Health Consultation

Review and comment on the Purdue University Contaminant Migration Study and Human Health Risk Assessment for Subsistence Anglers using Cape Romanzof Adjacent Areas

CAPE ROMANZOF LONG RANGE RADAR SITE (LRRS)

YUKON-KUSKOKWIM DELTA NATIONAL WILDLIFE REFUGE, ALASKA

EPA FACILITY ID: AK9572728633

SEPTEMBER 21, 2010

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared By:

Site and Radiological Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

Summary

Introduction

Since the construction and operation of the Cape Romanzof Long Range Radar Site (LRRS) in the early 1950s, chemical contaminants have been released into the environment, prompting concerns from Alaska Native peoples about the impact on subsistence foods harvested in the area of the LRRS.

Dr. Hugo Ochoa-Acuna with Purdue University wrote a report (the "Purdue study") on behalf of the tribal communities evaluating fish and shellfish sampling data collected in the areas around the LRRS. This report, entitled "*Contaminant Migration Study and Human Health Risk Assessment for Subsistence Anglers using Cape Romanzof Adjacent Areas*", evaluated the potential health impacts by estimating potential long term cancer risks from exposure to chemicals detected in fish and shellfish collected near the LRRS.

The project manager at Elmendorf Air Force Base with responsibilities for managing environmental activities at the LRRS contacted the Agency for Toxic Substances and Disease Registry (ATSDR) with a request to conduct an independent review of this report, identify any limitations in the report and offer recommendations to address any uncertainties and data gaps. ATSDR was asked to visit the affected communities near Cape Romanzof LRRS to discuss their concerns about chemical contaminants in subsistence foods.

Key Issues

Native communities surrounding the Cape Romanzof LRRS have voiced concerns about the health of area wildlife and fish that they depend on for subsistence.

Underlying the concern for chemical contaminants in subsistence species is the concern that the chemical contaminants are having an adverse effect on the people who consume a subsistence diet.

Purpose

ATSDR prepared this health consultation to document its activities in response to the request , and to offer conclusions about Dr. Ochoa-Acuna's report and recommendations for further public health activities.

Conclusions

The small number of samples collected creates significant uncertainty about the extent of contamination in subsistence foods near the LRRS. Because of the limited sampling data and incomplete information about the sample locations ATSDR was not able to determine whether the LRRS is source of the contamination and whether contaminants found at the LRRS were moving offsite. It is very possible that chemical releases from the LRRS contributed to contamination in local fish and shellfish, but the data do not support the level of analysis needed to confirm this.

From the sampling results that report all tissue samples combined, the PCB levels do not appear very different from the reference locations or from seafood sampled from other places in Alaska distant from Cape Romanzof. This suggests consuming subsistence foods gathered from several areas is still a healthy and beneficial tradition.

Tomcod liver and blackfish samples taken in the vicinity of the LRRS appear higher than the average PCB concentration in seafood throughout Alaska, with the tomcod liver samples more than twice the maximum level detected elsewhere in Alaska. This suggests that eating liver from tomcods collected near the LRRS area may be a source of PCB exposure.

Next Steps

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal government public health agency. ATSDR acts as an independent scientific agency to provide public health advice to citizens, community groups and government agencies regarding the body of scientific knowledge of human exposures to chemicals in the environment and whether such exposures would likely result in adverse health effects. ATSDR is not an environmental regulatory or clean up authority.

ATSDR makes recommendations to stop, reduce, or prevent exposures and for additional public health actions (e.g. further investigation) if needed.

ATSDR's recommendations include:

- Additional sampling of fish and shellfish in the vicinity of the LRRS
- Additional sediment sampling in the mouth of fowler creek where mussels are collected.

- Sampling other subsistence foods such as seal, whale, waterfowl and traditional plant foods.
- Avoid consuming livers from tomcod caught in the vicinity of LRRS.
- Citizens of Alaska should follow the state's fish consumption advice. No restriction on consumption of Alaskan salmon is needed.

