State of Alaska Epidemiology **Bulletin** Recommendations and Reports

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Use of Traditional Foods in a Healthy Diet in Alaska: Risks in Perspective

Second Edition:

Volume 1. Polychlorinated Biphenyls (PCBs) and Related Compounds

EXECUTIVE SUMMARY

Risks in Perspective - Second Edition: Volume 1.
Polychlorinated Biphenyls (PCBs) and Related Compounds

Executive Summary

Polychlorinated biphenyls (PCBs), dibenzo-*p*-dioxins (PCDDs), dibenzofurans (PCDFs), and polybrominated diphenyl ethers (PBDEs) are lipophilic, persistent, usually man-made chemicals. Due to concerns over potential adverse ecological and human health effects, the manufacture of PCBs was banned several decades ago by many industrial nations. However, trace amounts of PCDDs and PCDFs continue to be unintentionally produced during some industrial processes. PBDEs are currently used as fire retardants in many consumer products, although several PBDEs will soon be banned by the European Union and the State of California. Efforts are being made to dispose of PCB-like chemicals in a responsible manner, but some have been accidentally released into the environment by industrial nations.

Due to their environmental persistence, PCB-like chemicals have become distributed in small quantities throughout the globe. These Persistent Organic Pollutants (POPs) have been transported from temperate regions to the arctic through the atmosphere, oceans and the marine food chain. In aquatic environments, POPs partition from water into organic material and biomagnify up the food chain.

In Alaska and throughout the Arctic, people who consume large quantities of subsistence foods from the sea are exposed to these potentially toxic chemicals, as are consumers of many other foods. The focus of this chapter is to review what is known about the levels of PCB-like chemicals in subsistence foods in Alaska and the potential hazards they may pose to human health, using the most recent data available. A preliminary assessment of subsistence food safety is presented, and key knowledge gaps are identified. Although information about the concentrations of POPs in subsistence foods in Alaska is limited, recent studies included in this revision have broadened our knowledge.

Data that are available from several Alaskan studies are of limited utility due to poor or undocumented analytical quality, particularly in older research. It is important to consider the quality and limitations of existing POP data, because an uncritical interpretation of POP data can result in misleading conclusions. For the purposes of this review, the quality of existing Alaskan data was scrutinized. While all available data were carefully considered, more weight was placed on POP data from studies that met rigorous standards of analytical quality.

Our knowledge of POP concentrations in the blood of humans in Alaska is increasing. In addition to the Alaska Native serum bank study mentioned in our original monograph (Rubin et al., 2001), several additional investigations have since been conducted or are ongoing. In general, these investigations have documented the extent to which Alaskans have been exposed to POPs. Serum concentrations of PCBs in those Alaskans who have been tested were higher than those documented in the general population from the Lower 48, although they were similar to Great Lakes fish-eaters. Serum concentrations of dioxins, furans and coplanar PCBs in Alaskans were similar to other Americans. In Alaska, as elsewhere, serum POP concentrations were strongly associated with age and were higher in older persons. Serum POP concentrations were relatively low in women of childbearing age. All POP exposures documented in Alaska were far below concentrations associated with known adverse health effects.

There are a number of potential human health concerns related to exposure to PCB-like chemicals. Some consequences of acute, accidental high-dose PCB exposure are obvious; the skin disorder chloracne is particularly diagnostic. Doses of PCBs that cause such obvious effects are orders of magnitude greater than the background exposures encountered by Alaskans through the food chain. Risks about which public health officials are most concerned when considering subsistence food issues in Alaska are chronic, long-term or subtle effects that may occur at very low PCB dose concentrations. In particular, cancer, immunotoxicity, reproductive toxicity, and developmental/neurobehavioral toxicity have been considered as potential endpoints of exposure to PCB-like chemicals. Due to the controversy and confusion surrounding these endpoints and their relationships with exposure to PCB-like chemicals, this report considers these issues in some detail.

Thousands of studies have examined the potential health effects of PCBs and related compounds. The results of these studies have often been conflicting and difficult to interpret. Overall, we conclude that there is some small, unproven but theoretical risk of subtle health effects related to low-level exposure to PCB-like chemicals. These subtle effects may be impossible to detect with existing scientific and medical technology. Alternatively, there may be no adverse effects resulting from low-level PCB exposures such as those encountered through consumption of subsistence foods or store-bought foods.

The potential risks associated with POP exposure through subsistence food consumption are smaller than the risks associated with a decreased use of traditional foods, or the risks associated with many other aspects of Alaskan life. A decreased reliance on traditional foods would have a negative net effect on human health in native Alaskan communities. Traditional foods have important nutritional benefits as well as cultural and economic benefits. The Division of Public Health strongly encourages the continued unrestricted consumption of traditional foods.

