# Traditional Knowledge and Contaminants Project
# and
# Resource Guide Project
# Final Reports

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## Approach

The goal of these projects has been to build capacity among Alaska federally recognized tribes to address their concerns about adverse changes in the environment. The University of Alaska's Institute of Social and Economic Research and the Alaska Native Science Commission collaborated on both projects. Since the projects are complementary, we have combined the two final reports. There were seven components to the combined projects (component number five reflects the entire scope of work of the Resource Guide project):

1. Develop a traditional knowledge base
2. Develop a science knowledge base
3. Develop an integrated database
4. Develop a web-based resource guide for tribes wishing to act on their concerns
5. Design and implement a pilot program of mini-grants to tribes
6. Based on the mini-grant experience, recommend ways to support tribal actions

## Developing a Traditional Knowledge Base

We developed a traditional knowledge base on Native concerns about environmental change, ideas on possible causes of these changes, and ideas for action through a series of seven regional meetings:

| | |
|---|---|
| Northwest Talking Circle (Nome '99) | Number of Participants: 30 |
| Interior Talking Circle (Fairbanks '99) | Number of Participants: 27 |
| Southeast Talking Circle (Sitka '99) | Number of Participants: 25 |
| Yukon-Kuskokwim Talking Circle (Bethel '00) | Number of Participants: 31 |
| Western Talking Circle (Cordova '00) | Number of Participants: 14 |
| Southcentral Talking Circle (Anchorage '00) | Number of Participants: 18 |
| Arctic Region Talking Circle (Barrow '00) | Number of Participants: 25 |

The regional meetings were conducted according to Native ways of knowing and Native ways of building consensus. Each regional meeting took place over three days. On the first day, 20-30 community residents invited for their knowledge about environmental changes were asked to share their thoughts in a talking circle. The selection of participants to the Regional Meetings was an interactive process, involving a local steering committee from the region that assisted in identifying Native elders, culture bearers, hunters, youth, gatherers, resource managers and Native scientists. The project team notified all regional profit and non-profit Native corporations, health corporations, tribal organizations and councils, and municipalities about the Regional Meetings and the participants representing their communities.

The talking circle began with a prayer and traditional introductions. The circle order of speakers went clockwise in respect for the cycle of life and mother earth. These basic rules applied to the talking circle: (1) respect for confidentiality; (2) respect for each person in the circle; (3) each person was given a chance to speak without interruption or comment. The circle of speakers could go around multiple times to give those who want to share more time to do so. Then the order of speakers varied according to the topic being discussed. The circle ended with a closing prayer.

The talking circle process promoted understanding, sharing and trust. This was allowed participants to feel secure sharing cultural and sacred knowledge. They knew that their information would be used in respected and appropriate ways. An important part of the process was the sharing of food and gift-giving as is the usual community practice.

Patricia Cochran moderated the meetings. To record the meeting, scribes sat outside the circle and typed verbatim the remarks of participants as they spoke. Each day the scribes cleaned the typescript and returned the comments to participants for review. The intent was to produce an approved verbatim transcript by the end of the workshop. Participants reviewed and signed consent forms indicating their willingness to have what they said shared with others. Another member of the team used an LCD projector and a laptop running Microsoft Powerpoint to summarize discussion points as they were made. Participants could see the powerpoint summary and used it to refine points and to build a consensus about concerns and ideas for action.

To be true to Native ways of knowing and Native ways of building consensus and to build rather than undermine trust and relationships the research team could not predict what knowledge subject areas would be important to Native communities. Although the initial grant focus was on the potential effects of radionuclides in the environment, in keeping with Native ways of knowing the team asked EPA for permission to begin the talking circle with a set of questions that were based on prior contacts with tribes that did not pre-judge the scope of concerns. The questions were:

- 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 people observed environmental changes?
- To what extent are there apparent causes of these changes? Do radionuclides or other contaminants appear to be potential causes of change?
- How can the project best support community action?
- How can the project best document and access traditional knowledge?

The most important goal influencing the design of the talking circle discussion of traditional knowledge was that community ownership and trust were ***increased*** as a result. Most designs for the collection, archiving, and use of traditional knowledge are likely to ***decrease*** community ownership and trust (e.g. as in “collecting” traditional knowledge). We worked with community participants to design methods which preserved local control and which promoted local use of information.

Additional goals for documenting and accessing traditional knowledge included:

- 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

Following each workshop, the project team prepared a regional report containing the verbatim introductions of participants, their verbatim concerns and ideas for action organized by subject category, and the powerpoint consensus points. The team also incorporated the verbatim comments and introductions in a Microsoft Access database. This data base can be searched by species group, contaminant group, and issue group.

### *Concern Themes*

The major themes shared across the regional meetings included:

- Cancers
- Fish abnormalities
- Local contaminated sites
- Russian sources of contaminants
- Plants changing in taste
- Desire to test for contaminants
- Influx of beaver
- Caribou showing signs of poor health
- Changes in weather, ice, lakes
- Changes in diet, use of tobacco, medicines

### *Examples of Consensus Points*

Below are illustrative examples of concerns, possible causes of concerns, and ideas for action voiced in the regional meetings. The intent here is to demonstrate the holistic way of thinking of participants. The examples are not intended to represent the most important points voiced by participants. In fact, participants did not attempt to prioritize their concerns, as their relative importance varies by community and over time. For a full listing of concerns, possible causes of change, and ideas for action, please refer to the *Traditional Knowledge Base* powerpoint files for each regional meeting on CD Number One.

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.
- Change in winds and weather could change how contaminants travel
- Landfills are too close to water sources
- Work with communities to set their own standards for what is safe to consume
- Eat right, get exercise, stop smoking and be healthy
- Make it possible for communities to test their foods for contaminants

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.
- Make a time or a place away from town to rekindle our relationship with the natural elements

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.
- 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.

Yukon-Kuskokwim

- Increased incidence of disease – cancers, asthma, arthritis, Alzheimer's, heart attacks and strokes, brain tumors
- Problems with drug abuse, alcohol, tobacco, FAS, huffing, suicide, depression, mental health problems
- Change in diet: non- traditional food, store bought meats, pop, juices, junk food; changes in young people's diet results in changed lifestyle;
- Teacher's tell kids that they have to graduate and go to college; but when they get back, there aren't jobs for them in the villages. Increased dependence on welfare rather than self-reliance. Education should include what we learn about living off the land.
- Elders are concerned about young people showing loss respect by not participating in traditional activities or respecting other people's property
- Whitefish wormy
- Salmon that have white spots on flesh like lesions, are affected by whirling disease, or have broken jaws – possibly from propellers.
- Salmon broken jaws (may be from propeller action hitting fish)
- Lush fish livers; some kind of growth inside the liver or roundworms in the livers
- Mercury from mining camps in rivers
- Ballast water from barges introducing foreign organisms, species and pollutants
- Increase in beavers
- Decline in shore birds and songbirds
- Birds and fish found with plastic around their necks

- Increase in sport fishing, including catch-and-release fishers, resulting in increased waste in river and destruction of habitat
- Change in the weather
- New plants and trees where they didn't used to grow
- Where there used to be an abundance of edible plants, now only a few
- Water pollution: chlorine and fluoride; rust running into river; outboard motors; fuel spills; antifreeze; honey buckets that overflow
- Other Causes of Changes
  - Population changes in the Delta
  - Transboundary pollution from Russia and Europe
  - Large airplanes affecting the ozone layer
  - Dumps that are not fenced or are too close to water sources
- Ideas for Action
  - More listening to elders
  - Respect land, waters and animals
  - Follow traditional restrictions
  - Use traditional medicines
  - Get everybody involved so that there are no special interests – the idea of collaborative leadership.
  - Be flexible at the agency level – you hear good ideas but the agendas get written up an agency so that it is restricted to what the agency wants
  - Abnormal fish and animals should be tested - establish a regional lab

Arctic

- Health of animals
  - Caribou that are skinny, sick (pus, tumors, cysts), and fewer in number, around – vegetation is slow growing and there may be too many caribou
  - Marine mammals with health problems: beluga with pus, skinny polar bears
  - Grayling whose taste varies from river to river; taste better from rivers further south
- Imbalance of too many predators, including sea gulls, fox, and grizzlies
- Respect for animals: use of satellite collars and tranquilizers
- Health of people: exposures to radionuclides from experiments and nuclear testing; exposures to pollutants from unidentified dump sites (including offshore and in rivers) and military sites inadequately cleaned up
- Effects of onshore and offshore development: use of gravel from rivers and lake water for ice roads; loss of hunting areas; disruption of whales due to noise; effects of development on migrating fish.
- Climate change: meats spoil faster, boat travel offshore is more dangerous, dangerous ice conditions
- Present our traditional knowledge so that it is taken seriously and acted upon
- Talk about our concerns in a way that has legal standing
- Find out more about why these changes are happening
- Have an ongoing program to measure contaminants

Western

- Clams affected by increased red tides and the Exxon Valdez Oil Spill
- Salmon: deformed salmon, cysts, tape worms in spawned out salmon

- Seal livers and kidneys: Oil Spill
- Animal fat doesn't preserve meat as well (seal, fish, walrus) – Bristol Bay area
- Balding seal, skin elastic, blubber thinner and gristly - Cook Inlet and Bristol Bay
- roundworms in halibut, smelt, seals – PWS area; Tapeworms in salmon – Cook Inlet area
- There are more cancers and heart disease
- Moose and caribou livers discolored, have a gray sheen – Bristol Bay area
- Increased sport hunters/ fishers and guides – there is more waste of the animal and trash left behind and human waste
- The elders find the weather is less predictable because they have a hard time reading the sky
- Weather appears to be going back to the pattern of 40 or 50 years ago in the Kodiak area – more snow, colder
- Die-off of barnacles and badarki's (chiton, gumboots) winter of 1999 in the Seldovia and English Bay areas due to unusual cold/freeze
- Decrease in seabirds, kittiwakes, ducks, murres, black ducks, puffins, shags (cormorants), mallards, sawbills, scouters in PWS area
- Can no longer use medicinal plants in steam baths when they are partially dry because the leaves fall off – must use them when they are green
- Change in beach grass in Bristol Bay area – less strong, molds when keeping traditional amount damp, grass blades grow unevenly on same plant so you can't pick all blades at the same time.
- Increase in cancers; Liver cancer more prevalent in the Kuskokwim and Bristol Bay coastal area; Bristol Bay coastal villages – more internal cancers
- Bristol Bay interior villages – more breast and prostate cancer; Port Graham – increase in colon cancer and diabetes in the late 1980's after water system installed
- Seldovia and Port Graham – adults and young kids in new HUD housing (1983) having more respiratory problems: paint, mildew, mold
- Boat harbors are sources of contamination which then travels with the tides
- Logging sites – logs in bay, oil wastes, litter left behind.
- Researchers – glad to help them if they have an open mind to more than what is written in books
- We are making headway in taking action ourselves – e.g. Harbor Seal Commission. We traditionally base what we do on peer review – scientists need to know that, and we have specialties too.

Southcentral

- People are dying from lack of spirit. But we can regain this spirit by helping each other, learning from each other, sharing with each other, freeing ourselves from our material things, and listening.
- Speaking spiritually cuts people like scientists off, but it is important to bring an understanding of the spiritual to what we are doing in the environment.
- Our experience is that western society takes our knowledge without credit and with their own interpretation. We can borrow some of the structures about the way to document data. But some information is sacred to our

people and used for very specific purposes. Some information needs to stay within our own circles.

- Our choices in TV were not good. Now with the internet and the village TV channel, we need to take advantage of the information and communication, including in the villages. We can use it for education of ourselves
- Knowing why the fur seal has declined is an example – we can't expect to know, but if we heal ourselves first we can understand. We need to re-establish our ability to sense the environment and to communicate with all things in the environment.
- Cook Inlet: it does not flush away pollution; We have to look at the whole system – the salmon as well as beluga for example.
- Bering Sea: over fishing; climate change; dumping of wastes; pollutants from Russian rivers; new diseases: white muscle disease in fur seals; chemicals from WWII; airborne pollutants
- History of Alaska Natives: mistreatment, displacement, sickness, death; survival through personal strength and organization to protect our people and our land.
- Pollution makes plants not good to eat or use for medicinal purposes
- Big Su – channel is filling up with gravel so that it is too shallow for whitefish, grayling, ling cod to stay there and the area is being over fished
- The shurra, stinkweed used to be green and now they are yellow- Seward, Ninichik, Hatcher Pass.
- Living in the Anchorage area means that we each look for our own special places – people who don't know, go out and destroy areas (e.g. breaking branches, ripping roots)
- We don't trust agencies charged with the responsibility for investigating problems. Agency people don't take the time to involve people from the start. Agency people who do know local circumstances are transferred, or leave and you have to start over
- We need to tell communities about why traditional foods are healthy to prevent heart disease, cancer, and diabetes and they feed our spirits.
- We are a visual people. You could take this video and share it everywhere. People would look more to how we can communicate with each other. You can put this on the website to start the discussions.
- We need to take time to balance things. Sometimes that takes mixing them up. With computers and technology, we move too fast to do this.

