Traditional Knowledge and Contaminants Project: Progress Report

The Institute of Social and Economic Research
University of Alaska Anchorage
In collaboration with the
Alaska Native Science Commission

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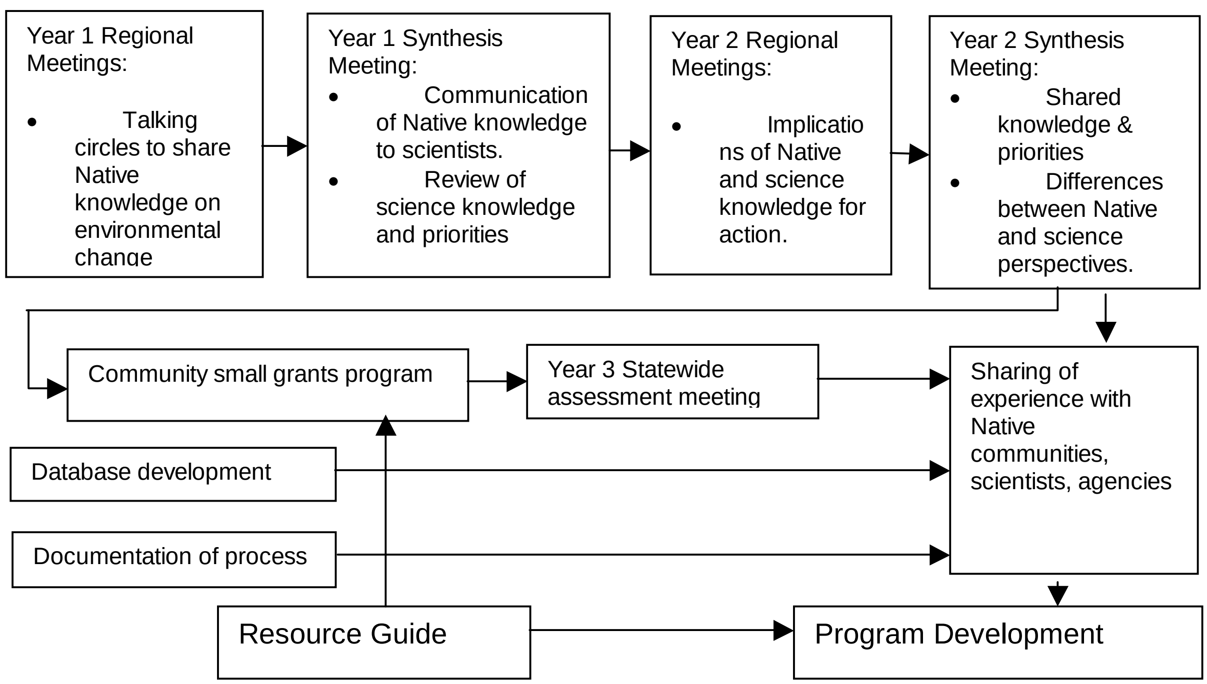
Traditional Knowledge and Radionuclides Project

This project is a joint effort of EPA Region 10 and the Office of Radiation and Indoor Air (ORIA). The goal of the project is to build capacity among Alaska Tribes to take effective action to clearly identify and address their concerns about radionuclides, other types of contamination, and adverse changes in the environment. The University of Alaska's Institute of Social and Economic Research and the Alaska Native Science Commission are collaborating to implement the project. We began work in the fall of 1996 under a grant from Region 10. Although the current three year grant funded by ORIA through Region 10 formally began in July 1998, an overlap between the previous grant and the current grant meant that we actually started work under the current grant in January 1999. The two grants are best seen as part of the same project. This is a status report on the entire project through July 2000. The main project website is www.nativeknowledge.org .

Approach

Figure 1: Project Approach



and to review a draft summary of science knowledge and priorities. The summaries of science knowledge and priorities are incorporated in the web-database (see "Use the Database") and summarized (see "Regional Meeting Presentation").

We are in year two of the grant. The major focus of activity this year has been the second round of regional meetings. We have completed this final round of regional meetings. The purpose of these meetings was for knowledgeable community residents to consider the bodies of Native and science knowledge, and to draw the implications of this knowledge for action. These meetings will set the groundwork for the community small grants program. See "Regional Meeting Presentation" on www.nativeknowledge.org

We will hold a second synthesis meeting with scientists and Native participants September 19-21, 2000. The purpose of this meeting is to share the traditional knowledge and research based perspectives and their implications for action. By involving both scientists and knowledgeable Native participants in this meeting, we hope that we can collectively identify points of shared knowledge and priorities and points where continuing differences in perspectives are important to respect.

The small grants program is intended to provide individual communities or small groups of communities an opportunity to begin to act on their own priorities. We anticipate providing about 10-15 grants averaging $10,000. In preparation for the small grants program, and in anticipation of an ongoing program of research undertake by tribes we are developing a Resource Guide for Measuring Contaminants in Native Foods. This site is under construction, and can be seen at www.nativeknowledge.org "Resource Guide" (see under "related sites").

Toward the end of Year Three, we plan to hold a statewide meeting to bring participants together to review and critique the project. We have hired a videographer who has documented all the regional meetings. He will also document the year-two synthesis meeting as well as the statewide assessment meeting.

Finally, we will continue to refine and develop a community database on contaminant measures, harvests and consumption of Native foods, nutritional value of Native foods, cultural values associated with Native harvest and consumption of Native foods, and Native knowledge about environmental change.

Contaminants and Native Foods Database

We initially focused on bringing together existing information on contaminants in Native foods and on building a network of Native villages and organizations concerned about contaminants and other environmental changes. We worked closely with people leading the Canadian Northern Contaminants Program, learning from their experience.

We decided that the most effective way to make information available to Alaska Natives and to interested government and university researchers is an interactive computer database. Three years ago many villages could not effectively access the internet. We therefore designed the database to work on individual computers. And, to avoid requiring Native villages to purchase special software, we designed the database to run on its own compiled version of Microsoft Access and Visual Basic. The database contains information on existing measures of contaminants in species of fish and animals harvested by Alaska Natives, harvest and consumption data, nutrition data, descriptions of the role of harvest and Native food consumption in communities, and examples of community initiatives taken in response to concerns about environmental change. The reader can see an overview of the Contaminants and Native Foods Database on the web at: www.nativeknowledge.org

We designed the Contaminants and Native Foods Database to store and report information by community. Appendix A contains a list of the 368 communities[1] in the database. Not all of these communities have Tribal governments; we include all communities in Alaska because Alaska Natives live in virtually all communities in the state.

[1] The database actually includes 403 place records. We have not shown the geographic records that represent the areas outside of named settlements.

Ideally, we would like to know how much Alaska Natives consume of each type of animal, fish, and plant. We collaborated with Betsy Nobmann, formally the nutrition specialist for the Public Health Service, to compile existing information about consumption of Native foods in Alaska. Such data are only available for 11 places in Alaska: Anchorage, Bethel, Dillingham, Kake Kotzebue, Kwigillingok, Mountain Village, Pedro Bay, Pilot Point, Selawik, and Sitka. Even in these places the data are not sufficient to identify subsets of the population that may eat large quantities of tissues that tend to accumulate contaminants (e.g. livers, kidneys). There clearly is a need for research on consumption of Native foods.

Consumption of Native foods is closely, but imperfectly, related to harvest of Native foods. The relationship is imperfect because harvesters frequently share Native foods and because there are likely to be large differences in consumption rates across individuals, even those living in the same community. Harvest data are valuable, however, in identifying the species that may be consumed in large quantities by many Native people. We collaborated with the Alaska Department of Fish and Game to incorporate their Community Profiles Database in the Contaminants and Native Foods Database. Appendix B lists the 168 communities for which measured per capita annual harvest for all harvested resources are available. We thus have comprehensive harvest data for at least one year for almost half (46 percent) Alaska communities. The number of harvested resource types represented in the database exceeds 400. Forty-six species harvested in excess of 20 pounds per capita in at least one Alaska community are shown in Appendix C.

We contacted researchers and research agencies to request contaminant data sets relevant to Alaska. We decided that we would not attempt to construct contaminant data sets from scratch but rather to bring together data sets already compiled by experts in the field. The database currently includes 21,475 contaminant observations. These observations are separately organized into eight sub-databases in order to preserve the integrity of the source data.

1. Alaska Marine Mammals Database: Chlorinated Hydrocarbons, Metals and Other Elements in Tissues banked by the Alaska Marine Mammal Tissue Archival Project, Paul R. Becker, et. al., U.S. Department of Commerce, National Institute of Standards and Technology (2,760 observations)

2. National Status and Trends, Fish Liver Data: National Status and Trends Program, Benthic Surveillance Sites, Fish Liver Data, National Oceanic and Atmospheric Administration (NOAA), National Status and Trends Program (2,089 observations)

3. National Oceanic and Atmospheric Administration (NOAA) report on contaminants following the Exxon Valdez Oil Spill (14,777 observations)

4. Tanana Chiefs Conference, Northern Pike Study: Mercury and Selenium Concentrations In Fish Tissue and Surface Waters of the Northern Unit of the Innoko National Wildlife Refuge (Northern Pike), Tanana Chiefs Conference, Inc., 122 First Avenue, Suite 600, Fairbanks, Alaska 99701 (96 observations)

5. Radionuclide Sampling Results. Data on Radionuclide Sampling Results Collected in Alaska or adjacent to Alaska beginning in the 1950s, Data Collected by: Alaska Department of Environmental Conservation, Environmental Radiation Program, 610 University Ave., Fairbanks, Ak 99709 (1,110 observations)

6. Contaminants Data for Places in Alaska from Various Published Sources: Data on Various Contaminants from Various Sources, compiled by Lori Feyk, Alaska DHHS Office of Epidemiology (316 observations)

7. Contaminants Data for Various Species in Alaska from Published Sources: compiled by Jesse Ford, Oregon State University (77 observations)

8. Contaminants in Northern Canada (CINE): Arctic Food Contaminants Database, Western Northwest Territories and Yukon Region, by Contaminant (CINE) (250 observations)

These eight data sources cumulatively provide observations on 1,293 unique place-species-contaminant combinations. We list these combinations in Appendix D. In addition, we compiled bibliographies on published contaminant studies. These include 1,246 references compiled by Jesse Ford, 42 references compiled by Joar Hovda, 51 CINE references, and 46 NIST references. The twelve hundred-plus contaminant observations represent a tiny fraction of the data needed to characterize contaminant concentrations in Alaska Native foods. One has to keep in mind that there are both local and non-local potential sources of contaminants, and that the pathways and forms of accumulation of contaminants vary by contaminant. Each observation pertains to one tissue type in a single animal. Taking into account variations in contaminant loads among individuals across communities by contaminant, species, and tissue type would require a multi-year program on the scale of the Canadian Northern Contaminants Program (i.e., on the order of $20 million over five years).

Betsy Nobmann compiled research results on the nutritional value of different Native foods. We incorporated this information in the Contaminants and Native Foods Database. We also wanted to provide some indication of the cultural value of Native foods. While there is a rich literature on cultural values in Alaska, it was not practical to undertake the task of identifying and incorporating such information from among hundreds of books and articles. We therefore decided that the most reasonable approach was to provide people unfamiliar with Alaska Native culture descriptions of annual harvest-related activities. These descriptions appear in searchable form in the Database as 2,523 html files.

Last year we asked several experts to review the Contaminants and Native Foods Database. We are currently transforming the Database to respond to their suggestions. We also decided that the rapid improvement in internet access by communities warrants moving to a web-based environment. We only have a month of database expert time in the current grant. To conserve this time, our database expert has opportunistically used other projects to develop the expertise needed to develop an interactive, searchable database as a web site. She is now in a position to make the transition and to simultaneously improve the accessibility of the database.

Synthesis of Science Knowledge

Given the vast gap between contaminant data needs and currently available data, we convened a group of 15 researchers to review the conclusions of the Canadian Northern Contaminant Program researchers. Following the workshop, we prepared a 16 page summary of findings for review by the researchers. A revised version of this summary appears as Appendix E. Major findings of the Alaska workshop include:

1. Alaska Natives have observed changes in the health of some animals and fish. They worry that these changes may be due to contaminants. We need to ask Native experts to share these observations in

order to see patterns of change (11)[2].

2. The diets of Alaska Natives are more likely to include predators which may concentrate contaminants (1). Alaska Native diets are also more likely to be higher in fats. These fats may contain higher concentrations of organochlorines.
3. Slower growing plants such as lichen can result in higher contamination levels. (14)
4. Contaminants reach the Arctic through long range atmospheric transport and exposure of migrating species exposed to non-local sources of contaminants (15).
5. Local sites and the natural environment may be sources of contaminants (17).
6. We need more data to understand the processes which move contaminants through the food chain. It is possible that accelerated processes during the spring may move contaminants through the food chain more quickly (18).
7. Marine mammals including polar bear, ringed seals, beluga, and walrus probably have elevated levels of PCBs and toxaphene. There is some Alaska data to support this statement, but more is needed. We cannot assume that the trend of decreasing levels of PCBs from eastern to western Canada extends into Alaska, particularly in the Bering Sea. The higher eastern levels of PCBs may be due to a coupling of a regional cooling trend in eastern Canada with atmospheric PCBs from lower latitudes of North America (104).
8. Polar bears, ringed seals, and beluga are likely to have elevated levels of mercury, but we need data to understand how the sedimentary geology differs in different areas off Alaska's coast as compared with the Canadian Beaufort Sea (120).
9. While cadmium concentrations in beluga decrease from the eastern to western Canadian Arctic, we cannot assume that the trend extends across the Alaska Beaufort, Chukchi Seas, or into the Bering Sea and Gulf of Alaska. The mineral composition of sediments may differ from those in the western Canadian Arctic (122).
10. Geographic coverage of levels of persistent organochlorines and heavy metals in marine mammals is not good in Alaska (130). In contrast to the Canadians, we have not studied contaminant levels in most stocks or populations of beluga, ringed seals, walrus, and polar bears. (128)
11. We do not have the data necessary to conclude that an observed increase in cadmium levels in caribou kidneys from eastern to western Canada continues into Alaska. We therefore cannot say that the levels in Alaska are comparable to those in northern Quebec and Norway, which is the case in western Canada. The source of cadmium is probably natural and may be related to soil and winter forage (63,64,69).
12. Concentrations of Cesium 137 are probably 4-10 times lower than they were in the 1960s when they increased due to atmospheric testing. Levels of Cesium 134, which also increased due to atmospheric testing, are now very low (75).
13. There is some confirmation of naturally occurring potassium 40, polonium 210 and lead 210 in caribou in Alaska. Levels of lead 210 may vary within herds as they do in Canada, but we don't have data to confirm this (78-82).
14. We do not have data to know whether the trend of decreasing PCB levels in caribou from eastern to western Canada extends to Alaska (85).
15. In northern Canada, fish of primary concern due to their contribution to Native diets include: burbot, lake trout, arctic char, northern pike, and whitefish. We cannot assume that this species are of primary concern in Alaska; rather, all species consumed are of potential concern. Included also should be anadromous fish such including salmon. We also cannot assume that PCBs, toxaphene, and mercury are the primary contaminants of concern in freshwater fish (26-29).
16. We don't know how organochlorine levels vary in birds. We cannot say whether the Canadian observation of lower organochlorine levels in the western Arctic extends to Alaska (93).

[2] The number in parentheses refers to the row number of the spreadsheet containing the original Canadian findings.

17. Geographic coverage of levels of persistent organochlorines and metals in seabird populations in Alaska is poor (137).
18. There is very limited information on levels of organochlorines and aromatic hydrocarbons in marine fish stocks in Alaska waters (140).
19. Military sites along Alaska's coast are likely to be local sources of PCBs and DDT contamination of the nearshore environment. While there is some Alaska data to support this conclusion, more data is needed (150).
20. At present, the temporal trend data are too limited to be able to predict future trends because they are based on two or at most three sampling times. By comparison, temporal trend data for contaminants in Lake Ontario lake trout and in various species from the Baltic and from lake Storinveld in northern Sweden are available yearly for a 15-20 year period (168).
21. There are few studies of biological effects indicators with arctic animals. There is particularly a need to study biological effects on immunosuppression in mammals at high trophic levels (216).
22. Native foods are widely consumed within communities. Marine mammals, large ungulates, and fish account for a large proportion of Native foods consumed. Consequently, potential exposure of Alaska Natives to contaminants in Native foods is widespread in Alaska (240)
23. Increases in consumption of imported foods by Alaska Natives have been associated with decreased physical activity, obesity, dental caries, anemia, lowered resistance to infection, heart disease, and diabetes (238).
24. Consumption of Native foods varies by region, income, access to urban centers, and by factors such as age and gender (246).
25. Dietary lipids are a concentrated source of energy, act as carriers of fat-soluble vitamins, and are a source of essential fatty acids (polyunsaturated fatty acids that are essential to health but cannot be synthesized by the human body). Fish and marine mammals which form a significant portion of the diet of Alaska Natives contain many n-3 polyunsaturated fatty acids which are not easily found in imported foods. Omega-3 fatty acids are found at high levels in fish and marine mammal tissues and have been associated with a decreased incidence of thrombotic and ischaemic disease (253).
26. If consumption of traditional food resources - particularly fish and wildlife- were discontinued, the mineral nutrition of most indigenous Arctic populations would be compromised to such an extent that nutritional deficiencies could occur (255).
27. In Arctic communities, a significant portion of the protein requirements are fulfilled by traditional foods such that limiting the supply of traditionally harvested meats and fish would drastically reduce protein intake (259).
28. A higher incidence of infectious diseases and ear infections among Alaska Native infants may be due to a complicated set of factors. It is unknown whether perinatal exposure to PCBs is one of these factors, nor is the extent of exposure known (271).
29. Although a major source of human exposure to cadmium is smoking, some individuals who frequently eat kidneys of caribou and marine mammals (e.g. once a week year round) may ingest significant amount of cadmium (296). However, only a small percentage of cadmium (about 5 percent) is absorbed through ingestion compared with direct absorption through smoking.
30. The greatest exposures to radionuclides occurred in the 1950s and 1960s (e.g. strontium 90). The long term effects of Strontium 90 in bone perhaps interacting with exposures to organochlorines is not known. Of all radionuclides, lead-210 and polonium-210, which are natural in origin, may make the greatest contribution to current human radiation doses in the Arctic. However, the greatest exposures to radionuclides may come from improperly used or maintained radiological equipment. Both lead-210 and polonium-210 occur in nature as airborne particles and rend to settle out on vegetation (i.e. lichens) thereby entering the terrestrial food chain (lichens-caribou-humans) (308). We should also consider polonium-210 levels in fish.
31. Of the anthropogenic radionuclides, the two main isotopes of radiocesium (cesium-137 and cesium-134) are considered to be of greatest concern in Arctic environment. Levels of radiocesium in Arctic

residents have declined from about 450 Bq-kg in 1965 to roughly 10 Bq-kg in 1990. The effects of exposures to Strontium 90 in the 1950s and 60s, however, may be important, but we don't know (312).

