COURSE OVERVIEW PE1052
Quality Control, Raw Materials & Raw Mix Design

Course Title
Quality Control, Raw Materials & Raw Mix Design

Course Date/Venue
July 27-31, 2025/Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE

Course Reference
PE1052

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

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using "MS-Excel" application.

This course is designed to provide participants with a detailed and up-to-date overview of Quality Control, Raw Materials & Raw Mix Design. It covers the importance of quality control in cement plants as well as the physical and chemical properties of cement raw materials; the chemical composition of raw materials covering key oxides, LOI, SO_3, MgO, alkalis and their impact; sampling and sample preparation and material analysis techniques; and the mineralogy and microscopic analysis and its role in problem-solving and quality optimization; the quarry planning and raw material evaluation and raw material variability and control; and the pre-blending techniques and online XRF/PGNAA analyzers for real-time analysis.

Further, the course will also discuss the stockpile management and the impact of quarry operations on product quality and discuss raw mix design, clinker chemistry and mineralogy targets; the key quality parameters in raw mix design comprising lime saturation factor (LSF), silica ratio (SR) and alumina ratio (AR); the raw mix design calculations and burnability and kiln feed optimization; and the corrective materials and mix adjustment and raw mix design for blended cement.

During this interactive course, participants will learn the raw meal quality control, clinker quality evaluation, cement quality parameters and laboratory quality assurance; the standard compliance and product certification covering ASTM, EN, BS, IS standards for cement and troubleshoot quality issues; the integration of QC with process control, statistical process control (SPC) techniques and CONTROL CHARTS AND Cpk/Ppk indices; and the using of software tools in raw mix optimization and the role of chemistry in fuel consumption; and using of low-cost alternative materials, minimize fuel and grinding energy and blend strategies and logistics.

Course Objectives

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

- Apply and gain an in-depth knowledge on quality control, raw materials and raw mix design
- Discuss the importance of quality control in cement plants as well as the physical and chemical properties of cement raw materials
- Recognize the chemical composition of raw materials covering key oxides, LOI, SO_3, MgO, alkalis and their impact
- Apply sampling and sample preparation and material analysis techniques
- Identify mineralogy and microscopic analysis and its role in problem-solving and quality optimization
- Employ quarry planning and raw material evaluation and raw material variability and control
- Apply pre-blending techniques and online XRF/PGNAA analyzers for real-time analysis
- Explain stockpile management and the impact of quarry operations on product quality and discuss raw mix design, clinker chemistry and mineralogy targets
- Identify the key quality parameters in raw mix design comprising lime saturation factor (LSF), silica ratio (SR) and alumina ratio (AR)
- Explain raw mix design calculations and burnability and kiln feed optimization
- Recognize corrective materials and mix adjustment and raw mix design for blended cement
- Apply raw meal quality control, clinker quality evaluation, cement quality parameters and laboratory quality assurance
- Identify the standard compliance and product certification covering ASTM, EN, BS, IS standards for cement and troubleshoot quality issues
- Apply integration of QC with process control, statistical process control (SPC) techniques and CONTROL CHARTS AND Cpk/Ppk indices
- Use of software tools in raw mix optimization and identify the role of chemistry in fuel consumption
- Use of low-cost alternative materials, minimize fuel and grinding energy and blend strategies and logistics

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 quality control, raw materials and raw mix design for production/process engineers, quality control (QC) engineers, geologists and mining engineers, laboratory staff, technical managers and supervisors and other technical staff.

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.

