



Advanced Reserve Estimation & PRMS Compliance: The Auditor's Perspective

Course Description

Oil and gas reserves are the financial and operational backbone of any energy company. Navigating the journey from asset discovery to abandonment requires precise, defensible evaluation workflows. This comprehensive, two-week training course delivers the essential concepts, methodologies, and advanced workflows required to master the entire reserve estimation and asset categorization lifecycle.

Participants will gain a holistic, project-based perspective on resource management by bridging the gap between subsurface technical analysis and the strict commercial requirements of the Petroleum Resources Management System (PRMS). The curriculum progresses systematically from foundational deterministic and probabilistic estimation methods—such as volumetrics, material balance, and numerical simulation—to complex, enhanced recovery scenarios (IOR/EOR).

A key differentiator of this program is its focus on the auditor's perspective. By exploring forensic evaluation techniques, static and dynamic model stress-testing, and compliance risk, participants will learn not just how to calculate volumes, but how to confidently defend their asset evaluations to external third-party certifiers and joint-venture partners.

Who Should Attend?

This advanced program is specifically designed for oil and gas professionals involved in asset evaluation, resource management, and strategic development planning. It is highly beneficial for: Reservoir Engineers & Petroleum Engineers, Geoscientists (Geologists & Geophysicists), Reserves Auditors & Compliance Managers, and Asset Managers & Joint Venture (JV) Representatives.

Key Learning Outcomes

By the conclusion of this intensive two-week training program, participants will be able to:



- Master the PRMS Framework: Confidently classify and categorize petroleum resources according to the latest international PRMS guidelines, accurately distinguishing between reserves, contingent resources, and prospective resources.
- Integrate Five Core Estimation Methods: Select, execute, and cross-validate the optimal estimation method—Analogy, Volumetric, Production Performance (DCA), Material Balance, and Numerical Simulation—based on reservoir maturity and data availability.
- Audit Static & Dynamic Models Forensically: Evaluate reservoir models from an external auditor's perspective, identifying volumetric inflation, unphysical tuning parameters, and hidden biases in history matching.
- Quantify Subsurface Uncertainty: Apply both deterministic and probabilistic (Monte Carlo) aggregation workflows accurately, avoiding common portfolio traps like the arithmetic summation of P90/IP volumes.
- Assess Commerciality & Entitlement: Execute the Economic Limit Test (ELT) and calculate net entitlement reserves under complex fiscal regimes, including Production Sharing Contracts (PSCs).
- De-Risk IOR/EOR Bookings: Evaluate the technical maturity and commercial readiness of secondary (waterflood) and tertiary (EOR/CO2) recovery projects to safely book compliant reserves.

Instructional Methodology

Our Blended Learning Approach:

- **Lectures (35%):** Core principles and industry frameworks.
- **Workshops (25%):** Collaborative real-world project simulations.
- **Case Studies (20%):** Solving Reserve estimation challenges – case studies.
- **Interactive Learning (20%):** Software demos and moderated group discussions.

Course Content

Day 1: The PRMS Framework, Guidelines, and Definitions

- **Classification Architecture**
 - The PRMS framework: Project-based resource classification.
 - Navigating the matrix: Discovered vs. Undiscovered, Commercial vs. Sub-Commercial vs. Non-Commercial.
 - Categorization of uncertainty: 1P/2P/3P (Proved, Probable, Possible) vs. 1C/2C/3C (Contingent Resources).
- **The Mechanics of Commerciality**



- Defining the "Chance of Commerciality" and its sub-components (Chance of Development vs. Chance of Discovery).
- Technical vs. Commercial maturity milestones.
- Case Study: Mapping an onshore/offshore asset portfolio into PRMS classes

Day 2: Static Methods – Analogy & Volumetrics

The Analogy Method (Exploration & Early Appraisal)

- Selecting valid analogous reservoirs: depositional environment, structural style, fluid properties, and drive mechanisms.
- Risks and pitfalls of over-reliance on analogies in green fields.

Volumetric Calculations & Static Uncertainty

- Bulk Volume, Net-to-Gross (NTG), Porosity (ϕ), and Water Saturation (S_w).
- Fluid PVT properties and the Formation Volume Factor (B_o , B_g). Case studies: constant reservoir properties versus vertical composition with depth reserve estimations
- Deterministic vs. Probabilistic Volumetrics, Geostatistical methods
- Introduction to Monte Carlo simulation
- Class exercises

Day 3: Dynamic Performance Methods – Decline Curve Analysis (DCA)

Conventional Production Performance

- Arps decline equations: Exponential, Hyperbolic, and Harmonic behavior.
- Determining the b-factor boundaries and final economic limit rates.

