes your present position? (specialization in the sense that your firm considers oil and gas to be an area in which you have expertise)

_____ partner with oil and gas industry specialization	3. How many years have you been in the position described in "2"?
_____ partner without oil and gas industry specialization	1-5 6-10 11-15 16-20 21+
_____ manager with oil and gas industry specialization	4. If you have work experience outside of public accounting, was it in the oil and gas industry?
_____ manager without oil and gas industry specialization	yes _____ number of years _____ in what capacity
_____ other: _____	5. If you have a non-accounting degree, what was the field of study?
- geology _____ petroleum engineering _____ other: _____

PLEASE SEND A COPY OF THIS RESEARCH WHEN COMPLETED

NO _____ YES _____ (please write name and address on the back of this page)



APPENDIX D

RESULTS OF FRIEDMAN TEST
AND SIGN TEST

Please Note: Each factor is independent.

For each factor, the responses to the Reference Level I have been filled in with response option "0" because, as the base case, there is no need for a change in procedures.

Response 0 = No, I would definitely NOT make this change
 1 = I would probably NOT make this change
 2 = I am neutral as to whether a change should be made
 3 = I would probably make this change
 4 = Yes, I would definitely make this change

	a change audit personnel	b reallocate budgeted time	c expand time budget	d use experts	e qualify audit opinion	f withdraw from engagement
<u>Factor One:</u> Estimator's record of accuracy	.051 *	.000 *	.000 *	.000 *	.000 *	.004 *
I. The revisions are relatively small and appear to be mainly the result of new production data.		.000 **	.000 **	.000 **	.000 **	.031 **
II. The revisions appear to be the result of estimators being overly optimistic in the selection of assumptions.		1.000 **	.078 **	.700 **	.109 **	.125 **
III. The estimator's assumptions are reasonable, but the production information was not used effectively.		.000 **	.000 **	.000 **	.000 **	.000 **
IV. The revisions appear to be the result of faulty assumptions and incorrectly used production information.						
<u>Factor Two:</u> Availability of production history	.020 *	.000 *	.000 *	.000 *	.000 *	.821 *
I. Most of the company's reserves are from a large number of established fields with production histories.		.000 **	.000 **	.000 **	.000 **	
II. Half of the company's reserves are from a large number of established fields with production histories. The other half are from fairly new fields that have no histories.		.727 **	.006 **	.002 **	.375 **	
III. Half of the company's reserves are in a few large, new fields. The other half are in several older, well-established fields.		.118 **	.000 **	.000 **	.000 **	
IV. Most of the company's reserves are in new fields with no production history.						

Please Note: Each factor is independent.

For each factor, the responses to the Reference Level I have been filled in with response option "0" because, as the base case, there is no need for a change in procedures.

Response Options	a change audit personnel	b reallocate budgeted time	c expand time budget	d use experts	e qualify audit opinion	f withdraw from engagement
0 = No, I would definitely NOT make this change 1 = I would probably NOT make this change 2 = I am neutral as to whether a change should be made 3 = I would probably make this change 4 = Yes, I would definitely make this change	.037 *	.000 *	.000 *	.000 *	.000 *	.001 *
Factor Three: External estimator's professional qualifications (education, training, experience) as per Society of Petroleum Engineers' established standards (assume that client's estimation is done 100% externally)						
I. All of the qualifications are met.		.000 **	.000 **	.000 **	.000 **	.002 **
II. The estimator has sufficient education and training, but the experience qualification is not met.		.039 **	.000 **	.000 **	.000 **	.063 **
III. The estimator has sufficient education, but the training and experience qualifications are not met.		.022 **	.000 **	.000 **	.000 **	.000 **
IV. None of the qualifications are met.						
Factor Four: External estimator's independence, objectivity and confidentiality as per Society of Petroleum Engineers' established standards (assume that client's estimation is done 100% externally)	.133 *	.000 *	.000 *	.000 *	.000 *	.002 *
I. All of the qualifications are met.		.000 **	.000 **	.000 **	.000 **	.004 **
II. The estimator meets the independence and objectivity qualifications, but not the confidentiality requirement.		.000 **	.000 **	.000 **	.000 **	.001 **
III. The estimator meets the independence requirement, but the objectivity and confidentiality qualifications are not met.		.057 **	.001 **	.000 **	.000 **	.039 **
IV. None of the qualifications are met.						

