Fact Sheet

Safe Use of "Tanker" Water for Dialysis

Facilities that provide renal replacement therapy for patients with end stage renal disease in the form of maintenance hemodialysis have a very large demand for water. Water is used in maintenance dialysis facilities to prepare dialysate and to rinse and reprocess dialyzers for reuse on the same patient. During emergency situations, the local municipal distribution of water may be disrupted for extended periods of time. This document provides guidance for both the suppliers of water and dialysis facilities for using water delivered by tanker trucks in emergency situations.

When safe community water supplies are unavailable, water for dialysis may be available by tanker truck or "water buffalo." This is a water tank used to provide an emergency supply by organizations like the Federal Emergency Management Agency (FEMA), state emergency management agencies, state drinking water agencies, and the Department of Defense. If an emergency supply of water is needed, work with your local Emergency Operations Center. They may be able to supply the tanker, or designate a contractor.

To use tanker water for dialysis, consider the following:

For the Water Hauler/Supplier

- The supplier should verify that the water being delivered meets Environmental Protection Agency (EPA) drinking water standards. If the water supplied is safe for consumption, then it may be used as source water for a water treatment system. The source for emergency trucked water must come from an approved public water supply. Other sources of water (i.e., private well) can be used only if shown to be safe to use by bacteriological, and possibly chemical and radiological testing, and approved by the state drinking water authorities.
- Commercial milk or potable water tanker trucks are preferred. However, trucks designed for the transport of wine, vegetable oil, beer, or other food products may also be used.
- The truck container must be contaminant-free, watertight, made of an EPA, Food and Drug Administration (FDA), or National Sanitation Foundation (NSF) approved water- or food-grade material (can only be used for transportation of items for human consumption) that can be easily cleaned and disinfected.
- To ensure that water-hauling equipment is adequately disinfected before using, the tank or truck container, along with all hoses, pumps, and other equipment, must be cleaned and then sanitized by a sanitizer listed in 21 CFR 178.1010. These sanitizing solutions shall be used in accordance with the EPA-approved manufacturer's label use instructions. Normally, these sanitizers will be chlorine, iodine, quaternary ammonium, or acid-based aqueous solutions. If disinfectant other than a chlorine-based chemical was used, the supplier should ensure that the tank was thoroughly rinsed to remove

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residual disinfectant. A test should be done by the contractor to ensure minimal residual levels of the disinfectant.

- Water to be transported by tanker trucks should contain a free chlorine residual of about one part per million (1 ppm) and not more than 4 ppm at the beginning of the haul. This is done by adding 5-6 tablespoons (2.5 – 3 ounces) of common household bleach to each 1,000 gallons.

At the Dialysis Facility

- An additional pressure pump may be needed. Sometimes the tanker truck or water buffalo will have a pump, but if not, the local system may not be able to push this water through the pre-treatment chain with enough pressure and volume to run the reverse osmosis (RO).
- Connect the tanker supply line to the local pre-treatment chain. Minimum requirements for pre-treatment include carbon filtration and monitoring for chlorine or chloramine breakthrough. An optional step is to consider the addition of a multimedia sediment filter on the input to the water treatment system, in case the tanker was not adequately flushed of all particulates.
- Water will be at ambient temperature rather than blended to the usual 76-78°F. If the water is cooler, carbon may not remove chlorine/chloramines as efficiently. Additional carbon filtration may be needed during this time.
- Determine the chemical contaminants in the supply water. If possible, get at least a minimum chemical analysis of the tanker supply water. Focus on those contaminates which have a direct effect on patients (e.g., aluminum, fluoride, copper, chlorine and chloramines). Many of these can be tested on-site with test kits (e.g., HACH Company, LaMotte Company, Orion, etc.) or samples may be sent to a state water quality lab or an approved renal lab. The samples that are sent to a water quality lab should be stored at 4-6^{o}C and analyzed within 24 hours.
- If using untempered water, the RO will not be functioning at optimum condition. You may note a drop in percent rejection and permeate flow rate so that some chemical contaminants may pass through the RO at higher levels than normal and product water flow may be lessened.
- Using a lower dialysate flow rate may be necessary while the water supply is reduced.
- Compare product water quality readings to any historical data. A significant difference could mean that RO membranes are damaged, or the quality of the incoming water has drastically decreased.† (See note below.) If the total dissolved solids (TDS) are more than 20% higher than the historical readings, deionization (DI) tanks may be needed as a polisher on the product water, followed by an ultrafilter to minimize microbial contamination. (See next paragraph.)
- If only DI tanks are being used, the water should then be treated with a UV-irradiator and a pyrogen filter or an ultrafilter to destroy and remove bacteria and endotoxins. Make sure the DI product water is continuously monitored and producing water that is $\geq$ 1 megohm-cm specific resistivity (or conductivity of $\leq$ 1 microsiemen/cm).
- Monitor carefully the water levels in the tanker to ensure an adequate supply of water for the entire dialysis treatment(s). As the water level in the tanker drops, try to secure

