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DRINKING WATER TREATMENT WITH BIOSAND FILTRATION SYSTEM: OPERATOR MANUAL

Maintaining water at drinking water quality standard is important to the health of the community. It prevents malnourishment, diarrheal diseases, and other illnesses. This manual discusses the testing parameters required to maintain water suitable for human consumption.

The chart below describes the basic parameters to be monitored to ensure water quality, the suggested limit, what can be used to test, test frequency, why it is important, and how to mitigate.

Parameter	Maximum Suggested Limit	Detection	Frequency	Mitigation	Notes/Rationale
Fecal Coliform	0 detectable /100 mL, 0 colonies present (see test kit directions as needed)	-3M Petrifilm or other E. coli test kit	Once a month, should be checked at first, middle, and last house/tap stand of the system	Clean out biosand filter	Fecal coliforms are a parameter to check for contaminated water. If above the maximum suggested limit, the filtration system is not functioning properly and maintenance is needed.
Turbidity	<5 NTU or Secchi disk visibility inside the reservoir	Secchi disk or equivalent instrument	Weekly, after a big rain event, should be measured inside of the reservoir	Sedimentation	If water is turbid, it is an indicator the filter is not functioning properly.

To ensure water quality and source protection, conduct the following:
-Monitor the water flow from the filtration system, if flow is low the filtration system may need further cleaning
-Check the upflow pre-filter; if it appears muddy it needs to be cleaned.
-No latrines, open defecation, animals, trash disposal, vehicle washing/maintenance, and washing within 30-meters of water source
-From water source, no uphill or upstream fumigation or agriculture
-The perimeter fence is secure and no repairs are needed
-Water source remains clean of garbage
-Plants around water source maintained to keep water source easily accessible
-Ensure there are no leaks, all lids are in place with locks and all air vents are screened
-Check cleanout line for blockages

After the first heavy rainfall, make sure to check turbidity and fecal coliform levels. Also look for garbage and plants around the water source

Do not forget to conduct required government water quality testing.

Troubleshooting

-**Upflow pre-filter media appears muddy**: Stir the gravel to disturb the muddy sediments until the water becomes brown. Then, open the filtration cleanout valve to flush the turbid water. Refill the gravel filter and repeat the process until the gravel filter media is thoroughly clean.

-**Biosand filter is clogged/low flow coming from the biosand filter to the reservoir**:

1. Check the gate valve between the filtration system and reservoir. Adjust as necessary. If completely open and flow is still low, proceed to step 2.

2. Check the upflow pre-filter to make sure the water is moving to the biosand filter. If water is not flowing to the biosand filter, the biosand filter inlet might be blocked or the upflow pre-filter might need to be cleaned. Once checked and if the flow from the biosand filter is still low, proceed to step 3.

3. Open the cleanout plug located on the biosand filter outlet pipe. Empty out all the water, making sure to remove anything that could be causing the reduction of water flow to the reservoir. If the problem is not resolved, proceed to step 4.

4. *Wet harrowing cleaning method*: Shut the gate valve located at the outlet pipe of the filtration system and inlet pipe of reservoir and let the water from the filtration tank overflow. Opening the biosand filter manhole, disturb the water inside by rotating your hand until the suspended particles on the top layer of sand are disturbed and become suspended. DO NOT touch the sand bed as you could disturb the biological layer. Do this until the water becomes brown. With water still flowing into the biosand filter from the upflow pre-filter, let the water overflow through the biosand filter overflow pipe until the water becomes clear. Repeat these steps until the water does not become brown when you disturb the water. Open the gate valve and let the water flow into the reservoir. Monitor the water flow by measuring the volume of water flowing in to the reservoir. If after doing this method water flow is still limited, proceed to step 5.

5. *Scraping method*: Shut the inflow valve into the filtration system. Open the cleanout valve of the biosand filter and flush out and drain the water. Using the biosand filter manhole, enter the biosand filter. Make sure to wash your feet thoroughly before entering the tank to prevent further contamination. Using a tape measure, measure 2 centimeters down into the sand. Mark the spot along the wall. Carefully remove 2 centimeters of sand off the entire biosand filter. Put removed sand in a clean, dry sack. Close the cleanout pipe and fill the biosand filter with water. Then, flush the water from the biosand filter via the biosand filter cleanout valve to remove the remaining sediments at the bottom of the of biosand filter. After completing the process, let the water flow through the filtration system for at least 10 to 15 days before using the water (this is sufficient time for the biological layer to form). DO NOT throw out removed sand. Keep the sand in the clean sack, stored in a safe place. The sand will be used, after cleaning, in the next scraping process to replace the sand that will be taken out. This will prevent reduction of the filter media. Make sure to clean the sand in the sack before putting it back into the biosand filter.

-**Water from tap is turbid**: If the water coming from the tap is turbid, the filtration system most likely needs to be cleaned. First check the upflow pre-filter. If it appears muddy, clean as described above. Then check the biosand filter. If flow is limited it needs to be cleaned as well. Follow the steps described in the "Biosand filter is clogged/low-flow" section above. If this does not decrease the water turbidity, the water distribution network needs to be cleaned/disinfected. See "Steps for Cleaning and Disinfection of Water Storage Tank and Distribution Network" document.

-**No Secchi disk**: if a Secchi disk is not available to test turbidity, one can be created with an old CD or DVD disk. With a marker, divide the disk into quarters and paint it black and white, as seen in the picture below. Using a 10-meter long string, put one end through the center of the disk and securely tie it to the disk. Tie it in a way to see the painted side of the disk when it is immersed in water. Also add weighted objects (i.e. washers, PVC pipe) as needed to ensure the disc sinks. At the reservoir, slowly lower the Secchi disk into the reservoir until it reaches the bottom. At the bottom, if the colored part of the Secchi disk can be seen clearly, the water is not turbid. If it cannot be seen clearly, the water is turbid.