Environmental Protection Agency

The U.S. Environmental Protection Agency's Arctic-related work is designed to protect the health of Arctic residents and safeguard the Arctic environment.

The U.S. Environmental Protection Agency's (EPA's) research in the Arctic is focused on the source, transport, fate, and effects of contaminants in the environment; the risks and benefits of subsistence foods; global climate change; and UV-B radiation. An emerging EPA effort to develop an Arctic strategy will help the agency coordinate activities and target resources more effectively. EPA Arctic priorities are:

- Research and development;
- Regional implementation; and
- International activities.

Within this framework, EPA research continues to focus on three primary objectives:

- Improving basic knowledge about Arctic stressors and effects;
- Understanding and reducing risk to Arctic residents and the Arctic environment; and
- Implementing innovative technologies to solve environmental problems.

These primary objectives are being addressed through a variety of research and project implementation efforts. The following discussion provides a brief summary of EPA-sponsored research and demonstration projects, each highlighted under a particular objective, although individual projects may address more than one objective.

	Funding (thousands)	
	FY 04	FY 05
Research and Development (including grants)	500	500
Regional Activities	100	100
International Activities	150	250
Total	750	850

Arctic Stressors and Effects

The EPA has increased the understanding and awareness among regional, national, and international partners concerning the risks associated with contaminants in the U.S. Arctic. Activities include leading international efforts to assess status and trends in the Arctic, investigating mercury deposition, and studying airborne contaminants.

Recent warming of the Arctic, thawing permafrost, increased infestations to vegetation, changes in migration patterns, increased fire activity, loss of sea ice, and increased coastal erosion are all signs of a changing climate that significantly affect Alaskans. Also of grave concern are the potential impacts from persistent and bioaccumulative toxic substances that are beginning to appear in the environment and some subsistence foods. Threats to subsistence species pose serious threats to traditional lifestyles in which subsistence foods provide not only nutrition but also form a solid foundation for the culture and social life that date back for generations.

The fact that the majority of sources are non-domestic has proven a challenge in determining the most appropriate and effective role for the EPA Region 10. The Alaska Office of the EPA works directly with tribes and other partners such as the Alaska Conservation Foundation and the Yukon River Intertribal Watershed Council to assist in collaborative efforts between tribes, the EPA, states, scientists, academia, and NGOs, as well as to facilitate the exchange of information. The Alaska Forum on the Environment (AFE) is an annual venue for the dissemination of research results, among other things. It has also provided an opportunity for ongoing dialogue to better understand priorities and firsthand observations from those living in the extreme Arctic conditions. The Alaska Office organized a contaminant track during both AFE '04 and '05 (44 presentations in 11sessions). The office has also promoted guidelines for scientists to follow when working with communities; this information was gleaned from NSF, ANSC, and the Northern Contaminant Program (NCP).

Environmental Monitoring and Assessment Program

The Environmental Monitoring and Assessment Program (EMAP) is a national research pro-

gram to develop the tools necessary to monitor and assess the status and trends of ecological resources. EMAP's goal is to develop the scientific understanding for translating environmental monitoring data from multiple spatial and temporal scales into assessments of current ecological condition and forecasts of future risks to our natural resources. EMAP aims to advance the science of ecological monitoring and ecological risk assessment, guide national monitoring with improved scientific understanding of ecosystem integrity and dynamics, and demonstrate multi-agency monitoring through large regional projects. EMAP develops indicators to monitor the condition of ecological resources. EMAP also investigates designs that address the acquisition, aggregation, and analysis of multi-scale and multi-tier data.

Alaska REMAP

The Alaska Department of Environmental Conservation's (DEC) Environmental Monitoring and Assessment Program is using the national EMAP approach at the regional and local scales (REMAP) to provide a practical, cost-effective method to characterize Alaska's coastal and surface waters. The EPA has been the funding source for EMAP, but partnerships are necessary to carry out the projects. The Alaska EMAP program has sampled both coastal and fresh waters since 2002. Coastal sampling projects have been completed in south-central Alaska (2002) and in southeast Alaska (2004) and will soon be completed in the Aleutian Islands (2006). A freshwater sampling project was completed in the Tanana River basin in 2004.

