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

5-Day Cement Industry Training Course
In

CHEMICALS USED IN THE WASTEWATER TREATMENT PLANT

Dubai - UAE, 10 – 14 Aug. 2026

COURSE LEVEL: INTERMEDIATE

COURSE OVERVIEW:

The effective treatment of industrial and municipal wastewater relies heavily on a sophisticated array of chemical interventions to remove contaminants and ensure environmental safety. This course defines the specific roles of coagulants, flocculants, pH adjusters, and disinfectants used within a treatment facility. By understanding the chemical interactions between these agents and the pollutants in water, participants will learn how to optimize the purification process.

The scope of this training covers the entire chemical treatment cycle, from the initial neutralization of raw effluent to the final disinfection of treated water. it explores the mechanics of chemical dosing, the safety protocols for handling hazardous substances, and the environmental impact of chemical residues. Furthermore, the course addresses the role of chemical precipitation in removing heavy metals and phosphorus, which is critical for compliance with modern water quality standards.

Coverage includes the principles of the "Jar Test" for determining optimal dosages, the management of sludge through chemical conditioning, and the monitoring of chemical oxygen demand (COD) and biological oxygen demand (BOD). Through technical workshops, participants will learn how to troubleshoot chemical imbalances and manage the storage and inventory of specialized treatment chemicals. Attendees will gain the technical expertise required to operate a chemically efficient and environmentally compliant wastewater treatment plant.

COURSE OBJECTIVES:

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

- Classify the different categories of chemicals used in wastewater treatment.
- Explain the chemical process of coagulation and flocculation.
- Determine the correct dosage of chemicals using the standard Jar Test.
- Adjust the pH of wastewater using acids and bases safely.
- Describe the function of oxidizing and reducing agents in water treatment.
- Select appropriate disinfectants such as chlorine, ozone, or UV.
- Manage the storage and handling of hazardous chemicals according to MSDS.
- Optimize the removal of heavy metals through chemical precipitation.
- Understand the role of polymers in sludge dewatering and thickening.
- Monitor the effectiveness of chemical treatment through water quality analysis.
- Troubleshoot common chemical dosing and equipment failures.

- Comply with environmental regulations regarding chemical discharge limits.

TARGET AUDIENCE:

This course is intended for Wastewater Plant Operators, Chemical Technicians, Environmental Engineers, Maintenance Staff, and Health and Safety 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: PRINCIPLES OF CHEMICAL WATER TREATMENT

- Introduction to the wastewater treatment lifecycle.
- Why chemicals are necessary: physical vs. chemical removal.
- Overview of key water quality parameters: pH, TSS, COD, BOD.
- The impact of untreated wastewater on the environment.
- Safety and regulatory framework for chemical usage.

MODULE 2: COAGULANTS AND FLOCCULANTS

- Chemistry of inorganic coagulants: Alum, Ferric Chloride, and Ferric Sulfate.
- Understanding charge neutralization and the formation of "micro-floc."
- Organic polymers and polyelectrolytes: cationic, anionic, and non-ionic.
- Mechanics of flocculation: bridging and "sweep" coagulation.
- Impact of temperature and alkalinity on coagulant performance.

MODULE 3: pH ADJUSTMENT AND NEUTRALIZATION

- Common acids used: Sulfuric acid and Hydrochloric acid.
- Common bases used: Caustic soda (NaOH), Lime, and Magnesium Hydroxide.
- The chemistry of buffering and its importance in biological treatment.
- Managing the safety risks of high-concentration acids and bases.
- Automation of pH control: sensors, controllers, and dosing pumps.

MODULE 4: OXIDATION AND REDUCTION (REDOX) AGENTS

- Removing cyanide and chromium through redox reactions.
- Use of Sodium Metabisulfite and Ferrous Sulfate as reducing agents.
- Oxidizing agents: Hydrogen Peroxide, Potassium Permanganate, and Chlorine.
- Managing the odor of wastewater through chemical oxidation.
- Safety protocols for handling strong oxidizers.

MODULE 5: CHEMICAL PRECIPITATION OF METALS

- Removing heavy metals: Lead, Copper, Zinc, and Nickel.
- The role of sulfides and hydroxides in metal precipitation.
- Optimizing the pH for maximum metal removal efficiency.
- Treating phosphorus through chemical precipitation with metal salts.
- Managing the stability of precipitated metal sludge.

MODULE 6: DISINFECTION CHEMISTRY

- Chlorine-based disinfection: Gas, Hypochlorite, and Chlorine Dioxide.
- The formation of Disinfection By-Products (DBPs) and how to avoid them.
- Alternative disinfection: Ozone (O3) and UV radiation.
- De-chlorination techniques using Sulfur Dioxide or Carbon.
- Measuring "Residual Chlorine" to ensure safety.

MODULE 7: SLUDGE CONDITIONING AND DEWATERING

- Chemistry of sludge: bound water vs. free water.
- Using lime and ferric salts for inorganic sludge conditioning.
- The role of high-molecular-weight polymers in centrifuge and press performance.
- Impact of chemical dosing on the final dryness of the sludge cake.
- Economic considerations of sludge chemical costs.

MODULE 8: SPECIALTY CHEMICALS AND DEFOAMERS

- Anti-foaming agents: silicone-based vs. oil-based.
- Using scale inhibitors to protect pipes and membranes.
- Nutrients for biological systems: Nitrogen and Phosphorus additions.
- Activated carbon for the removal of color and organic micropollutants.
- Bio-augmentation: adding specialized bacteria for specific contaminants.

MODULE 9: CHEMICAL DOSING SYSTEMS AND MAINTENANCE

- Design of chemical storage tanks and secondary containment.
- Operation of diaphragm and peristaltic dosing pumps.
- Calibration of flow meters and dosing controllers.
- Maintenance of piping, valves, and injection lances.
- Troubleshooting "air binding" and chemical crystallization in lines.

MODULE 10: THE JAR TEST AND LABORATORY ANALYSIS

- Purpose and methodology of the Jar Test.

- Interpreting Jar Test results to determine "Break-point" chlorination.
- Online sensors vs. laboratory testing for chemical control.
- Recording chemical consumption and treatment efficiency.
- Managing chemical inventory and supplier quality.

MODULE 11: CHEMICAL SAFETY AND EMERGENCY RESPONSE

- Understanding Safety Data Sheets (SDS) for all plant chemicals.
- Personal Protective Equipment (PPE) for chemical handling.
- Spill response procedures and containment strategies.
- First aid for chemical burns and inhalation.
- Training requirements for the Hazard Communication (HazCom) standard.

MODULE 12: COURSE CONCLUSION AND FINAL ASSESSMENT

- Case study: Optimizing a failing chemical treatment process.
- Final exam on wastewater chemicals and dosing.
- Group discussion on the future of "Green Chemicals."
- Closing remarks and course feedback.