5-Day Cement Industry Training Course
In

CEMENT MANUFACTURING PROCESS AND QUALITY (SITE VISIT)

Cairo - Egypt, 24 – 28 Aug. 2026

COURSE LEVEL: INTERMEDIATE

COURSE OVERVIEW:

The relationship between the manufacturing process and the final quality of cement is the core focus of this technical program. This course defines how operational parameters at each stage of production—from the raw mix design to the kiln temperature—directly influence the chemical and physical properties of the finished product. By understanding this cause-and-effect relationship, participants will learn how to optimize the process to meet specific quality targets.

The scope of this training includes the study of process control limits and the interpretation of laboratory data to make real-time operational adjustments. It covers the mineralogical development of clinker and how it is affected by heating and cooling rates, as well as the impact of grinding fineness on cement performance. Furthermore, the course addresses the management of "non-conforming" products and the strategies used to ensure consistent quality in a variable production environment.

Coverage includes detailed modules on X-ray analysis, microscopy, and physical testing protocols. Through a structured site visit, participants will see how the process team and the quality control team collaborate, using sophisticated software and instrumentation to monitor the plant. Attendees will develop the skills to troubleshoot quality deviations and implement process improvements that enhance the durability and strength of the cement produced.

COURSE OBJECTIVES:

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

- Describe how each stage of the cement process affects product quality.
- Analyze raw material chemistry to design an optimal raw mix.
- Monitor the kiln's thermal profile to ensure proper clinker mineralogy.
- Explain the impact of cooling rates on the reactivity of C3S and C3A.
- Control the grinding process to achieve target particle size distributions.
- Use laboratory results to adjust process set-points in the control room.
- Identify the causes of quality defects such as high free lime or low strength.
- Understand the role of minor elements (alkalis, Cl, S) in process stability.
- Implement a Quality Management System (QMS) based on ISO 9001.
- Perform basic clinker microscopy to evaluate burning conditions.
- Manage the quality of alternative fuels and their impact on the product.

- Prepare quality reports and trend analyses for plant management.

TARGET AUDIENCE:

This course is intended for Process Engineers, Quality Control Managers, Shift Supervisors, Chemists, and Senior Operators who are responsible for maintaining product standards.

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: INTRODUCTION TO PROCESS-QUALITY CORRELATION

- Defining quality in the context of cement manufacturing.
- The economic impact of quality deviations.
- Overview of the production flow and critical control points (CCP).
- Understanding customer requirements and standard specifications.
- The role of the process engineer in quality assurance.

MODULE 2: RAW MIX OPTIMIZATION AND QUALITY

- Impact of limestone purity on kiln energy and clinker quality.
- Controlling the Lime Saturation Factor (LSF) for consistency.
- Role of the Silica and Alumina moduli in melt formation.
- Managing raw meal fineness and its effect on burnability.
- Correcting raw mix deviations in the homogenization silo.

MODULE 3: KILN PROCESS CONTROL AND CLINKER QUALITY

- Temperature control in the burning zone and C3S formation.
- The importance of a stable kiln coating for product consistency.
- Impact of oxidizing versus reducing conditions on clinker color and chemistry.
- Managing the "liter weight" as an indicator of burning degree.
- Troubleshooting high free lime and its impact on cement soundness.

MODULE 4: CLINKER MINERALOGY AND MICROSCOPY

- Introduction to the four main clinker phases: Alite, Belite, Aluminate, Ferrite.
- Using microscopy to analyze crystal size and distribution.
- Identifying "over-burned" and "under-burned" clinker.
- Impact of cooling rates on the crystal structure of Alite.
- Correlation between mineralogy and cement strength development.

MODULE 5: GRINDING PROCESS AND PRODUCT FINENESS

- Controlling the Blaine value and its effect on water demand.
- Particle size distribution (PSD) and its impact on strength.
- Managing the addition of gypsum to control setting time.
- The effect of grinding temperature on gypsum dehydration.
- Quality impacts of using different types of grinding circuits.

MODULE 6: BLENDED CEMENTS AND ADDITIVE QUALITY

- Chemical and physical requirements for fly ash, slag, and pozzolana.
- Determining the optimal replacement level for performance.
- Managing the quality of limestone fillers in cement.
- Challenges in maintaining consistency with multi-component blends.
- Testing protocols for supplementary cementitious materials.

MODULE 7: MINOR ELEMENTS AND PROCESS RECIRCULATION

- Monitoring the sulfur and chlorine cycles in the kiln.
- Impact of alkalis on the alkali-silica reaction (ASR) in concrete.
- Using bypass systems to remove harmful elements.
- The effect of minor elements on setting time and strength.
- Managing the quality impact of using alternative raw materials.

MODULE 8: LABORATORY INSTRUMENTATION FOR QUALITY

- X-ray Fluorescence (XRF) for rapid chemical monitoring.
- X-ray Diffraction (XRD) for direct mineralogical analysis.
- Automatic sampling systems and their representativeness.
- Physical testing: setting time, expansion, and compressive strength.
- Statistical Process Control (SPC) and quality charting.

MODULE 9: ALTERNATIVE FUELS AND QUALITY IMPACTS

- Managing the ash chemistry of waste-derived fuels.
- Impact of fuel moisture and volatiles on kiln stability.
- Trace elements and heavy metals in the final product.
- Adjusting the raw mix to compensate for fuel ash.
- Environmental monitoring and product safety.

MODULE 10: QUALITY MANAGEMENT SYSTEMS (QMS)

- Implementing ISO 9001 in a cement plant.

- Documentation and record-keeping for quality audits.
- Handling non-conforming products and root cause analysis.
- Continuous improvement strategies (Six Sigma, Kaizen).
- Training and competency requirements for lab and process staff.

MODULE 11: SITE VISIT: PROCESS AND QC INTEGRATION

- Tour of the central control room and monitoring of quality KPIs.
- Review of the raw meal and clinker sampling stations.
- Hands-on look at the laboratory analysis and reporting.
- Discussion with the quality manager on typical process-quality issues.
- Review of the cement dispatch and certification process.

MODULE 12: COURSE CONCLUSION AND FINAL WORKSHOP

- Case study: Solving a low-strength problem in the plant.
- Final knowledge assessment and group discussion.
- Summary of key takeaways for process-quality optimization.
- Feedback and course evaluation.