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Subsurface Risk & Uncertainty Management and Modelling & Managing Uncertainty in the Subsurface

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Introduction

Subsurface risk and uncertainty management has become a fundamental discipline for supporting technical and investment decisions throughout exploration, reservoir characterization, field development, and production operations. The quality of decisions related to reservoir evaluation, well planning, reserve estimation, and development strategies depends on the ability to identify, quantify, and manage uncertainty using structured methodologies and reliable subsurface models. Rather than relying on a single deterministic interpretation, modern subsurface studies require multiple geological scenarios that represent different levels of uncertainty and probability, enabling organizations to make better-informed technical and commercial decisions.

Managing uncertainty in subsurface studies requires the integration of geological, geophysical, petrophysical, and engineering information with statistical analysis, probabilistic modelling, and risk assessment techniques. These approaches help evaluate data quality, identify knowledge gaps, assess alternative interpretations, and improve confidence in reservoir characterization. They also support reserve estimation, field development planning, and long-term resource management while reducing technical and operational risks.

This course is designed to provide participants with a comprehensive understanding of subsurface risk and uncertainty management principles. It covers uncertainty identification, risk assessment methodologies, probabilistic modelling, geological scenario generation, sensitivity analysis, reserve uncertainty evaluation, data integration, and decision support techniques. By combining theoretical knowledge with practical applications, participants will strengthen their ability to develop reliable subsurface models, improve technical decision-making, and enhance the overall quality of subsurface studies using internationally recognized best practices.

Course Objectives

By the end of this training course, participants will be able to:

- Understand the fundamental principles of subsurface risk and uncertainty management.
- Identify the major sources of uncertainty in geological, geophysical, and engineering data.
- Evaluate the impact of data quality on subsurface models.
- Apply structured risk assessment methodologies throughout subsurface studies.
- Utilize statistical techniques to quantify uncertainty.
- Develop multiple geological models representing different uncertainty scenarios.
- Assess the impact of uncertainty on reserve estimation and field development planning.
- Perform sensitivity analysis for critical subsurface variables.
- Apply scenario analysis to support technical decision-making.
- Integrate multidisciplinary datasets to improve model reliability.
- Develop effective risk mitigation strategies throughout the project lifecycle.
- Interpret probabilistic modelling results for decision support.
- Improve the quality and reliability of subsurface studies.
- Prepare professional technical reports that support informed decision-making.

Course Outlines

Day 1: Fundamentals of Subsurface Risk and Uncertainty Management

- Introduction to subsurface risk and uncertainty.

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- Types of geological and technical risks.
- Sources of uncertainty in subsurface data.
- Risk management lifecycle for subsurface projects.
- Relationship between data quality and model reliability.
- Principles of uncertainty assessment.
- The role of risk management in technical decision-making.

Day 2: Data Management, Geological Modelling, and Uncertainty Assessment

- Evaluating geological data quality.
- Assessing geophysical data reliability.
- Integrating multidisciplinary datasets.
- Managing incomplete and uncertain data.
- Building multiple geological realization models.
- Assessing the impact of data quality on modeling.
- Documenting modeling assumptions and uncertainties.

Day 3: Probabilistic Modelling and Scenario Analysis

- Principles of probabilistic subsurface modeling.
- Developing alternative geological scenarios.
- Performing sensitivity analysis.
- Evaluating critical uncertainty drivers.
- Estimating probabilities for alternative outcomes.
- Comparing technical scenarios.
- Using modeling results to support decision-making.

Day 4: Risk Management for Field Development

- Risk assessment during field development.
- Managing uncertainty in reserve estimation.
- Evaluating drilling location uncertainty.
- Assessing development planning risks.
- Improving technical decisions using multiple realizations.
- Monitoring risks throughout project execution.
- Updating models using newly acquired data.

Day 5: Integrated Subsurface Risk Management and Decision Support

- Integrating geological models with risk management.
- Developing risk matrices.
- Preparing risk response strategies.
- Producing technical reports for decision-makers.
- Best practices in subsurface risk and uncertainty management.
- Integrated practical case studies.
- Developing an organizational improvement plan for subsurface uncertainty management.

Why Attend This Course? Wins & Losses!

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- Develop a comprehensive understanding of subsurface risk and uncertainty management.
- Improve the ability to evaluate data quality and its impact on geological models.
- Strengthen skills in developing multiple geological scenarios.
- Enhance expertise in sensitivity analysis and probabilistic modeling.
- Improve reserve estimation under varying uncertainty conditions.
- Support better technical decisions through structured risk assessment.
- Develop professional reporting skills for technical decision support.
- Improve the effectiveness of subsurface project planning and execution.

Conclusion

Subsurface risk and uncertainty management plays a critical role in improving the reliability of geological studies, strengthening reservoir characterization, and supporting informed technical decisions throughout exploration and field development projects. As subsurface datasets become increasingly complex and multidisciplinary, organizations require structured approaches that effectively identify, quantify, and manage uncertainty to reduce technical risks and improve project outcomes.

This course provides a comprehensive framework covering the key principles and practices of subsurface risk and uncertainty management. Participants learn how to identify uncertainty sources, evaluate geological and engineering risks, build multiple geological scenarios, perform probabilistic and sensitivity analyses, integrate multidisciplinary datasets, and apply risk-based decision-making techniques. The course also emphasizes practical approaches for improving model quality, reserve estimation, and technical reporting.

By applying the concepts and methodologies presented throughout the program, participants will be able to strengthen subsurface modelling practices, improve confidence in technical interpretations, enhance field development planning, support more effective resource management, and contribute to better organizational decision-making while reducing uncertainty across the entire subsurface evaluation process.

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