### *Examples of Verbatim Comments*

The Access database containing participants' verbatim comments made at the regional meetings includes over 1,700 comments made by 187 participants. The individual comments of participants reflect an experience and understanding greater than the individual participant. Participants brought 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

To provide the reader with a sense of the contents of the database, below are examples of comments:

*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.

### *Cultural Values of Native Foods*

During one of the regional meetings, Elaine Abraham, a Tlingit elder from Yakutat, told us, "Why are you starting with talk about concerns? I have enough trouble getting my granddaughter to eat Native foods!" She made a very good point. Many Alaska Natives shared concerns about changes they have observed in fish and wildlife and about contaminants as a possible cause of these changes. At the same time, they also are aware of the many benefits of eating Native foods. The team realized that we should include in the traditional knowledge base a reference to cultural values of Native foods and to include in the science knowledge base nutritional information.

The Alaska Native Knowledge Network website has a section on Alaska Native Values for Athabascan, Cup'ik, Iñupiaq, Yup'ik, Tlingit, and Alutiiq people. With their permission, the team linked the project website to the Native Knowledge Network (see www.nativeknowledge.org and choose "Resource Guide for Tribes" and then "We would like our children to know more about the cultural values of Native foods" to access the Native Knowledge Network web pages on cultural values. Or go directly to http://www.ankn.uaf.edu/values/ .

### *Documentation of Traditional-based Knowledge*

The electronic file folder *Traditional Knowledge Base* on CD Number One contains a regional report and a powerpoint file containing consensus points for each regional

meeting. An additional powerpoint file contains the summary slides used to introduce the project to participants in each regional meeting. In this introduction we contrast the community-based approach used in the project with the traditional science-based approach. We explained the major elements of the current grant and the purpose of the first year's regional meetings. We also reviewed sources of concerns about radionuclides and explained that we were broadly interested in people's observations and concerns about environmental changes. The *Traditional Knowledge Base* folder also contains a copy of the Access database and a copy of the consent form used in the meetings. The Access database is accessible on the web at www.nativeknowledge.org by choosing "Looking for Information in the Database" and then "Native concerns". The regional meeting consensus points are also available on the web at the same URL by choosing "Native Concerns Raised at Regional Meetings".

## Developing a Science-Knowledge Base

Our main focus was to develop a traditional knowledge base. The team also hoped, however, to compile complementary science knowledge so that we could bring together both knowledge bases for use by Native communities. Toward that end, the project team:

1. Held a workshop on the current state of knowledge on uptake and effects of contaminants.
2. Worked with nutritionist Betsy Nobmann to compile nutritional and dietary data for Native foods.
3. Worked with government agencies and Native organizations to compile available data on contaminants in Native food sources.
4. Worked with other researchers to compile a bibliography on contaminant research.
5. Worked with the Subsistence Division of the Alaska Department of Fish and Game to incorporate data on harvests of Native foods and seasonal round descriptions of harvest activity by community.
6. Developed a summary of science knowledge concerning contaminants, the effects of the Exxon Valdez oil-spill, and climate change.

### *Workshop on Uptake & Effects of Contaminants*

As part of the process of developing a summary of science-based knowledge, on April 15th and 16th 1997 the Institute of Social and Economic Research and the Alaska Native Science Commission held a workshop with an invited panel of fourteen people who know about contaminant research in Alaska. The project team 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 summarized their findings in a technical report, *Canadian Arctic Contaminants Assessment Report*[1]. We received permission from the lead authors of two chapters of the draft report (Chapter 3: Ecosystem Uptake and Chapter 4: Effects and Human Health) to use their findings as a

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

stimulus for discussion by our Alaska panel. We should note that a subsequent report, *Highlights of the Canadian Arctic Contaminants Assessment Report: A Community Reference Manual*, is the best source of information about the findings of the Canadian program[2]. 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:

[2] 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.

| 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 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. Participants 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. The team provided a small amount of time for panelist comments. The team attempted to build a consensus finding for Alaska in revised wording of each point. That is, the team took the panelists' responses into account in changing the wording of the Canadian findings. The team 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).

### *Nutritional Value of Native Foods*

Lillian Elvsaas of Seldovia asked the team in a regional meeting: "We should have someone explain the nutritional difference between sea lion and harbor seal. They must have the same nutrients. All the nourishments -- all the vitamins that we get out of it. All of those good Native foods. I think we need to get some studies done on sea lions and see what kind of nutrients are in the skin. I love to eat the skin after it's been cooked. It's got that gristly texture--chewy--cut it and dip it in mustard and sesame seeds."

We asked Betsy Nobmann, a nutritionist with years of experience working with the Public Health Service, to compile information on the nutritional value of Native foods. She based her compilation on the report, Nutrient Values of Alaska Native Foods, compiled by Elizabeth D. Nobmann, MPH, RD, Alaska Area Native Health Service, Revised December 11, 1992; October 1993. Her work is available through www.nativeknowledge.org by choosing “Look for Information in the Database” and then “Nutrition”.

Imported sources of meat and fish are expensive and lower in protein, thiamin, riboflavin, niacin, and vitamin B12 than Native foods. In Alaska Native 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. Native peoples' intake of thiamin, riboflavin and niacin is reasonably adequate because traditional meats are such a rich source of these vitamins. Fish and game also contribute substantial amounts of vitamin B12 and pantothenic acid to the Native diet.

### *Compilation of Alaska data on Contaminants*

When the project started in 1997, an international effort to compile existing data on contaminants – the Arctic Monitoring and Assessment Program – was nearing conclusion of its first phase. The team contacted AMAP to explore how best to make Alaska data accessible to tribes. The team discovered that the United States had not fulfilled its intent to contribute to the AMAP database. The team considered options of its own to make these data accessible. We decided that the most cost-effective approach would be to contact agencies thought to have compiled data. 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 seven 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)

These seven data sources cumulatively provide observations on 1,293 unique place-species-contaminant combinations. These data are contained in the Excel file "contam_summary.xls" in the *Science Knowledge Base* folder of CD Rom Number One.

### *Bibliographic Database on Contaminant Research*

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). The contaminant bibliographic sources can be accessed at www.nativeknowledge.org by choosing "Look for Information in the Database" and then "Research on Contaminants".

### *Native Food Consumption Data*

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. The Betsy Nobmann compiled can be accessed at www.nativeknowledge.org by choosing "Look for Information in the Database" and then "Consumption Data".

### *Native Food Harvest Data*

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. There were 168 communities for which measured per capita annual harvest for all harvested resources was available in 2000. 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 (see Table 2).

## Table 2: 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

The data can be accessed by community at www.nativeknowledge.org by choosing "Look for Information in the Database" and then "Harvest Data".

### *Community Harvest Descriptions*

The project team explored ways to communicate the cultural importance of Native food. In particular, the team sought a consistent way to document the cultural importance by community. The only source the team found for a large number of Native communities in Alaska was were the "seasonal round", or community harvest descriptions, developed by Subsistence Division staff in the course of their research. We scanned these descriptions and made them available through www.nativeknowledge.org by choosing "Look for Information in the Database" and then "Community Harvest Descriptions". While these descriptions do convey a sense of the prevalence of Native food harvest and gathering activities across the year, they do not serve well to convey the cultural importance of these activities. Recognizing this fact, we subsequently added the link to the Alaska Native Knowledge Network cultural values pages.

### *Compilation of science-based knowledge*

As mentioned at the start of this section, our main focus was to develop a traditional knowledge base. We did, however, want to make accessible to Native communities plain English summaries of relevant science. Our major effort in this regard was the

assessment of current knowledge on uptake and effects of contaminants discussed above. We realized, however, that concerns raised in the regional meetings also involved climate change issues and the particular issue of the effects of the Exxon Valdez Oil Spill.

The team therefore used web-based sources of information on climate change and on the Exxon Valdez Oil Spill along with the results of the project's Contaminant Uptake and Effects Workshop as the basis for developing a powerpoint summary of science-based knowledge. The electronic file folder *Science Knowledge Base* on CD Number One contains the powerpoint file "Research Summary". If used in the slide format, this file allows the user to return to a table of contents at the end of each section. The same summary of science-based knowledge is available on the web at www.nativeknowledge.org by choosing "Research Summaries" (using Internet Explorer 5.0 or higher). A searchable database of the conclusions from the Workshop on Uptake and Effects is available on the same website by choosing "Look for Information in the Database" and then "Research-Based Knowledge".

## Development of an Integrated Database

The team's first step in synthesizing traditional- and science-based knowledge was to build an integrated database. We decided that the most effective way to make information available to Alaska Natives and to interested government and university researchers was an interactive computer database. In 1997 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. Since 1997, internet access – while still not universally available at sufficient speed, cost, and reliability – has become substantially more accessible. We therefore transferred the database to a web-based platform in 2000. We mention all this because sophisticated users of project web source material may better understand how to use the material if they know its history.

Our objective was to make it possible for each tribe to access the most relevant information on:

- Contaminant data
- Nutrition data
- Native concerns
- Harvest data
- Consumption data
- Summary of science-based knowledge
- Bibliography of published contaminant studies

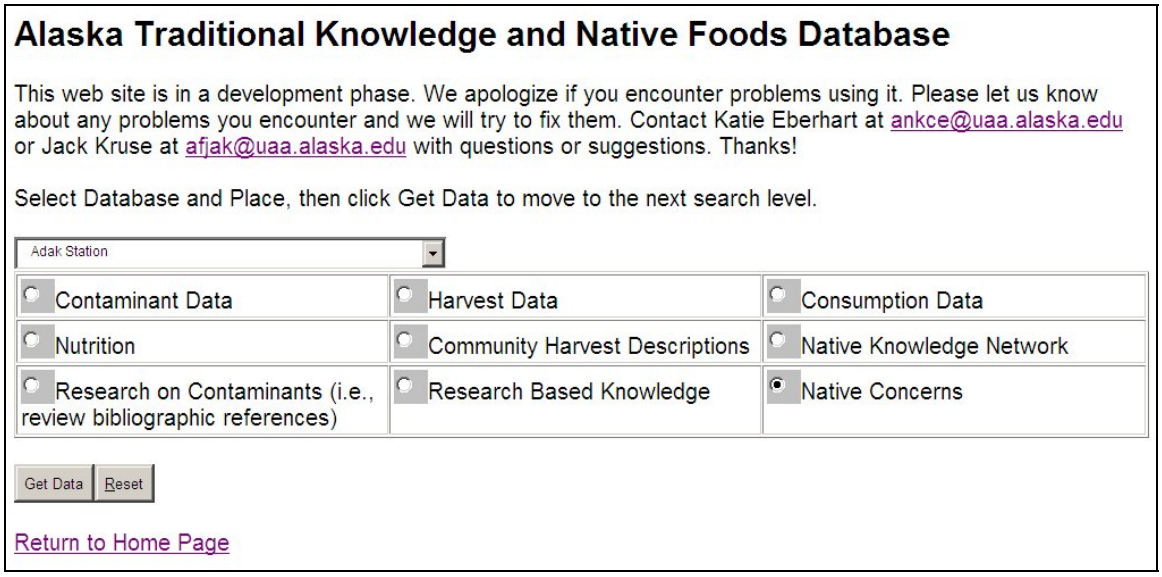
Since much of these data are most relevant if geographically specific to the community, we designed the "Alaska Traditional Knowledge and Native Foods Database" to store and report information by community. The database contains 368 communities. Not all of these communities have tribal governments; we include all communities in Alaska because Alaska Natives live in virtually all communities in the state.

