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Area	Laboratory-Chemistry
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Centra Reverse Osmosis Water System- Troy Chemistry

Document Type: Procedure

I. PURPOSE AND OBJECTIVE:

To provide instructions to monitor and test the Distilled Water(DI H2O) system in use by the laboratory. Including daily, quarterly and as needed maintenance and troubleshooting.

II. CLINICAL SIGNIFICANCE:

Laboratory reagent water must be used in test methods requiring minimal interference and maximum precision and accuracy. DIH2O is required for many operations in the laboratory. The Abbott Architect analyzers and the Sysmex analyzers require DIH2O for routine operation. Quality Control materials, proficiency testing materials, stains, and water baths all use water from the Centra water system. It is important to monitor the quality of water provided. Bacteria may inactivate reagents, contribute to total organic contamination or, alter optical properties of test solutions. Resistivity provides a non-specific measure of the ion content and, is also an indicatio of pH. Particulate matter includes organic carbon from biofilms and inorganic aggregates that can vary over time both in the nature of contamination and the effect on the laboratory use.

III. REAGENTS:

A. Model 5B Hardness Test Kit contains the supplies needed to perform hardness testing
    1. UniVer 3 Hardness Reagent : contains Ammonium Chloride, Etheylenediaminetetraac Acid, Magnesium Disodium salt, Sodium Carbonate and Sodium Sulfite.
    2. Titrant Solution Hardness: contains Propylene Glycol and demineralized water.

Warning: May cause eye, skin and respiratory tract irritation. May cause allergic respiratory reaction if swallowed or inhaled. Do not ingest. In case of contact, immediately flush eyes with water for 15 minutes. Wash skin with soap and plenty of water. Ingestion: Give large quantities of water and call physician immediately. Inhalation: Remove to fresh air, give artificial respiration if necessary. When

handling the reagents in the hardness test kit, follow the appropriate chemical safety guidelines, which include wearing gloves, lab coat, and safety glasses or protective face shield.

IV. EQUIPMENT:

A. Model 5B Hardness Test Kit (Hach Company)
B. Gloves
C. Orders in Beaker for testing
D. Sterile sample containers (100mL).
E. Urine cup filled with bleach
F. Alcohol pads
G. Gauze pads
H. Large plastic beaker to collect the 3-minute flush from the Centra/Abbott inlet entry point tap

V. MAINTENANCE:

A. Daily Maintenance

1. Check and record the system for water hardness using the Model 5B Hardness Test Kit.
2. Rinse the test tube and mixing bottle 3 times with water from the Centra Distilled (DI) water tap by the carbon tank in the water room.
3. Fill test tube to the top with the water sample and pour into the mixing bottle.
4. Add 1 level spoonful of UniVer 3 Hardness Reagent to the mixing bottle and swirl to mix. When the water hardness is as it should be, the solution will appear blue, and no further action is needed.
5. Record in the Water Maintenance Book zero (0) for water hardness.
6. When the water is measuring as "hard water," the solution will be pink in color.
7. Add the Hardness 3 Titrant Solution to the mixing bottle drop wise while swirling the mixing bottle. When the sample color changes from pink to blue, record the number of drops added in the Water Maintenance Book for water hardness.

   Note: If one drop produces a blue color, total hardness is <1 grain per gallon. Number of drops = Total Sample Hardness in grains per gallon as Calcium Carbonate ($CaCO_3$). Only 1 or 2 drops should be needed to ensure proper water hardness. If 3 or more drops are needed to change sample color from pink to blue, then service must be called.
8. Check the salt level in the brine tank.
   a. The proper quantity of salt must be present in the storage tank prior to regeneration; therefore, the salt level must be checked daily.
   b. Salt must be added to the brine tank when the level is at the bottom of the 2nd tape mark (on the storage tank) or lower.
   c. When the last bag is added, EVOQUA must be notified, and 5 more bags ordered.
9. Inspect system for leaks.

10. Check all connections and tubing for any leaks in the system. Repairing a leak while it is still small may prevent lengthy downtime later.
11. Check mixed bed resistivity lights.
    a. The system contains three mixed bed tanks.
    b. The closest tank to the blue storage tank is the worker tank and is the older of the two.
    c. This is the tank that is taken off of the system when the green resistivity indicator light turns to red.
    d. The other tank is switched to the worker position and a new mixed bed tank is brought in.
    e. The light indicates that the resistivity of the water is less than 1 Meg ohms.
    f. This usually occurs approximately every 2 months. Document in the problem log and notify EVOQUA to switch the tanks and change the filters.

