IMPACT

OF

WATER TREATMENTPROGRAMS

ON THE

ENVIRONMENT

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by

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INTRODUCTION

The primary objective of a water treatment program is to reduce scale formation and corrosion of the mechanical components of heating & cooling systems to acceptable levels.

In order to accomplish this objective, explicit water treatment programs are established for specific water systems. That is, open water systems (ie., steam boiler, condenser water & air washer humidifier systems) are treated with scale, corrosion & bacteria controlling agents, whereas closed water systems (ie., hot water heating, cooling water & glycol systems) are treated with corrosion controlling agents.

The scale and corrosion controlling agents which are employed for these water treatment programs consist of either generic or proprietary chemical inhibitors. A generic inhibitor is usually composed of a single chemical, whereas a proprietary inhibitor is a chemical which is usually identified with a chemical or supplier name, followed by a number, and is composed of numerous chemicals.

The APWS&S Property Management Water Treatment Program incorporates the use of generic scale and corrosion inhibitors. That is, open water systems are treated with generic chemicals such as sodium sulphite, sodium hydroxide, sodium hexameta phosphate, tri-sodium phosphate, morpholine, and sodium hypochlorite, whereas closed water systems are treated with generic chemicals such as sodium sulphite, ethylene glycol, and propylene glycol.

Conversely, a proprietary water treatment program incorporates the use of proprietary scale and corrosion inhibitors. For open water systems, most proprietary scale inhibitors are phosphonate based materials. For closed water systems, proprietary corrosion inhibitors are usually sulphite, silica, nitrite, or molybdate based materials.

Whether a generic water treatment program or a proprietary program is utilised, the quality of water containing scale & corrosion inhibitors that is released to the environment must be in compliance with regulations.

ENVIRONMENTAL QUALITY CONTROL AGENCIES

The release of material by individuals, corporations, and municipalities to the environment (ie., air/land/water) within the Province of Alberta is governed by the Alberta Environmental Protection and Enhancement Act.

This Act forms the basis by which By-Laws are established by Municipalities to regulate the quality of material that is directed to sewerage systems.

The Edmonton Sewers Use By-Law Number 9675 is in some respects the most stringent of all sewers use by-laws in the Province of Alberta. That is, the present contaminant limits for the discharge of restricted wastes to sanitary and combined sewers in the Cities of Edmonton and Calgary summarised in Table 1 overleaf show that the Biochemical Oxygen Demand limit is lower in Calgary than in Edmonton, whereas the copper limit is higher in Calgary than in Edmonton. However, the present Calgary Sewer Service By-Law Number 56M84 is currently being revised, and it is understood that it will closely resemble that of Edmonton when it is scheduled for completion in June 1996.

The sewers use by-laws of less populated municipalities range from non-existence to those approaching Edmonton and Calgary. Also, some cities in the province have a surcharge system, whereas others do not. These differences are due in part to the different treatment methods that are used; however, there is a mounting trend to unify standards in the province.

Table 1: Partial Listing of Present Contaminant Limits for the Discharge of Restricted Wastes to Sanitary & Combined Sewers for the Cities of Edmonton & Calgary

Contaminant	Units	Limit for Edmonton	Limit for Calgary
General Contaminants			
Biochemical Oxygen Demand	mg/l	10,000 (300)	1,200
Chemical Oxygen Demand	mg/l	20,000 (600)	NA
Oil & Grease	mg/l	800 (100)	450
Suspended Solids	mg/l	5,000 (300)	1,200
Total Kjeldahl Nitrogen	mg/l	500 (50)	NA
Temperature	° C	75 max.	77 max.
pH	pH units	6.0-10.5	5.5-10.0
Inorganic Contaminants			
Arsenic	mg/l	1.0	NA
Boron	mg/l	2.0	NA
Cadmium	mg/l	0.10	NA
Chlorine (free)	mg/l	5.0	NA
Chromium	mg/l	4.0	3
Copper	mg/l	1.0	3
Cyanide	mg/l	2.0	3
Lead	mg/l	1.0	1
Mercury	mg/l	0.10	0.01
Molybdenum	mg/l	5.0	NA
Nickel	mg/l	4.0	3
Phosphorus	mg/l	200 (10)	NA
Sulphate	mg/l	1500	NA
Sulphide	mg/l	1.0	3
Zinc	mg/l	2.0	3

