# COURSE OVERVIEW PE1049
# Cement Kiln Process & Operation

**Course Title**
Cement Kiln Process & Operation


**Course Date/Venue**
Session 1: May 25-29, 2025/Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE
Session 2: July 06-10, 2025/Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE

**Course Reference**
PE1049

**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 Cement Kiln Process & Operation. It covers the cement production process and the role of the kiln in clinker formation; the kiln system components and configuration, raw material and clinker chemistry and clinker formation reactions; the kiln process flow and heat transfer and essential kiln parameters and monitoring; the preheater and precalciner operation and burning zone control; and the fuel types and combustion management, the kiln pressure and draft control.

Further, the course will also discuss the kiln coating and ring formation and optimize kiln throughput and efficiency; the kiln process control systems, the PID control loops and automation basics, DCS interface, HMI interpretation, interlocks, alarms and control system tuning; the kiln monitoring and diagnostic tools, kiln alignment and mechanical stability and common kiln operational problems; the cooler operation and clinker handling, the preventive and predictive maintenance; and the kiln emissions and environmental impact, NOx and SOx control strategies and dust and particulate management.

During this interactive course, participants will learn the energy consumption and optimization, the thermal energy consumption and waste heat recovery systems (WHR); the types of alternative fuels and raw materials (AFR) and calorific value considerations; and the kiln operation in low-carbon cement manufacturing, perform indicators and benchmarking and team collaboration and operator best practices.

## Course Objectives

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

- Apply and gain an in-depth knowledge on cement kiln process and operation
- Discuss the cement production process and the role of the kiln in clinker formation
- Identify kiln system components and configuration, raw material and clinker chemistry and clinker formation reactions
- Explain kiln process flow and heat transfer and essential kiln parameters and monitoring
- Apply preheater and precalciner operation and burning zone control
- Identify fuel types and combustion management and employ kiln pressure and draft control
- Recognize kiln coating and ring formation and optimize kiln throughput and efficiency
- Apply kiln process control systems covering PID control loops and automation basics, DCS interface, HMI interpretation, interlocks, alarms and control system tuning
- Identify kiln monitoring and diagnostic tools, kiln alignment and mechanical stability and common kiln operational problems
- Employ cooler operation and clinker handling and discuss preventive and predictive maintenance
- Identify kiln emissions and environmental impact, NOx and SOx control strategies and dust and particulate management
- Explain energy consumption and optimization including thermal energy consumption and waste heat recovery systems (WHR)
- Recognize the types of alternative fuels and raw materials (AFR) and calorific value considerations
- Apply kiln operation in low-carbon cement manufacturing, perform indicators and benchmarking and team collaboration and operator best practices

## 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 cement kiln process and operation for process engineers, kiln operators, production supervisors/managers, maintenance engineers/technicians, quality control personnel, project engineers and other technical staff.

