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Historic Agreement Establishes Training Program for Petroleum Reserves Evaluators

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Abstract

This paper describes the process through which the E&P industry has recognized and acted upon meeting the need for consistent and global training of petroleum engineers and geoscientists responsible for estimating oil and gas reserves. The SPE, AAPG, SPEE and WPC have created "The Joint Committee On Petroleum Reserves Evaluator Training" (JCORET), which is developing a library of training modules that represent industry "best practices". Many, perhaps most, petroleum reserves evaluators worldwide have never participated in training opportunities that truly represent industry-recommended practices.

The sole purpose of JCORET is to develop high quality training modules to be presented and taught to professional reserves evaluators by industry experts at an affordable cost. The program will remain "evergreen" to accommodate new technology and unconventional reservoirs.

Introduction

The JCORET training modules are designed to be presented by recognized experts and taught to competent and experienced reservoir engineers and geoscientists who understand and appreciate the importance of adequate reservoir and fluid data. There are no rigid qualifications for individuals who may wish to participate in training, but all class members are expected to have a working knowledge of the fundamentals of fluid flow, formation evaluation, reservoir description and reserves definitions and possess a sincere interest in furthering their reserves estimation and evaluation skills.

A "reserves evaluator" was described by Harrell[1] as : "… usually a reservoir engineer by training who is responsible for estimating hydrocarbon reserves appropriate to some imposed, recognized definitions and who usually forecasts future production volumes, sales quantities, cost revenues and net income – potentially before and after any income taxes. Some evaluators may be additionally charged with estimating asset market values for various purposes not limited to taxation and litigation."

The same reference further describes a geoscience-trained evaluator as an individual usually proficient in the construction of various reservoir maps to enable estimates of hydrocarbons in place together with other information that may be beneficial in the prediction of a potential reservoir drive mechanism. This person (or persons) often will (but may not) work in close cooperation with one or more reservoir engineers in producing a reservoir evaluation

Composition of JCORET

Each sponsoring organization has designated two representatives. One additional "at large" individual serves as committee chair for a total of nine people. The committee meets together when possible but remains in frequent contact through teleconferences and the internet. The initial committee includes individuals employed by two large integrated oil companies, one large independent producer, three consulting firms and two retirees.

Terms of membership have not yet been established but rotating 3-year terms are being considered.

History of Industry Training

Industry growth and employment needs in the mid-1970s surpassed the availability of new petroleum engineering graduates. Industry compensated by hiring individuals from other science and engineering disciplines and provided them high quality training in all phases of petroleum engineering including drilling, production and reservoir. Some companies established Training Centers in Oklahoma, Texas and Colorado and in other locations outside the United States. With the downturn in oil prices in the early and mid 1980s, many, and perhaps most, companies instituted cost-saving measures that resulted in the closing of these training centers along with a further reduction in their internal training staff.

Somewhat concurrently with this, many companies established diverse profit centers run by "Asset Team" managers. These teams functioned as small oil companies competing for budgets (and recognition) with other company asset teams. These pared-down staffs found little time to devote to training. Some of these companies turned to the universities that had maintained their Petroleum Engineering

Departments and asked that they provide graduates who could join an asset team upon graduation and begin to contribute immediately. Some universities were open to altering their curriculums somewhat to allow for engineering and geoscience teams to work together on certain projects, usually at the senior level. This was and is not a satisfactory solution as universities are seriously challenged in maintaining sufficient course work to teach fundamentals of science and mathematics along with rapidly expanding petroleum technology.

New university graduates today in Petroleum Engineering and Geology are well trained in science fundamentals, some basic engineering and geological software and desk-top computing. They have been exposed to the fundamentals of reserves estimation and the equations used to compute in-place and recoverable hydrocarbons. They completely lack, however, an understanding of reserves estimation and evaluation techniques and the importance of petroleum resources and reserves definitions. The only solution to this is through experience and training through mentoring but this slow and irregular process can be accelerated through access to industry-approved training materials related to reserves evaluation. Indeed, the mentoring process is often not available in some of the smaller companies and organizations due to several reasons but primarily personnel shortages. The continuing retirement of experienced reserves evaluators also continues across the industry thus often leaving their younger counterparts to "sink or swim".

Presently, many large and mid-sized independent companies, along with many national oil companies, offer some level of internal training in reserves estimating and evaluation. Upon the successful completion of a designated course of study, some companies will designate the individual to be a Qualified Reserves Evaluator (QRE) or a similar title. The content of these internal training regimens is often excellent but a high level of inconsistency and a lack of thoroughness is evident. The JCORET will be pleased to adopt selected materials from these internal training programs, if made available, particularly sample problems and examples of common evaluation "pitfalls and mistakes".

