COURSE OVERVIEW DE0499
Pulsed Neutron Cased Hole Formation Evaluation
(Basic to Intermediate)

Course Title
Pulsed Neutron Cased Hole Formation Evaluation (Basic to Intermediate)

Course Date/Venue
Session 1: July 20-24, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE
Session 2: October 20-24, 2025, 2025/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
DE0499

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.

This course is designed to provide participants with a detailed and up-to-date overview of Pulsed Neutron Cased Hole Formation Evaluation (Basic to Intermediate). It covers the importance of formation evaluation and the differences between open hole and cased hole logging; the principles of neutron physics, pulsed neutron logging tools and measurement principles in pulsed neutron logging; the impact of casing and cement on neutron measurements and wellbore fluids and their influence; and the Sigma logging and difference between gas and water zones using Sigma.

Further, the course will also cover the well candidate selection for pulsed neutron logging including tool calibration procedures and pre-job environmental assessment; the data acquisition techniques, neutron interaction with reservoir rock and cross-section (Sigma) analysis; the neutron lifetime and decay curves as well as advanced modes covering spectral gamma ray (SGR) logging, pulsed neutron spectroscopy for elemental analysis, neutron capture spectroscopy (NCS) and neutron-induced gamma-ray spectroscopy; the reservoir saturation monitoring and formation porosity analysis; and the effect of water salinity on Sigma, cross-section, fresh versus saline water zones, variable water salinity and challenges in mixed salinity environments.

During this interactive course, participants will learn the gas zone identification and cement and casing integrity analysis; the pulsed neutron spectroscopy and time-lapse monitoring in reservoirs and integration of pulsed neutron logs with other logs; the formation lithology and mineralogy, data quality control (QC), advanced crossplot techniques and workflow for cased hole reservoir evaluation; identifying problems in high-pressure, high-temperature wells and addressing challenges in horizontal and deviated wells; managing tool calibration errors; and the advances in tool technology and role of machine learning in log analysis.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain a basic knowledge pulsed neutron cased hole formation evaluation
- Discuss the importance of formation evaluation and the differences between open hole and cased hole logging
- Explain the principles of neutron physics, pulsed neutron logging tools and measurement principles in pulsed neutron logging
- Identify the impact of casing and cement on neutron measurements and wellbore fluids and their influence
- Discuss Sigma logging and differentiate gas and water zones using Sigma
- Carryout well candidate selection for pulsed neutron logging including tool calibration procedures and pre-job environmental assessment
- Employ data acquisition techniques, neutron interaction with reservoir rock and capture cross-section (Sigma) analysis
- Describe neutron lifetime and decay curves as well as advanced modes covering spectral gamma ray (SGR) logging, pulsed neutron spectroscopy for elemental analysis, neutron capture spectroscopy (NCS) and neutron-induced gamma-ray spectroscopy
- Apply reservoir saturation monitoring and formation porosity analysis
- Identify the effect of water salinity on Sigma and capture cross-section, identify fresh versus saline water zones, adjust variable water salinity and interpret challenges in mixed salinity environments
- Employ gas zone identification and cement and casing integrity analysis
- Discuss pulsed neutron spectroscopy and apply time-lapse monitoring in reservoirs and integration of pulsed neutron logs with other logs
- Describe formation lithology and mineralogy and carryout data quality control (QC), advanced crossplot techniques and workflow for cased hole reservoir evaluation
- Identify problems in high-pressure, high-temperature wells, address challenges in horizontal and deviated wells and manage tool calibration errors
- Discuss the advances in tool technology and role of machine learning in log analysis

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of pulsed neutron cased hole formation evaluation for field engineers/logging engineers,completion engineers, reservoir engineers, petrophysicists, well log analysts, geologists, data scientists or technical specialists, and other operations personnel.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Fee

