Testimony to the House Standing Committee on the Environment and Climate Change

Re: Revisions to the Canadian Environmental Protection Act

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Madame Chair and honourable MPs: Thank you for inviting me to submit to your deliberations on the Canadian Environmental Protection Act (CEPA).

To begin my preparations, I first read the discussion paper produced in June of this year:

http://www.parl.gc.ca/Content/HOC/Committee/421/ENVI/WebDoc/WD8320863/421_ENVI_reldoc_PDF/ENVI_Chair_CEPA-e.pdf

I was dismayed to find that some of the excellent changes proposed in the 2006 review of CEPA were still extant. Upon further investigation I found that CEPA 1999 had last been updated to 6 February 2014, and there was no detail given on what updates had been made.

https://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=26A03BFA-1

I also note that many of the issues, such as numbers of unevaluated chemicals are virtually the same in the June 2016 discussion paper as in submissions in 2006. Although there has been some progress made on the problem of identifying which among the many chemicals produced should be targeted for more scrutiny (for example: Muir et al. 2009; Muir and Howard 2006; Hull et al. 2015), it appears that new chemicals are being added to the priority pollutants list too rapidly for the registry to catch up.

In what follows, I shall introduce a number of emerging problems that I think will cause problems for CEPA soon, and it would be best if they were addressed in the current revisions.

Vulnerable Populations

It is proposed that some life stages such as fetuses and children, be designated as "vulnerable populations." It seems to me that the vulnerability of remote, indigenous communities deserve special mention. Often they do not have the options for avoiding pollution that more accessible and affluent communities do. For example, subsistence communities downstream of the oil sands rely on fish and game for subsistence. Average mercury concentrations in three of the four most common fish species are at levels where consumption should be limited (Radmanowich 2012). There is already a consumption advisory for eating the eggs of fish-eating birds, and mercury concentrations are still increasing (Hebert et al. 2013). In Grassy Narrows, Ontario, mercury remains high enough to cause symptoms of Minimata Disease, over 50 years after direct discharge of the element to the Wabigoon River ceased (Takaoka et al. 2014). For remote communities with low incomes, high food prices and few

stores, switching food sources is not an option. And the numbered treaties guarantee that their traditional food sources will remain secure. Certainly these populations are as vulnerable as any sector of society.

Witches' Brews

Many of the most chronic pollution problems appear to occur where no single chemical is present at concentrations above CCME guidelines, but from several chemicals are present at concentrations that would not be regarded as toxic when administered singly, or have toxicologies that are virtually unknown and unassessed. To again use the oil sands as an example, discharges to air and water contain large numbers of organic and inorganic chemicals that were in the mined bitumen (Kelly et al. 2009, 2010; Kurek et al. 2013). Many of the organic compounds released are almost totally unassessed for toxicity, and many are unidentified. It is, however, well-known that the mixtures are highly toxic and teratogenic to fish eggs and embryos that are exposed to high concentrations of bitumen in water (He et al. 2012, Colavecchia et al. 2004) and that several percent of adult fish show lesions or malformations (Schwalb et al. 2014). This inability to detect and quantify chronic, multi-pollutant, cumulative effects is the Achilles Heel of CEPA and other attempts to set thresholds for contaminant exposure.

Some of the most toxic "brews" occur near population centers, where traces of antibiotics, personal care products, medications and endocrine disrupters are present, the result of human use and incomplete removal at sewage treatment facilities, or of runoff from non-point sources. While the concentrations detected are typically at parts per trillion, some of these may have detrimental environmental or health effects. For example, Kidd et al. (2007) found that the synthetic hormone used in birth control pills added at a few parts per trillion in water caused feminization of male minnows in a small lake. As the result of the ensuing lack of reproduction, the population went into steep decline, which was reversed only when addition of the estrogen ceased (Kidd et al. 2014). Evidence for feminization of male fish is frequently found downstream of sewage or pulp mill discharges, suggesting that estrogenic substances are present (Mills and Chichester 2005; https://www.researchgate.net/publication/297768149_Altered_reproduction_of_fish_exposed_to_pulp_and_paper_mill_effluents_Roles_of_individual_compounds_and_mill_operating_procedures_Environmental_Toxicology_and_Chemistry_2008_27_682-697).

Similarly it is believed that the low concentrations of antibiotics entering from sewage or runoff from animal culture facilities are leading to antibiotic resistant strains of pathogens in humans and animals, a rapidly developing global health emergency http://www.who.int/mediacentre/factsheets/fs194/en/

Some of the compounds threatening to cause development of antibiotic resistance are from sources that many people would not expect. For example, Triclosan, a common antimicrobial agent in soaps toothpastes and other personal care products until recently, has now been banned in the USA but not in Canada. Apparently it was not banned in Canada because in separate assessments, Health Canada and ECCC decided that it would not significantly affect human health although it might harm aquatic environments. There are some fears that Canada could become a dumping ground for triclosan-laden

products that are no longer marketable elsewhere. http://www.theglobeandmail.com/life/health-and-fitness/health/federal-decision-deems-triclosan-safe-to-use-in-consumer-products/article33051607/

It would seem expedient to have one Canadian agency evaluate chemicals for both human and environmental effects. In the USA, the EPA is responsible for both health and environmental assessments, and the evaluation process seems to proceed both more quickly and more smoothly.

