

## AMMONIA IN THE AQUATIC ENVIRONMENT

Comments on the **environmental sections** of the CEPA PSL Draft Assessment Report on Ammonia in the aquatic environment were provided by:

1. Alberta Environment
2. City of London, Ontario
3. Citizen from British Columbia
4. Greater Vancouver Regional District
5. Alberta Environment, Industrial Program Development Branch
6. B.C. Ministry of Environment, Lands and Parks, Kamloops
7. Canadian Fertilizer Institute
8. Canadian Cattlemen's Association
9. Regulatory Affairs Canadian Manufacturers of Chemical Specialties Association
10. City of Kamloops
11. Canadian Water and Wastewater Association
12. Regional Utility Planning, Greater Vancouver Regional District
13. City of Burnaby
14. City of New Westminster

Comments and responses are summarized below by Environment Canada. (All were based on the English version of the report).

Comment <sup>(source)</sup>	Response
<p>1. The PSL2 ammonia value is 41 µg/L, while the CCME value for Protection of Aquatic Life is 4 µg/L. Both values provide a value for ammonia at which ammonia is considered to be toxic to aquatic life. Both values originate within Environment Canada. I understand how each value is derived, but which value does Environment Canada recommend that industry follow? Having the two values creates a good deal of confusion. <sup>(1)</sup></p> <p>A similar comment was offered by Alberta Environment<sup>(5)</sup></p>	<p>Environment Canada does not at this time recommend any value of ammonia other than those in the current CCME Water Quality Guidelines document. The CCME value of 4 µg/L was a draft value that was put out for discussion. The CCME draft guideline has changed from 4 µg/L to around 19 µg/L. The value 41 µg/L was used by Environment Canada in the PSL2 assessment as a chronic Critical Toxicity Value intended to be a measure of low toxic effect. This toxicity endpoint was selected to be an EC<sub>20</sub> for growth and reproduction to the most sensitive 5% of a mixed, aquatic community.</p>
<p>2. The Environmental Resource Group appears deficient since it does not include any Municipal representatives. <sup>(2)</sup></p>	<p>The municipal “sector” was represented on the environmental resource group by Dr. Les Gammie of EPCOR as selected by the Canadian Water and Wastewater Association.</p>

<b>Comment</b> <sup>(source)</sup>	<b>Response</b>
	Mr. Glen Brown, of the City of Edmonton also sat in on a few meetings.
3. The impact of agricultural releases appears to be glossed over. This is especially concerning when the report states that 700,000 tonnes of ammonia are released to the air annually and that deposition of ammonia occurs fairly rapidly. In contrast, the top 10 Municipal discharges referenced in the report discharge 27,284 tonnes per year. Ammonia loading in the Thames river ( for the years 1978 to 1999 inclusive) downstream of London averages 2,200 lbs. per day of which 63% comes from upstream of London. The agricultural loading to the Thames river is very significant. <sup>(2)</sup>	Agricultural loading of ammonia to aquatic systems proved to be extremely difficult to estimate, as ammonia does not travel through soil, and ammonia evaporating and depositing from agricultural operations was extremely difficult to estimate. Despite these data limitations results of a screening level risk assessment indicate potential for harm from intensive animal husbandry operations (see Table 11).
4. Is un-ionized ammonia a problem in the environment or is it very localized? Monitoring data upstream and downstream of the City of London between 1978 and 1999 inclusive show that 99.6% of the results are less than 0.04 mg/l un-ionized ammonia. <sup>(2)</sup>	Un-ionized ammonia is problematic in a number of regions across Canada, based on the nature of the receiving stream (summer temperatures and pH) and the nature of the sewage effluents reaching those streams (volume and ammonia concentration).
5. The pH of effluent from sewage treatment plants are less than the average assumed for the receiving stream. The 1999 average pH for the City of London Greenway Plant was 7.6 and for the Oxford Plant was 7.3. This would have a significant impact on the percent of un-ionized ammonia. Was this considered in the assessment of the sewage treatment plants? <sup>(2)</sup>	The pH of the sewage effluent affects the formation of un-ionized ammonia until the effluent is mixed into the receiving water. After that point the pH of the receiving water will affect the concentration of un-ionized ammonia. The proportion of un-ionized ammonia increases under basic pH conditions, so that initial neutral pH conditions in the effluent will depress the un-ionized ammonia concentration. As the effluent is diluted in the receiving water, which in this case is more basic than the effluent, the relative proportion of un-ionized ammonia will increase. The assessment of ammonia was conducted under realistic conditions, where the dilution ratio was fairly high (greater than 10:1), so that the initial pH of the sewage effluent would not affect the results downstream.

