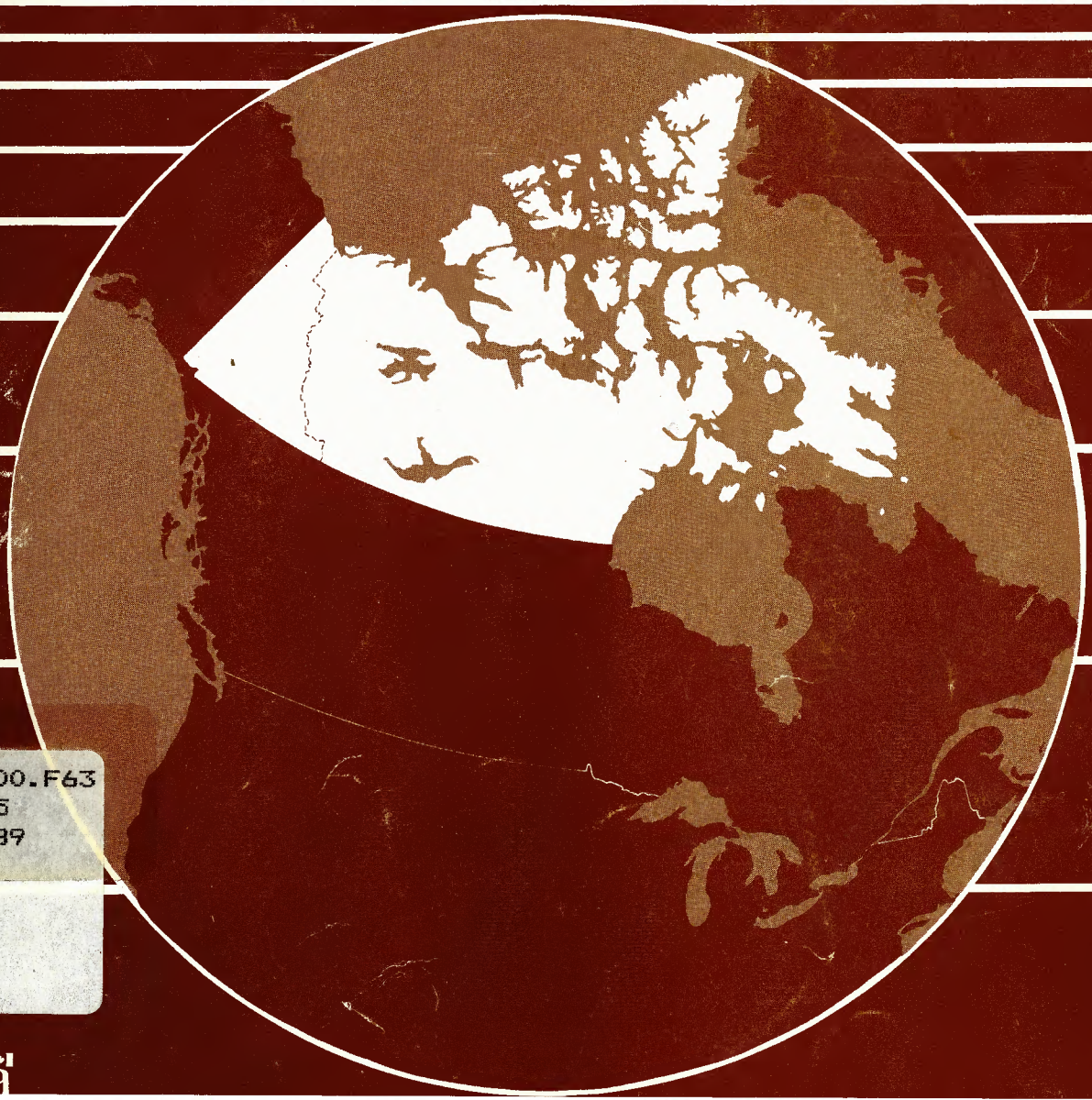
Indian and Northern Affairs Canada

Affaires indiennes et du Nord Canada

Contaminants in Northern Ecosystems and Native Diets:

Summary of an Evaluation Meeting Held in Ottawa February 28 to March 2, 1989.