       Note: The water quality is still acceptable as long as the Centra control panel is not giving any resistivity errors and instrument QC is within specifications.
12. Check the control panel and record system resistivity and temperature.
    a. The system resistivity should be greater than or equal to 10 Meg ohms.
    b. The system temperature should read < or = to 40 C. Anything above will cause the alarm to sound.

       Note: The control panel scrolls through the key operating parameters or you may manually scroll using the key on the lower left of the screen.
    c. Check the control panel and record any error codes that may be affecting the system operation.

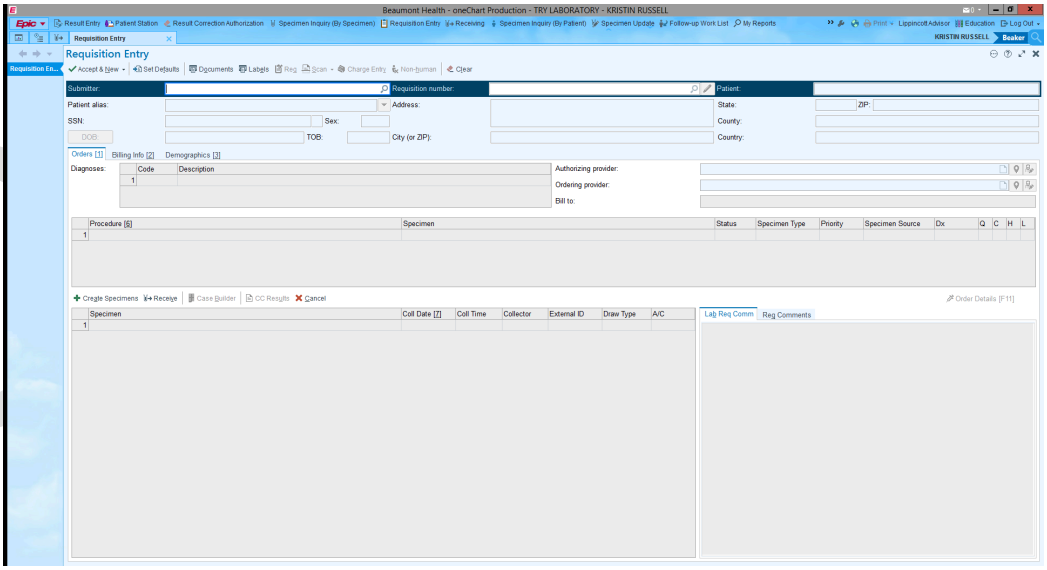
       Note: Notify EVOQUA and schedule service to repair the problem. The water quality is still acceptable as long as the Centra control panel is not displaying any resistivity errors and instrument QC is within specifications. Refer to the Alarm Conditions Chart attachment. Record the alarm and notify EVOQUA Water Tech Support immediately.

B. Quarterly Maintenance

An excess of bacteria in the water has been found to affect instrument and reagent performance. Bacterial cultures must be taken from each of the working taps to ensure high quality laboratory water.

1. **Culture and Sensitivity Orders**
    a. To generate labels and electronically file culture and sensitivity reports for water cultures, orders must be placed in the Laboratory Information System(LIS).
    b. Use the following medical record numbers for each of the locations to be tested:

Site Name	Site Name Abbreviation	Submitter	Medical Record Number
Troy Chem Centra Line DI H2O Tap	TR-CENTRA	Chem TR, Water Sterility-1	9106023
Troy Chem DI H2O Tap	TR-CHEM	Chem TR, Water Sterility-2	9106030
Troy Hemo DI H2O Tap	TR-HEMO	Hemo TR, New Hemo DI Tap	9122407
Troy BB DI H2O Tap	TR-BB	Chem TR, Water Sterility 5 BB DI Tap	9122238
Troy GW DI H2O Tap	TR-GW	Chem TR, Water Sterility 6 Glass Room Tap	9105854



c. Open Requisition Entry in the LIS.

