

Alaska Community Action on Toxics

505 West Northern Lights Boulevard, Suite 205

Anchorage, Alaska 99503

(907) 222-7714; (907) 222-7715 (FAX)

www.akaction.org

November 11, 2009

Mr. Mathy Stanilaus
Assistant Administrator
Office of Solid Waste and Emergency Response
EPA West
1301 Constitution Avenue NW, room 3146B
Washington DC 20314-1000

RE: THANK YOU

Dear Mr. Stanilaus:

On behalf of the St. Lawrence Island Delegation and Alaska Community Action on Toxics (ACAT), thank you for meeting with members of our delegation on Thursday September 24, 2009. We appreciated the time that you took with us to discuss the pressing needs of the people of St. Lawrence Island, including the toxic contamination of formerly used defense sites (FUDS), the need for proper site characterization and EPA oversight at Gambell and Northeast Cape FUDs, thorough and aggressive clean up, and the inclusion of Northeast Cape on the National Priorities List. The Yupik people of St. