



Health and the Environment

Protecting the health of future generations in the arctic through community-based participatory research and action

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EXPLORE's "Health and the Environment" column seeks to highlight areas of intersection between environmental issues and integrative health and healing.

The Arctic is a hemispheric sink for persistent industrial chemicals and pesticides that are transported on atmospheric and oceanic currents from lower latitudes through a process known as global distillation.^{1,2} These chemicals bioaccumulate in the bodies of fish, wildlife, and people of the north. Far from pristine, the Arctic contains some of the most highly contaminated animals and people in the world.^{3–8} These problems are exacerbated by the rapid pace and magnitude of climate change in the Arctic, which is now known to be warming at a much faster rate than earlier studies predicted—nearly four times faster than the planet as a whole.⁹ Melting of sea ice, permafrost, and glaciers mobilizes sequestered chemical contaminants and microplastics, threatening the health of our oceans, fish, wildlife, and peoples of the north.^{10,11} We see growing awareness of the Arctic as a place of vulnerability and an increasing interest in concerted action to protect the health and well-being of this region, its wildlife and peoples.

Initially, this community-based research collaboration began with Alaska Community Action on Toxics (ACAT) at the request of respected Savoonga elder and community health aide Annie Alowa. Annie witnessed health disparities among her people such as cancers, thyroid disease, miscarriages, birth defects, and reproductive disorders, particularly among the people who lived and worked at Northeast Cape on Sivuqaq. Our research team has been conducting community-based participatory environmental health research on Sivuqaq (traditional name for St. Lawrence Island) for more than 22 years. Sivuqaq is located in the northern Bering Sea region of Alaska, approximately 61 km from the Chukotka Peninsula of Russia and 322 km from the Alaskan mainland. It is home to approximately 1,700 Yupik residents living in the communities of Gambell and Savoonga. The people of Sivuqaq rely on a traditional diet of greens, berries, fish, reindeer, and marine mammals for their physical, cultural, and spiritual sustenance.

Due to the island's strategic geopolitical location, the U.S. established an Aircraft Control and Warning Station and White Alice Communications System Station at Northeast Cape (NEC) that operated from

1952–1972. The military displaced the traditional community of approximately 130 residents of NEC that included a governing tribal council, who relocated to Savoonga. Prior to the military's arrival, NEC and the Suqitughneq (Suqi) River were an especially important area for subsistence gathering, fishing, and hunting. The Suqi River was abundant with fish and the water was safe to drink. In a letter dated April 7, 1951, the Savoonga Tribal Council granted the U.S. Air Force a land withdrawal for military use at NEC with clear conditions, including the following provision: "Any refuse or garbage will not be dumped in streams or near the beach within the proposed area."¹² The military site encompassed about 39 km² and included 25 industrial buildings, an airstrip, and associated support facilities. When the military abandoned NEC in 1972, extensive debris and hazardous waste were left, in violation of the 1951 agreement. Contamination of soils, sediments, surface waters, groundwater, and biota derives from massive petroleum spills and releases of solvents, polychlorinated biphenyls (PCBs), organochlorine pesticides, and heavy metals.¹³ Within the NEC formerly used defense site, 30 areas of contamination were identified for investigation and removal actions.¹⁴

Residents today want to re-establish the once vital community at NEC; however, the health and safety of the people, land, water, and traditional food supply must be ensured. The watershed of the Suqi River is still severely polluted and the contamination prevents the safe consumption of traditional foods, practicing of cultural activities, and recovery of fish populations. Seal haul-outs at the mouth of the river also have not recovered. Collectively, both traditional knowledge and our data suggest that NEC is still unsafe for reestablishment of the traditional community. As the governing entity, the communities reiterate their right and authority to re-establish the viability of the land and water damaged by military activities at NEC.

Much of our community-based research has focused on documenting the nature and extent of contamination at the formerly used defense site at NEC, including extensive sampling of sediments, plants, and fish. We have documented elevated levels of PCBs, mercury, and pesticides in the environment and in fish. We have found that concentrations of numerous contaminants in the ninespine stickleback fish closely mirror concentrations in the blood serum of the people of Sivuqaq, indicating that stickleback are an effective sentinel species on the island.^{15,16}

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Despite extensive remediation of the former military site at NE Cape, stickleback and blackfish remain heavily contaminated with PCBs, which disrupt the endocrine function of fish (thyroid, reproductive) and decrease expression of genes important in repairing gene mutations. In addition, vitellogenin (yolk protein) concentrations in male stickleback indicate exposure to estrogenic contaminants (such as certain PCB congeners, or chemical compounds).¹⁷ The widespread health disruption in the fish is consistent with health problems of people on the island. Even after site remediation, contaminants from formerly used defense sites in remote regions of the Arctic remain a potential health threat to local residents, in this case, Yupik people who had no influence over site selection and use by the United States military. A recent paper documented elevated levels of PCBs and mercury in Dolly Varden, an important subsistence fish, downstream from the military site.¹⁸

We also investigate the levels and effects of persistent chemicals derived through global distillation, including PCBs, flame retardant chemicals, and per- and polyfluoroalkyl substances (PFAS). Our research has documented that Sivuqaq residents have concentrations of PCBs in their blood serum that are six to nine times higher than found in people who live in the lower 48 states. The people of Savoonga, who have traditional connections to Northeast Cape, have even higher levels of PCBs in their blood serum than people of Sivuqaq who are not associated with Northeast Cape.¹⁹ Our findings suggest that global transport of PCBs into the Arctic, coupled with elevated levels in traditional foods, results in elevated PCBs in Sivuqaq residents,²⁰ while some also experience added exposure from the military contamination at Northeast Cape.²¹ Our research has also documented the presence and effects of polybrominated diphenyl ethers (PBDEs), persistent legacy flame retardant chemicals that have been used in furniture foam and electronics, as well as per- and polyfluoroalkyl substances (PFAS), used in stain and stick resistant applications. Certain PBDEs and PFAS, which disrupt thyroid homeostasis, are present in elevated levels of the people of Sivuqaq, with sources including traditional foods and household dust.^{16,22–24}

The community-based research on Sivuqaq is guided by elders and other community leaders, and now includes eight universities²⁵ working together with the tribes and Alaska Community Action on Toxics. We train local people as community health researchers for the bio-monitoring work. The research informs agency decisions and aims to hold the military accountable for responsible clean up of the formerly used defense sites. We educate parents, teachers, and health care providers about ways to reduce exposures to harmful endocrine-disrupting chemicals in their homes and environment. The results of our research also inform environmental health policies at the state, national, and international levels. Alaska Community Action on Toxics organizes with community leaders to present information to policymakers in Juneau, Washington DC, and in Geneva, Switzerland at the United Nations. We have been active in the negotiation and implementation of the Stockholm Convention on Persistent Organic Pollutants (POPs treaty), a global legally-binding treaty to eliminate the world's most dangerous chemicals. The Preamble of the Convention acknowledges “that the Arctic ecosystems and Indigenous communities are particularly at risk because of the biomagnification of persistent organic pollutants and that contamination of their traditional foods is a public health issue.”²⁶ We recognize that it is critical for us to achieve comprehensive chemicals policy reform at state, national and international levels in order to protect the health of present and future generations, because chemicals do not recognize political boundaries.

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