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Water pollution in the Arctic

Keywords: Arctic environment, pollution, development and management

Abstract

The occurrence of high concentrations of anthropogenic contaminants in the Arctic environment has been a concern for many years. The present overview of the current threats of pollutants from atmospheric, oceanic, river, and local pathways uses results from recent national, pan-Arctic, and international reports to emphasize the need to address issues arising from climate change, particularly the effect of changing weather patterns on contaminant transportation via both waterways and the atmosphere. Regional and international actions over the past two decades attempting to manage pollutants in the Arctic environment from land-based sources have produced recommendations that focus primarily on increasing cooperation in research and monitoring activities, not only among the Arctic governments themselves, but also including the interests and resources of non-polar countries. Our Canadian perspective on the domestic and circumpolar context of the issue, with regard to mechanisms exerting immediate control on the spread of contaminants, describes national programs and policies that are important to the Canadian North and to the Arctic community as a whole. All levels of Canadian government, as well as foreign governments, have joined in working towards safeguarding the Arctic and other marine environments. Prioritization of concerns is an important approach to tackling the numerous current issues related to the spread of contaminants in the Arctic environment. The government needs to give increased priority to the North, and that action needs to be taken in partnership with local communities and pursued at the regional, national, and international levels.
Key words: Arctic pollution, ocean, human health.

1 **Introduction**

The effects of global pollution are magnified in the Arctic such that its ecosystems and people are often the first to feel adverse impacts – often compared with the “canary in the coal mine”. Priority pollution issues over the past 20 years include: Persistent Organic Pollutants (POPs), radionuclides, mercury and other heavy metals, acidifying substances, petroleum

hydrocarbons, greenhouse gases and other climate forcing substances such as black carbon and aerosols. Many of the problems of pollution in the Arctic are related to “legacy” pollutants. If the Arctic Council elects to take a leading role in addressing these “legacy” pollutants, priority should be focused on the issues surrounding Persistent Organic Pollutants (POPs). Current legal regimes for POPs consist of a fragmented system which targets specific chemicals, and not the introduction of chemicals and its influence on the environment. For instance, the effects of legacy POPs on apex predators has yet to be determined. Other gaps in legal regimes include the lack of adequate legal measures on greenhouse gases and the need for states to ratify the Stockholm convention. As a priority, Arctic states could encourage proactive approaches to toxic chemicals management in addition to precautionary approaches. Arctic states could also look to expedite risk assessment and listing consideration for chemicals of high concern for the Arctic. Since many of the sources of Arctic pollutants are from outside the region, Arctic states could make an international call for a new global chemicals convention with strong precautionary provisions, such as:

- ✓ Reverse listing approach for new chemicals through a global safe list.
- ✓ Require registering of exiting chemicals on global registry.
- ✓ Mandatory submission of chemical data prior to market access.

Other options for the Arctic Council to deal with Arctic pollution issues could be to strengthen the Council’s Regional Programme of Action for the Protection of the Arctic Marine Environment from Land-based Activities (Arctic RPA) by broadening its objectives and establishing support instruments. Arctic states may also elect to domestically implement the European Union’s “REACH”3 regulation for improved and early identification of the intrinsic properties of chemical substances. Consideration could also be made to establish a task force or an expert group to address toxic chemicals of concern in the Arctic marine environment.

1.1 Moderator Comments

This chapter seems to indicate a need to address international instruments in an more integrated manner, rather than just through sectoral lenses. One of the more practical opportunities for Arctic states would be to look at integrating chemical information within legal regimes or by piggy backing on existing initiatives. The Arctic Council could consider taking a leadership role in addressing how this might be achieved, and if this has been successful in the past.

Summary of Plenary Discussions

International arrangements

- ✓ In the case of POPs, consideration could be made to establishing a task force to look at the European Union's "REACH" models for implementation throughout the Arctic states.
- ✓ Arctic states should pursue the ratification of the Stockholm Convention on POPs, upcoming Mercury Agreement, in addition to addressing the issue of short lived climate forcers (SLCF) and black carbon.
- ✓ An emphasis on a SLCF Agreement is needed, with the Arctic Council potentially playing a leading role.
- ✓ Arctic states could also be encouraged to join the Climate and Clean Air Coalition.

Human Dimension

- ✓ Participants reiterated the idea throughout the discussion that pollution in the Arctic is not a case of history, but present in the Arctic. As such, the Arctic Council should look to emphasize and apply ethical, human rights considerations to pollution management.
- ✓ Mercury pollution continues to be a major factor in the health of Arctic inhabitants and needs to be expressed in terms of the implications on humans.

