1.0 PRACTICE STANDARD

1.1. Purpose

The Biomedical Technologist, Renal Dialysis Technician, or Renal Nurse who is trained and has demonstrated competency in dialysis water practices will use the procedure outlined in this document to collect dialysis water samples for chlorine testing, and to perform the necessary actions should test results for chlorine concentration exceed the acceptable limit.

1.2. Standards (based on CSA-ISO)

The total chlorine concentration in a sample of dialysis water must be less than 0.1 mg/L. This is the maximum level allowed for patient exposure to chloramine (combined chlorine).

Testing for total chlorine should be performed at the beginning of each treatment day prior to patients initiating treatment. More frequent monitoring may be necessary during temporary operation with a single carbon tank, or single carbon filter for portable ROs, or if changes in feed water quality have occurred. Testing should also be completed after any work completed on the carbon tank treatment system, or when carbon filters for portable ROs are replaced.

2.0 DEFINITIONS AND ABBREVIATIONS

Chloramine See Chlorine, combined.
Chlorine, combined Chlorine that is chemically combined, such as chloramine compounds.
Chlorine, free Portion of chlorine in a solution that has not chemically combined with other substances; dissolved molecular chlorine.
Chlorine, total Sum of combined chlorine and free chlorine.
Dialysis water Water that has been treated to meet the requirements of the CSA-ISO standards and which is suitable for use in hemodialysis applications, including the preparation of dialysis fluid, reprocessing of dialysate, preparation of concentrates and preparation of substitution fluid for online convective therapies.
Disinfection Destruction of pathogenic and other kinds of microorganisms by thermal or chemical means.
DPD N,N-diethyl-p-phenylene-diamine.
Hemodialysis 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.
RO Reverse osmosis.

Disclaimer: The procedure steps may not depict actual sequence of events. Site-specific considerations may be
made when applying the following procedures and protocols.

3.0 EQUIPMENT

- DPD based test kits (e.g., digital colorimeter, colour wheel)
- Dip-and-read test strips (optional)
- Titrometry (optional)
- Daily Dialysis Water Chlorine Testing Log Sheet

4.0 PROCEDURE

4.1 If applicable, check the performance of the DPD test according to the manufacturer instructions and calibrate as necessary.

4.2 Collect dialysis water sample.

   Note: Samples should always be collected before cleaning/disinfection.

   4.2.1 Make sure the RO has been operating for at least 15 minutes.

   4.2.2 Draw the sample between the first and second tanks. If temporarily operating with a single tank, draw the dialysis water sample after the single carbon tank. **Ensure that the carbon bypass valves are not set to bypass the carbon tanks. These tanks should never be bypassed during regular operation of the RO system.**

   For portable ROs, draw the sample between the second and third carbon filters.

   4.2.3 Rinse the sample container several times before taking the final sample. Make sure no contaminating material is introduced to the sample.

4.3 Test the sample.

   4.3.1 Use the manufacturer instructions provided with the DPD test kit.

   4.3.2 Perform the analysis on-site since chloramine levels will decrease if the sample is not assayed promptly.

   4.3.3 Record the test results on the Daily Dialysis Water Chlorine Testing Log Sheet.

4.4 Review the test results.

   4.4.1 Use the manufacturer instructions provided with the DPD test kit.

   4.4.2 If the total chlorine concentration is less than 0.1 mg/L, resume routine chlorine testing the following day. **Note: 1 PPM is equivalent to 1.0 mg/L.** Otherwise, contact Biomed or a Renal Dialysis Technician to take corrective measures (go to step 4.5).

4.5 Perform corrective action (refer to Process Flowchart below). **To be performed by Biomed or Renal Dialysis Technicians only.**

   4.5.1 Retest immediately.

   4.5.1.1 Collect another sample of dialysis water (repeat step 4.2).

   4.5.1.2 If available, use an alternative test method (i.e., a different DPD test, dip-and-read test strips, or titrometry) to test and analyze the sample.

   4.5.1.3 Record the test result on the Daily Dialysis Water Chlorine Testing Log Sheet.

   4.5.1.4 If the total chlorine concentration is less than 0.1 mg/L, resume routine chlorine testing the following day. Otherwise, continue to step 4.5.2.

   4.5.2 Test after second carbon tank, or after the third carbon filter for portable ROs.

   4.5.2.1 Collect a sample of dialysis water after the second carbon tank, or after the third carbon filter for portable ROs (see step 4.2).

   4.5.2.2 Use the same or an alternative test method to test and analyze the sample.
<table>
<thead>
<tr>
<th>4.5.2.3</th>
<th>Record the test result on the Daily Dialysis Water Chlorine Testing Log Sheet.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5.2.4</td>
<td>If the total chlorine concentration is less than 0.1 mg/L, move the second carbon tank into the first position, order new carbon tanks, replace the second tank with a new tank, and return the exhausted tank. <strong>Operation may be continued for a short time (up to 72 hours) until the replacement tank is installed.</strong> For portable ROs, if the total chlorine concentration is less than 0.1 mg/L, order and replace all carbon filters. Otherwise, continue to step 4.5.3.</td>
</tr>
<tr>
<td>4.5.3</td>
<td>Notify the Area Renal Manager, Biomed Risk &amp; Quality, the Biomed Lead Tech, and the Nephrologist.</td>
</tr>
<tr>
<td>4.5.4</td>
<td>Review results with Area Renal Manager and Nephrologist and decide whether the Renal Unit should be shut down. For portable ROs, decide whether use of the portable RO should continue.</td>
</tr>
<tr>
<td>4.5.5</td>
<td>Complete a PSLS report.</td>
</tr>
<tr>
<td>4.5.6</td>
<td>Order new carbon tanks and replace both tanks. For portable ROs, order new carbon filters and replace all filters.</td>
</tr>
<tr>
<td>4.5.7</td>
<td>Retest and ensure that the total chlorine concentration is less than 0.1 mg/L after installation of the new carbon tanks or filters (repeat steps 4.2 to 4.4.2).</td>
</tr>
</tbody>
</table>

### 5.0 DOCUMENTATION CONSIDERATIONS

All daily chlorine testing results for dialysis water must be recorded on the Daily Dialysis Water Chlorine Testing Log Sheet. The results on these log sheets must be reviewed by the Area Renal Manager and signed-off by the Nephrologist every month.

### 6.0 SPECIAL CONSIDERATIONS

- While taking samples, it is important that no contact is made with the inside of the sampling unit. Handle the sample in such a way as to prevent deterioration or contamination before the analysis is performed.
- Sample as frequently as possible.
- Sampling for total chlorine is often simpler than analyzing chloramines separately.
- Since chloramine concentrations decrease with time, testing must be performed immediately after sampling.
- The procedure should be done when the system is operating under stable conditions representing normal operation.
- The procedure should not be done within a 2-hour period following a heat clean procedure as the sample may be too warm.
- The test method used must have sufficient sensitivity and specificity to resolve the maximum level of 0.1 mg/L.
- If it is not possible to rotate the position of the tanks, replace both tanks.

### 7.0 REFERENCES

- Dialysate for hemodialysis (ANSI/AAMI RD52:2004/(R)2010), Association for the Advancement for Medical Instrumentation, Arlington (VA), 2009.

### 8.0 DEVELOPED BY

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IH Renal Biomedical Technologists and Renal Program Technicians and Managers
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FHA Renal Biomedical Technologists and Renal Managers
VIHA Renal Biomedical Technologists and Renal Managers
PHC Renal Biomedical Technologists and Renal Managers

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11.0 APPROVED BY
BCPRA Medical Advisory Council – November 2011
Daily Chlorine Testing of Dialysis Water Process Flowchart

START: Designated tester* takes dialysis water sample from between carbon tanks 1 and 2. For portable ROs, sample is taken from between carbon filters 2 and 3 before patient run.

Use DPD-based test for total chlorine

Review/analyze test result on site

Record test results on the Daily Dialysis Water Chlorine Testing Log Sheet

Total chlorine > 0.1 mg/L?

YES

Draw sample after carbon tank 2 (after carbon filter 3 for portable ROs)

Test sample using DPD or alternative method

Record test results on Daily Dialysis Water Chlorine Testing Log Sheet

Total chlorine > 0.1 mg/L?

YES

Move carbon tank 2 into first position; for portable ROs, order and replace all carbon filters

NO

Results are reviewed by the Area Renal Manager every month

Results are reviewed and signed off by the Nephrologist every month

Notify:
- Area Renal Manager
- Biomedical Lead Tech and Risk & Quality
- Nephrologist

Review results with Area Renal Manager and Nephrologist and decide whether Renal Unit (or portable RO) should be shut down/off

Complete PSLS report

Order new carbon tanks (or filters)

Install new carbon tanks (or filters)

*Note: Designated tester may be a Biomedical Technologist, Renal Dialysis Technician, or Renal Nurse, depending on the particular renal site.