Southeast Alaska was studied by EMAP protocols in 2004 as the second of the five Alaska regions. The region was selected as the second-most accessible region given DEC's resources. The sampling was done in July and August 2004 aboard a chartered vessel, the *Ocean Cape*, from Bering Sea Eccotech. The vessel mobilized and demobilized for the cruise in Sitka. Fifty-one sites were sampled, 11 of which were sampled for bacteria only, for the DEC Cruise Ships Program. Forty sites were sampled according to EMAP protocol and for many parameters. The final report for southeast Alaska is expected to be released in early 2007.

The Tanana River watershed, located in interior Alaska, was selected for the location of the EMAP wadeable streams demonstration project. This region was chosen because of the wide variety of land uses occurring within the watershed, including forestry, agriculture, mining, recreation, subsistence, national defense, and communities with suburban, urban, and village characteristics. The sampling took place in the summers of 2004 and 2005. The final report for this project is scheduled to be completed in the fall of 2006.

Western Airborne Contaminants Assessment Project

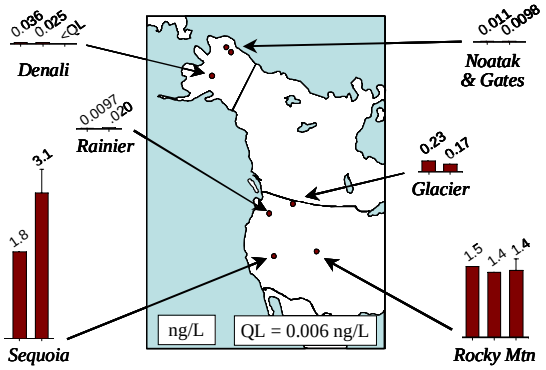
The Western Airborne Contaminants Assessment Project (WACAP) has been initiated to determine the risk to ecosystems and food webs in western national parks from the transport of airborne contaminants. WACAP was designed and implemented by the Environmental Protection Agency and the National Park Service's Air Resources Division in cooperation with many western National Parks, the U.S. Geological Survey, USDA Forest Service, and several universities. There are two parks, Gates of the Arctic and Noatak (one site each), located above the Arctic Circle and two sites in Denali National Park among the eight primary National Parks involved in WACAP. At each of the eight park units, two relatively high elevation, small lake catchments have been selected. Samples are collected at these sites to reveal where and to what extent airborne contaminants have been deposited on these landscapes and how these contaminants may be distributed within food webs.

Airborne contaminants can pose serious health threats to wildlife and humans. Some toxic compounds tend to "biomagnify," meaning that small concentrations in air, water, snow, and plants can result in large concentrations at higher levels of the food chain, such as fish and mammals. The biological effects of airborne contaminants include impacts on reproductive success, growth, behavior, disease, and survival. Subsistence hunters and gatherers in Alaska depend on wild food sources that may be affected by airborne contaminants.

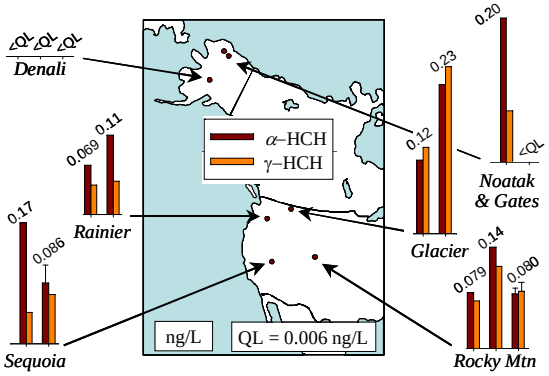
The contaminants of concern are compounds that are sometimes called semi-volatile organic compounds, or SOCs. This group contains a variety of persistent organic pollutants (POPs) such as PCBs and DDT. The element mercury (Hg) behaves similarly to SOCs and is also being investigated by WACAP. These materials are direct or indirect products of human industrial activity and can be transported thousands of miles in the atmosphere. In some cases, they can be deposited to aquatic or terrestrial ecosystems and then be re-emitted back into the atmosphere. Some of these materials have physical properties that permit them to accumulate preferentially in

