CORE CONCEPT

Brine Management and Zero Liquid Discharge Course: Outfalls, MVR Evaporators and Brine Mining

4 – 8 April 2027
Riyadh - KAFD district five-star

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Ref: 1950_29025 **Date:** 4 – 8 April 2027 **Location:** Riyadh - KAFD district five-star **Fees:** 20000 SAR

Introduction:

Brine management and zero liquid discharge, from desalination outfalls through MVR evaporators and crystallisers to brine mining, is a 1-week course for desalination, industrial water and environmental engineers that ends with a Brine Management and ZLD Option Plan for a case organisation. Organisations face saline plume concerns, costly evaporation ponds and thermal trains chosen without a salt balance or lifecycle cost view. Nominees already handle reject streams, sampling or project studies, and the course is taught as a modelling build on brine, plume and cost data. CoreConcept Training Center delivers this brine management and zero liquid discharge course.

Course Objectives:

- Characterise reject brine from membrane and thermal desalination and industrial sources by salinity, density, scaling ions and residual treatment chemicals
- Model near-field plume dilution for submerged outfalls and diffusers and compare predicted salinity excess with a mixing zone limit
- Size a brine concentrator, MVR evaporator and crystalliser train from mass and salt balances and specific energy figures
- Compare zero and minimal liquid discharge options on capital cost, energy, chemical use, solid residue and recovered water
- Screen recovery routes for sodium chloride, gypsum, magnesium, bromine and lithium from concentrated reject brine
- Assemble a Brine Management and ZLD Option Plan with a preferred disposal and recovery route for a case organisation

Target Audience:

- Desalination process engineering staff responsible for recovery ratio, concentrate quality and brine disposal routes
- Industrial water and utilities staff responsible for cooling tower blowdown, demineraliser regenerant and other saline reject streams
- Environmental engineering staff responsible for marine discharge monitoring, plume surveys and discharge permit data
- Project and technical studies staff responsible for evaluating evaporators, crystallisers and resource recovery options
- Operations support staff responsible for running or commissioning thermal brine concentration and salt handling units

Course Outline:

Day 1: Reject Brine Sources, Characterisation and Current Disposal Baseline

- Reject Brine Sources From Membrane and Thermal Desalination
- Industrial Saline Streams From Blowdown and Ion Exchange Regeneration
- Brine Analysis Sheet for Salinity, Density and Scaling Ions
- Residual Antiscalant, Coagulant and Cleaning Chemical Inventory in Concentrate
- Disposal Route Baseline From Outfall to Deep Well Injection

Day 2: Outfall Hydraulics, Dilution Modelling and Marine Receiving Limits

- Negatively Buoyant Plume Behaviour Along Seabed Contours
- Submerged Diffuser Port Spacing, Angle and Jet Velocity Design
- Near-Field Dilution Model Inputs From Currents and Bathymetry
- Mixing Zone Boundary and Salinity Excess Limit Setting
- Benthic Community Sensitivity Survey and Plume Monitoring Plan

Day 3: Brine Concentrators, MVR Evaporators and Crystalliser Trains

- Membrane Brine Concentration With High-Pressure and Electrodialysis Stages
- Falling Film Brine Concentrator With Calcium Sulphate Seeded Slurry
- MVR Compressor Duty, Temperature Rise and Specific Energy Calculation
- Forced Circulation Crystalliser Magma Density and Purge Ratio Control
- Mother Liquor Handling, Salt Cake Dewatering and Condensate Reuse

Day 4: ZLD and MLD Economics, Residue Risks and Brine Mining Routes

- Lifecycle Cost Model Comparing ZLD, MLD and Sea Disposal
- Evaporation Pond Liner Leakage and Land Footprint Risk Review
- Mixed Salt Residue Classification and Landfill Acceptance Testing
- Selective Recovery of Sodium Chloride, Gypsum and Magnesium Hydroxide
- Lithium and Bromine Extraction With Adsorbents and Ion Exchange

Day 5: Modelling Build of the Brine Management and ZLD Option Plan

- Case Organisation Brine Flow and Salt Balance Worksheet
- Case Outfall Dilution Check Against the Mixing Zone Limit
- Case Evaporator and Crystalliser Sizing With Energy Demand
- Case Option Ranking by Lifecycle Cost and Recovered Products
- Brine Management and ZLD Option Plan Completion and Peer Review

Skills You Will Gain:

- Reject Brine Characterisation
- Plume Dilution Modelling
- Diffuser Design Review
- Salt and Mass Balancing
- Thermal Concentration Sizing
- Crystalliser Purge Control
- Brine Disposal Cost Appraisal
- Mineral Recovery Screening

Why Attend This Course:

- Hand a Brine Management and ZLD Option Plan for a case organisation to the plant manager and the environmental lead for decision
- Choose between sea outfall upgrade, minimal liquid discharge and full zero liquid discharge using salt balances and lifecycle cost rather than vendor claims
- Avoid plume exceedances, leaking evaporation ponds and crystallisers that foul or produce unsaleable mixed salt
- Share brine analysis sheets, dilution worksheets and evaporator sizing templates with operations and project colleagues

Conclusion:

Once back at work, the participant presents the Brine Management and ZLD Option Plan to the plant manager, the environmental lead and the project sponsor. They use it to decide whether to upgrade the outfall diffuser, add a brine concentrator and crystalliser, or pilot salt and mineral recovery, and to fix target recovery, energy and residue figures. After the first pilot run or plume survey under the plan, the unit should compare measured dilution, energy use and salt purity with the plan estimates and revise the option ranking.

Frequently Asked Questions FAQ:

What should participants prepare before a brine management and zero liquid discharge course?

Participants should already handle reject streams, water sampling or project studies and be comfortable with mass balances on a spreadsheet. Bringing anonymised brine analyses, outfall layouts or energy data from their own site helps the modelling build reflect real conditions.

How does a brine management and zero liquid discharge course differ from a desalination plant operation course?

It starts where the desalination plant ends: the concentrate. Plant operation courses cover intakes, membranes and distillers producing water, while this course covers what happens to the reject stream through outfalls, thermal concentration, crystallisation and mineral recovery.

Why do zero liquid discharge systems need a brine concentrator before the crystalliser?

A concentrator removes most of the water at lower energy per cubic metre, so the crystalliser only handles a small, near-saturated flow. Skipping it makes the crystalliser larger, more energy hungry and harder to control for fouling and purge.

What do participants take back from the brine management and zero liquid discharge course?

Participants take back a Brine Management and ZLD Option Plan for a case organisation, with a brine analysis sheet, an outfall dilution check, evaporator and crystalliser sizing worksheets and a lifecycle cost ranking of disposal and recovery options.