Another example of this cumbersome split agency process is the decision to continue allowing the use of pentachlorophenol as a wood preservative in Canada, although both the EU and USA have banned its use. According to statistics compiled by Carex Canada, is would not pass CEPA's threshold, but it is still allowed http://www.carexcanada.ca/en/pentachlorophenol/environmental_estimate/

Micro and Nano Chemicals

Few people realize how deeply micro and nano particles are embedded in our daily activities, with largely unknown effects. An example of micro particles is the use of tiny (5 µm and less) plastic beads in toothpastes soaps and skin creams to accelerate the scrubbing action of these products. It is known that many pollutants bind to these small particles, reaching high concentrations that can be ingested by small aquatic animals. Amounts of microplastic in both freshwaters and oceans are becoming of great concern. Action in Canada already appears to be under way, with Bill 680 introduced earlier this year.

Nano particles are even more intrusive, with some being capable of moving though cell membranes, carrying with them tiny loads of toxins. Nano silver is now used in over 250 products. Almost all of us are sitting here with socks or underwear containing it, because silver is one of Earth's most toxic elements to microorganisms. When these items are washed the nanoparticles can be washed into sewage systems eventually entering waterways. http://beyondpesticides.org/programs/antibacterials/nanosilver and http://ehp.niehs.nih.gov/121- a220/ summarize the ambiguous state of knowledge on nanosilver. Other nano particles are also potential health threats due to their tissue-penetrating properties, but so far little is known about potential health or environmental impacts. Application of nanoparticles is a rapidly developing field which bears continued scrutiny.

Impending problems in the energy and climate fields

Several large projects have recently been approved, including the Site C dam on the Peace River, construction of an LNG terminal near Prince Rupert, and the Trans-Mountain pipeline. The Site C environmental impact assessment by the proponent describes how the dam will block fish passage both up and downstream. As in every reservoir built in Canada, mercury in fish will increase to levels that are unsafe for commercial or subsistence users. The LNG terminal will compromise key salmon spawning and nursery habitats near the mouth of the Skeena River, the west coast's second largest fishery. Chemical releases to water will certainly create many toxicity problems, as all of the tankers will be powered by rather toxic fossil fuels, and the shipping channels are notorious for bad weather and fog. The Trans Mountain pipeline will carry diluted bitumen across hundreds of fish-bearing streams, even

though oil spilled under winter ice can not be cleaned up (Andrishak and Hicks 2011). Simply put, these decisions show little foundation in science,

Emerging decisions about how to reduce greenhouse gas emissions also have potential to cause big problems for CEPA. For example, Canada's proposed strategy for meeting its mid-century greenhouse targets relies very heavily on hydroelectric development http://unfccc.int/files/focus/long-term_strategies/application/pdf/canadas_mid-century_long-term_strategy.pdf .

Nowhere in the report is it mentioned that all hydroelectric reservoirs transform significant sinks for greenhouse gases to significant sources. As a rule of thumb, sinks of roughly 100 gC/m2/y are turned into sources of about the same magnitude, for a net change of 200 g C/m2/y for flooded areas in eastern Canada. This is certainly more efficient (when carbon emissions alone are considered) than burning coal to obtain the same energy, but if other detrimental effects are considered, the reliance on hydroelectric power becomes very questionable.

In various power options considered, except for the high nuclear scenario, from 101500 to 130000 MW of hydro power per year are required by 2050. This is equivalent to building from 80-120 large dams, of the size of Site C or Muskrat Falls, in the next 30 years. Most of the likely reservoir sites are either in the Hudson's Bay or Mackenzie Basin watersheds, as there are not enough remaining sites to construct this many large dams in southern Canada. Every one of these would block passage of migratory fishes, and contaminate downstream fisheries with enough mercury to render fish unacceptable either for subsistence or marketing (Rosenberg et al. 1995; Calder et al. 2016). Almost all of the potential reservoir sites are in areas where the numbered treaties of 1871-1921 guarantee the subsistence and traditional lifestyles of indigenous people. The increased mercury is mobilized from that stored in wetlands and forest soils in the watersheds that would be flooded (Kelly et al 1997). There is no practical way to prevent the contamination once the reservoirs are filled. Yet impacts on indigenous people are mentioned in only a few lines of the report. In addition to violating the terms of the numbered treaties, poisoning the fisheries of vast reaches of traditional territory with mercury will greatly undermine attempts to develop proper consultation and co-management plans with indigenous people. In my view, the plan for greenhouse reductions needs much more consideration, and much more input from science, than it has received to date.

