مركز المستشار الوطني للتدريب
National Consultant Centre For Training
YOUR GATE TO HANDS-ON TRAINING

5-Day Cement Industry Training Course
In

FUNDAMENTALS OF POWER SYSTEMS IN CEMENT PLANTS

Abu Dhabi - UAE, 05 – 09 Jan. 2026

COURSE LEVEL: INTERMEDIATE

COURSE OVERVIEW:

The reliable operation of a cement plant is entirely dependent on the integrity and efficiency of its electrical power system. This course defines the architecture of industrial power distribution, from the high-voltage utility intake to the low-voltage motor control centers that drive the process. By understanding the flow of electricity and the coordination of protection devices, participants will learn how to maintain power quality and prevent costly unplanned outages.

The scope of this training includes the technical management of transformers, switchgear, and large AC motors which constitute the bulk of the electrical load. It covers the principles of power factor correction, harmonic mitigation, and the importance of a robust earthing system in a high-dust environment. Furthermore, the course addresses the integration of captive power plants and waste heat recovery systems into the main plant grid, ensuring a stable and resilient energy supply.

Coverage includes detailed modules on protective relaying, circuit breaker maintenance, and the diagnostic tools used for electrical fault analysis. Through technical simulations and case studies, participants will learn how to interpret single-line diagrams and manage load-shedding protocols during grid instability. Attendees will gain the technical expertise required to oversee the electrical infrastructure of a modern cement facility, prioritizing safety, reliability, and energy efficiency.

COURSE OBJECTIVES:

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

- Describe the typical layout and components of a cement plant power system.
- Interpret complex Single Line Diagrams (SLD) and electrical schematics.
- Understand the function and maintenance of high-voltage transformers.
- Manage Medium Voltage (MV) and Low Voltage (LV) switchgear operations.
- Explain the principles of overcurrent, short-circuit, and earth-fault protection.
- Analyze the impact of power factor on energy costs and system capacity.
- Identify the sources and effects of harmonics in a variable-speed drive environment.
- Implement effective earthing and lightning protection for plant structures.
- Execute safe switching procedures and "Lockout Tagout" for power circuits.
- Monitor power quality parameters using advanced metering infrastructure.
- Troubleshoot common electrical faults using root cause analysis techniques.
- Evaluate the benefits of Waste Heat Recovery (WHR) integration into the grid.

TARGET AUDIENCE:

This course is intended for Electrical Engineers, Maintenance Supervisors, Power Plant Operators, and Senior Electrical Technicians.

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: INDUSTRIAL POWER DISTRIBUTION ARCHITECTURE

- Overview of the power value chain: Generation, Transmission, and Distribution.
- Design of the Main Intake Substation (MIS) in cement plants.
- Understanding radial, ring, and mesh distribution topologies.
- Role of the Power Management System (PMS) in industrial control.
- Safety standards and regulations for high-voltage installations.

MODULE 2: TRANSFORMERS AND VOLTAGE REGULATION

- Principles of electromagnetic induction and transformer design.
- Cooling methods: ONAN, ONAF, and forced oil systems.
- Managing "Tap Changers" for voltage stability.
- Transformer protection: Buchholz relays, oil temperature, and pressure.
- Dissolved Gas Analysis (DGA) for predictive maintenance.

MODULE 3: SWITCHGEAR AND CIRCUIT BREAKERS

- Types of MV switchgear: Air, Vacuum, and SF6 insulation.
- Arc quenching mechanisms and circuit breaker ratings.
- Busbar configurations and interlocking logic.
- Maintenance of contactors and secondary injection testing.
- Safe operation of "Withdrawable" vs. "Fixed" switchgear units.

MODULE 4: PROTECTION COORDINATION AND RELAYING

- Function of Numerical Relays in modern power systems.
- Time-current grading and discrimination principles.
- Differential protection for large motors and transformers.
- Role of Instrument Transformers (CTs and VTs).
- Analyzing "Trip Logs" and event sequences after a fault.

MODULE 5: POWER QUALITY: POWER FACTOR AND HARMONICS

- Understanding Active, Reactive, and Apparent Power (kW, kVAR, kVA).
- Benefits of Capacitor Banks and Automatic Power Factor Controllers (APFC).
- Impact of non-linear loads (VFDs) on the electrical waveform.
- Passive vs. Active Harmonic Filters in cement plant grids.
- Power quality auditing: Measuring THD and voltage sags.

MODULE 6: LARGE MOTORS AND STARTING METHODS

- Operation of Squirrel Cage and Slip Ring Induction Motors.
- Comparison of starting methods: DOL, Star-Delta, and Soft Starters.
- High-power Variable Frequency Drives (VFD) for process fans.
- Motor protection: Thermal overload, stall, and phase unbalance.
- Vibration and insulation resistance (Megger) testing.

MODULE 7: EARTHING AND LIGHTNING PROTECTION

- Types of system earthing: Solidly earthed, NGR, and unearthed.
- Design of the plant earthing grid and soil resistivity impact.
- Equipotential bonding for silos and conveyor galleries.
- Maintenance of lightning arrestors and surge protection devices.
- Measuring earth electrode resistance and grid integrity.

MODULE 8: EMERGENCY AND BACKUP POWER SYSTEMS

- Role of Diesel Generators (DG) in protecting the kiln and bearings.
- Uninterruptible Power Supply (UPS) for DCS and instrumentation.
- Critical load identification and automated changeover logic.
- Battery bank maintenance and charger health monitoring.
- Black-start procedures after a total plant blackout.

MODULE 9: ELECTRICAL SAFETY AND ARC FLASH MANAGEMENT

- Hazardous area classification for electrical installations.
- Personal Protective Equipment (PPE) for arc flash protection.
- Creating safe work zones and permit-to-work systems.
- Safety interlocks between the DCS and the electrical system.
- Emergency response to electrical fires and shock incidents.

MODULE 10: CAPTIVE POWER AND WHR INTEGRATION

- Operating a Captive Power Plant (CPP) in parallel with the grid.
- Synchronization requirements: Voltage, Frequency, and Phase.

- Managing the "Export/Import" balance with the utility.
- Challenges of integrating intermittent Waste Heat Recovery power.
- Load shedding strategies to prevent total system collapse.

MODULE 11: ELECTRICAL MAINTENANCE AND RELIABILITY

- Thermographic inspections of panels and terminations.
- Partial Discharge (PD) monitoring for high-voltage assets.
- Scheduling preventive maintenance during plant shutdowns.
- Managing electrical spare parts and critical inventory.
- Root Cause Analysis (RCA) for recurring electrical failures.

MODULE 12: COURSE CONCLUSION AND ASSESSMENT

- Practical workshop: Solving power system fault scenarios.
- Final examination on power system fundamentals.
- Summary of key takeaways for plant reliability.
- Course feedback and continuous improvement ideas.