5-Day Cement Industry Training Course
In

CO AT PREHEATER EXIT

Abu Dhabi - UAE, 09 – 13 Nov. 2026

COURSE LEVEL: INTERMEDIATE

COURSE OVERVIEW:

Monitoring Carbon Monoxide (CO) at the preheater exit is a vital diagnostic practice for assessing the overall thermal efficiency and safety of the kiln system. This course defines the specific origins of CO within the preheater tower, differentiating between combustion-derived CO and CO generated from the organic matter in raw materials. By understanding these distinctions, participants will learn how to accurately interpret gas data to optimize the calcination process.

The scope of this training includes an analysis of the gas flow through the multiple cyclone stages and the impact of the preheater's internal environment on CO oxidation. It covers the technical management of the ID fan, the monitoring of "false air" ingress, and the safety implications for downstream bag filters and electrostatic precipitators. Furthermore, the course addresses the role of CO as an early indicator of process instabilities, such as blockages or material surges within the preheater.

Coverage includes the calibration of gas sensors at the top of the preheater tower, the impact of raw meal moisture on gas readings, and the strategies for managing CO spikes during kiln start-up and shut-down. Through practical exercises, participants will learn how to balance the thermal load between the kiln and the precalciner to maintain low CO levels at the exit. Attendees will gain the technical proficiency required to enhance fuel efficiency and ensure the safe operation of the preheater system.

COURSE OBJECTIVES:

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

- Identify the sources of CO at the preheater exit (fuel vs. raw material).
- Explain the impact of raw material "organics" on preheater gas chemistry.
- Monitor the O2 and CO profile across the cyclone stages.
- Assess the risk of CO build-up in the preheater and downstream ducts.
- Optimize the ID fan speed to ensure proper gas residence time for CO burnout.
- Calibrate and maintain gas analyzers at the preheater tower top.
- Understand the safety relationship between CO levels and dust filter operation.
- Detect and mitigate "false air" ingress that masks true CO levels.
- Analyze the effect of precalciner temperature on CO at the exit.
- Troubleshoot gas sampling errors caused by high dust and moisture.
- Calculate the heat loss associated with CO at the preheater exit.

- Prepare technical reports on preheater efficiency and emission compliance.

TARGET AUDIENCE:

This course is intended for Kiln Operators, Process Engineers, Energy Managers, and Environmental Compliance Officers.

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: GAS DYNAMICS IN THE PREHEATER TOWER

- Overview of the gas-material heat exchange in cyclones.
- Gas velocity and residence time requirements for CO oxidation.
- The difference between CO at the kiln inlet vs. preheater exit.
- Understanding the impact of the "Induced Draft" on gas chemistry.
- Safety standards for preheater gas monitoring.

MODULE 2: SOURCES OF CO: RAW MATERIALS VS. FUEL

- Identifying organic carbon in limestone and clay.
- The temperature ranges for organic matter decomposition.
- Differentiating between combustion-derived CO and material-derived CO.
- Impact of "Pyritic Sulfur" and organic matter on CO spikes.
- Laboratory testing for Total Organic Carbon (TOC) in raw meal.

MODULE 3: PRECALCINER IMPACT ON EXIT GASES

- Role of the precalciner in CO generation and destruction.
- Managing the "Oxygen Buffer" in the calciner.
- Impact of tertiary air flow on preheater CO levels.
- Optimizing the calciner burner to minimize unburned carbon.
- Effect of meal-to-fuel ratio on combustion efficiency.

MODULE 4: MONITORING AND ANALYZER TECHNOLOGY

- Positioning of gas probes for representative exit readings.
- Handling high-dust environments at the preheater top.
- Technology of infrared (IR) and electrochemical CO sensors.
- Managing probe purging and filter cleaning cycles.
- Redundancy in gas analysis for safety-critical trips.

MODULE 5: FALSE AIR AND ITS CONSEQUENCES

- Sources of air ingress: expansion joints, manholes, and valves.
- The "Dilution Effect": how false air hides high CO levels.
- Impact of false air on the ID fan power and kiln capacity.
- Techniques for detecting and sealing air leaks in the tower.
- Calculating the "Leakage Rate" based on O2 change.

MODULE 6: SAFETY TRIPS AND DUST FILTERS

- CO limits for safe operation of Electrostatic Precipitators.
- Logic for "Gas Trip" systems and automated shutdowns.
- Risks of CO accumulation in the Raw Mill during "Mill On" operation.
- Managing CO during unstable kiln conditions and surges.
- Safety protocols for gas duct cleaning.

MODULE 7: HEAT LOSS AND THERMAL EFFICIENCY

- Calculating the "Combustion Efficiency" of the preheater.
- Impact of 1% CO on the specific heat consumption (kcal/kg).
- Correlating CO levels with the preheater exit temperature.
- Benefits of high-efficiency cyclones in reducing CO.
- Energy audit procedures for the preheater gas circuit.

MODULE 8: OPERATIONAL TROUBLESHOOTING

- Identifying the causes of sudden CO increases at the exit.
- Dealing with "Surges" of raw meal and their impact on CO.
- Solving the problem of analyzer drift and calibration errors.
- Managing gas flow during "Raw Mill Off" transitions.
- Root cause analysis of incomplete burnout in the tower.

MODULE 9: START-UP AND SHUT-DOWN DYNAMICS

- Managing CO levels during the kiln heating-up phase.
- Risks of CO peaks during the introduction of fuel to the calciner.
- Safety monitoring during "Purge" cycles.
- Controlling the ID fan during transition states.
- Preventing CO build-up in the downcomer duct.

MODULE 10: ALTERNATIVE FUELS AND PREHEATER CO

- Impact of "Volatile Heavy" alternative fuels on exit gas.

- Managing the "Burning Zone" of the calciner for waste fuels.
- Trace elements in alternative fuels and their gas signatures.
- Case study: optimizing a kiln for 100% alternative fuel.
- Environmental monitoring of total carbon emissions.

MODULE 11: ENVIRONMENTAL AND REGULATORY COMPLIANCE

- Continuous Emission Monitoring (CEMS) at the main stack.
- Compliance with local environmental air quality standards.
- Reporting CO as part of the greenhouse gas inventory.
- Public safety and odor control related to CO emissions.
- Impact of CO on the "Carbon Intensity" of the cement.

MODULE 12: COURSE WRAP-UP AND ASSESSMENT

- Practical exercise: interpreting a preheater gas trend log.
- Final exam on CO monitoring and control.
- Group discussion: future of low-emission preheater design.
- Closing remarks and course feedback.