Please Note: Each factor is independent.

For each factor, the responses to the Reference Level I have been filled in with response option "0" because, as the base case, there is no need for a change in procedures.

Response Options	a change audit personnel	b reallocate budgeted time	c expand time budget	d use experts	e qualify audit opinion	f withdraw from engagement
0 = No, I would definitely NOT make this change 1 = I would probably NOT make this change 2 = I am neutral as to whether a change should be made 3 = I would probably make this change 4 = Yes, I would definitely make this change						
Factor Five: Quality of client's established review procedures for reserve estimation						
I. The review procedures are well established and adhered to.	.005 *	.000 *	.000 *	.000 *	.000 *	.033 *
II. The review procedures have been established, but are not followed.	1.000 **	1.226 **	.065 **	.607 **	.344 **	
III. There are no established procedures, but several engineers are involved in making and compiling the estimates.	.006 **	.031 **	.000 **	.000 **	.000 **	
IV. No one performs any review procedures.						
Factor Six: Quality of client's documentation of reserve estimation						
I. Client's documentation is complete and easily followed.	.018 *	.000 *	.000 *	.000 *	.000 *	.018 *
II. Client's documentation seems complete, but is difficult to follow.		.000 **	.000 **	.000 **	.000 **	
III. Client's documentation seems incomplete, but is easily followed.		.267 **	.000 **	.000 **	.000 **	
IV. Client's documentation seems incomplete and is difficult to follow.		.012 **	.000 **	.000 **	.000 **	

Please Note: Each factor is independent.

For each factor, the responses to the Reference Level I have been filled in with response option "0" because, as the base case, there is no need for a change in procedures.

- Response 0 = No, I would definitely NOT make this change
- 1 = I would probably NOT make this change
- 2 = I am neutral as to whether a change should be made
- 3 = I would probably make this change
- 4 = Yes, I would definitely make this change

	a change audit personnel	b reallocate budgeted time	c expand time budget	d use experts	e qualify audit opinion	f withdraw from engagement
Factor Seven: Integrity (reliability) of client's data base of reserve information	.007 *	.000 *	.000 *	.000 *	.000 *	.000 *
I. A high degree of reliance can be placed on the data base of reserve information.	.002 **	.000 **	.000 **	.000 **	.000 **	.000 **
II. Some reliance can be placed on the data base of reserve information.	.021 **	.011 **	.000 **	.000 **	.000 **	.002 **
III. Little reliance can be placed on the data base of reserve information.	.012 **	.000 **	.002 **	.000 **	.000 **	.000 **
IV. No reliance can be placed on the data base of reserve information.						

	a change audit personnel	b reallocate budgeted time	c expand time budget	d use experts	e qualify audit opinion	f withdraw from engagement
Factor Eight: Source of reserve estimation	.186 *	.000 *	.000 *	.000 *	.002 *	.193 *
I. Estimation is done internally and audited by external estimators.		.000 **	.000 **	.000 **	.004 **	
II. Estimation is done externally with some review and verification by internal estimators.		.227 **	.004 **	.039 **	.625 **	
III. Estimation is done 100% externally.		.000 **	.000 **	.000 **	.000 **	
IV. Estimation is done 100% internally.						

Please Note: Each factor is independent.

For each factor, the responses to the Reference Level I have been filled in with response option "0" because, as the base case, there is no need for a change in procedures.

- 0 = No, I would definitely NOT make this change
 1 = I would probably NOT make this change
 2 = I am neutral as to whether a change should be made
 3 = I would probably make this change
 4 = Yes, I would definitely make this change

	a	b	c	d	e	f
	change audit personnel	reallocate budgeted time	expand time budget	use experts	qualify audit opinion	withdraw from engagement
Factor Nine: Extent to which proved reserve values exceed book values.	.035 *	.000 *	.000 *	.000 *	.000 *	.665 *
I. Discounted net present value exceeds book value by 50%.	.000 **	.000 **	.000 **	.000 **	.000 **	
II. Discounted net present value exceeds book value by 5%.	.002 **	.002 **	.000 **	.000 **	.004 **	
III. Discounted net present value is equal to book value.	.180 **	.180 **	.008 **	.002 **	.000 **	
IV. Book value exceeds discounted net present value by 10%.						