Concentrations of dacthal, a currently used pesticide that has much higher concentrations in snow near agricultural regions (Sequoia and Rocky Mountain sites) than in remote sites in Alaska. The hexachlorocyclohexanes are banned (a-HCH) or are being phased out (g-HCH, also known as lindane) in North America. The HCH concentrations in snow are more uniform throughout the WACAP sites and have lower concentrations in snow than dacthal. (QL is the detection limit.)

DACTHAL *(current-use pesticide)*



Hexachlorocyclohexanes *(α is banned pesticide)*



colder areas of the global environment. This phenomenon has been termed "cold fraction" and has been observed for some types of PCBs, hexachlorocyclohexane (HCH), and even mercury. Therefore, high-elevation and high-latitude ecosystems may be at greater risk because of the accumulation of these toxic compounds, simply because they are colder than other locations.

WACAP completed all field work in September 2005. Now that samples are in hand and analytical methods have been tested and confirmed adequate, samples are being analyzed for organic and inorganic contaminants at a rapid pace.

Snowfall provides 50–90% of the annual precipitation in high-altitude and high-latitude areas of the western United States, and seasonal snowpacks that accumulate during the fall, winter, and spring contain a record of chemicals deposited during the snow-covered season. By collecting a full-depth column of the snowpack near the time of maximum snow accumulation, the EPA can cost-effectively determine seasonal atmospheric deposition inputs to these types of ecosystems. Twenty-three samples from eight parks were sampled for organic and inorganic contaminants in FY 2004. Processes controlling mercury deposition in the snowpack have been investigated as part of WACAP, including the relation between mercury concentration and particulate concentration, canopy cover, and snow-water equivalent. These findings are important to the scientific community and to resource managers, because they will improve estimates of total mercury deposition based on other measurement techniques.

Two years of mercury concentration data for snowpack samples are now available, and they reveal spatial patterns in mercury deposition. Mercury concentrations in samples from the Alaska parks tend to be quite variable. This is likely related to the shallow depth of snowpacks at low-elevation inland sites in Alaska and the relatively large amounts of windblown "crustal" material in the snowpack. Even when concentrations were moderately high in Alaska snow, the total atmospheric loading of mercury via snow was not great because the volume of snow deposited in the Alaska sites is quite low in comparison to sites in the lower 48 states. Along the west coast of the lower 48 states, most of the parks had fairly low concentrations of mercury, while inland sites at Glacier and Rocky Mountain National Parks had somewhat higher concentrations of mercury, which, again, were related to higher concentrations of particulates.

Airborne contaminants have been detected in alpine aquatic ecosytems and fish in Canada and Europe. However, little information exists about similar occurrences in the U.S., despite the preferential deposition of some contaminants in high-elevation and polar ecosystems. The fish component of WACAP focuses on determining the impacts and appropriate indicators of contaminant exposure in fish. In the summer of 2003, salmonid fishes from five lakes in Sequoia, Rocky Mountain, and Olympic National Parks were captured and assessed for endocrine disruption, physiological impairment, and, in some lakes, contaminant loads. General health, histopathology, age, and sex steroids were also determined. In the summer of 2004, fish were collected from four sites in Alaska.

One of the WACAP objectives is to determine the sources for contaminants measured at the National Park sites. Because of the strong westerly flow in the middle latitudes, it is anticipated that long-range transport from distant sources in Asia will be important in explaining some of the WACAP results, but contributions from other sources will not be overlooked. In particular, transport from major agriculture regions in California, Mexico, and Canada appear to be important in explaining the concentrations of pesticides in

some of the WACAP parks. The primary goal of the atmospheric component of WACAP is to help elucidate the time-varying transport of air masses from all major source regions that may be affecting western National Parks.