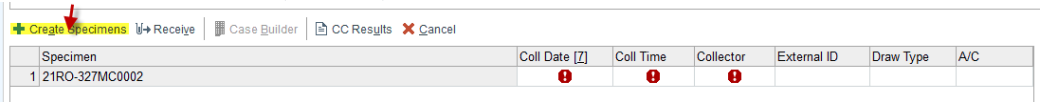
d. Check the Non-Human Only box.

e. Choose the search option in th e **submitter** box. Type the Medical Record Number (MRN)/Submitter number in the submitter box. See the chart above for submitter.

f. In the **Patient/source field**, type in the current date (mm/dd/xxxx). Followed by the "Site Name Abbreviation" found in the chart. Ex: 7/17/22-Troy-Centra.In the Order section, find the **Procedure** field (middle left) and type CXSTR then enter.

g. **Specimen Source** (middle right has a stop sign) select Sterility from the drop-down menu.

h. Click **Create Specimen** (left side).



i. Fill in the Collection Date, Time and Collector fields.

j. **Receive** specimen.

k. Label Automatically prints from the command center label printer.

l. Click on **Accept and New** or **Accept** to complete the ordering process.

2. **Sample Collection**
Note: Wear gloves during the cleaning and collecting of the bacterial samples so as not to contaminate the tap or the water specimen.

a. Pour a 10% bleach solution into a small container (a urine container works well) until there is enough to cover the tap's nipple.

b. Clean the water taps and entry port nipples with alcohol wipes, gauze and the 10% bleach solution. Let sit for a few minutes to allow the bleach to properly disinfect.

c. Turn on the water and allow to flow for approximately 3 minute clearing any residue.

d. Collect a sample, at least 60-80 ms of DiH2O in the Starplex 100 ml container. Label appropriately.

e. Wrap Parafilm around cap and container to prevent leakage.

f. Put each specimen in a small biohazard or resealable plastic bag.

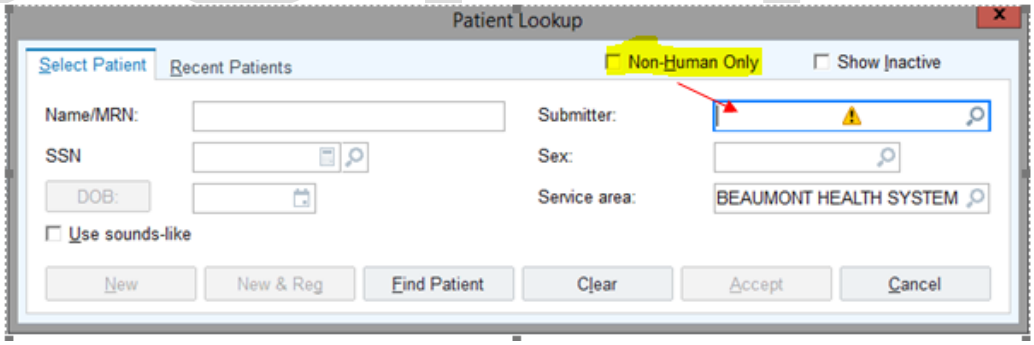
g. Seal and take to Microbiology.
WARNING: When handling bleach, as used for the cleaning solution, follow the appropriate chemical safety guidelines, which include wearing gloves,lab coat, and safety glasses or protective face shield.

3. **Finding Results and Printing Reports**

a. From **Specimen Inquiry** (by patient).

b. **Click Non-Human** (top middle).

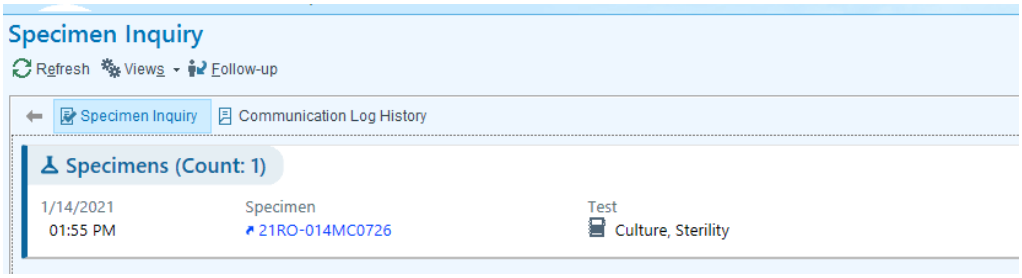
c. Enter the medical record numbers from chart above in the submitter field. Enter.



d. Choose the appropriate date for the result you are searching.

e. Click **Accept.**

f. Choose desired blue specimen number (begins with RO).



g. Select the actions menu and choose **Result Report** (by specimen).

h. The culture results need to be saved in the Water Purification System Maintenance book. To save space, cut each of the reports in half and tape to a single piece of paper using the front and back of the sheet. At the top of the page, Document Sterility, Month and Year.

i. Place in the Sterility section of the Water Purification System book.