<b>Comment</b> <sup>(source)</sup>	<b>Response</b>
6. Even in sewage treatment plants that nitrify, there can be plant upsets that will yield higher levels of ammonia. The proposed water quality limit of 0.04 mg/l un-ionized ammonia is based on long term effects and if a limit for sewage treatment plants is considered, a limit based on an average should be considered. <sup>(2)</sup>	Yes, it is most appropriate to compare the value 41µg/l (which as noted previously, is not a “proposed water quality limit”), to temporally averaged exposure values.
7. Ammonia is not persistent in the environment. In oxidized waters it readily converts to nitrates, which are not toxic. Depending on the pH of the waters, ammonia may not be in a form that is toxic to fish. It is an important fertilizer in the agricultural sector. Given that it is not persistent or bioaccumulative I don’t think ammonia ranks as a “priority” substance. There are numerous other substances, not being looked at yet by your program, which in my view are a much greater priority. <sup>(3)</sup>	The priority ranking for “ammonia in the aquatic environment” was determined by the Minister’s Expert Advisory Panel on the Second Priority Substances List. The rationale provided by the Panel for inclusion of this substance on the List is provided in the Introduction of the assessment report.
8. The assessment report that accompanied the Gazette notification identifies some areas of real concern to municipal wastewater treatment plant (WWTP) discharges to specific water systems – primarily on the prairies and other inland water systems. The report also clearly states in several locations that the ecological impacts of ammonia from municipal WWTP discharges are highly specific. We are concerned that the site-specific nature of these effects was not captured at all in the assessment report synopsis, in spite of being a significant finding of the report itself. <sup>(4, 13, 14)</sup>	The synopsis of the report has been amended to mention these conclusions.
9. In the discussion of ecological significance (Section 3.1.2.5), the report notes that most of the “urban populations in the Maritimes and B.C. discharge to a large river, to lakes, or directly to the Ocean. There is little information on, or evidence of, potentially significant impacts of these discharges on the receiving environment, due largely to the high dilution capacity of the water bodies”. We cannot speak	The synopsis of the report focussed on major themes of the assessment and on those aspects that showed the toxicity of ammonia. Not all of the conclusions developed in the report were put into the synopsis.

Comment <sup>(source)</sup>	Response
<p>for other jurisdictions, but in the Greater Vancouver region, there exists a body of evidence that suggests that ammonia has not caused significant ecological effects to receiving waters as evidenced by measured ammonia concentrations below provincial water quality objectives in the receiving environment near our outfalls.</p> <p>More specifically, the assessment report notes that “there does not seem to be an ecological toxicity hazard from the Iona Island deep-sea outfall”. We agree with this statement and are concerned that such significant conclusions were not raised to the summary of the report. <sup>(4, 13, 14)</sup></p>	
<p>10. We strongly feel that a broad national policy tool such as the CEPA process should provide a mechanism to take regional and site specific conditions into account, possibly through other existing processes or programs.</p> <p>We are very concerned that a national policy might not recognise the site-specific nature of discharges of ammonia resulting in inappropriate management decisions. <sup>(4, 13, 14)</sup></p>	<p>Following a declaration of CEPA toxicity, the Risk Management phase of the program is developed where-in discussions of processes and programs to achieve reduction of the toxic substance are conducted with all interested stakeholders. During this risk management phase, relevant site-specific data can be presented and considered.</p>
<p>11. The recommendation to add ammonia to the toxic substance list without qualification ignores the site-specific and regional significance of the ecological impacts of ammonia. <sup>(4)</sup></p>	<p>The substance assessed was “ammonia” with a focus on aquatic environment. Schedule 1 of CEPA 1999 represents a list of Toxic Substances. Site-specific or regional significance of ecological impacts are not considered in the definition of a substance in Section 3. Therefore it was proposed that “ammonia” be added to the List of Toxic Substances without qualification. However, such factors will be critical in the development of risk management actions.</p>
<p>12. I hope that the Minister will reconsider the recommendation and not add ammonia to the list of CEPA toxic substances. <sup>(4, 13, 14)</sup></p>	<p>It was determined by the assessment team that there was sufficient evidence of ammonia toxicity under some aquatic conditions in many locales across Canada. The methods used in</p>