Arctic Council

- ✓ The issue of Arctic pollution is complex, but the Arctic Council should consider the designation of one assessment and monitoring program. This will focus the efforts of a limited capacity of subject matter experts towards common objectives.
- ✓ An expert group could be established with the mandate of identifying toxic chemicals of relevance to the Arctic marine environment, including the reduction and containment of chemical releases from activities.
- ✓ The implication of chemical pollutants on the marine environment needs to be highlighted with respect to key drivers and explicit description of triggers for new actions.
- ✓ Improvements are needed regarding the coordination and monitoring of pollutants, and the dissemination or accessibility of pollution related data.

- ✓ Arctic Council Ministers may have some challenges to link the AOR recommendations to the Arctic Monitoring and Assessment Program (AMAP) objectives.

There should be a transition from science based decision making processes to ethicsbased decision making.

2. **Arctic Pollution Sources**

This session focused on identifying existing and emerging issues of Arctic pollution sources, with particular attention to the impacts on the marine environment; how pollution impacts Arctic inhabitants and communities; and, options for possible future agreements and measures. These topics where divided into the following three presentations as summarized below:

- ✓ Priority pollutant sources and their impact on the marine environment – Helgi Jensson
- ✓ Contaminants and human health – Duane Smith, James Stotts
- ✓ Preliminary reflections on possible future agreements/ measures – David L. VanderZwaag

Priority pollutant sources and their impact on the marine environment

It was noted that recent time series data of legacy Persistent Organic Pollutants (PCB, DDT, HCH, etc.) indicate a decreasing trend over the past two decades in the Arctic marine environment. While these signs are encouraging, the concentrations in animals are still high enough to affect the health of the marine food web, and the pathways and distribution of the contaminants may be affected by climate change in the future. The primary concerns with emerging and current POPs is the lack of pan-Arctic time series data, the high volume of chemicals with POPs characteristics that are being produced on a yearly basis, and the lack of global capacity to determine the long term health effects of new contaminants in the environment. Short term actions for consideration include the necessity to support a global mercury treaty, ratify the Stockholm convention to reduce levels of POPs, and strengthen measures and plan the safe transport of potentially harmful waste.

2.1 **Contaminants and human health**

Arctic inhabitants have an acute interest in supporting efforts to globally strengthen the control of pollution sources and environmental contamination. Ensuring a sufficient source of nutritious and safe country food is of high importance to the cultural, economic and social well being of Arctic inhabitants and communities. These sources are being compromised through global pollution sources which accumulate in the food chain and result in contamination levels in Arctic inhabitants that exceed acceptable levels by the World Health Organization. The recent health trend for Arctic inhabitants has shown that the adoption of a western diet into their lifestyle may increase the likelihood of high blood pressure, diabetes, weakening immune systems, and developmental effects in children. The Permanent Participants of the Arctic Council and Arctic States should continue to be involved in developing global partnerships and instrument

development to reduce pollution sources, research the effects of new contaminants, and support the development of an agreement on mercury.

2.2 **Opportunities and Options**

Existing international agreements and arrangements relevant to Arctic pollutants are fragmented and do not offer a clear direction on ways to strengthen the prevention and control of Arctic pollutants. However, there are many opportunities within these agreements and arrangements to attain an international consensus to address pollution issues of relevance for the Arctic. States should be encouraged to ratify existing international agreements relevant to Arctic pollution (i.e. Stockholm Convention). Under the existing international agreements and arrangements, implementation measures should be taken to expedite risk assessments and listing considerations for chemicals of high concern in the Arctic. The Arctic States should also encourage the completion of international negotiations and review processes relevant to Arctic pollutants (i.e. Mercury, Short Lived Climate Forcers). The rapid rate of new chemicals introduced into the market each year emphasizes the need for a more proactive approach to chemical management, e.g. registration of chemical, toxicological and eco-toxicological information, before they become an additional factor in the pollution of the Arctic marine environment.

3 **Types of Water Pollution**

The contamination of water bodies can be classified into three types, mainly, groundwater pollution, marine pollution and surface water pollution. Contaminated water from drains and industries which flows above the topmost layer of the soil usually creeps into the soil and gets mixed with the groundwater, thereby polluting it. This contaminated water then interacts with the nutrients present in the soil and alters their quality. This is termed as groundwater pollution.

Similarly, the wastewater released from the industries flows into the river and thereby reaches the seas and oceans. This is termed as marine pollution. It only affects humans but has an adverse effect on marine life as well.

In the case of surface water pollution, the wastewater remains on the surface of the earth and polluted it. This leads to the deficiency of nutrients in the soil as nutrients from other sources are not able to penetrate in the soil due to the presence of this contaminated water.

