Project information

Keywords
organic contaminants, passive air sampling, passive water sampling, local sources, long-range transport

Project title
Impact of Arctic urbanization on the occurrence of new “urban” contaminants in the Norwegian Arctic

Year
2017

Project leader
Pernilla Bohlin-Nizzetto

Geographical localization of the research project in decimal degrees (max 5 per project, ex. 70,662°N and 23,707°E)
69.64822°N and 18.93968°E, 78.2223°N and 15.6308°E, 78.9245°N and 11.9284°E, 79.260°N and 11.5180°E, 78.9071°N and 11.8866°E

Participants

Anders Røsrud Borgen – NILU, Kjeller, Norway

Knut Breivik – NILU, Kjeller, Norway

Ingjerd Sunde Krogseth – NILU, Tromsø, Norway

Nicholas A. Warner – NILU, Tromsø, Norway

Ian Allan, NIVA – Norwegian Institute for Water Research, Oslo, Norway

Guttorm Christensen – Akvaplan-NIVA, Tromsø, Norway

Branislav Vrana – RECETOX, Brno, Czech Republic

Flagship
Hazardous Substances

Funding Source

Fram Centre flagship for Hazardous Substances

Summary of Results

The ARC-URB project was initiated in 2016 with selection of sampling sites and sampling strategies in spring followed by sampling campaigns using passive samplers during summer and autumn.

The project has been performed in close collaboration with PassNet (project funded by Svalbard Strategic Grants) coordinated by Ian Allan (NIVA) in order to obtain a wider spatial distribution of sites for ARC-URB and to initiate a possible passive sampling network for Svalbard.

The activities during the final year of the ARC-URB project (i.e. 2017) have focused on i) chemical analyses of air and water samples collected in 2016, and ii) data analyses of the results.

The passive air samplers deployed at six-seven sites frequently detected 56 of the 96 targeted organic contaminants, including new (non-regulated) "urban" contaminants: chlorinated paraffins (CPs), cyclic volatile methyl siloxanes (cVMS) and novel brominated flame retardants (nBFRs), and the regulated chlorinated biphenyls (PCBs, HCB, PeCB). Detected to lower extent (25-45%) were the polybrominated diphenyl ethers (PBDEs) and organophosphorous flame retardants (OPFRs). The lower detection of these contaminants can be explained by a less efficient uptake in the passive air samplers due to a higher partitioning to particle.

For cVMS, nBFRs and PBDEs, the highest levels were observed in the populated sites: Longyearbyen, Tromsø, and Ny-Ålesund (source areas) while the lowest levels were observed at the remote sites; Erlingvatn and Zeppelin. This spatial distribution was clearest for cVMS. In addition, the pattern of the cVMS congeners (D4, D5 and D6) was significantly differ between source areas and remote areas with D4 being dominant at the remote site and D5 being dominant in source areas. This suggest that long-range transport dominates at the remote sites and that the local sources do not affect the remote sampling sites.

The observations for flame retardants, higher levels than at Tromsø and other sites, suggest the Longyearbyen area to be a local source for flame retardants. This can potentially be due to different regulations compared to mainland Norway (e.g. within building industries).

The results for CPs are in contrast to the other new “urban contaminants”. The levels of medium-chain CPs (MCCPs) increased with latitude and the highest levels were observed in the two most remote sites; Zeppelin and Erlingvatn. SCCPs were highest at Tromsø but then homogeneously distributed resulting in a decreasing ratio of SCCP/MCCP with latitude. The reasons for these findings are not

known.

High levels of PCB were observed at Pyramiden, 20 times higher than at the other sites. Highlighting this local source. The levels of PCBs and the other regulated POPs (HCB and PeCB) were homogeneously distributed between the other sites.

Master and PhD-students involved in the project

Master student at NMBU - thesis to be submitted in May 2018.

For the Management

Passive samplers are shown to be efficient tools for obtaining new knowledge on the spatial distribution of new organic contaminants in the Arctic area.

Longyearbyen seem to be a local source for flame retardants in the Arctic - potentially due to different regulations compared to mainland Norway.

Siloxanes (D4) is long-range transported to remote areas in the Arctic - local sources do not affect the remote sites.

Modling activities under WP4 have been postponed to 2018 as a result of lack of man power in 2018.

Published Results/Planned Publications

Publications are planned for 2018.

1. Spatial distribution of cVMS

2. New, non-regulated organic contaminants versus regulated contaminants in the Arctic

Communicated Results

Warner, N.A., Nikiforov, V., Krogseth, I.S., Bohlin-Nizzetto, P. Is octamethylcyclotetrasiloxane (D4) a Persistent Organic Pollutant? Weighing the Evidence and Risk to Arctic Environments. 16th International Conference on Chemistry and the Environment (ICCE), 18-22 June 2017, Oslo, Norway.

Interdisciplinary Cooperation

The ARC-URB project has been enabled by the cooperation between experts in sampling and chemical analyses of organic contaminants in air and water. This cooperation has been sufficient to fulfil the scope of this project.

Budget in accordance to results

The funding from FRAM has covered costs for sampling equipments, field work, logistics, chemical analyses and data analyses.
The funding for 2017 will be used by the end of 2017.

Could results from the project be subject for any commercial utilization

No

Conclusions

Passive samplers deployed on a transect from Tromsø to remote Svalbard (via Longyearbyen and Ny-Ålesund) have provided new knowledge on the spatial distribution of new organic contaminants in air and water. Populated areas were shown to be sources for cVMS and flame retardants. For example, Longyearbyen area seem to be source for flame retardants. Reason for this has to be further studied but different regulations on Svalbard and mainland Norway can be a possible reason. The results from the remote sites did not show to be affected by these local sources. Instead, long-range transport seem to be dominant for cVMS at the remote sites. For CPs, the results were in contrast to the other new contaminants. Reasons for this is not known.