32. Risk determination for contaminants in Native food involves a consideration of the type and amount of food consumed and the sociocultural, nutritional, economic, and spiritual benefits associated with Native foods (315)
33. Risk management decisions must involve the community and must take all aspects into account to arrive at an option that will be the most protective and least detrimental to the community (316).
34. In Alaska Native communities, advising against Native food consumption is also to advise against hunting and fishing. To the extent that aboriginal identity and the collective sense of well-being is based on subsistence as a social system and as an activity, as well as a dietary staple, then loss of confidence in Native food undermines confidence in identity and society (321)
35. Perception of risk in the Alaska, as in many communities, differs between the public experts. A lack of straightforward and credible information about toxicity and safe levels leads to unnecessary anxiety. This anxiety in turn can disrupt Native food harvest and consumption. The goal should be to provide clear information that will minimize unnecessary anxiety and alert people to real problems where they exist (330).
36. In Arctic communities, communication is most effective when it is interpersonal and face-to-face. It should be a two-way flow of information where the opportunity for feedback is maximized (334).
37. Communication should occur from the onset of a study and should be an ongoing process through to the reporting of findings and the development of remedial options. The best studies and the best solutions to local contaminant problems are developed with and by the community (336).

We will incorporate results of this work in our Synthesis Meeting to be held in conjunction with the Arctic Division of the American Association of the Advancement of Science 1999 Arctic Science Conference to be held September 19-22 in Denali Park.

We are working with both the AMAP secretariat and with the Canadian Northern Contaminants Program to bring together plain English summaries of available knowledge about contaminants in the Arctic. In addition, we conducted a literature review to bring in articles published after the summaries were prepared. We have identified 68 such articles of which we have obtained 48 in hard copy. Over the summer of 1999 we prepared a Powerpoint summary of available knowledge to use in the September 1999 Synthesis Meeting. Our objective was to advance toward a consensus on available knowledge among researchers. We brought this consensus to communities in regional meetings held in 1999-2000. We asked community representatives for their views on the scientific consensus. We will share community views with the scientific community in the September 2000 Synthesis Meeting.

Regional Meetings

As stated above, the principal goal of the project is to build capacity among Alaska Tribes to take effective action to clearly identify and address their concerns about radionuclides and other types of contamination. The most important components of capacity to take effective action are ownership and trust. We mean by ownership that tribes take responsibility for their own lives. We mean by trust that tribes trust the world in which they live - the natural environment, the efficacy of their own actions, and the actions of others.

Traditional Knowledge and Radionuclides - "The Process"

> *A healthy village is a circle whose people are safe within its fold.*
> *Love, understanding, kindness, culture, history, goals, truth - these*

make the circle strong and protect the village, the family, the individual. Harold Napoleon

The process designed for the project incorporates Native worldview and protocols. In order to capture traditional knowledge, one must use traditional methods. Traditional knowledge, taken out of context, is no longer traditional knowledge.

The process involves the primary elements of the Native worldview - a holistic view where all things are connected, the creator, earth, animals and humans, and the aspects of the physical, mental, emotional and spiritual are equally represented. This worldview serves as the basis upon which the model process has been developed.

The first step is having knowledge of the area, communities and cultures and understanding their unique protocols and circumstances. Each region of the State represents primary culture groups - Iñupiat, Yupik, Athabascan, Tlingit, Haida, Tsimpsian, Aleut, and each have their distinctive practices and protocols.

The selection of participants to the Regional Meetings is an interactive process, involving a local steering committee from the region that assists in identifying Native elders, culture bearers, hunters, youth, gatherers, resource managers and Native scientists. All regional profit and non-profit Native corporations, health corporations, tribal organizations and councils, and municipalities are notified of the Regional Meetings and of the participants representing their communities.

The Regional Meetings take place in a "Traditional Talking Circle" format, with a trained facilitator, and begin with rules of the circle and formal introductions. The Talking Circle has been used throughout history but has gained prominence as a teaching tool, a therapeutic tool, and a support group system. Traditional Talking Circles are conducted by traditional healers, elders or trained facilitators who are knowledgeable and disciplined in tradition, custom and spirituality. The facilitators may prepare for days in order to conduct the Talking Circle according to traditional beliefs.

These basic rules apply to the Talking Circle:

1. Respect for confidentiality.
2. Respect for each person in the circle.
3. Each person is given a chance to speak without interruption or comment.

There are different types of Talking Circles. For this process, we use the Traditional Talking Circle.

Traditional Talking Circle - The traditional facilitator begins the circle with prayer, singing, or drumming; establishing rules; and setting the tone for the circle. They may use a symbolic object (e.g., rock, feather, or prayer stick) in the circle. The circle generally begins with traditional introductions. The circle goes clockwise in respect for the cycle of life and mother earth. Each person in the circle gets a chance to share if they choose to. The circle may go around multiple times to give those who want to share more time to do so. There is normally a beginning, middle and a closure. The circle ends with a closing prayer.

The Talking Circle promotes understanding, sharing and trust. This is key to participants feeling secure in sharing knowledge that is cultural or sacred and knowing that their information will be used in respected and appropriate ways. An important part of the process is the sharing of food and gift-giving as is the usual community practice.

To record the meeting, the scribes sit outside the circle and take remarks from participants. Each day the scribes return the comments to participants for review. General themes and actions are also reviewed by participants. Consent form are reviewed with all participants before asking for their signature. Draft report documents in their entirety are also sent to all participants before the final report is prepared.

Knowledge Subject Areas

To be true to Native ways of knowing and Native ways of building consensus and to build rather than undermine trust and relationships we cannot predict what knowledge subject areas will become important to Native communities. We have a beginning set of questions that are based on prior contacts with tribes. We intend these questions to stimulate thinking in the regional meetings; however, we do not intend to structure the meetings around them. The questions are:

- What environmental changes are causing concerns about the safety of eating Native foods, and human health? What environmental conditions continue to appear healthy?
- Where and when have environmental changes been observed?
- To what extent are there apparent sources of these changes? Do radionuclides or other contaminants appear to be potential sources of changes?
- How can we support community action?
- How can we document and access traditional knowledge?

Goals for Documenting and Accessing Traditional Knowledge

The most important goals influencing the design of a process for documenting and accessing traditional knowledge are that community ownership and trust are ***increased*** as a result. Most designs for the collection, archiving, and use of traditional knowledge are likely to ***decrease*** community ownership and trust. We work with community participants to design methods which preserve local control and which promote local use of information.

Additional goals for documenting and accessing traditional knowledge include:
- Relevancy
  - Observations of environmental change
  - Ideas on related changes and possible sources of change
  - Observations of changes in human health and related changes
  - Observations made over time
- Specificity
  - Species
  - Location
  - Time
  - Quantity/prevalence
- Builds a network of expertise and builds credibility of knowledge
  - Source of observations (individuals, documents)
  - Means of contacting source for additional knowledge

- Means of safeguarding local knowledge where desired

We have conducted the regional meetings. The meeting dates were:

- Northwest Arctic Regional Meeting: Nome, September 30 – October 2, 1998
- Southeast Regional Meeting: Sitka, January 28 – January 30, 1999
- Interior Regional Meeting: Fairbanks March 25 – March 27, 1999
- Yukon-Kuskokwim Regional Meeting: Bethel, August 26-28, 1999
- Prince William Sound-Alaska Peninsula Regional Meeting: February 23-25, 2000
- Southcentral Regional Meeting: Anchorage, February 28-29, 2000
- Interior-Northwest Regional Meeting: Anchorage, April 6-7, 2000
- Southeast-Northwest Arctic Regional Meeting: Anchorage, April 10-11, 2000
- Arctic Regional Meeting: Barrow, June14-16, 2000

Appendix F reproduces the "homework assignment" that we send to meeting participants prior to the meeting. We encourage participants to talk about community concerns with other community members before coming to the regional meeting.

Appendix G contains the summary slides used to introduce the project to participants in each regional meeting. We contrast the community-based approach used in this project with the traditional science-based approach. We explain the major elements of the current grant and the purpose of the first year's regional meetings. We also review sources of concerns about radionuclides and explain that we are broadly interested in people's observations and concerns about environmental changes.

We record participants' comments as close to verbatim as possible using Microsoft Access. We begin the second day by asking participants to edit printed copies of comments they made on day one. We repeat this procedure the third day. In addition, the first evening we prepare Powerpoint a summary of the major points made by participants. We use this summary interactively with participants the second day using a video projector. In this way, we work toward a consensus of points made during the meeting as a whole. Appendices H, I, and J contain the consensus summary points from the three regional meetings. Key findings to date from the regional meetings include:

Northwest Arctic

- There are increased numbers of fish with abnormalities. These increases appear to be associated with local sources of contaminants.
- Beavers and Bears are moving into the region and there is increased willow growth.
- There was a large die off of seabirds (cormorants, puffins, murres) in the summer of 1996.
- There is more dirty ice seen and the extent and thickness of sea ice has decreased.
- There are more years of warmer, wetter weather.
- Lakes and normally wet areas are drying up.
- Residents are concerned about Russian sources of contaminants including nuclear power plants and dumping of wastes.
- People would like to be able to test for contaminants. They want training for collection and testing.
- People are concerned about higher rates of cancer in some villages than others. There appears to be a relationship between cancer rates and local military sites.

Southeast Alaska

- There has been a decline in herring, herring spawning areas, and a shift to earlier spawning.
- Sea otters are moving into inside waters.
- There have been declines in local shellfish, halibut, smelt, hooligan, rockfish, and sockeye.
- There is a loss in the spiritual relationship that people have with the natural environment and a loss of respect for animals.
- People are changing in how they act and think; these changes bring pollution, cancers and other illnesses. There is a need for healing.
- There is a loss of old growth forest habitat, with a decrease in availability of medicinal herbs and plants for weaving.
- Sources of contamination range from fuel tanks, asbestos, lead-based paint, pulp mills, inadequate buffers of trees along streams with resultant siltation.
- Fishing pressure on herring and halibut is high.
- Warmer ocean temperatures appear to be bringing tuna, mackerel, barracuda, sunfish, giant turtles, and white sharks to the region.
- Marine buffer zones for subsistence are needed.
- Sea otters need to be controlled.
- Tourists need to be educated about the environment and local customs.
- We need a traditional knowledge study to identify resource population levels when the system was healthy and we need large area contaminants analysis.

Interior Alaska

- Peoples' diets are increasingly including store bought meats and vegetables, instant foods, pop, and improperly stored canned and frozen food.
- More people are dying from stomach cancer, ulcers, and other cancers. There has been a loss of traditional medicine people and an increased use of the clinic.
- There are local signs of pollution: E-Coli, discolored river and village water.
- Whitefish and salmon show increased numbers of abnormalities. There have been local die offs of Whitefish.
- Moose meat tastes different and some have water bags in their lungs.
- Muskrats have spots on their liver and lungs and are not as fat. There has been a decline in muskrats around Fort Yukon.
- There are increased numbers of beavers. Beaver recently have had spots on their liver.
- Caribou have runny bone marrow.
- The Tanana Chiefs Conference has measured high levels of PCB's and DDT's in King Salmon and high levels of mercury in fish.
- Sources of pollutants include dumps, honey buckets, military sites, mines, chemicals used in dust control, vehicle oil leaks, fire retardants, acid rain, and distant sources like sunken submarines.
- Winters have not had the usual severe cold snap with the result that lakes do not freeze to the bottom.
- Summers have been hotter and dryer with the result that lakes and wet areas are drying up.

- There is a need to return to use of traditional medicines and to use healthier practices in living.
- Youth need to be taught to be caretakers of the ecosystem.
- Gwitch’n people need to have a voice on the Arctic Council.

Following each regional meeting we edit the MS Access database of participant comments. We divide comments so that each record in the database contains a comment by a single participant about a single concern. We send this edited version of comments out to participants to review. The combined database of Native concerns now contains 857 concern records provided by 105 regional meeting participants.

The individual comments of participants reflect an experience and understanding greater than the individual participant. Participants bring to the regional meetings the collective traditional knowledge of their community and region. Here is an opening commentary by Enoch Scheidt from Kotzebue:

> *My dad came from Noorvik and mom came from Noatak. I was adopted and raised mostly by my grandfather after my dad had a stroke. I lived mostly on animals and berries, both inland and on the coastline. My grandfather told me about animals everywhere we go. He said that they would change one of these days and I should worry about it.*
>
> *I moved to Kotzebue 35 years ago and I hunt up river and on the ocean. We get to see scars a lot on fish and we think it is from the catch and release sport fisherman. This year for the first time we are noticing that our salmon have pus on them inside and outside. Are they bringing the disease in from Russia or is it here already?*
>
> *We boat from Kotzebue to a little way from Wales - one season I went almost to Pt. Hope and back to Kivalina (about 350 miles) - just to say I did it once. When we go hunting on the ocean for 2-3 days it didn’t used to be hard to find clean ice. Now it is harder and harder to find clean ice - why? Why is it getting so dirty and making it harder to hunt?*
>
> *We used to walk way up to go caribou hunting - but nowadays most of our caribou are getting sick. We eat from the caribou and they eat the lichen, the moss. They need to study the caribou because it is our main diet inland. Is it coming in the rain to the moss?*
>
> *Why are our people getting sick? A young kid came to my office. He had been looking for ivory across the east side of Kotzebue Sound. He found two mud sharks which still had meat. The sea gulls wouldn't eat them and you know sea gulls will eat anything.*
>
> *Anytime someone does a study, they say they will get back to us, but they never do. It's too late for us, but our kids and grandchildren need the choice to eat Native food or not. Maybe elders are getting*

sick from the canned food - maybe our elders are immune from the preservatives, we don't know.

A lot of our fisherman get sea fish with tags. They are always skinny. We know they are trying to do studies for our own good but the tags may cause a problem. It's the same with caribou collars. The necks of the collared caribou are all raw. I shot a caribou but found that it was sick so I left it. ADF&G found it and gave it to an elder. The elder didn't eat it; there were white spots on the liver, the lungs were stuck and it was green, it stunk.

On the berries, the cycle is a lot earlier - why? Maybe it is the rainfall. I've been hunting since I was 7 years old and never went to high school. I've got relatives all the way to Barrow. When I was 8 there was a scientist from Canada involved with Project Chariot. He hired me to take him out to take samples of moss for two and a half months. He said afterwards that your family will never get sick. A boy ate caribou and soon died. We never found out why he died.

Our concerns here in Kotzebue are with the White Alice site - a lot people from Kotzebue are dying from cancer.

I hunt all the way to Ambler - I try to learn and I hunt both sea and inland.

Enoch Scheidt, Kotzebue

We will be analyzing the database to present in the synthesis meeting in September. To provide the reader with a sense of the contents of the database, we provide below examples of comments from the first three regional meetings:

We are putting together a database from 10 of our villages here. They are reporting about each village and on state lands. Where we are finding reported and proven contamination (tar, gasoline, fuel oil), we are finding deformities in the fish. The fish being reported are unhealthy when they open them up. There is definitely a relationship between reported places, waters, and fish deformities. Example - Davidson's Landing was an army fuel reserve dump (cache) during WW2. Agiapuk River and American River - we are gearing up for active remediation. That's where the reports of fish with lesions and sores are coming from.

Guy Martin, Nome.

We have a high rate of increase in beaver. What's happening is that because the winters are warmer, the lakes don't freeze all the way down and more of the young beaver survive. That's what is causing them to proliferate. We are having warmer winters than usual on a consecutive basis. This allows for more favorable conditions for beaver—but most important of all—is that the lakes in

Interior Alaska do not freeze all the way to the bottom—thus allowing a much higher percent of beaver to survive the winter.

Paul Erhart, Tanana

There have been a lot of changes in the sea ice currents and the weather. Solid ice has disappeared and there are no longer huge icebergs during fall and winter. The ice now comes later and goes out earlier and it is getting thinner. The current is stronger. We used to have a very low tide down at the bead and it is windier on the island. We had a bad hunting season with lots of high winds. Some years ago there was a massive amount of dead murres that floated on the water. I think thy caught the ward currents from Japan. Our elders tell us that our earth is getting old and needs to be replaced by a new one.

Jerry Wongittilin, Sr., Savoonga, St. Lawrence Island

I noticed that a long time ago when I was growing up the plant and berries use to be sweet in July. Nowadays the greens and even the berries don't last long.

Roseanna Dan-Waghiyi, Stebins

There are a lot of things happening. The weather has gotten warmer. The taste of the plants has changed. The fur is coming off the seals like they are molting but it is not molting time. We're wondering if Chernobyl was responsible. They were wondering about Russian military dumping toxic waste and it is coming over to our side. I'm glad to be here and to understand that we aren't the only ones to experience these changes. We are isolated with one week mail service. It is really hard to get off and on our island.

Eric Iyapana, Little Diomede

I was born in Deering on the south side of Kotzebue but I was raised in Shishmaref. I worked for the federal government for 31 years and just retired this April. Even though I work for the government, I make sure I go hunting every year for my family. I've seen a lot of studies on contaminants and animal behavior, and the problem I see is that we never get feedback on why this behavior is happening and what contaminants are present in them until it is too late. In the meantime, we are eating them and possibly being contaminated by something we don't know. We just have to guess at the sources of contamination because we don't know. My sister died a couple of months ago of cancer. I often wonder what caused it? Was it her Native food, the air she breathes, or the non-Native food she ate? It makes you wonder why cancer is getting more frequent, especially in our older people. I certainly hope we get some feedback on the results of these studies because everyone is getting concerned on why these things are happening.

Delano Barr, Shishmaref

What I'm saying is that I truly believe that we will never get action unless we do it ourselves. We have to put things together, with the help of some technical, responsible people. So the movement to gather all the information that we can is good and we should try to get a committee or statewide support to do what we're tying to do. I think that you have a pretty good group here.

Robert Charlie, Minto

My concern in Allakaket is water. We don't have running water at home. We have outdoor bathrooms. We have real problems with our water pollution, all over.

Johnson Moses, Allakaket

There are real environmental concerns about a proposal that would bring in freighters from China to get water here. It would bring in things that our environment is not ready for.

Teri Rofkar, Sitka

This summer we had no sockeye. The sockeye they were catching up the river in June, they had tumors, they were deformed. Some had only one eye, some had bumps.

Elaine Abraham, Yakutat

There is Fish Lake, and I saw dead fish there. You know when you see dead fish in a river, you know something is wrong. Like I said, the people have been mining there since I can remember. What have they been putting into that lake? Makes you wonder.

John Starr Tanana

They sprayed DDT in Galena area. They just sprayed everything around year after year. The military dump chemicals everywhere. Soaked the ground with PCPs. I told my little girl not to drink the water.

Orville Huntington, Huslia

My concern is the pollution and garbage. Everywhere I go in the summer with a boat or by snow machine in the winter, I find trash left around. The cans don't weigh hardly anything, so I haul them home. But most people don't do that. People dump oil in their machine and dump the can in the river.

Paul Herbert, Fort Yukon

There is a very visibly an over-population of sea otter in Southeast Alaska. Normally, the sea otter is an outer coast animal. That is where we would like to see them stay. Because of the large *population, the seal otter are infiltrating into the inside waters. The threat of this trend is that sea otter feed on the same things that we consider subsistence foods.*

Harold Martin, Juneau

Unalakleet had a White Alice site and Moses Point (Elim) had a CAA station. Elim has much higher rates of cancer among people in their 40-50s. At home we don't have any of these sites.

