

# PREPARATION OF ENGINEERING APPRAISAL REPORTS

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The purpose of this discussion is to set forth some broad, general guidelines concerning the preparation of petroleum engineering appraisal reports. First, let me state that I feel that no engineering society or group of engineering societies should dictate the style or format of an engineering report to either the engineer preparing the report or the client for whom the report is prepared. The engineering report may consist of anything from a verbal report on the telephone or a xerox copy of work notes to a formal report bound in red leather with gold engraving. The report should adequately cover the scope of engineering work and be in a form which is in accordance with the function of the engineering report. The form of this report should be based on an agreement between the client and the engineer concerning what the client requires for his purpose, the availability and cost of data and data preparation, the amount of information available and pertinent to the study, and the amount of money that the client is willing to pay for engineering work. If, in the preliminary discussions concerning the scope of work and the nature of the engineering assignment and subsequent report, the engineer feels that he cannot do an adequate appraisal with the information available or for the amount of money the client is willing to pay for the work, or for any other reason he feels that his professional conduct would be compromised in this assignment, he should turn the work down and make such recommendations as he feels advisable to the prospective client. It is obvious in the case of a number of extremely small interests of low value that extreme detail work is not justified either from an engineering standpoint or an economic standpoint.

The writer was privileged to serve on a committee under the Chairmanship of the late D. V. Carter under the auspices of the Society of Petroleum Engineers from late 1965 through early 1967. The assignment of the committee was "(1) To develop an evaluation format suitable for the bulk of evaluations, whether or not third parties are involved, for the purpose of: financing the purchase of oil and gas properties which are wholly or partially proved; financing installation of some method of improved recovery; borrowing money; or any other purpose such as Estate evaluations, trading of properties or merger purposes, as well as field-wide unit or reservoir unitization or relatively simple drilling unit evaluations with the objective of achieving acceptable equities to all interested parties concerned. (2) To write a code of ethics or a list of admonishments to guide the evaluation." The report of this committee was published in the Society of Petroleum Engineers' Journal of Petroleum Technology in February, 1967 on Page 193. Generally, the conclusions of this committee were (1) The committee could not standardize an accepted format for all engineering reports, (2) any statement or action by the committee could not have

any material effect on the ethics of individual engineers. The writer was and is still in agreement with the conclusions drawn by Mr. Carter's committee.

During World War II, the Armed Services had a policy concerning reports. This policy stated, "A report should not be written so that it may be understood; it should be written so that it is absolutely impossible for it to be misunderstood." While everyone here would certainly agree that this is an excellent policy, I am sure everyone here would also agree that it is extremely difficult to carry out. However, this is a goal that we should all strive for in the preparation of engineering reports and the writer has a few suggestions for your consideration. It has been my experience that most misunderstandings are brought about by lack of proper definition of terms. Such simple things as working interest and net interest, future gross revenue, and present worth of future net revenue can be, and frequently are, misunderstood. For this reason it is frequently desirable to define these terms in the body of the report or to use such terms that cannot be misunderstood. For instance, the term "working interest" to some companies and individuals means the share of expenses paid by the company and to others it means the share of income received. For this reason, the writer has ceased using the term "working interest" and "net interest" and has started to use "expense interest" and "income interest." These terms are more easily understood. "Future gross revenue" to some companies means revenue before production or severance taxes and in some cases, revenue before taxes and royalty, while to most companies "future gross revenue" means revenue derived from the sale of their interest in production after royalty and production or severance taxes. The term "present worth of future net revenue" means a great variety of things to various individuals. In any event, the meaning as the appraisal engineer understands it should be clearly defined in the engineering report. The discount rate together with the method of discounting should be stated. The writer has found some present worth projections discounted as if income were received in one lump sum at the end of the year, at the mid-point of the year, compounded monthly, quarterly, semi-annually, or annually and frequently the client confuses the term "present worth of future net revenue" with "fair market value." For these reasons, it is highly desirable that a good understanding and a meeting of the minds should exist between the client and the engineer on definition of these terms.

Much committee work has been done on definition of categories of oil and gas reserves. The American Petroleum Institute and the Society of Petroleum Engineers have achieved some degree of agreement through work by a committee under the Chairmanship of John J. Arps on the definition of proved reserves for property evaluation. The report of this committee was

published in the July, 1965 issue of the Journal of Petroleum Technology. This definition includes proved developed reserves, proved developed nonproducing reserves and proved undeveloped reserves. We have all seen reports which have included, in addition to proved reserves, various categories such as probable reserves and possible reserves. The writer has seen engineering reports which included possible reserves which might be more reasonably carried under the category of "possible but highly unlikely" reserves. If categories other than proved reserves are used, the engineer should go to the trouble to adequately define what he considers to be probable and possible reserves and should be prepared to substantiate his reasons for their inclusion. It has been the writer's experience that reserves in the probable and possible category are not valued so highly by lenders or prospective purchasers as they are by owners and usually should be omitted from most engineering appraisals. However, there are occasions where probable and possible reserves should be a part of the engineering report and here again, the treatment of these reserves should be left to the discretion of the appraising engineer.