Users accessing www.nativeknowledge.org for the first time are asked to give their name and email address. The intent of this step is to encourage users to show respect for the data they access. Recognizing that students are taught not to enter person information on the internet, however, there is a button for them to press to circumvent

this step (obviously anyone can act as is they are a student or enter a bogus name and email address, but we think that this step nevertheless causes people to stop and think about how they use the data).

The home page of www.nativeknowledge.org (shown below) shows links to a description of the project, a Resource Guide for Tribes (discussed in the next section), the database itself, summaries of Native concerns voiced in the regional meetings, and summaries of research. There is also a link to the AMAP website.


Our focus here is on the database. The next screen (shown below) offers the user a choice of searchable data sets. The user can first identify the community of interest. If data are



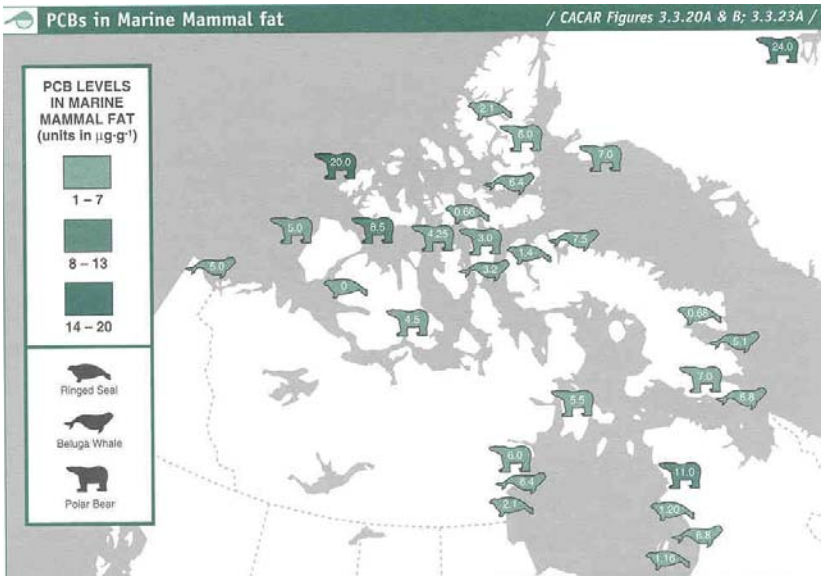

not available for a selected community, the search returns with suggestions for places in the same region with data from each data set (if available), or as a last resort, a list of all places with such data from a given data set. Note that in the case of contaminant data, there are seven data sets, each from a different agency. When the user ultimately chooses contaminant data to view, the data are posted along with a suggested link such

as, “About Persistent Organic Pollutants (POPs): What do these numbers mean?” This link provides the user with the following contextual information:

1. A link to AMAP reports
2. The following advice:

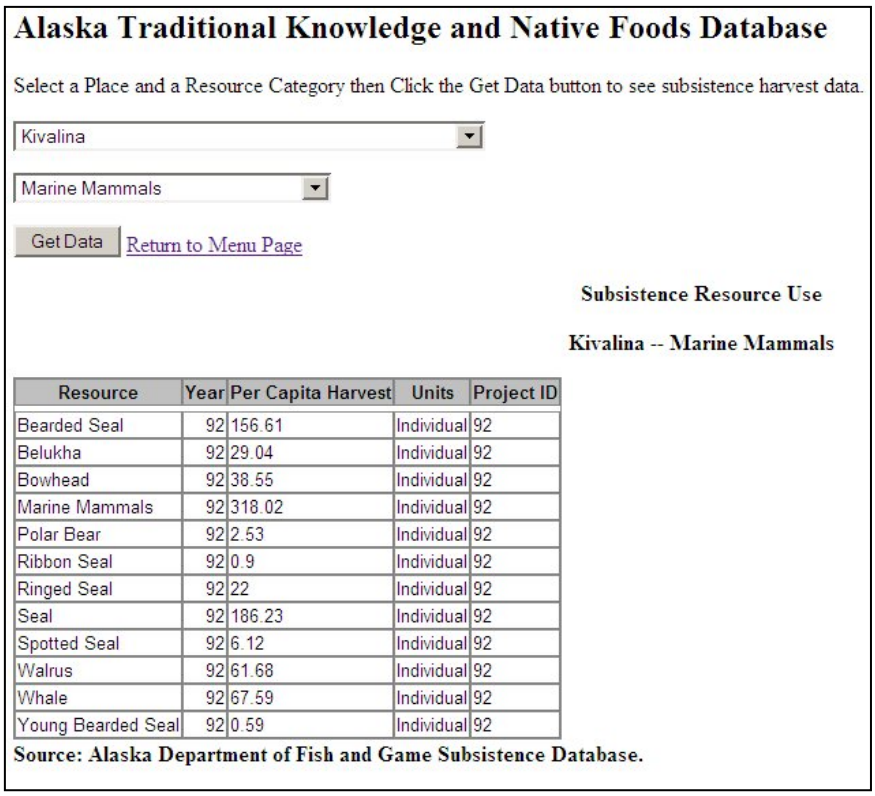
> *We think that making measures of contaminants in animals, fish, and plants available to people is important to developing trust between federally recognized tribes and researchers. At the same time, we realize that seeing the numbers makes people wonder, what do the numbers mean? One of the most important things to know is that modern day measurement instruments are able to pick up tiny amounts of contaminants. For example, the instruments can measure PCBs - a persistent organic pollutant - in parts per billion. Another way to think of parts per billion is one drop in nine full water trucks (Canadian Northern Contaminants Program). So if you see that there are some amount of contaminants in an animal you eat, it doesn't necessarily mean that you should be concerned.*
>
> *Government agencies do publish guidelines about levels of acceptable contamination. We have included in our database links to information published by the U.S. Agency for Toxic Substances and Disease Registry (choose What are Contaminants in the menu). Included in this information are such guidelines. The guidelines don't take into account the benefits of eating Native foods. Rather, they are conservative estimates of minimum amounts of contaminants that may begin put people at some health risk. We have included information about nutrition benefits in the database (see the main menu). For people who are unfamiliar with the central role of harvesting, processing, and consuming Native foods to Native culture in Alaska, we have included in the database descriptions of the annual round of harvest activities (see the main menu).*

3. Comparable contaminant data from other regions, for example:



4. Relevant conclusions from the Workshop on Uptake and Effects of Contaminants described earlier in this report.
5. Relevant conclusions from the AMAP report on contaminants.

Users selecting “Harvest Data” can choose to view data on all resources, or data on a specific resource, as in the following example:



**Alaska Traditional Knowledge and Native Foods Database**

Select a Place and a Resource Category then Click the Get Data button to see subsistence harvest data.

Kivalina

Marine Mammals

Get Data  Return to Menu Page

**Subsistence Resource Use**

**Kivalina -- Marine Mammals**

| Resource | Year | Per Capita Harvest | Units | Project ID |
|---|---|---|---|---|
| Bearded Seal | 92 | 156.61 | Individual | 92 |
| Belukha | 92 | 29.04 | Individual | 92 |
| Bowhead | 92 | 38.55 | Individual | 92 |
| Marine Mammals | 92 | 318.02 | Individual | 92 |
| Polar Bear | 92 | 2.53 | Individual | 92 |
| Ribbon Seal | 92 | 0.9 | Individual | 92 |
| Ringed Seal | 92 | 22 | Individual | 92 |
| Seal | 92 | 186.23 | Individual | 92 |
| Spotted Seal | 92 | 6.12 | Individual | 92 |
| Walrus | 92 | 61.68 | Individual | 92 |
| Whale | 92 | 67.59 | Individual | 92 |
| Young Bearded Seal | 92 | 0.59 | Individual | 92 |

**Source: Alaska Department of Fish and Game Subsistence Database.**

Similarly, users can view the nutritional content of specific Native foods:

**Nutrition Value per 100 Gram Serving of:**

**BELUGA, OIL, DELPHINAPTERUS LEUCAS:**

| food | definition | value | Weight |
|---|---|---|---|
| BELUGA, OIL, DELPHINAPTERUS LEUCAS | Kilocalories (kcal) | 900 | (G/TSP:5) |
| BELUGA, OIL, DELPHINAPTERUS LEUCAS | Protein (grams) | 0 | (G/TSP:5) |
| BELUGA, OIL, DELPHINAPTERUS LEUCAS | Carbohydrate (grams) | 0 | (G/TSP:5) |
| BELUGA, OIL, DELPHINAPTERUS LEUCAS | Lipids (grams) | 100 | (G/TSP:5) |
| BELUGA, OIL, DELPHINAPTERUS LEUCAS | Calcium (mg) | 0 | (G/TSP:5) |
| BELUGA, OIL, DELPHINAPTERUS LEUCAS | Phosphorus (mg) | 0 | (G/TSP:5) |
| BELUGA, OIL, DELPHINAPTERUS LEUCAS | Iron (mg) | 0 | (G/TSP:5) |
| BELUGA, OIL, DELPHINAPTERUS LEUCAS | Vitamin A (IU) | 2310 | (G/TSP:5) |
| BELUGA, OIL, DELPHINAPTERUS LEUCAS | Riboflavin (mg) | 0 | (G/TSP:5) |
| BELUGA, OIL, DELPHINAPTERUS LEUCAS | Thiamin (mg) | 0 | (G/TSP:5) |
| BELUGA, OIL, DELPHINAPTERUS LEUCAS | Niacin (mg) | 0 | (G/TSP:5) |
| BELUGA, OIL, DELPHINAPTERUS LEUCAS | Water (gm) | 0 | (G/TSP:5) |

Users selecting “Native Concerns” are told, “Native people throughout Alaska have shared their knowledge with us. We discussed with them the pro's and con's of sharing this knowledge with others through the internet. The consensus of Native participants is

that they would like to share their knowledge. We ask that you show your respect for their knowledge.

If you shared your knowledge with us, please let us know if you would rather we not share this knowledge with others over the internet. We can remove your quotes from the internet database. We realize that none of us really knows what will happen with knowledge shared on the internet and that you should be able to withdraw your consent to share your knowledge on the internet. If you would like us to remove your quotes, please contact Jack Kruse at afjak@uaa.alaska.edu"

Users can proceed by selecting verbatim comments by contaminant group and/or animal/plant/fish group and/or issue group. The following is an example of a quote in the heavy metals category of the contaminant group:

> *We should try to do research and see if there is mercury in these resources. Nowadays they are looking at sea mammals, seals, whales, and anything else like otter and mink. They are doing research on these species. Maybe some support could be given by the ANSC for a baseline study for heavy metals that are showing up in the fish. Just in case something happens, we could know what to compare and contrast. A lot of people in our village complain about abnormalities, and we'd like to study seals, whales, otter, and develop a lab and get some funds. We'd like to get behind Mekoryuk on their concerns.*
>
> *Allen Joseph, Bethel Yukon-Kuskokwim Delta Meeting, Yukon-Kuskokwim Delta Meeting, Aug. 26-28, 2000*

*Users can also view harvest descriptions, selecting by place, resource, resource group, or region. Finally, as described above, users can view summaries of research-based knowledge using Internet Explorer 5.0 or above.*

The Alaska Traditional Knowledge and Native Foods Database is now housed at the Alaska Native Science Commission. A copy of the current (2004) version of the entire www.nativeknowledge.org website is contained on CD Number Two. A 63 page Technical Documentation for the Database ("Traditional Knowledge and Native Foods Database.doc") is contained in the folder "Database Documentation" on CD Number One.

## Development of a Resource Guide for Tribes

One component of the Traditional Knowledge and Contaminants project was a pilot program of mini-grants to tribes. The project team realized that tribes would need technical assistance to take advantage of the mini-grant pilot program. There are 229 tribes in Alaska. The person or persons in each tribe having a responsibility for addressing the tribe's environmental concerns changes over time, as does the composition of the traditional council. Reports sent to individuals may not be transferred as positions change. The issues facing tribes also change over time: the village fresh water system may fail, or the caribou may not arrive in their usual numbers. The team began the project with the assumption that support for tribes would have to be available "on demand".

Based on input from tribes in the regional meetings, the team anticipated that many tribes would request grant funds to initiate a testing program for contaminants in Native foods. The team also learned that tribes receiving grants to measure contaminants would be required to adhere to EPA guidelines for quality assurance. The team therefore requested supplemental funds to prepare a resource guide to measuring contaminants in Native foods, including the preparation of quality assurance project plans.

