

# Practical Reserve Evaluation Using Reservoir Engineering Tools

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*This practical workshop is designed for reservoir engineers, reserve evaluators, commercial analysts, and geoscientists, who are actively engaged in practicing conventional reservoir engineering toward reserve evaluation, classification and financial book reporting. Half of the workshop time will be spent to the class exercises, and the other half the instructor will use the case studies to explain reservoir engineering principles and hands-on skills.*

## COURSE CONTENT

### 1. Fundamentals of Reserve Filing, Classification and Evaluation

1. Oil and gas reserve/resource definitions
2. Corporate financial statement and reserve filing
3. US **SEC** oil and gas reserve reporting standard
4. Reserve evaluation and classification practice (**SPE/WPC/AAPG**, Canada **CSA/CIM/NI-51**, UK **SORP**, etc)
5. Sample annual reports of corporate reserve statement
6. Technical and commercial assessment criteria
7. Probabilistic vs. deterministic approaches
8. Reservoir engineering aspects of reserve evaluations

### 2. Analog and Volumetric Methods

Estimates of undiscovered resources are based on analogy with similar fields, reservoirs, or wells in the same area. With the geoscience data provided such as seismic, geological and petrophysical models, reservoir engineers assist the analog and volumetric assessment process by studying fluid samples, core analysis, hydrostatic and hydrodynamic pressure data, fluid contact levels. Analog and volumetric methods provide an initial static mapping of potential reserve size, which will not be booked until sanctioned by engineering and commercial criteria.

### 3. Reservoir Engineering Aspects of Reserve Evaluation

Through a number of field examples, key factors are discussed: reservoir size; column heights (delineated from WFT pressure and fluid samples, and capillary pressure curves); drainage size; fluid properties; and recovery factor. Reservoir engineering sanctions extend reserve progression as a dynamic process

### 4. Volumetrics and Fluid Property

This case study examines how pressure hydrodynamics, gradient and fluid sample data are used in defining pay column height, fluid contact, reservoir compartmentalization, and field extension, how WFT data are collected and used in geological and geophysical mapping for initial reserve benchmarking with volumetric analysis (such as correlating initial rates with recoverable reserves).

### 5. Material Balance, Decline Curve, and Hydrodynamics

A gas field case study is used to explain a number of reserve evaluation approaches, including initial volumetrics, early time production, decline curve analysis, and material balance approach (p/z), to demonstrate how to reconcile time-lapsed risk-minimized reserve booking and progression. Additional notes elaborate how to sanction pressure data quality from various sources (e.g. WFT, static pressure gradient, DST, and AOF). Also discussed is the uncertainty of material balance method for predicting ultimate remaining reserves.

## 6. Decline Curve and Rate Transient Analysis

Two field cases are included to show how empirical Arps decline curve analysis is properly performed, and how a variety of rate-transient analysis techniques can be exercised, such as those of Fetkovitch, Gardner, Material Balance, and Blassingame. A multiple well field case illustrates how reliable a production decline trend after aggregation.

## 7. Use of Well Test and Pressure Transient Analysis in Reserve Evaluation

This section uses a number of case studies to illustrate the role of well test in reserve evaluation. Practice is explained on what test should be run, what information can be extracted from a PTA analysis. Focus is on flow assurance and deliverability, drainage size, radius of investigation, average pressure estimate, and formation performance forecast.

## 8. Reserve Progression

This session uses examples to explain how reserves or resources are progressed, from non-proved to proved, from PUD to PDP, from 3P to 2P to 1P.

### WHO SHOULD ATTEND:

Reservoir engineers, exploitation engineers, reserve evaluators, commercial analysts, & geoscientists.

### WHAT YOU WILL LEARN:

- Fundamentals of reserve definitions, classifications, and commercial filings
- Sample reserve reporting regulations (e.g. SEC and SPE/COGEH)
- Differences between geoscience's evaluation and engineering/commercial booking
- Key reservoir engineering parameters of reserve evaluation/progression process
- Practical skills of using basic reservoir engineering tool kits to perform reserve evaluations (analog, volumetrics and performance-based techniques)
- Reserve category labeling based on reservoir engineering assessment results
- Reserve assessment uncertainty quantifications

### ABOUT THE INSTRUCTOR

**Dr. ANDREW CHEN** has worked with British Petroleum, AJM Petroleum Consultants, Schlumberger and other companies as reservoir engineers and reserve evaluators, responsible for operation reservoir engineering, oil and gas reserve and resource estimates, economical forecast and budgeting, acquisition and divestment, equity financing, and mid-stream supply studies.

Dr. Chen also specializes in formation testing with wireline testers in most aspects of WFT application and interpretation, from pressure gradient error analysis and fluid contact uncertainty quantification, fluid identification/sampling, to permeability tests, WFT as DST alternatives, and operation program designs. He is an instructor of "Wireline Formation Testing and Interpretation" for PetroSkills/OGCI ([www.petroskills.com](http://www.petroskills.com)), the world's largest professional training alliance in the petroleum industry.

Between 1986-1991 he was a university lecturer teaching reservoir engineering before he worked with Schlumberger Canada for 6 years, providing a variety of technical and interpretation reservoir engineering support. Andy earned his PhD degree in mechanical engineering at University of Manitoba, Canada, and over the years has several publications in the SPE proceedings, The Log Analyst, AIChE Journal, and Journal of Petroleum Science and Engineering. He has worked on consulting projects from North America land, the Atlantic Canada offshore, the Gulf of Mexico, Africa, Southeast Asia, Australia, the Central Asia, and the North Sea.