Background

Site Description

Geographic and environmental setting

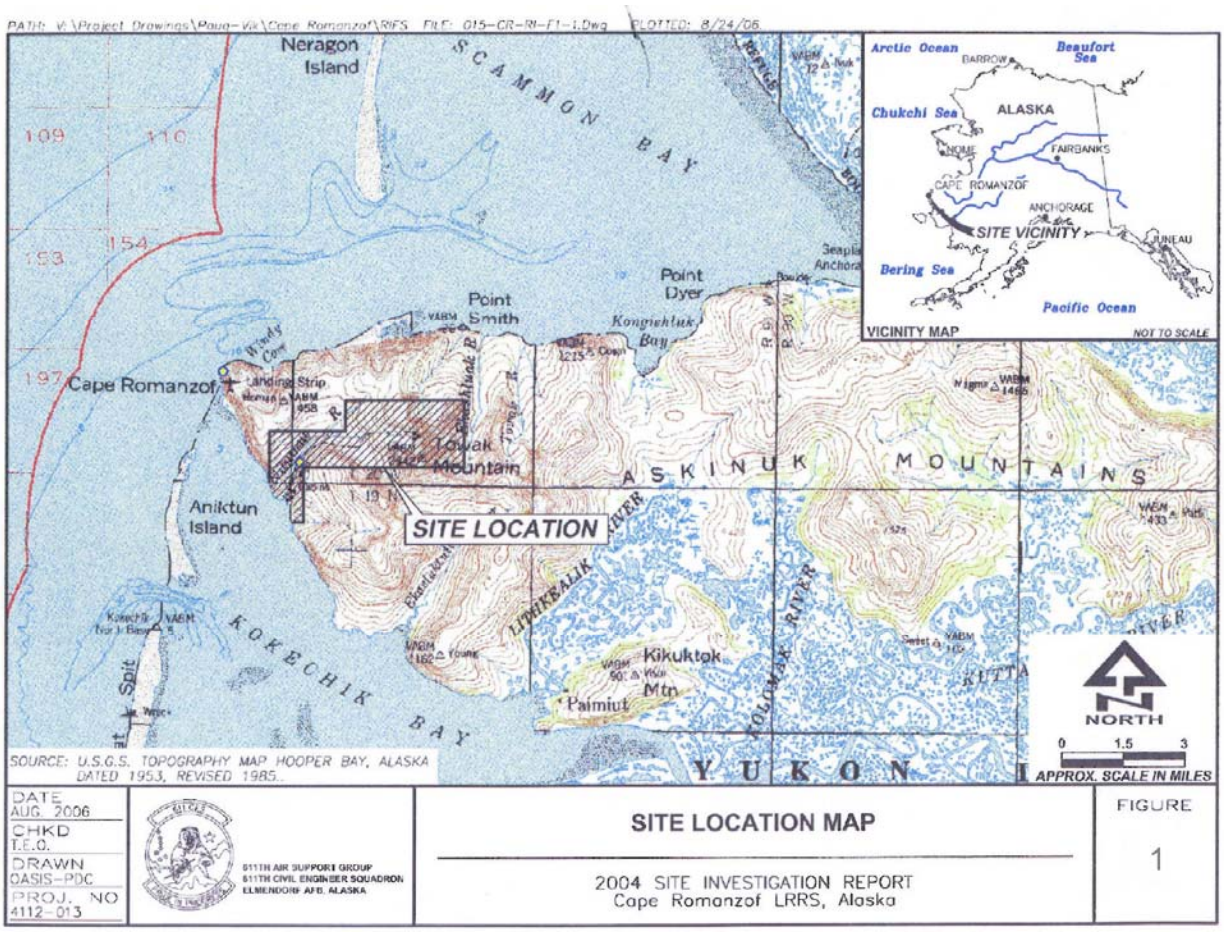
The Cape Romanzof Long Range Radar Site (LRRS) is located on the Southwest coast of Alaska on a small peninsula between Scammon and Kokechik Bays in the Yukon-Kuskokwim Coastal Lowland, and surrounded by the Yukon-Kuskokwim Delta National Wildlife Refuge (Figure 1). The LRRS was constructed in 1952 and began operations as one of the ten original Aircraft Control and Warning System sites in the Alaska Air Defense System. Since then, a White Alice Communication System replaced the initial systems, and technological advancements and facility upgrades allowed the facility to become a Minimally Attended Radar site by the mid-1980s.

Fisheries resources occurring near the Cape Romanzof LRRS include Dolly Varden, chum salmon and pink salmon found in Fowler (Nilumat) Creek. Nearshore marine species identified in Kokechik Bay include tomcod, Irish lord sculpin, starry flounder, yellowfin sole, and boriealis smelt. A small commercial and subsistence herring fishery is conducted annually in Kokechik Bay. Other resident fish species include pike, whitefish, and burbot. Various invertebrate species occur near the beach area of the LRRS and are harvested for subsistence including blue mussels and Alaska razor clams.

There are approximately seventeen locations identified at the CR LRRS that have been contaminated by past military site operation and maintenance activities. The list of contaminants of concern includes fuel components such as diesel range organics (DRO), pesticides, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and the heavy metals lead and cadmium.

DROs are a wide range of volatile organic chemicals, including PAHs, which resemble or make up diesel fuel. PAHs are a group of many chemicals found in oil or in burned items. The chemicals are called PAHs because of their unique carbon chemical bonds (aromatic) that form in a ring (cyclic). Because of their chemical structure, several PAHs have odors (aromatic), some good and bad. Some PAHs are commonly found in grilled meats and are of a concern for increased cancer risk after many years of exposure.

PCBs are man-made chemicals that were used as insulation material for the electronics at the LRRS. PCBs are mixtures of many similar compounds called congeners. If released into the environment, PCBs don’t dissolve easily and slowly break down naturally over many years. They can build up in the fat of fish and animals that eat them.



Contaminant fate and transport

The primary release mechanisms at Cape Romanzof LRRS include past leaks and spills, fugitive dust generation, infiltration and percolation into soil, and overland flow. Most primary sources of contamination were originally located at the ground surface, and the majority of past releases likely occurred to surface soils. After release to surface soils, constituents may partition onto soil particles or exist in the pore space between soil particles. Surface water (such as rainwater) may percolate through contaminated soil and dissolve the contaminants, creating leachate that may be released to subsurface soil or groundwater, or as surface water seeps collecting in drainages and major water bodies and impacting sediments. Higher trophic-level animal species and people may then be exposed during gathering and harvesting activities.