Concentrations of PCB-like chemicals vary substantially among species and tissues. The highest concentrations of PCBs are likely to be found in the fatty tissues of animals that occupy the highest trophic levels of the marine food chain. In marine mammals, tissue concentrations are often higher in older animals, and in male animals relative to female animals. Recent studies of Alaskan fish have documented very low concentrations of PCB-like chemicals. Alaskan fish can be consumed safely in unlimited quantities. Most Alaskan fish and seafood have lower PCB concentrations than fish from the Lower 48, which reflects the relatively remote, nearly industry-free environment of many regions of Alaska. The highest current concentrations of PCBs known in Alaska are in the blubber of transient killer whales, and relatively high concentrations have also been detected in stellar sea lion blubber. Concentrations of PCBs in beluga whale blubber from Alaska are somewhat higher than the concentrations found in Great Lakes fish, although they are within the same order of magnitude. Marine mammal blubber is often consumed in combination with epidermis; this “muktuk” has lower POPs concentrations than blubber alone.

All Alaskan human biomonitoring data to date provides evidence that women of childbearing age have been exposed to concentrations of contaminants far below those associated with adverse health effects to the fetus. Therefore, in view of the known health benefits of traditional food consumption to the mother and infant, the continued unrestricted consumption of all Alaskan traditional foods is recommended.

Future research should focus on addressing the following key knowledge gaps:

- Monitoring of subsistence species for POP concentrations in tissues should focus on six species: the beluga whale, Stellar sea lion, northern fur seal, Pacific walrus, ringed seal and bearded seal. Among Alaskan subsistence foods, the first three species have the potential to accumulate the greatest concentrations of PCBs in their tissues. The Pacific walrus is an important subsistence species, and PCB concentrations have the potential for elevation in “rogue” animals that prey on seals (it is unknown whether this behavior is common in Pacific walrus in Alaska). The ringed seal is significant due to its moderate level of contamination and high rate of consumption by Alaskan natives. Monitoring the bearded seal is important because it is a preferred native food source, and very few samples have been analyzed for POP concentrations to date.

- Monitoring of POP concentrations in human tissues such as serum, adipose tissue or breast milk has only recently taken place in Alaska, and more data are needed. Exposure measurements are especially needed for polybrominated diphenyl ethers (PBDEs), which have not yet been analyzed for in Alaskans. As the most direct indicator of human exposure to POPs, this information is essential in order for health officials to estimate the risks associated with the consumption of traditional foods. Measurement of POP concentrations in Alaskans will enable a comparison of their exposures and risks relative to people in other circumpolar areas that have previously been characterized, such as the Inuit of Quebec and Greenland.

- POP concentrations in prepared traditional foods should be characterized, and village-specific dietary surveys conducted to assess dietary exposure to these chemicals. This would provide information on how food preparation methods influence POP concentrations, and help us to determine which foods contribute most to dietary exposures. This information would be essential to any efforts to reduce future POP exposures, if desired, while continuing to enjoy a healthy subsistence lifestyle.

- The nature of POP exposure through the Alaska marine food chain needs to be characterized by use of sophisticated analytical methods that have only recently been employed for Alaska samples. Patterns of PCB congeners vary significantly among species as a function of trophic level and metabolic capacity and among geographic areas, and these patterns influence toxicity. Congener-specific profiles which include the bioactive coplanar PCBs, PCDDs and PCDFs are needed for human tissues and for the more contaminated subsistence food species. In order to achieve adequate detection of important trace congeners, these coplanar analyses should focus on fatty tissues such as marine mammal blubber and human milk.

"Use of Traditional Foods in a Healthy Diet in Alaska: Risks in Perspective" was originally published as an Epidemiology Bulletin, Recommendations and Reports on January 15, 1998. We issued a second printing in May 1999. At that time, we did not have the capacity to make the entire document available in an electronic form on our website.

We are pleased to now publish an updated, second edition. Due to the length of the document, we are publishing the second edition in three separate volumes.

Use of Traditional Foods in a Healthy Diet in Alaska: Risks in Perspective – Second Edition

Volume 1. Polychlorinated Biphenyls (PCBs) and Related Compounds
Volume 2. Mercury
Volume 3. Benefits from Traditional Foods

We will be publishing an electronic version on the State of Alaska, Department of Health and Social Services, Division of Public Health, Section of Epidemiology website http://epi.alaska.gov/. Readers may request a hard copy of each volume by contacting the Section of Epidemiology at 907-269-8000 or e-mail your request to envhealth@health.state.ak.us.

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