

## Ability of Treatment Processes to Remove Manganese

Selection of the best treatment process to remove manganese from a particular water supply depends on several factors including:

- the amount of manganese present in the raw water;
- other contaminants in the water such as iron, arsenic, hydrogen sulfide, and organics;
- treatment goals;
- treatment flow rate;
- site size;
- operator availability;
- capital costs; and
- operations and maintenance costs.

Treatment of manganese can be achieved through different methods ranging from manganese sequestering to physical removal through the use of processes such as pressure filtration, membranes, biological filtration, ion exchange and conventional treatment.

### Sequestering

Sequestering is also used to mitigate the effects of manganese by binding manganese in water to prevent oxidizing on contact with air or chlorine and helps prevent staining of fixtures. However, sequestering is only effective for manganese up to about 0.1 mg/L. Additionally, during sequestering manganese is not removed, so potential health impacts remain.

### Pressure Filtration with Manganese Oxide Coated Media

Pressure filtration involves the use of oxidative and/or adsorptive type media for manganese removal such as Manganese Greensand or GreensandPlus and several other proprietary media.

These media can be successful in treating water with manganese up to 2 mg/L, assuming the water does not contain significant concentrations of other contaminants and is not influenced by organics. The factor that limits pressure filter treatment of waters with higher manganese levels is the filter run time. Figure 1 shows the theoretical run times achieved by manganese oxide coated media for varying raw water manganese concentrations assuming 18 inches of media and a loading rate of 5 gpm/sf. As the raw water manganese approaches 2 mg/L, the filter run time approaches 13 hours.

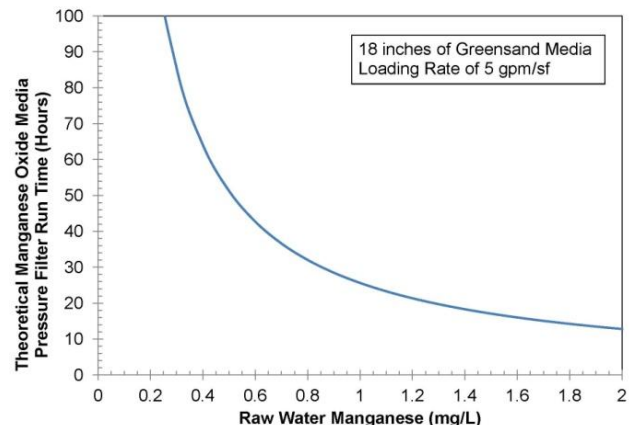


Figure 1. Theoretical Run Times by Manganese Oxide Coated Media for Varying Raw Water Manganese Concentrations



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The run time can be lengthened slightly by increasing the media depth and decreasing the loading rate.

### Other Processes for Manganese Removal

High levels of manganese and/or the presence of additional contaminants may preclude the use of a stand-alone manganese oxide coated media pressure filter system. Manganese removal can be complicated by the presence of organics, high levels of iron, hydrogen sulfide, arsenic, radium, high hardness, and more. When levels of manganese exceed 2 mg/L, alternative treatment process such as membranes or aeration with multi-media filtration could be the solution. If the manganese is organically complexed, it may be possible to simply add a coagulant or polymer ahead of the pressure filters or it may be necessary to use a different treatment process such as membranes or conventional treatment (coagulation, clarification, and filtration). Manganese removal can be a straight forward process but it can also require intricate study and evaluation to achieve successful treatment.

### Summary

Selection of a treatment process for manganese removal can seem like a complicated and overwhelming process. CEI is available to assist you in comparing the advantages and disadvantages of treatment methods and completing pilot testing. Pilot testing is recommended to determine the ability of the process to remove manganese from the water supply. Pilot testing provides valuable data about run times, loading rates, chemical usage and the ability of the treatment process to successfully treat the water supply being tested. Our engineers have experience in working with water system suppliers on manganese issues. CEI can work with you to determine which technology is the right fit for your system.

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