5-Day Cement Industry Training Course
In

ALTERNATIVE FUEL IN CEMENT PRODUCTION (SITE VISIT)

Cairo - Egypt, 05 – 09 Oct. 2026

COURSE LEVEL: INTERMEDIATE TO ADVANCED

COURSE OVERVIEW:

The utilization of alternative fuels in the cement industry represents a critical shift toward sustainable manufacturing and circular economy principles. This course defines the meaning of co-processing, where waste materials such as tires, biomass, and industrial sludges are used as energy sources in the kiln. By replacing traditional fossil fuels, cement plants can significantly reduce their carbon footprint while managing communal waste streams effectively.

The scope of this training extends from the initial selection and chemical analysis of waste materials to the technical modifications required for kiln injections. Participants will explore the thermodynamic impacts of various fuel types on clinker quality and kiln stability. The program also addresses the logistical challenges of material handling, storage, and the rigorous environmental regulations governing emissions and residue disposal.

Coverage includes a comprehensive breakdown of the feeding systems, combustion kinetics, and the economic feasibility of switching to non-conventional energy sources. Through detailed technical sessions and a structured site visit, the course provides a practical roadmap for optimizing kiln operations. Attendees will gain hands-on insights into how pre-processing and quality control ensure that alternative fuels do not compromise the integrity of the final cement product.

COURSE OBJECTIVES:

After completion of this course, the participants will be able to:

- Identify and categorize different types of alternative fuels suitable for cement kiln co-processing.
- Analyze the chemical composition and calorific value of waste-derived fuels for energy efficiency.
- Evaluate the impact of moisture content and volatile matter on kiln flame temperature and stability.
- Implement safety protocols for the handling and storage of hazardous and non-hazardous waste materials.
- Design efficient feeding and dosing systems for solid and liquid alternative fuels into the pre-calciner.
- Assess the effects of chlorine and sulfur cycles on refractory lining and bypass systems.

- Monitor and control gas emissions to ensure compliance with international environmental standards.
- Optimize the combustion process to prevent the formation of carbon monoxide and organic pollutants.
- Calculate the substitution rate and the resulting cost savings compared to traditional coal or oil.
- Troubleshoot operational issues related to build-ups and blockages caused by alternative fuel usage.
- Conduct a life cycle assessment of the environmental benefits of waste-to-energy in cement production.
- Prepare a comprehensive technical report on kiln performance during the integration of new fuel streams.

TARGET AUDIENCE:

This course is designed for Plant Managers, Production Engineers, Kiln Operators, Environmental Compliance Officers, Sustainability Managers, and Maintenance Supervisors working within the cement and heavy manufacturing industries.

TRAINING COURSE METHODOLOGY:

A highly interactive combination of lectures, discussion sessions, and case studies will be employed to maximize the transfer of information, knowledge, and experience. The course will be intensive, practical, and highly interactive. The sessions will start by raising the most relevant questions and motivating everybody to find the right answers. The attendants will also be encouraged to raise more of their questions and to share in developing the right answers using their analysis and experience. There will also be some indoor experiential activities to enhance the learning experience. Course material will be provided in PowerPoint, with necessary animations, learning videos, and general discussions.

The course participants shall be evaluated before, during, and at the end of the course.

COURSE CERTIFICATE:

National Consultant Centre for Training LLC (NCC) will issue an Attendance Certificate to all participants completing a minimum of 80% of the total attendance time requirement.

COURSE OUTLINE / COURSE CONTENT:

MODULE 1: FUNDAMENTALS OF CO-PROCESSING IN CEMENT KILNS

- Definition and history of alternative fuels in heavy industry.
- The role of the cement industry in the global circular economy.
- Comparison between incineration and co-processing techniques.
- Basic thermodynamic requirements for successful fuel substitution.
- Regulatory frameworks and international waste management standards.