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SUMMARY OF THE FINDINGS AND CONCLUSIONS OF THE SCIENTIFIC EVALUATION MEETING ON CONTAMINANTS IN THE NORTH

Meeting held in Ottawa, Ont.
Feb. 28 - Mar. 2, 1989

Foreward:

This report provides a summary of the present state of knowledge concerning contaminants in northern Canada. This knowledge base was the subject of a scientific evaluation meeting held in Ottawa, February 28-March 2, 1989. Approximately 50 scientists representing a broad spectrum of interests attended the meeting including a representative of each of the other seven circumpolar countries. An integrated ecosystem approach was taken to assess the contaminants issue which considered all aspects of the problem from sources to transport, freshwater, terrestrial and marine systems, human exposure through diets, and finally implications to human health.

It is intended that the proceedings of the scientific evaluation meeting will be published this year in a refereed journal as a benchmark report on contaminants in the northern Canada.

A participants list for the meeting is found in Appendix I.

SUMMARY OF THE FINDINGS AND CONCLUSIONS OF THE SCIENTIFIC EVALUATION MEETING ON CONTAMINANTS IN THE NORTH HELD IN OTTAWA - FEBRUARY 28 - MARCH 2, 1989

Introduction:

There have been since the early 1970's a number of studies of contaminants in the Canadian North. These studies revealed the presence of organic, metals and radionuclide contaminants in the Arctic ecosystem.

The interdepartmental clean-up of PCBs and other wastes at Canada's abandoned Distant Early Warning (DEW) line sites in 1985 raised initial concern about contaminants in native diets. During the course of this work, surveys were carried out to determine whether any hazardous materials had escaped into the neighbouring environment. The results showed that there was only limited contamination at some of the sites.

In 1985, the Department of Indian and Northern Affairs (DIAND) established an inter-agency working group on contaminants in native diets consisting of representatives from the Departments of National Health and Welfare (NH&W), Environment (DOE), and Fisheries and Oceans (DFO) and the Government of the Northwest Territories (GNWT). The committee first conducted a baseline literature review and determined that there was a definite need to assess the extent of wildlife contamination in the north and to determine the implications for the health of northerners.

One of the first conclusions of this group was that contamination of the North was in fact serious and widespread and that it was highly unlikely that the small quantities of PCBs found at the DEW line sites were contributing to the problem.

Subsequently, a cooperative program was designed involving all of the participants. The program comprised elements of monitoring, research, and evaluation. The first phase, a comprehensive monitoring and research program was initiated four years ago to assess the extent of contamination of local food sources used by northern people.

During the four years that the committee has been investigating the problem of arctic contamination, the scope of interest has been widened to include four classes of contaminants including organochlorines, acids, metals, and radionuclides. The major effort has been on occurrences of these contaminants and not on

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biological effects. The working group also adopted an integrated ecosystem approach to assess the problem which considered all aspects of the problem from sources to transport, freshwater, terrestrial and marine systems, human exposure through diets and finally implications for human health.

The technical committee has been preparing a benchmark report summarizing the current state of knowledge on the subject based on the results of the four year research and monitoring program. A scientific evaluation meeting was held on February 28 to March 2, 1989 to critically review draft chapters of the benchmark report and identify the present limits of our knowledge and the gaps that still remain to be filled. The need to have such a meeting was a priority to ensure that a solid assessment and synthesis of the data took place. Only then can the problem be fully defined and clarified without which responsible decisions cannot be made.

Approximately 50 scientists representing a broad spectrum of interests attended the scientific evaluation meeting including a representative of each of the other seven circumpolar countries. Scientists representing the interests of native organizations were also in attendance. The meeting was divided into six sessions which included sources, sinks, and pathways of Arctic contaminants, marine, terrestrial, and aquatic ecosystem contamination, human health effects and synthesis, conclusions and recommendations. A summary of the major findings of this meeting is given below.

A. SOURCES, PATHWAYS AND SINKS

1. Metals and acids deposited in the North have been primarily derived from Eurasian sources. On an annual basis over 95% of the sulphur entering the North is from this source.