Advanced Production Diagnostics

- Diagnostic plots (Log-Log flow paths, Water-Cut vs. Cumulative Production).
- Adapting DCA for unconventional or low-permeability reservoirs (Transient flow constraints).
- Exercise: Using DCA to determine Remaining Technical Reserves.



Day 4: Material Balance & Reservoir Drive Mechanisms

The Zero-Dimensional Reservoir

- The generalized Material Balance Equation (MBE) for oil and gas systems.
- Straight-line Material Balance techniques (Havlena-Odeh method).

Identifying Drive Mechanisms & Energy Contribution

- Quantifying water drive strength, gas cap expansion, and solution gas drive.
- Determining Initial PIIP/GIIP dynamically and comparing it against static volumetric estimates.
- Drive mechanism and recovery factor relationship

Day 5: Numerical Simulation & Workflow Integration

Simulation Roles in Reserve Estimation

- When is a numerical model required by PRMS guidelines?
- Overview of Fluid Flow in Porous Media
- Understanding the simulation workflow: Grid cell dimensions, upscaling geology, PVT data, saturation functions, and model initialization.
- History Matching and forecast: Distinguishing between a "good fit" and a predictive tool.

Method Selection & Week 1 Wrap-up

- Choosing the right method based on reservoir maturity (The Maturity Ladder).
- Round-table workshop: Reviewing data gaps and selecting a reserve estimation strategy for a sample asset.

Day 6: The Auditor's Mindset & PIIP Forensic Auditing

Standard Auditing Principles

- Auditing vs. Evaluation: The role of independent third-party certifiers.
- The concept of "Reasonable Certainty" for Proved (1P) reserves.





Auditing Petroleum-Initially-In-Place (PIIP)

- Forensic inspection of static models: Auditing structural horizons, fluid contacts (GOC, OWC), and Net Pay cut-offs.
- Identifying "Volumetric Inflation": Spotting aggressive interpolation and optimistic distribution skewing in geomodels.

Day 7: Auditing Primary Reserves & Uncertainty Limits

Auditing Deterministic Reserves

- Verifying conservative vs. best-estimate parameters in Arps decline analysis.
- Audit check: Ensuring non-analogous high b-factors (>1.0) are not applied without physical justification.

Auditing Probabilistic Aggregations

- Checking for the misuse of probability distributions (e.g., misapplying log-normal distributions to narrow datasets).
- The "Aggregation Trap": Understanding why arithmetic summation of P90 volumes yields incorrect portfolio estimates.

Day 8. Auditing Improved & Enhanced Oil Recovery (IOR/EOR)

Overview of Secondary, Improved Oil Recovery, and Enhanced Oil Recovery Concepts

Secondary Recovery & Waterflooding Audits

- IOR/EOR definitions overview
- Incremental recovery
- PRMS requirements for booking reserves under active fluid injection.
- Auditing pilot performance data: Determining when a response is technically "proven."
- Voidage Replacement Ratio (VRR) audits and sweep efficiency realities.

Tertiary EOR (Gas Injection, CO₂, Thermal, Chemical, others)



- Classification of EOR volumes: Reserves vs. Contingent Resources in un appraised EOR projects.
- EOR Screening Criteria in Analog Selection
- Assessing technical risk: Viscous fingering, early breakthrough, volumetric sweep efficiency, and chemical retention issues in the subsurface.

Day 9: Dynamic Model Auditing & Simulation Integrity

Stress-Testing the Reservoir Simulator

- Auditor inspection of the history-matched model: Is the match achieved through physical reality or artificial tuning parameters (e.g., unphysical multipliers, Kv/Kh, productivity index, saturation function inspection)?
- Evaluating forecast constraints: Ensuring facility limits (gas handling, water disposal, skin degradation) are accurately integrated.

Quantifying Predictive Risk

- Multi-scenario simulation workflows (Ensemble-based forecasting).
- Converting simulator output profiles into discrete PRMS 1P/2P/3P production profiles.

Day 10: Commerciality Auditing, Entitlement, & Course Defense

The Economic Limit Test (ELT) & Entitlement

- Auditing OPEX and CAPEX assumptions: Ensuring inflation and decommissioning costs are correctly handled.
- Production Sharing Contracts (PSCs): Calculating Net Entitlement Reserves vs. Gross Field Reserves.

Mock Audit Defense Panel

- Capstone Exercise: Participants act as operators defending a reserve upgrade proposal, while the instructor acts as the strict external Auditor reviewing the technical and commercial evidence.
- Course debrief, feedback, and graduation certificates.