

Chemical Use and Storage at Waterworks

There are numerous chemicals used at water treatment plants in the production of drinking water. Water plant operators must become familiar with the chemicals used at their facilities, specific chemical selection and applications, and safe storage and handling. All chemicals are potentially dangerous and necessary precautions must be taken before handling any chemical.

Material Safety Data Sheets (MSDS)

A Material Safety Data Sheet (MSDS) is the best source of information regarding a chemical. The manufacturer or formulator of the hazardous substance or mixture develops a MSDS that provides pertinent information and a profile of a particular hazardous substance or mixture. The MSDS is required to be made available to employees and operators whenever there is the likelihood of the hazardous substance or mixture being introduced into the workplace. Some manufacturers prepare MSDS for products that are not considered to be hazardous to show that the product or substance is not hazardous. No chemical should be received, stored or handled without essential safety information being provided to those who come into contact with the substance.

The MSDS will provide at least the following information:

- identification of composition, formula, and common and scientific names;
- specific gravity, boiling/freezing points, solubility and vapour pressure;
- incompatible substances and decomposition products;
- health hazards;
- environmental impacts;
- personal protective measures and engineering/administrative controls; and
- safe handling, storage, disposal and cleanup procedures.

Don't ever work with a chemical unless you understand the hazards involved and you are using the protective equipment necessary to protect yourself. If there is any doubt in your mind about safe procedures for a specific chemical, contact your chemical supplier or your Environmental Project Officer (EPO) for information and/or direction.

Chemical Storage at Waterworks

Water treatment chemicals can be stored in a number of ways including:

- solid (dry) form (bags, cartons, drums);
- liquid form (drums, tanks, cylinders); and
- gaseous form (cylinders).

When unloading or transferring chemicals, be especially careful. Be familiar with the locations and use of all safety showers and eye wash fountains and test them periodically to be sure they function properly. Wear protective clothing when working with chemicals. Goggles and face shields will protect your eyes and face. Protect other exposed portions of the body by wearing rubber or neoprene gloves, aprons or other protective clothing. Chemical dust can irritate the eyes and respiratory system. Use respirators when appropriate and always use dust collectors if available. Promptly wash down or clean up all chemical spills to prevent falls and/or physical contact with the chemical.

Chemicals should be stored in accordance with the manufacturer's written recommendations and in accordance with the requirements of *The Hazardous Substances and Waste Dangerous Goods Regulations (HSWDG)*. Since 1995, storage of industrial hazardous substances (includes corrosive, ignitable and oxidizing substances) in containers above a total combined weight of 1,000 kilograms requires approval to store under the *HSWDG Regulations*. Storage of acutely hazardous substances (includes chlorine gas, chlorine dioxide, sodium fluoride, etc) or environmentally persistent or chronically hazardous substances in total combined quantities greater than 100 kilograms also requires approval to store.



Chemicals are used in the following aspects of water treatment:

- algae control;
- taste and odour control;
- clarification;
- corrosion/scaling control;
- water softening;
- fluoridation; and
- disinfection.



Approval separate from a waterworks permit is required from Saskatchewan Environment (SE) for chemical storage in excess of the above noted quantities. Contact the Environmental Project Officer (EPO) who inspects your water treatment plant for more information and an application for approval to store chemical in excess of the above noted quantities.

General requirements of the *HSWDG Regulations* for storage of hazardous substances in containers above the quantities outlined above include:

- containers must be situated in an area which is constructed and maintained to prevent any release from entering a water supply, sanitary sewer or storm sewer or from contaminating any other area. Containers must be stored within a building or area outside of a building which is fenced and posted to restrict access and warn of the materials stored within;
- containers must be clearly marked or labelled in accordance with the *Transportation of Dangerous Goods Act (Canada)*;
- kept in segregated storage which, in the event of a spill or release, will prevent chemical reactions or fires. Chemicals must also be stored apart from food for people or animals;
- certain records and documents must also be kept including MSDSs, an inventory of chemicals (hazardous substances) in storage, records of spills, leaks or unaccountable inventory discrepancies, inspection and maintenance records for leak detection and containment systems at the facility and an emergency response plan in relation to chemicals stored on site. Additionally, at least semi-annually, a current copy of the chemical storage inventory must be provided to the local fire department. A copy of the facility chemical storage emergency response plan must be provided to the local fire department either annually or whenever the plan is revised.

In instances where greater than a total of 2,000 kilograms of hazardous substances are stored in containers, certain requirements for structural fire ratings and fire alarms may apply depending on the nature and location of the building used to store the substances. If chemicals are stored in tanks, certain requirements will also apply, including the need for approval to store. The information provided below in Table 1, Summary of Water Treatment Chemical Information, provides information on the regulatory storage limits for commonly used water treatment chemicals. Additional information and fact sheets on chemical storage requirements applicable to containers, warehouses and tanks are available from SE.

Chlorine Gas Storage – An Example of the Hazards and Controls

Chlorine is one of the most common chemicals used in the water treatment industry. Chlorine is a strong respiratory irritant, and either prolonged exposure to chlorine gas or high concentrations of chlorine gas could be fatal. Wherever chlorine gas is stored or used, the following safety equipment should be provided:

- shower and eye wash facility;
- emergency breathing apparatus;
- chlorine gas detector;
- floor level vents; and
- fans that maintain a positive air pressure in the storage facility.