Course Fee

US$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Accommodation

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

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Haward's 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**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). 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:

Dr. John Petrus, PhD, MSc, BSc, is a **Senior Process Engineer** with over **30 years** of **onshore & offshore** experience within the **Oil & Gas**, **Refinery** and **Petroleum** industries. His wide experience covers in the areas of **De-Sulfurization** Technology, **Process Troubleshooting**, **Distillation Towers**, **Fundamentals of Distillation** for Engineers, **Distillation** Operation and Troubleshooting, **Advanced Distillation** Troubleshooting, **Distillation** Technology, Vacuum **Distillation**, **Distillation Column** Operation & Control, **Oil Movement** Storage & Troubleshooting, **Process Equipment** Design, Applied **Process Engineering** Elements, **Process Plant** Optimization, **Revamping & Debottlenecking**, **Process Plant** Troubleshooting & Engineering Problem Solving, **Process Plant** Monitoring, **Catalyst** Selection & Production Optimization, Operations Abnormalities & Plant Upset, **Process Plant** Start-up & Commissioning, **Clean Fuel** Technology & Standards, Flare, Blowdown & Pressure Relief Systems, **Oil & Gas Field Commissioning** Techniques, **Pressure Vessel** Operation, **Gas Processing**, **Chemical** Engineering, **Process Reactors** Start-Up & Shutdown, **Gasoline Blending** for Refineries, **Urea Manufacturing** Process Technology, Continuous Catalytic Reformer (**CCR**), Advanced Operational & Troubleshooting Skills, Principles of Operations Planning, **Rotating Equipment** Maintenance & Troubleshooting. Further he is also well versed in **Rotating Machinery** Principles & Applications, **Rotating Equipment** Selection, Operation, Maintenance, Inspection & Troubleshooting, **Rotating Machine/Equipment** in Industry, **Control Valves & Actuators**, **PSV** Maintenance & Testing, **Pump Selection**, Installation, Performance & Control, **Screw Compressor** Theory and Troubleshooting, **Reliability-Centered Maintenance** (**RCM**), **Preventive & Predictive Maintenance**, **Spare Parts Planning & Inventory** Management, Computerized Maintenance Management Systems (**CMMS**), **Process Plant Shutdown & Turnaround**, **Maintenance Optimization** & Best Practices, **Reliability Centered Maintenance** Principles & Application, Efficient Shutdowns, Turnaround & Outages, Effective Reliability Maintenance & Superior Maintenance Strategies, **Integrity & Asset** Management, **Total Plant Reliability** Maintenance, **Vibration** Measurement, **Advanced Analytics** in Oil & Gas, **Business Intelligence Data Analytics**, Audit Analytics & Computer-Assisted Audit Techniques (**CAATs**), **Basic Database** Concepts & Data Formats, **Data Analysis** Cycle & Best Practices, **Data Importing & Integrity** Verification, **Advanced Analytics Tools** in **Auditing**, Leveraging **AI & Machine Learning** in **Audits**, **Data Mining Techniques** for Auditors, **Data Analytics** for Managerial Decision Making, **Business Process Analysis**, Mapping & Modeling, **Research Methods & Analysis**, **Statistical Data Needs Analysis**, Oil & Gas Industry **Business Environment & Competitive Intelligence Gathering & Analysis**, Petroleum **Economics & Risk Analysis**, Certified **Data Analysis**, **Risk Management** & SWIFT Analysis, Best Practices Management System (**BPMS**), **GIS System** Management, **Database** Management, Strategic Planning, Best Practices and Workflow, **Quality** Management, **Project** Management and **Risk Assessment** & Uncertainty Evaluation. Further, he is also well-versed in **seismic interpretation**, **mapping** & **reservoir modelling tools** like **Petrel** software, **LandMark**, **Seisworks**, **Geoframe**, **Zmap** and has extensive knowledge in MSDos, Unix, **AutoCAD**, MAP, Overlay, Quicksurf, 3DStudio, **Esri ArcGIS**, Visual Lisp, Fortran-77 and Clipper. Moreover, he is a world **expert** in **analysis** and **modelling** of **fractured prospects** and **reservoirs** and a **specialist** and **developer** of **fracture modelling software tools** such as FPDM, FMX and DMX Protocols.

