



Severn Trent Water Purification, Inc.  
SORB 33® As Removal Systems

## Media Preparation & Handling Procedures

### A. MEDIA STORAGE

1. Until installation, Bayoxide® E33 As media should be stored in original shrink-wrapped bags, in a dry warehouse or covered securely with tarps. Bags should be stored on pallets to keep them off the ground.
2. If media support gravel is to be used, it should also be stored similarly to the E33 media.
3. Any small tears in bags from unloading or delivery should be sealed with duct tape.
4. Damage to bag lifting loops may require rebagging to permit safe handling later.
5. Inspect bags periodically to make sure rodents or insects have not damaged them.

### B. PREPARATION FOR STARTUP

1. Have Severn Trent Services review operating manual, backwash sequence, and control design before plant start-up.
2. Flush and disinfect all process piping and vessels. Make sure any fine passages in underdrain components do not become plugged with debris.
3. Backwash water source should be clean potable water containing no chemical other than chlorine. If other chemicals are present, such as pipe corrosion inhibitors, they could adsorb onto the media and shorten its life. Have Severn Trent Services review any proposed chemical additions.
4. Hydrotest all piping and tanks.
5. Test all valves and calibrate control equipment.
6. Test backwashing sequence before adding gravel or media to adsorber vessels.
7. Set backwash water rate at no less than 10 gpm/ft<sup>2</sup> and no more than 12 gpm/ft<sup>2</sup> with the upper value preferred for initial backwash. It is very important that flowmeter calibration (mag meters excluded) be verified by an independent method such as rise rate tests inside the empty adsorber vessel (16 to 19.25 inches/minute) or in another tank such as the backwash reclaim tank (rise rate diameter dependent).
8. Backwash water source should be pressure-regulated with maximum flow positively limited to prevent too high a rate.
9. Control action should bring backwash flow up from zero flow in a controlled manner, to prevent water hammer to the media or gravel.
10. Control action should also be smooth when starting or stopping regular forward flow to an adsorber, again to prevent water hammer to the media or gravel. Water hammer can crush the media over time.
11. Check stored support gravel for contamination. Discard contaminated gravel. Add support gravel and backwash as required.
12. Leave adsorber vessels 2/3 full of water for media installation.

### C. CHLORINATION

1. All media is to be saturated fully with chlorine prior to being put into service. Media will adsorb approximately 12-15 grams of free chlorine (Cl<sub>2</sub>) per cubic foot of media. **Chlorine does not have an adverse effect on the media.**  
*For calculating chlorine, saturation is assumed at 13.0 grams Cl<sub>2</sub> per cubic feet of media*
2. NSF approved 12.5% Sodium Hypochlorite should be used to saturate the media and is added directly to the 2/3 full of water vessel.
3. Calculate the concentration of chlorine in ppm required for saturation in the vessel

- a. Volume of media per vessel in cuft. x 1.5 x 7.48 (gal/cuft) = approximated volume of water in the vessel

$$\text{PPM Free Chlorine as Cl}_2 = \frac{\text{cuft (media per vessel)} \times 13.0 \text{ g/cuft (g Cl}_2 \text{ / cuft media)} \times 1000 \text{ (mg Cl}_2 \text{ / g Cl}_2\text{)}}{\text{gal. water per vessel} \times 3.78 \text{ (gal water / Liter)}}$$

- b. Calculate the required gallons of 12.5% sodium hypochlorite solution to be added per vessel

$$\text{Gallons 12.5\% NaOCl} = \frac{\text{calculated ppm of free chlorine} \times \text{gal. water per vessel}}{143,946 \text{ (conversion factor)} - \text{calculated ppm of free chlorine}}$$

4. Add the calculated gallons of 12.5% hypochlorite solution directly to the vessel and mix with a shovel or rake. Allow for the solution to mix for 5-10 minutes. Water is ready for the media to be added. All media must be submerged under water after adding.

