INORGANIC CHLORAMINES

Comments on the CEPA PSL Draft Assessment Report on Inorganic Chloramines were provided by:

1. Canadian Water and Wastewater Association
2. Greater Vancouver Regional District (GVRD).

Throughout the comments provided, several references were made to risk management activities. An individual response to each of these comments is presented in the table below. In addition, the following general response is offered.

> The PSL Assessment of Inorganic Chloramines is a scientific risk assessment which has been conducted in order to determine whether inorganic chloramines are "toxic" as defined by the CEPA 1999. The assessment is a thorough and unbiased analysis of the scientific knowledge pertaining to inorganic chloramines. It concluded that inorganic chloramines are "toxic" to the environment as defined by in Section 64(a) of CEPA 1999. If the Ministers of Environment and Health recommend that inorganic chloramines be added to Schedule 1 of the Act, then the risk management phase will commence. Risk management strategies for "toxic" substances are then developed through a multistakeholder process. While evaluating management options to control inorganic chloramine exposure in the Canadian environment, such things as the sources, release rates, potential effects, and existing pollution control technologies will be considered. Risk management options can include voluntary controls, process changes, substitutions, economic measures, federal regulations, guidelines or codes of practice, control by other federal or provincial/territorial legislation, or a combination of these measures.

Detailed responses to individual comments are summarized in the following table by Environment Canada. (All were based on the English version of the report).

Comment[(source)]	**Response**
1….in respect of all but the most massive of discharges (normally associated with unavoidable and unpredictable events), no detectable effects or only minimal effects are observed in the aquatic environments at the discharge points and that these are rapidly attenuated. The overall impact on the viability of the affected biota in the entire receiving body of water is not significant. [(1)]	Although it is not explicitly stated, this comment seems to relate to potable water releases. The conservative level assessment of chloramine in potable water sources found that even very small direct discharges of chloramine-treated potable water could result in impacts. As is indicated, these sources are unavoidable and unpredictable, but very common (see Assessment Report and Supporting Document No. 4). The conservative level assessment found that approximately half of all reported releases in Mission and Abbotsford occurred within 50 m of a small stream. Assuming that the flow would travel at 0.01 to 0.1 m/s, a large flow would take between 0.14 to 1.4 hrs to travel 50 m. Table 8 of

Comment[(source)]	Response
	Supporting Document No 4 (attached to these comments) shows that flows of this nature certainly have potential to cause impact when encountering either a high or low chemical demand pathway. In addition, Appendix C of Supporting Document No. 4 shows that chloramine concentrations in surface waters can persist for great distances. Severely negative consequences to freshwater ecosystems have occurred in the Lower Mainland of British Columbia, where releases of chloramine-treated potable water due to water main breaks resulted in the mortality of many thousands of salmonids and several thousand invertebrates. These breaks, which occurred in Surrey, B.C. in 1990, are described thoroughly in the Assessment Report. Inorganic chloramines are also produced in wastewaters containing ammonia that are chlorinated, but not dechlorinated. These discharges are continuous and occur at several locations across Canada. The assessment found moderate to high risk resulted from some of these discharges.
2. The use of chlorine to disinfect municipal effluents is equally controlled to use the minimum doses required to meet public health standards and many utilities are in the process of converting to other disinfection methods. If further reductions in the use of chlorine (or other disinfectants) is considered necessary, the members of CWWA are willing and eager to join in a technical assessment of the possibilities of doing so with both environmental and health authorities at the provincial and federal level, and to encourage the implementation of such possibilities. [(1)]	Such input will be welcomed during the risk management phase. This comment will be forwarded to the lead Risk Manager for inorganic chloramines for consideration.
3. The CWWA believes that the Ministers should distinguish between the **potable water situation** and the **wastewater effluent situation** and that they can do so easily and simply while still achieving the environmental goals of	Potable water and wastewater sources of chloramines are clearly distinguished in the Assessment Report, and the risk assessment has been conducted for each source separately. Based on the input of stakeholders during the risk management stage, such as the CWWA, the selection of controls can also acknowledge this division in sources.