3.1 **Sources and Effects of Water Pollution**

Different activities of humans have led to the contamination of the water bodies. For instance-

Industrial Waste - Pollutants such as mercury, asbestos, lead and petrochemicals which are released as industrial waste, find their way in the water bodies and contaminate them. Often this makes the water unfit not only for drinking but also for domestic use and survival of marine

life as well. There have been numerous occasions where groups of dead fish have swept ashore at a given time due to the sudden increase of such chemicals in the water. Moreover, the spillage of oil from the ships often creates a hindrance for the oxygen in the air to get dissolved in water, thereby making it difficult for the marine animals to breathe.

Sewage and Waste Water - Another instance where the water bodies get contaminated is due to the release of sewage and wastewater directly into the bodies without being treated. Untreated wastewater can at times pose to be very poisonous not only for human life but for fishes as well.

Global Warming – Global warming is another phenomenon which has been often credited with the cause of increasing water pollution. There has been a rise in water temperature levels due to global warming which has even led to the death of water animals as well as plants as they were not able to survive in the increased temperatures.

Radioactive Waste – Radioactive waste is another major cause of water pollution. Radioactive substances are utilized in atomic power plants, mechanical, medicinal and other logical procedures. They can be found in watches, glowing timekeepers, TVs and x-beam apparatus. There are likewise normally occurring radioisotopes from creatures and inside the earth. If not appropriately discarded, radioactive waste can result in genuine water contamination episodes.

Dumping – Dumping of strong squanders and litters in water bodies cause water pollution. Litters incorporate glass, plastic, aluminium, Styrofoam and so on. They influence amphibian plants and creatures.

3.2 **Measures to Control Water Pollution:**

It has become utmost importance for all of us that we must seriously think over executing some strong steps so as to decrease, if not stop, this ever growing menace of water pollution. Some of the measures which can be incorporated are:

Educating People – First and above all measure, we ought to teach individuals on the harmful impacts of water pollution. In cities where lack of education is high among the rustic individuals, there ought to be state-funded training from those talented in these fields to assist the provincial individuals with stopping the release of waste in the water bodies. Moreover, open defecation and wrong fishing practices should be controlled.

Fines and Laws – In the urban zones, Industries and production lines let out a considerable measure of their waste into the water bodies. An appropriate fine forced on them and in addition publication on their wrongdoing will enable them to stop these practices. Laws

ought to be likewise authorized to guarantee that such industries stop from rough spillage strategies which wreck water assets like fish, lobsters and so on.

Media contribution – Using radio and TV with adverts on the impacts of water contamination additionally ought to be urged to get the message crosswise over and also Public Service Announcements. The more developments there are to lessen water pollution, the more secure the water bodies will be.

Appropriate transfer of waste – There ought to be legitimate transfer of both strong and fluid waste. Experts in charge of waste administration in the nation must give territories to discard waste so that waste is not spilt all around. Businesses ought to be set up to reuse waste materials.

Appropriate utilization of chemicals on farms – Water pollution can be controlled if agriculturists are made to apply agro-synthetic concoctions legitimately on their farms through state-provided instructions. This will reduce the spillage of such synthetic compounds into waterways, lakes, tidal ponds and streams when rain falls. Farmers ought to be warned not to wash the compartments of the synthetics into water bodies.

Cleaning of Drains – To avoid water pollution, the drains are required to be cleaned all the time. In the provincial territories, pucca channels are required to be made, on the grounds that the water is going wherever in a proper way and not just reaching the rives and seas straightaway without being properly treated. We ought to build up an innovation to repel the channels from the water sources.

4 Effects of pollutants

Effects of pollutants have been found in animals high in the food chains in the Arctic. Impacts on the hormone and immune systems, reduced reproduction and increased offspring mortality are some of the effects found in the polar bear, arctic char and harp seal. Impaired immune system and reduced reproduction show that far-transported pollutants affect populations of arctic animals.

The polar bear is a predator at the peak of the marine food chain in the Arctic. It mainly eats seals, such as the ringed seal, which it hunts on the ice. Polar bears are extremely dependent upon sea ice for hunting and living on, and will be affected by changes in the ice. As a top predator in the marine food web, it is exposed to high levels of contaminants, especially the persistent organic pollutants. These are slowly degradable contaminants which are stored in fat and increase in concentration up the food chain.