### D. MEDIA INSTALLATION

5. Take care not to damage bag lifting loops with sharp edges from forklifts or from rough handling. Bags with damaged lifting loops either must be rebagged or remain on the original pallet and be installed more slowly under careful supervision by cutting the sides of the bag.
6. Crane straps or cables should be at least 10 feet long to prevent lifting straps from being at sharp angles during lifting. Four lifting cables or straps will be needed, one for each bag lifting loop.
7. As bags are lifted off pallets, sweep off any debris on the bottom of the bags. Small abrasion tears from moving may be sealed with duct tape. If holes are due to animal or insect infestation, the media may be contaminated and should be inspected carefully.
8. Position bag over the top manhole of the adsorber vessel. Untie the elephant trunk that is folded up on the bottom of the bag. A loop of rope may be tied around the trunk to control the flow of media from the bag.
9. Dusk masks should be worn to avoid breathing the non-hazardous media dust.
10. Untie the first trunk seal cord, and extend the trunk into the manhole. Open the second upper trunk seal cord, and allow the media to fall into the water inside the adsorber. A large funnel may be used but may not be necessary if the trunk extends down past the manhole opening.

11. Install the required number of bags of media.
12. Level the media in the vessel with a rake or shovel so that all the media is covered with water. Close and seal the top manhole. Allow to soak at least 3 hrs, preferably overnight, to allow the media to become saturated with chlorine and water.

#### **D. INITIAL BACKWASH**

1. Set up each adsorber for backwash. Begin backwash water flow, ramping up smoothly from zero to maximum flow over a 2 minute period.
2. Backwash the new media at up to 12 gpm/ft<sup>2</sup> to remove fines. This process may take 30 minutes or longer the first time. Initial color of the water will be dark red just like the media. Normal sized media will not be discharged if the correct backwash water rate is used.
3. Take samples of dirty backwash water after backwash start at 1, 3, 5, 10, 15, 20, 25, 30, and 35 minute intervals (and perhaps longer) in clear sample bottles or other clear containers to determine that full size media particles are not being discharged, and to determine when the water clarity has improved as much as possible.
4. When two consecutive samples are nearly without color and are similar in appearance, cease backwashing by smoothly ramping backwash water flow down to zero over a 2 minute period.
5. After initial backwash, it is recommended that initial media levels be checked in all of the adsorbers for future reference. The bed surface is leveled and media height is expanded about 7% by backwashing, so future measurements should also be taken after backwashing.

#### **E. STARTUP AND OPERATION**

1. After initial backwash, the adsorber should be run in the forward flow mode at its design flow rate, equivalent to a maximum loading rate of 8 gpm/ft<sup>2</sup> with the initial effluent discarded to sewer, ditch or dirty backwash tank for 3 to 5 minutes. This allows effluent turbidity to drop quickly to normal levels, and prevents small particles loosened by backwashing to be discharged to the distribution system. This is also recommended practice for subsequent backwashes as well.
2. Ongoing monitoring should include flow rate, influent and effluent arsenic concentration, differential pressure across the media and amount of water treated (recorded in bed volumes – volume the media bed displaces in an adsorber).
3. High differential pressure across the adsorber can cause the media to be crushed. Backwashes should be scheduled before differential pressure reaches 10 psi or if effluent arsenic begins to rise (evidence of channeling within the media).
4. When the predicted useful life of the media is approaching, check arsenic removal performance more frequently.
5. Backwash water rate should be 10 to 12 gpm/ft<sup>2</sup>, sustained for about 15 minutes. Control should include a smooth 2 minute ramp up from and down to zero flow.

## F. SHUTDOWN

1. If an adsorber is not to be used for a period of time, chlorinated influent with 5-10 ppm free  $\text{Cl}_2$  should be run through the adsorber about 15 minutes per week with the effluent discarded to the dirty backwash tank.
2. For extended shutdown, add chlorine to the water on top of the media until a 5 mg/l residual is obtained, then drain water down until 6 inches of water covers the media. Check water for a residual every two months and add chlorine if it is below 0.5 mg/L. Backwash the adsorber before placing back in service.