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a replacement tanker and get a water analysis of that water, to prevent further disruption of service.

- Increase your frequency of monitoring:
  - Check chlorine/chloramine with each new delivery of water.
  - Verify hourly that product water quality is acceptable.
  - Monitor water cultures and endotoxin at least weekly. If possible, test for endotoxin on-site daily.

The medical director is ultimately responsible for the quality of the water the facility uses for dialysis. Involve medical directors early: it may be better to dialyze patients for a few treatments with water that may not quite meet usual standards (Association for the Advancement of Medical Instrumentation or AAMI) than not to dialyze, as hyperkalemia and fluid overload can be life-threatening, whereas a low level of aluminum exposure can probably be tolerated for a short period.

[†]Note:

If the product water TDS is high and the percent rejection is in line with historical performance, then the RO membranes are most likely good. But the feed water may have a higher than usual level of contaminants. DI polishing will help cope with the extra burden in the feed water.

If the product water TDS is high and the percent rejection is lower than historical values, then the RO membranes are probably bad and should be replaced promptly. DI polishing may or may not be needed once the RO membranes are replaced.

Prepared in collaboration with the Food and Drug Administration, the Centers for Medicare and Medicaid Services, the University of Louisville Kidney Disease Program, and input from the Environmental Protection Agency.

Hemodialysis Water Treatment References:

Technical considerations when bringing a facility back on line after Hurricane Katrina
http://www.bt.cdc.gov/disasters/hurricanes/hcp.asp

Northwest Renal Network document *Monitoring Your Dialysis Water Treatment System*
http://www.nwrenalnetwork.org/watermanual.pdf

Association for the Advancement of Medical Instrumentation, Recommended Practices for Dialysis Water Treatment Systems (RD 52 and RD 62)
http://aami.org/publications/standards/dialysis.html

Tanker Truck Cleaning and Disinfection

FDA. Indirect food additives: adjuvants, production aids, and sanitizers. 21 CFR 178.1010.
http://www.cfsan.fda.gov/~lrd/FCF178.html

FDA. Final Guidance: Guidance on Bulk Transport of Juice Concentrates and Certain Shelf Stable Juices http://www.cfsan.fda.gov/~dms/juicgui8.html

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Juice Products Association. Model Tanker Wash Guidelines For the Fruit Juice Industry, 2004.
http://www.juiceproducts.org/pdf/ModelTankerWashGuidelines.pdf

Cleaning and Disinfection of Water Storage Tanks and Tankers
http://w3.whosea.org/LinkFiles/Update_on_SEA_Earthquake_and_Tsunami_tankerdisinfection.pdf

Tanker Truck and Water Haulers

Guidelines for truck transportation of potable water for public use
http://www.metrokc.gov/health/disaster/truck.htm

Texas Department of Health. Title 25 Health Services, Part 1: Texas Department Of Health, Chapter 229: Food And Drug, Subchapter F: Production, Processing, And Distribution Of Bottled And Vended Drinking Water, Rule §229.83: Water Hauling
http://www.tdh.state.tx.us/bfds/foods/rules/staterules/bvw/229.83.html

Guidelines for Hauling Bulk Drinking Water for Emergency Distribution
http://www.health.state.mo.us/EHOG_manual/Ch_4.6.doc

State of Missouri Emergency Plan
http://www.dnr.state.mo.us/oac/EmergencyPlan.doc

Maine Department of Human Services, Division of Health Engineering: Bulk water hauling
http://mainegov-images.informe.org/dhhs/eng/water/Forms/bulkwaterhauling.pdf

United States Forest Service Water hauler Checklist:
http://www.fs.fed.us/r6/wenatchee/contract/fire/water_hauler_checklist.pdf

Applicability of the Safe Drinking Water Act to Water Haulers:
http://www.epa.gov/safewater/wsg/wsg_6a.pdf