Comment <sup>(source)</sup>	Response
	<p>this assessment are consistent with those applied to other Priority Substances. In view of this, and the fact that no scientific information contradicting the proposed conclusion was received as a result of the public review period, and that the assessment was reviewed by members of the Environmental Resource Group and by Environment Canada staff, we believe that the proposed conclusion and the recommendations to add ammonia to the List of Toxic Substances is justified.</p>
<p>13. Last sentence of page 13, paragraph 1 seems to contradict page 11 where environmental effects of particulate from NH<sub>3</sub> were not evaluated.<sup>(5)</sup></p>	<p>Ammonia as a particulate was not assessed here as it was covered under another Priority Substance assessment 'Respirable Particulate Matter Less Than or Equal to 10 Microns'.</p>
<p>14. In saying "Alberta released the largest quantity...." is misleading since agriculture and municipal releases are not included; if they were included Alberta would <u>not</u> be the largest contributor.</p> <p>Most of ammonia in Alberta is deep welled – it is not quite accurate to consider them as release to environment and include them in the total.<sup>(5)</sup></p>	<p>The sub-heading for this section is Industrial, therefore all the material presented is on the industrial releases. Alberta does have the highest industrial releases of ammonia in Canada. Most ammonia released in Alberta is released to air, based on the NPRI data from 1996 used in the report.</p> <p>Most ammonia released in Alberta, in 1996, was released to air (9454 t to air vs 7774 t to underground). If only air emissions are considered Alberta still leads Ontario. However, deep-well injection is considered a release under the NPRI. The report has been adjusted to reflect this release.</p>
<p>15. The information on Alberta streams is out of context; it should have supporting information like the size of data set. Is it for all stations? Is it for all years and throughout the year? And how many sites?</p> <p>The paragraph suggests that Alberta Environment does not provide temperature and pH values. These information are available if correct inquires are made. The case here it may be that the inquiry was not properly carried</p>	<p>We did not provide a great deal of information on the details of the sample numbers, number of sites, etc. as the information was not that useful due to the lack of pH and temperature data.</p> <p>Alberta Environment did not provide temperature and pH data for their data set, despite our careful attempts to explain what we needed, which included pH and temperature.</p>

Comment <sup>(source)</sup>	Response
<p>out. Therefore it is suggested to clarify this in the final draft. <sup>(5)</sup></p>	<p>Requests for said data were sent several times.</p>
<p>16. Appendix B: The numbers are misleading because there is an assurance that same quality of data is available from all the provinces. Can this be assured that all the provinces have same level of monitoring and reporting as Alberta? Or Alberta's values are higher because they have good monitoring and reporting programs/requirements?</p> <p>The title of the appendix should specifically say that these values are for industrial releases and do not include municipal or agricultural release. If they did, Alberta would not be the highest releaser.</p> <p>Overall it is suggested that this appendix and reference to it in the document be taken out of the document because we are not sure that we are comparing apples to apples. Therefore, having the table and the comparison between the provinces may <u>cause confusion and unnecessary alarms!</u></p> <p>In page 8 paragraph 7 it is noted that ammonia releases from fertiliser plants to the atmosphere totals to 12,000 tonnes/y, and from agriculture it is estimated at 700,000 tonnes per year. The table in Appendix B amounts to only approx. 32,000 tonnes/y. Therefore relatively quite insignificant and one could ask why include this table, for what purpose is this of value? It suggests Alberta is the largest anthropogenic producer, which is not correct. <sup>(5)</sup></p>	<p>The level and quality of reporting is based on companies responding correctly to the NPRI. It is reasonable to expect that Alberta's numbers are higher because more ammonia is released in Alberta than elsewhere in the country due to Alberta's mix of industries.</p> <p>The report has been modified in response to this comment.</p> <p>It is important, in our opinion, to include this Appendix.</p> <p>The significance of the release of ammonia has more to do with where and how it is released, and not necessarily the gross amount released. Alberta is the largest industrial releaser of ammonia, that is all that is suggested by this table. With Alberta's large animal husbandry industry and relatively large population, it would likely be either first or second behind Ontario as a gross releaser of ammonia.</p>

