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PCB in snow of the Baikal region.

E.A.Mamontova*, A.A.Mamontov*, N.I.Matorova***, E.N.Tarasova*, U.A.Chuvashev**.

* - Institute of Geochemistry, Siberian Branch of the Russian Academy of Sciences, Favorsky str., 1A, Irkutsk, 664033, Russia.** - Institute of Organic Chemistry, Siberian Branch of the Russian Academy of Sciences, Favorsky str., 1, Irkutsk, 664033, Russia. ***Institute of Professional Health risks and Human Ecology. P.O.Box 1170, Angarsk, 665827, Russia

Abstract

Contamination of polychlorinated biphenyls (PCBs) was assessed in snow from the lake Baikal region, Russia. A high concentration of PCBs was found in the snow of the towns Usolye-Sibirsk (430 ng/l), Angarsk (490 ng/l), Sayansk (170 ng/l), Cherenkhovo (89 ng/l), Sliudianka (89 ng/l) and Baikalsk (72 ng/l). Comparison of PCB compositions of the Russian technical mixtures (TCD and Sovol) and snow samples evidently reflects the leakage of Sovol rather than TCD around the lake region.

Introduction

PCB determination was started in 1981¹⁾. Contamination by PCBs has been found in the entire food chain of lake Baikal with a maximum concentration in the fat of nerpa (the Baikal seal) of up to 20 mkg/g (average 10.69 mkg/g). As a result of the mass deaths of nerpa in 1987 and 1988 and the organisation of an international scientific centre, foreign specialists have taken part in investigations into organochlorines. Environmental contamination by persistent organochlorines (Ocs) such as HCB (hexachlorobenzene), HCHS (hexachlorocyclohexanes) was assessed in air, water, sediment, soil, fish and Baikal seal (*Phoca sibirica*) from the lake Baikal region. Residue levels and their composition of DDTs and PCBs in abiotic samples suggests the presence of a local source. In spite of the lower contamination of Ocs in abiotic samples, noticeably high concentrations of DDTs (above 100 mkg/g) and PCBs (up to 64 mkg/g) were detected in Baikal seal^{2,3)}. Kucklick et al⁴⁾ note that contamination of lake Baikal by DDT and PCBs occurred recently.

Our investigations into PCB concentrations also began after the deaths of nerpa in 1989^{5,6,7)}. The main task of this paper is to determine the PCB content and composition in snow of the Baikal region with the aim of assessing the input of PCBs into lake Baikal with emissions from the towns of Irkutsk Oblast along the basin of the river Angara.

Experimental Methods

A diagram of the sites of snow samples is presented in fig. 1. A large hydro-electric power station, pulp and paper plant, chemical and aluminium plants are situated in Irkutsk Oblast. In Baikalsk and Sliudianka, located on the shores of southern Baikal, a pulp and paper plant and coal-fired power plant, respectively, are still operating. Samples were taken between 15th February and 1st March 1995 and 1996. The sites of the samples in 1995 and 1996 were identical.

Total PCB concentrations in the samples were calculated by adding the concentrations of individual congeners. Procedural blanks for snow were simultaneously treated and quantified

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with those samples throughout the whole analytical procedure. Quantification was made using a gas chromatography/mass spectrometer (Hewlett - Packard 5890, GC coupled with 5970 mass selective detector).

Results and Discussion

Σ PCBs in the snow cover of Irkutsk Oblast is shown in fig.2. The range of Σ PCBs in the snow of Irkutsk Oblast is from 20 ng/l to 490 ng/l. Maximum values for Σ PCBs was noted in the towns of Angarsk (490 ng/l), Usolye-Sibirsk (430 ng/l), Sayansk (170 ng/l), Cheremkhovo (89 ng/l), Sliudianka (89 ng/l) and Baikalsk (72 ng/l). It should be noted that there is a high Σ PCB content in the snow cover on the lake's ice by the town of Baikalsk (230 ng/l) and by the village of B. Koty (245 ng/g).

The concentration of PCBs in snow from the town of Irkutsk to the settlement of Listvyanka decreases from 120 to 20 mkg/l. According to these sample sites, approximately 10-20% of the industrial emissions from towns in Irkutsk Oblast reach lake Baikal.