Comment[(source)]	Response
the assessment. Declaring chloramines (as a substance) to be CEPA toxic will create the perception that potable water supplies contain a toxic substance - when the use of chlorine or chloramine is required for public health reasons. This effect is not justified for the environmental benefits that might eventually be obtained. [(1)]	The assessment was conducted for inorganic chloramines which are released to the Canadian environment from all known sources, including wastewater and potable water. This reflects the recommendations of the Ministers' Expert Advisory Panel which are identified in the Assessment Report. The Assessment Report clearly indicates that the determination of "toxic" pertains to the environment and not to human health. In addition, the Assessment Report recognizes the need for a balanced approach to risk management which acknowledges both ecological risk and human health benefits. The report states that "*considerations for subsequent risk management of one of the principal sources of chloramines in the environment — i.e., the disinfection of drinking water supplies — must necessarily be balanced against the beneficial impacts of chloramine use on human health.…Chloramination is considered to offer several advantages, such as increased residual activity in the distribution system, reduction of the formation of trihalomethanes (THMs) and other by-products associated with chlorine use, possible control of bacterial biofilm regrowth in the distribution system and, in some circumstances, reduction of taste and odour problems associated with chlorination of drinking water supplies.*" Environment Canada and Health Canada have prepared a communication plan to ensure that there is no confusion that the declaration of "toxic" pertains to the environment and not to human health among the general public or in the media.
4. The CWWA therefore [see Comments 1, 2 and 3] proposes that chloramines NOT BE ADDED to the List of Toxic Substances, and notes that **chloramines in the municipal effluent stream** are already included in the List of Toxic Substances within the substance **Chlorinated Municipal Effluents**. If there is a need to address chloraminated industrial cooling discharges, then the substance **chlorinated municipal**	See responses to Comments 1, 2 and 3. Chloramines were acknowledged in the PSL 1 assessment of Chlorinated Wastewater Effluent; however, in this case the entire effluent was declared "toxic" and no rigorous assessment was conducted on the inorganic chloramine component. These effluents contained many chlorinated substances, including chloramines. Since the foci of these assessments are different, it is not appropriate that they be merged. However, it is acknowledged that risk management steps taken to control chlorinated wastewater effluents may

Comment[(source)]	Response
effluents on the List of Toxic Substances should be amended to be **chlorinated effluents** or **chlorinated municipal and industrial effluents**. [(1)]	also address their chloramine releases. This would be considered during the Risk Management Process.
5. The CWWA also believes that this Notice is a statutory instrument and is therefore subject to the Regulatory Impact Analysis Policy of the Government of Canada. This Policy requires, amongst other things, that the proponent examine and reject all alternative mechanisms to achieve the stated objectives or purposes of the instrument - in this case, the ability to manage the risk from the release of inorganic chloramines into the environment. Even if the scientific basis of the assessment is sound (see additional comments below) and there is a need to manage the release of the substance, mechanisms other than adding the substance to the List of Toxic Substances and using the provisions of CEPA, 1999 already exist and should have been considered and discussed. [(1)]	A regulatory impact analysis (RIAS) is required pursuant to the Federal Regulatory Policy at the time the Minister decides to add a "toxic" substance to Schedule 1. However, there is no assessment of the economic impacts associated with this step, given that the decision to add a substance to Schedule I is solely based on science. As part of the risk management stage, a full assessment of alternatives, costs and benefits will be addressed.
6. … the Ministers should establish a tri-level National Advisory Council on Municipal Wastewater Effluents to examine and advise the Ministers on the scope of any environmental risks, the existence of solutions and the manner of implementing such solutions. [(1)]	Such input will be welcomed during the risk management phase. This comment will be forwarded to the lead Risk Manager for inorganic chloramines for consideration.
7. The assessment notes that many pathways involving potable water releases have sufficiently high chemical decay and are sufficiently long such that concentrations entering the aquatic environment do not result in impacts in surface waters, and that where this is not the case, the discharge is the result of unintended and unpredictable incidents	The Assessment Report states that "*…pathways that have sufficiently high chemical decay and that are sufficiently long could decrease chloramine concentrations to levels that do not result in impacts to surface waters. A high-demand pathway may result from exposure to biological materials such as slimes and fungi and entrainment with high levels of suspended sediments containing various oxidizable organic substances. Soil infiltration and evaporation would influence losses en route to the surface waters. On the other hand,*