Past and ongoing environmental studies at Cape Romanzof LRRS

Since the early 1970s, environmental investigations identified areas where hazardous substances or petroleum products may have been stored, released to the environment, or disposed of on-site. The 611 Civil Engineer Squadron began an investigation of the environmental contamination at Cape Romanzof LRRS to collect sufficient data to find the nature and extent of potential contamination present. The investigation was performed in four separate study areas; at IRP sites LF003 (Landfill No. 2 northwest of Composite Facility along access road), SS010 (Spill/Leak No. 4 at the Weather Station Building), SS016 (Upper Tram Area) and SS017 (Lower Tram Area). There are seventeen identified sites with 13 having a clean-up remedy in place.

Beginning in 2003, work began on a project called the "Cape Romanzof Contaminant Migration and Subsistence Receptor Study". The project was contracted through the Yukon Kuskowim Health Corporation (YKHC) to give control to the local communities. Community members received training to collect water, sediment, plant, animal, and seafood samples. Sampling data were provided to a private consultant, Oasis, Inc., culminating in a 2005 final report. ATSDR was unable to obtain a copy of this report.

Due to community concerns about the conclusions made in the Oasis report, the air force requested that Dr. Hugo Ochoa-Acuna of Purdue University perform a human health risk assessment on the fish and shellfish sampling data collected in the original 2003 study. This work culminated in a report entitled "Contaminant Migration Study and Human Health Risk Assessment for Subsistence Anglers using Cape Romanzof Adjacent Areas" in October 2007. This report was the basis of the review by ATSDR (Ochoa-Acuna 2007).

Communities near Cape Romanzof LRRS

Four Alaska Native villages are in the vicinity of the LRRS, including the Alaska Native communities of Chevak, Hooper Bay, Scammon Bay and Paimiut. All villages are continuously inhabited with the exception of Paimiut which is used as a summer fish camp by residents of Hooper Bay. Similarly, a fish camp at the mouth of Fowler Creek is historically used during subsistence gathering activities.

Land use at Cape Romanzof LRRS is currently limited to hunting and fishing in the vicinity of the Lower Camp, at the LRRS beach area, and in nearby Kokechik Bay. Subsistence activities include gathering Pacific herring eggs (roe) from eelgrass and kelp in the Bay, fishing near the beach area for resident (e.g. tomcod) and migratory species (e.g. blackfish), hunting marine mammals, hunting furbearers and birds on land, and gathering terrestrial vegetation.

In the spring and fall, ice seals (e.g., bearded, ribbon, ring, and spotted), walrus, and Steller sea lions migrate along the coast of both Scammon Bay and Hooper Bay. These

marine mammals are hunted for their meat, blubber, and hide. Waterfowl such as eiders (common, king, Steller's, and spectacled), ducks, geese, and swans migrate through the community areas in the spring and are pursued both for their meat, eggs, and down. Beavers and muskrats are hunted as well, but on a limited basis. Wild plants collected for subsistence use include many varieties of berries, Pallus buttercup, Labrador tea, cowslip, fiddlehead ferns, horsetail, cottongrass, and driftwood. Beluga whales migrate through the areas in the fall and are hunted. Furbearers such as mink, land otter, and red and arctic fox are harvested in the winter. Ptarmigan and hares are harvested in the winter.

Native communities surrounding the Cape Romanzof LRRS have voiced concerns about the health of area wildlife and fish that they depend on for subsistence. Underlying the concern for chemical contaminants in subsistence species is the concern that the chemical contaminants are having an adverse effect on the people who consume a subsistence diet.

ATSDR meetings with Alaska Native Communities

ATSDR staff travelled to Chevak, AK June 22-26, 2009. The purpose of the trip was to:

- Meet tribal and city council members of native communities
- Obtain information to aid contaminant migration study evaluation
- Discuss ATSDR involvement and activity
- Identify information needs of communities
- Discuss community needs and identify next steps
- Identify contacts and preferred communication channels

During the visit, ATSDR staff met with several groups in the community, including representatives of Chevak Tribal Council and City Council, to discuss their concerns. ATSDR met with staff of the local YKHC health clinic to discuss the status of health care delivery and any community health concerns related to the LRRS. During the meeting ATSDR staff discussed information and resource needs specific to training/education on chemical exposure and health impacts.

ATSDR staff participated in an informational public meeting with residents of Chevak, Scammon Bay, Hooper Bay, and Paimiut communities. The meeting was broadcast live on KCUK Radio (88.1) FM radio station. Several listeners called into the station to ask questions (provided verbatim):

- Does ATSDR want samples of new game that has been caught?
- Samples from SCM have been taken and sent to Purdue University. Has ATSDR evaluated the samples (samples were of Tomcod and other fish)?
- Can you tell us if it is just one chemical or several different chemicals?