Tribes are concerned about multiple sources and types of contaminants. Potential contaminants include persistent organic pollutants, heavy metals, and radionuclides. Potential sources of concern include abandoned local military sites, local dumps, abandoned public buildings, mines, industrial development and nuclear power plants in Russia, tobacco products, atmospheric pollutants from temperate regions, natural sources of heavy metals and radionuclides, and food additives. The intent of the Resource Guide is to provide federally recognized Alaskan Tribes with web-based information helpful in addressing their concerns about environmental change.

The Resource Guide contains over 7,500 files addressing the following topics:

### *Cultural and Nutritional Values*
We link tribes to the Alaska Native Knowledge Network for information on cultural values. We incorporate information developed by Betsy Nobmann on nutritional values and link users to the Nutritional component of our Traditional Knowledge and Native Foods Database.

### *Introduction to Mini-Grant Program*
We introduced the concept of the mini-grant program, inviting Tribes to apply for grants of $5,000-$10,000. These grants are intended to complement EPA GAP grants and other tribal resources. They are intended to help Tribes to begin to address their concerns.

### *Preparing Mini-Grant Applications ("Getting Ready One")*
We intend the mini-grant application process to be possible for tribes to complete without outside technical assistance. We asked the tribes to:

- Describe their principal concern about environmental change,
- Share their thinking on what may have caused the environmental change,
- Identify the primary question that they wish to address,
- Commit community resources (e.g. project manager, project accountant, samplers) to the project, and
- Prepare a budget based on a sample budget we provided.

### *Working with a Science Advisor ("Getting Ready Two")*
This section of the Resource Guide helps tribes to think through alternative approaches to addressing their primary concern, to decide how the community can best be involved in different phases of the project, and to anticipate what different results will mean to their community.

### *Preparing a Quality Assurance Project Plan*

Tribes receiving grant funds through an EPA project are required to fulfill EPA guidelines for obtaining approval of a Quality Assurance Project Plan. The Resource Guide provides guidance to tribes on the contents of a Quality Assurance Project Plan. We worked with tribes to prepare these plans and that project results met project objectives.

### *Implementing and Tracking Grants ("Making It Work")*

The team recognized that we needed to provide tribes with an easy way to track and report work on the mini-grants. In this section we provided budget and contact tools for tribes to use. We also described the laboratories that we worked with to design and implement the mini-grants involving testing. The final section advises tribes how to have a community discussion to interpret testing results.

We now turn to more detailed descriptions of each of the above sections of the Resource Guide. The Guide itself can be accessed through www.nativeknowledge.org by choosing "Resource Guide for Tribes". A copy of the current version of the Resource Guide is on CD Number Two (start by opening "index.htm").

### *Cultural and Nutritional Values*

Chin'an gu nin yu  Waqaa  Paglan  Yak' ei haat yigoodee  Aang  Quyakamsi

A Prayer

*People are dying from lack of spirit. But we can regain this spirit by helping each other, learning from each other, sharing with each other, freeing ourselves from our material things, and listening. Try to find those who will listen. If they don't want to listen, pray for them.*

As experienced in the Canadian Northern Contaminants Program, people often react to uncertainty and anxiety about the safety of eating Native foods by ceasing to eat them. This response cascades through the community, affecting daily activities, social relationships, as well as spiritual relationships with the environment. For this reason, the team tried to always couch discussions of the safety of eating Native foods in the context of their cultural and nutritional values.

### *Introduction to the Mini-Grant Program*

One of the most remarkable experiences of this project was the degree to which EPA joined with the project team in adopting a holistic approach. The scope of the mini-grants was determined by the scope of concerns raised by tribes in the regional meetings. The introduction to the mini-grants program made clear that tribes could apply for a mini-grant under the full range of concerns:

- We are concerned that an animal, fish, or plant may not be healthy to eat.
- We are concerned that a local site may be contaminating local resources.

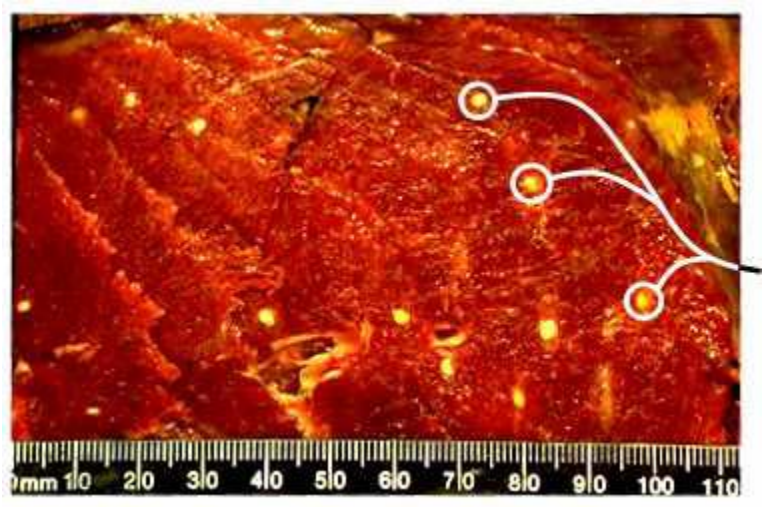
- We are concerned about changing numbers or condition of an animal, fish, or plant.
- We are concerned about changes in the land, water, ice, and weather.
- We are concerned about illnesses in our community.
- We are concerned about the loss of our traditional knowledge, language and practices.

### *Preparing Mini-Grant Applications ("Getting Ready One")*

There are seven section in "Getting Ready One":

1) Getting the Application
2) Identify your community's concerns
3) Identify possible causes for these concerns
4) Identify your question or other proposed action
5) Prepare a proposed budget
6) Prepare a community commitment of people and resources
7) Submitting the application

We developed a downloadable Word application and Excel budget. We then asked tribes to consider whether their concern was best addressed as "looking for quick answers" or "looking for-not-so-quick answers". This distinction arose from synthesis discussions which we describe later in this report. Many concerns voiced by tribes had to do with observed abnormalities in individual animals, fish, or plants. In keeping with the goals of minimizing uncertainty and anxiety, the team wanted to offer tribes an opportunity to get a quick answer if one was available. The team worked with The Resources, Wildlife, and Economic Development Department of the Northwest Territories in Canada to link the Resource Guide to their excellent web site containing information about these kinds of questions for terrestrial animals in the north. A Field Guide to Common Wildlife Diseases. Here is an extract from the Guide:




*This condition is caused by the larvae of the tapeworm Taenia krabbei.*

*Lifecycle: The tapeworm needs two hosts: a carnivore (eg. wolf or dog) and a (eg. caribou). The tapeworm grows and lays eggs in the intestines of the carnivore. Eggs come out in the carnivore's droppings and contaminate plants that are eaten by the herbivore. The eggs hatch into larvae that travel in the blood to other parts of the herbivores body where they form cysts in the muscle. Carnivores become infected when they eat meat with cysts.*

*The adult tapeworm occurs in wolves, lynx, bears and dogs without causing any harm.*

*The larval stage occurs in barren-ground and woodland caribou, and moose.*
*In the NWT and Nunavut, Taenia krabbei occurs commonly in caribou and occasionally in moose. Animals will probably appear healthy.*
*In the herbivore host, cysts are whitish or yellowish-white, round, and about 5 mm in diameter. Cysts generally occur in both muscle and the heart but may also occur in unusual sites. Surrounding tissues are usually normal.*

*You cannot be infected by the cysts of T. krabbei. Cysts can be easily removed during butchering. Meat from infected animals is suitable for human consumption. Cooking will kill the parasite. Dogs can be infected with tapeworms if they eat the liver cysts. Do not feed infected parts to dogs.*

If the tribes' concern did not appear to have a quick answer, the Resource Guide encouraged the tribe to review a summary of research on contaminants, climate change, and the effects of the Exxon Valdez Oil Spill. The web-based summary has the following interactive table of contents:


The intent of linking the research summary to the Resource Guide was to help the tribe frame its concern in terms of a research question. To also help them in this regard, the Guide provided a link to the summaries of concerns raised by tribes in the regional meetings.

To help the tribe identify more detailed relevant information, the Guide asked them to match their concern with one of the following categories:

- We are concerned that an animal, fish, or plant may not be healthy to eat.
- We are concerned that a local site may be contaminating local resources.
- We are concerned about changing numbers or condition of an animal, fish, or plant.
- We are concerned about changes in the land, water, or ice, weather.
- We are concerned about illnesses in our community.
- We are concerned about the loss of our traditional knowledge, language and practices

With the exception of the last category, each was linked to more information. If their concern was that an animal, fish, or plant may not be healthy to eat, for example, the Guide asked:

*Are you primarily concerned because you have seen:*

- *Abnormalities (like open sores), deformities (like deformed jaws), parasites (like worms), body conditions (like runny marrow), strange behavior, or changes in color or taste?*

*or because you think:*

- *There may be an unseen contaminant in the animal, plant, or fish?*

The team's reasoning for making this distinction is that the type of pilot study best fitting the tribe's concern would likely differ depending on their answer to this question. If their concern was about an abnormality, the Guide showed them examples of similar concerns raised by others and provided a link to the Canadian wildlife pathology website. The Guide then encouraged the tribe to think about possible causes of the observed abnormalities.

If the tribe's concern was about an unseen contaminant, the Guide provided a plain English definition of contaminants, and example of contaminant-related concerns raised by tribes in Alaska. The Guide provided links to more detailed, but plain English, definitions for persistent organic pollutants, heavy metals, and radionuclides. These pages in turn had links to yet more detailed descriptions of contaminants prepared by the federal Agency for Toxic Substances and Disease Registry.

Once the tribe had the opportunity to review information related to their concern, they were asked to continue with preparation of their mini-grant proposal. The proposal consisted of the following:

- A question or other action to be taken (e.g. purchase of a burn barrel)
- A proposed budget
- A community commitment of resources and people

The Resource Guide provides downloadable forms for each of these elements of the proposal. Mailing their application completes the "Getting Ready One" part of the Resource Guide.

### *Working with a Science Advisor ("Getting Ready Two")*

The second part of the Resource Guide is intended for use by tribes selected to receive a mini-grant. It consists of four sections:

1) Working with a science advisor
2) Choosing an answer strategy
3) Community involvement in sampling, analysis (if possible), and interpretation of results
4) Think ahead about what different test results will mean to your community

Section One, Working with a Science Advisor begins:

*The ideal way to plan how to look for answers to your questions is to have someone who knows about different ways of looking for answers to meet with people in your community. This may be hard to do because your community may not have money to pay for someone to come. We hope that our mini-grant program will help pay for a science advisor to come to your community.*

*A science advisor is a person who can help you choose a strategy for looking for answers. It may be that it is possible to look for quick answers. If not, then a science advisor can help you plan a pilot study.*

*The best science advisor for your community depends on the questions you have. We'll try to help you find one.*

To help the science advisor and the community to work together to refine the tribe's question, the Guide offered six different research strategies:

1) Finding out what caused an individual animal, fish, or plant to be sick or die.

2) Finding out why many of the same type of animal, fish, or plant seem to be getting sick or dying and may not be safe to eat.

3) Testing only for contaminants in an animal, fish, or plant that looks healthy but may not be safe to eat.

4) Testing for contaminants from local sites in the water or soil.

5) Learning more about causes of sickness in people.

6) Testing for contaminants in people

Each of these research strategies is linked to further information about the strategy. The Guide then identifies how the community can participate:

- Starting with your concerns
- Choosing a science advisor
- Deciding on a research strategy or community action
- Collecting samples
- Understanding what happens in labs
- Interpreting the results of tests

Finally, the *Getting Ready Two* section concludes with a discussion titled, "Thinking Ahead About Results". The text reads:

*Nowadays testing equipment is so sensitive that it is likely to find some amount of whatever contaminant you test for.*

*If your community doesn't think ahead about what amount of a contaminant is high enough to be of concern, then people are bound to worry about any result you get.*

*It would be great if there was some magic number below which we could be sure that each contaminant is safe. The federal government does publish guidelines (see the pages under "Contaminants"), but these guidelines don't take into account the cultural and nutritional values of eating Native foods.*

*We suggest that you work with a science advisor to consider how many times a week (or a month) people would like to eat the Native food you are concerned about.*

*Say, for example, you are concerned about eating livers of caribou. How many times would people in your community like to eat caribou livers? The answer may be different for people who really like caribou livers! If so, give us a number of times for them as well.*

*If you do this before you get results, it will be easier to interpret the results in a way that benefits your community.*

*At this point, your science advisor will have enough information from your community to draft up a project plan. To look ahead at what such a plan will have in it, please go to "Quality Assurance Project Plan*

### *Preparing a Quality Assurance Project Plan*

Obtaining EPA approval of a Quality Assurance Project Plan is reputedly a time consuming and often frustrating process. The team was shocked to discover that the mini-grants would be subject to EPA quality assurance guidelines. The team was determined, however, to establish the precedent that it could work with tribes and EPA quality assurance staff to expeditiously develop approved quality assurance project plans for each mini-grant involving testing. This, in fact, was our experience.