William Takak, Shaktoolik.

This morning there were questions about blueberries. We analyzed our blueberries and came back with DDT. We're Indian people, we don't use pesticides. Yet we have it all over our land. I researched this and most of our pesticides come from Russia and Asia. Russians sprayed 17,528 tons of pesticides last year, and it becomes airborne and comes to us. I'd like us to face the question of whether it is safe to eat. From my perspective, the benefits far outweigh the risks.

Paul Erhart, Tanana

There is a real hesitancy about eating the clams now. When I was a kid, you know, we use to eat the muscles on the clam raw. As my mother and dad were cleaning it out, we ate all those little buttons. And you know, I won't let my kids eat that anymore. We use to eat it raw. But now you don't know anymore. We have a joke in my house because I have two Siamese cats and my kids say, "Gram, test it on your cat first." So, we have a generation that's scared of eating their Native foods.

Elaine Abraham, Yakutat

My greatest concern for the Tanana area is how can we save our elders? A lot of them have passed away from cancer. We know the cause is White Alice and all the mining that has been done in our area. The most difficult question is how are we going to make the government and the mining industry really clean up their sites? This is one of our greatest concerns.

Gerald Nicholia, Tanana

You don't hear birds any more. All the time we used to hunt there use to be so much noise from the geese and cranes going north. The noise just isn't there now. Go back there is the fall and you don't hear it any more. The changes we're seeing—it's not very good the changes that we're hearing.

John Starr, Fort Yukon

I've lived most of my life in western Alaska. I've been in groups like this in the past. The animals and berries are changing. I've noticed *that the silver salmon had sore-like spots on their sides. They said a few years ago when the birds were dying that there was a yellow-like substance foam in the bay. We've never seen anything like that before. When I talked to the elders at home before I came here they talked about the migration patterns of the walrus and caribou changing. Recently two families lost their reindeer to caribou because they came right down the beach near Koyuk. The caribou used to come 15-20 miles inland and now they are migrating towards our area. One family lost most of their herd this year. It seems that in my lifetime the migration of the walrus and beluga are really changing too. Take an example from the lemmings, when there are too many, they go to different areas to feed. That is the way it is with the walrus too. They are going to new places to feed. Last year thousands of them went to Norton Bay. When we opened their bellies, we found rocks in there. They migrated towards the land; maybe it was because they ran out of things to eat.*

William Takak, Shaktoolik

Well, since you're talking about health. I work at Kawerak on subsistence. I'll talk about Brevig and in recent years there has been a lot of deaths (6?) from cancer. Being from Sishmaref, I know that people are dying from cancer and people are wondering why. It is mostly at Brevig and Teller. Since the whalers came, tobacco has been part of our lives. It gets to the point that it starts killing people. But I know a woman in Brevig who didn't smoke all her life and she died from cancer.

Jake Olanna, Nome.

Status of the Budget

As of April 14, 1999 the available balance on the current three-year, $700,000 grant was $551,306. Participant and meeting costs for both regional meetings completed under the current grant totaled $36,787 compared with anticipated costs for the two meetings of $36,120. Labor charges to date on the current grant are under anticipated charges by about $20,000 as Kruse, Killorin, and Eberhart have had competing demands for their time on other projects. We anticipate that we will be able to make up this project time on synthesis and database tasks in June, July, and August. It has been challenging to schedule the fourth and fifth Year One regional meetings. We expect to hold meetings in Bethel and Barrow. In order to get full participation it will be necessary to schedule the regional meetings in the fall.

Appendix A: Communities in the Contaminants and Native Foods Database

Adak Station
Akhiok
Akiachak
Akiak
Akutan
Alakanuk
Alatna
Alcan
Aleknagik
Alexander Creek
Allakaket
Allakaket/Alatna
Ambler
Amchitka
Anaktuvuk Pass
Anchor Point
Anchorage
Anderson
Angoon
Aniak
Annette
Anvik
Arctic Village
Atka
Atmautluak
Atqasuk
Barrow
Beaver
Beecher Pass
Beluga
Bethel
Bettles
Bettles/Evansville
Big Delta
Big Lake
Birch Creek
Brevig Mission
Buckland
Butte
Campion Station
Cantwell
Canyon Village
Cape Lisburne
Cape Newenham
Cape Pole
Central
Chalkyitsik
Chase
Chefornak
Chenega Bay
Chevak
Chickaloon
Chicken
Chignik Bay
Chignik Lagoon
Chignik Lake
Chiniak
Chisana
Chistochina
Chitina
Chuathbaluk
Circle
Circle Hot Springs Station
Clam Gulch
Clark's Point
Coffman Cove
Cohoe
Cold Bay
Cooper Landing
Copper Center
Copperville
Cordova
Council
Covenant Life
Craig
Crooked Creek
Crown Point
Cube Cove
Deadhorse
Deering
Delta Junction
Denali Highway
Dillingham
Diomede
Dora Bay
Dot Lake
Dry Creek
Eagle
Eagle Village
East Glenn Highway
Edna Bay
Eek
Egegik
Eielson Air Force Base
Ekwok
Elfin Cove
Elim
Emmonak
Ester
Evansville
Eyak
Fairbanks
False Pass
Ferry
Fort Greely
Fort Yukon
Fox
Fox River
Freshwater Bay
Fritz Creek
Gakona
Galena
Gambell
Game Creek
Glennallen
Gold Creek
Golovin
Goodnews Bay
Grayling
Grouse Creek Group
Gulkana
Gustavus
Haines
Halibut Cove
Happy Valley
Harding Lake
Healy
Healy Lake
Hobart Bay
Hollis
Holy Cross
Homer
Hoonah
Hooper Bay
Hope
Houston
Hughes
Hurricane-Broad Pass
Huslia
Hydaburg
Hyder

Igiugig
Igloo
Iliamna
Indian Mountain
Ivanof Bay
Jakolof Bay
Juneau
Kachemak City
Kake
Kaktovik
Kalifonsky
Kaltag
Karluk
Kasaan
Kasigluk
Kasilof
Kenai
Kenny Lake
Ketchikan
Kiana
King Cove
King Salmon
Kipnuk
Kivalina
Klawock
Klukwan
Knik
Kobuk
Kodiak City
Kodiak Coast Guard Station
Kokhanok
Koliganek
Kongiganak
Kotlik
Kotzebue
Koyuk
Koyukuk
Kwethluk
Kwigillingok
LaBouchere Bay
Lake Creek
Lake Louise
Lake Minchumina
Larsen Bay
Lazy Mountain
Levelock
Lignite
Lime Village
Livengood
Long Island
Lower Kalskag
Lower Tonsina
Lutak
Manley Hot Springs
Manokotak
Marshall (Fortuna Ledge)
Matanuska Glacier
McCarthy
McCarthy Road
McGrath
McKinley Park Village
Meadow Lakes
Mekoryuk
Mendeltna
Mentasta
Mentasta Pass
Metlakatla
Meyers Chuck
Minto
Montana
Moose Creek
Moose Pass
Mosquito Lake
Mountain Village
Nabesna Road
Naknek
Nanwalek
Napakiak
Napaskiak
Naukati Bay
Nelson Lagoon
Nenana
New Stuyahok
Newhalen
Newtok
Nightmute
Nikiski
Nikolaevsk
Nikolai
Nikolski
Ninilchik
Noatak
Nome
Nondalton
Noorvik
North Pole
North Wrangell Mountains
Northway
Northway Junction
Northway Village
Nuiqsut
Nulato
Nunapitchuk
Old Harbor
Oscarville
Ouzinkie
Palmer
Parks Highway South
Paxson
Paxson-Sourdough
Pedro Bay
Pelican
Perkinsville
Perryville
Petersburg
Petersville Road
Pilot Point
Pilot Point/Ugashik
Pilot Station
Pitka's Point
Platinum
Pleasant Valley
Point Baker
Point Hope
Point Lay
Polk Inlet
Port Alexander
Port Alice
Port Alsworth
Port Clarence
Port Graham
Port Heiden
Port Lions
Port Protection
Portage Creek
Primrose
Prudhoe Bay
Quinhagak
Rampart
Red Devil
Ridgeway
Rowan Bay
Ruby
Russian Mission
Saint George
Saint John's Harbor
Saint Marys (Andreafsky)
Saint Michael
Saint Paul

Salamatof
Salcha
San Juan Bay
Sand Point
Savoonga
Saxman
Scammon Bay
Selawik
Seldovia
Seward
Shageluk
Shaktoolik
Sheep Mountain
Sheldon Point
Shemya Station
Shishmaref
Shungnak
Sitka
Skagway
Skwentna
Slana
Slana Homestead North
Slana Homestead South
Sleetmute
Soldotna
Solomon
Sourdough
South Naknek
South Wrangell Mountains
Sparrevohn Air Force Base
Stebbins
Sterling
Stevens Village
Stony River
Sutton
Takotna
Talkeetna
Tanacross
Tanana
Tatalina Station
Tatitlek
Tazlina
Telida
Teller
Tenakee Springs
Tetlin
Thorne Bay
Togiak
Tok
Toksook Bay
Tonsina
Trapper Creek
Tuluksak
Tuntutuliak
Tununak
Twin Hills
Two Rivers
Tyonek
Ugashik
Unalakleet
Unalaska
Upper Kalskag
Usibelli Mine
Valdez
Venetie
Wainwright
Wales
Wasilla
West Glenn Highway
Whale Pass
White Mountain
Whitestone Logging Camp
Whittier
Willow
Wiseman
Women's Bay
Wrangell
Yakutat

Appendix B: Pounds of Native Foods Harvested Per Capita By Community

(Source: Alaska Department of Fish & Game Subsistence Division)

Akhiok	322
Akutan	466
Alakanuk	725
Aleknagik	379
Allakaket/Alatna	906
Anderson	139
Angoon	242
Atka	439
Barrow	289
Beaver	732
Beecher Pass	532
Bettles/Evansville	260
Brevig Mission	579
Cantwell	112
Chase	209
Chenega Bay	275
Chickaloon	224
Chignik Bay	357
Chignik Lagoon	211
Chignik Lake	442
Chisana	128
Chistochina	262
Chitina	342
Clark's Point	363
Coffman Cove	186
Cooper Landing	92
Copper Center	174
Cordova	128
Craig	185
Deering	672
Dillingham	242
Dot Lake	116
East Glenn Highway	132
Edna Bay	517
Egegik	384
Ekwok	797
Elfin Cove	264
Emmonak	612
False Pass	413
Fort Yukon	999
Gakona	95
Galena	787
Glennallen	99
Gold Creek	174
Golovin	604
Gulkana	153
Gustavus	257
Haines	104
Healy	132
Hollis	164
Homer	94
Hoonah	388
Hope	111
Hughes	1492
Hurricane-Broad Pass	178
Huslia	1082
Hydaburg	337
Hyder	401
Igiugig	725
Iliamna	848
Ivanof Bay	490
Kake	159
Kaktovik	886
Karluk	269
Kasaan	186
Kenai	84
Kenny Lake	136
King Cove	256
King Salmon	220
Kivalina	761
Klawock	235
Klukwan	239
Kodiak City	151
Kodiak Coast Guard Station	115
Kodiak Road	168
Kokhanok	1013
Koliganek	830
Kotlik	503
Kotzebue	593
Kwethluk	836
Lake Louise	179
Larsen Bay	451
Levelock	884
Manokotak	384
McCarthy Road	230
McGrath	182
McKinley Park Village	242
Mentasta	125
Mentasta Pass	188

Metlakatla	71
Meyers Chuck	414
Minto	1015
Mountain Village	820
Nabesna Road	250
Naknek	188
Nanwalek	305
Nelson Lagoon	258
New Stuyahok	700
Newhalen	747
Nikolai	787
Nikolski	761
Ninilchik	86
Noatak	461
Nondalton	1175
Northway	278
Nuiqsut	742
Nunapitchuk	802
Old Harbor	391
Ouzinkie	218
Parks Highway South	58
Paxson	289
Pedro Bay	865
Pelican	355
Perryville	394
Petersburg	200
Petersville Road	167
Pilot Point	384
Point Baker	344
Point Lay	890
Port Alexander	306
Port Alsworth	361
Port Graham	212
Port Heiden	408
Port Lions	331
Port Protection	311
Quinhagak	768
Saint George	63
Saint Paul	267
San Juan Bay	250
Sand Point	256
Saxman	89
Seldovia	184
Sheldon Point	1393
Shishmaref	663
Sitka	146
Skagway	52
Slana	250
Slana Homestead North	174
Slana Homestead South	121
Sourdough	118
South Naknek	297
South Wrangell Mountains	139
Stebbins	997
Stevens Village	1139
Talkeetna	55
Tanacross	250
Tanana	2157
Tatitlek	270
Tazlina	107
Tenakee Springs	345
Tetlin	214
Thorne Bay	188
Tok	149
Tonsina	156
Trapper Creek	65
Tununak	1093
Tyonek	260
Ugashik	814
Unalaska	195
Valdez	79
Wainwright	751
Wales	744
West Glenn Highway	92
Whale Pass	186
Whittier	80
Wrangell	164
Yakutat	398

Appendix C: Species Harvested in Excess of 20 Pounds Per Capita by at least One Community

Arctic Char
Bearded Seal
Beaver
Beluga
Black Bear
Blackfish
Bowhead
Broad Whitefish
Brown Bear
Burbot
Caribou
Char
Chinook Salmon
Chum Salmon
Cisco
Clams
Cod
Coho Salmon
Deer
Dolly Varden
Dungeness Crab
Eulachon (hooligan, candlefish)
Halibut
Harbor Seal
Hare
Herring
Herring Roe
Humpback Whitefish
Humpback Whitefish [Other Gear]
Lake Trout
Moose
Pacific Tom Cod
Pike
Pink Salmon
Ringed Seal
Rockfish
Round Whitefish
Sheefish
Shrimp
Smelt
Sockeye Salmon
Spotted Seal
Steller Sea Lion
Trout
Walrus
Whitefish

Appendix D: Community-Species-Contaminant Observations

Community	Species	Contaminant
Barrow	Bearded Seal	Cs 137
Barrow	Bearded Seal	Sr 90
Barrow	Bowhead	Ag
Barrow	Bowhead	Al
Barrow	Bowhead	As
Barrow	Bowhead	Br
Barrow	Bowhead	Ca
Barrow	Bowhead	Cd
Barrow	Bowhead	Cl
Barrow	Bowhead	Co
Barrow	Bowhead	Cr
Barrow	Bowhead	Cs
Barrow	Bowhead	Cu
Barrow	Bowhead	Fe
Barrow	Bowhead	Hg
Barrow	Bowhead	K
Barrow	Bowhead	Mg
Barrow	Bowhead	Mn
Barrow	Bowhead	Na
Barrow	Bowhead	Ni
Barrow	Bowhead	Pb
Barrow	Bowhead	Rb
Barrow	Bowhead	Sb
Barrow	Bowhead	Se
Barrow	Bowhead	V
Barrow	Bowhead	Zn
Barrow	Bowhead Or Black Whale	Cs 137
Barrow	Bowhead Or Black Whale	Sr 90
Barrow	Bowhead Whale	S Pcb
Barrow	Bowhead Whale	Dieldrin
Barrow	Bowhead Whale	Hcb
Barrow	Bowhead Whale	Hch
Barrow	Bowhead Whale	Heptachlor Epoxide
Barrow	Bowhead Whale	S Ddt
Barrow	Bowhead Whale	T-Nonachlor
Barrow	King Eider	Cs 137
Barrow	King Eider	Sr 90
Barrow	Ringed Seal	Ag
Barrow	Ringed Seal	Al
Barrow	Ringed Seal	As
Barrow	Ringed Seal	Br
Barrow	Ringed Seal	Ca
Barrow	Ringed Seal	Cd
Barrow	Ringed Seal	Cl
Barrow	Ringed Seal	Co
Barrow	Ringed Seal	Cr
Barrow	Ringed Seal	Cs
Barrow	Ringed Seal	Cu
Barrow	Ringed Seal	Fe
Barrow	Ringed Seal	Hg
Barrow	Ringed Seal	K
Barrow	Ringed Seal	Mg
Barrow	Ringed Seal	Mn
Barrow	Ringed Seal	Na
Barrow	Ringed Seal	Ni
Barrow	Ringed Seal	Pb
Barrow	Ringed Seal	Rb
Barrow	Ringed Seal	Sb
Barrow	Ringed Seal	Se
Barrow	Ringed Seal	V
Barrow	Ringed Seal	Zn
Barrow	Ringed Seal	Cis-Chlord
Barrow	Ringed Seal	Dieldrin
Barrow	Ringed Seal	Hcb
Barrow	Ringed Seal	Heptachlor Epoxide
Barrow	Ringed Seal	Lindane (G-Hch)
Barrow	Ringed Seal	P,P'-Ddd
Barrow	Ringed Seal	P,P'-Dde
Barrow	Ringed Seal	P,P'-Ddt
Barrow	Ringed Seal	Spcb
Barrow	Ringed Seal	T-Nonachlor
Barrow	Walrus	Cs 137
Barrow	Walrus	Sr 90
Barrow	Whitefish	Cs 137
Barrow	Whitefish	Sr 90
Bering Sea	Chum Salmon	A-Hch
Bering Sea	Chum Salmon	B-Hch
Bering Sea	Chum Salmon	Cis-Chlordane
Bering Sea	Chum Salmon	Cis-Nonachlor
Bering Sea	Chum Salmon	G-Hch
Bering Sea	Chum Salmon	Oxychlordane
Bering Sea	Chum Salmon	P,P'-Ddd