US$ 8,000 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. Stan Constantino, MSc, BSc, is a **Senior Petroleum & Reservoir Engineer** with over **35 years** of **Offshore & Onshore** extensive experience within the **Oil**, **Gas & Petroleum** industries**.** His area of expertise include **Reserves & Resources**, **Reserves Estimation & Uncertainty**, **Reservoir** Characterization, **Unconventiona**l **Resource & Reserves** Evaluation, **Oil & Gas Reserves** Estimation, Methods for **Aggregation of Reserves & Resources**, **Fractured Reservoir** Classification & Evaluation, **Sequence Stratigraphy**, **Petrophysics & Rock** Properties, **Seismic** Technology, **Geological** Modelling, **Water Saturation**, **Crude Oil & Natural Gas** Demand, **Exploration Agreements & Financial** Modelling, **Seismic Survey** Evaluation, **Exploration Well** Identification, **Field Production** Operation, **Field Development** Evaluation, Crude Oil Marketing, **Core & Log Data** Integration, **Core Logging**, Advanced **Core & Log Integration**, **Well Logs & Core Analysis**, Advanced Petrophysics/Interpretation of **Cased Hole Logs**, **Cased Hole Formation Evaluation**, **Cased Hole Formation** Evaluation, **Cased Hole Evaluation**, **Cased-Hole Logging**, Applied **Production Logging & Cased Hole & Production Log** Evaluation, **Cased Hole Logging & Formation** Evaluation, Open & Cased Hole Logging, Screening of Oil Reservoirs for **Enhanced Oil Recovery**, **Enhanced Oil Recovery**, **Enhanced Oil Recovery** Techniques, **Petroleum Economic** Analysis, **Oil Industry** Orientation, **Oil Production & Refining**, **Crude Oil Market**, **Global Oil Supply & Demand**, **Global Oil Reserves**, **Crude Oil** Types & Specifications, **Oil Processing**, **Oil Transportation-Methods**, **Oil & Gas** Exploration and Methods, **Oil & Gas** Extraction, Technology Usage in Industrial Security; **Upstream**, **Midstream** & **Downstream Operations**; **Oil Reservoir** Evaluation & Estimation, **Oil Supply & Demand**, **Oil Contracts**, **Government Legislation & Oil Contractual Agreements**, **Oil Projects** & Their Feasibility (revenue and profitability), **Water Flooding**, **Reservoir** Souring & Water Breakthrough, **Reservoir Performance** Using Classical Methods, **Fractured Reservoir** Evaluation & Management, **Reservoir Surveillance** & Management, **Reservoir Engineering** & Simulation, **Reservoir Monitoring**, **Pressure Transient** Testing & **Reservoir** Performance Evaluation, **Reservoir** Characterization, **Reservoir** Engineering Applications with ESP and Heavy Oil, **Reservoir** Volumetrics, Water Drive Reservoir, **Reserve** Evaluation, Rock & Fluid Properties, Fluid Flow Mechanics, PVT Analysis, Material Balance, Darcy's Law & Applications, Radial Flow, **Gas Well** Testing, Natural Water Influx, EOR Methods, Directional Drilling, **Drilling** Production & Operations, Field Development & Production of Oil & Gas, **Wireline Logging**, **Mud Logging**, **Cased Hole Logging**, **Production Logging**, **Slick Line**, **Coil Tubing**, Exploration Wells Evaluation, **Horizontal Wells**, **Well Surveillance**, **Well Testing**, **Design & Analysis**, **Well Testing & Oil Well Performance**, **Well Log Interpretation** (**WLI**), **Formation Evaluation**, **Well Workover Supervision**, **Pressure Transient Analysis** and **Petrophysical Log Analysis**. Currently, he is the **CEO** & **Managing Director** of **Geo Resources Technology** wherein he is responsible in managing the services and providing technical supports to underground energy related projects concerning **field development**, **production**, **drilling**, **reservoir engineering** and **simulation**.

Throughout his long career life, Mr. Stan has worked for many international companies such as the **Kavala Oil**, **North Aegean Petroleum Company** and **Texaco Inc.**, as the **Managing Director**, **Operations Manager**, **Technical Trainer**, **Training Consultant**, **Petroleum Engineering & Exploration Department Head**, **Assistant Chief Petroleum Engineer**, **Reservoir Engineer, Resident Petroleum Engineer**, **Senior Petroleum Engineer** and **Petroleum Engineer** wherein he has been managing the evaluation of exploration wells, reservoir simulation, development training, production monitoring, wireline logging and well testing including selection and field application of well completion methods.