Comment[(source)]	Response
(main breaks, fire fighting, etc.) that would be difficult, if not impossible to manage. [(1)]	*pathways not exposed to organic materials, without significant losses due to infiltration and evaporation, would not result in large chloramine losses*." In the case of potable water discharges containing chloramines, it is correct that such discharges are often the result of unintended and unpredictable incidents. The fact that accidental discharges may be difficult to manage would require close consideration during the risk management phase; however, this does not change the conclusion of the scientific assessment. This comment will be forwarded to the lead Risk Manager for inorganic chloramines for consideration.
8. Chloramines are formed in trace quantities in potable water supplies from the chlorination process used to disinfect public water supplies and not just from the application of a chloramination processes. The quantities will depend on the organic content of the potable water itself.[(1)]	Chloramines may be formed in chlorinated potable water supplies if there are appropriate inorganic or organic nitrogen compounds at the time of chlorination. In the presence of ammonia, inorganic chloramines may be formed. In the presence of certain organic nitrogen compounds, organic chloramines may be formed. The Assessment Report states that the scope of the scientific assessment includes inorganic chloramine releases from potable water treated with free chlorine.
9. Chloramine toxicity to freshwater and saltwater biota is highly variable, thus the ecological impacts are highly variable and depend on the site, the quantities discharged, the species present and seasonal conditions - suggesting a site-by-site approach to management, if at all. [(1)]	The Assessment Report reflects this concern and indicates that site specific characteristics should be considered in the event that a facility discharging chloramines to the marine environment is proposed. This comment will be forwarded to the lead Risk Manager for inorganic chloramines for consideration.
10. CWWA also notes that the assessment itself includes the comment that "reducing the exposure of aquatic biota to chloramines may involve an examination of regionally or locational specific characteristics that affect chloramine risk." This suggests that existing provincial and territorial water and wastewater management mechanisms rather than CEPA, 1999 - a national instrument - should be used to	Risk management options can include voluntary controls, process changes, substitutions, economic measures, federal regulations, guidelines or codes of practice, control by other federal or provincial/territorial legislation, or a combination of these measures. Input regarding risk management mechanisms will be welcomed during the risk management phase. This comment will be forwarded to the lead Risk Manager for inorganic chloramines for consideration.

Comment[(source)]	Response
address any environmental concerns that may exist.[(1)]	
11. Systematic monitoring surveys at the case study and other sites would provide further data regarding chloramine exposure and would facilitate an analysis of risk using actual data; however, it should be noted that the concentrations at which toxic effects are noticed may not be easily detected by current, commonly used monitoring equipment. If a facility is required to monitor discharges to ensure these concentrations are not exceeded, the costs may be extreme and the data/equipment may not be reliable. [(1)]	During the risk management stage, concerns with respect to future requirements for monitoring can be presented and considered. This comment will also be forwarded to the Risk Manager for Inorganic Chloramines.
12. No assessment was made of the total chloramine exposure within the environment to indicate whether or not the exposure is significant. It is recognized that exposure where it may occur is point specific and highly variable. Almost all human activities have site impacts, but in total these do not necessarily constitute a significant risk to the environment. The question yet to be answered is how significant is chloramine exposure in terms of the total aquatic environment and the overall sustainability of aquatic biota. [(1)]	The risk assessment was conducted on inorganic chloramines and not total chloramines since this reflects the main intent of the conclusion of the Ministers' Expert Advisory Panel and their rationale to add chloramines to the PSL2. Although not required for the assessment, the state of scientific knowledge of organic chloramines was researched and reported (see Supporting Document No. 2). Chloramine exposure was evaluated in terms of ecological relevance and not exposure to the total aquatic environment. This is consistent with the PSL Program (Environment Canada, 1997). Priority Substances List Program uses assessment and measurement endpoints to characterize the ecologically relevant biota (receptors) at risk. The assessment endpoint chosen was mortality to the invertebrate *Ceriodaphnia dubia*, and chinook salmon. These species are ecologically important, and relevant to the case studies as detailed in the Assessment Report. Chinook salmon are related to other salmonid species, such as rainbow trout and coho salmon, which have a similar or greater sensitivity to chloramines, and together, salmonids are widely distributed throughout Canada. The results of the exposure modelling (using reviewed

