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

**5-Day Cement Industry Training Course**
**In**

# GRINDING TECHNOLOGY AND EFFICIENCY IN CEMENT PLANTS (SITE VISIT)

**Cairo - Egypt, 05 – 09 Jan. 2026**

**COURSE LEVEL: INTERMEDIATE**

## COURSE OVERVIEW:

Efficiency in the grinding department is a critical driver of the overall profitability and sustainability of a cement plant. This course defines the technical strategies used to optimize grinding performance, focusing on the reduction of specific energy consumption (kWh/ton) and the maximization of throughput. By combining mechanical knowledge with process optimization, participants will learn how to fine-tune the milling circuit for peak efficiency.

The scope of this training involves a deep dive into advanced classification technology, the impact of grinding aids, and the optimization of the ball charge or roller pressure. It covers the heat balance of the mill, the efficiency of the separator (Tromp Curve analysis), and the management of "False Air" which often degrades fan performance. Furthermore, the course addresses the role of "Expert Systems" and automated control loops in maintaining stable and efficient mill operation.

Coverage includes detailed modules on the wear management of liners and rollers, the calculation of circulation factors, and the influence of clinker mineralogy on "grindability." Through an analytical site visit, participants will perform on-site measurements and review historical data to identify bottlenecks in the grinding circuit. Attendees will gain the technical proficiency required to implement energy-saving initiatives and improve the "Blaine-to-Power" ratio of the plant.

## COURSE OBJECTIVES:

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

- Calculate the specific power consumption of a grinding circuit.
- Optimize the "Tromp Curve" to improve separator efficiency.
- Analyze the impact of "False Air" on mill fan energy use.
- Evaluate the benefits of different grinding media size distributions.
- Implement the use of grinding aids (chemical additives) for throughput.
- Manage the "Heat Balance" of the mill to prevent overheating.
- Understand the relationship between mill ventilation and product fineness.
- Optimize the "Hydraulic Pressure" and "Table Speed" in a VRM.
- Use "Electronic Ear" data to stabilize the mill filling level.
- Conduct a "Circulating Load" calculation to identify bottlenecks.
- Implement "Predictive Maintenance" for mill liners and wear parts.
- Design a cost-reduction strategy for the cement grinding department.

## TARGET AUDIENCE:

This course is intended for Process Engineers, Mill Operators, Production Managers, and Energy Efficiency Auditors.

## 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: THE ECONOMICS OF GRINDING EFFICIENCY

- Energy cost breakdown in cement manufacturing.
- Benchmarking mill performance against international standards.
- The impact of 1 kWh/ton saving on the plant's bottom line.
- Introduction to the "Energy Efficiency Audit" for mills.
- Safety and operational stability as foundations for efficiency.

### MODULE 2: ADVANCED SEPARATOR OPTIMIZATION

- Mechanics of third-generation high-efficiency separators.
- Calculating the "Bypass" and "Imperfection" of the separator.
- Adjusting the "Air-to-Solids" ratio for better classification.
- Impact of rotor cage design on the particle size distribution.
- Troubleshooting separator vibrations and wear.

### MODULE 3: BALL MILL EFFICIENCY AND MEDIA OPTIMIZATION

- Mathematical models for ball charge selection.
- Monitoring the "Power-to-Media" ratio.
- Impact of "Classifying Liners" on grinding performance.
- Managing the "Internal Moisture" and "Mill Ventilation."
- Determining the optimal "Diaphragm Opening" for material flow.

**MODULE 4: VERTICAL ROLLER MILL (VRM) OPTIMIZATION**

- Managing the "Grinding Bed" thickness and stability.
- Impact of "Table Speed" on material residence time.
- Optimizing "Nozzle Ring" velocity for material lift.
- Fine-tuning the hydraulic "S-Curve" for pressure control.
- Reducing the "Water Injection" rate through process adjustment.

**MODULE 5: CHEMICAL GRINDING AIDS AND PERFORMANCE**

- Mechanism of "Pack-Set" reduction and dispersancy.
- Selecting the right grinding aid for specific cement types.
- Calculating the Return on Investment (ROI) for chemical additives.
- Impact of grinding aids on cement "Flowability" and "Strength."
- Safe storage and dosing of chemical additives.

**MODULE 6: FAN EFFICIENCY AND SYSTEM RESISTANCE**

- Characteristics of large process fans: Centrifugal vs. Axial.
- Impact of system "Pressure Drop" on energy consumption.
- Managing "False Air" ingress: Seals, dampers, and expansion joints.
- Using Variable Frequency Drives (VFD) for fan speed control.
- Fan performance curves and "Stall" prevention.

**MODULE 7: MILL HEAT BALANCE AND COOLING**

- Sources of heat in the grinding process (Friction and Impact).
- Managing mill exit temperatures for quality and safety.
- Efficiency of internal water spray systems.
- External cooling: Cement coolers and vertical heat exchangers.
- Impact of temperature on gypsum "Dehydration" and setting time.

**MODULE 8: WEAR MANAGEMENT AND LIFECYCLE COST**

- Abrasivity of clinker and raw materials.
- Selecting "High-Chrome" vs. "Manganese" steel components.
- Monitoring wear rates through "Profile Measurements."
- Hard-facing and "On-Site Welding" for roller refurbishment.
- Strategic planning for mill liner and media replacement.

**MODULE 9: AUTOMATION AND EXPERT SYSTEMS**

- Role of "Fuzzy Logic" and AI in mill control.
- Implementing "Automated Fineness Control" loops.
- Integrating "Real-Time Particle Size Analyzers" into the DCS.
- Using "Big Data" to predict mill trips and inefficiencies.
- Benefits of "Unmanned" mill operation.

**MODULE 10: SITE VISIT: PRACTICAL EFFICIENCY AUDIT**

- On-site measurement of "False Air" and system pressures.
- Review of the DCS "Trend Logs" for mill stability.

- Visual inspection of the "Separator" and "Reject" circuit.
- Discussion with the process team on recent efficiency gains.
- Identifying "Energy Leaks" in the auxiliary transport systems.

**MODULE 11: TROUBLESHOOTING INEFFICIENCIES**

- Solving the problem of "High Circulation" and "Low Output."
- Dealing with "Coating" issues on grinding media.
- Reducing "Specific Power" spikes during mill start-ups.
- Root cause analysis of "Separator Plugging."
- Managing "Quality Fluctuations" in a high-efficiency circuit.

**MODULE 12: FINAL ASSESSMENT AND STRATEGIC PLANNING**

- Final exam on grinding technology and efficiency.
- Developing a "Personal Action Plan" for plant improvement.
- Group presentation on a simulated efficiency project.
- Course feedback and summary.