Mercury and Arctic Sunrise

One of the key findings in the AMAP Phase II heavy metals report is the transformation of mercury in the Arctic at polar sunrise. EPA has been instrumental in investigating the nature and geographical extent of the phenomenon termed "Arctic sunrise," where atmospheric elemental gaseous mercury levels have been shown to drop drastically during the Arctic spring, when sunlight returns to the region. The majority of atmospheric mercury is present in elemental form, but reactive gaseous mercury has much higher wet and dry deposition rates. Thus, speciation of mercury is of particular interest in the Arctic because of the sunrise phenomenon and the greater local impact of reactive forms. Since 2000, EPA scientists have designed and implemented a series of mercury speciation studies. Successful work first completed in Barrow, Alaska, led to the implementation of partnership studies during 2002 and 2003 at the Italian South Pole Atmospheric TerraNova Science Research Base and at the Norwegian Polar Research Base at Ny Alesund. EPA scientists trained collaborators and helped design and install specialized instrumentation at all three polar monitoring sites. The primary objectives of the monitoring studies conducted during polar sunrise were threefold:

- Measure and speciate the various forms of mercury in air and snow [elemental mercury (HgO), reactive gas-phase mercury (HgX_2, where X is a halide), and fine-particle-bound mercury (HgP)];
- Obtain snow samples for subsequent chemical analysis; and
- Obtain air quality data and meteorological measurements.

These measurement campaigns were designed to obtain information on the factors that lead to mercury depletion events (MDEs) to better understand and model the impact of MDEs on the half-life of mercury in the atmosphere and the potential bioavailability of mercury transformation products. The instrumentation and methods developed by EPA to speciate mercury are being used by atmospheric scientists in the U.S., Canada, Norway, Italy, Germany, Denmark, and Sweden, and study results are being published in the scientific literature.

Understanding and Reducing Risk

EPA and others have broadened the risk assessment approach to effectively bring together scientific research and management strategies for reducing risks. In the Arctic this specifically targets reducing risk to humans potentially exposed to contaminants in traditional foods, as well as addressing the profound changes occurring in the Arctic and Bering Sea region from the combined effects of many stressors. EPA is focusing resources and time in the Arctic to integrate ecosystem-level risk assessment with human health and cultural risk.

Monitoring of Umbilical Cord and Maternal Blood

Alaska Native populations became concerned in the early 1990s with the accumulation of organic and heavy metal pollutants, which were accumulating in subsistence foods. Accordingly, and in response to Alaska Area Native Health Service (AANHS) concerns with Arctic contamination, the EPA, along with the National Center for Environmental Health (NCEH) of the Centers for Disease Control (CDC), proposed a project, supporting AMAP, to monitor selected heavy metals and persistent organic pollutants (including PCB congeners) in umbilical cord blood and maternal blood of indigenous groups of the Arctic, with a focus on Alaska Native populations.

The program was a collaborative project involving the AANHS, the Alaska Native Regional Health Corporations, the CDC Arctic Investigations Program (AIP), the CDC National Center for Environmental Health (NCEH), and the Alaska Native Tribal Health Consortium (ANTHC). Funding support came from the EPA Office of International Affairs. The responsible Federal agency was the Indian Health Service (IHS), which was represented by the AANHS and acted through the ANTHC. The ANTHC was responsible for managing all aspects of an interagency agreement, in collaboration with CDC.

Analysis of the initial 200 women in the program has generally found levels of persistent organic pollutants (POPs) similar to those found in western Arctic Canadian Inuits but lower than values from Greenland Inuits. Toxaphene, perfluorooctanyl sulfonate (PFOS), and brominated flame retardants (BFR) were higher than in other regions. PCB levels are much higher for Aleut women living in the Commander Islands, with a congener pattern similar to women on the Bering

Sea coast, suggesting a common, transboundary source.

The program will continue to monitor Yupik and Aleut Alaska Natives residing along the Bering Sea Coast, the rivers that drain into it, and the Aleutian Islands. Analyses will include blood levels of POPs, PCBs (including congener analysis required to help track sources), BFRs, toxaphene, and PFOS. An additional 200 pregnant women were recruited between March 2005 and January 2006. The EPA will also open discussions with the health corporations in the monitored regions to initiate POP measurements in relevant subsistence species important in these regions.

