

# MAIN REGULARITIES OF AND PROPHYLACTIC MEASURES AGAINST HAZARDOUS INFLUENCE OF PERSISTENT TOXIC SUBSTANCES ON THE HEALTH OF INDIGENOUS PEOPLES OF THE RUSSIAN NORTH



Alexey Dudarev

**Objectives.** Persistent toxic substances (PTS) have a tendency to bioaccumulate and biomagnify in food chains. Certain indigenous communities in the Russian Arctic are known to be at the highest risk of exposure to polychlorinated biphenyls (PCBs), hexachlorobenzene (HCB), organochlorine pesticides, some metals and radionuclides. This is the result of a number of factors including lipid-rich traditional food, cold climate and a special lifestyle. Exposure of humans to persistent organic pollutants (POPs) has been found to be associated with the occurrences of some adverse health effects. Due to their ability to pass the placenta barrier and be transferred from the mother to the newborn through breast milk, the possible effects of PTS during the critical stages of foetal development are of greatest significance. The project has been designed to evaluate the different ways of PTS migration to humans, particularly via local foods; to define the PTS content in the blood of indigenous populations of the Russian north; to determine dietary habits, life style and health status; to evaluate whether individual POPs and metals may be responsible for specific reproductive health effects, and whether radiation body burdens (over decades) could be associated with cancer mortality rates.

**Study design and methods.** Persistent Toxic Substances under the scope of the project: PCBs (15 congeners), HCB, HCHs, DDTs (6 metabolites), chlordanes, toxaphenes, metals (Pb, Hg, Cd), radionuclides (natural Pb-210/Po-210 and artificial Sc-137 and Sr-90). Geographical scope: four regions in northern Russia have been involved in the investigation: Kola Peninsula, Pechora basin (Nenetsk okrug), Taimyr and Chukotka. The particular significance of the Chukotka region is underlined by the possibility to investigate an exclusive population in Russia (Eskimo and coastal Chukchi) who use marine mammals (whale, walrus, seal) as a food staple, in comparison with other northern natives who mainly eat reindeer meat and fish. Community-based dietary and lifestyle surveys, environmental exposure assessment, including contamination of local foods and houses, determination of major POPs and metals concentra-

tions in maternal and cord blood, radiation dosimetry methods and epidemiological analysis were used in the study. Almost 2,000 native people have been interviewed and blood-sampled during 2001-2003; about 1,000 blood and 700 biota samples have been analysed for PTS content. Four laboratories from Russia, Norway and Canada, which participated in the AMAP intercalibration ring-tests, took part in the analyses. The main database consisting of 350 mother-child pairs (with personal PTS blood levels) permitted the assessment of dose-response relationships regarding adverse reproductive health effects and menstrual disorders. The results of thousands of measurements of ionizing radiation in man, biota and environment in the Arctic have been combined over the period of the last 30 years, as well as demographic and medical data in dynamics specifically for aboriginal peoples (birth rates, mortality, morbidity, cancer rates).

**Results.** Large-scale investigations in the Russian Arctic covering the main territories of aboriginal peoples (from Kola to Chukotka) have documented the environmental impact of global and local PTS sources. In particular, there is evidence of relatively fresh environmental releases of such contaminants as DDT and PCB. In general, PTS levels in the natural environment and biota of the Russian Arctic are moderate. Metal and POP levels in the majority of traditional fresh food products are less than or equal to allowable (in Russia) levels, including marine mammal fat. Significant levels of metals have been detected in the liver and kidneys of reindeer and waterfowl. Among marine mammals of coastal Chukotka, very high levels of Hg (exceeding the allowable level up to 100 times) have been observed in seal meat, liver and kidneys of seal and walrus. Exposure to PTS of the Russian Arctic indigenous peoples including pregnant women, specifically to PCB, HCB, Pb and Hg, is significant. Some PTS levels in the blood of indigenous men in coastal Chukotka present high levels, similar to Arctic Canada and Greenland. Concentrations of PCB, mercury and lead in the blood of women of reproductive age were found (in different proportion for different regions) exceeding the internationally recommended levels of concern and, in some cases, action levels. Indoor and occupational sources of PTS, including contamination of dwellings, are likely to be a significant contributor to higher blood contamination among indigenous peoples of the Russian Arctic. It was observed that 100% of the houses of indigenous peoples studied during the targeted surveys were contaminated by POPs, mostly PCB and DDT due to widespread use of insecticides and technical liquids in private life. Homemade local food had higher levels of PTS contamination compared to products obtained in the natural environment. It was established that salted fish and meat, fermented food and homemade alcohol are subjected to additional contamination during processing in contaminated containers in household environment. PCB can be considered one of the most serious environmental and human health risk factors in northern areas. Epidemiological analysis of reproductive health disorders, developmental impairments and menstrual disorders recorded in indigenous mother-child pairs has shown a significant association and dose-response relationship between the maternal serum concentration of some PTS (such as total PCBs, HCB,

sum of chlordanes, Hg) and a number of effects such as the prevalence of premature births, low birth weight, miscarriages, stillbirths, congenital malformations as well as the age of first menses and duration of bleeding. An increase of adverse effects was found at concentrations of PTS significantly lower than the recognized effect level. Today, the main ionizing radiation dose-forming northern food chain, i.e., lichen-reindeer-man, has been to a great extent cleaned up from artificial radionuclides. Cs-137 body burdens for aboriginal population consuming venison decreased 15-50 times in comparison with the period of maximum exposure in the 1960s and 1970s. Analyses performed on the levels, structure and dynamics of cancer deaths among native peoples of Russian Arctic during a period of 35 years have revealed a lack of an additional detectable cancer risk for the low-dose ionizing radiation diapason.

**Conclusions.** As a result of the studies, a number of recommendations for prophylactic measures of habitation contamination and nutrition advice can be provided that will significantly reduce PTS intake (and, correspondingly, health risk) in indigenous peoples without interfering with their basic traditional lifestyle and cultural identity.

**Keywords:** persistent toxic substances, reproductive health, aboriginal population, traditional food

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Alexey Dudarev, Dr. Med.  
 Head of Hygiene Department,  
 North-West Public Health Research Center  
 4, 2-Sovetskaya st., 193036, St-Petersburg  
 RUSSIA  
 Email: dudarev@sznc.spb.ru