#### Quality Assurance Project Plan Outline

The Resource Guide includes a downloadable Word template for a quality assurance project plan, an interactive version of the following quality assurance plan outline, and a sample approved quality assurance project plan for Aleknagik:

*1.0 PROJECT MANAGEMENT*

*1.1 Title and Approval Page*
*1.2 Table of Contents*
*1.3 Distribution List*
*1.4 Project/Task Organization*
*1.5 Problem Definition/Background*
*1.6 Project/Task Description and Schedule*
*1.7 Quality Objectives and Criteria for Measurement Data*
*1.8 Special Training Requirements/Certification*
*1.9 Documentation and Records*

*2.0 MEASUREMENT / DATA ACQUISITION*

*2.1 Sampling Process Design (Experimental Design)*
*2.2 Sampling Methods Requirements*
*2.3 Sample Handling and Custody Requirements*
*2.4 Analytical Methods Requirements*

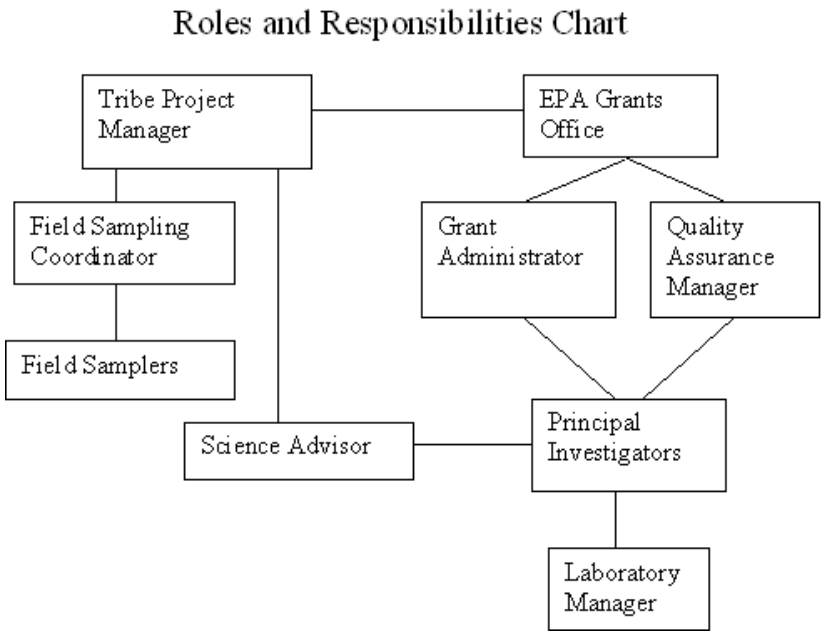
*2.5 Quality Control Requirements*
*2.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements*
*2.7 Instrument Calibration and Frequency*
*2.8 Inspection/Acceptance Requirements for Supplies and Consumables*
*2.9 Data Acquisition Requirements (Non-direct Measurements)*
*2.10 Data Management*

*3.0 ASSESSMENT / OVERSIGHT*
*3.1 Assessments and Response Actions*
*3.2 Reports to Management*

*4.0 DATA VALIDATION AND USABILITY*
*4.1 Data Review, Validation, and Verification Requirements*
*4.2 Validation and Verification Methods*
*4.3 Reconciliation with User Requirements*

### Interactive Help by Outline Element

Clicking on each element of the outline takes the user to an explanation of the contents of the element and information intended to help the user complete that element of the project plan. For example, it offers the following example for organization of a mini-grant team:




### Project Definition

The Resource Guide is written in the context of knowing that each mini-grant is only $5,000-$10,000. Under project definition, the Guide suggests:

*Given the scale of the mini-grants, we think that the appropriate problem definition is, "Is there evidence of specific contaminants in the 5 (or other small number of samples) animals, fish or plants sampled?"*

*The mini-grants are not appropriate for estimating levels of contaminants in animal, fish, or plant populations. They are also not appropriate for risk assessments. Rather, they are best viewed as Pilot Studies that are a first step in addressing a community's concern about maintaining the health of their environment. The community can use the results of pilot studies to decide whether they think further study is warranted.*

### Data Quality Objectives

EPA's Quality Assurance guidelines are written with regulatory enforcement actions in mind. Most EPA-sponsored testing is intended to provide legal evidence, and as such, involves large-scale testing programs. The same concepts of quality assurance, however, apply to pilot projects like the mini-grants. They are just applied differently. Here is how the Resource Guide introduces the concepts of data quality objectives:

*The mini-grants are small and it is a complex problem to understand the causes of concerns. This means that the data collected under each mini-grant will not be able to completely answer a community's concern. Rather, the goal is for the community to collect information useful to a decision of whether the community wants to make the effort to do a full-scale testing study.*

*Our data quality objectives are focused on ensuring that we obtain accurate assessments of whether specific contaminants are observed in the 5 (or other small number of samples) animals, fish or plants sampled.*

*In addition, we would like Native communities to think about how data from larger samples that are representative of animal, fish, or plant populations can be used to answer concerns raised by communities.*

*Community projects are likely to generate localized samples that do not lend themselves to the quality control practices recommended for long range environmental monitoring programs. We will work with laboratories with an established ability to provide adequate quality control and adhere to established standard operating procedures to ensure reliable data. Data must be of sufficient quality that the analysis will stand on its own merit*

*We want to take into account the following indicators of data quality:*

- *Selection of target compounds*
- *Precision*
- *Accuracy*
- *Representativeness*
- *Completeness*
- *Comparability*
- *Range of Measurement*

Under Selection of Target Compounds, the Guide continues:

*We want to be sure that we are testing contaminants potentially related to the community's concern.*

*We are building on the accumulated knowledge of the Canadian Northern Contaminants Program, the Arctic Monitoring and Assessment Program, the International Arctic Seas Assessment Project, and the results of our own project workshop to apply Canadian research results to Alaska (see Research Summaries).*

*This knowledge provides hypotheses about potential sources of contaminants from long-range transport, local man-made sources, and natural sources.*

***Reasons for Selection of Target Compounds***
*The community and the science advisor work together to identify possible sources of contaminants. Possible sources may be distant, as in the case of long-range transport of persistent organic pollutants through the atmosphere, or local, as in the case of a sunken barge. The community may be concerned about a multiple sources, both local and distant.*

*Identification of possible sources can help in the selection of target compounds. Concerns about a sunken fuel barge, for example, may lead to selection of petroleum-related compounds such as PAH's.*

*Closely related to the selection of target compounds is the selection of the type of material to be tested, often called by laboratories "the matrix". Consider a community that is concerned about the safety of eating fish caught in a river downstream from a sunken fuel barge. Materials that they might choose to test include:*

- *Sediments around the barge*
- *Water from the river downstream from the barge*
- *The meat of fish from the river*
- *The liver of fish from the river*
- *Meat of fish from the river prepared the way people often eat it*
- *Blood of people who eat the fish*

*The decision on what material to test depends on how the community wants to approach their concern.*

***Target Compounds***
*There are often many different compounds under the same category of contaminant. The following information may help in selection of the specific compounds ("analytes") to be tested. Long-range transport of stable compounds extensively used in the past in temperate regions coupled with concentration of compounds up the food chain and consumption of predators by humans means that compounds no longer used in Alaska like PCBs, DDT, and Toxaphene are of potential concern. Based on the work of the Canadian Northern Contaminants Program, the following specific analytes are of primary concern. We suggest a two-tiered approach with all or most of the following in tier one:*

*1.1. Chlordanes: alpha-chlordane, gamma-chlordane, cis-nonachlor, trans-nonachlor and nonachlor III, heptachlor epoxide*

*1.2. DDT compounds: p,p'-DDT, p,p'-DDE and p,p'-DDD*

*1.3. PCB congeners: 17, 18, 28, 31, 33, 44, 49, 52, 66, 70, 74, 82, 87, 95, 99, 101/90, 105, 110, 118, 128, 138/163/164, 149, 151, 153/132, 156, 158, 170/190, 171, 177, 180, 183, 187/159/182, 191, 194, 195, 199, 205, 206, 208, 209*

*1.4. Hexachlorobenzene (HCB)*

*1.5. Toxaphenes: 2 congeners, an octachlorotoxaphene and a nonachlorotoxaphene*

*There are additional persistent organic pollutants of potential concern. A second tier of analysis would be required:*

*a-HCH, ß-HCH, lindane, aldrin, dieldrin, endosulfan I & II & sulfate, atrazine, chlorpyrifos, pentachloranisole, polybrominated diphenyl ethers, polychlorinated diphenyl ethers, TCPM, TCPMOH, PCB sulfones, dioxins and dibenzofurans and dioxin-like PCBs.*

*Also of potential concern are atmospheric transport of industrial heavy metals from Russia and China and current use pesticides that may not degrade as rapidly as expected.*

*Local sites (e.g. abandoned military sites and mines) may be a source of PCBs, aromatic hydrocarbons, and heavy metals. There also may be local site use of industrial chemicals like toxaphene and defoliants.*

*Natural sources of cadmium, mercury, polonium-210, potassium-40 and lead-210 are also of potential concern.*

*We will recommend sets of contaminants (called analytes by laboratories) for testing based on whether tribes are concerned about:*

- *Contaminants from long-range atmospheric transport*
- *Contaminants from mines, military sites, dumps, or other industrial sites (local or in the range of migratory species)*
- *Contaminants from natural sources, including biotoxins (e.g. toxins that accumulate in shellfish and fish as the result of some algal blooms)*

### Measurement and Data Acquisition

The small size of the mini-grants means that it was not possible for communities to attempt to test enough samples to describe contaminant levels in an entire population or even to describe contaminant levels in the subpopulation of individuals normally harvested.

In consultation with the Canadian Centre for Indigenous Peoples' Nutrition and the Environment (CINE), the team instead advised communities to propose projects which screened a small set of samples for contaminant levels that were of concern. Animals (fish or plants) normally harvested were targeted for samples. Sample sizes for individual projects were in the range of 5-20.

The approach used by CINE is to observe the range of contaminant levels among the 5-20 samples. They expect to observe a two- to three-fold variation among the samples. Using the highest observed level, they calculate the tolerable daily intake of the food source. Taking into account the 10-100 safety factor built into consumption guidelines, they flag results of potential concern if actual consumption is at least 10 times the calculated tolerable daily intake. A decision is then made whether a larger sample would help clarify if the food source poses a significant risk to the community.

One of the trickiest challenges in the mini-grants is to provide for sufficient direct contact between the science advisor and the tribe. Minimally, the team wanted the science advisor to go to the community at the start of the project to refine the tribe's question and plan the research strategy, and again at the end of the project to help the tribe interpret research results. With airfares from Anchorage to a village easily $600, it was not feasible to add to these two trips a third trip to train samplers.

We drew on the experience of Dr. Laurie Chan of CINE. Dr. Chan has had extensive experience working with aboriginal communities on pilot studies. He and his lab team have developed sampling procedures that are easy to learn and follow, yet do not jeopardize the value of the samples taken. CINE's approach for metals sampling, for example, is as follows:

**Food and Metal Analysis**

1) Freshly caught fish should be wiped dry with tissue (kimwipe) and placed in labeled sampling bags (high density polyethylene bags).
2) Raw meat and organ samples should be taken from freshly slaughtered or killed animals.
3) Use glass, plastic or stainless steel utensils for food preparation.
4) Label each bag or package with:
    i) name of species
    ii) sample number
5) For each sample fill out a data sheet as completely as possible at the time of harvest.
6) Remove as much air as possible from the sample bags before sealing them.
7) Place labeled samples in an insulated cooler with ice or ice packs, and freeze as soon as possible (i.e. within 5 to 10 hours).
8) Ship frozen samples to the CINE Lab as soon as possible.