- Will ATSDR study people's health now that there has been a study of the fish, clams, Tomcods and other like sea mammals?
- When did the dumping begin?
- Can the contaminants spread farther out?
- Can PCBs bio-accumulate in people from fish?
- What are the health effects?
- Will the info/meeting notes be shared with residents because they are already harvesting or working? If so, send info to the tribal offices.
- If your findings, especially coming from the tribal community and working for the tribes well indicated any blatant wrongdoing, maybe the tribal can get some (compensation), financial compensation?
- Do you think that the PCBS are affecting the Blackfish and Tomcods that we consume?
- Where can fish samples be sent; especially if it has tumors?
- The Tribal Council and City Council representatives would like to know what ATSDR has done at Cook Inlet. Their primary focus is on the impact of cleanup, what they don't know and what they need to know. Subsistence Seal Harvest takes place January thru September. The mammal is killed with a spear. Seals provide blubber, oil and sausage.

Community concerns

Traditional lifestyles of Alaska Native people are based on hunting, fishing, and close relationships to the land. Subsistence foods are an essential part of Alaska Native culture. Village residents rely on many animals for foods, such as seals, whales, fish, birds and bird eggs. The residents of the Alaska Native communities ATSDR met with believe they have been exposed to pollutants from LRRS through subsistence foods.

Specific concerns/issues identified are:

- Long-standing mistrust of the Air Force
- The impact of the LRRS on the health of fish, birds, wildlife, plants and mammals they depend on for subsistence foods
- Incidence of cancers such as lung, breast and colon
- Incidence of gastroschisis (a birth defect in which an infant's intestines protrude through a defect on one side of the umbilical cord)
- Mercury exposure and impacts on pregnant women and fetal development

Conclusions from Review of the Purdue Contaminant Migration Study

This section discusses observations ATSDR made about the study methods and conclusions about the study's findings. As requested, ATSDR reviewed the report "Contaminant Migration Study and Human Health Risk Assessment for Subsistence Anglers using Cape Romanzof Adjacent Areas" authored in October 2007 by Dr. Hugo

Ochoa-Acuna of Purdue University ("the Purdue study"). This report was a reanalysis of the results of the previous "Cape Romanzof Contaminant Migration and Subsistence Receptor Study" conducted by the Yukon-Kuskokwim Health Corporation. ATSDR did not have access to a copy of this previous report, or to the data upon which both reports were based. The data evaluated in both reports consisted of data summaries of tissue analysis for various fish and shellfish on and near the LRRS.

A primary focus of the Purdue study was to compare of the presence and concentration in fish and shellfish of chemicals potentially related to the LRRS at different geographic locations. These locations include areas that are many miles away from the LRRS and are unlikely to have been impacted by any chemicals released from the LRRS (referred to as "Reference"); areas that are in the vicinity of LRRS but unlikely to be impacted ("On-Site Reference"); and areas directly down gradient or in water bodies receiving drainage from the LRRS ("On Site") and are presumed to have the potential to be impacted by chemical releases. The Purdue study concluded that chemical contaminants released from the LRRS are likely impacting natural resources (e.g. fish and shellfish) in areas adjacent to the LRRS.

The report indicated that PCBs are the predominant source of lifetime excess cancer risk for subsistence consumers; therefore, ATSDR focused primarily on the PCB data reported in the study.

Since it was not in the scope of the request and ATSDR did not have access to the original sampling data, ATSDR did not perform an evaluation of exposure to chemicals detected in fish and shellfish sampled from the LRRS. Our review and comment are based solely on the contents of the Purdue University report.

Observations on data gaps and their implications

The major weakness of the study report was the small number of fish and shellfish samples collected from onsite and offsite areas. It is uncertain whether the samples, 1) represent the extent of contamination in the fish and shellfish population surrounding the LRRS; 2) whether the samples can give the necessary statistical power to demonstrate that contaminants found at the LRRS were moving offsite; and 3) whether contamination detected in the samples was related to the LRRS.

The Purdue study stated that the small number of samples made it difficult to establish a chemical concentration in fish and shellfish that people were likely exposed to when they ate them. Because ATSDR did not have the complete data results, ATSDR was not able to determine if there was a statistically significant difference between offsite and onsite concentrations in fish, or whether apparent differences were actually due to chance or another source of contamination. There may be a difference, but the existing sampling data are inadequate to detect a difference with high confidence.

From ATSDR's review of the sampling data from the report (Table 1) it was not possible to determine specific fish/biota sampling locations relative to "onsite", "onsite-reference" and "reference" descriptors, or how the concentrations and consumption rates were adjusted for those geographic areas. An improvement would be to include a map of sampling locations, and to spatially adjust concentration and consumption data to account for real harvest patterns.

Table 1. Median concentrations for total PCBs and dioxin-like PCB TEQs collected from Cape Romanzof [from Ochoa-Acuna 2007]

Species	Sampling location	Sample number	Median total PCB (ppb)	Median dioxin-like PCB TEQs (ppt)
Bivalves (mussels)	Onsite	9	3.834	0.0607
	Onsite reference	3	0.690	0.0043
Blackfish	Onsite	8	15.00	1.0316
	Reference	8	0.777	0.0056
Herring eggs	Onsite	6	0.719	0.0061
	Onsite reference	3	0.860	0.0077
Tomcod, liver	Onsite	8	47.95	1.1543
	Reference	15	35.00	0.1746
Tomcod, whole	Onsite	8	4.894	0.6089
	Reference	16	2.030	0.0606
All tissue samples	Onsite	39	7.270	0.2497
	Onsite reference	6	0.787	0.0061
	Reference	39	7.841	0.0450
	All areas	84	6.471	0.1258

There was no discussion of onsite concentrations compared to reference areas.
A visual inspection of the data presented in table 1 for all tissue samples did not show a significant difference; however, data limitations did not allow a more thorough evaluation of LRRS impact on subsistence foods and exposure to subsistence consumers.