During his career life, Dr. Petrus held significant positions and dedication as the **Executive Director**, **Senior Geoscience Advisor**, **Exploration Manager**, **Project Manager**, **Manager**, **Process Engineer**, **Mechanical Engineer**, **Maintenance Engineer**, **Chief Geologist**, **Chief** of **Exploration**, **Chief** of **Geoscience**, **Senior Geosciences Engineer**, **Senior Explorationist**, **Senior Geologist**, **Geologist**, **Senior Geoscientist**, **Geomodeller**, **Geoscientist**, **CPR Editor**, **Resources Auditor**, **Project Leader**, **Technical Leader**, **Team Leader**, **Scientific Researcher** and **Senior Instructor/Trainer** from various international companies and universities such as the Dragon Oil Holding Plc., ENOC, MENA, ENI Group of Companies, Ocre Geoscience Services (OGS), Burren RPL, Ministry of Oil-Iraq, Eni Corporate University, Standford University, European Universities, European Research Institutes, NorskHydro Oil Company, Oil E&P Companies, just to name a few.

Dr. Petrus has a **PhD** in **Geology** and **Tectonophysics** and **Master** and **Bachelor** degrees in **Earth Sciences** from the **Utrecht University**, **The Netherlands**. Further, he is a **Certified Instructor/Trainer**, a **Certified Trainer/Assessor/Internal Verifier** by the **Institute of Leadership & Management** (**ILM**), a Secretary and Treasurer of Board of Directors of Multicultural Centre, Association Steunfonds SSH/SSR and Founding Member of Sfera Association. He has further published several scientific publications, journals, research papers and books and delivered numerous trainings, workshops, courses, seminars and conferences internationally.

Course Program

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

Day 1: ***Sunday, 27th of July 2025***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to Quality Control in Cement Manufacturing*** *Importance of Quality Control in Cement Plants • Quality Control Objectives: Consistency, Compliance, Performance • Integration of QC with Process & Product Optimization • Structure of a Cement Plant's QC Department*
0930 – 0945	*Break*
0945 – 1030	***Cement Raw Materials*** *Main Raw Materials: Limestone, Clay, Shale, Marl • Correctives & Additives: Iron Ore, Bauxite, Sand, Mill Scale • Physical & Chemical Properties • Sourcing, Variability & Processing Methods*
1030 – 1130	***Chemical Composition of Raw Materials*** *Key Oxides: CaO, SiO_2, Al_2O_3, Fe_2O_3 • LOI, SO_3, MGO, Alkalis & Their Impact • Trace Elements & Impurities • Influence on Burnability & Clinker Quality*
1130 – 1215	***Sampling & Sample Preparation*** *Sampling Protocols for Quarry, Crusher, Stacker • Representative Sampling Techniques • Sample Reduction, Grinding & Homogenization • Avoiding Contamination & Bias*
1215 – 1230	*Break*
1230 – 1330	***Material Analysis Techniques*** *X-Ray Fluorescence (XRF) Analysis • Gravimetric & Volumetric Classical Analysis • Thermal Analysis: TGA, LOI, DSC • Fusion versus Pressed Pellets for XRF*
1330 – 1420	***Mineralogy & Microscopic Analysis*** *X-Ray Diffraction (XRD) for Phase Identification • Microscopic Techniques (Optical & Sem) • Influence of Mineral Phases on Performance • Role in Problem-Solving & Quality Optimization*
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: ***Monday, 28th of July 2025***

0730 – 0830	***Quarry Planning & Raw Material Evaluation*** *Geological Survey & Mapping • Core Sampling & Chemical Profiling • Deposit Evaluation & Mine Planning • Ensuring Long-Term Material Availability*
0830 – 0930	***Raw Material Variability & Control*** *Natural Variation in Deposit Chemistry • Daily, Monthly, Seasonal Fluctuations • Impact of Variability on Kiln Feed & Clinker • Strategies for Minimizing Variability*