The Resource Guide provided tribes with forms to document each step of sample handling:

- Individual Form
- Sample Form
- Sample Container Label
- Chain of Custody Form

## *Implementing and Tracking Grants ("Making It Work")*

Unlike many large scale testing projects where the testing laboratory is selected through requests for proposals, in this project several laboratories were integral to the design and implementation of the testing program. A major focus of the team's activities in the

Resource Guide grant was to identify laboratory resources that could meet the needs of Tribes in Alaska. Following consultations with a number of experts, the team decided that the National Institute of Standards and Technology Marine Mammal Quality Assurance Program and the US Fish and Wildlife Service Patuxent Laboratory offer two ongoing methods of identifying laboratories that meet rigorous standards for testing of the types most likely sought by tribes in Alaska. The team visited the NIST and USFWS laboratories and established ongoing relationships with both labs. The team photographed and voice recorded NIST staff to construct a tour of the NIST facility. This tour is accessible via the web through the Resource Guide (see “Making it Work” and chose “Working with Laboratories”.

The team also identified the Canadian Northern Contaminants Program and specifically the Canadian Centre for Indigenous Peoples' Nutrition and the Environment (CINE) as useful models for a program involving laboratory testing in Alaska. The team visited the Centre for Indigenous Peoples’ Nutrition and Environment laboratory in Montreal to establish an ongoing working relationship. The team also prepared a tour of the CINE facility, again accessible through the Resource Guide.

Through these relationships the team identified several laboratories with demonstrated excellence and experience in testing target compounds in matrices (tissues) of concern to tribes in Alaska. These laboratories include: The National Marine Fisheries Service Environmental Conservation Division Laboratory in Seattle, AXYS Analytical Services in Sidney British Columbia, Research Triangle Metals Lab in North Carolina, and the EPA Region 10 laboratory in Manchester, Washington. The team visited all these laboratories and prepared virtual laboratory tours for the NMFS and AXYS laboratories accessible through the Resource Guide.

### Community Discussion of Results

If the approach worked as planned in the Resource Guide, the community would be in the driver's seat from the start of the project. The community would decide on the most important questions or actions to take. The community would choose a research strategy. The community would think ahead about the meaning of different test results, and it would choose how much it wants to participate in the research done or actions taken. The community would approve a project plan, and would choose what laboratory to work with.

If all these things take place, then the community discussion of results would naturally flow from the entire process. The science advisor and the community would review the results together knowing what questions the results are meant to address.

This approach builds on work in Canada - to be able to talk about contaminants in terms that we all can understand. The discussion of results starts with estimates of "tolerable daily intake" of each type of contaminant for a person of a given weight (see worksheet example below). Then, based on the measured amount of contaminants in Native foods, we estimate the amount of a Native food that falls within the tolerable daily intake of the contaminant.

**Calculation of the amount of food that can be consumed daily by individual, as a function of their weight and the concentration of contaminants in the food.**

| | lbs | Kg | Formula |
|---|---|---|---|
| Person's weight | 155 | 70 | [weight (kg) = weight (lbs)/2.2 kg/lb] |
| Contaminant | Allowable daily intake (ADI) (µg/kg body wt per day) | Allowable daily dose (µg per day) for person with weight shown above | Formula |
| ∑DDTs | 20.0 | 1409 | ADI (µg/kg b.w. per day) x person's weight (kg) |
| ∑PCBs | 1.0 | 70 | |
| HCB | 0.27 | 19 | |
| ∑Chlordanes | 0.05 | 4 | |
| Dieldrin | 0.10 | 7 | |
| Mirex | 0.07 | 5 | |
| Contaminant | Concentration µg/kg (ppb) | Amount of food (g) that can be consumed daily by person of weight shown above | Formula |
| ∑DDTs | 450 | 3131 | allowable daily dose (µg per day) x 1000g/kg / contaminant conc (µg/kg) |
| ∑PCBs | 970 | 73 | |
| HCB | 350 | 54 | |
| ∑Chlordanes | 340 | 10 | |
| Dieldrin | 160 | 44 | |
| Mirex | 10 | 493 | |

## Synthesis of Traditional- and Science- Based Knowledge

Development of the Alaska Traditional Knowledge and Native Foods Database, and the Resource Guide represented the first two steps in bringing traditional- and science-based knowledge together. Both these steps were grounded on discussions with scientists and Native knowledge specialists.

### *AAAS Review*

Following the first round of regional meetings intended to develop a traditional knowledge base and following the Workshop on Uptake and Effects of contaminants, the team met with about 50 scientists at the 1999 Arctic Science Conference in Denali Park to present a summary of Native knowledge about environmental change, and to review a draft summary of science knowledge about contaminants in Alaska.

### *Native Knowledge Specialist Review*

The team followed the 1999 AAAS conference review by scientists with reviews of Native concerns voiced at all the regional meetings and of the Alaska Traditional Knowledge and Native Foods Database by Native specialists in traditional knowledge from western, southeast, interior, northwest, and arctic at three meetings held February 23-25 in Cordova, and April 6-7 and 10-11 in Anchorage Alaska. The presentation given at the AAAS conference and regional meeting is entitled “1999 Denali AAAS Review” in the folder *Synthesis of Traditional and Science Knowledge* on CD Number One. An expanded presentation used in the regional synthesis meetings, “2000 Cordova Synthesis Meeting” is in the same folder.

### *Native Knowledge Specialist – Scientist Synthesis Meeting*

Up through 2000, the project team anticipated two outcomes from the synthesis of traditional- and science based- knowledge: a consensus action agenda, and an integrated approach to helping tribes address their concerns about environmental change. With these two objectives in mind, the team invited a small group of scientists and Native knowledge specialists to meet September 19-21 in Girdwood Alaska. The following people participated: Jim Berner , Lianna Jack, Anne Lanier , Anne Walker, Richard Glenn, Todd O'Hara, Carla Willetto, Tauni Rogers, Monica Riedel, Molly Chythlook, Vera Alexander , John Blake, Oscar Kawagley, Gabe Sam, Orville Huntington, Dolly Garza, Caleb Pungowiyi , Charlie Johnson, Jack Lorrigan, Paul Erhart, Elaine Abraham, Jim Schumacher , Doris Cook , Stephanie Pfirman , Laurie Chan , Paul Becker, Peggy Krahn, Fran Stefan, Jack Kruse, Patricia Cochran, Gregory Nothstine, Mary Killorin, Amy Craver, and John Butzke.

In preparing for the Girdwood Synthesis Meeting, the project team noted the following themes in the concerns voiced in the regional meetings:

- Widespread observations of abnormalities in animals, fish, and plants.
- Concerns about increasing cancers and other diseases among Alaska Native people
- Persistent organic pollutants, heavy metals, and radionuclides in animals, fish, and plants eaten by Alaska Natives. Changes in the number or condition of animals, fish, or plants
- Changes in weather and climate
- Recognition of the importance of culture and spirituality
- Other changes affecting the lives of Alaska Natives including change in diet, commercial fish harvests, smoking, tourism, sport hunting and fishing

The team asked participants to consider how these themes might be related. For example:

- What do climate change and contaminants have to do with abnormalities in salmon?
- What do persistent organic pollutants contained in beluga, tobacco use, and diet have to do with diseases in people?
- Are people's spiritual connection with the land and animals affected by abnormalities in caribou?

These questions touched off a lively discussion. At the root of the discussion was a disconnect between the questions we (both tribes and scientists) would like to answer and the questions we might hope to even address. While we keenly want to know if contaminants have anything to do with observed abnormalities in animals, for example, it is extremely difficult to answer this question. It is certainly not possible to answer this question in a pilot study.

To further focus our discussion, we reviewed the substantial progress made in the Canadian Northern Contaminants Program. At the time of the Girdwood meeting over $25 million dollars had been spent on a collaborative effort over seven years of scientists, government staff, and aboriginal people on investigations of sources and pathways of contaminants, ecosystem health, human health, and communications. Members of our own project team attended information synthesis meetings for the Canadian Northern Contaminants Program and were impressed by the degree to which scientists and aboriginal communities worked together.

What was also impressive is that there were no easy answers forthcoming from this major effort. As noted in the Canadian Arctic Contaminants Assessment Report,

> *Perception of risk in the Arctic, as in many countries, differs between the public and experts. The predominant effect of inaccurate perception of risk is uncertainty and anxiety often leading to virtual cessation of country food consumption. In many cases, this seems to be related to a lack of straight-forward and credible information about toxicity and safe levels.*[3]

We noted changes made in the Canadian Northern Contaminants program addressing these concerns:

1. The budget for communications was increased to 20 percent of the entire program.
2. All project proposals had to identify an aboriginal partner
3. Each project had to identify how results will be communicated back to community
4. Regional risk management groups were established including a wildlife biologist, and aboriginal leaders. These groups decided how to interpret research and local knowledge and relay it back to the community.
5. The risk management group also learned community questions and suggested research programs to address questions.

[3] J. Jensen, K. Adare, R. Shearer (editors). 1997. Canadian Arctic Contaminants Assessment Report, Department of Indian Affairs and Northern Development, 10 Wellington, 6th Floor, Ottawa, Ont. K1A 0H4.

6. It was recognized that not all questions lend themselves to research; funds were reserved for other types of “service work” that don’t produce data.
7. Core aboriginal organizations working together was recognized as critical to success of program.
8. Continuity of core group of people helped to build ability to work together.
9. A lot of times there is no one message that comes from the data; it is still necessary to come up with a consensus message.

The Girdwood synthesis group concluded that in this project, we are operating at a pilot scale, and should not lose sight of the overall project objective of increasing the capacity of tribes to address their own concerns and of increasing trust. We left the objective of creating a consensus agenda for action to activities outside the project itself. A major example of this has been the long-standing participation of Patricia Cochran in an effort by the federal and state governments and Alaska tribes to come up with a joint proposal to Congress for a program addressing Native concerns about the safety of eating Native foods. We should note that the conclusions of our project workshop on uptake and effects of contaminants were adopted by this ad hoc group.

The Girdwood synthesis group turned its attention to how best to help tribes begin to address their concerns in pilot studies. The group reviewed an initial draft of the Resource Guide. There were three substantial decisions made by the group:

1. The consensus of the group was to change the Guide to treat separately a tribes’ interest in getting a diagnosis for a single sick animal, and a testing program for contaminants.
2. The Guide would incorporate CINE’s three-tier model for addressing the concerns of tribes: quick answers, pilot studies, and research studies. The mini-grants would be designed as pilot studies. Tribes could use the results to help decide if a larger research study is warranted.
3. The group agreed on an approach to working with tribes:
    a. Pilot studies should be community-directed, community-based, and endorsed by the community. A member of the community is the principal investigator.
    b. Communities should be encouraged to be fully involved in all aspects of the pilot study. This includes planning, implementing, and conducting the research, and interpreting the results
    c. Communities should be involved in presenting information and should feel an ownership of the results of actions taken in the pilot study.
    d. Possible actions taken in the mini-grants include diagnosis, observation, research, mitigation, and prevention
    e. Communities accept the responsibility to honor the intent of the action and not to bias it in their interests. To help in this, communities will work within guidelines for ethical research.
    f. Spirituality should be part of each mini-grant from the beginning and throughout. Researchers need to respect Native spirituality even if they can never understand it.
    g. Education and communication work both ways – communities, including youth, and researchers

The Girdwood group extensively discussed the merits of including concerns about human cancers and other diseases within the scope of possible mini-grants. People’s

concerns about changes in the environment are two-fold: adverse effects to the environment itself are of concern and adverse consequences for people are also of concern. While the group wanted to honor the holistic way of thinking of tribes, the challenges of adequately addressing concerns about human health in pilot studies were seen as enormous. In the end, the group decided that we should keep human health within the scope of concerns relevant to the mini-grants, but that we should work with tribes to encourage them to postpone questions involving human testing until larger studies could be conducted.

