RO Water Treatment System Training

Presented by
Michael Henry

Based on
- ANSI/AAMI 2005 volume 3: Hemodialysis systems
- RD52-2004
- RO QC Log
Today we will....

- Different components of Pretreatment System
- RO function
- Post Treatment
- Distribution system and storage tank
- Delta pressure monitoring
- Actions for exceeding limits
- Factors Affecting Operation
Pretreatment

*Online Incoming water total chlorine monitor*

1. **Purpose:** Monitor incoming water total chlorine levels before first shift and at every four hours thereafter

*Mixing Valve*

1. **Purpose:** Mix hot and cold water
2. **What to monitor:** Water temperature
3. **What to look for:** Water temperature range between 60 – 85 °F
Pretreatment

**Booster Pump**
1. **Purpose**: Add pressure to the water treatment system so that the feed pressure is constant
2. **What to monitor**: Water pressure
3. **What to look for**: Pump turning on at 30 psi and off at 60 psi

**Bladder Tank**
1. **Purpose**: Maintain Pressure and act as a pressure absorber
2. **What to monitor**: Air leak
Pretreatment

Multimedia Filter

1. **Purpose:** To remove dirt, slit, and particles of 10-micron and larger from the incoming water
2. **What to monitor:** Pressure drop across the device, backflush timer
3. **What to look for:** Delta Pressure drop of 15 PSI or more, and timer is set correctly
4. **Action for exceeding limits:** Call Marcor for service and notify dialysis technical manager
Pretreatment

Softener System

1. Contains a Water Softener, Brine Tank, Regeneration Timer
2. Purpose of Water Softener: To remove calcium and magnesium from the incoming water
3. Purpose of Brine Tank: Create Brine for regeneration purpose
4. What to monitor:
   • Post softener hardness < 1 gpg
   • Amount of salt in the brine tank should be greater than Half
   • Delta Pressure drop of 15 PSI or more settings on regeneration timer.
5. Action for exceeding Limits: Call Marcor for service and notify dialysis technical manager
**Pretreatment**

**Carbon Tanks**

1. **Purpose:** To remove Chlorine and Chloramine from the incoming water

2. **Effect of Chlorine:** Exposure of high amounts of chlorine causes hemolysis in dialysis patients

3. **What to monitor:**
   - Total chlorine levels after the worker tank before the first patient shift and at every four hours thereafter
   - Pressure drop across each tank
   - Backflush timers

3. **What to look for:**
   - Total chlorine levels within AAMI standards (<0.1 mg/L or ppm)
   - Delta Pressure drop of 15 PSI or more
   - Backflush timer set to activate when facility is not in operation.
Pretreatment

**Carbon Tanks**

**Action for exceeding Limits (Med Surg Tech and Dialysis Nurse)**

- If the total chlorine test result is $< 0.1 \text{mg/L}$, no action is needed.
- If the total chlorine test (TP4) result is equal to or greater than $0.1 \text{mg/L}$, repeat test to validate previous test reading.
- If the repeat test result (TP4) is equal or greater than $0.1 \text{mg/L}$, Test for total chlorine post carbon tank two (Polisher TP5) and notify dialysis nurse manager and dialysis technical manager.
- If the total chlorine test result (TP5) is less than $0.1 \text{mg/L}$, Test for total chlorine (TP5) at every hour and log result.
- If the total chlorine test result (TP5) is equal to or greater than $0.1 \text{mg/L}$, repeat test to validate.
- If the repeat test at TP5 is equal to or greater than $0.1 \text{mg/L}$ notify dialysis nurse manager, director and dialysis technical manager.
Carbon Tanks

Action for exceeding Limits (Biomed Tech)

- Notify dialysis technical manager,
- Contact Marcro to bring emergency carbon tanks and to schedule carbon re-bedding
Reverse Osmosis

Purpose: To remove 95% of inorganic salts, bacteria, and bacterial endotoxins

Operation:
2. Water is forced through the membrane by RO pump.
3. Water that pass through the membrane is the product or permeate water
4. Water that flows along the membrane surface and to the drain is known as reject or concentrate water
# Monitoring the Reverse Osmosis

**Purpose:** To ensure RO % rejection, RO feed temperature, RO conductivity in and RO conductivity out are within the range

<table>
<thead>
<tr>
<th>Description</th>
<th>Limits</th>
<th>Action</th>
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</thead>
<tbody>
<tr>
<td>RO % rejection</td>
<td>&gt; 90%</td>
<td>1. Call Marcor and notify dialysis nurse manager, dialysis technical manager, and medical director</td>
</tr>
<tr>
<td>RO feed temperature</td>
<td>60 – 85 °F</td>
<td>2. Switch to DI, after medical director’s approval</td>
</tr>
<tr>
<td>RO conductivity in</td>
<td>&lt; 200 μS</td>
<td></td>
</tr>
<tr>
<td>RO conductivity out</td>
<td>&lt; 10 μS</td>
<td></td>
</tr>
<tr>
<td>Reject flow</td>
<td>1.5 – 3 gpm</td>
<td></td>
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<tr>
<td>Product flow</td>
<td>3 – 6 gpm</td>
<td></td>
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</tbody>
</table>
Deionization Tanks (DI Tanks)

1. **Purpose:**
   - DI is an ion exchange process that removes both anions (negatively charged ions) and cations (positively charged ions) from water.
   - Water treated by DI may be very high quality with regard to ionized contaminants, but the process does not remove nonionized substances, including bacteria and bacterial endotoxins.

2. **What to Monitor:**
   - DI Exhaustion light status
   - If the light is On, the worker DI tank is not exhausted
   - If the light is Off, the worker DI tank is exhausted
   - Resistivity after DI polisher tank should be greater than 3 Meg-Ohms

3. **Actions for exceeding limits**
   - Notify Marcor to replace, disinfect, and to do AAMI chemical Analysis
   - Notify Nurse Manager and Dialysis technical Manager
Endotoxin Filter

1. **Purpose**: To remove endotoxin from the product water

2. **What to monitor**: Delta Pressure drop of 30 PSI or more

3. **Actions for exceeding limits**: Notify Marcor to replace the endotoxin filter
   - Notify dialysis nurse manager, dialysis technical manager, and medical director
   - Switch to DI, after approval from medical director
Distribution System and Storage Tank

1. Distribution System: To circulate product water from storage tank to the distribution loop

2. Storage Tank: Holds 200 gallons of product water

3. What to monitor:
   - Temperature
   - Unusual noise
   - Alarms

4. Actions for exceeding limits
   Notify dialysis nurse manager, dialysis technical manager and marcor
Do you have any questions?

Competency Test

Thank You