## G. STARTUP AND INSPECTION SERVICE

Severn Trent Water Purification (STWP) process engineer should be onsite during media installation, initial backwashing, and plant startup. Follow up plant inspection and consultation with plant operators should be conducted by an STS engineer 2 months after startup, 6 months after startup and then yearly. Startup and inspection services are currently available for \$1,250 per day, plus expenses at cost. Typical startup time required, depending on number of adsorber vessels, is one day for media loading, one to two days for initial backwash, and two days for initial operation, plus travel days. A typical inspection visit would require one to two days onsite and two additional days for travel and written report.

**Please Note:** Proper media storage, backwashing, operating practice, and experienced follow up attention is required to maximize media performance and media life. Changes to these procedures or recommendations could void the media performance warranty. Consult with Severn Trent Services about any deviation from recommended practices.

# SORB 33® As Removal Frequently Asked Questions Bulletin F



**Date:** August 15, 2007

**Subject:** **SORB 33® System & Bayoxide® E33  
Disinfection**

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**Q: WHAT STANDARD DISINFECTION METHODS ARE USED DURING COMMISSIONING OF A SORB 33® SYSTEM?**

**A:** Regulations governing the degree of disinfection required when commissioning drinking water pumping, treatment and distribution systems vary across State and Local environmental and health agencies. Nonetheless, these regulations set the precedent for a utilities' compliance in a region.

The recommended standard SORB 33® System disinfection methods are conducted after the equipment and any gravel underbedding have been installed and tested hydrostatically for leaks. The equipment systems are dosed with chlorinated water, checking free chlorine ( $\text{Cl}_2$ ) residual levels periodically until the residual stops decreasing and becomes a steady value.

**Q: WHAT STANDARD DISINFECTION METHODS ARE USED DURING COMMISSIONING OF BAYOXIDE® E33 MEDIA?**

**A:** At the end of the Bayoxide® E33 manufacturing process, the final step is high temperature thermal drying of the iron oxide media prior to packaging the product in sealed, shrink wrapped sacks free of bacterial contamination. Emptying the media directly into disinfection adsorber vessels from these sacks does not require any disinfection to the actual media. In fact, Bayoxide® E33 behaves somewhat like granular activated carbon and adsorbs a limited amount of free chlorine. Thus, it is impossible to maintain a residual if the media was to be disinfected although the media will eventually become saturated with free  $\text{Cl}_2$ . The standard process is to backwash the media after allowing it to soak for 4-24 hours for wetting, and then collect water samples from the backwash effluent and treated water lines for bacteria analysis (bacti's). If any bacti sample tests positive, add two gallon of 10-12% NSF certified NaOCl per 100 cubic foot ( $\text{ft}^3$ ) of media into the top of the adsorber, and allow 1-2 hours for dispersing. Then flow water downward at 3-5 gpm/ $\text{ft}^2$  for two bed volumes discharging the effluent to waste and resample for bacti's.

**NOTE:** Bayoxide® E33 media reversibly adsorbs about 17 grams of free  $\text{Cl}_2$  per cubic foot of media. With out chlorine preloading, it takes 40-60 hours of treatment of chlorinated water before saturating the media and measuring a free residual in treated water. Adsorbed chlorine has no negative impact on the arsenic adsorption process providing contacted water does not exceed 150 ppm free chlorine. Some free  $\text{Cl}_2$  will desorb from the media if feed water is not chlorinated.

**Q: WHAT ARE THE DISINFECTION PROCEDURES IF REGULATONS REQUIRE BAYOXIDE® E33 MEDIA DISINFECTION?**

**A:** When regulations require disinfection of the media, add four gallons of 5.25%-6.5% NaOCl Clorox® Brand or two gallons 10%-12%NSF approved bleach per 100  $\text{ft}^3$  of media into the adsorber after gravel addition. Add another four gallons of 5.25%-6.5% NaOCl Clorox® Brand or two gallons 10%-12%NSF approved bleach 100  $\text{ft}^3$  of media into the flooded adsorber after media addition. Allow for the minimum soak period of 4 hours for media wetting, and then proceed with the conditioning media backwash procedures using chlorinated water for this service. Collect bacteria samples as required by regulation. It is important not to exceed 150 ppm free chlorine otherwise damage to media could occur.