The safety equipment mentioned is not a regulatory requirement, but is an important safety consideration. Although the above noted safety related items are not mandatory within the Guidelines for Chlorine Gas Use in Water and Wastewater Treatment EPB 265, some fall under the *Occupational Health and Safety Regulations*. All water treatment plant operators should be fully trained in chlorine safety and leak detection procedures. Training in the use and storage of chlorine gas is not a mandatory requirement within *The Water Regulations*, however training is highly recommended. Further information specific to chlorine use is available from Guidelines for Chlorine Gas Use in Water and Wastewater Treatment. Information on confined space and hazardous space entry is available from local Occupational Health and Safety officials.

Chemicals Used at Water Treatment Plants

The choice of specific chemicals to use in a water treatment plant will vary depending on source water quality, type of treatment to be performed, availability of chemicals and possibly economic considerations. Advice on chemical selection, feed rates and optimization can be obtained from engineering consultants. Table 1 provides a summary of chemicals commonly used in the water treatment industry and the applicable regulatory storage limits.

Table1: Summary of Water Treatment Chemical Information

Chemical Name	Chemical Formula	Chemical Category (in accordance with the <i>Hazardous Substances and Waste Dangerous Goods Regulations</i>)	Regulated Storage Quantity (Kilograms)*
Coagulants			
Aluminium Sulphate (Alum, granular)	$Al_2(SO_4)_3 \cdot 18 H_2O$	Industrial Hazardous Substance (in liquid form) Non-Hazardous in solid form	1,000 Kg (liquid form) Not Applicable – solid form
Ferric Chloride	$FeCl_3 \cdot 6 H_2O$	Industrial Hazardous Substance (in liquid form)	1,000 Kg
Ferric Sulphate	$Fe_2(SO_4)_3 \cdot 9 H_2O$	Not Applicable	Not Applicable
Ferrous Sulphate	$FeSO_4 \cdot 7 H_2O$	Not Applicable	Not Applicable
Cationic Polymer	Varies with specific chemical	Varies with specific chemical	Varies with specific chemical
Anionic Polymer	Varies with specific chemical	Varies with specific chemical	Varies with specific chemical
Non-ionic Polymer	Varies with specific chemical	Varies with specific chemical	Varies with specific chemical
Poly-aluminium Chloride	$Al_2(OH)nCl_{6-n}$	Industrial Hazardous Substance	1,000 Kg
Disinfectants			
Sodium Hypochlorite	NaOCl	Industrial Hazardous Substance	1,000 Kg
Anhydrous Ammonia	NH_3	Industrial Hazardous Substance	1,000 Kg
Ammonium Hydroxide	NH_4OH	Industrial Hazardous Substance	1,000 Kg
Ammonium Sulphate	$(NH_4)_2SO_4$	Not Applicable	Not Applicable
Calcium Hypochlorite	$Ca(OCl)_2 \cdot 4 H_2O$	Industrial Hazardous Substance	1,000 Kg
Chlorine	Cl_2	Acute Hazardous Substance	100 Kg
Chlorine Dioxide	ClO_2	Acute Hazardous Substance	100 Kg
Ozone	O_3	Generated on Site – Not Applicable	Generated on Site – Not Applicable
Taste and Odour Control			
Activated Carbon	C	Industrial Hazardous Substance	1,000 Kg
Hydrogen Peroxide	H_2O_2	Industrial Hazardous Substance	1,000 Kg
Potassium Permanganate	$KMnO_4$	Industrial Hazardous Substance	1,000 Kg
Algae Control			
Copper Sulphate	$CuSO_4 \cdot 5 H_2O$	Industrial Hazardous Substance	1,000 Kg
Corrosion Control			
Calcium Hydroxide (Hydrated Lime)	$Ca(OH)_2$	Industrial Hazardous Substance	1,000 Kg
Orthophosphates	PO_4	Varies with specific chemical	Varies with specific chemical
Polyphosphates	$NaPO_3$	Varies with specific chemical	Varies with specific chemical
Sodium Hydroxide (Caustic Soda)	NaOH	Industrial Hazardous Substance	1,000 Kg
Softening			
Calcium Oxide (Quicklime)	CaO	Acute Hazardous Substance	100 Kg
Sodium Carbonate (Soda Ash)	Na_2CO_3	Not Applicable	Not Applicable
Fluoridation			
Fluosilicic Acid	H_2SiF_6	Acute Hazardous Substance	100 Kg
Sodium Fluoride	NaF	Acute Hazardous Substance	100 Kg
Sodium Silicofluoride	Na_2SiF_6	Acute Hazardous Substance	100 Kg

* Quantities include total combined weight of industrial hazardous substances and/or acute hazardous substances

Is More Information on Chemical Storage at Waterworks Available?

Additional information on chemical properties is available from product manufacturers and from product MSDSs. Additional information on the requirements for storage of chemicals at a waterworks is available from the EPO who regularly inspects the waterworks.