Concerning the value of pilot studies, the group thought that it is possible for tribes to see pilot study results in the context of working toward long term answers that would benefit "the seventh generation". At the same time, the pilot studies would have to be sufficient to for "food for thought" along the way. Based on CINE's experience, a workable scale for a pilot study could be 5-20 samples. One would expect a two- to three-fold variation in contaminant levels in this set of samples. One could use the highest observed value as an indicator of whether a larger study were warranted. There are two powerpoint presentations relevant to the Girdwood Synthesis Meeting: "2000 Girdwood Synthesis Meeting Briefing.ppt" and "2000 Girdwood Outcomes". Both are contained in the *Synthesis of Traditional and Science Knowledge* folder of CD Number One.

### *Alaska Native Science Commission Review*

The Girdwood meeting held in September 2000 was seminal in refining our approach to the Resource Guide and to the mini-grants. In November of 2000, the team met with the Alaska Native Science Commission to review plans for the mini-grant program and the Resource Guide. The consensus was:

1. The mini-grants program is intended to provide individual communities or groups of communities an opportunity to begin to act on their own priorities.
2. We hope that this mini-grant program will be the start of a larger program in Alaska.
3. The role of the Resource Guide is to help Alaska Native communities to participate in a mini-grant program funded by the US Environmental Protection Agency and administered by the Alaska Native Science Commission.
4. The Guide is also intended to provide information that may address concerns of Alaska Native communities about maintaining the quality of subsistence foods and the environment.
5. Mini-grants:
    a. Would address concerns about maintaining the quality of subsistence foods and resources and would be related to topics raised in regional meetings
    b. Would be small projects that may help assess need for large projects
    c. Could include actions to reduce problem and prevention

In deciding the number of mini-grants to award, the ANSC considered the following factors:

1. Setting precedents for future program
2. How much do we work with tribes to define and carry out project – esp. travel costs
3. Coverage of tribe personnel & overhead costs

4. Payment for sample collection
5. Sample sizes in testing projects
6. Pathology and/or contaminant testing/diagnosis
7. Role/costs of science advisors
8. Cost of quality assurance manager
9. Cost of administering grants

Concerning the level of interaction with the tribes, the ANSC decided:

1. Tribes would think through their own concerns, causes, questions, possible results, and degree of community involvement. Each of these issues are important to success of the project.
2. Projects involving testing will require an EPA-approved quality assurance project plan that the team will need to draft and discuss with the tribe.
3. Person-to-person discussion of research results is critical to the success of the project.

The ANSC considered whether the mini-grants should cover salary costs for the tribe, or whether the tribe should be asked to pay for these costs?

1. To be successful, projects will need substantial local investment of time (at least 3 months or $15,000; see Project Manager job description)
2. As an example of a project mainly targeting personnel costs: EPA GAP grants of $95,000 per year including related costs (but no testing – as of 2000, this later changed).
3. Tribes could partner mini-grants with GAP, NIEHS, or other grants
4. Mini-grants should cover at least some salary costs for the tribe

Concerning payment of samplers:

1. The type of animal collected is relevant to this question: apparently healthy animals harvested for food versus stranded, apparently sick or dead animals
2. Animals sampled at multiple locations involve higher costs
3. CINE projects pay the hunter or gatherer $20/sample
4. In an Alaska example, the Sea Otter Commission budgets $75-100 boat/$75-100 person per day + costs of gas and oil

Concerning sample size:

1. Statistical samples would involve 50-250 samples of different age groups @ $400-$1,000/sample for testing, well beyond the feasible scope for a mini-grant
2. Samples sufficient to describe the variability in a population: 20-100, again beyond the scope of mini-grant.
3. To screen for a possible concern, the CINE approach is to initially analyze five sample, selecting individuals who are typical as a food source. Expect differences in contaminant levels of 2-3 times among samples. Use the high estimate to compare with “tolerable daily intake”. The level triggering concern would be 10 times the tolerable daily intake, based on the 10-100 fold safety factor usually built into TDI values. The results would be used to decide on additional samples.

Concerning pathology versus testing:

1. Largest number of concerns raised in regional meetings are about abnormalities
2. Contaminants are only one of many possible causes of abnormalities

3. Most abnormalities have known (direct) causes and concerns could be answered quickly – the focus could be on observing changes in prevalence
4. Testing for immune system effects of contaminants would require large projects and/or accumulation of small project results over a long period
5. But we should defer to tribes in the selection of the research strategy

Concerning the role and cost of science advisors:

1. CINE approach: focus primarily on small research projects. Laboratory faculty serve as science advisors.
2. CINE received $1million/yr from the Canadian Northern Contaminants Program to support all phases of research, including science advice.
3. Scope of projects is important to selection of science advisors
4. Amount we work with tribes has a direct implication for role/cost of science advisors

Concerning the role and cost of a quality assurance project manager:

1. Projects involving testing require an EPA-approved Quality Assurance Project Plan.
2. This plan must identify who will serve as the Quality Assurance Manager.
3. This position requires someone with special training not currently funded in this project.
4. EPA QA staff will ultimately have to approve project results

Finally, concerning administrative costs for the mini-grant program:

1. We budgeted for grant administration for the project generally
2. We did not anticipate the level of effort required to meet EPA requirements
3. We are being deliberately cautious about initiating a program that will set precedents
4. We need to revise our expectations for grant administration costs

The above detailed summary is intended to show how engaged the Alaska Native Science Commission has been in the design and implementation of the mini-grant program and in the design of the Resource Guide. This November 2000 meeting of the ANSC established the operating principles for the mini-grant program. The powerpoint summary of this meeting is contained in the file “2000 Mini-grant Program Briefing to the ANSC.ppt” located in the *Synthesis of Traditional and Science Knowledge* folder of CD Number One

# Lessons Learned: Strategies for Improving Participant Research in Alaska Native Communities

## *Introduction and Background*

The Alaska Native Science Commission (ANSC) received grant funds from EPA and other sources to develop a program for participant research on contaminants in Alaska Native traditional foods. The ANSC contracted with Larry Merculieff in April 2003 to serve as the project science advisor. Jack Kruse, professor emeritus from the University of Alaska; Laurie Chan, assistant professor for the Center of Indigenous Nutrition and Environment at the University of Montreal, Canada; Peggy Krahn and Don Brown with NOAA Labs in Seattle; Patricia Cochran, Executive Director of ANSC, and Larry Merculieff, Science Advisor, served as the primary team leaders on the project.

After a process where grantees were selected by a Tribal Review Panel to participate in the project, the science advisor initiated contact with all ten local project coordinators, by phone and on-site visits, to finalize the priority lists of what traditional foods were to be analyzed in the labs for contaminants, and to complete the project agreements and budgets. Once the agreements between the ANSC and the tribes were executed and budgets finalized, the local project coordinators were given the go-ahead to proceed in the late spring of 2003. (The actual process from project initiation to completion is described in the previous sections of this report.)

**The principal duties and tasks of the science advisor included:**

- Conducting on-site visits with the tribal grantees in the villages to assist the tribe in identifying and prioritizing what traditional food species would be sampled and analyzed for contaminants, meeting with tribal officials and residents to discuss the project and local concerns, conducting on-site training of designated samplers and community coordinator, securing project agreements, and finalizing the grantee budget.
- While on-site, conduct field observations of possible point source pollutants that may or may not have been identified by the grantee as a source of concern.
- Coordinating with program advisors on identifying the contaminants to be assessed at the labs, determining the sampling and lab protocols, and development of the Quality Assurance Plan for each community.
- Maintaining liaison with community coordinators.
- Arranging purchase and shipment of sampling supplies to the grantees.
- Arranging receipt and re-shipment of samples to the labs.
- Coordinating with the labs on analysis of traditional food samples.
- Assisting in the assessment of lab results and the reporting of these results to the grantees.
- Assisting grantees to determine best course of actions as follow-up, including the transmission of results to the community residents.
- Providing status reports to the ANSC executive director and others.
- Developing the project final report.

### *The Challenges*

The project involved a number of challenges during the course of this effort. Since participant research is relatively new in Alaska, and certainly new to most of the communities involved in this project, and given that there are unique cultural and sociological aspects to each community, there were a number of unanticipated situations that had to be dealt with by the science advisor and the affected communities. Detailed below are some of the more significant issues that arose during the course of the project.

#### Communication Issues: Technologies and other circumstances

All selected tribes, with two exceptions, are located in small villages with limited telecommunications capabilities and very limited number of staff in the tribal offices. In most cases, communities have a few long-distance lines available to the entire community. In every case, electronic mail is very slow, making e-mail use an arduous task for most communities. For example, in Eek, the science advisor watched as the local project coordinator made four attempts to sign onto the Internet to send an e-mail. The process took about twenty-five minutes. Downloading information may take longer.

All tribes can and do receive faxes with relative ease, and have at least one telephone line to the tribal office. Frequently, the tribal office phone was busy when called and required more than one attempt to call in. In all, telephonic contact required an average of three attempts per "event" before reaching someone. The individual to be contacted may or may not be in the office. In most cases, when a message was either placed on the tribal message machine or with someone in the office, the individual usually did not return the call the same day. When the local field coordinator is also harvesting their own fish at fish camp, the call may not be returned for several days. If the issue was important enough, the science advisor would follow-up the phone call with a fax.

#### Communication Issues: Cultural and other

Communication challenges, when English is used, are more pronounced if the majority of the people in any given community use predominantly the language of their respective cultures. Each community has its own idiosyncrasies regardless of whether or not a majority of community residents speak their own language. For example, individuals in Yupik speaking communities, tied to a seasonal sense of time and cultural protocols, will speak slowly in English, and conversations where responses to questions or issues are required will take more time as responses are culturally required to be thoughtful. Outsiders who have no cultural grounding may tend to "speak over" someone from a community who is pondering answers to a question or issue, because the outsider generally tends to try to "fill in" what is mis-perceived to be conversation vacuums. Frequently the outsider may use terms in their conversations that are not generally used in the community, and therefore verbal or written communications may not be properly understood. This can be compounded when the communications require translation into the local language.

In the context of this specific project, written communications alone were insufficient to relay critical information. Additionally, faxed communications sometimes did not reach

the intended parties. When followed up by telephonic communications, the faxed materials were sometimes not available because either they were misplaced, or someone received the fax and did not make copies for all key personnel.

On occasion, the selected samplers may not communicate with the local project coordinator either because they are out at the fish or hunting camps, or the samplers (all who are usually engaged in subsistence gathering activities) may leave early in the morning before the tribal office opens, and return after the tribal office closes. In such cases, the local coordinator may not know what progress is being made in collecting samples and therefore cannot inform the Science Advisor whether or not the project is on track. This required direct contact with samplers as well as project coordinators.

### Tribal Staff Workloads

Many challenges faced in the course of this project can be attributed to the fact that tribal office personnel have too many issues/tasks/projects they must tend to, particularly in the summer months. Tribal office workloads may increase in the summer months while staffs decrease their time in the office due to summer subsistence activities. If there are any construction projects scheduled in the village, they will occur in the short summer construction season. Additionally, most tribal projects requiring field work, fish and wildlife sampling, water quality testing, running traditional camps for youth, or construction must take place in the very short summer season. Compounding the tribal workloads, most federal and state agencies involved in community projects send their officials or staff to the villages during the summer and early fall. Many of these visitors require tribal staff time or organizing and conducting council and community meetings. If the community is along or near a river or tributary, summer activities are conducted around the salmon seasons that begin in May and end in August. Obviously, the smaller the community, the larger the challenges in terms of staffing projects. Most small communities are deluged with summer activities and staff spread quite thin.

### Time Issues: The Tribal Council

Most sampling projects did not begin until June, even though the ANSC contacted the communities in late March of the year, even though fish camps begin or are in full operation by mid-May. This project required several council actions, including approval of the priority list of species to be sampled, the grant agreement between the ANSC and the tribe, and the project budget. All tribes are governed by community councils, and many do not meet on any set schedule, and may meet only as adequate tribal business justifies a meeting. Tribal council members are likely engaged in fish camp preparations in April and are out at the camps in May until mid to late August, making council meetings difficult at best. Each council's process for approval of business items varies from community to community. In some cases, the tribal council allows poll voting to approve items outside of any regular council meeting; in others the tribal president or chair, or the tribal administrator may be authorized to sign agreements; or, it may be that no action can be taken until a full council meeting. In any case, none of the tribes engaged in this project were able to initiate their projects until June because of these factors.