Additionally there are several recognized companies, including consulting firms, that offer training to individuals or companies in several areas of specialization. Even though most of these training courses are prepared and presented by competent individuals, there remains a serious concern about consistency and thoroughness.

Unfortunately, there remain some companies that simply assume that an experienced reservoir engineer or geologist is somehow adequately trained and is fully capable of understanding the nuances of reserve estimation methodologies and the complexities involved in reserves categorization and resource classification.

Who Are Primary Candidates for Such Training

Any petroleum reservoir geologist or engineer who is responsible for preparing reserves estimates should recognize their professional responsibility to become as qualified and proficient as possible through either (1) employer-provided training or (2) other quality training opportunities that become available. Many evaluators worldwide simply do not have such an opportunity provided directly by their employer and must seek other solutions to this deficiency.

On the other hand, many employers will be pleased to provide an opportunity for their reservoir engineers and geologists to avail themselves of the training modules being made available through JCORET. One of JCORET's clear mandates is to ensure that interested companies and individuals become aware of the content of the training materials to be offered and the benefits to be gained through this program.

Continuing Education

Engineers and geologists who have been licensed by one or more state licensing boards in the US or through appropriate agencies in other countries are typically required to maintain their status through the annual completion of a specified number of approved continuing education hours or courses This requirement affects primarily those professional evaluators working as independent consultants, however, as few evaluators employed by a producing company are presently licensed. The courses to be made available through JCORET are expected to become recognized by all licensing authorities providing meaningful training to those licensed engineers and others who are engaged as petroleum reserves evaluators.

"Certification" of Petroleum Reserves Evaluators

The concept of providing an opportunity to advance the professionalism of petroleum reserves evaluators, both engineers and geoscientists, by becoming "certified" through a course of training followed by the successful completion of an examination, was widely discussed in 2004 and 2005. The most prevalent view was that an individual would need to meet some minimum defined entry qualifications that would incorporate an appropriate degree from a recognized university, several years of experience in reserves estimation and possibly letters of recommendation from recognized and respected reserves professionals. He or she would then embark on a course of study embracing (1) a comparison and study of various reserves definitions (2) recommended evaluation practices (engineering or geoscience), (3) ethics training, and (4) continuing education with periodic recertification.

The primary focus of the certification initiative was to provide a voluntary option to evaluators who wanted an opportunity to be considered "professionals" along with board certified attorneys, physicians, accountants and other recognized career achievements. Indeed, even in the oil and gas industry, landmen and geologists can become certified through their respective professional organizations.

Despite the high level of enthusiasm generated by the discussion surrounding certification, there was inadequate support from some of the more influential members of the industry and the initiative was reconfigured to focus only on

developing the training materials now under the auspices of JCORET. The discussion around the need for additional training for reserves evaluators far predated the certification proposal, but the generally fragmented training discussions never gained enough traction to advance the initiative to where we now are.

Training topics

Much of the training material to be included in the various training modules is already available through numerous excellent SPE and AAPG technical papers and SPEE publications. There are many other privately developed training courses, including some developed "in house" by E&P companies, consulting firms and academia, which can be adapted to the JCORET purposes.

The 2007 SPE "Auditing Standards" (The Standards Pertaining to The Estimating and Auditing of Oil and Gas Reserves Information[2]) contains a listing of a number of proficiencies expected of Reserves Estimators and Reserves Auditors. These are as follow:

1. The creation and understanding of reservoir maps and models
2. The judicious selection of and reliance upon appropriate reservoir analogs
3. The appropriate application of and reliance upon seismic interpretations in preparing reserves estimates
4. The fundamentals and limitations of reservoir simulation
5. A basic knowledge and understanding (and appropriate applications) of probabilistic and deterministic methodologies
6. The use of numerous performance evaluation techniques to confirm or refine geological interpretations
7. An understanding of the consequences of reliance upon computer software without an adequate understanding of the internal calculation processes
8. Various fiscal systems including Production Sharing Agreements and other contractual licensing and/or royalty agreements
9. Ongoing and in-depth studies of relevant reserves and resources definitions and/or management systems.