Bering Sea	Chum Salmon	P,P'-Dde
Bering Sea	Chum Salmon	P,P'-Ddt
Bering Sea	Chum Salmon	Trans-Chlordane
Bering Sea	Chum Salmon	Trans-Nonachlor
Bering Sea	Dall'S Porpoise	A-Hch
Bering Sea	Dall'S Porpoise	B-Hch
Bering Sea	Dall'S Porpoise	Cis-Chlordane
Bering Sea	Dall'S Porpoise	Cis-Nonachlor
Bering Sea	Dall'S Porpoise	G-Hch
Bering Sea	Dall'S Porpoise	Oxychlordane
Bering Sea	Dall'S Porpoise	P,P'-Ddd
Bering Sea	Dall'S Porpoise	P,P'-Dde
Bering Sea	Dall'S Porpoise	P,P'-Ddt
Bering Sea	Dall'S Porpoise	Trans-Chlordane
Bering Sea	Dall'S Porpoise	Trans-Nonachlor
Bonanza Crk.	Northern Pike	Hg
Bonanza Crk.	Northern Pike	Se
Camp Crk.	Northern Pike	Hg
Camp Crk.	Northern Pike	Se
Cape Thompson	American Brant	Cs 137
Cape Thompson	American Brant	Sr 90
Cape Thompson	Arctic Loon	Cs 137
Cape Thompson	Arctic Loon	Sr 90
Cape Thompson	Black Brant	Cs 137
Cape Thompson	Black Brant	Sr 90
Cape Thompson	Bottom Crab	Cs 137
Cape Thompson	Bottom Crab	Sr 90
Cape Thompson	Caribou	Cs 137
Cape Thompson	Caribou	Sr 90
Cape Thompson	Chum Salmon	Cs 137
Cape Thompson	Chum Salmon	Sr 90
Cape Thompson	Glaucous Gull	Cs 137
Cape Thompson	Glaucous Gull	Sr 90
Cape Thompson	Heir Seal	Cs 137
Cape Thompson	Heir Seal	Sr 90
Cape Thompson	Horned Puffin	Cs 137
Cape Thompson	Horned Puffin	Sr 90
Cape Thompson	King Crab	Cs 137
Cape Thompson	King Crab	Sr 90
Cape Thompson	Marine Amphipod	Cs 137
Cape Thompson	Marine Amphipod	Sr 90
Cape Thompson	North Pacific (Common) Murre	Cs 137
Cape Thompson	North Pacific (Common) Murre	Sr 90
Cape Thompson	Northern Pelagic Cormorant	Cs 137
Cape Thompson	Northern Pelagic Cormorant	Sr 90
Cape Thompson	Pacific (Black-Legged) Kittiwake	Cs 137
Cape Thompson	Pacific (Black-Legged) Kittiwake	Sr 90
Cape Thompson	Pacific Herring	Cs 137
Cape Thompson	Pacific Herring	Sr 90
Cape Thompson	Porcupine	Cs 137
Cape Thompson	Porcupine	Sr 90
Cape Thompson	Red-Throated Loon	Cs 137
Cape Thompson	Red-Throated Loon	Sr 90
Cape Thompson	Thick-Billed Murre	Cs 137
Cape Thompson	Thick-Billed Murre	Sr 90
Cape Thompson	Whitefish	Cs 137
Cape Thompson	Whitefish	Sr 90
Chena	Burbot	A-Hcb
Chena	Burbot	Cis-Chlor
Chena	Burbot	Ddd
Chena	Burbot	Dde
Chena	Burbot	Ddt
Chena	Burbot	Pcb1254
Chena	Burbot	Pcb1260
Chena	Burbot	Toxaphene
Chena	Burbot	Trans-Nonachl
Chena	Longnose Sucker	A-Hcb
Chena	Longnose Sucker	Cis-Chlor
Chena	Longnose Sucker	Ddd
Chena	Longnose Sucker	Dde
Chena	Longnose Sucker	Ddt
Chena	Longnose Sucker	Pcb1254
Chena	Longnose Sucker	Pcb1260
Chena	Longnose Sucker	Toxaphene
Chena	Longnose Sucker	Trans-Nonachl
Chilkoot River Mouth	Flathead Sole	Ag
Chilkoot River Mouth	Flathead Sole	Aldrin

Chilkoot River Mouth	Flathead Sole	Alphachl
Chilkoot River Mouth	Flathead Sole	As
Chilkoot River Mouth	Flathead Sole	Cd
Chilkoot River Mouth	Flathead Sole	Cr
Chilkoot River Mouth	Flathead Sole	Cu
Chilkoot River Mouth	Flathead Sole	Di
Chilkoot River Mouth	Flathead Sole	Dieldrin
Chilkoot River Mouth	Flathead Sole	Fe
Chilkoot River Mouth	Flathead Sole	Hep
Chilkoot River Mouth	Flathead Sole	Heptachl
Chilkoot River Mouth	Flathead Sole	Heptaepo
Chilkoot River Mouth	Flathead Sole	Hex
Chilkoot River Mouth	Flathead Sole	Hexachl
Chilkoot River Mouth	Flathead Sole	Hg
Chilkoot River Mouth	Flathead Sole	Lindane
Chilkoot River Mouth	Flathead Sole	Mirex
Chilkoot River Mouth	Flathead Sole	Mn
Chilkoot River Mouth	Flathead Sole	Ni
Chilkoot River Mouth	Flathead Sole	Non
Chilkoot River Mouth	Flathead Sole	Oct
Chilkoot River Mouth	Flathead Sole	Opddd
Chilkoot River Mouth	Flathead Sole	Opdde
Chilkoot River Mouth	Flathead Sole	Opddt
Chilkoot River Mouth	Flathead Sole	Pb
Chilkoot River Mouth	Flathead Sole	Pcb101
Chilkoot River Mouth	Flathead Sole	Pcb105
Chilkoot River Mouth	Flathead Sole	Pcb11077
Chilkoot River Mouth	Flathead Sole	Pcb118
Chilkoot River Mouth	Flathead Sole	Pcb126
Chilkoot River Mouth	Flathead Sole	Pcb128
Chilkoot River Mouth	Flathead Sole	Pcb138
Chilkoot River Mouth	Flathead Sole	Pcb153
Chilkoot River Mouth	Flathead Sole	Pcb170
Chilkoot River Mouth	Flathead Sole	Pcb18
Chilkoot River Mouth	Flathead Sole	Pcb180
Chilkoot River Mouth	Flathead Sole	Pcb187
Chilkoot River Mouth	Flathead Sole	Pcb195
Chilkoot River Mouth	Flathead Sole	Pcb206
Chilkoot River Mouth	Flathead Sole	Pcb209
Chilkoot River Mouth	Flathead Sole	Pcb28
Chilkoot River Mouth	Flathead Sole	Pcb44
Chilkoot River Mouth	Flathead Sole	Pcb52
Chilkoot River Mouth	Flathead Sole	Pcb66
Chilkoot River Mouth	Flathead Sole	Pcb8
Chilkoot River Mouth	Flathead Sole	Pen
Chilkoot River Mouth	Flathead Sole	Ppddd
Chilkoot River Mouth	Flathead Sole	Ppdde
Chilkoot River Mouth	Flathead Sole	Ppddt
Chilkoot River Mouth	Flathead Sole	Se
Chilkoot River Mouth	Flathead Sole	Sn
Chilkoot River Mouth	Flathead Sole	Tet
Chilkoot River Mouth	Flathead Sole	Tnonchl
Chilkoot River Mouth	Flathead Sole	Tri
Chilkoot River Mouth	Flathead Sole	Zn
Colville R. Drainage	Red Fox	Cs 137
Colville R. Drainage	Red Fox	Sr 90
Cook Inlet	Beluga	Ag
Cook Inlet	Beluga	Al
Cook Inlet	Beluga	As
Cook Inlet	Beluga	Br
Cook Inlet	Beluga	Ca
Cook Inlet	Beluga	Cd
Cook Inlet	Beluga	Cl

Cook Inlet	Beluga	Co
Cook Inlet	Beluga	Cr
Cook Inlet	Beluga	Cs
Cook Inlet	Beluga	Cu
Cook Inlet	Beluga	Fe
Cook Inlet	Beluga	Hg
Cook Inlet	Beluga	K
Cook Inlet	Beluga	Mg
Cook Inlet	Beluga	Mn
Cook Inlet	Beluga	Na
Cook Inlet	Beluga	Ni
Cook Inlet	Beluga	Pb
Cook Inlet	Beluga	Rb
Cook Inlet	Beluga	Sb
Cook Inlet	Beluga	Se
Cook Inlet	Beluga	V
Cook Inlet	Beluga	Zn
Diomede	Pacific Walrus	Dieldrin
Diomede	Pacific Walrus	Oxychlordane
Dutch Harbor	Flathead Sole	Ag
Dutch Harbor	Flathead Sole	Aldrin
Dutch Harbor	Flathead Sole	Alphachl
Dutch Harbor	Flathead Sole	As
Dutch Harbor	Flathead Sole	Cd
Dutch Harbor	Flathead Sole	Cr
Dutch Harbor	Flathead Sole	Cu
Dutch Harbor	Flathead Sole	Di
Dutch Harbor	Flathead Sole	Dieldrin
Dutch Harbor	Flathead Sole	Fe
Dutch Harbor	Flathead Sole	Hep
Dutch Harbor	Flathead Sole	Heptachl
Dutch Harbor	Flathead Sole	Heptaepo
Dutch Harbor	Flathead Sole	Hex
Dutch Harbor	Flathead Sole	Hexachl
Dutch Harbor	Flathead Sole	Hg
Dutch Harbor	Flathead Sole	Lindane
Dutch Harbor	Flathead Sole	Mirex
Dutch Harbor	Flathead Sole	Mn
Dutch Harbor	Flathead Sole	Ni
Dutch Harbor	Flathead Sole	Non
Dutch Harbor	Flathead Sole	Oct
Dutch Harbor	Flathead Sole	Opddd
Dutch Harbor	Flathead Sole	Opdde
Dutch Harbor	Flathead Sole	Opddt
Dutch Harbor	Flathead Sole	Pb
Dutch Harbor	Flathead Sole	Pcb101
Dutch Harbor	Flathead Sole	Pcb105
Dutch Harbor	Flathead Sole	Pcb11077
Dutch Harbor	Flathead Sole	Pcb118
Dutch Harbor	Flathead Sole	Pcb126
Dutch Harbor	Flathead Sole	Pcb128
Dutch Harbor	Flathead Sole	Pcb138
Dutch Harbor	Flathead Sole	Pcb153
Dutch Harbor	Flathead Sole	Pcb170
Dutch Harbor	Flathead Sole	Pcb18
Dutch Harbor	Flathead Sole	Pcb180
Dutch Harbor	Flathead Sole	Pcb187
Dutch Harbor	Flathead Sole	Pcb195
Dutch Harbor	Flathead Sole	Pcb206
Dutch Harbor	Flathead Sole	Pcb209
Dutch Harbor	Flathead Sole	Pcb28
Dutch Harbor	Flathead Sole	Pcb44
Dutch Harbor	Flathead Sole	Pcb52
Dutch Harbor	Flathead Sole	Pcb66
Dutch Harbor	Flathead Sole	Pcb8
Dutch Harbor	Flathead Sole	Pen
Dutch Harbor	Flathead Sole	Ppddd
Dutch Harbor	Flathead Sole	Ppdde
Dutch Harbor	Flathead Sole	Ppddt
Dutch Harbor	Flathead Sole	Se
Dutch Harbor	Flathead Sole	Sn
Dutch Harbor	Flathead Sole	Tet
Dutch Harbor	Flathead Sole	Tnonchl
Dutch Harbor	Flathead Sole	Tri
Dutch Harbor	Flathead Sole	Zn
Fairbanks	Arctic Grayling	A-Hcb
Fairbanks	Arctic Grayling	Cis-Chlor
Fairbanks	Arctic Grayling	Ddd
Fairbanks	Arctic Grayling	Dde
Fairbanks	Arctic Grayling	Ddt
Fairbanks	Arctic Grayling	Pcb1254
Fairbanks	Arctic Grayling	Pcb1260
Fairbanks	Arctic Grayling	Toxaphene
Fairbanks	Arctic Grayling	Trans-Nonachl
Gambell	Pacific Walrus	Dieldrin
Gambell	Pacific Walrus	Oxychlordane
Kamishak Bay	Flathead Sole	Ag
Kamishak Bay	Flathead Sole	Aldrin
Kamishak Bay	Flathead Sole	Alphachl
Kamishak Bay	Flathead Sole	As

Kamishak Bay	Flathead Sole	Cd
Kamishak Bay	Flathead Sole	Cr
Kamishak Bay	Flathead Sole	Cu
Kamishak Bay	Flathead Sole	Di
Kamishak Bay	Flathead Sole	Dieldrin
Kamishak Bay	Flathead Sole	Fe
Kamishak Bay	Flathead Sole	Hep
Kamishak Bay	Flathead Sole	Heptachl
Kamishak Bay	Flathead Sole	Heptaepo
Kamishak Bay	Flathead Sole	Hex
Kamishak Bay	Flathead Sole	Hexachl
Kamishak Bay	Flathead Sole	Hg
Kamishak Bay	Flathead Sole	Lindane
Kamishak Bay	Flathead Sole	Mirex
Kamishak Bay	Flathead Sole	Mn
Kamishak Bay	Flathead Sole	Ni
Kamishak Bay	Flathead Sole	Non
Kamishak Bay	Flathead Sole	Oct
Kamishak Bay	Flathead Sole	Opddd
Kamishak Bay	Flathead Sole	Opdde
Kamishak Bay	Flathead Sole	Opddt
Kamishak Bay	Flathead Sole	Pb
Kamishak Bay	Flathead Sole	Pcb101
Kamishak Bay	Flathead Sole	Pcb105
Kamishak Bay	Flathead Sole	Pcb11077
Kamishak Bay	Flathead Sole	Pcb118
Kamishak Bay	Flathead Sole	Pcb126
Kamishak Bay	Flathead Sole	Pcb128
Kamishak Bay	Flathead Sole	Pcb138
Kamishak Bay	Flathead Sole	Pcb153
Kamishak Bay	Flathead Sole	Pcb170
Kamishak Bay	Flathead Sole	Pcb18
Kamishak Bay	Flathead Sole	Pcb180
Kamishak Bay	Flathead Sole	Pcb187
Kamishak Bay	Flathead Sole	Pcb195
Kamishak Bay	Flathead Sole	Pcb206
Kamishak Bay	Flathead Sole	Pcb209
Kamishak Bay	Flathead Sole	Pcb28
Kamishak Bay	Flathead Sole	Pcb44
Kamishak Bay	Flathead Sole	Pcb52
Kamishak Bay	Flathead Sole	Pcb66
Kamishak Bay	Flathead Sole	Pcb8
Kamishak Bay	Flathead Sole	Pen
Kamishak Bay	Flathead Sole	Ppddd
Kamishak Bay	Flathead Sole	Ppdde
Kamishak Bay	Flathead Sole	Ppddt
Kamishak Bay	Flathead Sole	Se
Kamishak Bay	Flathead Sole	Sn
Kamishak Bay	Flathead Sole	Tet
Kamishak Bay	Flathead Sole	Tnonchl
Kamishak Bay	Flathead Sole	Tri
Kamishak Bay	Flathead Sole	Zn
Kenai	Dolly Varden	A-Hcb
Kenai	Dolly Varden	Cis-Chlor
Kenai	Dolly Varden	Ddd
Kenai	Dolly Varden	Dde
Kenai	Dolly Varden	Ddt
Kenai	Dolly Varden	Pcb1254
Kenai	Dolly Varden	Pcb1260
Kenai	Dolly Varden	Toxaphene
Kenai	Dolly Varden	Trans-Nonachl
Kenai	Round Whitefish	A-Hcb
Kenai	Round Whitefish	Cis-Chlor
Kenai	Round Whitefish	Ddd
Kenai	Round Whitefish	Dde
Kenai	Round Whitefish	Ddt
Kenai	Round Whitefish	Pcb1254
Kenai	Round Whitefish	Pcb1260
Kenai	Round Whitefish	Toxaphene
Kenai	Round Whitefish	Trans-Nonachl
Kisimulowk Creek	Arctic Ground Squirrel	Cs 137
Kisimulowk Creek	Arctic Ground Squirrel	Sr 90
Kisimulowk Creek	Muskrat	Cs 137
Kisimulowk Creek	Muskrat	Sr 90
Kisimulowk Creek	Northern Raven	Cs 137
Kisimulowk Creek	Northern Raven	Sr 90
Kobuk River	Wolf	Cs 137
Kobuk River	Wolf	Sr 90
Noatak River	Chum Salmon	Cs 137
Noatak River	Chum Salmon	Sr 90
Noatak River	Dolly Varden	Cs 137
Noatak River	Dolly Varden	Sr 90
Noatak River	Grayling	Cs 137
Noatak River	Grayling	Sr 90
Noatiak River	Dolly Varden	Cs 137
Noatiak River	Dolly Varden	Sr 90
Nome	Bearded Seal	Ag
Nome	Bearded Seal	Al
Nome	Bearded Seal	As

Nome	Bearded Seal	Br
Nome	Bearded Seal	Ca
Nome	Bearded Seal	Cd
Nome	Bearded Seal	Cl
Nome	Bearded Seal	Co
Nome	Bearded Seal	Cr
Nome	Bearded Seal	Cs
Nome	Bearded Seal	Cu
Nome	Bearded Seal	Fe
Nome	Bearded Seal	Hg
Nome	Bearded Seal	K
Nome	Bearded Seal	Mg
Nome	Bearded Seal	Mn
Nome	Bearded Seal	Na
Nome	Bearded Seal	Ni
Nome	Bearded Seal	Pb
Nome	Bearded Seal	Rb
Nome	Bearded Seal	Sb
Nome	Bearded Seal	Se
Nome	Bearded Seal	V
Nome	Bearded Seal	Zn
Nome	Pacific Walrus	Dieldrin
Nome	Pacific Walrus	Oxychlordane
Nome	Ringed Seal	Ag
Nome	Ringed Seal	Al
Nome	Ringed Seal	As
Nome	Ringed Seal	Br
Nome	Ringed Seal	Ca
Nome	Ringed Seal	Cd
Nome	Ringed Seal	Cl
Nome	Ringed Seal	Co
Nome	Ringed Seal	Cr
Nome	Ringed Seal	Cs
Nome	Ringed Seal	Cu
Nome	Ringed Seal	Fe
Nome	Ringed Seal	Hg
Nome	Ringed Seal	K
Nome	Ringed Seal	Mg
Nome	Ringed Seal	Mn
Nome	Ringed Seal	Na
Nome	Ringed Seal	Ni
Nome	Ringed Seal	Pb
Nome	Ringed Seal	Rb
Nome	Ringed Seal	Sb
Nome	Ringed Seal	Se
Nome	Ringed Seal	V
Nome	Ringed Seal	Zn
Nome	Ringed Seal	Cis-Chlord
Nome	Ringed Seal	Dieldrin
Nome	Ringed Seal	Hcb
Nome	Ringed Seal	Heptachlor Epoxide
Nome	Ringed Seal	Lindane (G-Hch)
Nome	Ringed Seal	P,P'-Ddd
Nome	Ringed Seal	P,P'-Dde
Nome	Ringed Seal	P,P'-Ddt
Nome	Ringed Seal	Spcb
Nome	Ringed Seal	T-Nonachlor
Nome	Spotted Seal	Ag
Nome	Spotted Seal	Al
Nome	Spotted Seal	As
Nome	Spotted Seal	Br
Nome	Spotted Seal	Ca
Nome	Spotted Seal	Cd
Nome	Spotted Seal	Cl
Nome	Spotted Seal	Co
Nome	Spotted Seal	Cr
Nome	Spotted Seal	Cs
Nome	Spotted Seal	Cu
Nome	Spotted Seal	Fe
Nome	Spotted Seal	Hg
Nome	Spotted Seal	K
Nome	Spotted Seal	Mg
Nome	Spotted Seal	Mn
Nome	Spotted Seal	Na
Nome	Spotted Seal	Ni
Nome	Spotted Seal	Pb
Nome	Spotted Seal	Rb
Nome	Spotted Seal	Sb
Nome	Spotted Seal	Se
Nome	Spotted Seal	V
Nome	Spotted Seal	Zn
North/American Crks.		Hg
North/American Crks.		Se
Ogotoruk Creek	Alaska Longspur	Cs 137
Ogotoruk Creek	Alaska Longspur	Sr 90
Ogotoruk Creek	Arctic Ground Squirrel	Cs 137
Ogotoruk Creek	Arctic Ground Squirrel	Sr 90
Ogotoruk Creek	Bottom Crab	Sr 90
Ogotoruk Creek	Dolly Varden	Cs 137