**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**

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. Karl Thanasis**, PEng, MSc, MBA, BSc, is a **Senior Engineer** with **30 years** of extensive industrial experience within the **Oil & Gas**, **Refinery** and **Petrochemical** industries. His wide expertise includes **Control Valve** Maintenance & Testing, Advanced **Operational Skills**, Operations & Maintenance for **Gas Processing Plant**, Oil & **Gas Processing Facilities** Operations, **Applied Natural Gas Processing**, Dehydration & Advanced Rotating Equipment, **Gas Processing & Compression**, **Process Equipment** Design & Troubleshooting, **Process Plant** Optimization & Continuous Improvement, **Production Process** Optimization, **Cement Kiln** Process & Operation, **Cement** Production, **Cement** Quality & Chemistry, **Preheater & Precalciner** Operation, **Kiln** System Components, **Operations Planning** Optimization, **Process Equipment** Design, **Process Plant** Performance & Efficiency, **Process** Integration & Optimization, Root Cause Analysis (**RCA**) Methods, **Root Cause Analysis**, **Process Equipment & Piping** System, **Rotating Equipment Reliability** Optimization & Continuous Improvement, **Material Cataloguing**, **Mechanical & Rotating Equipment** Troubleshooting & Maintenance, **Rotating Equipment** for Process Industry, **Rotating Machinery** Best Practices, **Centrifugal Pumps** Operation, **Positive Displacement Pumps** Repair, **Pump** Maintenance & Troubleshooting, **Heat Exchanger** Maintenance & Repair, **Heat Exchanger** Inspection & Troubleshooting, **Fin-fan Coolers**, Fundamentals of **Engineering Drawings**, **Codes & Standards**, **P&ID Reading Interpretation & Developing**, **Boiler Design**, **Boiler** Inspection & Maintenance, **Boiler** Operation & Control, **Boiler** Troubleshooting & Inspection, **Boiler Instrumentation & Control**, **Steam Boiler** Maintenance, **Boiler & Steam Generation System**, **Boiler** Failure Analysis & Prevention, **Boiler** Burner Management, **Boiler** Water Treatment Technology, **Machinery Failure Analysis**, **Preventive & Predictive Maintenance**, **Condition Monitoring**, Root Cause Analysis (**RCA**), Root Cause Failure Analysis (**RCFA**), Reliability Centred Maintenance (**RCM**), Risk Base Inspection (**RBI**), **Metallurgical Failure Analysis**, **Corrosion Failure Analysis**, **Steam Generation**, **Steam Turbines**, **Power Generator Plants**, **Gas Turbines**, **Combined Cycle Plants**, **Boilers**, **Process Fired Heaters**, Air Preheaters, Induced Draft Fans, All Heaters Piping Work, Refractory Casting, Heater Fabrication, Thermal & Fired Heater Design, Heat Transfer, Coolers, **Pumps**, Turbo-Generator, Turbine **Shaft Alignment**, **Lubrication**, **Mechanical Seals**, **Packing**, **Blowers, Bearings**, **Couplings**, **Clutches** and **Gears**. Further, he is also versed in **Wastewater Treatment Technology**, **Networking System**, **Water Network Design**, **Industrial Water Treatment** in Refineries & Petrochemical Plants, **Piping System**, **Water Movement**, **Water Filtering**, **Mud Pumping**, **Sludge Treatment** and **Drying**, **Aerobic Process** of **Water Treatment** that includes **Aeration**, **Sedimentation** and **Chlorination Tanks**. His strong background also includes **Design** and **Sizing** of all **Waste Water Treatment Plant Associated Equipment** such as **Sludge Pumps**, **Filters**, **Metering Pumps**, **Aerators** and **Sludge Decanters**.

Mr. Thanasis has acquired his thorough and practical experience as the **Project Manager**, **Plant Manager**, **Area Manager**, **Maintenance Manager**, **Engineering Manager**, **Technical Consultant & Trainer**, **Head of Capital Projects**, **Refractory Specialist**, **Construction Superintendent**, **Maintenance Supervisor**, **Project Engineer**, **Process Engineer**, **Maintenance Engineer** and **Thermal Design Engineer** of various companies worldwide in the **USA**, **Germany**, **England** and **Greece**.

Mr. Thanasis is a **Registered Professional Engineer** in the **USA** and **Greece** and has **Master's** and **Bachelor's** degree in **Mechanical Engineering** with **Honours** from the **Purdue University** and **Southern Illinois University** (**USA**) respectively as well as an **MBA** from the **University of Phoenix** (**USA**). Further, he is a **Certified Instructor/Trainer**, **Certified Internal Verifier/Trainer/Assessor** by the **Institute of Leadership & Management** (**ILM**), a member of the **American Society of Heating, Refrigeration and Air-Conditioning Engineers** and delivered various trainings, courses, seminars and workshops worldwide.