Part 2: Demographic Questions

*Friedman Test Level of Significance ** Sign Test P Value

This demographic data is being accumulated for the sole purpose of classifying data in analyzing the results of the survey. It will not be associated or identified with individual questionnaire responses. All of your responses to these questions will be kept strictly confidential. Data will be reported only after it is aggregated. Please indicate your response below.

- How many years of auditing experience do you have?
 1-5 6-10 11-15 16-20 21-25 26-30 31-35 36+
- Which of the following best describes your present position? (specialization in the sense that your firm considers oil and gas to be an area in which you have expertise)
 ___ partner with oil and gas industry specialization
 ___ partner without oil and gas industry specialization
 ___ manager with oil and gas industry specialization
 ___ manager without oil and gas industry specialization
 ___ other: _____
- How many years have you been in the position described in "2"?
 1-5 6-10 11-15 16-20 21+
- If you have work experience outside of public accounting, was it in the oil and gas industry?
 yes ___ number of years ___ in what capacity _____
- If you have a non-accounting degree, what was the field of study?
 ___ geology ___ petroleum engineering
 ___ other engineering ___ other: _____

PLEASE SEND A COPY OF THIS RESEARCH WHEN COMPLETED
 NO ___ YES ___ (please write name and address on the back of this page)

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BIBLIOGRAPHY

Books

- Arens, Alvin A., and James K. Loebbecke, Auditing--An Integrated Approach, 2nd Edition, Englewood Cliffs, New Jersey, Prentice Hall, Inc., 1980.
- Cox, D. R., The Analysis of Binary Data, London, Methuen & Co. Ltd., 1970.
- Hull, C. Hadlai, and Norman H. Nie, SPSS Update 7-9; New Procedures and Facilities for Releases 7-9, New York, McGraw-Hill Book Company, 1981.
- Kleinbaum, David G., and Lawrence L. Kupper, Applied Regression Analysis and Other Multivariable Methods, North Scituate, Mass., Duxbury Press, 1978.
- Porter, Stanley P., A Study of the Subjectivity of Reserve Estimates and Its Relation to Financial Reporting, Stanley P. Porter with the assistance of Arthur Young & Company, 1980.
- SAS User's Guide: Statistics, 1982 Edition, Cary, North Carolina, SAS Institute Inc., 1982.
- Siegel, Sidney, Nonparametric Statistics For The Behavioral Sciences, New York, McGraw-Hill Book Company, 1956.

Articles

- American Petroleum Institute, "Estimation and Valuation of Underground Oil and Gas Reserves," (1971).
- Anderson, H. M., J. W. Giese, and Jon Booker, "Some Propositions About Auditing," The Accounting Review, 45 (July, 1970), 524-531.
- Bell, Alan D., "The Petroleum Reserve Estimation Process-- An Introduction For Accountants," Journal of Extractive Industries Accounting, 2 (Spring, 1983), 71-82.

- Booker, Jon, "Relative Risk Evaluation: A Supplement to Professional Liability Insurance," The National Public Accountant, 18 (May, 1973), 18-25.
- Kelley, Robert, "Accounting for the Effects of Reserve Changes on Interim Results," Journal of Extractive Industries Accounting, 1 (Fall, 1982).
- May, Alan, Jr., "Public Reporting of Oil and Gas Reserves-- Auditing Oil and Gas Reserve Information (Part I)," Institute on Oil and Gas Accounting 15th Southwestern Legal Foundation, 1979 Proceedings (1980), 3.1-3.11.
- Morris, William and Hershel Anderson, "Audit Scope Adjustments for Internal Control?" CPA Journal, 46 (July, 1976), 15-20.
- Society of Petroleum Engineers, "Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserve Information," Journal of Petroleum Technology, 31 (December, 1979), 1557-1565.
- Warren, Carl S., "Audit Risk," The Journal of Accountancy, 148 (August, 1979), 66-74.

Materials of Professional Organizations

American Institute of Certified Public Accountants, "Audit Sampling," Statements on Auditing Standards No. 39, New York, AICPA, June 1981.

"Evidential Matter," Statements on Auditing Standards No. 31, New York, AICPA, August 1980.

"Materiality and Audit Risk in Conducting An Audit," Exposure Draft, Proposed Statement On Auditing Standards, New York, AICPA, December 6, 1982.

"Supplementary Information Required by the Financial Accounting Standards Board," Statements on Auditing Standards No. 27, New York, AICPA, December 1979.