Ogotoruk Creek	Dolly Varden	Sr 90
Ogotoruk Creek	Ermine	Cs 137
Ogotoruk Creek	Ermine	Sr 90
Ogotoruk Creek	Gray Whale	Cs 137
Ogotoruk Creek	Gray Whale	Sr 90
Ogotoruk Creek	Grizzly Bear	Cs 137
Ogotoruk Creek	Grizzly Bear	Sr 90
Ogotoruk Creek	Horned Puffin	Cs 137
Ogotoruk Creek	Horned Puffin	Sr 90
Ogotoruk Creek	Midges	Cs 137
Ogotoruk Creek	Midges	Sr 90
Ogotoruk Creek	Net Plankton	Cs 137
Ogotoruk Creek	Net Plankton	Sr 90
Ogotoruk Creek	Net Zooplankton	Cs 137
Ogotoruk Creek	Net Zooplankton	Sr 90
Ogotoruk Creek	North Pacific (Common) Murre	Cs 137
Ogotoruk Creek	North Pacific (Common) Murre	Sr 90
Ogotoruk Creek	Old Squaw Duck	Cs 137
Ogotoruk Creek	Old Squaw Duck	Sr 90
Ogotoruk Creek	Pintail Duck	Cs 137
Ogotoruk Creek	Pintail Duck	Sr 90
Ogotoruk Creek	Red-Throated Loon	Cs 137
Ogotoruk Creek	Red-Throated Loon	Sr 90
Ogotoruk Creek	Tundra Vole	Cs 137
Ogotoruk Creek	Tundra Vole	Sr 90
Ogotoruk Creek	Wheatear	Cs 137
Ogotoruk Creek	Wheatear	Sr 90
Ogotoruk Creek	Willow Ptarmigan	Cs 137
Ogotoruk Creek	Willow Ptarmigan	Sr 90
Ogotoruk Creek	Wolverine	Cs 137
Ogotoruk Creek	Wolverine	Sr 90
Ogotoruk Creek	Yellow Wagtail	Cs 137
Ogotoruk Creek	Yellow Wagtail	Sr 90
Oliktok Point	Fourhorn Sculpin	Ag
Oliktok Point	Fourhorn Sculpin	Aldrin
Oliktok Point	Fourhorn Sculpin	Alphachl
Oliktok Point	Fourhorn Sculpin	As
Oliktok Point	Fourhorn Sculpin	Cd
Oliktok Point	Fourhorn Sculpin	Cr
Oliktok Point	Fourhorn Sculpin	Cu
Oliktok Point	Fourhorn Sculpin	Di
Oliktok Point	Fourhorn Sculpin	Dieldrin
Oliktok Point	Fourhorn Sculpin	Fe
Oliktok Point	Fourhorn Sculpin	Hep
Oliktok Point	Fourhorn Sculpin	Heptachl
Oliktok Point	Fourhorn Sculpin	Heptaepo
Oliktok Point	Fourhorn Sculpin	Hex
Oliktok Point	Fourhorn Sculpin	Hexachl
Oliktok Point	Fourhorn Sculpin	Hg
Oliktok Point	Fourhorn Sculpin	Lindane
Oliktok Point	Fourhorn Sculpin	Mirex
Oliktok Point	Fourhorn Sculpin	Mn
Oliktok Point	Fourhorn Sculpin	Ni
Oliktok Point	Fourhorn Sculpin	Non
Oliktok Point	Fourhorn Sculpin	Oct
Oliktok Point	Fourhorn Sculpin	Opddd
Oliktok Point	Fourhorn Sculpin	Opdde
Oliktok Point	Fourhorn Sculpin	Opddt
Oliktok Point	Fourhorn Sculpin	Pb
Oliktok Point	Fourhorn Sculpin	Pcb101
Oliktok Point	Fourhorn Sculpin	Pcb105
Oliktok Point	Fourhorn Sculpin	Pcb11077
Oliktok Point	Fourhorn Sculpin	Pcb118
Oliktok Point	Fourhorn Sculpin	Pcb126
Oliktok Point	Fourhorn Sculpin	Pcb128
Oliktok Point	Fourhorn Sculpin	Pcb138
Oliktok Point	Fourhorn Sculpin	Pcb153
Oliktok Point	Fourhorn Sculpin	Pcb170
Oliktok Point	Fourhorn Sculpin	Pcb18
Oliktok Point	Fourhorn Sculpin	Pcb180
Oliktok Point	Fourhorn Sculpin	Pcb187
Oliktok Point	Fourhorn Sculpin	Pcb195
Oliktok Point	Fourhorn Sculpin	Pcb206
Oliktok Point	Fourhorn Sculpin	Pcb209
Oliktok Point	Fourhorn Sculpin	Pcb28
Oliktok Point	Fourhorn Sculpin	Pcb44
Oliktok Point	Fourhorn Sculpin	Pcb52
Oliktok Point	Fourhorn Sculpin	Pcb66
Oliktok Point	Fourhorn Sculpin	Pcb8
Oliktok Point	Fourhorn Sculpin	Pen
Oliktok Point	Fourhorn Sculpin	Ppddd
Oliktok Point	Fourhorn Sculpin	Ppdde
Oliktok Point	Fourhorn Sculpin	Ppddt
Oliktok Point	Fourhorn Sculpin	Se
Oliktok Point	Fourhorn Sculpin	Sn
Oliktok Point	Fourhorn Sculpin	Tet
Oliktok Point	Fourhorn Sculpin	Tnonchl
Oliktok Point	Fourhorn Sculpin	Tri

Oliktok Point	Fourhorn Sculpin	Zn
Point Hope	Bearded Seal	Cs 137
Point Hope	Bearded Seal	Sr 90
Point Hope	Beluga	1234Tcb
Point Hope	Beluga	1245Tcb
Point Hope	Beluga	2,4'-Ddd
Point Hope	Beluga	2,4'-Dde
Point Hope	Beluga	2,4'-Ddt
Point Hope	Beluga	4,4'-Ddd
Point Hope	Beluga	4,4'-Dde
Point Hope	Beluga	4,4'-Ddt
Point Hope	Beluga	A-Hch
Point Hope	Beluga	Ag
Point Hope	Beluga	Al
Point Hope	Beluga	As
Point Hope	Beluga	Br
Point Hope	Beluga	C
Point Hope	Beluga	C1A
Point Hope	Beluga	C2/U-5
Point Hope	Beluga	C3
Point Hope	Beluga	C5
Point Hope	Beluga	Ca
Point Hope	Beluga	Cd
Point Hope	Beluga	Cis-Chlordane
Point Hope	Beluga	Cis-Nonachlor
Point Hope	Beluga	Cl
Point Hope	Beluga	Co
Point Hope	Beluga	Cr
Point Hope	Beluga	Cs
Point Hope	Beluga	Cu
Point Hope	Beluga	Dieldrin
Point Hope	Beluga	Fe
Point Hope	Beluga	G-Hch
Point Hope	Beluga	Hcbz
Point Hope	Beluga	Heptachlor
Point Hope	Beluga	Heptachlor-Epoxide
Point Hope	Beluga	Hg
Point Hope	Beluga	K
Point Hope	Beluga	Mg
Point Hope	Beluga	Mirex
Point Hope	Beluga	Mn
Point Hope	Beluga	Na
Point Hope	Beluga	Ni
Point Hope	Beluga	Ocstyr
Point Hope	Beluga	Oxychlorodane
Point Hope	Beluga	P5Cbz
Point Hope	Beluga	Pb
Point Hope	Beluga	Pcb1
Point Hope	Beluga	Pcb101
Point Hope	Beluga	Pcb105
Point Hope	Beluga	Pcb110
Point Hope	Beluga	Pcb114
Point Hope	Beluga	Pcb118
Point Hope	Beluga	Pcb128A
Point Hope	Beluga	Pcb130/176
Point Hope	Beluga	Pcb131
Point Hope	Beluga	Pcb132
Point Hope	Beluga	Pcb134
Point Hope	Beluga	Pcb136
Point Hope	Beluga	Pcb137
Point Hope	Beluga	Pcb138
Point Hope	Beluga	Pcb141
Point Hope	Beluga	Pcb144/135
Point Hope	Beluga	Pcb146
Point Hope	Beluga	Pcb149
Point Hope	Beluga	Pcb151
Point Hope	Beluga	Pcb153
Point Hope	Beluga	Pcb156
Point Hope	Beluga	Pcb158
Point Hope	Beluga	Pcb16/32
Point Hope	Beluga	Pcb17
Point Hope	Beluga	Pcb170
Point Hope	Beluga	Pcb171
Point Hope	Beluga	Pcb172/197
Point Hope	Beluga	Pcb174
Point Hope	Beluga	Pcb175
Point Hope	Beluga	Pcb177
Point Hope	Beluga	Pcb178/129
Point Hope	Beluga	Pcb179
Point Hope	Beluga	Pcb18
Point Hope	Beluga	Pcb180
Point Hope	Beluga	Pcb183
Point Hope	Beluga	Pcb185
Point Hope	Beluga	Pcb187
Point Hope	Beluga	Pcb189
Point Hope	Beluga	Pcb19
Point Hope	Beluga	Pcb191
Point Hope	Beluga	Pcb193
Point Hope	Beluga	Pcb194
Point Hope	Beluga	Pcb195

Point Hope	Beluga	Pcb196/203
Point Hope	Beluga	Pcb198
Point Hope	Beluga	Pcb199
Point Hope	Beluga	Pcb200
Point Hope	Beluga	Pcb201/157
Point Hope	Beluga	Pcb205
Point Hope	Beluga	Pcb206
Point Hope	Beluga	Pcb207
Point Hope	Beluga	Pcb209
Point Hope	Beluga	Pcb22
Point Hope	Beluga	Pcb24/27
Point Hope	Beluga	Pcb25
Point Hope	Beluga	Pcb26
Point Hope	Beluga	Pcb28
Point Hope	Beluga	Pcb31
Point Hope	Beluga	Pcb33
Point Hope	Beluga	Pcb4/10
Point Hope	Beluga	Pcb40
Point Hope	Beluga	Pcb41/71
Point Hope	Beluga	Pcb42
Point Hope	Beluga	Pcb44
Point Hope	Beluga	Pcb45
Point Hope	Beluga	Pcb46
Point Hope	Beluga	Pcb48
Point Hope	Beluga	Pcb49
Point Hope	Beluga	Pcb52
Point Hope	Beluga	Pcb56/60
Point Hope	Beluga	Pcb6
Point Hope	Beluga	Pcb64
Point Hope	Beluga	Pcb7
Point Hope	Beluga	Pcb70/78
Point Hope	Beluga	Pcb74
Point Hope	Beluga	Pcb8/5
Point Hope	Beluga	Pcb83
Point Hope	Beluga	Pcb84/89
Point Hope	Beluga	Pcb85
Point Hope	Beluga	Pcb87
Point Hope	Beluga	Pcb91
Point Hope	Beluga	Pcb95/66
Point Hope	Beluga	Pcb97
Point Hope	Beluga	Pcb99
Point Hope	Beluga	Rb
Point Hope	Beluga	S-Cbz
Point Hope	Beluga	S-Chlor
Point Hope	Beluga	S-Ddt
Point Hope	Beluga	S-Deca
Point Hope	Beluga	S-Hch
Point Hope	Beluga	S-Hepta
Point Hope	Beluga	S-Hexa
Point Hope	Beluga	S-Mon/Di
Point Hope	Beluga	S-Nona
Point Hope	Beluga	S-Octo
Point Hope	Beluga	S-Pcb
Point Hope	Beluga	S-Penta
Point Hope	Beluga	S-Tetra
Point Hope	Beluga	S-Tox
Point Hope	Beluga	S-Toxsrf
Point Hope	Beluga	S-Tri
Point Hope	Beluga	Sb
Point Hope	Beluga	Se
Point Hope	Beluga	ß-Hch
Point Hope	Beluga	T.Srf-1
Point Hope	Beluga	T.Srf-2
Point Hope	Beluga	Trans-Chlordane
Point Hope	Beluga	Trans-Nonachlor
Point Hope	Beluga	U1
Point Hope	Beluga	U3
Point Hope	Beluga	V
Point Hope	Beluga	Zn
Point Hope	Beluga	Dieldrin
Point Hope	Beluga Whale	S Pcb
Point Hope	Beluga Whale	Cis-Chlord
Point Hope	Beluga Whale	Dieldrin
Point Hope	Beluga Whale	Hcb
Point Hope	Beluga Whale	Hch
Point Hope	Beluga Whale	Heptachlor Epoxide
Point Hope	Beluga Whale	Lindane (G-Hch)
Point Hope	Beluga Whale	Mirex
Point Hope	Beluga Whale	P,P'-Ddd
Point Hope	Beluga Whale	P,P'-Dde
Point Hope	Beluga Whale	P,P'-Ddt
Point Hope	Beluga Whale	S Cbz
Point Hope	Beluga Whale	S Chlordane
Point Hope	Beluga Whale	S Ddt
Point Hope	Beluga Whale	S Toxaphene
Point Hope	Beluga Whale	Spcb
Point Hope	Beluga Whale	T-Nonachlor
Point Hope	Bowhead Whale	Cs 137
Point Hope	Bowhead Whale	Sr 90
Point Hope	Ringed Seal	Cs 137

Point Hope	Ringed Seal	Sr 90	Point Lay	Beluga	Pcb1
Point Lay	Beluga	1234Tcb	Point Lay	Beluga	Pcb101
Point Lay	Beluga	1245Tcb	Point Lay	Beluga	Pcb105
Point Lay	Beluga	2,4'-Ddd	Point Lay	Beluga	Pcb110
Point Lay	Beluga	2,4'-Dde	Point Lay	Beluga	Pcb114
Point Lay	Beluga	2,4'-Ddt	Point Lay	Beluga	Pcb118
Point Lay	Beluga	4,4'-Ddd	Point Lay	Beluga	Pcb128A
Point Lay	Beluga	4,4'-Dde	Point Lay	Beluga	Pcb130/176
Point Lay	Beluga	4,4'-Ddt	Point Lay	Beluga	Pcb131
Point Lay	Beluga	A-Hch	Point Lay	Beluga	Pcb132
Point Lay	Beluga	Ag	Point Lay	Beluga	Pcb134
Point Lay	Beluga	Al	Point Lay	Beluga	Pcb136
Point Lay	Beluga	As	Point Lay	Beluga	Pcb137
Point Lay	Beluga	Br	Point Lay	Beluga	Pcb138
Point Lay	Beluga	C	Point Lay	Beluga	Pcb141
Point Lay	Beluga	C1A	Point Lay	Beluga	Pcb144/135
Point Lay	Beluga	C2/U-5	Point Lay	Beluga	Pcb146
Point Lay	Beluga	C3	Point Lay	Beluga	Pcb149
Point Lay	Beluga	C5	Point Lay	Beluga	Pcb151
Point Lay	Beluga	Ca	Point Lay	Beluga	Pcb153
Point Lay	Beluga	Cd	Point Lay	Beluga	Pcb156
Point Lay	Beluga	Cis-Chlordane	Point Lay	Beluga	Pcb158
Point Lay	Beluga	Cis-Nonachlor	Point Lay	Beluga	Pcb16/32
Point Lay	Beluga	Cl	Point Lay	Beluga	Pcb17
Point Lay	Beluga	Co	Point Lay	Beluga	Pcb170
Point Lay	Beluga	Cr	Point Lay	Beluga	Pcb171
Point Lay	Beluga	Cs	Point Lay	Beluga	Pcb172/197
Point Lay	Beluga	Cu	Point Lay	Beluga	Pcb174
Point Lay	Beluga	Dieldrin	Point Lay	Beluga	Pcb175
Point Lay	Beluga	Fe	Point Lay	Beluga	Pcb177
Point Lay	Beluga	G-Hch	Point Lay	Beluga	Pcb178/129
Point Lay	Beluga	Hcbz	Point Lay	Beluga	Pcb179
Point Lay	Beluga	Heptachlor	Point Lay	Beluga	Pcb18
Point Lay	Beluga	Heptachlor-Epoxide	Point Lay	Beluga	Pcb180
Point Lay	Beluga	Hg	Point Lay	Beluga	Pcb183
Point Lay	Beluga	K	Point Lay	Beluga	Pcb185
Point Lay	Beluga	Mg	Point Lay	Beluga	Pcb187
Point Lay	Beluga	Mirex	Point Lay	Beluga	Pcb189
Point Lay	Beluga	Mn	Point Lay	Beluga	Pcb19
Point Lay	Beluga	Na	Point Lay	Beluga	Pcb191
Point Lay	Beluga	Ni	Point Lay	Beluga	Pcb193
Point Lay	Beluga	Ocstyr	Point Lay	Beluga	Pcb194
Point Lay	Beluga	Oxychlorodane	Point Lay	Beluga	Pcb195
Point Lay	Beluga	P5Cbz	Point Lay	Beluga	Pcb196/203
Point Lay	Beluga	Pb	Point Lay	Beluga	Pcb198

Point Lay	Beluga	Pcb199
Point Lay	Beluga	Pcb200
Point Lay	Beluga	Pcb201/157
Point Lay	Beluga	Pcb205
Point Lay	Beluga	Pcb206
Point Lay	Beluga	Pcb207
Point Lay	Beluga	Pcb209
Point Lay	Beluga	Pcb22
Point Lay	Beluga	Pcb24/27
Point Lay	Beluga	Pcb25
Point Lay	Beluga	Pcb26
Point Lay	Beluga	Pcb28
Point Lay	Beluga	Pcb31
Point Lay	Beluga	Pcb33
Point Lay	Beluga	Pcb4/10
Point Lay	Beluga	Pcb40
Point Lay	Beluga	Pcb41/71
Point Lay	Beluga	Pcb42
Point Lay	Beluga	Pcb44
Point Lay	Beluga	Pcb45
Point Lay	Beluga	Pcb46
Point Lay	Beluga	Pcb48
Point Lay	Beluga	Pcb49
Point Lay	Beluga	Pcb52
Point Lay	Beluga	Pcb56/60
Point Lay	Beluga	Pcb6
Point Lay	Beluga	Pcb64
Point Lay	Beluga	Pcb7
Point Lay	Beluga	Pcb70/78
Point Lay	Beluga	Pcb74
Point Lay	Beluga	Pcb8/5
Point Lay	Beluga	Pcb83
Point Lay	Beluga	Pcb84/89
Point Lay	Beluga	Pcb85
Point Lay	Beluga	Pcb87
Point Lay	Beluga	Pcb91
Point Lay	Beluga	Pcb95/66
Point Lay	Beluga	Pcb97
Point Lay	Beluga	Pcb99
Point Lay	Beluga	Rb
Point Lay	Beluga	S-Cbz
Point Lay	Beluga	S-Chlor
Point Lay	Beluga	S-Ddt
Point Lay	Beluga	S-Deca
Point Lay	Beluga	S-Hch
Point Lay	Beluga	S-Hepta
Point Lay	Beluga	S-Hexa
Point Lay	Beluga	S-Mon/Di
Point Lay	Beluga	S-Nona
Point Lay	Beluga	S-Octo
Point Lay	Beluga	S-Pcb
Point Lay	Beluga	S-Penta
Point Lay	Beluga	S-Tetra
Point Lay	Beluga	S-Tox
Point Lay	Beluga	S-Toxsrf
Point Lay	Beluga	S-Tri
Point Lay	Beluga	Sb
Point Lay	Beluga	Se
Point Lay	Beluga	ß-Hch
Point Lay	Beluga	T.Srf-1
Point Lay	Beluga	T.Srf-2
Point Lay	Beluga	Trans-Chlordane
Point Lay	Beluga	Trans-Nonachlor
Point Lay	Beluga	U1
Point Lay	Beluga	U3
Point Lay	Beluga	V
Point Lay	Beluga	Zn
Point Lay	Beluga Whale	S Pcb
Point Lay	Beluga Whale	Cis-Chlord
Point Lay	Beluga Whale	Dieldrin
Point Lay	Beluga Whale	Hcb
Point Lay	Beluga Whale	Hch
Point Lay	Beluga Whale	Heptachlor Epoxide
Point Lay	Beluga Whale	Lindane (G-Hch)
Point Lay	Beluga Whale	P,P'-Ddd
Point Lay	Beluga Whale	P,P'-Dde
Point Lay	Beluga Whale	P,P'-Ddt
Point Lay	Beluga Whale	S Ddt
Point Lay	Beluga Whale	Spcb
Point Lay	Beluga Whale	T-Nonachlor
Port Moller	Flathead Sole	Ag
Port Moller	Flathead Sole	Aldrin
Port Moller	Flathead Sole	Alphachl
Port Moller	Flathead Sole	As
Port Moller	Flathead Sole	Cd
Port Moller	Flathead Sole	Cr
Port Moller	Flathead Sole	Cu
Port Moller	Flathead Sole	Di
Port Moller	Flathead Sole	Dieldrin
Port Moller	Flathead Sole	Fe