Mr. Stan has a **Master's** degree in **Petroleum Engineering** and a **Bachelor's** degree in **Geology** from the **New Mexico Institute of Mining & Technology** (**USA**) and from the **Aristotelian University** (**Greece**) respectively. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership of Management (ILM**) and a member of the Society of Petroleum Engineers, USA (**SPE**), Society of Well Log Professional Analysts, USA (**SPWLA**) and European Association of Petroleum Geoscientists & Engineers (**EAGE**). Moreover, Mr. Stan published numerous scientific and technical papers and delivered various trainings, courses and workshops worldwide.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Cased Hole Formation Evaluation*** *What is Formation Evaluation, & Why is it Important? • Differences Between Open Hole & Cased Hole Logging • Overview of Pulsed Neutron Tools & Their Evolution • Applications of Pulsed Neutron Logging*
0930 - 0945	*Break*
0945 – 1045	***Principles of Neutron Physics*** *Basic Neutron Properties & Interactions • Thermal & Epithermal Neutrons • Capture Cross-Sections of Common Elements in Formations • Importance of Neutron Moderation & Diffusion*
1045 - 1145	***Pulsed Neutron Logging Tools*** *Components of a Pulsed Neutron Tool (Source, Detector, Electronics) • Key Tool Specifications & Their Impact on Performance • Types of Detectors (He-3, Scintillation Detectors) • Safety Considerations in Handling Neutron Sources*
1145 - 1230	***Measurement Principles in Pulsed Neutron Logging*** *Time-Domain Measurements: Capture Cross-Section (Sigma) Logging • Energy-Domain Measurements: Spectral Gamma Ray & Elemental Analysis • Neutron Decay Curves & Their Interpretation • Introduction to Saturation & Porosity Determination*
1230 – 1245	*Break*
1245 – 1330	***Borehole Environment Considerations*** *Impact of Casing & Cement on Neutron Measurements • Wellbore Fluids & Their Influence • Understanding Tool Standoffs & Eccentricity • Managing Environmental Corrections*
1330 - 1420	***Sigma Logging*** *Theory Behind Sigma (Σ) Measurement • Differentiating Gas & Water Zones Using Sigma • Limitations & Challenges in Sigma Measurements • Practical Examples & Case Studies*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***Pre-Job Planning & Preparation*** *Well Candidate Selection for Pulsed Neutron Logging • Tool Calibration Procedures • Pre-Job Environmental Assessment • Tool Programming for Job-Specific Objectives*
0830 – 0930	***Data Acquisition Techniques*** *Logging Speed & Depth Control • Real-Time Monitoring of Tool Response • Logging Quality Control Parameters • Overcoming Challenges in Highly Deviated or Horizontal Wells*

0930 - 0945	Break
0945 – 1130	***Neutron Interaction with Reservoir Rock*** *Interactions with Hydrocarbons versus Water • Role of Porosity in Neutron Scattering • Neutron Absorption in Different Lithologies • Differentiating Matrix Effects from Fluid Effects*
1130 - 1230	***Capture Cross-Section (Sigma) Analysis*** *Detailed Interpretation of Sigma Logs • Impact of Salinity on Sigma Values • Crossplot Analysis for Fluid Identification • Limitations of Sigma Logging in Mixed Lithologies*
1230 - 1245	Break
1245 - 1330	***Neutron Lifetime & Decay Curves*** *Time-Lapse Measurements & Their Significance • Pulse Delay Measurements for Advanced Interpretation • Analyzing Fast & Thermal Neutron Decay Curves • Linking Decay Patterns to Formation Properties*
1330 - 1420	***Advanced Modes*** *Spectral Gamma Ray (SGR) Logging • Pulsed Neutron Spectroscopy for Elemental Analysis • Neutron Capture Spectroscopy (NCS) • Neutron-Induced Gamma-Ray Spectroscopy*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	Lunch & End of Day Two