## 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 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***

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| *0730 – 0800* | *Registration & Coffee* |
| *0800 – 0815* | *Welcome & Introduction* |
| *0815 – 0830* | ***PRE-TEST*** |
| *0830 – 0930* | ***Introduction to Cement Manufacturing***<br>*Overview of the Cement Production Process • Role of the Kiln in Clinker Formation • Kiln Types: Dry, Semi-Dry, Wet & Modern Preheater/Precalciner • Importance of Kiln Operation in Overall Plant Efficiency* |
| *0930 – 0945* | *Break* |
| *0945 – 1030* | ***Kiln System Components & Configuration***<br>*Preheater & Precalciner Functions • Rotary Kiln Shell, Internals & Refractory Lining • Clinker Cooler (Grate, Rotary, Planetary) • Kiln Drive & Transmission Systems* |
| *1030 – 1130* | ***Raw Material & Clinker Chemistry***<br>*Key Oxides: CaO, $SiO_2$, $Al_2O_3$, $Fe_2O_3$ • Lime Saturation Factor (LSF), Silica Ratio (SR), Alumina Ratio (AR) • Free Lime & Burnability Index • Mineralogical Phases in Clinker ($C_3S$, $C_2S$, $C_3A$, $C_4AF$)* |
| *1130 – 1215* | ***Clinker Formation Reactions***<br>*Decarbonation Zone & Calcination Reactions • Solid-Phase Reactions in the Kiln • Liquid Phase Formation & Sintering • Cooling & Clinker Mineral Stabilization* |
| *1215 – 1230* | *Break* |
| *1230 – 1330* | ***Kiln Process Flow & Heat Transfer***<br>*Material & Gas Flow Direction • Heat Transfer Mechanisms (Conduction, Convection, Radiation) • Residence Time & Heat Balance • Importance of Temperature Profiles* |

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| 1330 – 1420 | ***Essential Kiln Parameters & Monitoring***<br>*Kiln Feed Rate & Rotation Speed • Inlet/Outlet Temperature Profiles • Secondary & Tertiary Air Control • Oxygen, CO, NOx Levels in the Kiln System* |
| 1420 – 1430 | ***Recap***<br>*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* |

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***Day 2***

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| 0730 – 0830 | ***Preheater & Precalciner Operation***<br>*Cyclone Operation & Separation Efficiency • Calciner Combustion & Residence Time • Temperature Control in Riser Duct • Managing Incomplete Calcination* |
| 0830 – 0930 | ***Burning Zone Control***<br>*Flame Shape & Stability • Temperature Measurement & Coating Behavior • Clinker Color & Nodulization • Identification of Hot & Cold Spots* |
| 0930 – 0945 | *Break* |
| 0945 – 1100 | ***Fuel Types & Combustion Management***<br>*Primary Fuels: Coal, Petcoke, Natural Gas • Alternative Fuels: RDF, Biomass, Tire-Derived Fuels • Combustion Air Control & Burner Tuning • Flame Momentum & Fuel Burnout* |
| 1100 – 1215 | ***Kiln Pressure & Draft Control***<br>*ID Fan & Induced Draft Balance • Sealing Systems & False Air Control • Impact on Combustion & Emissions • Using Draft Indicators & Automation* |
| 1215 – 1230 | *Break* |
| 1230 – 1330 | ***Kiln Coating & Ring Formation***<br>*Desired Coating Thickness & Characteristics • Causes of Ring Formation: Sulphate, Alkali, High Iron • Detecting Early Signs of Coating/Ring Issues • Strategies for Removal & Prevention* |
| 1330 – 1420 | ***Optimization of Kiln Throughput & Efficiency***<br>*Maximizing Feed Rate Without Quality Loss • Energy Efficiency Measures • Clinker Quality versus Kiln Load • Benchmarking Against Best Practices* |
| 1420 – 1430 | ***Recap***<br>*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***

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| 0730 – 0830 | ***Kiln Process Control Systems***<br>*PID Control Loops & Automation Basics • DCS Interface & HMI Interpretation • Interlocks & Alarms • Control System Tuning* |
| 0830 – 0930 | ***Kiln Monitoring & Diagnostic Tools***<br>*Kiln Scanner & Shell Temperature Analysis • Gas Analyzers & Burner Cameras • Vibration & Alignment Sensors • AI & Predictive Analytics Applications* |
| 0930 – 0945 | *Break* |
| 0945 – 1100 | ***Kiln Alignment & Mechanical Stability***<br>*Kiln Axis & Shell Run-Out • Roller Adjustment & Load Distribution • Ovality & Kiln Shell Expansion • Alignment Inspection Procedures* |