A partial listing of individual training courses for engineers that are being developed, compiled and/or adapted includes the following:

Engineering Topics

I. Reserves Definitions – An extensive examination of categorization of reserves
    a. Historical information
        i. Lahee's 1944 American Petroleum Institute ("API") classification scheme
        ii. McKelvey Box, proposed in 1972
    b. Modern classifications
        i. U.S. Securities and Exchange Commission
        ii. SPE/WPC/AAPG/SPEE
        iii. United Nations Framework Classification (UNFC)
        iv. UK Statement of Recommended Practices (SORP)
        v. Canadian Security Administrators (CSA)
        vi. Russian Ministry of Natural Resources (RF)
        vii. China Petroleum Reserves Office (PRO)
        viii. Norwegian Petroleum Directorate (NPD)
        ix. Others as required

II. Analogy Estimates
    a. Similarity Requirements and Documentation
    b. Methods
        i. Analytical
        ii. Statistical

III. Volumetric Methods
    a. Volumetric mapping
    b. Reservoir limits
    c. Recovery efficiency estimates
    d. Reservoir heterogeneity
    e. Allocation of reserves to wells and leases
    f. Computer mapping
    g. Geostatistical methods
    h. Common geoscience errors

IV. Material Balance Methods
    a. Classical material balance equation
    b. Havlena-Odeh method
    c. Prediction methods
        i. Tank models
        ii. Reservoir simulation
    d. Uncertainties
    e. Gas reservoir material balance
    f. Reconciliation between material balance and volumetric estimates

V. Performance/Decline Trend Analysis
    a. Classical empirical decline curve methods (Arps methodology)
    b. Type curve analysis
    c. Other performance trends
    d. Economic limit
    e. Distinction between reservoir performance and wellbore/mechanical problems
    f. Analysis of leases or pools versus individual wells
    g. Curtailment
    h. Reconciliation between performance and volumetric estimates
    i. Reliance upon various evaluation software "packages"

VI. Special Problems in Reserve Estimation and Classification

VII. Field Examples

VIII. Reserves Analysis, Field Development, and Performance Monitoring

IX. Probabilistic Estimation and Classification of Reserves
    a. Basic statistics
    b. Types of uncertainties
    c. Sampling and analysis of data
    d. Frequency distributions in nature
    e. Decision trees
    f. Parametric method
    g. Monte Carlo simulation
    h. Comparison of probabilistic and deterministic reserves
    i. Expected, risk-weighted, conditional, and risk-adjusted reserves
    j. Probabilistic performance estimates
    k. Aggregation of probabilistic reserves
X. Improved recovery methods
    a. Waterflooding
    b. Enhanced recovery methods
        i. Miscible
        ii. Thermal
        iii. Chemical

The tabulation above represents only a topical outline which is expected to be followed for both selecting currently available training courses and designing courses for which no qualifying course material has been developed. Most courses will be designed to maximize student understanding and comprehension through class participation in problem-solving or discussion. It is presently anticipated that various courses from the broad outline above will be selected and placed within several study "modules" focused upon a related topic. Upon the successful completion of the various courses within a module, it is intended that a "Certificate of Course Completion" will be awarded as evidence of the instructor's affirmation that the student has participated fully with the classroom discussions and related exercises and has demonstrated competency in the subjects covered.

Instructor Selection and Qualifications

In virtually all cases, it is expected that the JCORET will seek course materials already prepared and recognized as clearly being acceptable for program purposes. In other instances, the JCORET may solicit qualified and recognized individuals to prepare certain courses appropriate to the program needs. In either circumstance, the JCORET anticipates that the training courses will be ideally taught by the course originator. Where that is not feasible, the originating author shall retain the opportunity to select and train an alternate to present the course or approve/disapprove an alternate (or alternates) proposed by the JCORET.

Classroom vs Internet-based Training

The JCORET members have had many discussions about the clear benefits of providing training programs through the internet – particularly to those individuals in remote locations who may not be able to participate in a classroom setting. For the foreseeable future, however, the JCORET is in general agreement to limit participation to a classroom setting where the benefits of participation can be maximized.

Conclusions

This initiative is still very much in a formative stage but the enthusiasm within the JCORET and the dedication and support of the sponsors ensure that the need for this program has been firmly established and that an outstanding opportunity for additional training will become available to individuals who are committed to furthering their professional abilities. The beneficiaries of this effort will not only include the successful students, but also their employers, their internal corporate management, investors, regulators (where applicable) and the general public at large.

References

1. Harrell, D. Ronald, "*Certifying Reserves Certifiers: The Time Has Come*", SPE Paper No. 94517, SPE Hydrocarbon Economics and Evaluation Symposium, 3-5 April 2005.
2. "Standards Pertaining To The Estimating And Auditing of Oil And Gas Reserves Information", SPE 2007 (Draft awaiting board approval)