What do the sampling data indicate about the source of contamination in fish and shellfish near Cape Romanzof?

ATSDR noted that information was lacking about whether fish and shellfish samples were located in areas where sediment, water and soil samples were collected. This made it difficult to determine if there was a link between PCB in fish and shellfish and chemical releases from the LRRS.

An inspection of the PCB congener sampling data summaries in appendix 2 of the Purdue study did not identify a clear pattern or distribution between the onsite, onsite reference and reference locations. However, PCB concentrations appeared to have accumulated in biota onsite to a greater extent than offsite locations.

For example, several of the PCB congeners detected onsite were not found in reference locations. Additionally, the heavy metal lead was detected at a higher frequency in tissue from on site locations compared to reference locations. This implies that the contamination may be localized to areas on the LRRS.

From an inspection of the data summaries in the Purdue study appendices, total PCBs are higher in mussels collected onsite compared to reference locations. Three of the PCB congeners are higher in tomcod liver from onsite locations, and two PCB congeners are higher in whole tomcod onsite. This would suggest that PCB contaminants found on the LRRS are not moving off site into the surrounding environment. Lack of a clear difference suggests the possibility that some of the fish contamination may be resulting from a non-point source such as atmospheric deposition of PCB congeners.

Observations on exposure estimates

To help make more realistic exposure estimates that are specific to the communities surrounding the LRRS, it would be helpful to adjust annualized intake rates to account for species-specific consumption rates, such as how much of the community's typical diet comprises salmon vs. tomcod. Fish from onsite locations should account for a small percentage of overall fish consumption. This may be reflected in "onsite reference" exposures but it is difficult to determine from the report.

Dietary estimates were not clearly identified in the report since it did not clearly identify what portion of a typical subsistence diet came from the study area. A conservative assumption in the report was that all subsistence harvesting came from the study area and subsistence consumers would harvest all their fish/seafood for a lifetime to the exclusion of all other fish caught in other locations. It's questionable whether the productivity provided by Fowler Creek will support subsistence harvesting at levels modeled in the risk assessment. While a conservative estimate of harvesting and consumption activities might serve to determine the theoretical cancer risks associated with eating species in the study area, it does not represent actual conditions or realistic health risks to the community from PCBs and other contaminants in subsistence foods.

Public health considerations

For all tissue samples combined, PCB data don't appear very different from the reference locations or from salmon sampled from other places in Alaska distant from Cape Romanzof (Table 2). All tissue samples combined appear to represent the average concentration a subsistence consumer would be exposed to from harvesting a variety of fish and shellfish near the LRRS. Figure 2 shows a comparison of PCB in Alaska fish relative to other North American areas and Japan. Note that the low concentration of contaminants in Yukon-Kuskowim Delta region (Y-K) Chum and Chinook salmon species are on par with concentrations in all tissue samples combined from the LRRS onsite and reference areas.

Although the fish and shellfish samples from LRRS are not directly comparable to salmon samples, no data were available to compare species samples near the LRRS with identical species sampled in other parts of Alaska. The salmon sampling results are presented as a surrogate to represent PCB concentrations in seafood in other areas of Alaska. It is relevant to include the salmon information as salmon is a major component of the subsistence foods harvested by communities near the LRRS and the communities voiced concern about the safety of salmon they harvest in the Yukon Kuskowim Delta area.