4. **Acceptable Ranges**

   a. <10 colonies per mL.

   b. If limits are exceeded, repeat culture.

      i. Fill a 20 mL syringe with a 10% bleach solution and back flush the contaminated tap.

      ii. Let the bleach solution sit for a few minutes to allow for disinfection.

      iii. Repeat the sterile collection and submit to Microbiology.

      iv. If it is still out of limits, EVOQUA and the supervisor in charge of the contaminated tap (Chemistry, Hematology, or Blood Bank) should be notified and troubleshooting should begin to find the source of contamination.

      v. If justified, the system may need to be shut down for decontamination, and not available for use until bacterial cultures are within specified laboratory guidelines.

5. **Alternative options for DI H2O when a tap is unacceptable:**

   a. Hematology DI Tap: Use Chemistry, Blood Bank or Glass Washing Room DI taps.

   b. Chemistry DI Tap: Use Hematology, Blood Bank or Glass Washing Room DI taps.

   c. Centra/Abbott Tap DI Tap: As long as the Quality Control guidelines are met on all of the instruments the water is considered acceptable. If the Instruments error or Quality Control falls outside of the guidelines, specimens for testing may be sent to Royal Oak.

   d. Blood Bank DI Tap: Use Glass Washing Room , Chemistry, or Hematoloty taps for reconstituting reagents or filling water baths.

   e. Glass Washing Room DI Tap: The DI tap is used for rinsing glass and plastic laboratory containers/pipettes. If washing must be completed prior to resolving the contamination, use Hematology, Chemistry or Blood Bank DI taps to rinse the containers/pipettes.

C. As Needed Maintenance:

Note: All of the as needed maintenance procedures are performed by EVOQUA service technicians. Chemistry's responsibility is to make sure that the maintenance is performed when needed.

1. Replace Mix Bed Tanks
   Mixed bed ion exchange cylinders are used for higher quality water with a neutral pH. This ion exchange process has enhanced silica and CO2 removal capabilities.
    a. After 6 months or when indicated by the consumables alarm.
    b. When the water purity starts to deteriorate (usually indicated by resistivity).
    c. After system decontamination.
2. Replace the 0.2 micron in-line filter. The 0.2 micron in-line filter is used to eliminate bacteria and small particles.
    a. After 6 months or when indicated by the consumables alarm.
    b. When the water purity starts to deteriorate.
    c. Changes leading to low flow performance.
    d. After operation without a functioning UV filter.
    e. After system decontamination.
3. Replace the 9.75- 5um Code F filter.
   This filter protects the system against particles in the feed water from pre-treatment media and installation debris.
    a. Performed 3 months after initial installation
    b. When the water purity starts to deteriorate.
    c. Low-pressure alarms occur due to filter blockage.
    d. After system decontamination.
4. Replace Carbon Tank.
   Carbon is a common media used to remove dissolved organics like chlorine and other contaminants from water. It can also help extend the life of the water purifier and it's components by lessening the amount of work required by the system.
    a. Performed 6 months after initial installation.
    b. When reservoir overflow indicated by incorrect reservoir volume.
    c. As indicated by quality tests.
    d. After system decontamination.
5. Replace UV Lamp.
   The UV lamp is used to eliminate bacteria and promote breakdown of organic particles.
    a. After a maximum of 12 months.
    b. When indicated by the consumable alarm.
    c. Bacterial contamination continues even after sanitization of the loop.
6. System Sanitization

Sanitization is used to destroy the bacteria within the pipe-work and reservoir.

a. If bacteria counts are unacceptable.
b. If the unit is being operated under adverse conditions (high temperature).
c. If the unit has not been used for a prolonged period of time.
d. After a maximum of 12 months.
e. Evoqua will bring backup pressurized tanks and hook them to the C1600 instruments to allow us to continue testing patients while sanitization is being completed.