Day 3

0730 – 0830	***Reservoir Saturation Monitoring*** *Determining Water, Oil, & Gas Saturations • Using Sigma Logs for Gas Zone Identification • Time-Lapse Monitoring for Reservoir Depletion • Applications in Enhanced Oil Recovery (EOR)*
0830 – 0930	***Formation Porosity Analysis*** *Neutron Porosity Vs. Sigma Porosity • Impact of Lithology on Porosity Measurements • Techniques for Accurate Porosity Computation • Crossplots for Porosity & Saturation Determination*
0930 - 0945	Break
0945 – 1130	***Water Salinity & Its Impact*** *Effect of Water Salinity on Sigma & Capture Cross-Section • Identifying Fresh Vs. Saline Water Zones • Adjustments for Variable Water Salinity • Interpretation Challenges in Mixed Salinity Environments*
1130 - 1230	***Gas Zone Identification*** *Neutron Response in Gas-Bearing Formations • Crossplot Techniques for Gas Identification • Managing Uncertainties in Gas-Saturated Zones • Integration with Other Cased Hole Logs (e.g., Gamma Ray)*
1230 - 1245	Break
1245 - 1330	***Cement & Casing Integrity Analysis*** *Detecting Cement Bond Quality Using Neutron Tools • Impact of Poor Cement Bonding on Neutron Logs • Differentiating Formation Signals from Casing Signals • Applications in Casing Integrity Evaluation*

1330 - 1420	***Case Studies & Practical Exercises*** *Real-World Examples of Pulsed Neutron Log Applications • Analysis of Log Data from Different Reservoirs • Common Challenges in Field Operations • Interactive Group Problem-Solving Exercises*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4

0730 – 0830	***Pulsed Neutron Spectroscopy*** *Principles of Spectroscopy-Based Measurements • Identifying Elements Using Gamma-Ray Spectra • Applications in Mineralogy & Reservoir Characterization • Advanced Software Tools for Spectral Analysis*
0830 – 0930	***Time-Lapse Monitoring in Reservoirs*** *Importance of Periodic Logging in Dynamic Reservoirs • Identifying Fluid Movement & Breakthrough • Case Studies in EOR & Secondary Recovery • Challenges in Repeatability & Calibration*
0930 - 0945	*Break*
0945 – 1130	***Integration with Other Logs*** *Combining Pulsed Neutron Logs with Resistivity & Porosity Logs • Cross-Validation with Production Data • Multi-Log Interpretation for Reservoir Characterization • Advanced Workflows for Data Integration*
1130 - 1230	***Formation Lithology & Mineralogy*** *Identifying Lithology Using Neutron Responses • Understanding Elemental Contributions to Sigma & Spectra • Techniques for Differentiating Shales & Clastics • Role of Carbonate & Anhydrite in Sigma Interpretation*
1230 - 1245	*Break*
1245 - 1330	***Data Quality Control (QC)*** *Evaluating Log Consistency & Repeatability • Recognizing & Correcting Tool Malfunctions • Addressing Noise & Interference in Logging Data • Field Examples of QC Procedures*
1330 - 1420	***Advanced Crossplot Techniques*** *Porosity-Saturation Crossplots for Fluid Identification • Multi-Log Crossplot Workflows • Application of Machine Learning in Log Interpretation • Field Examples of Crossplot Analysis*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

Day 5

0730 – 0930	***Workflow for Cased Hole Reservoir Evaluation*** *Step-By-Step Workflow for Formation Evaluation • Interpreting Sigma & Spectroscopy Data in Workflows • Integration with Reservoir Modeling & Simulation • Final Report Preparation & Presentation*
0930 - 0945	*Break*
0945 – 1030	***Case Studies in Field Applications*** *Reservoir Monitoring in Mature Fields • Identification of Bypassed Pay Zones • Time-Lapse Logging Case Studies • Gas Reservoir Evaluation Under Challenging Conditions*
1030 - 1130	***Troubleshooting Common Issues*** *Problems in High-Pressure, High-Temperature Wells • Addressing Challenges in Horizontal & Deviated Wells • Managing Tool Calibration Errors. • Solutions for Ambiguous Data Interpretation*
1130 - 1230	***Future Trends in Pulsed Neutron Logging*** *Advances in Tool Technology (Detector Advancements, AI Integration) • Role of Machine Learning in Log Analysis • Digitalization & Remote Data Interpretation • Potential for Real-Time Downhole Analysis*
1230 - 1245	*Break*
1245 - 1345	***Hands-On Data Analysis Workshop*** *Participants Analyze Sample Datasets • Identifying Reservoir Properties & Challenges • Generating Crossplots & Reports • Group Presentations of Findings*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions

This practical and highly-interactive course includes real-life case studies and exercises:-

Course Coordinator

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