

Longterm follow-up of airborne contaminants in Northern Finland – voles as wild indicator species

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1 Introduction

Despite of its rather pristine location, the Arctic environment receives contaminants, such as organochlorines and heavy metals, via long-distance transportation from industrialised source areas of Europe, North America and Asia. Even though levels of many persistent organic pollutants (POPs) and heavy metals have declined in the northern environment due to past bans and restrictions, concentration of some contaminants are still high enough to affect the health of wildlife and humans. In addition, “new” compounds such as brominated flame retardants, fluorinated compounds and polychlorinated naphthalenes that are in commercial use today have a potential to transport and accumulate in the food web (Burkow and Kallenborn 2000; Braune et al. 2005). Environmental levels of contaminants in both abiotic environment and biota have been monitored for long, but additional years of monitoring are needed to increase the statistical power of existing time series in order to verify temporal trends.

2 Objectives of the research

In Värriö biological station (north-east Finland) small mammals such as voles and shrews have been caught annually since early 80's. Previous studies (Murtomaa et al. 2007) showed interestingly elevated concentrations of dioxin-like compounds in bank voles from that area, indicating transportation of dioxins to the area via air. In this research, we intend to use the pristine northern environment as an indicator of long-distance transportation and, on the other the hand, study the first signals of chemical exposure in wild small mammals. The aim is to use vole data from time the period of 25 years to assess the variation of levels and composition of dioxin-like compounds and heavy metals through the time series and, with the help of time trend analysis, to draw up the model for exposure prediction in future. The contaminants analyzed include polychlorinated dibenzo-p-dioxins and -furans (PCDD/Fs), polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs) and perfluorinated alkyl sulfonates (PFAS). In addition, levels of cadmium (Cd), lead (Pb) and mercury (Hg) are determined. The study is carried out together with the Thule Institute, the National Institute of Health and Welfare (THL), the Finnish Forest Research Institute (METLA), Finland's environmental administration (SYKE), and the zoological museum of the University of Oulu.

3 Results

Preliminary results are from three time points: years 1986, 1998 and 2007. So far we have analyzed PCDDs, PCBs and PBDEs.

3.1 PCDDs and PCBs

Both PCDDs and PCBs show declining trend in males. Concentrations of PCDDs in 1986 were 578 pg WHO-TEQ / fat, while in 2007 it was 242 pg WHO-TEQ / fat. Levels of PCBs (non-ortho/other) were 86/88,4 pg WHO-TEQ in 1986 and 39,5/40 pg WHO-TEQ / fat in 2007. In females, the levels of PCDDs and PCBs were without exception lower than in males.

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However, in females the trend was not declining but slightly increasing in PCDDs; 139 pg WHO-TEQ / fat in 1986 and 172 pg WHO-TEQ / fat in 2007. In PCBs (non-ortho/other) females had highest levels in 1998, 43/45,2 pg WHO-TEQ / fat. In 1986 and 2007 levels were 26,7/27,9 and 10,9/12 pg WHO-TEQ / fat, respectively.

3.2 PBDEs

The prevalent trend in concentrations of PBDEs in bank voles from Värriö seems to be parable shaped; levels are substantially higher in 1998 than in 1986 or 2007. However, variation between congeners exists. Unlike in PCDDs and PCBs, females have higher levels of PBDEs in some cases.

4 Relevance of the research

Once the analyses are completed, we hope to be able to give new information on the variation of levels and composition of dioxin-like compounds and heavy metals in north-east Finland through the time series. Since there are no sources of these contaminants nearby, evidence points to long-distance transportation of contaminants. Therefore, this research plays an important role in studying the trends of contaminant transport.

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