MODULE 2: CHARACTERIZATION AND SELECTION OF WASTE FUELS

- Classification of municipal, industrial, and agricultural waste.
- Chemical analysis: ash content, heavy metals, and chlorine levels.
- Determining Net Calorific Value (NCV) and its impact on fuel consumption.
- Physical properties: particle size distribution and bulk density.
- Criteria for selecting high-quality alternative fuel suppliers.

MODULE 3: PRE-PROCESSING AND STORAGE INFRASTRUCTURE

- Shredding and drying technologies for Refuse Derived Fuel (RDF).
- Blending and homogenization techniques for consistent fuel quality.
- Design of storage silos and bunkers for different material types.
- Fire detection and suppression systems in waste storage areas.
- Odor control and dust management in the pre-processing plant.

MODULE 4: MECHANICAL FEEDING AND DOSING SYSTEMS

- Pneumatic versus mechanical conveying systems for waste solids.
- Precision dosing and weighing equipment for kiln stability.
- Injection points: Main burner versus pre-calciner and kiln inlet.
- Air lock systems and double flap valves for pressure maintenance.
- Troubleshooting common blockages in the fuel delivery line.

MODULE 5: COMBUSTION KINETICS AND KILN THERMODYNAMICS

- Understanding the oxygen requirements for alternative fuel combustion.
- Impact of alternative fuels on flame shape and heat transfer.
- Managing the residence time for complete burnout of large particles.
- The effect of secondary and tertiary air temperatures on ignition.
- Modeling the thermal profile of the kiln with high substitution rates.

MODULE 6: IMPACT ON CLINKER CHEMISTRY AND QUALITY

- Changes in clinker mineralogy due to ash incorporation from fuels.
- Managing the alkali-sulfur ratio and chlorine bypass requirements.
- Impact on setting time and strength development of the final cement.
- Monitoring minor elements and their limits in the clinker.
- Adjusting the raw mix design to compensate for fuel ash.

MODULE 7: EMISSIONS MONITORING AND ENVIRONMENTAL IMPACT

- Continuous Emission Monitoring Systems (CEMS) for NOx and SO2.
- Strategies for controlling dioxins and furans during co-processing.
- Heavy metal leaching and immobilization within the clinker matrix.
- Particulate matter control and electrostatic precipitator efficiency.
- Reporting and documentation for environmental regulatory bodies.

MODULE 8: REFRACTORY MANAGEMENT AND KILN COATINGS

- Influence of alternative fuels on the chemical attack of bricks.
- Monitoring coating thickness and stability in the burning zone.
- Selecting refractory materials resistant to chlorine and alkalis.

- Thermal imaging and shell temperature monitoring techniques.
- Preventing rings and build-ups in the preheater and riser duct.

MODULE 9: OPERATIONAL SAFETY AND RISK ASSESSMENT

- Hazardous material handling and personal protective equipment.
- Explosion protection (ATEX) standards for dust-prone areas.
- Emergency shutdown procedures during fuel system failures.
- Risk assessment for manual handling and mechanical maintenance.
- Health monitoring for staff exposed to specific waste types.

MODULE 10: ECONOMIC FEASIBILITY AND COST OPTIMIZATION

- Calculating the Total Cost of Ownership (TCO) for fuel systems.
- Analyzing the gate fee versus the procurement cost of waste.
- Carbon credit mechanisms and their impact on plant profitability.
- Maintenance costs associated with high-wear alternative fuels.
- Return on Investment (ROI) for upgrading kiln feeding infrastructure.

MODULE 11: SITE VISIT AND PRACTICAL DEMONSTRATION

- Guided tour of the alternative fuel pre-processing facility.
- Observation of the kiln control room and dosing monitoring.
- Inspection of the feeding points and burner pipe configuration.
- Review of the on-site laboratory for fuel quality testing.
- Discussion with plant engineers on daily operational challenges.

MODULE 12: STRATEGIC PLANNING AND FUTURE TRENDS

- Developing a long-term alternative fuel implementation roadmap.
- Innovations in plasma gasification and hydrogen enrichment.
- Digitalization and AI in optimizing fuel substitution rates.
- Community engagement and public perception of waste co-processing.
- Final review and course wrap-up session.