Port Moller	Flathead Sole	Hep	Port Moller	Flathead Sole	Zn
Port Moller	Flathead Sole	Heptachl	Port Valdez	Flathead Sole	Ag
Port Moller	Flathead Sole	Heptaepo	Port Valdez	Flathead Sole	Aldrin
Port Moller	Flathead Sole	Hex	Port Valdez	Flathead Sole	Alphachl
Port Moller	Flathead Sole	Hexachl	Port Valdez	Flathead Sole	As
Port Moller	Flathead Sole	Hg	Port Valdez	Flathead Sole	Cd
Port Moller	Flathead Sole	Lindane	Port Valdez	Flathead Sole	Cr
Port Moller	Flathead Sole	Mirex	Port Valdez	Flathead Sole	Cu
Port Moller	Flathead Sole	Mn	Port Valdez	Flathead Sole	Di
Port Moller	Flathead Sole	Ni	Port Valdez	Flathead Sole	Dieldrin
Port Moller	Flathead Sole	Non	Port Valdez	Flathead Sole	Fe
Port Moller	Flathead Sole	Oct	Port Valdez	Flathead Sole	Hep
Port Moller	Flathead Sole	Opddd	Port Valdez	Flathead Sole	Heptachl
Port Moller	Flathead Sole	Opdde	Port Valdez	Flathead Sole	Heptaepo
Port Moller	Flathead Sole	Opddt	Port Valdez	Flathead Sole	Hex
Port Moller	Flathead Sole	Pb	Port Valdez	Flathead Sole	Hexachl
Port Moller	Flathead Sole	Pcb101	Port Valdez	Flathead Sole	Hg
Port Moller	Flathead Sole	Pcb105	Port Valdez	Flathead Sole	Lindane
Port Moller	Flathead Sole	Pcb11077	Port Valdez	Flathead Sole	Mirex
Port Moller	Flathead Sole	Pcb118	Port Valdez	Flathead Sole	Mn
Port Moller	Flathead Sole	Pcb126	Port Valdez	Flathead Sole	Ni
Port Moller	Flathead Sole	Pcb128	Port Valdez	Flathead Sole	Non
Port Moller	Flathead Sole	Pcb138	Port Valdez	Flathead Sole	Oct
Port Moller	Flathead Sole	Pcb153	Port Valdez	Flathead Sole	Opddd
Port Moller	Flathead Sole	Pcb170	Port Valdez	Flathead Sole	Opdde
Port Moller	Flathead Sole	Pcb18	Port Valdez	Flathead Sole	Opddt
Port Moller	Flathead Sole	Pcb180	Port Valdez	Flathead Sole	Pb
Port Moller	Flathead Sole	Pcb187	Port Valdez	Flathead Sole	Pcb101
Port Moller	Flathead Sole	Pcb195	Port Valdez	Flathead Sole	Pcb105
Port Moller	Flathead Sole	Pcb206	Port Valdez	Flathead Sole	Pcb11077
Port Moller	Flathead Sole	Pcb209	Port Valdez	Flathead Sole	Pcb118
Port Moller	Flathead Sole	Pcb28	Port Valdez	Flathead Sole	Pcb126
Port Moller	Flathead Sole	Pcb44	Port Valdez	Flathead Sole	Pcb128
Port Moller	Flathead Sole	Pcb52	Port Valdez	Flathead Sole	Pcb138
Port Moller	Flathead Sole	Pcb66	Port Valdez	Flathead Sole	Pcb153
Port Moller	Flathead Sole	Pcb8	Port Valdez	Flathead Sole	Pcb170
Port Moller	Flathead Sole	Pen	Port Valdez	Flathead Sole	Pcb18
Port Moller	Flathead Sole	Ppddd	Port Valdez	Flathead Sole	Pcb180
Port Moller	Flathead Sole	Ppdde	Port Valdez	Flathead Sole	Pcb187
Port Moller	Flathead Sole	Ppddt	Port Valdez	Flathead Sole	Pcb195
Port Moller	Flathead Sole	Se	Port Valdez	Flathead Sole	Pcb206
Port Moller	Flathead Sole	Sn	Port Valdez	Flathead Sole	Pcb209
Port Moller	Flathead Sole	Tet	Port Valdez	Flathead Sole	Pcb28
Port Moller	Flathead Sole	Tnonchl	Port Valdez	Flathead Sole	Pcb44
Port Moller	Flathead Sole	Tri	Port Valdez	Flathead Sole	Pcb52

Port Valdez	Flathead Sole	Pcb66	Prudhoe Bay	Fourhorn Sculpin	Pcb153
Port Valdez	Flathead Sole	Pcb8	Prudhoe Bay	Fourhorn Sculpin	Pcb170
Port Valdez	Flathead Sole	Pen	Prudhoe Bay	Fourhorn Sculpin	Pcb18
Port Valdez	Flathead Sole	Ppddd	Prudhoe Bay	Fourhorn Sculpin	Pcb180
Port Valdez	Flathead Sole	Ppdde	Prudhoe Bay	Fourhorn Sculpin	Pcb187
Port Valdez	Flathead Sole	Ppddt	Prudhoe Bay	Fourhorn Sculpin	Pcb195
Port Valdez	Flathead Sole	Se	Prudhoe Bay	Fourhorn Sculpin	Pcb206
Port Valdez	Flathead Sole	Sn	Prudhoe Bay	Fourhorn Sculpin	Pcb209
Port Valdez	Flathead Sole	Tet	Prudhoe Bay	Fourhorn Sculpin	Pcb28
Port Valdez	Flathead Sole	Tnonchl	Prudhoe Bay	Fourhorn Sculpin	Pcb44
Port Valdez	Flathead Sole	Tri	Prudhoe Bay	Fourhorn Sculpin	Pcb52
Port Valdez	Flathead Sole	Zn	Prudhoe Bay	Fourhorn Sculpin	Pcb66
Prudhoe Bay	Fourhorn Sculpin	Ag	Prudhoe Bay	Fourhorn Sculpin	Pcb8
Prudhoe Bay	Fourhorn Sculpin	Aldrin	Prudhoe Bay	Fourhorn Sculpin	Pen
Prudhoe Bay	Fourhorn Sculpin	Alphachl	Prudhoe Bay	Fourhorn Sculpin	Ppddd
Prudhoe Bay	Fourhorn Sculpin	As	Prudhoe Bay	Fourhorn Sculpin	Ppdde
Prudhoe Bay	Fourhorn Sculpin	Cd	Prudhoe Bay	Fourhorn Sculpin	Ppddt
Prudhoe Bay	Fourhorn Sculpin	Cr	Prudhoe Bay	Fourhorn Sculpin	Se
Prudhoe Bay	Fourhorn Sculpin	Cu	Prudhoe Bay	Fourhorn Sculpin	Sn
Prudhoe Bay	Fourhorn Sculpin	Di	Prudhoe Bay	Fourhorn Sculpin	Tet
Prudhoe Bay	Fourhorn Sculpin	Dieldrin	Prudhoe Bay	Fourhorn Sculpin	Tnonchl
Prudhoe Bay	Fourhorn Sculpin	Fe	Prudhoe Bay	Fourhorn Sculpin	Tri
Prudhoe Bay	Fourhorn Sculpin	Hep	Prudhoe Bay	Fourhorn Sculpin	Zn
Prudhoe Bay	Fourhorn Sculpin	Heptachl	Red Dog Mine	Starry Flounder	Aldrin
Prudhoe Bay	Fourhorn Sculpin	Heptaepo	Red Dog Mine	Starry Flounder	Alphachl
Prudhoe Bay	Fourhorn Sculpin	Hex	Red Dog Mine	Starry Flounder	Di
Prudhoe Bay	Fourhorn Sculpin	Hexachl	Red Dog Mine	Starry Flounder	Dieldrin
Prudhoe Bay	Fourhorn Sculpin	Hg	Red Dog Mine	Starry Flounder	Hep
Prudhoe Bay	Fourhorn Sculpin	Lindane	Red Dog Mine	Starry Flounder	Heptachl
Prudhoe Bay	Fourhorn Sculpin	Mirex	Red Dog Mine	Starry Flounder	Heptaepo
Prudhoe Bay	Fourhorn Sculpin	Mn	Red Dog Mine	Starry Flounder	Hex
Prudhoe Bay	Fourhorn Sculpin	Ni	Red Dog Mine	Starry Flounder	Hexachl
Prudhoe Bay	Fourhorn Sculpin	Non	Red Dog Mine	Starry Flounder	Lindane
Prudhoe Bay	Fourhorn Sculpin	Oct	Red Dog Mine	Starry Flounder	Mirex
Prudhoe Bay	Fourhorn Sculpin	Opddd	Red Dog Mine	Starry Flounder	Non
Prudhoe Bay	Fourhorn Sculpin	Opdde	Red Dog Mine	Starry Flounder	Oct
Prudhoe Bay	Fourhorn Sculpin	Opddt	Red Dog Mine	Starry Flounder	Opddd
Prudhoe Bay	Fourhorn Sculpin	Pb	Red Dog Mine	Starry Flounder	Opdde
Prudhoe Bay	Fourhorn Sculpin	Pcb101	Red Dog Mine	Starry Flounder	Opddt
Prudhoe Bay	Fourhorn Sculpin	Pcb105	Red Dog Mine	Starry Flounder	Pcb101
Prudhoe Bay	Fourhorn Sculpin	Pcb11077	Red Dog Mine	Starry Flounder	Pcb105
Prudhoe Bay	Fourhorn Sculpin	Pcb118	Red Dog Mine	Starry Flounder	Pcb11077
Prudhoe Bay	Fourhorn Sculpin	Pcb126	Red Dog Mine	Starry Flounder	Pcb118
Prudhoe Bay	Fourhorn Sculpin	Pcb128	Red Dog Mine	Starry Flounder	Pcb126
Prudhoe Bay	Fourhorn Sculpin	Pcb138	Red Dog Mine	Starry Flounder	Pcb128

Red Dog Mine	Starry Flounder	Pcb138
Red Dog Mine	Starry Flounder	Pcb153
Red Dog Mine	Starry Flounder	Pcb170
Red Dog Mine	Starry Flounder	Pcb18
Red Dog Mine	Starry Flounder	Pcb180
Red Dog Mine	Starry Flounder	Pcb187
Red Dog Mine	Starry Flounder	Pcb195
Red Dog Mine	Starry Flounder	Pcb206
Red Dog Mine	Starry Flounder	Pcb209
Red Dog Mine	Starry Flounder	Pcb28
Red Dog Mine	Starry Flounder	Pcb44
Red Dog Mine	Starry Flounder	Pcb52
Red Dog Mine	Starry Flounder	Pcb66
Red Dog Mine	Starry Flounder	Pcb8
Red Dog Mine	Starry Flounder	Pen
Red Dog Mine	Starry Flounder	Ppddd
Red Dog Mine	Starry Flounder	Ppdde
Red Dog Mine	Starry Flounder	Ppddt
Red Dog Mine	Starry Flounder	Tet
Red Dog Mine	Starry Flounder	Tnonchl
Red Dog Mine	Starry Flounder	Tri
Savoonga	Pacific Walrus	Dieldrin
Savoonga	Pacific Walrus	Oxychlordane
Se Of Prudhoe Bay	Grayling	Dieldrin
Se Of Prudhoe Bay	Grayling	Hcb
Se Of Prudhoe Bay	Grayling	Hept.Epoxide
Se Of Prudhoe Bay	Grayling	P,P'Dde
Se Of Prudhoe Bay	Grayling	S-Chlordane (Cis&Trans)
Se Of Prudhoe Bay	Grayling	Shch(Alpha, Gamma)
Se Of Prudhoe Bay	Grayling	Spcb*
Se Of Prudhoe Bay	Grayling	T-Nonachlor
Se Of Prudhoe Bay	Lake Trout	Dieldrin
Se Of Prudhoe Bay	Lake Trout	Hcb
Se Of Prudhoe Bay	Lake Trout	Hept.Epoxide
Se Of Prudhoe Bay	Lake Trout	P,P'Dde
Se Of Prudhoe Bay	Lake Trout	S-Chlordane (Cis&Trans)
Se Of Prudhoe Bay	Lake Trout	Shch(Alpha, Gamma)
Se Of Prudhoe Bay	Lake Trout	Spcb*
Se Of Prudhoe Bay	Lake Trout	T-Nonachlor
Singoalik River	Dolly Varden	Cs 137
Singoalik River	Dolly Varden	Sr 90
Singoalik River	Pink Salmon	Cs 137
Singoalik River	Pink Salmon	Sr 90

Singoalik River	Whitefish	Cs 137
Singoalik River	Whitefish	Sr 90
Skagway River	Flathead Sole	Ag
Skagway River	Flathead Sole	Aldrin
Skagway River	Flathead Sole	Alphachl
Skagway River	Flathead Sole	As
Skagway River	Flathead Sole	Cd
Skagway River	Flathead Sole	Cr
Skagway River	Flathead Sole	Cu
Skagway River	Flathead Sole	Di
Skagway River	Flathead Sole	Dieldrin
Skagway River	Flathead Sole	Fe
Skagway River	Flathead Sole	Hep
Skagway River	Flathead Sole	Heptachl
Skagway River	Flathead Sole	Heptaepo
Skagway River	Flathead Sole	Hex
Skagway River	Flathead Sole	Hexachl
Skagway River	Flathead Sole	Hg
Skagway River	Flathead Sole	Lindane
Skagway River	Flathead Sole	Mirex
Skagway River	Flathead Sole	Mn
Skagway River	Flathead Sole	Ni
Skagway River	Flathead Sole	Non
Skagway River	Flathead Sole	Oct
Skagway River	Flathead Sole	Opddd
Skagway River	Flathead Sole	Opdde
Skagway River	Flathead Sole	Opddt
Skagway River	Flathead Sole	Pb
Skagway River	Flathead Sole	Pcb101
Skagway River	Flathead Sole	Pcb105
Skagway River	Flathead Sole	Pcb11077
Skagway River	Flathead Sole	Pcb118
Skagway River	Flathead Sole	Pcb126
Skagway River	Flathead Sole	Pcb128
Skagway River	Flathead Sole	Pcb138
Skagway River	Flathead Sole	Pcb153
Skagway River	Flathead Sole	Pcb170
Skagway River	Flathead Sole	Pcb18
Skagway River	Flathead Sole	Pcb180
Skagway River	Flathead Sole	Pcb187
Skagway River	Flathead Sole	Pcb195
Skagway River	Flathead Sole	Pcb206
Skagway River	Flathead Sole	Pcb209
Skagway River	Flathead Sole	Pcb28
Skagway River	Flathead Sole	Pcb44

Skagway River	Flathead Sole	Pcb52
Skagway River	Flathead Sole	Pcb66
Skagway River	Flathead Sole	Pcb8
Skagway River	Flathead Sole	Pen
Skagway River	Flathead Sole	Ppddd
Skagway River	Flathead Sole	Ppdde
Skagway River	Flathead Sole	Ppddt
Skagway River	Flathead Sole	Se
Skagway River	Flathead Sole	Sn
Skagway River	Flathead Sole	Tet
Skagway River	Flathead Sole	Tnonchl
Skagway River	Flathead Sole	Tri
Skagway River	Flathead Sole	Zn
Soldotna	Rainbow Trout	A-Hcb
Soldotna	Rainbow Trout	Cis-Chlor
Soldotna	Rainbow Trout	Ddd
Soldotna	Rainbow Trout	Dde
Soldotna	Rainbow Trout	Ddt
Soldotna	Rainbow Trout	Pcb1254
Soldotna	Rainbow Trout	Pcb1260
Soldotna	Rainbow Trout	Toxaphene
Soldotna	Rainbow Trout	Trans-Nonachl
St Paul	Fur Seal	Ag
St Paul	Fur Seal	Al
St Paul	Fur Seal	As
St Paul	Fur Seal	Br
St Paul	Fur Seal	Ca
St Paul	Fur Seal	Cd
St Paul	Fur Seal	Cl
St Paul	Fur Seal	Co
St Paul	Fur Seal	Cr
St Paul	Fur Seal	Cs
St Paul	Fur Seal	Cu
St Paul	Fur Seal	Fe
St Paul	Fur Seal	Hg
St Paul	Fur Seal	K
St Paul	Fur Seal	Mg
St Paul	Fur Seal	Mn
St Paul	Fur Seal	Na
St Paul	Fur Seal	Ni
St Paul	Fur Seal	Pb
St Paul	Fur Seal	Rb
St Paul	Fur Seal	Sb
St Paul	Fur Seal	Se
St Paul	Fur Seal	V
St Paul	Fur Seal	Zn
St Paul	Northern Fur Seal	Cis-Chlord
St Paul	Northern Fur Seal	Dieldrin
St Paul	Northern Fur Seal	Hcb
St Paul	Northern Fur Seal	Heptachlor Epoxide
St Paul	Northern Fur Seal	Lindane (G-Hch)
St Paul	Northern Fur Seal	P,P'-Ddd
St Paul	Northern Fur Seal	P,P'-Dde
St Paul	Northern Fur Seal	P,P'-Ddt
St Paul	Northern Fur Seal	S-Chlordane
St Paul	Northern Fur Seal	S-Ddt
St Paul	Northern Fur Seal	Spcb
St Paul	Northern Fur Seal	T-Nonachlor
Utukok River	Grizzly Bear	Cs 137
Utukok River	Grizzly Bear	Sr 90
Wales	Pacific Walrus	Dieldrin
Wales	Pacific Walrus	Oxychlordane
Yukon Crk.	Northern Pike	Hg
Yukon Crk.	Northern Pike	Se

Appendix E:
Results of A Workshop on Uptake and Effects of Contaminants in Alaska Native Foods

Funded by the Environmental Protection Agency, Region 10

Under a Grant to:

The Institute of Social and Economic Research
University of Alaska Anchorage
In Collaboration with
The Alaska Native Science Commission

May 1999

The Environmental Protection Agency, Region 10, awarded a grant to the Institute of Social and Economic Research to study what is known about contaminants and subsistence foods in Alaska. The goals of the project are to help village tribal organizations, Native regional organizations, government agencies, and scientists to:

- Access existing information relevant to concerns about contaminants in subsistence foods;
- Achieve consensus on a process for setting research, monitoring, and clean-up priorities
- Communicate with each other to advance toward common goals

Project Objectives

We are addressing these three project goals by:

- ***Developing a database which contains information in seven categories***:
    1. Community concerns and priorities
    2. Harvest of subsistence foods
    3. Measured contaminants in subsistence resources
    4. Health effects of contaminants on animals and people
    5. Nutritional value of subsistence foods
    6. Cultural benefits of subsistence foods
    7. Grants and programs to address contaminant concerns
- ***Learning from the experience of the Canadian Northern Contaminants Program***:
    1. How tribal organizations are involved in setting priorities for contaminant research, obtaining samples, overseeing laboratory testing, interpreting testing results, enabling communities to decide how they will deal with the issue of whether subsistence foods are safe to eat.
    2. How scientists have interpreted the meaning of contaminant research results in Canada.
- ***Developing electronic links between village tribal organizations, Native regional organizations, government agencies, and scientists***:
    1. An interactive internet web site and internet email
    2. First Class, an electronic telecommunications system that provides email, document transfer and conferencing capabilities with villages that do not have high speed, reliable telephone connections.
- ***Collaborating with village tribal organizations to demonstrate communication linkages, provide university technical assistance to tribes, and learn about the concerns of tribes***:
    1. Collaborating with the Alaska Native Science Commission to ensure that the Alaska Native community is a full participant in contaminant research, communication and action priorities.
    2. Working with Kuigpagmiut, Inc. a consortium of four lower Yukon villages working under an EPA GAP grant (Mountain Village, Andreafsky, Pitka's Point, Marshall) to demonstrate a collaborative approach to environmental risk assessment.
    3. Working with the Council of Athabascan Tribal Governments (CATG), a consortium of 11 upper Yukon villages that is operating under several grants, including an EPA GAP grant and a NIEHS environmental justice grant. The villages include: Arctic Village, Venetie, Beaver, Birch Creek, Canyon, Chalkyitsik, Circle, Fort Yukon, Rampart, Stevens Village, and Venetie, again to demonstrate a collaborative approach.