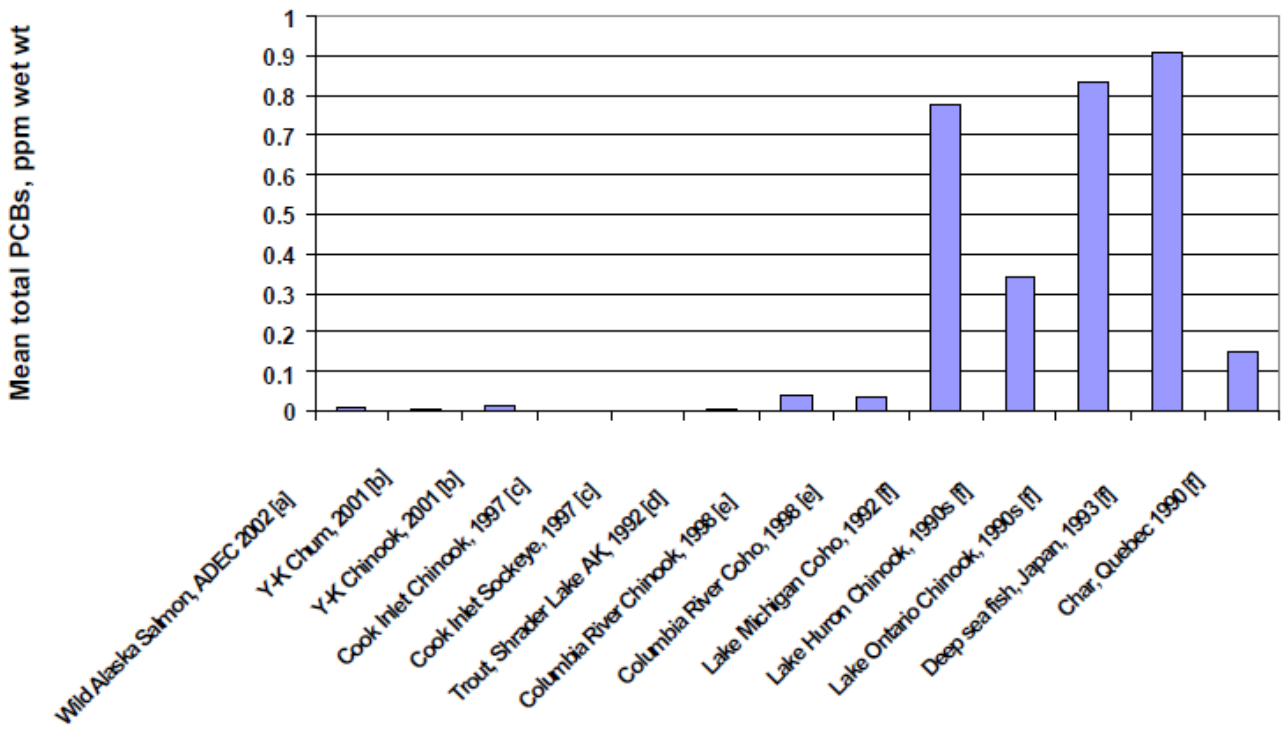
Tomcod liver and blackfish samples reported in Table 1 are higher than the average PCB concentration in salmon throughout Alaska, with the tomcod liver samples more than twice the maximum level detected in salmon elsewhere in Alaska.

Table 2. Concentrations of total PCBs in all tissue samples collected from Cape Romanzof compared to salmon fillets collected from marine waters and river mouths throughout Alaska (ppb).

	Cape Romanzof[1]	Throughout Alaska[2]		
	Median	Minimum	Maximum	Average
All areas	6.471	1.59	18.78	7.19
On site	7.270			
Reference	7.841			

1. Only median values reported for total PCBs in Ochoa-Acuna 2007
2. Source: ADEC 2009

Figure 2. Total PCB in Alaska fish compared to other areas.



Source: ADEC 2009
Note: Y-K refers to Yukon-Kuskowim Delta Region

Although the reported theoretical lifetime cancer risk in the Purdue study was elevated (Table 3), the conservative assumption of a high subsistence consumer intake of fish and shellfish along with the assumption that all fish and shellfish eaten are harvested exclusively from the site does not represent actual conditions and overestimates PCB cancer risks to native communities in the area of the LRRS from eating fish and shellfish. It's reasonable to assume that over a lifetime fish and shellfish consumed will be harvested from a variety of locations and not limited exclusively to the vicinity of the LRRS.

The authors reported that the elevated cancer risks in this report are primarily due to high PCB concentrations in one tomcod sample and one mussel sample. From discussion in the report, it does not appear that the tomcod was collected from Fowler Creek, the sampling location closest to the LRRS. This suggests that this sample may not be representative of LRRS-related contamination in the general fish population. However, it's possible that the concentrations in tomcod and liver could be higher than the reported sample. More sampling would resolve this data gap.

Table 3. Lifetime excess cancer risk estimates for subsistence users exposed to PCBs in fish and shellfish harvested in the vicinity of Cape Romanzof.

	Sampling area	Consumption level (grams /day)		
		50th %	75th %	95th %
Total fish consumption rate		327.78	538.76	1166.25
Lifetime Excess Cancer Risk (total PCB)	Onsite	6.81E-05	1.12E-04	2.42E-04
	Reference	7.34E-05	1.21E-04	2.61E-04
	All areas	6.06E-05	9.96E-05	2.16E-04
Lifetime Excess Cancer Risk (Dioxin-Like PCB TEQ)	Onsite	1.75E-04	2.88E-04	6.24E-04
	Reference	3.16E-05	5.20E-05	1.12E-04
	All areas	8.84E-05	1.45E-04	3.14E-04
Combined excess cancer risk	Onsite	2.43E-04	4.00E-04	8.66E-04
	Reference	1.05E-04	1.73E-04	3.73E-04
	All areas	**1.49E-04**	**2.45E-04**	**5.30E-04**

Source: Ochoa-Acuna 2007

One cause for concern is that no data on other traditional foods like aquatic mammals (e.g. seal and whales) or waterfowl was available. These animals can accumulate organic chemicals (like PCBs) in their fat tissue, resulting in some exposure to people who eat them. This exposure was unaccounted for in the report and is therefore a source of uncertainty about the extent of PCB exposure from other food sources.

Furthermore, no plant food data was discussed in the report. Although plants are unlikely to significantly accumulate PCB (ATSDR 2000), other contaminants found at the site such as cadmium can accumulate in the plants resulting in human exposure. Because plant data are lacking, it's not known how cadmium levels in local plant foods compare to other sources of cadmium exposure (e.g. tobacco) or if the levels are even significant. Since cadmium is a contaminant of concern at the LRRS, it may be present in local plant foods, but this is uncertain because this data were not available to ATSDR.

