Impact of climate change on pollutant transfer in the Arctic

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1 Introduction

Long-range transport of contaminants to the Arctic, the resulting exposures observed in Arctic human populations, and impacts of such exposures on human health have been the subject of considerable work in recent years, providing a baseline against which to compare future developments (see AMAP 1998, AMAP 2009). Global climate change has the potential to remobilize environmental contaminants and alter contaminant transport pathways, fate and routes of exposure in human populations. The Arctic is particularly sensitive to climate change and already exhibits clear impacts (ACIA 2005). The University of Oulu is a member in an FP7 EU-project Arctic Health Risks (ArcRisk, 2009-2013), which is studying the impacts of climate change on contaminant cycling and its effect on human health in the Arctic and Europe. The project is lead by the Arctic Monitoring and Assessment Programme (AMAP) Norway, and there are 17 partners from twelve countries. Research into contaminant exposure and its effects on human health in Arctic, in comparison with other exposed populations in Europe, presents an opportunity to gain insight into changes that may later impact other areas.

2 Objectives of the research

The main objectives of the project are 1) to study the influence of climate change on contaminant spreading; 2) the transfer of contaminant to the food chain; and 3) the resultant risk to human populations in the Arctic and other areas of Europe.

1) The research on the ways in which climate change will affect the long-range transport and fate of selected groups of contaminants, and possible implications for the re-distribution of contaminants (geographically and between relevant environmental media) involves modelling, utilizing the information base that exists on the distribution of such contaminants in the Arctic and other areas in Europe.
2) The study on the impacts that changing pathways and climatic conditions will have on contaminant uptake and transfer within food webs, leading to foods consumed by humans (geo graphically and between relevant environmental media) involves experimental work, process studies and targeted analytical studies, the latter focussed on supporting the modelling work and process studies related to human exposure to contaminants.
3) The research focus on human health, aimed at determining how climate- mediated changes in the environmental fate of selected groups of contaminants will result in changes in exposure of human populations, in the Arctic and in selected areas of Europe uses emissions and climate scenarios for the first half of the 21st century and up to year 2100.

The key processes of environmental cycling of chemicals under climate change conditions will be studied including:

– Exchange between air and sea-ice,
– Variability of contaminant concentrations in time and space,
– Partitioning to and sinking with various classes of marine particles, and
– Entry of pollutants into marine and terrestrial food chains.

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A key area of investigation is the retreat of sea-ice cover, which acts as a barrier for air-see exchanges and as a transport medium as well as a secondary source for deposited pollutants.

3 Results

During the first year of the ArcRisk project, we have selected the contaminants for the modelling part of the work; designed the structure of the database on human health and contaminants; made the selection of climate scenario and climate model output; and selected the samples to be collected for the risk analyses of exposition by food web (marine and terrestrial). The first contaminants to be modelled are polychlorinated biphenyls (PCBs) and mercury (Hg), followed by hexacholorcyclohexanes (HCHs), dichloro-diphenyl-tricholoethanes (DDTs), cadmium (Cd), lead (Pb) and perfluoroalkylated substances (PFAS).

4 Relevance of the research

The results of ArcRisk project will provide information relevant to EU policies in relation to the Environment and Health Action Plan, the REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) process, and the development of strategies for adaptation to climate change. It will also contribute to the work of Member States and others in relation to international commitments such as the Stockholm Convention on Persistant Organic Pollutants and the UNECE Convention on Long-Range Transboundary Air Pollution.

References

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