0930 – 0945	*Break*
0945 – 1100	***Pre-Blending Techniques*** *Pre-Homogenization Yard Design • Linear & Circular Stackers/Reclaimers • Chevron, Windrow & Cone Shell Stacking Methods • Efficiency of Blending & Homogenization*
1100 – 1215	***Online Analyzers & Process Integration*** *Online XRF/PGNAA Analyzers for Real-Time Analysis • Cross-Belt Analyzers & Feeders • Integration with Raw Mill Control Systems • Immediate Correction of Raw Mix Ratios*
1215 – 1230	*Break*
1230 – 1330	***Stockpile Management*** *Inventory Tracking & Chemical Zoning • Sampling from Stockpile & Reclaimers • Ensuring Uniformity of Feed to Raw Mill • Tracking Material Flow & Composition*
1330 – 1420	***Impact of Quarry Operations on Product Quality*** *Influence of Overburden & Contamination • Explosive Residue & Drilling Pattern Effects • Moisture & Particle Size Distribution • Quarry-to-Clinker Traceability Systems*
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: ***Tuesday, 29th of July 2025***

0730 – 0830	***Basics of Raw Mix Design*** *Objectives of Raw Mix Design • Clinker Chemistry & Mineralogy Targets • Balance Between Cost, Performance & Burnability • Setting Target Oxide Levels*
0830 – 0930	***Key Quality Parameters in Raw Mix Design*** *Lime Saturation Factor (LSF) • Silica Ratio (SR) & Alumina Ratio (AR) • Modular Ratios & their Significance • Target Ranges for Different Cement Types*
0930 – 0945	*Break*
0945 – 1100	***Raw Mix Design Calculations*** *Linear Equations for Raw Material Proportions • Using Excel or Software for Raw Mix Design • Balancing Major & Minor Oxides • Example Problems & Hands-on Sessions*
1100 – 1215	***Burnability & Kiln Feed Optimization*** *Influence of Raw Mix Chemistry on Burnability • Free Lime Control & Clinker Phase Formation • Fineness & Homogenization of Raw Meal • Kiln Operating Adjustments Based on Feed*
1215 – 1230	*Break*
1230 – 1330	***Corrective Materials & Mix Adjustment*** *Role of Iron Ore, Bauxite, Sand & Other Correctives • Flexibility in Mix Design for Cost Control • Adjustments Based on Feedback from Quality Control • In-Plant Scenarios & Case Studies*

1330 – 1420	***Raw Mix Design for Blended Cement*** *Inclusion of Pozzolans, Slag & Fly Ash • Adjusting Base Clinker Chemistry • Strength Development & Workability Impact • Compliance with Product Standards*
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: Wednesday, 30th of July 2025

0730 – 0830	***Raw Meal Quality Control*** *Sampling from Blending Silo • Hourly Chemical Analysis • Controlling Variations & Standard Deviation • XRF Calibration & Drift Monitoring*
0830 – 0930	***Clinker Quality Evaluation*** *Free Lime, Liter Weight & Microscopy • Phase Composition: C_3S, C_2S, C_3A, C_4AF • Burning Zone Control & Flame Stability • Impacts of Overburning & Underburning*
0930 – 0945	*Break*
0945 – 1100	***Cement Quality Parameters*** *Blaine Fineness & Particle Size Distribution • Setting Time, Soundness & Strength Tests • Chemical Limits (SO_3, Alkalis, Chloride) • Control Charts & Statistical Tools*
1100 – 1215	***Laboratory Quality Assurance*** *Instrument Calibration & Maintenance • Proficiency Testing & Inter-Lab Comparisons • SOPs & Documentation • Training of Lab Personnel*
1215 – 1230	*Break*
1230 – 1330	***Standard Compliance & Product Certification*** *ASTM, EN, BS, IS Standards for Cement • Type I–V, Cem I–Cem V Specifications • Conformity Assessment & Third-Party Audits • Quality Labels & Customer Acceptance*
1330 – 1420	***Troubleshooting Quality Issues*** *Raw Mix Instability • Clinker Phase Imbalance • Strength Non-Conformance • Collaborative Feedback Loop Between Lab, Process & Quarry*
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*