The scope of work should be defined in general terms and in some cases, very specific terms. The source or sources of information used in the preparation of the report should be stated together with all qualifications deemed necessary by the engineer involved. For instance, the Carter Committee Report includes a statement "The valuation engineer does not fulfill his obligation and does not relieve himself of the responsibility for erroneous conclusions by the acceptance of data and the statement that all such data were accepted as provided by the client. He should attempt to obtain all available pertinent data, whether furnished to him by the client or not, by a diligent search of all sources of existing data known to him." Here again, all of us would be in agreement that this is an excellent policy but one that is usually very difficult to follow. An engineer who must appraise several dozen leases in 20 or more fields with a very tight deadline, on non-operated leases, maintaining strict secrecy, cannot be expected to go into the amount of detail that might be justified in another situation. In this case, the engineer and the client should achieve absolute understanding on the scope of work, and if such is impossible or unacceptable to the engineer, he should refuse the assignment. During the course of the Carter Committee deliberations, a case in point was raised where an engineer made an erroneous evaluation due to a typographical error on the elevation of a well or wells. The typographical error was made by parties other than the engineer involved and the engineer in this case could hardly be expected to go to the field with a level and check all elevations involved. The engineer should be experienced and knowledgeable to the extent that he will probably catch obvious errors of this nature. A few months ago, the writer was confronted with a structure map that did not make sense—it was possible, but highly unlikely. The wells were spotted according to the locations given on the logs and com-

pletion cards on the lease plat supplied to the Railroad Commission, but two wells created rather severe problems on the structure map. In this case, a simple telephone call to the pumper determined that these wells were west of a key well rather than to the east as shown on the logs. This simplified the structure and isopach maps and cost about 10 minutes of engineering time. Especially in the area of well tests, the engineer is frequently confronted with well test data that his experience tells him is erroneous. We have all seen absolute open flow tests which indicated deliverability far in excess of the true sustained capacity of the well or wells. The writer once heard a knowledgeable engineer state that under a given set of conditions he could probably get an absolute open flow of one million feet a day from a butane lighter; this may be stretching a point but we have all seen situations which attest, to some extent, to its basic truthfulness. The engineer should use his best judgment in the use of all information available and relevant to the study, but he should not be expected to do any title work to check interests or carry the use or validation of information available to unwarranted and ridiculous extremes.

The advent of the high-speed computer has made possible a number of refinements in engineering calculations which have been uneconomic to perform by hand with a desk calculator. We can now discount by compounding monthly and do a great number of things which add to the basic accuracy of those things which we can control by mathematical processes. We can now handle a great array of data and simulate various conditions which affect the economics and market value of a property or a group of properties. These new tools should be used but not misused in the preparation of engineering appraisal reports. For instance, a model study might be justified in appraising extremely valuable properties in some cases, but it would not materially affect the fair market value of royalty under a one-well lease in the East Texas Field in the Castleberry survey of Gregg County. A great number of highly exotic engineering tools are available for our use but these tools should be used judiciously so that the form of the engineering study follows its function. If the individual engineer is not possessed of enough judgment to decide when and where these techniques are applicable, he should find another line of work.

Some engineering reports consist of a one-page letter and a one-page projection of reserves and revenue while others include maps, curves, cross-sections, and all manner of basic data. Here again, the form of the report should follow its function and be in keeping with the scope of investigation as determined by the engineer, the client and the ultimate user. Some statement may be made in the report giving an indication of the nature and quantity of the data available in the engineer's files available for examination by interested parties with permission of the client. In all cases the engineer's judgment on what should and should not be included in the report is the determining factor.

The writer has found the following outline to be helpful in the preparation of appraisal reports. He is

not, however, recommending its adoption, but only stating an outline that seems to be suitable for the purpose in a great many cases.

#### FOREWORD

Scope of Investigation

Authority

Source of Information

#### ESTIMATION OF RESERVES

#### PROJECTION OF FUTURE PRODUCTION AND REVENUE

#### SUMMARY AND CONCLUSIONS

#### TABLES AND/OR FIGURES (IF ANY)

In the case of letter reports a similar format can be used with each general heading being a new paragraph or group of paragraphs.

Finally, I would like to say that this paper, of necessity, has been of a very general nature. Engineering reports, in the final analysis, are like truth, beauty and contact lenses—in the eye of the beholder. The engineer should make every effort to define his terms so that the chance for possible misunderstanding should be minimized. He should, to the extent of his ability, be absolutely fair, honest and unbiased. He should make every effort to gather and examine all factual data which are available and relevant to the study within the scope of investigation agreed upon by the engineer and the client. The client has every right to expect competence and honesty from an appraisal engineer; by the same token, the engineer has every right to expect honesty and full disclosure from the client. We are all familiar with situations where these conditions have not been met. The client, or any other interested

person using an engineering report, should understand that the appraisal represents the conclusion of the appraiser and the estimates contained therein are estimates based on his best judgment. The method, or combination of methods utilized in the study, should be tempered by experience in the area, state of development, quality and completeness of basic data, and production history. After all, an appraisal engineer can *estimate* fair market value but fair market value is *determined* in the market place. By definition, fair market value is the value determined by a willing buyer and a willing seller, both being equally knowledgeable of the facts involved and neither being under any compulsion to buy or sell. These conditions are rarely met. Appraisal of oil and gas properties is frequently an art rather than a science but is an extremely satisfying and fascinating profession. We deal with quantities that cannot be measured as the civil engineer measures the length of a highway and the span of a bridge. We only see little pieces of the reservoir as cores and can only examine small quantities of the reservoir rock and fluids in the laboratory. At Texas A & M in 1950, Harold Vance told us that this business was similar to the problems of a carpenter who had to drive nails with a hammer having a handle a mile long. Sometimes the handle on the hammer is too flexible and we make mistakes. As long as these mistakes are honest mistakes, we will enhance the professional status of Petroleum Evaluation Engineers. This society, in a few years, has had an impact on the petroleum industry. Let us continue to work for those things which improve the society, the industry and ourselves.