2. The source and movement of organic contaminants is less well understood.

3. Organic contaminants derived from agricultural and industrial sources have been transported to the North through the atmosphere, ocean currents and fluvial processes. Very few measurements of organic contaminants have been made in air, ocean currents and river run-off. Exact source regions are unknown but are global in nature. Some sources are likely Northern Hemispheric in origin.

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4. Deposition of radionuclides north of 60 peaked in the 1960's and has declined ever since. Chernobyl was a minor source in the Canadian Northern compared to the earlier atmospheric bomb testing.

5. Monitoring of organic contaminants in snow, ice, air, and water in the North has indicated the presence of PCBs and chlorinated pesticides such as DDT compounds, toxaphene, hexachlorocyclohexane (HCH), dieldrin, chlordane compounds and hexachlorobenzene (HCB).

B. CONTAMINANTS IN NORTHERN BIOTA

Organic Contaminants

1. Virtually all organochlorine contaminants found in southern Canada have been detected at lower levels in Northern biota.

2. Although sample size for species other than polar bears has been limited, the levels of organochlorine contaminants in fish, marine mammals and wildlife are similar over a wide geographic area in the North.

3. The most abundant organic contaminants found in marine mammals have been toxaphene, chlordane and PCBs. Chlordane compound residue levels in polar bear fat have been reported to be four times higher in levels measured in 1984 than in levels measured in 1969, whereas levels of DDT did not change and the other organochlorines measured have been twice as high. There is however insufficient data to suggest a trend. The highest levels of PCBs in northern biota have been detected in polar bear fat (3-8 ppm).

4. Chlorinated dioxins and furans (2,3,7,8-TCDD and 2,3,7,8-TCDF) have been detected in the Canadian Arctic. Levels of 2,3,7,8-TCDD in pooled ringed seal blubber samples from seven Arctic communities range from 2 to 37 parts per trillion.

5. PCB and DDE (a metabolite of DDT) residue levels in Arctic ringed seal blubber collected at Holman Island, NWT, were lower in 1981 than in 1972. Similar results for PCBs in ringed seals and seabirds from

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central/eastern Arctic have been reported. The DDT levels in Holman Island ringed seal blubber did not change, suggesting new inputs via long range transport.

6. The highest mean concentrations of DDT and PCBs in marine mammals have been found in narwhal blubber from Pond Inlet and Pangnirtung, NWT (both approximately 5 ppm). Beluga have somewhat lower levels (3 ppm in blubber) while ringed seals average 0.8 ppm. The levels in beluga and seals are much lower than Gulf of St. Lawrence animals.

7. Toxaphene levels in Mackenzie River burbot livers were found to be similar to levels measured in samples taken from N.W. Ontario. Toxaphene levels in Arctic char are 10 times lower than in Lake Superior (lake trout).

Metals

1. High cadmium and mercury levels have been found in Arctic marine mammals (mainly associated with kidney and liver). For example, cadmium levels in narwhal kidney averaged 63.5 ppm which was among the highest reported in marine mammals. They are, however, mainly from natural sources rather than industrial ones.

2. Lead in the Arctic region is mainly from industrial sources. This is reflected in Greenland glacial ice deposits and in mussels which show higher concentrations in recent times than in pre-industrial times.

Radioactivity

1. The Cs-137 data base for caribou and other animals is not large but what data exists indicates relatively low levels of radioactivity. Levels in caribou are much lower than during the atmospheric bomb testing period in the late 1950's.

Acids

1. Twentieth century mid-latitudinal pollution has led to enhanced deposition of acidic sulphates and nitrates in the North. Acid levels in precipitation are 10 to 20 times lower than those found in high acid-rain impact areas further south in eastern Canada.