Like the ringed seal, the polar bear is exposed to both pollution and decreasing sea ice. Effects from persistent organic pollutants have been demonstrated on the hormone, vitamin, enzyme, and immune systems of polar bears. This is a stress factor which may pose a threat to the population in Svalbard. In addition, it has been observed that higher mortalities of cubs coincide with higher contaminant loads in Svalbard and Franz Josef Land compared with Russia, Alaska and Greenland. This indicates that the reproductive ability of the polar bear may also be weakened by contaminants. Ringed seals form an important food item for polar bears, and they in turn feed on such creatures as crustaceans and polar cod. The content of contaminants in ringed seals was investigated in 1996 and 2004, and PCB levels fell significantly in this period.

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Effects from persistent organic pollutants have been demonstrated on the hormone, vitamin, enzyme, and immune systems of polar bears. Lower concentrations of pollutants may mean that these effects will decline in the years to come. Since the fitness of polar bears and their food supply can vary considerably in the course of a year, there will be periods when bears will be more prone to the effect of the fat-soluble pollutants.

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The sea ice is the most important polar bear hunting ground. The primary threat to the polar bear will therefore be global warming and melting sea ice. If these lead to food becoming less readily available, the concentration of contaminants may rise because the polar bear must turn to its body fat and burn that, but it is not clear how the contaminants will affect the bear in such periods. Changes in the type of prey due to altered habitat use may also result in changes in how the animals are exposed to different types of contaminants. Future studies will be able to reveal how levels and effects of different substances may be determined by changes in habitat use as a consequence of climate change.

Arctic Fox. The Arctic fox in Svalbard belongs to the ecotype, coastal fox, which mainly subsists on birds and carrion. The arctic fox is a top predator, linked to all the main groups of animals in the archipelago, and utilizes both the terrestrial and marine food chains. Due to its link

to the marine food chain and the enormous variation in its storage of fat from one season to another, the arctic fox is exposed to high levels of contaminants.

The arctic fox is exposed to relatively high levels of contaminants, corresponding to those measured in polar bears. The levels in arctic foxes in Svalbard exceed those found in Alaska, Canada and Iceland. A study of young arctic foxes from West Spitsbergen has shown a reduction in persistent organic pollutants between 1997 and 2010 **(Andersen et al. unpublished)**.

The fat reserves of Arctic foxes change dramatically through the year, making them especially vulnerable because contaminants stored in adipose tissue may be liberated when the fat stores are burnt. Large, natural, annual fluctuations in the storing of body fat mean that toxins may be liberated from adipose tissue in the form of lipids to internal organs like the liver and brain. The highest level of lipids, over 20 %, is attained in November-December and it is reduced during the spring to a minimum of 6 % in summer. The Arctic fox also experiences extreme variations in its fat reserves through the winter in periods when food is in short supply.

Animals that are in good health have been found to have lower levels of contaminants than unfit ones. Arctic foxes have little body fat when they are experiencing a comparatively high degree of physiological stress in the breeding season in spring and summer, and in periods when they are hungry in winter.

We know very little about the effects the high levels of contaminants have on, for example, a suckling mother and her cubs, or a fox that cannot find food and has to burn its lipid reserves in winter. An impairment of their immune system has been found in sledge dogs in Greenland after they have been fed whale blubber containing high levels of contaminants. It is therefore likely that the current high level of contaminants may have negative effects on the immune and reproductive systems of the Arctic fox.

Polar cod and capelin are key species in the arctic ecosystem, and both are being monitored with a view to their contaminant load. Since both species are important food items for other fish-eating fish and for seals, whales and seabirds, this monitoring will provide better information about the bioconcentration up the food chain.

In general, the levels of organic pollutants are very low in both polar cod and capelin, and it is believed that neither of these species suffers any effects of a contamination load.

Conclusion

Water has played a pretty much noticeable role is the sustenance of life on the earth. Present-day practices have regularly disregarded the old practices of saving water leading to undesired results in the form of increasing water pollution.

In any case, in the present social orders, we frequently observe a recovery of old conventions and a more normal and manageable utilization of water. Finding the correct blend among ‘old’ and ‘present day’ rehearses finds practical answers for adapt to environmental change.

Water pollution has turned into a consistent expanding issue on the earth which is influencing human and creature lives in all viewpoints. Water contamination is tainting the drinking water by the harmful toxins produced by the human exercises. The entire water is getting dirtied through numerous sources, for example, urban spill over, rural, mechanical, sedimentary, syphoning from landfills, creature squanders, and other human exercises. Each one of the toxins is exceptionally destructive to nature. Human populace is expanding step by step and in this way their requirements and rivalry driving contamination to the best dimension. We have to pursue some extreme changes in our propensities to spare the water on earth and also proceed with the likelihood of life here. Or else, the day is not far off when life would not be able to survive on earth to the enormous levels of water pollution.

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