Table of Contents

1.0 Scope of Guideline................................................................. 1

2.0 Summary of the Literature & Internet ......................................... 1

3.0 Definitions & Abbreviations..................................................... 1

4.0 Recommendations ............................................................... 2

Table 1: Components, Values & Intervals for Monitoring Water Treatment Equipment.................................................. 4

5.0 References ......................................................................... 2

6.0 Sponsors ............................................................................ 2

7.0 Appendix 1: Components of a Dialysis Water Treatment System..................................................................................... 7

IMPORTANT INFORMATION

This BCPRA guideline/resource was developed to support equitable, best practice care for patients with chronic kidney disease living in BC. The guideline/resource promotes standardized practices and is intended to assist renal programs in providing care that is reflected in quality patient outcome measurements. Based on the best information available at the time of publication, this guideline/resource relies on evidence and avoids opinion-based statements where possible; refer to www.bcrenalagency.ca for the most recent version.

For information about the use and referencing of BCPRA provincial guidelines/resources, refer to http://bit.ly/28SFr4n.
1.0 Scope of Guideline

This guideline applies to in-centre and community dialysis units (CDUs) that provide hemodialysis (HD) and/or hemodialfiltration (HDF). It is applicable to both adult and pediatric units.

The purpose of this guideline is to support the implementation of common standards and processes for monitoring the equipment used to treat dialysis water within BC’s HD units.

2.0 Summary of the Literature & Internet

Patients undergoing conventional hemodialysis three times per week are exposed to 300-600 litres of water per week, depending on their prescription (Coulliette, 2013). More than 90% of the dialysate delivered to the dialyzer is water (Layman-Amato, 2013).

The source of water used in HD consists basically of drinking water, purified by various techniques, whose composition and quality depend on its origin. Water treatment systems employ several physical and/or chemical processes either singly or in combination. These systems may be portable units or large facility systems.

The quality of the source water can change from season to season or even day to day (Layman-Amato, 2013). Monitoring of the quality of water used for dialysis is a vital aspect of hemodialysis treatment. Minerals in the water can be toxic to patients and harmful to equipment.

Refer to the Appendix for a visual of a dialysis water treatment system.

3.0 Definitions & Abbreviations

DI: Deionization

Dialysis water: Water that has been treated to meet the requirements of the CSA standard and is suitable for HD use in applications.

GPG: Water hardness unit; grains per gallon.

Hemodialysis (HD): Form of renal replacement therapy in which waste solutes are removed primarily by diffusion from blood flowing on one side of a membrane into dialysis fluid flowing on the other side.

Mis: Manufacturer’s instructions

Percent rejection: Measurement of rejection of solutes by RO membrane and, thus, measurement of equipment performance.

Product water: Water produced by a water treatment system or individual component thereof.

PSI: Pressure unit; pounds per square inch

RO: Reverse osmosis. Water is pushed through a membrane with pores small enough to remove most contaminants, including ions.

Salt bridge: Where salt at the top of the tank solidifies, making it appear as though the tank is full when it is actually empty underneath.

TDS: Total dissolved solids

Water treatment system: Collection of water treatment devices and associated piping, pumps, valves, gauges, etc. that together produce treated
water for hemodialysis applications and deliver it to the point of use.

4.0 Recommendations

**Recommendation #1: Conduct performance checks on dialysis water equipment as per Table 1.**

Table 1 (see page 4) provides guidelines on monitoring systems used for preparing and distributing dialysis fluid. Not every item listed in the table will be required in all dialysis units and the frequency of monitoring may differ depending on the nature of the water supplied to the dialysis unit (e.g., whether the water supply is disinfected using chloramine). The water quality management program for a given centre will depend on the components used in that unit's water treatment system, the purpose for which the fluid is to be used, the results of validation procedures and any applicable local regulations (CSA/ISO 23500: 2011(E), page 50).

**Recommendation #2: Document all checks on designated log sheet(s).**

Log sheets may be site or manufacturer specific.