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C. INUIT FOODS AND DIET - AN ASSESSMENT OF BENEFITS AND RISKS
Findings from Contaminant Dietary Surveys in Broughton Island 1985-1988

SUMMARY

Background

In 1985, the community of Broughton Island was asked to participate in a pilot study to determine the amount of PCBs consumed in their diet, the amount of PCBs and mercury present in blood and the amount of PCBs in breast milk. Results of this study, conducted during the month of September, indicated a high intake of Inuit foods and an associated intake of PCBs which exceeded the amount considered "tolerable"* by Health and Welfare Canada (HWC) for 18.9% of study participants. Blood PCBs exceeded the unpublished HWC "tolerable" levels in 29 of 46 children (63%); 26 of 67 women of childbearing age (39%); 4 of 70 males (6%) and 7 of 24 females 45 years of age or older (29%). PCB levels in 3 of 4 breast milk samples were within the range reported in southern Canadian samples (13, 16 and 19 ppb); the fourth contained 69 ppb. The current "tolerable" level is 50 ppb. Blood organic mercury levels in Broughton Island exceeded the guideline range (under 100 ppb) in three persons, all adult males.

In companion studies, it was demonstrated that the blood and breast milk from Broughton Island residents contained up to 10 times the levels of omega-3 fatty acids found in southern Canadian controls. These fatty acids are believed to be protective against heart disease and other diseases, and to serve other important metabolic functions.

The intake of PCBs from food, blood levels for PCBs, and the organic mercury blood levels observed during the pilot survey were not considered to represent any immediate threat, but were of sufficient concern to merit additional work designed to assess seasonal variations in diet and in PCB intake. It was also felt necessary to examine in greater detail the nutritional benefits of Inuit food

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* The word tolerable in this context means the amount of contaminant which could be consumed on a daily basis over a lifetime with reasonable assurance of no adverse effects. Such a level incorporates a "safety factor" applied to the highest exposure for laboratory animals at which no adverse effect was observed.

consumption in a manner which would support a benefit-risk assessment of the diet. Inuit foods have sustained the Inuit over millennia but is now known to be contaminated by PCBs and other chemical residues.

Results of the pilot survey were presented to the Mayor and Council of Broughton Island, and permission obtained for further survey work to deal with these issues. This paper presents some early results of 7 surveys conducted over the period July 1987 to September 1988 in relation to PCB intake. Results relating to the intake of other contaminants will be reported separately.

PCBs in Inuit Foods

1. Inuit foods are used by nearly all Broughton Island residents, and are a major part of the diet for the community. Only about 12% of participants reported no consumption of Inuit foods during any of the survey periods.

2. All Inuit foods tested contain some PCBs; the smallest amounts were found in plants and fish and were higher in animals which feed on them; the largest amounts were found in narwhal and beluga blubber and in polar bear fat.

3. More PCBs are consumed by older than younger persons, and by males than by females. Marketed foods are used more by younger persons.

4. Over all survey periods, about 10% of female participants and 15% of male participants consumed more than the "tolerable" amounts of PCBs - 1 microgram per kilogram of body weight per day (ug/kg); the highest intake was about 5 ug/kg. This intake represents an erosion of the safety factor for PCB intake which is included in the calculation of a "tolerable" level. However, at this time it is not considered advisable to recommend a change in diet.

Nutritional Value of Inuit Foods

1. Inuit foods are nutritionally superior to the marketed foods used in the community.

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2. Blubber, which has the highest levels of PCBs, is rich in at least in one essential vitamin (retinol), and may be its major source in the diet. Blubber also contains high levels of omega-3 fatty acids, which are believed to provide protection against heart disease and other diseases, and to support other metabolic processes, such as the development of nerve tissue (particularly important in utero and during infancy).

3. Inuit food meats - from marine mammals, caribou and char provide large quantities of high protein, and the essential minerals iron and zinc, among other nutrients.

4. The use of Inuit foods provides a uniquely healthful, nutritionally sound diet; breast feeding and breast milk convey enormous benefits to developing infants.

Conclusions

1. The nutritional value of Inuit foods is high.

2. Substitution of Inuit foods with marketed foods currently available and consumed in the community will result in a poorer diet, with risk of damage to health.

3. Based on current information, the benefits of Inuit foods, and of breast feeding to Broughton Island residents are greater than the risk from the PCBs in Inuit foods or in breast milk.

APPENDIX I - LIST OF PARTICIPANTS

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