Objectives and other details of module

Duration – 75 minutes

Training aids
Power point Presentation

Objective

At the end of the session participants will be able to:

- Explain problems in power plant chemistry areas – Water treatment plant, Cooling water treatment and Boiler & Feed Water
- State events leading to contaminant ingress
- Suggest actions for minimizing / eliminating/preventing contaminant ingress
- Perform process for chemical cleaning prior to commissioning and post long shut down.
- List out causes for chemistry excursions and undertake corrective actions for such excursions.
Problems in Power Plants in Different Areas

• **WATER TREATMENT PLANT**
  - Pre Treatment Area
  - DM Plant
  - RO/DM Plant

• **COOLING WATER TREATMENT**
  - Circulating Water
  - Condenser Water Quality

• **BOILER & FEED WATER**
• **PRE TREATMENT AREA**

  - Coagulation
  - Telescopic Sludge removal device
  - Colloidal Silica

• **DM PLANT**

  - Filter
  - Gravity Filter
  - Pressure Filter
  - Active Carbon Filter
  - Resine of Cation and Anion

  ✔ Counter Flow Regeneration
  ✔ Packed Bed Regeneration
  ✔ Through Fare Regeneration
  ✔ Continuous Deionizers
RO/DM Plant

• UF – RO – MB
  - UF & RO - Membrane technology
  - Membrane - policy unit

• Problems associated with UF & RO Membrane Technology:
  - Chocking
  - Fouling
  - Reduction in capacity
### DM Plant vs. RO/DM Plant – Comparison

<table>
<thead>
<tr>
<th>DM Plant</th>
<th>RO/DM Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bigger Layout in size</td>
<td>Smaller Layout</td>
</tr>
<tr>
<td>Less Capital Cost</td>
<td>More Capital Cost</td>
</tr>
<tr>
<td>More Operation Cost</td>
<td>Less Operation Cost</td>
</tr>
<tr>
<td>Maintenance Intensive</td>
<td>Easy to maintain</td>
</tr>
</tbody>
</table>
Cooling Water Treatment

- CIRCULATING WATER
  - Chemical Treatment
    - Anticorrosive,
    - Anti Scalent
    - Bio side
    - Bio Dispersant
    - Sulphuric Acid
  - Physical Treatment
    - Bullet Cleaning
    - Online Condenser Tube Cleaning Systems
Events leading to Contaminant Ingress

- Makeup demineralizer regenerations
- Boiler and Turbine startups
- Condenser Operation
- Deaerator startup, operation and lay-up
- Chemical injection system startup and operation
Contaminant Ingress from DM Plant

- Usually in the forms of:
  - Regenerate chemicals (acid or caustic),
  - Substandard effluent (high silica),
  - Non-reactive silica, iron and aluminum, or
  - Organic matter

- The following instrumentation should be installed on the DM Plant effluent and alarm in the control room:
  - Conductivity recorder
  - pH recorder
  - Silica recorder
Upon Detection & Alarm of DM Plant Contaminant Ingress Event

The following operator actions are considered best practice:

- Verify condition as soon as possible
- Isolate the DM Plant as soon as possible
- Protect power generation process equipment
- Determine and/or correct the root cause
- Restore proper water/steam system chemistry
Minimizing Contaminant Ingress from DM Plant

Contaminant ingress can only be minimized by:

- Installing instrumentation to detect ingress and alarm in the control room as soon as possible.

- Establishing utility-specific limits on DM Plant effluent contaminant levels, based on EVONIK target value methodology described in appropriate Cycle Chemistry Guidelines for Fossil Plants.

- Adopting action-oriented operating procedures that address:
  - Condition verification,
  - Isolation of DM Plant from condensate system,
  - Correction of root cause of DM Plant effluent problems, and
  - Protection of in-service power generation process equipment.
Eliminating Repeat DM Water Contaminant Ingress Events

Ensure the following are properly performed:

- Proper isolation of the system before and during regeneration,
- Establishing and maintaining correct backwash and air mixing flows,
- Maintaining correct regenerate temperature, and
- Maintaining correct regenerate flow rates and strengths,
- Periodic testing of resins.
To Minimize Other Contaminant Ingress

- Clean up of heater drains during startup
- Detection and reporting of increased air in-leakage
- Location and isolation of air in-leakage sources
- Detection, reporting and isolation of contaminated make-up
- Detection, reporting and isolation of condenser leakage
- Minimum use of desuperheating sprays
- Prompt isolation of Attemperator spray valves on detection of major ingress events
- Maintaining proper drum level
- Blowing down to maintain proper boiler water chemistry
- Detection and reporting of main steam contamination
Instrument Accuracy Checking on Steam Contamination Event

- Check flow to instrument
- Check cation resin column for exhaustion

**If above indications are normal**

- Visually check drum level
- Check chemical injection system for proper operation and feed rates
- Check other appropriate system chemical parameters
Actions to Prevent Contaminant Ingress

• Routine testing for condenser cooling water and air in-leakage during suitable maintenance opportunities

• Breather/Bladders/nitrogen blanketing of make-up storage tanks

• Checking make-up water quality prior to startup

• Use of auxiliary steam for prompt pegging of the deaerator

• Strong reliability-centered-maintenance (RCM) programs for condensers, deaerators and demineralizers
Operator Responsibilities - Deaerator Performance

• **Prompt use of pegging steam on startup**
  ✓ Manually check deaerator steam injection valve

• **Monitoring dissolved oxygen analyzers**
  ✓ Check analyzer flow and temperature

• **Adjusting oxygen scavenger feeds**
  ✓ Check feed pumps for proper operation and leaks

• **Monitoring condenser air ingress**
  ✓ Report any increase in air ingress

• **Monitoring deaerator level**
  ✓ Visually check deaerator level

• **Monitoring deaerator temperature**
Chemical Cleaning prior to commissioning and post long shut down.

- Preheating of the boiler
- Isolating the unit to be cleaned from other units in the plant
- Maintaining circulation during the cleaning process
- Back flushing the economizer and/or superheater
- Draining the chemical solvent from the boiler
- Filling the boiler with a passivation solution
- Firing the boiler during the naturalization/passivation stage of the cleaning process
- Draining of the passivation solution from the boiler
- Filling the boiler up with lay-up chemicals if the unit is not being returned to service.
Possible Causes of Chemistry Excursions

- For sodium, chloride, silica and free hydroxide:
  - Insufficient boiler blowdown
  - Condenser leakage
  - Makeup demineralizer

- For iron and copper:
  - Air in-leakage
  - Feedwater dissolved oxygen
  - Feedwater pH
### CORRECTIVE ACTIONS – MAKEUP TREATMENT EFFLUENT

<table>
<thead>
<tr>
<th>Parameter(s) deviation</th>
<th>Corrective Actions</th>
</tr>
</thead>
</table>
| Sodium, Chloride, hydroxide, sulfate, silica and specific conductivity | 1. Re-circulate effluent to appropriate inlet point such as:  
  - Pretreatment system  
  - Cation or anion vessel  
  - Mixed-bed vessel  
  2. Identify contaminant source:  
    - Raw water quality  
    - Effluent water quality from an operating unit  
  2. Regenerate demineralizers  
  3. Install mixed-bed polisher |
### CORRECTIVE ACTIONS – DEAERATOR OUTLET

<table>
<thead>
<tr>
<th>Parameter(s) deviation</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissolved oxygen</td>
<td>1. Check DA Performance</td>
</tr>
<tr>
<td></td>
<td>2. Check DA Vent Control</td>
</tr>
<tr>
<td></td>
<td>3. Check DA inlet oxygen</td>
</tr>
</tbody>
</table>