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| *1100 – 1215* | ***Common Kiln Operational Problems***<br>*High Free Lime & Low Burn Clinker • Incomplete Combustion & CO Spikes • Red River in Cooler • Snowman & Nose Ring Formation* |
| *1215 – 1230* | *Break* |
| *1230 – 1330* | ***Cooler Operation & Clinker Handling***<br>*Grate Speed & Airflow Control • Heat Recovery Efficiency • Clinker Discharge Temperature • Refractory Wear & Clinker Crusher Issues* |
| *1330 – 1420* | ***Preventive & Predictive Maintenance***<br>*Routine Kiln Inspections • Refractory Condition Monitoring • Gear, Tire & Roller Maintenance • Predictive Techniques (Thermography, Ultrasound, Oil Analysis)* |
| *1420 – 1430* | ***Recap***<br>*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***

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| *0730 – 0830* | ***Kiln Emissions & Environmental Impact***<br>*Key Pollutants: $CO_2$, NOx, $SO_2$, CO, Dust • Regulatory Standards & Compliance Monitoring • Kiln Contribution to Plant Emissions • Continuous Emission Monitoring Systems (CEMS)* |
| *0830 – 0930* | ***NOx & SOx Control Strategies***<br>*Combustion Modification • Low-NOx Burners & Staged Combustion • Raw Material Management • Use of Additives & Bypass Systems* |
| *0930 – 0945* | *Break* |
| *0945 – 1100* | ***Dust & Particulate Management***<br>*ESPs & Baghouse Filters • Material Handling & Fugitive Dust Control • Dust Return Systems & Cyclone Efficiency • Stack Emission Troubleshooting* |
| *1100 – 1215* | ***Energy Consumption & Optimization***<br>*Thermal Energy Consumption (kcal/kg clinker) • Electrical Energy Savings in Drives & Fans • Waste Heat Recovery Systems (WHR) • Use of AFR to Reduce Specific Heat Consumption* |
| *1215 – 1230* | *Break* |
| *1230 – 1330* | ***Alternative Fuels & Raw Materials (AFR)***<br>*Types of AFR & Calorific Value Considerations • Feeding Systems & Kiln Compatibility • AFR Impact on Emissions & Clinker Quality • Health & Safety Considerations* |
| *1330 – 1420* | ***Kiln Operation in Low-Carbon Cement Manufacturing***<br>*Challenges with SCM-Rich Clinker • Belite-Rich & Low-Lime Clinker Burning • Adjusting Combustion & Cooling Profiles • Kiln's Role in Achieving Sustainability Targets* |
| *1420 – 1430* | ***Recap***<br>*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***

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| *0730 – 0830* | ***Kiln Operation Case Study 1: Clinker Quality Deviation***<br>*Scenario Introduction • Investigation Steps & Parameter Analysis • Root Cause Identification • Corrective Action Planning* |
| *0830 – 0930* | ***Kiln Operation Case Study 2: Ring Formation Event***<br>*Kiln Condition Before, During, After Ring Formation • Process Data Review • Response Strategy & Results • Preventive Practices Learned* |
| *0930 – 0945* | *Break* |
| *0945 – 1100* | ***Troubleshooting Workshop***<br>*Common Scenarios: Temperature Drop, High CO, False Air • Group Discussion & Diagnostic Thinking • Developing Corrective & Preventive Actions • Control Logic Validation* |
| *1100 – 1230* | ***Performance Indicators & Benchmarking***<br>*Key KPIs: Clinker Production, Thermal/Electrical Consumption • Availability, Run Factor & Kiln Uptime • Comparison with Industry Benchmarks • Continuous Improvement Planning* |
| *1230 – 1245* | *Break* |
| *1245 – 1345* | ***Team Collaboration & Operator Best Practices***<br>*Shift Handover & Communication Protocols • Daily Reporting Formats & Operational Logs • Operator Responsibility in Kiln Protection • Training & Mentoring of New Operators* |
| *1345 – 1400* | ***Course Conclusion***<br>*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**

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