**Recommendation #3: Develop mechanisms within each Health Authority for designated individuals to review the results and, if required, take action.**

5.0 References

**CSA Standards (CSA)**


**Articles**


6.0 Sponsors

This BCPRA guideline/resource was developed to support equitable, best practice care for patients with chronic kidney disease living in BC. The guideline/resource promotes standardized practices and is intended to assist renal programs in providing care that is reflected in quality patient outcome measurements. Based on the best information available at the time of publication, this guideline/resource relies on evidence and avoid opinion-based statements where possible; refer to [www](http://www).
bcrenalagency.ca for the most recent version.
Developed by:
• a working group of biomedical/renal technicians
  from across BC (one per health authority)

Approved by:
• BCPRA Hemodialysis Committee
• BCPRA Medical Advisory Committee

For information about the use and referencing of
BCPRA provincial guidelines/resources, refer to
### Table 1: Components, Values & Intervals for Monitoring Water Treatment Equipment

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Feed water</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backflow prevention valves</td>
<td>To check that water cannot reverse its flow</td>
<td>Not applicable</td>
<td>Not on CSA/ISO guidelines</td>
<td>Annually or as requested by the municipality.</td>
<td>Some systems don’t require the blending valve so monitoring would not be required.</td>
</tr>
<tr>
<td>Temperature blending valve</td>
<td>Water temperature</td>
<td>Appropriate water temperature with minimal fluctuation.</td>
<td>Not on CSA/ISO guidelines</td>
<td>Daily</td>
<td></td>
</tr>
<tr>
<td><strong>Pre-treatment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sediment filter (multi media or NextSand) or cartridge filter</td>
<td>Pressure drop across the filter</td>
<td>Based on manufacturer's instructions (MIs) - typically a delta of 10 psi</td>
<td>Daily</td>
<td>Daily</td>
<td>If no history of sediment or cartridge filter clogging, may reduce monitoring.</td>
</tr>
<tr>
<td>Water softener</td>
<td>Product water softness</td>
<td>Based on MIs of RO equipment - typically &lt;1 grain</td>
<td>Not specific in CSA/ISO guidelines.</td>
<td>Monthly</td>
<td>If feed water hardness is very low, a softener and, therefore monitoring, may not be required.</td>
</tr>
<tr>
<td>Carbon beds</td>
<td>Product-water total chlorine between the beds</td>
<td>&lt;0.1 mg/l of total chlorine</td>
<td>Beginning of each treatment day.¹ For units that run 24/7, unit to determine time of day for sampling.</td>
<td>Daily</td>
<td></td>
</tr>
<tr>
<td>Sediment/carbon control head</td>
<td>Backwash cycle timer setting</td>
<td>Based on MIs</td>
<td>Daily</td>
<td>Monthly &amp; PRN (e.g., power outage; work done on system)</td>
<td>Not essential. No harm to patient if timer setting is incorrect.</td>
</tr>
</tbody>
</table>

¹ Testing for total chlorine should be performed at the beginning of each treatment day prior to the patient’s initiating treatment. Where chloramine is used to disinfect the potable water supply at a level of 1 mg/l or more, testing should be repeated prior to the beginning of each patient shift; if there are no set patient shifts, testing should be performed approximately every 4 h during operation. More frequent monitoring could be appropriate during temporary operation with a single carbon bed, which can occur following breakthrough of the first bed. In such instances, testing is performed on water exiting the second carbon bed in a series-connected pair. The decision to change the frequency of monitoring should be based on the past performance of the system and on whether changes in feed-water quality have occurred. Samples should be drawn when the system has been operating for at least 15 min. The analysis should be performed onsite, since total chlorine levels will decrease if the sample is not assayed promptly. Results of monitoring should be recorded in a log sheet.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Water softener controller head</td>
<td>Regeneration cycle timer setting</td>
<td>Based on MIs</td>
<td>Daily</td>
<td>Monthly</td>
<td>Not essential. No harm to patient if timer setting is incorrect.</td>
</tr>
<tr>
<td>Water softener brine tank</td>
<td>Level of undissolved salt in tank</td>
<td>Based on MIs</td>
<td>Daily</td>
<td>Weekly</td>
<td>Effect of water softener lasts at least a week. No harm to patient if run out.</td>
</tr>
<tr>
<td>Pre endotoxin-retentive filters</td>
<td>Pressure drop across the filter at a fixed flow rate or product water flow rate at a fixed pressure drop</td>
<td>Based on MIs</td>
<td>Daily</td>
<td>Daily</td>
<td>Manual recording not needed if filter is monitored by the system or filters are self-cleaning.</td>
</tr>
</tbody>
</table>