* Note: Surcharged Limits are Parenthesised

COMPLIANCE OF THE GENERIC WATER TREATMENT PROGRAM WITH ENVIRONMENTAL REGULATIONS

The pertinent control limits for the generic water treatment program for the open water systems, as well as the respective discharge limits, converted to the same units, for restricted wastes to the sanitary & combined sewers in the City of Edmonton are summarised in Table 2 below. As indicated therein, the only limits that are surpassed are the pH and possibly the surcharged limit for phosphorus for steam boiler systems. However, it is expected that the normal flow of building service water that is discharged to the sanitary & combined sewer system will sufficiently dilute the marginally high levels of these control parameters.

Table 2: Control Limits & City of Edmonton By-Law Limits for the Generic Water Treatment Program of Open Water Systems

Control Limit	Converted By-Law Limit
Steam Boiler System	
10.5-11.5 pH	**6.0-10.5 pH**
40-80 ppm PO_4	**60 mg/l PO_4**
30-60 ppm SO_3	1250 mg/l SO_3
5 ppm morpholine	282 mg/l morpholine
Condenser & Air Washer Humidifier	
10-20 ppm PO_4	60 mg/l PO_4

Similarly, the pertinent control limits for the generic water treatment program for the closed water systems, as well as the respective discharge limits, converted to the same units, for restricted wastes to the sanitary & combined sewers in the City of Edmonton are summarised in Table 3 below. As indicated therein, the only limit that is surpassed is the oxygen demand associated with glycol in the glycol heating & cooling systems. However, it is expected that the normal flow of building service water that is discharged to the sanitary & combined sewer system will sufficiently dilute the minor loses of glycol from these systems.

Table 3: Control Limits & City of Edmonton By-Law Limits for the Generic Water Treatment Program of Closed Water Systems

Control Limit	Converted By-Law Limit
Hot Water Heating & Chilled Water	
8.5-9.5 pH	6.0-10.5 pH
50-100 ppm SO_3	1250 mg/l SO_3
2000 ppm TDS	2218 mg/l TDS
Glycol Heating & Cooling	
1352 mg/l total oxygen demand	**300 mg/l BOD**

COMPLIANCE OF THE PROPRIETARY WATER TREATMENT PROGRAMS WITH ENVIRONMENTAL REGULATIONS

Because of the vast number of different proprietary scale & corrosion inhibitors for the open water systems (ie., steam boiler, condenser water & air washer humidifier systems), a comparison of the control limit concentrations for these inhibitors with the by-law limits can only be made on an individual basis.

The pertinent control limits for the proprietary water treatment program for the closed water systems, as well as the respective discharge limits, converted to the same units, for restricted wastes to the sanitary & combined sewers in the City of Edmonton are summarised in Table 4 overleaf. As indicated therein, the molybdenum level for the molybdate based program, and the nitrogen level for the nitrite based program are substantially greater than their respective by-law limits. It is also assumed that where these inhibitors are being used, the water losses are minor and the normal flow of building service water that is discharged to the sanitary & combined sewer system will sufficiently dilute the high concentrations of these control parameters to acceptable levels.

Table 4: Control Limits & City of Edmonton By-Law Limits for the Proprietary Water Treatment Program of Closed Water Systems

Inhibitor	Control Limits	Converted By-Law Limit
Sulphite	50-100 ppm SO_3	1250 mg/l SO_3
	8.5-9.5 pH	6.0-10.5 pH
	2000 ppm TDS	2218 mg/l TDS
Molybdate	**50-100 ppm Mo**	**5.0 mg/l Mo**
	9.0-10.0 pH	6.0-10.5 pH
Nitrite	**700-1500 ppm $NaNO_2$**	**246 mg/l $NaNO_2$**
	9.0-10.0 pH	6.0-10.5 pH
Silica	30-40 ppm SiO_2	NA
	8.5-9.5 pH	6.0-10.5 pH

CONCLUSION

It appears that the generic water treatment program is less susceptible than the proprietary programs to violations of sewage use by-law limits. However, all building waste water that is discharged to municipal sewer systems must be in compliance with municipal by-law regulations.