VI. TROUBLESHOOTING THE CENTRA WATER SYSTEM:

A. City Water Unavailable

1. The water filtration system is fed by the hospital's city water lines.
2. If there is an interruption of the water flow at the sinks or bathrooms, IMMEDIATELY notify facilities management at ext. 16300 STAT and request help.
3. If the city water supply is shut down to the lab, the Centra water system will eventually not have any water to filter for use on our analyzers. **It will NOT remedy the situation by putting the system into bypass mode.**
4. There is a holding reservoir in the Centra system that can store up to about 350 liters. Depending on the work volume, this could last for several hours.
5. Conserve water usage by using only ONE Architect c System and ONE Architect i System.
6. Prioritize testing and perform only STAT or time-sensitive testing.
7. Do not put any analyzer into a WASH or CLEANING cycle, this increases water usage.
8. Once the city water is available to use, open several faucets and allow tap water to run until clear. Only after 5-10 minutes of running clear tap water, turn on the Centra water system.
9. Check monitor for alarms.
10. The automation line will need the restored DI water flushed through the system for at least 2-3 minutes to be certain impurities are cleared out of the lines.
11. Run Quality Control on all analyzers before running patient samples.

B. Audible Alarm

If a problem occurs, the Centra unit will sound a weak audible alarm and icons will flash on the remote Centra screen in the Chemistry department mounted on the pole near the automation line and located in the water room.

1. Refer to the Alarm Conditions Chart.
2. Record the alarm code and notify EVOQUA water tech support, if necessary. The chart will assist you in determining whether tech support needs to be called.
3. Silence and reset the alarm by pressing the bottom far right soft key (below the flashing alarm) on the main Centra unit in the water room. You must use the keypad on the unit and NOT the

remote screen in Chemistry.

4. To call Technical Support 1800-466-7873 Our site # 0012062586. Follow their instructions- they may instruct you to put the system into bypass.

C. Switching Centra System to Bypass

ALERT HEMATOLOGY IF THERE IS ANY ISSUE WITH THE CENTRA WATER SYSTEM OR, IF SWITCHING TO BYPASS.

1. In the water room, turn off the Centra system (large blue unit) by pressing the light blue oval process button (covered with red tape) located on the front of the display panel.
2. Close return valve #2 located behind the large blue Centra-200 unit indicated by red tape on the wall pointing to it.
3. Open Bypass valve #3 located behind the mixed bed DI tanks(3) across the room form the Centra unit. The valve is marked "valve #3 indicated by red tape on the wall pointing to it.
4. The Centra water system is now in Bypass and DI water is being provided by the back-up mixed bed tanks.
5. When in bypass, 100% of the city water impurities are eliminated by the mixed bed tanks.
6. When the Centra system is operating, the mixed bed tanks are only used to about 10% of their capacity to "polish" the Reverse Osmosis water.
7. The tanks need to be closely monitored to make certain the indicator lights remain green.
8. Water softness needs to be checked daily while on bypass.
9. Once the system is back online, the Orange valves must be turned to a vertical position to provide water to the analyzer.
10. Perform water line flush as directed by instrument in "as needed maintenance".

D. Centra Water Not Available for Automation Line

1. If the Centra system cannot provide water for the instruments, the automated line should not be used and instruments loaded manually.
    a. Abbott Architect i2000 system.
        i. While the Centra System is unavailable, wash buffer can be loaded on the instrument manually if needed.
        ii. There is a large reservoir on the i2000 so, it may not be necessary to load wash buffer.
        iii. See Architect i2000 onboard operator's manual for instructions to make buffer and load onto the instrument(s).
    b. Abbott Architect c16000 system.
        i. When the DI system is on bypass, the Architect c16000 instruments can run as usual.
        ii. The mixed bed resistivity tank light should be checked 2 times per shift to ensure the water quality is acceptable.
        iii. If the system has some other problem and cannot be used in bypass ex. no

city water, the c16000 systems are INOPERABLE until the water system is back online.

iv. Send specimens to Royal Oak on a packing list for testing.

VII. REFERENCES:

1. Elga Centra Operator's Manual, version 3, 8/2006.

Attachments

Centra alarm codes.pdf

Centra bypass instructions.pdf

Approval Signatures

Step Description	Approver	Date
	Vaishali Pansare: Chief, Pathology	2/21/2023
Policy and Forms Steering Committee (as needed)	Gail Juleff: Project Mgr Policy	2/21/2023
Policy and Forms Steering Committee (as needed)	Kristin Russell: Supv, Laboratory	2/21/2023
	Kristin Russell: Supv, Laboratory	2/21/2023