Comment <sup>(source)</sup>	Response
<p>17. I am rather concerned that any implementation program that is imposed with respect to ammonia allow sufficient lead time for the rather costly implementation program for the installation of the necessary treatment works. <sup>(6)</sup></p>	<p>Following a declaration of CEPA toxicity, the Risk Management phase of the program is developed where-in discussions of processes and programs to achieve reduction of releases of the toxic substance are conducted with all interested stakeholders. The RM phase has two years to develop a proposed preventive or control action with respect to the release of the toxic substance.</p>
<p>18. Defining all ammonia as CEPA-toxic without due regard to relevant risk factors is inappropriate and furthermore, this could result in unwarranted associations between a CEPA-toxic substance and ammonia manufacturing.</p> <p>... in our view the report's conclusion falls substantially short of meeting the government's stated intent that the CEPA is risk and release-based as opposed to hazard and use-based. To be consistent with this intent, the substance of concern should be explicitly designated e.g. by referring to "sewage ammonia", "municipal sewage treatment plant effluent", or otherwise describing the substance's risk/release characteristics as identified by the assessment report. <sup>(7, 8, 9)</sup></p>	<p>Environment Canada understands the Canadian Fertilizer Institute's desire to have a separation between a potentially CEPA toxic substance and one of their products. However, the substance under assessment is "ammonia" not ammonia from a specific source or in a specific medium. In the early stages of the ammonia assessment we expanded the scope of the assessment from the aquatic medium to all environmental media based on indications of environmental damage in European forests from agricultural air emissions. Currently, the major sources of ammonia causing potential toxicity in water are municipal wastewater treatment plants and intensive livestock operations. Environment Canada has consistently identified these as being the sources of potentially toxic concentrations of ammonia to aquatic ecosystems.</p>
<p>19. The City of Kamloops is concerned that the resulting document from Environment Canada relating toxicity to ammonia in the aquatic environment may be over-generalized in an attempt to simplify the issue and ensure that sensitive areas, such as those highlighted in the synopsis, are protected adequately. As we are sure that this document will play an important part in determining effluent criteria, it is important to the City of Kamloops that the receiving environment be taken into account when considering ammonia toxicity including the concentrations which are pertinent to</p>	<p>The summary report states in Section 3.4 'Considerations for Further Action' that : <i>'options to reduce the exposure to ammonia from municipal wastewater systems should be examined on a site-specific basis'</i>. This was done as a recognition that ammonia behaviour in water is complex and that not all municipal wastewater effluents may be toxic due to differences in the receiving environment.</p> <p>We also made mention that many cities in B.C. discharge to water systems that have a very high dilutional capacity, and that little, or no</p>

<b>Comment</b> <sup>(source)</sup>	<b>Response</b>
specific environmental conditions. <sup>(10)</sup>	evidence could be found for environmental toxicity in these situations.
20. It is not clear from the quoted text drawn directly from the cited Canada Gazette, whether the Ministers propose to recommend to the Governor in Council the addition of “ammonia” or “ammonia in the aquatic environment” to the List of Toxic Substances. Accordingly, the CWWA requests if the Ministers wish to proceed, that this be clarified, and the Notice be re-Gazetted. <sup>(11)</sup>	The revised Assessment Report is quite clear on this point " <i>it is concluded that ammonia is entering the aquatic environment in a quantity, or concentration or under conditions that have or may have an immediate or long-term harmful effect on the environment or its bio-diversity.</i> " The recommendation is for the addition of ‘ammonia’ to the List of Toxic Substances.
21. The CWWA requests therefore that the Ministers take all the time that is necessary to determine if they wish to proceed to add a substance in the ammonia ‘family’ to the List; and if so to do so as precisely and as narrowly as possible in order to focus and limit both their own subsequent responsibilities and the consequent responding actions and obligations of the parties that will be affected by their action. <sup>(11)</sup>	Environment Canada has spent considerable time developing this assessment, and is of the opinion that there is no need to delay the process.
22. Again, CWWA requests that the precise identity of substance that is recommended for addition to the List of Toxic Substances be clarified : is it ‘ammonia’, ‘ammonia in the aquatic environment’, ‘un-ionized ammonia’ or ‘total ammonia’. <sup>(11)</sup>	The Assessment Report is quite clear on this point " <i>The terms ‘total ammonia’ and ‘ammonia’ refer to the sum of un-ionized ammonia and ionized ammonia (NH<sub>3</sub> + NH<sub>4</sub><sup>+</sup>).</i> " The toxic component of ammonia is un-ionized ammonia (NH <sub>3</sub> ), its formation is strongly dependent on the temperature and pH of the water. As noted previously, it is proposed that “ammonia” be added to the List of Toxic Substances.
23. CWWA requests if the Ministers wish to proceed, that in addition to clarifying the identity of the substance that would be recommended for addition to the List, that the entry to be made to the List, if any, also specify the concentration of the substance. <sup>(11)</sup>	The PSL toxicity assessment process is not intended to identify a regulatory limit for a compound. There are provincial and inter-jurisdictional processes (through the Canadian Council of Ministers of the Environment) that set regulatory limits and recommended guidelines for a variety of water uses. The Risk Management phase of this process may deal with the issues inherent in setting regulatory limits if the stakeholders desire it.