4. Working with the Louden Village tribal council in Galena to provide technical assistance and to incorporate six middle Yukon River villages in the FirstClass communications network (Galena, Kaltag, Nulato, Ruby, Huslia, and Koyukuk)
5. Working with the Bristol Bay Native Association on incorporating concerns about subsistence foods in their environmental risk assessment.
6. Contacting 226 village tribal councils as well as village health aides and village natural resource specialists to invite them to join a network

- ***Working with university, Native and government programs to develop a coordinated approach***:
    1. The Alaska Native Health Board Epidemiology program
    2. The North Slope Borough contaminants program
    3. The National Institute of Standards and Technology tissue archiving program
    4. The RuralCAP Subsistence and Natural Resources Department
    5. The Native American Fish and Wildlife Society
    6. The Alaska Department of Fish and Game
    7. The University of Alaska Fairbanks Institutes of Arctic Biology and Marine Science
    8. Greenpeace
    9. The University of Alaska Fairbanks Center for Global Change Research
    10. The Alaska Department of Environmental Conservation
    11. The University of Alaska Anchorage Telemedicine Project
    12. The US Fish and Wildlife Service
    13. The University of Alaska Environment and Natural Resources Institute
    14. The Alaska Intertribal Council
    15. Rural Systemic Initiative, AFN
    16. Americorps

Purpose of this Report

As part of the process of developing a consensus on research, monitoring, and clean-up priorities, we want to develop a summary of the state of knowledge about contaminant uptake and effects on animals and people in Alaska. This report represents a first step in producing such a summary. We intend to develop a summary of Alaska Native perspectives on contaminants and subsistence foods and a synthesis of these two important perspectives. We hope that the forthcoming synthesis will contribute to the goal of achieving a consensus on research, monitoring, and clean-up priorities for Alaska and a consensus on how to conduct such a program.

The report is the result of an unorthodox approach. On April 15th and 16th 1997 ISER and the Alaska Native Science Commission held a workshop with an invited panel of fourteen people who know about contaminant research in Alaska. We asked the panel to assess the applicability of some 200 findings made by the Canadian Arctic Environmental Strategies Northern Contaminants Program (AES/NCP).

The Canadian government initiated the NCP in 1991. Since that time the program has funded $19.9 million in research. Participants in the program recently summarized their findings in a technical report, *Canadian Arctic Contaminants Assessment Report*[3]. We received permission from the lead authors of two chapters of the report (Chapter 3: Ecosystem Uptake and Chapter 4: Effects and Human Health) to use their findings as a stimulus for discussion by our Alaska panel. We should note that a subsequent report, *Highlights of the Canadian Arctic Contaminants*

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[3] Jensen, J., K. Adare, R. Shearer (eds). 1997. Canadian Arctic Contaminants Assessment Report. Department of Indian Affairs and Northern Development. Ottawa.

Assessment Report: A Community Reference Manual, is the best source of information about the findings of the Canadian program[4]. The people we invited and who participated (shown with an asterisk) included:

Paul Becker, National Institute of Standards and Technology*
Jim Berner, MD
John Blake, Institute of Arctic Biology, UAF*
John Booker, Institute of Circumpolar Health Studies, UAA
Terry Bowyer, Department of Biology and Wildlife, UAF*
Michael Castellini, Institute of Marine Science
Patricia Cochran, Alaska Native Science Commission*
Doug Dasher, Alaska Department of Environmental Conservation
Ted DeLaca, Office of Arctic Research, UAF*
Larry Duffy, Department of Chemistry and Biochemistry, UAF*
Sven Ebbesson, Institute of Marine Science, UAF
Grace Egland, Division of Public Health, State of Alaska*
Tom Evans, US Fish and Wildlife Service, Marine Mammals Mgt.*
Jim Fall, Alaska Department of Fish and Game, Subsistence Div.
Jesse Ford, Oregon State University*
Rosyland Frazier, Institute of Social and Economic Research, UAA*
Carl Hild, Rural Alaska Community Action Program*
Sue Hills, Institute of Marine Science, UAF
Henry Huntington, Inuit Circumpolar Health Conference
Mary Killorin, Institute of Social and Economic Research, UAA*
Kim Kloeker, US Fish and Wildlife Service
Jack Kruse, Institute of Social and Economic Research, UAA*
Ann Lanier, MD Alaska Native Health Board*
Rita Miragalia, Alaska Department of Fish and Game, Subsistence Div.
Lori, Division of Public Health, State of Alaska*
Dan Mulcahy, US Geological Survey BRD
Thomas Nighswander, MD
Betsy Nobman, formerly of Public Health Service*
Todd O'Hara, North Slope Borough
Scott Schliebe, US Fish and Wildlife Service
Joel Schmutz, US Geological Survey, BRD
Fran Stephan, US Environmental Protection Agency*
Kimberly Trust, US Fish and Wildlife Service, WAES
Bob White, Institute of Arctic Biology, UAF*

Prior to the workshop, we sent each panelist copies of the two chapters of the Canadian Northern Contaminants Program Assessment Report. At the time of the workshop, we distributed overheads and a tabular summary of the major points made in each chapter. We suggested a format for panelist assessments that used structured responses as shown in Table 1:

Table 1: Response Categories Used in Assessing Status of Knowledge in Alaska Concerning Contaminant Uptake and Effects

Response Category	**Meaning of Response**
Finding confirmed with Alaska data	You know of Alaska data that leads you to

[4] Department of Indian and Northern Affairs Canada. 1997. Highlights of the Canadian Arctic Contaminants Assessment Report: A Community Reference Manual. Northern Contaminants Program. 83pp. Ottawa.

	the same conclusion.
Good bet	Given other priorities, it is worth assuming that the Canadian conclusion holds in Alaska.
Need data	The Canadian conclusion probably applies in Alaska, but we need data.
Don't know	We don't know. Another conclusion is just as likely.
Probably wrong	The Canadian conclusion probably doesn't apply in Alaska.
Screwed up	The summary presented in the workshop is not correct.
Ask someone else	This isn't my area of expertise.

The panel decided to follow the suggested format. We all recognized that our assessments of some 200 points made by the Canadian experts would exceed the time available in the workshops if we permitted ourselves to comment on each point. Such comments, however, are critically important to the development of an understanding of the Alaska situation. We provided a small amount of time for panelist comments.

We attempted to build a consensus finding for Alaska in revised wording of each point. That is, we took the panelists' responses into account in changing the wording of the Canadian findings. We used the bullet format of presentation to highlight each finding. Note that the row number on the spreadsheet in which the original Canadian finding appears is shown in parentheses.

Summary Points
Contaminants of Concern

Contaminants of concern in northern Canada include:

- Persistent organic pollutants, particularly organochlorines
- Heavy metals, particularly mercury and cadmium
- Radionuclides, particularly cesium 137, cesium 134, and potassium 40

More data is needed in Alaska in all three categories to conclude that each should be of concern. There is, however, some Alaska data on heavy metal contamination and persistent organic pollutants. It is probable that heavy metals are of concern in some areas (2). Other potential contaminants of concern include phthalate esters, plutonium, and brominated compounds.

Importance of Subsistence Foods in Alaska

- A substantial proportion, on the order of a third or more, of the meat and fish eaten by rural Alaska Natives comes from local harvests of fish and game. We do not have consumption data for most Alaska Native communities (10).
- The concept of "health" among Native people is holistic. Health is socially and culturally defined. It has spiritual dimensions. Alaska Natives have a strong traditional value of respect for the environment. They see degradation of the environment as a threat to health (227).
- Sharing of Native foods is a common practice in Alaska. Harvesting, sharing, processing, and consuming Native foods is an opportunity to practice and teach humility and spirituality (233).
- Imported sources of meat and fish are expensive and lower in protein, thiamin, riboflavin, niacin, and vitamin B12 than Native foods (257).
- If Alaska Natives were to stop eating Native foods, they would experience nutrition and

protein deficiencies. Native foods are as important to Native social well-being as they are to physical health (231,255, 259).

Causes for Concern About Contaminants in Native Foods

- Alaska Natives have observed changes in the health of some animals and fish. They worry that these changes may be due to contaminants. We need to ask Native experts to share these observations in order to see patterns of change (11).
- The diets of Alaska Natives are more likely to include predators which may concentrate contaminants (1). Alaska Native diets are also more likely to be higher in fats. These fats may contain higher concentrations of organochlorines.
- Slower growing plants such as lichen can result in higher contamination levels. (14)
- Contaminants reach the Arctic through long range atmospheric transport and exposure of migrating species exposed to non-local sources of contaminants (15).
- Local sites and the natural environment may be sources of contaminants (17).
- We need more data to understand the processes which move contaminants through the food chain. It is possible that accelerated processes during the spring may move contaminants through the food chain more quickly (18).

Marine Mammals

- Marine mammals including polar bear, ringed seals, beluga, and walrus probably have elevated levels of PCBs and toxaphene. There is some Alaska data to support this statement, but more is needed. We cannot assume that the trend of decreasing levels of PCBs from eastern to western Canada extends into Alaska, particularly in the Bering Sea. The higher eastern levels of PCBs may be due to a coupling of a regional cooling trend in eastern Canada with atmospheric PCBs from lower latitudes of North America (104).
- DDT and chlordane related contaminants may be important in polar bears and seals (104) DDT concentrations may be lower in the Bering Sea.
- We need data to confirm the Canadian finding that toxaphene predominates in the lower food web of marine organisms and does not become concentrated in polar bears to the same extent as PCBs or some chlordane components (105).
- Canadian results show a large variation in organochlorines in walrus. The presence of many different types of organochlorines in some walrus indicates that the source is not local (and hence specific types). The variation may be due to differences in diet. Walrus that eat seals may have higher levels. We need Alaska data to test this idea (111).
- It is likely that observed concentrations of PCB’s in Baltic (Europe) ringed seals and in St. Lawrence estuary (Eastern Canada) beluga are 10 to 20 times higher than concentrations in Alaska ringed seal and beluga (118).
- Polar bears, ringed seals, and beluga are likely to have elevated levels of mercury, but we need data to understand how the sedimentary geology differs in different areas off Alaska’s coast as compared with the Canadian Beaufort Sea (120).
- It appears that beluga eliminate mercury from their systems through molting. Canadians found that 20 percent of the total mercury and methylmercury in the skin was lost through molting (126).
- While cadmium concentrations in beluga increase from the western to eastern Canadian Arctic, we cannot assume that the trend extends across the Alaska Beaufort, Chukchi Seas, or into the Bering Sea and Gulf of Alaska. The mineral composition of sediments may differ from those in the western Canadian Arctic (122).
- We don’t have the data to confirm the Canadian finding that cadmium levels in marine

mammal livers and kidneys are similar to concentrations in the livers and kidneys of caribou and moose (124). It is probably true that Cadmium concentrations are as high or higher than those of the same or similar species living in temperate waters, but again we need data (123).

- Geographic coverage of levels of persistent organochlorines and heavy metals in marine mammals is not good in Alaska (130). In contrast to the Canadians, we have not studied contaminant levels in most stocks or populations of beluga, ringed seals, walrus, and polar bears. (128)
- We have a poor understanding of how organochlorines and metals move within the marine food web (131).

Caribou

- We do not have the data necessary to conclude that an observed increase in cadmium levels in caribou kidneys from eastern to western Canada continues into Alaska. We therefore cannot say that the levels in Alaska are comparable to those in northern Quebec and Norway, which is the case in western Canada. The source of cadmium is probably natural and may be related to soil and winter forage (63,64,69).
- It is likely that cadmium levels in caribou kidneys in some Alaska herds are higher than the Canadian guideline of 30 micrograms per gram, but we don't have the data (65).
- Concentrations of Cesium 137 are probably 4-10 times lower than they were in the 1960s when they increased due to atmospheric testing. Levels of Cesium 134, which also increased due to atmospheric testing, are now very low (75).
- There is some confirmation of naturally occurring potassium 40, polonium 210 and lead 210 in caribou in Alaska. Levels of lead 210 may vary within herds as they do in Canada, but we don't have data to confirm this (78-82).
- We do not have data to know whether the trend of decreasing PCB levels in caribou from eastern to western Canada extends to Alaska (85).
- It is likely, but we need data to confirm, that PCDDs, PCDFs (polycholorinated dibenzodioxins and -furans) and nPCBs (non-ortho PCBs) are extremely low in all herds (86).
- We can't say, as the Canadians can, that TCDD toxic equivalent concentration (TEQ) levels observed in caribou are comparable to levels observed in domestic animals in Canada (87).
- Geographic coverage of contaminant measures in caribou in Alaska is incomplete (89)

Freshwater Fish

- In northern Canada, fish of primary concern due to their contribution to Native diets include: burbot, lake trout, arctic char, northern pike, and whitefish. We cannot assume that this species are of primary concern in Alaska; rather, all species consumed are of potential concern. Included also should be anadromous fish such including salmon. We also cannot assume that PCBs, toxaphene, and mercury are the primary contaminants of concern in freshwater fish (26-29).
- We don't know if mercury levels in freshwater fish are relatively high or low in Alaska. Higher mercury levels are probably the result of both natural environmental conditions and human activity. Increases in mercury concentrations in sediments in this century may indicate increased human sources (47-55). The correlation of selenium with mercury does not necessarily indicate that the source of mercury is natural.
- Toxaphene is the major organochlorine contaminant in all freshwater fish in northern Canada. We do not know if this is the case in Alaska (1). It may be true that high toxaphene levels are related to differences in food web structure (i.e. fish eating other fish that are also

predators) (31)

- Toxaphene concentrates in fish livers. Burbot with high levels of toxaphene in their livers may have concentrations in their flesh that are comparable to other fish (39).
- There is likely to be a wide variation of PCB's in freshwater fish by location and weight of the fish. In northern Canada, lakes with the highest concentrations of PCB's (e.g. Lake Labarge) have local sources of PCB's and DDT. We need data to know if this pattern is also true in Alaska (33,36).
- Canadian researchers have concluded that they can limit future measurements to non-ortho PCBs unless waste PCB oils or pentachlorophenol use is suspected. They have observed that CB126 accounts for most of the toxic equivalent concentrations in arctic fish. We cannot assume that these findings apply in Alaska (44,45).
- Polyaromatic Hydrocarbons (PAH's) are more likely to be detected in lower molecular weights (3- and 4-ring) than higher molecular weights, but we can't say that even the lower molecular weight hydrocarbons are present at low levels in all areas of Alaska (56-58).
- Geographic coverage of contaminants in freshwater fish in Alaska is poor (60).

Waterfowl, Game Birds, and Small Mammals

- We don't know how organochlorine levels vary in birds. We cannot say whether the Canadian observation of lower organochlorine levels in the western Arctic extends to Alaska (93).
- We don't know if the Canadian conclusion that there are low levels of heavy metals in birds applies in Alaska (lead not tested) (94).
- Geographic coverage of contaminants in birds in Alaska is poor (96).
- It is likely that mink production is extremely sensitive to PCB contaminants (98).
- We do not have the data to verify the Canadian observation that most organochlorine pesticides and PCB congeners are found at very low levels and that these levels decrease with increasing latitude. At these levels, the Canadians do not suspect any effect on reproduction (100).

Sea Birds

- We don't have data to confirm the Canadian observation of lower levels of organochlorines in Glaucous gulls in the western Arctic (134). Factors affecting organochlorine levels in the Bering Sea may be different, for example.
- Geographic coverage of levels of persistent organochlorines and metals in seabird populations in Alaska is poor (137).

Marine Fish

- There is very limited information on levels of organochlorines and aromatic hydrocarbons in marine fish stocks in Alaska waters (140).

Local Sources of Contaminants

- Military sites along Alaska's coast are likely to be local sources of PCBs and DDT contamination of the nearshore environment. While there is some Alaska data to support this conclusion, more data is needed (150).

Temporal Trends

- We need to confirm observed trends of declining concentrations of organochlorines in marine mammals and sea birds from the 1970s to the 1980s and a leveling off of concentrations during the mid-1980s to the mid-1990s (153).

