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ALUMINUM FACT SHEET

Contaminant	In Water As	Secondary Maximum Contaminant Level
Aluminum (Al)	Al^{3+} $Al(OH)_3$	**US EPA** SMCL* = 0.05 to 0.2 mg/L **WHO† Guideline** = 0.1 to 0.2 mg/L **Health Canada** OG** = 0.1 to 0.2 mg/L
Sources of Contaminant	Rock and soil leaching	
Potential Health Effects	High risk associated with dialysis patients	
Treatment Methods **Point-of-Entry** **Point-of-Use**	Portable Cation Exchange*** Distillation Reverse Osmosis	

*Secondary Maximum Contaminant Levels (SMCLs), or National Secondary Drinking Water Regulations (NSDWRs), are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. EPA recommends secondary standards to water systems but does not require systems to comply. However, states may choose to adopt them as enforceable standards.

**Operational Guidance Value (OG) established by Health Canada based on operational considerations.

***Cation exchange is not a preferred method for fully automatic home treatment systems due to the need for periodic acid regeneration. If this method is used, a tank exchange program is recommended so regeneration is handled by trained and qualified personnel at a central facility.

WHO† - World Health Organization

Aluminum is an extremely abundant metal in the earth's crust and is often found in the form of silicates such as feldspar ($KAlSi_3O_8$). The oxide of aluminum known as bauxite ($Al_2O_3 \cdot nH2O$) provides a convenient source of uncontaminated ore. Aluminum can be selectively leached from rock and soil to enter any water source. Al^{3+} is known to exist in groundwater in concentrations ranging from 0.1 ppm to 8.0 ppm. Aluminum can be present as aluminum hydroxide, a residual from the municipal feeding of alum (aluminum sulfate) or as sodium aluminate from clarification or precipitation softening. It has been known to cause deposits in cooling systems and contributes to boiler scale. Aluminum may precipitate at normal drinking water pH levels and accumulate as a white gelatinous deposit.

HEALTH EFFECTS

Aluminum is regulated in public drinking water with a recommended Secondary Maximum Contaminant Level (SMCL). SMCL's are used when the taste, odor, or appearance of water may be adversely affected. In this case, the EPA and WHO agree that aluminum above 0.1 ppm may impact color but recognize that level may not be appropriate for all water supplies. US EPA encourages utilities to maintain levels below 0.05 ppm, but recognizes the need to be flexible in this case because of the

usefulness of Aluminum salts in the coagulation process. WHO's guideline of no more than 0.2 ppm is based on the importance of Aluminum as a coagulant and that all municipal systems should be able to keep treated water below this value. Studies linking Aluminum in drinking water to human health issues have been inconclusive.

TREATMENT METHODS

Residential	Distillation
Point-of-Entry	Reverse Osmosis
Point-of-Use	Portable Cation Exchange*
Municipal	N/A
***Cation exchange is not a preferred method for fully automatic home treatment systems.**	

Although aluminum is readily removed from water by cation exchange resins such as those used in water softeners, aluminum is not readily removed back off the resin by normal salt regeneration. Periodic acid treatment is required to exchange accumulated aluminum off the resin, therefore self-regenerating cation exchange systems are not practical for residential use. Point-of-use methods (POU) such as reverse osmosis (>98% reduction) or distillation (>99% reduction) should be considered. When alum ($Al_2(SO_4)_3 \cdot 14.3H_2O$) is used in coagulation in municipal water treatment, it can, under certain pH conditions, precipitate as a result of the concentration effects in the reject waters of either reverse osmosis or distillation systems. Aluminum floc, depending on equipment design and pH, can foul reverse osmosis membranes.

The treatment methods listed herein are generally recognized as techniques that can effectively reduce the listed contaminants sufficiently to meet the SMCL. However, this list does not reflect the fact that point-of-use/point-of-entry (POU/POE) devices and systems currently on the market may differ widely in their effectiveness in treating specific contaminants, and performance may vary from application to application. Therefore, selection of a particular device or system for specific contaminant reduction should be made only after careful investigation of its performance capabilities based on results from competent equipment validation testing for the specific contaminant to be reduced.

As part of point-of-entry treatment system installation procedures, system performance characteristics should be verified by tests conducted under established test procedures and water analysis. Thereafter, the resulting water should be monitored periodically to verify continued performance. The application of the water treatment equipment must be controlled diligently to ensure that acceptable feed water conditions and equipment capacity are not exceeded.

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REGULATIONS

The US EPA sets unregulated Secondary Maximum Contaminant Levels (SMCLs) for contaminants that affect the aesthetics of drinking water but do not pose a risk to human health. Because SMCLs are federally non-enforceable, public water treatment facilities are not required to monitor them unless regulations at the state level require it. The federal SMCL for aluminum is between 0.05 to 0.2 mg/L or ppm, which means at or above these levels certain aesthetic effects, specifically the coloration of water, could occur.

REFERENCES/SOURCES

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