Comment[(source)]	Response
	methods, and whose results compared favourably with the measured data) showed ecological risk in all case study areas. For the Don River, risks *to C. dubia* are severe, with probabilities >80% for 50% or greater mortality for over half the river and >35% over the entire river at the greatest distance from the outfall modelled (1900 m). The level of risk for March was similar. In January, the risk to chinook was 41% for 20% mortality 1900 m from the source. This analysis indicates severe mortality of organisms used as food sources for fish over a broad area of the river during the winter season. The creation of this impact zone could impede safe passage of biota to and from Lake Ontario to the upper reaches of the river. Fish in this zone could also suffer mortality, particularly during the winter season. Shallow bays, such as Ashbridges Bay, are important sites of productivity in that they provide sources of food for fish and they also provide important fish habitat. Thus, they affect the overall health of the lake. Risk modelling for Ashbridges Bay of Lake Ontario showed that there was a probability of approximately 70% for 50% mortality to *C. dubia* in a semi-elliptical band that was at least 500 m in width and extended approximately 6000 m in January. For chinook salmon, the highest risk was forecasted for January, at which time there was estimated to be a 30–40% probability of 20% or greater mortality in a zone approximately 500 m wide and 3000 m. Due to the morphology of the North Saskatchewan River, the chloramine plume from the from the Clover Bar Generating Station was followed the shoreline. The analysis showed an 86% probability of 50% or greater mortality to *C. dubia* and 52% probability of 20% or greater mortality to chinook salmon was forecasted in a narrow plume 1000 m from the source. The results of these analyses, measured concentrations and documented fish kills provided sufficient evidence to show that inorganic chloramines are entering the environment in a quantity or concentration or under conditions that have or may have an immediate or long-term harmful effect on the environment.

Comment[(source)]	Response
13. …we feel that the assessment report does not sufficiently recognise that many wastewater treatment facilities dechlorinate their chlorinated effluents and thus do not discharge chloramine.[(2)]	Changes have been made to the Assessment Report to ensure that it is clear that the facilities that completely dechlorinate chlorinated effluents, including those in the GVRD, do not release measurable concentrations of chloramines. In addition, Table 4 (Chloramine speciation at three municipal WWTPs in British Columbia) has been edited to ensure that the reader clearly understands that these effluents were subsequently dechlorinated and hence no measurable chloramine discharge to the environment resulted from these sources.
14. …we view the statement "if a facility discharging chloramines to a marine environment is proposed, a precautionary risk assessment is recommended to evaluate site-specific characteristics that affect ecological risk"…We feel that the comment highlights the site specific nature of environmental effects from municipal discharges and urge that this be more dominantly recognised in the assessment report.[(2)]	The participation of the GVRD will be welcomed during the risk management phase. This comment will be forwarded to the lead Risk Manager for inorganic chloramines for consideration.

Sources of Comments:
[1] Canadian Water and Wastewater Association.
[2] Greater Vancouver Regional District (GVRD).

Reference Cited:
Environment Canada, 1997. Environmental assessments of Priority Substances under *the Canadian Environmental Protection Act*. Guidance manual version 1.0--March 1997. Chemicals Evaluation Division, Commercial Chemicals Evaluation Branch, Hull, Quebec (EPS/2/CC/3E).

Attachment: Excepts from Supporting Document No. 4

Table 8. Approximate duration (hours) of overland flow required to decrease chloramine concentration to no impact levels: Coastal British Columbia.

Dilution Ratio	High Demand [a]				Low Demand [b]			
	8 Hour Discharge		17.9 Hour Discharge		8 Hour Discharge		17.9 Hour Discharge	
	200 µg/L	1,020 µg/L	200 µg/L	1,020 µg/L	200 µg/L	1,020 ug/L	200 µg/L	1,020 µg/L
1:1,000	NA[c]	NA	NA	NA	NA	NA	NA	NA
1:100	NA	NA	NA	Imm.	NA	NA	NA	26
1:10	NA	Imm.	Imm.	Imm.	NA	129	73	> 170
1:1	Imm. [d]	1.1	0.1	2.7	135	> 170	> 170	> 170
10:1	Imm.	2.1	1.1	3.7	> 170	> 170	> 170	> 170
100:1	Imm.	2.2	1.2	3.8	> 170	> 170	> 170	> 170
1,000:1	Imm.	2.2	1.2	3.9	> 170	> 170	> 170	> 170

Note:

[a] Determined using k= 14.83 /d, initial chloramine demand = 0.93.

[b] Determined using k = 0.281 /d, initial chloramine demand = 0.11.

[c] NA = Not applicable since this dilution ratio produces no impacts under the direct discharge scenario.

[d] Imm. = Immediate decrease (in seconds to minutes) in chloramine concentration to no impact level. Immediate reduction to no impact level results from initial chloramine demand.

Source: Pasternak, J.P 2000. *Canadian Environmental Protection Act*. Tier 2 assessment of drinking water releases for inorganic chloramines. Supporting document no. 4. Commercial Chemicals Division, Environment Canada, Pacific and Yukon Region, North Vancouver, British Columbia.