- It is likely that the observed decline in SDDT in peregrine falcons is greater than that in arctic sea birds, but we need data to confirm this Canadian finding (155).
- There is limited data on changes in organochlorines such as toxaphene, chlordane, and chlorobenzenes in marine biota. What Canadian data there is for the 1980s and 1990s suggests that there has been no significant decline in concentrations of these contaminants in marine mammals or sea birds. We do not have comparable temporal data for Alaska (157).
- We do not have Alaska data to confirm the Canadian finding that higher concentrations and rates of accumulation of mercury were found in ringed seals and beluga in more recent (1993-94) samples than in earlier collections (1981-83 in eastern Arctic, 1972-73 in the Western Arctic) (159). However, AMAP studies for Eastern Beaufort Sea Polar Bear support the Canadian findings.
- While it may be true that the eastern Canadian arctic finding that cadmium concentrations have showed no change over a 10 year period may apply in Alaska, we need data to confirm it (161).
- There is very limited temporal trend information on organochlorines and heavy metals in the terrestrial and freshwater environments of Alaska (164).
- At present, the temporal trend data are too limited to be able to predict future trends because they are based on two or at most three sampling times. By comparison, temporal trend data for contaminants in Lake Ontario lake trout and in various species from the Baltic and from lake Storinveld in northern Sweden are available yearly for a 15-20 year period (168).
- There is clearly a need for well-designed temporal trend studies (170).

Biological Effects

- The Canadian Northern Contaminants Program concluded that, with the possible exception of peregrine falcons, contaminant levels or biochemical indicators of effects have not been linked to effects on arctic animals at the individual or population level. The lack of research of this type in Alaska makes it impossible to conclude whether or not there have been effects of contaminants on arctic animals. Local observations of possible effects of contaminants on the environment are needed (173).
- As is usually the case with arctic animals, the lack of experimental dosage/response data continues to limit the ability to interpret concentrations observed in animals (176).
- Canadian researchers have not observed the presence of effects related to toxaphene exposure on fish and ringed seals. We need data to confirm this finding in Alaska (175).
- We lack the data to confirm the Canadian conclusion that Arctic animals have relatively high body burdens of heavy metals and radionuclides compared to similar or related species in temperate regions. We also cannot conclude that Arctic animals may be adapted to relatively high exposure because of the importance of natural sources of these contaminants (178).
- We concur with Canadian researchers that the potential effects of high doses of metals such as cadmium on caribou and beluga are not clear (180).
- It may or may not be true that the polar bear is the species with the most significant risk of exposure to PCBs and organochlorine pesticides (182).
- It is likely that Arctic animals with relatively low levels of contaminants may be vulnerable to the biological effects of these contaminants if they have to draw on lipid deposits during fasting or starvation (184).
- It is likely that organochlorine contaminant levels in arctic beluga are 10 to 20 fold lower than in St. Lawrence Estuary (Eastern Canada) beluga. In the case of St. Lawrence beluga,

there is preliminary evidence of a link to immune system dysfunction due to high PCB exposure (185).

- We lack the data to confirm the Canadian observation that concentrations of TCDD TEQs in arctic ringed seal and beluga blubber are 3 to 5 times lower than those associated with impaired immune function in harbor seals (187).
- It may be true, but we also lack data to confirm that concentrations of PCBs in blubber lipids of ringed seals are 10 to 20 fold lower than concentrations associated with poor reproductive success in captive harbor seals (188).
- It is likely true that marine mammal females and their offspring may be most vulnerable during mobilization of fats containing contaminants because this mobilization occurs at a crucial point in the growth and development of the young. Overall, the MFO enzyme data in Canada for polar bear and beluga suggest that even the relatively low levels of contaminants present in the arctic animals may have biological effects, especially during years of poor feeding (190).
- Carnivores such as polar bear may be at risk due to consumption of ringed seal tissues, but we need data to support or refute this Canadian finding (193).
- As a result of the Canadian Northern Contaminants Program, the list of priority substances monitored in northern Canada over the past five years is relatively long (including PCB congeners, isomers of HCH, numerous components of technical chlordane and DDT and 25 metals in many samples). We do not have a comparable data set for Alaska. Even in Canada, there are still a number of chemical contaminant groups for which information is quite limited or nonexistent. These groups include PCDD/Fs and non-ortho PCBs, chlorinated napthalenes, chlorinated diphenyl ethers or their brominated analogs (all of which are cytochrome P4501A1 enzyme inducers) (196).
- As in Canada, there are no data in Alaska on toxaphene in terrestrial animals and in waterfowl and seabirds, despite that fact the likelihood that toxaphene may be a major organochlorine contaminant in arctic air, seawater, fishes and marine mammals (198).
- Current methods of quantifying toxaphene may overestimate levels in some species such as marine mammals (199).
- Current use pesticides, a diverse group of less persistent organics, have not been monitored, although recent work indicates that they are likely present in arctic air and snow and terrestrial plants (201).

Gaps in Spatial and Temporal Data

- In Alaska, there are large spatial and temporal gaps in contaminant data. In contrast, geographic coverage on most contaminants in northern Canada is good (208).
- The complete lack of data over time in Alaska is a major problem. Even where there are measures of contaminants over time, however, changes in methods make it difficult to compare recent and older data (208).
- Canadian concern with increasing levels of mercury in beluga and ringed seal may be warranted in Alaska as well. It is not clear whether the observed increase is due to human sources, which have been shown to be increasing slowly all this century in dated sediment cores, or is due to some other environment change which is mobilizing mercury (210).
- While studies show that the PCB contamination of terrestrial plants, soils and nearshore sediments and biota in Canada due to pollution from military radar facilities is localized when considered on a broad regional scale, there is a need to confirm these findings in Alaska. There is also a need to determine whether marine mammals frequenting the waters within the general area of these sites as well as terrestrial animals, such as caribou and arctic fox feeding with the impacted zones, have elevated PCB and lead contamination (212).

- It is likely true that individual and community variations in methods of preparing muktuk affect the fat content of this food. These variations should be taken into account in assessments of exposure to organochlorines (214).
- There are few studies of biological effects indicators with arctic animals. There is particularly a need to study biological effects on immunosuppression in mammals at high trophic levels (216).
- More work is needed to confirm observed correlations of non-ortho and mono-ortho PCB concentrations with CYP1A1 activity in polar bear and beluga livers. There is also a need to combine MFO measurements with other biochemical indicators of effects of PCBs such as retinol levels (218).
- Given that some of the persistent organochlorines such as o,p'-DDE, p,p'-DDE and –DDT have estrogen activity, information is needed on steroid and thyroid hormone levels in polar bears and beluga (219).
- There are likely high levels of mercury and cadmium in sea birds and marine mammals as observed in Canada. The biological implications for the animals themselves is, however, unknown. Given that the levels of cadmium, for example, are among the highest ever reported in marine mammal tissues, further efforts are needed to examine possible physiological effects (221).

Human Health

- Native foods are widely consumed within communities. Marine mammals, large ungulates, and fish account for a large proportion of Native foods consumed. Consequently, potential exposure of Alaska Natives to contaminants in Native foods is widespread in Alaska (240)
- Increases in consumption of imported foods by Alaska Natives has been associated with decreased physical activity, obesity, dental caries, anemia, lowered resistance to infection, heart disease, and diabetes (238).
- Dietary survey data in Alaska is limited to 12 communities. While there are data on harvests for many Alaska Native communities, these data do not contain information on variations in consumption patterns among individuals (e.g consumption of organs, frequency of consumption, method of preparation) (241).
- Consumption of Native foods varies by season and by year. Dietary surveys which measure consumption for 2 or 3 24 hour periods may not reliably estimate consumption of Native foods (244).
- Consumption of Native foods varies by region, income, access to urban centers, and by factors such as age and gender (246).
- Dietary lipids are a concentrated source of energy, act as carriers of fat-soluble vitamins, and are a source of essential fatty acids (polyunsaturated fatty acids that are essential to health but cannot be synthesized by the human body). Fish and marine mammals which form a significant portion of the diet of Alaska Natives contain many n-3 polyunsaturated fatty acids which are not easily found in imported foods. Omega-3 fatty acids are found at high levels in fish and marine mammal tissues and have been associated with a decreased incidence of thrombotic and ischaemic disease (253).
- If consumption of traditional food resources - particularly fish and wildlife- were discontinued, the mineral nutrition of most Arctic populations would be compromised to such an extent that nutritional deficiencies could occur (255).
- Thiamin, riboflavin and niacin intake in the North are reasonably adequate due to the major contributions of these vitamins from traditional meats. Fish and game contribute substantial amounts of vitamin B12 and pantothenic acid. Total intakes of these vitamins are likely higher than in the general US population. Some reports indicate that vitamin A, calcium, and vitamin

C may be below recommended intakes (257).

- In Arctic communities, a significant portion of the protein requirements are fulfilled by traditional foods such that limiting the supply of traditionally harvested meats and fish would drastically reduce protein intake (259).
- We do not know if levels of DDT in human tissue in Alaska are, as in the Canadian Arctic, higher than that of southern Canadians and Americans (262).
- We do not know if DDE is higher in the human milk of Alaska Native groups as it is among Inuit in northern Canada (263).
- We do not know if levels of PCBs in the breast milk of at least some Alaska Native groups is higher than that of non-Natives living in southern Canada or the lower-48 states (270).
- A higher incidence of infectious diseases and ear infections among Alaska Native infants may be due to a complicated set of factors. It is unknown whether perinatal exposure to PCBs is one of these factors, nor is the extent of exposure known (271).
- Canadian Inuit show a higher exposure to dioxin-like PCBs than southern Canadians. Factoring this in increases difference in the toxic equivalent burden in the two populations. This type of comparison has not been made in Alaska (273).
- We don't know enough to conclude that there is a relationship between PCDD/PCDF/coplanar PCB exposure and immunologic and neurodevelopmental alterations associated with breast feeding (275).
- We don't have data to compare levels of chlordane in the milk of Alaska Native mothers and mothers in the lower 48 (279). Canadian Inuit mothers had chlordane levels 10 times higher than southern Canadian mothers.
- We don't have data to compare HCB levels in Alaska Native mothers' and lower 48 mothers' milk. Canadian Inuit mothers' milk has HCB levels five to nine times higher than levels seen in southern Canadian mothers' milk (283).
- Although there are Alaska Native cord blood samples to measure contaminant concentrations, they have not been analyzed (287).
- Although a major source of human exposure to cadmium is smoking, some individuals who frequently eat kidneys of caribou and marine mammals (e.g. once a week year round) may ingest significant amount of cadmium (296). However, only a small percentage of cadmium (about 5 percent) is absorbed through ingestion compared with direct absorption through smoking.
- Smoking may make the kidneys less effective in handling cadmium exposures from frequent consumption of organs, particularly among the elderly and diabetics (299) More study is needed to accept this theory.
- Methylmercury is a potent neurotoxin and the most toxic form of mercury in the environment. Human exposure in the Arctic is almost exclusively through food consumption, especially fish and marine mammals (301).
- We do not have data to confirm the Canadian findings that there is a recent decline in mercury levels in the blood of Inuit and Dene newborns in the NWT (304).
- The amount of radionuclides in the Arctic environment is generally about the same as, or lower then, levels found in the temperate zone (307).
- The greatest exposures to radionuclides occurred in the 1950s and 1960s (e.g. strontium 90). The long term effects of Strontium 90 in bone perhaps interacting with exposures to organochlorines is not known. Of all radionuclides, lead-210 and polonium-210, which are natural in origin, may make the greatest contribution to current human radiation doses in the Arctic. However, the greatest exposures to radionuclides may come from improperly used or maintained radiological equipment. Both lead-210 and polonium-210 occur in nature as airborne particles and rend to settle out on vegetation (i.e. lichens) thereby entering the

terrestrial food chain (lichens-caribou-humans) (308). We should also consider polonium-210 levels in fish.

- Residents in Arctic communities may be receiving up to 10 mSv of 210Po per year through dietary sources compared with normal background doses of about 2 mSv. This has likely been occurring in the Arctic for several thousand years. The effects of exposure may be increased by smoking. (311)
- Of the anthropogenic radionuclides, the two main isotopes of radiocesium (cesium-137 and cesium-134) are considered to be of greatest concern in Arctic environment. Levels of radiocesium in Arctic residents have declined from about 450 Bq-kg in 1965 to roughly 10 Bq-kg in 1990. The effects of exposures to Strontium 90 in the 1950s and 60s, however, may be important, but we don't know (312).
- Feather moss (*Hylocomium splendens*), and lichens can be used to monitor atmospheric deposition of radionuclides and heavy metals. They can help to distinguish between atmospheric sources of these pollutants and rivers.

Risk Management

- Risk determination for contaminants in Native food involves a consideration of the type and amount of food consumed and the sociocultural, nutritional, economic, and spiritual benefits associated with Native foods (315)
- Risk management decisions must involve the community and must take all aspects into account to arrive at an option that will be the most protective and least detrimental to the community (316).
- Regardless of the decision taken, some health risks associated with exposure to contaminants may remain. In the Arctic, these risks and benefits often pose a large and confusing public, moral and political dilemma (318)
- Risk management is an evolving process subject to change as new information about the situation is learned and assessed. The approach must be continually modified to suit each situation and each community and the advice monitored to ensure it is providing the best possible health outcome (319).
- In Alaska Native communities, advising against Native food consumption is also to advise against hunting and fishing. To the extent that aboriginal identity and the collective sense of well-being is based on subsistence as a social system and as an activity, as well as a dietary staple, then loss of confidence in Native food undermines confidence in identity and society (321)
- If not released with proper communication and consultation, advisories related to Native food can also result in individual estimations of risk that are often based on untested assumptions and are frequently wrong, leading to harmful and undesirable social and economic results (323)
- While Alaska Natives are unlikely to abandon their harvests of Native foods, the lack of proper communication and consultation can seriously compromise the contribution of harvests to Native well-being and the integrity of the community. Hunters may stop sharing harvests, for example, if they fear that they will make other people sick. (324)
- As such, risk management decisions must be carefully considered and must be implemented in ways that minimize the extent to which nutritional and sociocultural aspects of Aboriginal societies are compromised (326)
- Regardless of the difficulties in the processes of risk assessment and risk management and the different views on their adequacy, we must be guided by one objective. Risk assessment and management decisions are undertaken to serve public health. They must be

our "best estimate" and seen in the context on which they were created - an imperfect and ever-changing data base (327)

Perceptions of Risk

- Perception of risk in the Alaska, as in many communities, differs between the public experts. A lack of straightforward and credible information about toxicity and safe levels leads to unnecessary anxiety. This anxiety in turn can disrupt Native food harvest and consumption. The goal should be to provide clear information that will minimize unnecessary anxiety and alert people to real problems where they exist (330).
- Transfer of accurate and complete information via good communication plans may help limit the social and cultural effects resulting from the presence of contaminants in traditional food. If this does not occur, people will be forced to draw their own conclusions and will act accordingly based on their perceptions of the situation (333)
- In Arctic communities, communication is most effective when it is interpersonal and face-to-face. It should be a two-way flow of information where the opportunity for feedback is maximized (334)
- Communication should occur from the onset of a study and should be an ongoing process through to the reporting of findings and the development of remedial options. The best studies and the best solutions to local contaminant problems are developed with and by the community (336)

Risk Determination Conclusions

- There are many recognized advantages of nursing for both infants and for mothers, including improved nutrition, increased resistance to infection, protection against allergy, better parent-child relationships, and possibly a degree of protection of the mother against breast cancer. In the Arctic, alternatives to breast-feeding, such as infant formula, can be difficult to obtain (due to availability and affordability) and can pose difficulties with respect to the maintenance of hygiene in cases where the water supply is compromised (339)
- We do not have the data necessary to assess the Canadian conclusion that the organochlorines of primary health concern at this time for Alaska Natives consuming marine mammals as a major component of their diet are chlordane, toxaphene, and PCBs. In Canada, exposures in the eastern region are higher than in the western region (341)
- Canadians concluded that Dene/Metis, exposure to OCs is in general below a level of concern. However levels of chlordane and toxaphene exposure are elevated in some individuals and are a cause for concern if individual exposures are elevated on a regular basis. We lack the necessary data in Alaska to assess this conclusion with regard to Alaska Natives who do not consume marine mammals as a major component of their diet (342).
- The developing fetus and breast fed infant are likely to be more sensitive to the effects of OCs than adults and are the age group at greatest risk in the Arctic. Fetus/infant intakes of dioxins and furans, PCBs, toxaphene and HCB through human cord blood/milk are of primary concern even though the toxic effects that might occur are uncertain. In consideration of this uncertainty, the extensive knowledge of the benefits of breast-feeding are a strong rationale for Alaska Native women eating substantial quantities of marine mammals to continue to breast feed unless told otherwise by their health care provider. However, this advice should be decision of Alaska Native communities made in the context of a collaborative program of research and assessment (344)
- Risk management decisions must continue to be developed in cooperation with communities to reduce exposures and to sustain traditional ways (348)
- Current levels of lead in the Arctic do not pose a significant threat to health and, based on

declining emissions of lead globally, are not likely to pose a threat to health. When there is a potential source of lead contamination, however, cord blood and infant blood monitoring should occur to ensure local or regional lead levels are not increasing. (350).

- Cadmium intakes by non-smokers in the Alaska are likely to be low and similar to intakes reported in southern Canada (353).
- Smokers are likely to have 20 to 30 times higher mean blood levels of cadmium than non-smokers. These intake levels exceed the current WHO TDI value several-fold and are not related to consumption of Native food (355).
- We do not have adult blood mercury measurements to assess the risk of mercury exposure (25). Canadian results show that some Native populations are in the 5 percent risk range for neonatal neurological damage. Umbilical cord blood level measurements could be used to screen for exposures (357).
- It is likely that Alaska Native consumers of Native foods are exposed to an approximately seven-fold higher radiation dose than non-consumers of traditional food. More than 95% of this increased radiation dose is due to the bioaccumulation of natural radionuclides in the food chain (363)
- This increased radiation dose gives consumers of Native foods a cancer risk that is approximately 10% higher than that compared with consumers of a southern diet. In Canada, this increased risk is in fact not seen in NWT Inuit cancer statistics where Inuit have a significantly lower rate of all cancers, with the exception of lung cancer, than the Canadian population. In Alaska, there is a higher incidence of some cancers (e.g. stomach cancer), but this may be unrelated (365).

Appendix F

Nome Regional Meeting
Participant "Homework" Assignment

Thank you for planning to come to the Nome Regional Meeting of the Traditional Knowledge and Radionuclides Project. We hope that this memo will help you to prepare for the meeting.

The principal goal of the Traditional Knowledge and Radionuclides project is to help Alaska Tribes to identify and address their concerns about radionuclides and other types of contamination. The purpose of the Nome Regional Meeting is to learn from you what environmental changes are of concern to you and why.

By environmental changes, we mean changes in the:

- Health or numbers of animals, plants, and fish
- Health of people
- Sources of radionuclides and other contaminants
- Sea ice, currents, or weather

For each of these environmental changes, we would like to learn:

- How you came to be concerned
- Why you think the change may be happening
- What you think should be done about the change

We are looking to you as an interpretor of your experience, the experience of other people you know, especially community elders and active hunters. Your "homework" assignment, then, is to talk with others and come to the Nome Regional Meeting prepared to share:

- What animals, plants, fish, sources of contaminants, and aspects of people's health are of concern.
- Why the health or numbers of these animals, plants or fish may be declining.
- Why people's health may be declining.
- Why sources of contaminants may increase.
- Who may be able to share more knowledge than you might have about a particular concern.

Appendix G: Summary Slides Used to Introduce Regional Meeting

Appendix H: Northwest Arctic Regional Meeting Concerns

Appendix I: Southeast Regional Meeting Concerns

Appendix J: Interior Regional Meeting Concerns