**Reverse osmosis (RO) system**

| Reverse osmosis system            | Product water conductivity                                                     | Depends on local feed water quality (action levels vary across BC HD units but are typically 5 - 10 uS). | Daily; preferable option is to set up audible alarm to sound if outside recommended limits. | Depends on local feed water quality. | CSA recommends monitoring reject & calculated recovery rates; however, this does not provide useful information on a daily basis & may not be applicable to all systems. |
|-----------------------------------| Feed water conductivity                                                        | Depends on local feed water quality. |                                      | Depends on local feed water quality. |                                      |
| Reverse osmosis system            | Calculated % rejection                                                         | >85%                             |                                      | Depends on local feed water quality. |                                      |
| Reverse osmosis system            | Product flow rate                                                              | Sufficient to meet the needs of dialysis machine consumption. |                                      | Depends on local feed water quality. |                                      |

**Delivery system**

| Deionizers (DI tanks or cannisters) | Product water resistivity or conductivity | Resistivity ≥1 MΩ cm Conductivity <1 uS/cm | Continuous monitoring | Set up audible alarm to sound if outside recommended limits. Sound is audible to end users. | Deionization can be set up as a dry back-up system and does not require continuous monitoring unless the system is put into operation. |
## Dialysis Water Treatment Equipment Monitoring

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Post endotoxin-retentive filters</td>
<td>Endotoxin levels (Eu/mL)</td>
<td>&lt;0.25 EU/mL (action level: &gt;0.125 EU/mL)</td>
<td>Monthly (CSA)</td>
<td>Monthly</td>
<td>These filters should not clog because they are post RO filters.</td>
</tr>
<tr>
<td>UV irradiators2</td>
<td>Energy output and/or the lamp lifespan</td>
<td>Based on MIs</td>
<td>Monthly</td>
<td>Daily: Check that light is on. Monthly: Check to see the energy output is sufficient. Annually: Replace lamp.</td>
<td></td>
</tr>
<tr>
<td>Hot water disinfection systems</td>
<td>Temperature and time of exposure of the system to hot water</td>
<td>Based on MIs</td>
<td>During each disinfection</td>
<td>Monitored by the system. If out of range, system will alert. Check that each disinfection was successful.</td>
<td></td>
</tr>
<tr>
<td>Chemical disinfection systems</td>
<td>Concentration of germicide in water and contact time</td>
<td>Based on MIs</td>
<td>During each disinfection</td>
<td>Automated chemical disinfection: Will be monitored by the system. If out of range, system will alert. Check that each disinfection was successful. Manual chemical disinfection: Verify the concentration during disinfection as per MIs. Check post-disinfection residual manually.</td>
<td></td>
</tr>
</tbody>
</table>

2 Try and phase out.

### Notes:

1. The list of “items to monitor” in Table 1 was extracted from ISO 23500:2011(E) Annex C Monitoring Guidelines for Water Treatment Equipment, Distribution Systems and Dialysis Fluid.
2. Six items from the ISO guideline were not included in Table 1 as they are addressed in separate BCPRA guidelines:
   - Sampling for water system chemical contaminants: BCPRA Chemical & Chlorine Sampling of Dialysis Water.
   - Sampling for dialysis water storage tanks and water distribution piping system: BCPRA Dialysis Water System Microbiology & Endotoxin Sampling.
   - Sampling of standard and ultrapure dialysis fluid: BCPRA Dialysate Microbiology & Endotoxin Sampling.
7.0 Appendix: Components of a Dialysis Water Treatment System

Direct Feed

** Actual components and configurations will vary - this is a guide only.
**Indirect Feed**

**Actual components and configurations will vary - this is a guide only.**