References

Andrishak and F Hicks. 2011. Pipeline Rupture Under River Ice Conditions: An Assessment of Available Techniques to Mitigate Environmental Impacts. CGU HS Committee on River Ice Processes and the Environment 16th Workshop on River Ice Winnipeg, Manitoba, September 18 – 22, 2011

Calder, RS, Schartup, AT, Li, M, Valberg, AP, Balcom, PH and EM Sunderland. 2016. Future Impacts of Hydroelectric Power Development on Methylmercury Exposures of Canadian Indigenous Communities. Environ. Sci. Technol. DOI:10.1021/acs.est.6b04447

Colavecchia, M, Backus SM, Hodson, PV, and JL Parrott. 2004. Toxicity of oil sands to early life stages of fathead minnots (Pimephales promelas). Environ. Toxicol. Chem. 23: 1709-1718.

He, Y, Patterson, S, Wang, N, Hecker M, Martin, JW, El Din, mG, Giesy JP and SB Wiseeman. 2012. Toxicity of untreated and ozone-treated oil sands process-affected water (OSPW) to early life stages of the fathead minnow (Pimephales promelas). Water Research 46: 6359-6368.

Hebert CE et al. 2013. Mercury trends in colonial waterbird eggs downstream of the Oil Sands region of Alberta, Canada. Environ. Sci. Technol. 47: 11785−11792.

Hull, RN, Kleywegt, S, and J. Schroeder.2015. Risk-based screening of selected contaminants in the Great Lakes Basin. Environ. Sci. Technol. 41: 238-245.

Kelly, CA, et al. (1997), Increases in fluxes of greenhouse gases and methyl mercury following flooding of an experimental reservoir, Environ. Sci. Technol., 31(5), 1334–1344, doi:10.1021/ES9604931

Kelly, EN, Short, JW, Schindler, DW, Hodson, PV Ma, M, Kwan, A, and BL Fortin. 2009. Oil sands development contributes polycyclic aromatic compounds to the Athabasca River and its tributaries. Proc. Natl. Acad. Sci. *U.S.A*. 106: 22346-22351.

Kelly, EN, Schindler, DW, Hodson, PV Short, JW, Radmanovich, R, and CC Nielsen. 2010. Oil sands development contributes toxic elements at low concentrations to the Athabasca River and its tributaries. Proc. Natl. Acad. Sci. *U.S.A.* 107: 16178-16183.

Kidd KA, Blanchfield PJ, Mills KH, Palace VP, Evans RE, Lazorchak JM, and R Flick. 2007 Collapse of a fish population following exposure to a synthetic estrogen. Proc. Natl Acad. Sci. USA 104, 8897–8901. (doi:10.1073/pnas.0609568104

Kidd KA, Paterson MJ, Rennie MD, Podemski CL, Findlay DL, Blanchfield PJ, and K Liber. 2014 Direct and indirect responses of afreshwater food web to a potent synthetic oestrogen. Phil. Trans. R. Soc. B 369: 20130578. http://dx.doi.org/10.1098/rstb.2013.0578

Kurek, J, Kirk, JL, Muir, DCG, Wang, X, Evans, MS, and JP Smol. 2013. Legacy of a half century of Athabasca oil sands development recorded by lake ecosystems. Proc. Nat. Acad. Sci. USA . doi/10.1073/pnas.1217675110

Mills, LJ, and C Chichester. 2005**.** Review of evidence: Are endocrine-disrupting chemicals in the aquatic environment impacting fish populations? Sci. Tot. Environ. 343: 1-34.

Muir, D, Howard, PH, and W. Meylan. 2009. Identification of New, Possible PB&T Substances Important in the Great Lakes Region by Screening of Chemicals in Commerce.
Available at: http://www.epa.gov/grtlakes/p2/PBTReport.pdf (2009)

Muir, DCG, and PH Howard (2006). Are there New Persistent Organic Pollutants? A Challenge for Environmental Chemists. Environ. Sci. Technol. 40: 7157-7166.

Radmanowich, R. 2012. Mercury in the lower Athabasca River and its watershed. MSc thesis, University of Alberta. 113 p.

Rosenberg, DM, Bodaly, RA, and PJ Usher. 1995. Environmental and social impacts of large scale hydro-electric development: who is listening? Global Environmental Change 5: 127-148.

Schwalb, AN , Alexander, AC, Paul, AJ, Cottenie, K and JB Rasmussen. 2014. Changes in migratory fish communities and their health, hydrology, and water chemistry in rivers of the Athabasca oil sands region: a review of historical and current data. Environ. Rev. 23: 1-18.

Takaoka S, Fujino, T, Hotta, N, Ueda, K, Hanada, M, Tajiri, M and Y Inoue. 2014. Signs and symptom s of methyl mercury contamination in a First Nations community in Northwestern Ontario, Canada. Sci. Tot. Environ. 468-469: 950-957.