Rose & Associates

5 Day Unconventional Resource Assessment and Valuation

This course is focused on effective business decision making in Unconventional Reservoirs. In a realm where we are constantly dealing with limited data, it is critical that we develop the necessary skill sets required to deal with these so called statistical plays. The course covers the assessment and valuation methods required for the characterization of resource plays from the selection of "sweet spots" to the forecasting of Proved reserves and PUDs using SPEE Monograph 3 & 4 methods. The premise for this course is that sound estimation of key engineering, geotechnical, and economic parameters is essential for maximizing profitability. Due to uncertainty and prevailing risks, unconventional resource characterization requires a staged, probabilistic approach conducive to more-informed decision making. We will cover a variety of topics:

- Dealing with limited data sets. It's not that the information is imperfect, it's that we are dealing with an imperfect representation of an unknown population. Rather than call it perfect or imperfect, the participant will learn how to quantify the uncertainty in terms of confidence levels relative to the number of well samples and the variance in the mean given the sample size. This knowledge is critical to making educated decisions on: pilot well counts, well spacing and testing of new technologies.
- Developing Probabilistic Production Type Well curves and how to aggregate them to the Project level. Sound knowledge of aggregation is required for the proper economic evaluation of resource plays.
- Decision tree concepts, incorporating value of information techniques.
- How do I know if my Production Type Well Curve is still representative? The use of Sequential Accumulation plots to validate that your predictions are still within statistical control. This can be applied to drill or completion costs, cycle time estimates, as well as your production forecasts.

Who Should Attend

This course is intended for, engineers, commercial team members, business analysts, geoscientists and managers charged with creating value. Unlike traditional deterministic methods which call for the ongoing study of key parameters to get ever closer to "The Answer." Probabilistic methods recognize that most parameters are fraught with uncertainty.

Course Outline

Day 1 – Fundamental Concepts

- **Introduction**
- **Probability, Distributions, and Correlation**
- **Estimating Under Uncertainty**

Day 2 – Fundamental Concepts – Geology

- **Tight Clastic and Carbonate Reservoirs Assessment**
- **Shale Assessment**

Day 3 – Reservoir Uncertainty Management and VOI Assessment

- **Decision Trees & The Value of Information**
- **Probabilistic Reserves & Aggregation Principles**

Day 4 – Reserve, Resource

- **Production Forecasting and Reserve Estimation**
- **General Assessment & Valuation**

Day 5 – Utopia Shale Exercise

<u>Course Content</u>

♦ Introduction to Probability and Statistics as the Language of Uncertainty.

- Distribution Types and when to use what
- Sampling and the number of samples required to validate a distribution
- Dependencies and their impact
- Unconventional Resource sampling exercise

♦ Estimating Under Uncertainty

- What is an 80% Confidence Interval?
- Deterministic P50 versus estimating P50's using probabilistic ranges
- How to develop P10 to P90 Ranges, reality checks!
- Exercises focused on developing better estimating skills with an emphasis on estimating in ranges, rather than single values

♦ Tight Gas Characteristics and Assessment

- Historical perspective and Paradigm shift of understanding
- The "Basin Centered" gas concept
- Requirements for a Tight Gas accumulation
- How to develop high grading maps (Common Risk Segment mapping)
- The basics of assessing the chance of Geological success

♦ Shale Characteristics and Assessment

- Mechanisms of Formation and Exploitation history
- The importance of thermal maturity. Vitrine reflectance oil and wet gas targeting
- The use of Common Risk Segment mapping to identify "sweet spots"
- Volumetric assessment uncertainties
- Fundamentals of gas desorption in shale

♦ Resource and Reserve Estimation

- Average Concept – Porosity. Saturations, and Net pay

- Well Spacing considerations
- PRMS PUD's booking philosophy
- Booking extended PUD's using SPEE's Monograph 3 methodology
- Aggregation Principles
- Probabilistic resource and reserve estimation

♦ Production Forecasting
- Uncertainty in forecasts, Arps vs other methods, B value discussion
- The use of the Duong and Modified Hyperbolic decline for Unconventional gas resources
- The use of Linear flow assumptions in Unconventional reservoir production forecasting
- Production Type Well Curves – basis for generation, their pros and cons

♦ Decision Trees and the Value of Information.
- Decision Tree basics and the Expected Value concept
- Conditional dependence modeling – eg Pilots

♦ Unconventional Resource Assessment
- Unconventional flow processes – how does oil and gas move through a shale?
- High grading the sweet spots using CRS (Common Risk Segment) mapping
- Developing performance tracking Type curves – How do I know if my Type curves are representative?
- How do I select the best Unconventional resource for my company?
- Work flow for assessing Unconventional resources

♦ Making Better Business Decisions based on limited data
- How many wells do I need before I can move to the next stage?
- Can we fast track this program or do we need to slow down?
- How do I determine the range of the mean outcomes from my limited sample size?
- One Shale gas exercise and one Shale oil exercise are worked by the class to develop this understanding in the attendees.

♦ Utopia Shale Exercise
- Apply the assessment concepts covered in the course
- Simulate the workflow you would undertake to assess a liquids-rich shale opportunity:
  - Integrate geoscience, engineering, and economics
  - Use appropriate analytical tools
  - Apply good judgment and sound reasoning with respect to: Sweet Spot Identification; Type Curve Selection; Pilot and Demonstration Well Allocation, Economics and Recommended Acquisition Strategy