Fig.3 gives the characteristic composition of PCB homologues in snow samples of Irkutsk region along the line from the settlement of Bayandai - Sliudianka. As a rule, tetra-, penta-, and hexa-, PCB homologues dominate. A similar picture is found in the towns of Irkutsk Oblast (fig.4). In the snow of the towns of Sliudianka and Cheremkhova only tetra-, penta- and hexa- CB has been found, a wider spectrum of PCB homologues is observed in the towns of Angarsk (from tri- to hexa-CB) and Usolye-Sibirsk (from tetra- to octa-CB).

The percentage composition of PCB homologues in the snow of Baikalsk is similar to that in the snow of Cheremkhova and Sliudianka, but in its pattern of homologues it is closer to the snow of Usolye-Sibirsk and Angarsk, i.e. to towns with chemical plants. Comparison of the PCB composition in snow with the Russian technical mixtures (TCD and Sovol)⁸ showed a closer link with Sovol than with TCD. A similar conclusion was arrived at in investigations into the PCB composition in the soil of the Baikal region⁹.

Acknowledgments

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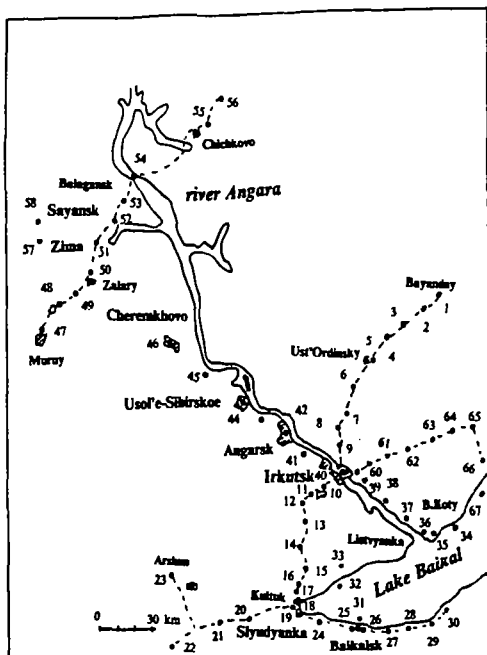


Fig. 1. Sampling scheme in the snow of the Baikal region, February-March 1995, 1996 years.

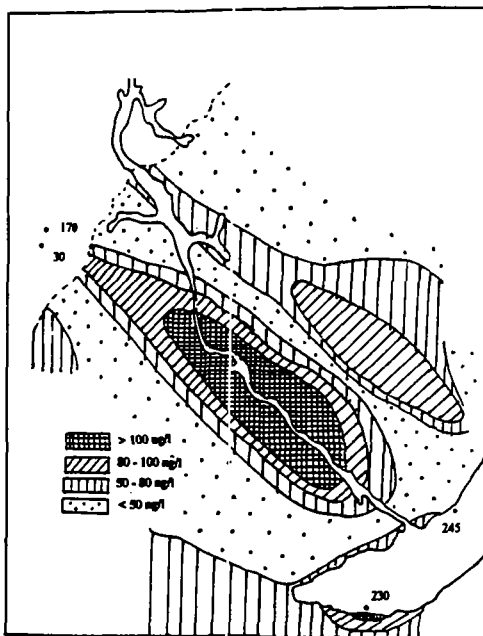


Fig. 2. Σ PCB distribution in the snow cover of Irkutsk region, ng/l.

Fig. 3. Compositions of PCB homologues in snow cover in Bayanday - Slyudyanka, ng/l.

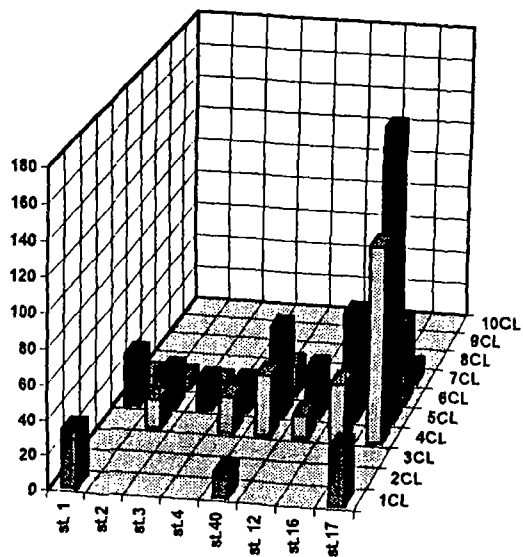


Fig. 4. Compositions of PCB homologues in snow cover in main towns of Irkutsk region, ng/l.

