

Ozone



This information sheet is intended to assist the waterworks designer, owner, manager or operator in understanding ozone and the related requirements of *The Water Regulations, 2002*.

What is ozone?

Ozone is commonly used in drinking water treatment for disinfection as well as taste and odor control. Ozone is a strong oxidant that can inactivate microorganisms, including *Cryptosporidium*, *Giardia*, and viruses, as well as oxidize and break down natural organic matter. Ozone exists as a gas at room temperature and must be generated on-site. Ozone reacts rapidly with organic and inorganic compounds and does not maintain a residual in water for a significant amount of time.

Do I need a permit to add ozone to my water treatment plant?

If you wish to add ozone to your treatment plant, there is a requirement for a permit to construct. The application must include a design plan stamped by a professional engineer (plan may be marked 'for regulatory review only') including minimum dose rates, a Concentration-Time (CT) calculation, a Startup Plan describing the dosage rate of ozone and any change in dosage of other chemicals during commissioning, and all other routine application requirements seen in Section 1 of [A Guide to Waterworks Design EPB 201](#) produced by the Ministry of Environment (Environment).

Can ozone be the only disinfectant for a water system?

Ozone is a strong oxidant and is able to achieve disinfection with less contact time and concentration than weaker disinfectants; however, ozone decays rapidly and does not remain in water for any significant amount of time. As such, ozone makes a good primary disinfectant (disinfection of microorganisms in the water treatment plant), but cannot be used as a secondary disinfectant (protection against microorganisms in the distribution system). Because ozone cannot be used as a secondary disinfectant, another disinfectant, such as chlorine, chloramines, or chlorine dioxide, must be used for a complete system disinfection.

What is the minimum level of ozone residual that must be maintained?

Since ozone is so volatile, ozone residual does not remain in water long enough for it to be measurable in the distribution system. Ozone residual must be monitored at the outlet of the tank(s) where disinfection is occurring. As each tank and water are different, the minimum ozone residual required will vary from location to location. An engineering consultant must be hired to set an appropriate ozone residual for each tank where disinfection is occurring.

Does ozone have regulated disinfection by-products?

An issue with the use of ozone is the formation of the by-product bromate, which can be produced if the water that is being treated contains bromide. *Health Canada's interim maximum acceptable concentration (IMAC) for bromate in drinking water is 10 µg/L*. The Permit to Operate for the system will be updated to include routine bromate testing where bromide is present in the raw water.

How will ozone be monitored in the water treatment plant?

Ozone residual monitoring must be conducted daily during the peak hourly flow rate. As ozone dose can vary over time, it is recommended that monitoring be conducted on a continuous basis. Ozone residual monitoring is required at the outlet of every tank where CT credits are awarded for disinfection.



Is ambient air ozone monitoring required in the water treatment plant?

All water treatment plants that use ozone shall have ambient air ozone monitors which are set up to measure the ambient ozone level at all entrances into the building, at all areas where high ambient ozone could occur (such as near ozone generation equipment and near all ozone contactor tanks), and by the outlet of all ozone destructors. The monitors should be set up to sound an alarm when the ozone concentration reaches 0.05 ppm and should be set up to shut down the water treatment plant when concentrations exceed 0.15 ppm.

Are there Occupational Health and Safety issues with ozone?

The amount of ozone that is transferred into the water depends on the transfer efficiency of the ozone contactor. Ozone that is not transferred into water during contacting is released from the contactor as off-gas and must be contained since the concentration of ozone in the off-gas from an ozone contactor is usually well above the fatal limit. Ozone contacting tanks must be sealed and the off-gas must be routed through an off-gas destructor in order to ensure the safety of workers. *The Occupational Health and Safety Regulations, 1996*, state that the 8 hour average contamination limit for ozone is 0.05 ppm, and that the 15 minute average contamination limit for ozone is 0.15 ppm.

Can ozone be stored before use?

Because ozone is an unstable molecule, it should be generated at the point of application for use in water treatment.

Are any small-scale trials required before we install ozone at our facility?

Yes, at a minimum tabletop or pilot studies must be conducted to assist designers with setting an appropriate ozone dosage for the water treatment plant, and to determine the required ozone residual in the contacting tanks to ensure that adequate disinfection is taking place. Include an evaluation of oxidizables like iron and manganese, since high levels of oxidizables can adversely affect turbidity after treatment with ozone. The designers should be aware of the concentration of bromide present in the water, since bromide will react with ozone to form bromate. *Not all water will be a suitable candidate for ozone.* Results of tabletop or pilot studies can form part of the application for a permit to construct.

What about the maintenance of the ozone generators?

Maintenance on ozone generators requires skilled technicians. Please contact your equipment supplier for a list of technicians qualified to service your particular ozone generator. Since many water treatment plant operators may not be familiar with servicing ozone generators, it is recommended that backup units be installed. Generators should be checked daily when in operation to ensure an adequate ozone dose is maintained.

Is more information on ozone available?

Additional information on design and safe use of ozone is available from engineering consultants and equipment suppliers.

Additional information on the regulation of ozone is available from the Ministry of Environment's Environmental Project Officers and from the Ministry's Approval Engineers. To speak to an Environmental Project Officer or an Approval Engineer please call 306-787-6517.