Indian General Assistance Program Grants

EPA Region 10 continues to support capacity building for Federally recognized tribes in Washington, Oregon, Idaho, and Alaska for managing community-based environmental protection programs. The total Indian General Assistance Program (IGAP) investment, while not represented in the research budget, represents an annual investment of over $21 million for Region 10 across the four states, with approximately $17.5 million going to Alaska tribes. Access by Alaska Native villages to IGAP funds has resulted in research to develop sustainable technologies amenable to remote areas of the Arctic that assist in achieving local environmental goals. Funding has enabled the pursuit of low-tech alternatives for pollution prevention, specifically in the area of waste oil recycling and the use of antifreeze washers and can crushers. Practical implementation of management alternatives based on this research has had a direct impact on the ability of Alaskan villages to protect watersheds and extend the life of rural Alaskan landfills. The EPA is continuing to support emerging management strategies and technologies to reduce local environmental pollution and improve quality of life.

ACAP Community-Based Projects with Indigenous Peoples

New projects initiated in 2005 by the Arctic Council Action Plan to Eliminate Pollution in the Arctic (ACAP) include:

- A community-based model for PCB mitigation in the Arctic, by the Gwich'in Council International (GCI). On-site inspection for obsolete electrical equipment has been completed in four Alaskan villages. Six obsolete electrical transformers have been identified. The next step is to sample the transformer liquids and package the transformers for shipment to safe storage and disposal. An additional village has recently notified GCI that they have 15 improperly discarded obsolete transformers.
- A dioxin/furan project, also by the GCI. The focus is on community training awareness programs to reduce dioxin/furan emissions from open burning (barrel burning).
- A community-based model for identifying sources of PCBs and obsolete pesticides in the Russian North, by the Russian Association of Indigenous People of the North (RAIPON). Activities started in three indigenous villages in the Nenets Autonomous Region, including training the local population to identify sources of PCBs, collecting samples from the local landfills to test for PCBs and pesticides, and providing new food storage containers to local communities to replace POPs-contaminated containers used in the households.

Collaborating with the AIA (Aleut International Association) and the Northwest Public Health Research Center in St. Petersburg, Russia, the human assessment of POPs exposure in the Russian Commander Islands (CI) will include the non-Aleut women and the adult household members of highly exposed individuals. The relevant subsistence species for the CI will also be sampled and tested for POPs, in cooperation with the U.S. Fish and Wildlife Service and Russian authorities. Further analysis of the existing data from both the CI and the Alaska Native Monitoring Program will continue looking for health effects from the POPs and heavy metals in the data collected thus far.

Additional analysis of congener patterns of PCBs will be sought to identify patterns indicative of particular sources of PCBs, both in human and in wildlife tissues, from existing data. At present, preliminary analysis points to a PCB source in the western North Pacific circulation that results in particular congener ratios in the residents on both sides of the Bering Sea, but this needs further work. It is proposed to continue to fund the Aleut International Association for epidemiologic and laboratory analysis by the Northwest Institute for Public Health Research, in St. Petersburg, Russia.

Implementing Technologies

Introducing and implementing innovative technologies and management opportunities has been a cornerstone within EPA. In the Arctic, EPA continues to focus on reducing contaminants reaching the Arctic through long-range transport and

building capacity within the U.S. Arctic to reduce potential environmental impacts. Since 2003, the EPA Office of International Affairs has chaired ACAP. Under the U.S. chairmanship, ACAP has broadened its sphere of activities to include emerging chemical contaminants such as brominated flame retardants and has extended its cooperative initiatives to include formal projects with the indigenous peoples and the Barents Euro-Arctic Council's Working Group on Environment.