"Supplementary Oil and Gas Reserve Information," Statements on Auditing Standards No. 33, New York, AICPA, October 1980.

American Institute of Certified Public Accountants, "Using the Work of A Specialist," Statements on Auditing Standards No. 11, New York, AICPA, December 1975.

Field, Robert E., "Financial Reporting in the Extractive Industries," Accounting Research Study No. 11, New York, AICPA, 1969.

Financial Accounting Standards Board, "Disclosures About Oil and Gas Producing Activities," Statement of Financial Accounting Standards No. 69, Stamford, Conn., FASB, November 1982.

_____, "Disclosures About Oil and Gas Producing Activities," Exposure Draft, Proposed Statement of Financial Accounting Standards, Stamford, Conn., FASB, April 15, 1982.

_____, "Financial Accounting and Reporting by Oil and Gas Producing Companies," Statement of Financial Accounting Standards No. 19, Stamford, Conn., FASB, December 1977.

_____, "Suspension of Certain Accounting Requirements for Oil and Gas Producing Companies," Statement of Financial Accounting Standards No. 25, Stamford, Conn., FASB, February 1979.

Oil and Gas Committee of the American Institute of Certified Public Accountants, "Proposed Audit Guide--Audits of Oil and Gas Producing Companies," New York, AICPA, 1982.

Public Documents

Securities and Exchange Commission, "Adoption of Requirements for Financial Accounting and Reporting Practices for Oil and Gas Producing Activities," Release Nos. 33-5966; 34-15108; 35-20688; IC-10383; AS-253, Washington, Government Printing Office, August 1978.

_____, "Disclosure of Oil and Gas Reserves and Operations: Amendment to Regulation S-K," Release Nos. 33-6008; 34-15418; 35-20838; IC-10532, Washington, Government Printing Office, December 1978.

Securities and Exchange Commission, "Disclosure of Oil and Gas Reserves and Operations, Proposed Amendment to Regulation S-K," Release Nos. 33-5967; 34-20691; IC-10385, Washington, Government Printing Office, August 1978.

, "Financial Reporting by Oil and Gas Producers," Release Nos. 33-6294; 34-17581; 35-21936; IC-11650; AS-289, Washington, Government Printing Office, February 1981.

, "Notice of Adoption of Amendments to Regulation S-X Requiring Disclosure of Certain Replacement Cost Data," Accounting Series Release No. 190, Washington, Government Printing Office, 1976.

, "Oil and Gas Producers--Full Cost Accounting Practices," Release Nos. 33-6007; 34-15417; 35-20837; IC-10531; AS-258, Washington, Government Printing Office, December 1978.

, "Oil and Gas Reserve Information--Postponement of Audit Requirement," Release Nos. 33-6207; 34-16752; 35-21526; IC-11133; AS-277, Washington, Government Printing Office, April 1980.

, "Oil and Gas Reserve Information--Postponement of Audit Requirement for Reserve Information," Release Nos. 33-6128; 34-16219; 35-21223; IC-10876; AS-270, Washington, Government Printing Office, September 1979.

, "Oil and Gas Producers Supplemental Disclosures on the Basis of Reserve Recognition Accounting," Release Nos. 33-6126; 34-16218; 35-21222; IC-10875; AS-269, Washington, Government Printing Office, September 1979.

, "Requirements for Financial Accounting and Reporting Practices for Oil and Gas Producing Activities," Release Nos. 33-6006; 34-15416; 35-20836; IC-10530; AS-257, Washington, Government Printing Office, December 1978.

Unpublished Materials

- Arens, Alvin A., "The Adequacy of Audit Evidence Accumulation in Public Accounting," unpublished doctoral dissertation, Graduate School, The University of Minnesota, Minneapolis, Minnesota, 1970.
- Booker, Jon A., "A Study of Risk Evaluation in the Audit Function of Public Accounting Firms," unpublished doctoral dissertation, College of Business Administration, North Texas State University, Denton, Texas, 1971.
- Brewer, Carl William, "The Nature of Audit Risk Indicators and Their Effect on the Intensity of Audit Work Performed," unpublished doctoral dissertation, College of Business Administration, The University of Houston, Houston, Texas, 1981.
- Kissinger, John N., "A Study of Factors Which Affect Audit Evidence Accumulation," unpublished doctoral dissertation, Department of Accounting and Financial Administration, Michigan State University, East Lansing, Michigan, 1974.