The lack of data on mercury content in fish and shellfish harvested in areas near Cape Romanzof is a significant data gap. Although not a site-related contaminant of concern, mercury in seafood is a primary basis for fish consumption limits across the state of Alaska (and elsewhere in North America).

One health endpoint of concern for both PCB and mercury exposure is their effect on the developing nervous systems of newborn babies and fetuses that are exposed while still in their mother's womb (ATSDR 2000, ATSDR 1999). This underscores the need for additional sampling and comprehensive analysis of traditional foods harvested in the vicinity of the LRRS.

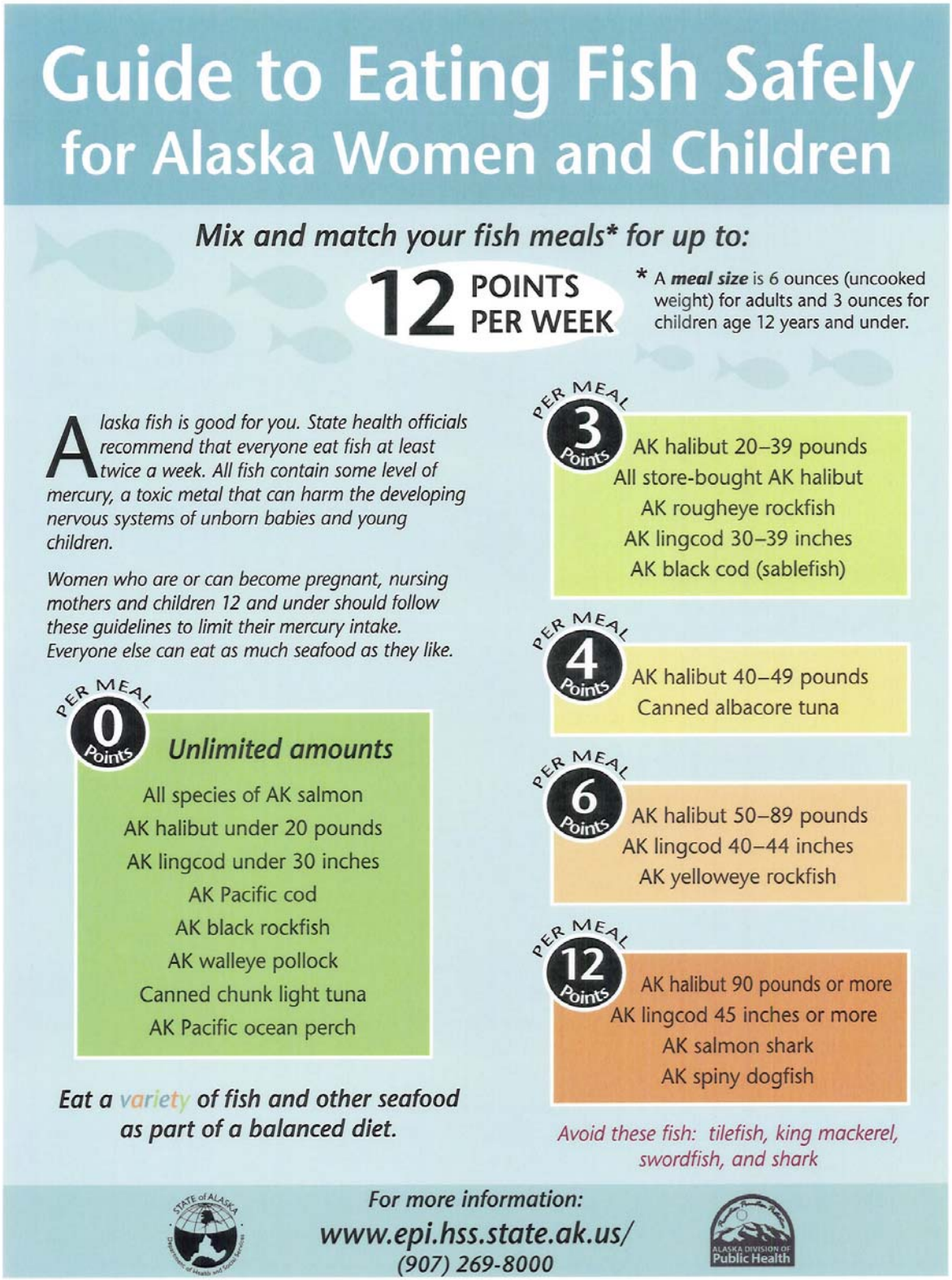
Benefits of consuming fish and a traditional diet

Harvesting and eating wild-caught foods is an important cultural tradition among native peoples in Alaska. In developing public health advice about the dietary intake of fish, it is important to consider both benefits and the risks of wild fish consumption. Fish are a nutritious protein source low in saturated fat and provides essential fatty acids, antioxidants and vitamins important for good health. Alaska salmon and other fatty fish are good sources of omega-3 fatty acids, which offer health benefits like protection from diabetes and cardiovascular disease, and improved infant brain development.