Reducing Atmospheric Mercury Releases from Arctic States

The Arctic Council agreed to act to reduce exposures to a number of priority pollutants, such as mercury, in the Arctic region. To accomplish this, the ACAP Mercury Project was initiated in 2002. The project is being led by the Danish Environmental Protection Agency. All eight Arctic nations are participating, and four, including the U.S., are providing funding. The EPA is coordinating U.S. involvement. The project objective is "to contribute to a reduction of mercury releases from the Arctic countries; partly by contributing to the development of a common regional framework for an action plan or strategy for the reduction of mercury emissions, and partly by evaluating and selecting one or a few specific point sources for implementation of release reduction measures. The reduction of mercury release should serve as a demonstration of existing possibilities, giving inspiration to other measures in the region."

In 2005, two ACAP mercury reports were issued. The first, *Arctic Mercury Releases Inventory*, summarizes and discusses current releases, usage, and disposal of mercury within all eight Arctic countries. The second, *Assessment of Mercury Releases from the Russian Federation*, represents the first comprehensive assessment of mercury releases at the national level by that country. Sectors include coal combustion, non-ferrous metallurgy, chlor-alkali production, gold mining, and management of mercury-containing products. All of these materials have been shared with the UNEP Global Mercury Program and other international fora, including regional bodies such as the Barents Euro-Arctic Council. Two additional reports are in the final stages of preparation: *Russia Mercury Action Plan to Reduce Major Mercury Release Sources* and *Assessment of Mercury Reduction Measures in Existing Binding and Non-Binding International Instruments*.

With the cooperation of the Russian authorities, a limited number of point sources in the Russian Federation are being evaluated in terms of their potential as sites for demonstration projects on mercury reduction measures. Potential projects that have been identified for further evaluation by the Mercury Project Steering Group include:

- Mercury-specific air pollution controls on a coal-fired facility;
- Technical upgrades and improved air pollution controls on a mercury-recycling plant; and
- Collection and preliminary treatment of mercury waste in an existing recycling facility in northwest Russia.

An additional ACAP mercury project was endorsed by the Mercury Project Steering Group in September 2005 that directly responds to the UNEP Governing Council (GC23) Partnership initiative to reduce sources of mercury in the environment. This project, jointly funded by Canada and the U.S., will assist Russian chlorine production facilities to reduce mercury consumption and release when using mercury cell technology.

Reducing PCBs in Russia

The Russian Federation no longer produces, but still uses, PCBs and PCB-containing equipment, and it has not accepted the Protocol on Persistent Organic Pollutants (POPs) of the Convention on Long-Range Transboundary Air Pollution (LRTAP) because of its inability to phase out PCB use. However, Russia has signed the Stockholm Convention on Elimination of Persistent Organic Pollutants, which includes PCBs and obsolete and prohibited pesticides. To assist Russia in phasing out PCB use, EPA has proposed a multilateral technology transfer and demonstration project under the auspices of ACAP. The objective of this multilateral cooperative pilot program is to protect the Arctic ecosystems and indigenous U.S. populations by assisting the Russian Federation in:

- Developing an inventory of PCB sources in the Russian Federation;
- Ceasing the use of PCBs; and
- Providing safe disposal and destruction of PCBs and PCB-contaminated equipment and material.

The project has been implemented in three phases. Phase I, implemented during 1997–1999, organized the effort and developed an inventory of PCBs in Russia. During Phase II, feasibility studies were conducted to identify effective collection, storage, destruction, and remediation techniques, as well as to identify alternative dielectric fluids and technologies to convert and

retrofit facilities so that they produce and use PCB alternatives. Phase III began in mid-2002. The project for destroying PCBs in active use in Russia is underway.

Environmentally Safe Management of Obsolete and Prohibited Pesticides

To protect northern villages, including those of indigenous peoples, from the Soviet legacy of stockpiled and unused pesticides that have been released into their environment, ACAP began a program to address this problem. Over 854 tons of obsolete pesticides have been inventoried, repackaged, and placed into safe storage in six Russian regions impacting the Arctic. Over 216 additional tons of obsolete and prohibited pesticides were discovered during the inventory development. Eighty-eight tons of unidentified pesticides have been analyzed in the six regions. Work is underway in an additional five regions impacting the Arctic.