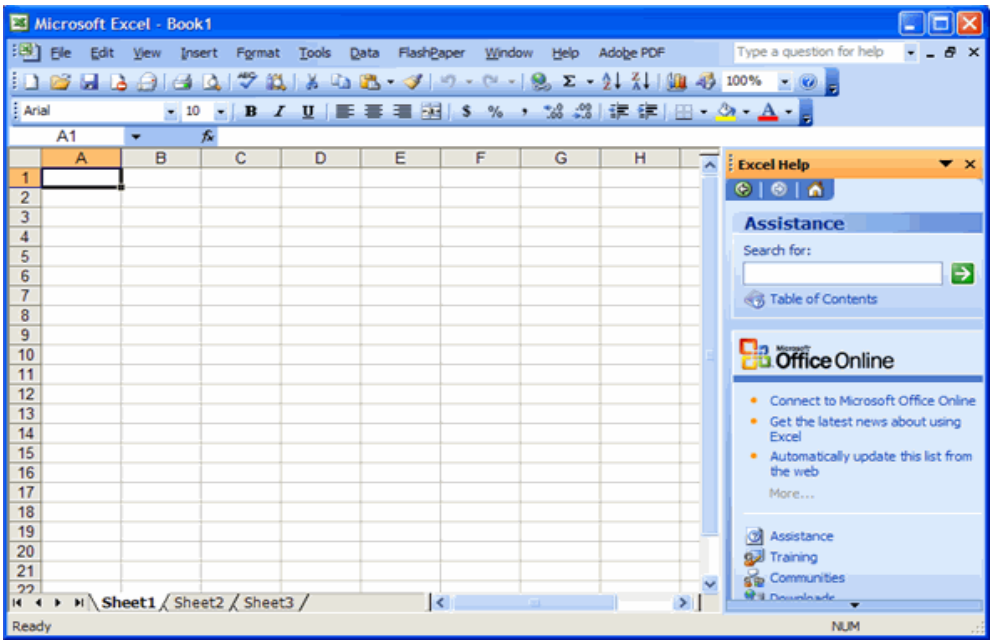
Day 5: Thursday, 31st of July 2025

0730 – 0830	***Integration of QC with Process Control*** *Communication Between Lab & Process Operators • Using QC Data to Adjust Raw Mill & Kiln • Cross-Functional Team Approach • Closing the Control Loop*
0830 – 0930	***Advanced Data Analysis for Quality Improvement*** *Statistical Process Control (SPC) Techniques • Control Charts & CPK/PPK Indices • Regression & Correlation Analysis • Data Visualization & Dashboards*
0930 – 0945	*Break*

0945 – 1100	***Use of Software Tools in Raw Mix Optimization*** *LIMS (Laboratory Information Management Systems) • Raw Mix Software & Kiln Feed Calculators • Predictive Modeling Using Historical Data • Digital Transformation in QC Departments*
1100 – 1230	***Energy, Emissions & Raw Mix Interaction*** *Role of Chemistry in Fuel Consumption • Impact of Alkalis, Sulfur & Chloride on Emissions • Reducing CO_2 Through Raw Mix Adjustments • Limestone Quality & Carbon Footprint*
1230 – 1245	*Break*
1245 – 1345	***Cost Optimization Through Raw Mix Design*** *Use of Low-Cost Alternative Materials • Minimizing Fuel & Grinding Energy • Blending Strategies & Logistics • Economic versus Quality Trade-Offs*
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*

Simulator (Hands-on Practical Sessions)

Practical session will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the simulator "MS-Excel" application.



MS-Excel

Course Coordinator

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org