In deciding whether to recommend eating a traditional diet, it is also necessary to consider the potential health risks of alternative replacement foods. Many market foods that replace locally harvested fish in Alaska are high in saturated fat, sugars, and often low in nutrient value. Diets high in saturated fat and carbohydrates are strong risk factors for a number of chronic diseases such as heart disease, diabetes, and cancer. Increasing non-traditional food use and sedentary lifestyles have been associated with increasing chronic disease prevalence, including an increase in hypertension, glucose intolerance, and diabetes.

The issue of contaminants in subsistence foods is of concern in the state of Alaska and all over the world. The Alaska Department of Environmental Conservation conducts regular monitoring of contaminant levels in Alaska seafood. Additional information about this topic can be obtained from Alaska Department of Environmental Conservation's Division of Public Health Fish Monitoring Program web site (http://www.dec.state.ak.usJehJveUfish.htm).

The Alaska Department of Public Health uses the fish monitoring data to make fish consumption guidelines for Alaskans The current guidelines are available on the Alaska Fish Facts and Consumption Guidelines website (http://www.epi.alaska.gov/eh/fish/). A copy of these guidelines is on the following page.


Guide to Eating Fish Safely
for Alaska Women and Children
Mix and match your fish meals* for up to:
12 POINTS PER WEEK
* A meal size is 6 ounces (uncooked weight) for adults and 3 ounces for children age 12 years and under.
Alaska fish is good for you. State health officials recommend that everyone eat fish at least twice a week. All fish contain some level of mercury, a toxic metal that can harm the developing nervous systems of unborn babies and young children.
Women who are or can become pregnant, nursing mothers and children 12 and under should follow these guidelines to limit their mercury intake. Everyone else can eat as much seafood as they like.
PER MEAL 0 Points
Unlimited amounts
All species of AK salmon
AK halibut under 20 pounds
AK lingcod under 30 inches
AK Pacific cod
AK black rockfish
AK walleye pollock
Canned chunk light tuna
AK Pacific ocean perch
PER MEAL 3 Points
AK halibut 20–39 pounds
All store-bought AK halibut
AK rougheye rockfish
AK lingcod 30–39 inches
AK black cod (sablefish)
PER MEAL 4 Points
AK halibut 40–49 pounds
Canned albacore tuna
PER MEAL 6 Points
AK halibut 50–89 pounds
AK lingcod 40–44 inches
AK yelloweye rockfish
PER MEAL 12 Points
AK halibut 90 pounds or more
AK lingcod 45 inches or more
AK salmon shark
AK spiny dogfish
Eat a variety of fish and other seafood as part of a balanced diet.
Avoid these fish: tilefish, king mackerel, swordfish, and shark
For more information:
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(907) 269-8000
ALASKA DIVISION OF Public Health

Recommendations

1. Additional sampling of fish and shellfish in the vicinity of the LRRS would fill data gaps about the extent of contaminant in fish and shellfish. In addition to organic analysis that includes PCBs and pesticides, samples should be analyzed for a full suite of metals including methyl mercury. Reporting fish size and whether data are in wet weight would aid analysis.
2. If additional fish and shellfish sampling is performed, soil and sediment samples should be collected in areas where biota are harvested. An example would be sediment in the mouth of fowler creek where mussels are collected.
3. Sampling other subsistence foods such as seal, whale, waterfowl and traditional plant foods would help characterize other sources of exposure.
4. Exposure assessments could be refined to include a fish consumption survey documenting amounts harvested, species type, and harvest locations specific to communities near the LRRS. This would help make exposure estimates more realistic and specific to the local communities.
5. To reduce the potential for PCB exposure, avoid consuming livers from tomcod caught in the vicinity of LRRS. Tomcod livers had the highest detected PCB concentrations and exceeded the maximum PCB levels found in fish (salmon) in Alaska.
6. Citizens of Alaska should follow the state's fish consumption advice. Note that no restriction on consumption of Alaskan salmon is needed.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological Profile for Mercury. U.S. Public Health Service. U.S. Department of Health and Human Services. March 1999.

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Polychlorinated Biphenyls (PCBs). U.S. Public Health Service. U.S. Department of Health and Human Services. November 2000.

Alaska Department of Environmental Conservation (ADEC). 2009. Fish Monitoring Program: Analysis of Organic Contaminants. November. Accessed online: http://www.dec.state.ak.us/eh/vet/fish.htm

Alaska Department of Public Health. Fish Facts & Consumption Guidelines for Alaskans. Accessed online: http://www.epi.alaska.gov/eh/fish/

Alaska Native Epidemiology Center. 2004. *Final Report on the Alaska Traditional Diet Survey*. Alaska Native Health Board. March.

Ochoa-Acuna, H. 2007. *Contaminant Migration Study and Human Health Risk Assessment for Subsistence Anglers using Cape Romanzof Adjacent Areas*. Purdue University. October 2.

U.S. Air Force Center for Engineering and the Environment (AFCEE). 2009. *Draft Remedial Investigation Report, Cape Romanzof Long Range Radar Site. Prepared for the 611th Air Support Group Civil Engineering Squadron, Civil Environmental Restoration Element.* March.