Science To Achieve Results Program

The EPA supports high-quality research by the nation's leading scientists and engineers to strengthen the basis for decisions about local and national environmental issues. Through its Science to Achieve Results (STAR) grants and fellowship programs, EPA works with academia, state and local agencies, other Federal agencies, and scientists in EPA to increase our knowledge of how to protect our health and natural resources in Alaska and the rest of the U.S.

Two hallmarks of the STAR program are competition and high-quality science. STAR counts four Nobel Prize winners among its grant recipients. In addition, all awards are made using competitive requests for applications and peer-review panels that are outside the EPA to ensure no conflict of interest. Each year, EPA uses about 1,000 outside scientific experts to peer-review its grant and fellowship submissions.

Research on Subsistence Lifestyles

The STAR-funded Alaska Community Action on Toxics program is working with the Siberian Yupik people of St. Lawrence Island, Alaska, who have relatively high levels of PCBs and pesticides in their blood. This research is examining the traditional foods of the Yupik people, including seal, whale, walrus, fish, seal oil, greens, sea bird eggs, and berries, to determine which foods could cause them to be exposed to significant levels of PCBs, three pesticides, and several metals. They are also investigating how the foods are prepared to see if preparation influences the levels of these contaminants in the foods.

Mote Marine Laboratory scientists have focused on the potential effects of petroleum hydrocarbons on the Inupiat people who have subsistence lifestyles. Oil and gas production in the Arctic occurs at a high level and may increase. Humans can be exposed to petroleum hydrocarbons by consuming species that form a major part of the Inupiat diet in northern Alaska. In Barrow, 75% of households consume bowhead whale, and nearly 50% consume bearded seals. Marine mammals are exposed to petroleum directly or through their diet and may metabolically transform petroleum-related compounds. Preliminary results show that there are no detectable levels of hydrocarbons in the tissues of these two marine mammals. In fact, the whales harvested in Barrow in the fall of 2004 traveled through waters where oil and gas development occur, but they did not have any detectable levels of hydrocarbon contamination in the portions of the animal typically consumed. The researchers are recording traditional knowledge on the quality of meat and other tissues obtained from subsistence hunting. Preliminary results suggest that hunters and consumers are sensitized to inedible seal and whale meat and that they are vigilant in their monitoring of animals' conditions.

Mercury Research

Mercury, a silvery metal that is very poisonous, can have adverse health effects on mammals, fish, and birds. Understanding why and how atmospheric mercury becomes part of the food chain is also important for mercury control. STAR researchers at the University of Connecticut are analyzing the mercury in sediment cores collected from the Tongass National Forest of southeastern Alaska in the spring of 2004. These scientists are attempting to determine whether the mercury is produced by natural or manmade sources, the mechanisms by which mercury is removed from the atmosphere, and the bioaccumulation of mercury in sensitive aquatic ecosystems. The results of this research should have major implications since atmospheric mercury deposition in southeastern Alaska can be viewed as an integrated sample of global mercury pollution in the northern hemisphere.

Understanding the chemical reactivity, atmospheric concentrations, and rates of emission and deposition of mercury are important in understand-

ing its atmospheric transformation. Researchers at the University of Miami are developing measurements and techniques to better define these criteria by studying the depletion of elemental mercury that occurs in the Arctic every spring. By monitoring the role of the various halogen species in the depletion of mercury, they hope to determine the rate of chemical conversion of elemental mercury to less-toxic, chemically bound mercury in beach areas.

POP Goes the Pollutant

The Arctic is considered one of the most pristine and remote environments on Earth. However, increasing evidence is showing that long-range atmospheric migration is bringing persistent organic pollutants, or POPs, to the region. POPs are toxic chemicals that adversely affect human health and the environment around the world. Because they can be transported by wind and water, most POPs generated in one country can affect people and wildlife far from where they are used and released. At the University of Alaska, a STAR fellow is using new tools to measure the levels and determine the types of POPs at five locations in Alaska. This research will provide baseline concentrations for many POPs that can be used in future work in Alaska.