### Time Issues: Decision-Making Response Time

Because of the myriad of issues the typical tribe must engage in, many tribal personnel are required to travel to regional centers and major Alaskan cities where business or training workshops are being conducted. Frequently, this involves the local project coordinators, tribal administrators, and/or presidents. Even if the key personnel are not traveling, many key tribal personnel are working half times in the summer, or simply take annual leave in order to engage in the all important subsistence and commercial fishing activities. When this occurs, decision-making is frequently delayed. Again, all tribes have their own unique circumstances that may cause delays in making key decisions, thus delaying the project implementation and completion.

### Time Issues: Cultural Considerations

Most villages where subsistence is important have a different sense of time and priorities than people in the cities because the community gauges time seasonally. Government and private companies conducting business with a community are frequently goal oriented and usually have time deadlines to work with, particularly if the project is grant funded, or construction is involved. Government and company personnel may not be aware of the limited tribal staffing and what the staff has to deal with on a daily basis. Frequently, when we asked local coordinators to respond to an inquiry or issue, or submit such things as the budget, resolution, or partnership agreements, it rarely is done in the time requested. Days, sometimes weeks, may pass before a response is received or action taken-- despite phone calls and faxes urging response. If one person is responsible to get something done, and if that person is unavailable because he/she is out at fish camp, taking annual leave, traveling, or is sick, the response or action needed is left until the person returns.

### Personnel Issues: Personnel Turnover, Political Changes, other

In at least three communities (out of ten selected participants), there were key personnel changes in mid-term of the project, resulting in lack of performance or inability to perform. In the course of two months, one organization changed their local project coordinator five times, resulting in delays until they concluded they could not perform. In another case, all tribal employees were suddenly laid off due to lack of funds, leaving tribal responsibilities to volunteer tribal council members who knew little or nothing of any projects their employees were engaged in. In yet another case, the local coordinator was terminated and no replacement was designated. In one case, the tribal staff wanted to hold on any implementation of the grant until after the tribal election because the entire council and key staff members were to be replaced. By the time the election was held and staff sorted out, the window for securing samples became very short, to the point that key personnel who left on vacation could not secure any samples.

In one village, the local coordinator became gravely ill and had to be taken into Anchorage for a major operation that required two months of recuperation. This situation was not communicated to the Science Advisor, nor was anyone else designated to replace the individual as the local coordinator. The science advisor attempted numerous phone calls, leaving phone messages on the tribal voice machine,

and faxes over the same two-month period with no response from either the individual's home or the tribal office. As a result, the summer fishing season ended before the science advisor discovered what had occurred, and samples had to be secured from individuals in the community. It was decided that it would be useful to conduct contaminant analyses on subsistence foods as they were actually prepared by the community residents.

### Use of Sampling Forms

None of the samplers or local coordinators of the selected tribes filled out all three sampling forms in the way they were instructed, despite oral and written instructions. In one case, it was necessary to reconstruct what was done to properly identify the specie in two-dozen sample bags. This situation required two weeks of communication efforts between the tribe involved, and the lab.

### Availability of Species

In three cases, availability of species became an issue. For example, the lab required a minimum of ten samples from each species, with each of the ten samples coming from a different animal or fish. One community was able to get only two bearded seals; one moose was taken the entire moose season in one community; and, in another community, the caribou were more than a day's boat ride away from the community in the wilderness, making it impossible to freeze the samples within the requisite 5 to 8 hours.

### Limited Human Resource Pool

Almost all participating tribes are located in relatively small communities where availability of workers (or, in this case, samplers) is very limited even when samplers are paid. If there are higher paying jobs (such as any construction work), it makes it very difficult to hire qualified individuals to properly secure samples. In some cases, the tribes are required to advertise for a minimum period of time, and after advertising, have unqualified applicants or no applicants. This situation may result in going past a particular season when the specie to be sampled has left the area.

### Shipment of Samples

The Science Commission arranged for purchase and shipment of coolers and ice-gel packs to each participating tribe to use when shipping samples. All samples arrived in relatively good condition, but once shipped from the village, it was necessary to pick up the samples at the Anchorage Airport to be rushed to a freezer. The process requires the tribe to pack the coolers at the last possible minute before they have to be received by the carrier for shipping. The amount of time the samples have to spend in the cooler varies considerably between villages due to such factors as: weather or flight schedule delays, cancellations from point of origin to regional hub, weather or flight schedule

delays from regional hub into Anchorage, variations in carrier requirements as to when items to be shipped have to be checked in. In at least two cases, the samples arrived partially thawed despite being packed thoroughly with gel ice packs. No village has access to dry ice.

### Number of Tribal Participants

The project required oversight of sampling efforts in 10 communities over a three to four month period. Each project required a community visit. In 2003, three of the initially selected tribes subsequently dropped out of the project for failure to implement sampling efforts. Each time a tribe drops out, additional time is required for the next rated recipient to be contacted. Following contact, it is necessary to conduct on-site visits to train local samplers, conduct field observations to identify possible local point sources of pollutants, meet with local officials to complete a project budget and agreement, and to identify priority species to be sampled. Given what occurred in 2003, the science advisor dealt with 13 communities. Obviously, the larger the number of participants, the higher the likelihood of some failing to perform. By the time a failure to perform is known, newly selected participants have little time to get trained and geared up before their summer season ends, or it forces a community to select a specie (that may have less priority) because it is available in the fall and early winter.

### Funds for Grantees

Most tribal operations are small, with small budgets, and tribes have limited funds to cover expenses. In almost all cases in 2003, tribes did not have sufficient funds to cover expenses during the actual sampling. Last minute arrangements had to be made to advance a portion of their project grant funds.

## *Strategies for the Future*

The following are suggested strategies to improve and/or address the challenges outlined above:

### General Strategies

1. Grantee Tribes should be selected and contacted at least four, preferably five months prior to the anticipated project start-up date. Since most communities begin preparations for summer subsistence activities by late April, the process of selecting tribes should begin no later than late fall or early winter. This will provide adequate time to work with the tribe on species to be assessed, budgets, and agreements before summer subsistence actually begins in the latter part of May and early June. Additionally, this provides the tribe adequate time to advertise and hire local samplers and project coordinators if the coordinator is not already on staff. This means that advertising for applicants and selection of the science advisor and program advisors must begin in at least a month before applicants are

solicited in order to review grantee selection criteria and go over advertising requirements.

2. The program must either: a) limit the number of tribes participating in any given year to the number that allows the science advisor to be present in each community when the first samples are taken (so that there is experiential training in collection of samples and filling out the necessary forms); or b) provide funds to allow hiring of an adequate number of assistants to conduct on-site visits when each community is initiating sampling, and for follow-up visits; or c) seasonally stagger the number of villages involved in active sampling. It is suggested, for example, that there is someone assigned to work with no more than three villages at any given time. It may be possible to increase the number of communities involved if each group of three communities requires sampling in different season. If the species to be harvested is salmon, for example, it is known that the sampling will occur in late May through mid-to-late August. Caribou in some locations are harvested in the late fall to early winter. Staggering the sampling in this way would be problematical as we will not know what species each applicant is asking be sampled.

3. Grantee selection criteria should take into account recommendations made in this report.

4. Funding program requirements should be as flexible as the agency regulations allow in order to accommodate the kinds of circumstances noted in this report.

5. A checklist of tribal responsibilities under the project should be created.

## Communications: Meetings, Telephone, Faxes, Written Materials

1. All written and faxed communications should be followed up by phone calls.

2. Written communications should be straightforward with little or no use of professional jargon unless it is important for the individual to understand a term or word. If jargon is used, it should be explained.

3. Where use of professional terms is required, they should be defined in writing and further explained orally.

4. Personal visits to the community must be conducted as soon as possible at the outset of the project because meeting face-to-face is considered important in every Alaska Native community.

5. If a telephone message is left either with a tribal staff member or message machine for someone, it is advisable to follow-up the message with a fax.

## Communications: Cultural and Other

1. Individuals who are unfamiliar with the cultures and communities should receive cultural orientations from personnel at the Alaska Native Science Commission, regional Alaska Native organizations, or some other appropriate group, and consider using a "go-between" who is familiar with the culture and/or village when visiting.

2. Sufficient time must be allocated in the planning phase of any project that **anticipates delays in response or action** in a village in all critical steps—particularly, in the busy summer seasons.

3. All written communications involving instructions for a project or requests for information must be followed up with phone calls and/or faxes to confirm receipt and to review the written communications to ensure that the information is understood.

4. When sending or faxing written information, the communiqué should ask that copies be provided to all key personnel. Copies should be sent to the Tribal Administrator if the communiqué was directed to tribal staff.

5. Project coordinators should anticipate the possibility that local samplers may not be able to communicate with the local coordinator during regular office hours. A local communications plan should be established at the outset of the project. For example, the local coordinator could leave a telephone message at the sampler's home or leave a written message at the home, and vice-versa. A contingency plan should be in place in case the local samplers
are not responding to requests for status reports for whatever reason.

## Tribal Staff Workloads and Turnovers: Mitigating Measures

1. Initial work involving tribal staff should take place before the rush of subsistence and summer activities if possible. Whatever the case, **granting agencies should make allowances for delays or grant extensions** as projects in the communities usually take longer than expected.

2. All tribes should be required to **designate alternate local coordinators** in the event that the primary coordinator becomes ill or cannot perform for whatever reason. The alternate should be fully briefed on the project at the outset.

3. Meeting and informing the tribal officials and council members of the need to follow-up and follow-through is important.

## Time Issues: The Tribal Council

1. If tribal council action is being asked to approve the project or make decisions on any aspect of the project, the requesting agency or individual should anticipate that it will take at least a month, perhaps two depending on the time of year action is requested. **During the summer months, at least**

**six weeks may be required for the tribal council to meet and act** unless there is a planned council meeting. During other times of the year, a minimum of a month for council action should be anticipated. The requesting agency or individual should inquire (well in advance of when council action is needed) as to the schedule of the tribal council and its decision-making processes; i.e., if poll votes are used, who can initiate a poll-vote, and under what conditions.

**Even under the best of circumstances, it should not be assumed that the Tribal council will meet as scheduled**. There may be any number of reasons why the council is not meeting as scheduled.

2. Whenever possible, key steps in the project process should be well outlined and discussed with the tribal administrator to determine what should be in a tribal resolution**. Potential problems should be anticipated and addressed in the resolution** if possible to minimize the number of times the council may be asked to make a decision.

3. Ideally, for projects expected to commence in the spring of any given year, requested meetings should be either in the late fall to early winter period when it is likely that the majority of the council members will be present.

## Use of Sampling Forms

1. When sending forms to communities for use in sampling projects, at least one set of forms should be filled out as examples, followed up by a phone call to review the forms. When in the village, a meeting should be called with the local project coordinator and the samplers to again review the proper way to fill out forms.

2. If at all possible, **forms should be simplified to the maximum extent** possible. The more information required, the greater the likelihood of error. Likewise, the number of forms used should be minimized.

## Availability of Species

1. The larger the animal to be harvested, the more difficult it is to get an adequate number of samples. For example, in one village, only one moose was taken. In another village, only three bearded seals were taken. In yet another, only two caribou were taken. Given that the number of animals depends on the availability of species, and success of the hunter, and the distance a hunter has to go to get the animal, **contingency plans should be established**. For example, if bearded seals are a high priority, **allow more time in the pr**oject. It may also be possible to secure samples from household freezers under the right circumstances. Alternative species should be identified and other options explored with the community.

## Limited Human Resource Pool

1. Given local competition for scarce community jobs and a limited human resource pool, funds for sampling projects should allow grantees to be competitive enough to ensure the hiring of qualified village samplers.

2. Grantee selection criteria should require information as to the availability of qualified personnel, and a schedule for advertising jobs if that is procedurally required by the tribe.

## Shipment of Samples

1. All village shipments must be shipped to Anchorage. Receivers must pick up samples immediately and samples taken to a freezer.

2. Samples must be repacked in Anchorage and shipped with dry ice.

3. Contingency plans must be outlined at the outset of any project to anticipate whether any other circumstances may delay a flight into or out of a community.

## Number of tribal participants

1. (See recommendations in #1 of this section)

2. At least five tribal applicants should be selected as alternates in the event a successful applicant is unable to perform on the grant.

## Funds for Grantees

**1.** As a standard procedure, tribes should be offered the opportunity to request partial payments under the grants to cover operational costs. Payments could be issued in thirds (1/3) with conditions established for payment of advances.