<b>Comment</b> <sup>(source)</sup>	<b>Response</b>
<p>24.... the CWWA questions whether it is appropriate for a national instrument such as CEPA to attempt to address potential or actual environmental conditions on a national basis, and recommends that the Ministers not proceed to recommend the addition of ammonia to the List of Toxic Substances.<sup>(11)</sup></p>	<p>The PSL assessment of ammonia has determined whether, and under what conditions and from what major sources ammonia is toxic. The question of how to identify and deal with potentially toxic situations will be dealt with on a national basis in the Risk Management phase of this process.</p>
<p>25. CWWA urges the Ministers to establish with the Provinces and Territories and through the CWWA with representative municipalities a national Task Force to examine the possibility of introducing an entirely voluntary program of ammonia reduction where appropriate, in lieu of initiating an approach using a broad, national instrument through CEPA.<sup>(11)</sup></p>	<p>The Risk Management phase of this process is an open, consultative and participatory process that will seek solutions to the management of ammonia from Municipal Wastewater Treatment Systems using the full suite of options. This suite of options includes voluntary agreements, risk reduction strategies, pollution prevention plans, site specific assessments, regulations, etc. Environment Canada welcomes the participation of any and all stakeholders in the Risk Management phase of this process. Environment Canada will assess with interested stakeholders the available options to find appropriate solutions within a rigorous timeframe in order to ensure that the work before us is completed in a timely manner, as has been demanded by Canadians.</p>
<p>26. The CWWA therefore urges the Ministers not to proceed to recommend ammonia to the List of Toxic Substances in Schedule 1, of CEPA, 1999 at this time.<sup>(11)</sup></p>	<p>The addition of “ammonia” to the List of Toxic Substances is justified based on the result of the risk assessment, and as there have been no data presented to contradict the science, then it is proposed that listing should go ahead.</p>
<p>27. “Synopsis: The report highlights the limited number of waters potentially affected by ammonia discharges, highlighting the site specific nature of this issue. As well, the synopsis states that releases of ammonia from other sources may be causing environmental harm. Despite these two statements a general conclusion is reached that “priority should be given to consideration of options to reduce exposure to ammonia from municipal systems.” We feel that this general conclusion is not</p>	<p>This conclusion is considered justified, since the major sources of ammonia causing potential toxicity in water, that are identified in the report, are municipal wastewater treatment plants.</p>

<b>Comment</b> <sup>(source)</sup>	<b>Response</b>
supported by the previous two statements” <sup>(12)</sup>	
<p>28. “The conclusion is reached that there does not appear to be an ecological toxicity hazard from the Iona Deep Sea Outfall. We agree and feel that this conclusion is not represented in the summary of the report.</p> <p>The statement is made that most of the urban populations in BC discharge to a large river, to lakes, or directly to the ocean, and that there is little information on or evidence of potentially significant impacts. We feel that this is an important point that is overlooked in the Synopsis of the report”<sup>(12)</sup></p>	<p>As noted previously, the synopsis of the report focused on major themes of the assessment and on those aspects that showed the toxicity of ammonia. Not all of the conclusions developed in the report were put into the synopsis.</p>
<p>29. “Section 3.4: This section states that options to reduce exposure to ammonia should be viewed on a site-specific basis. It also states that discharges to water bodies with large dilution capacities may not require ammonia control. We agree with both these points and feel these important results should be included in the synopsis”<sup>(12)</sup></p>	<p>As noted previously, the synopsis of the report has been amended to mention of site-specific considerations.</p>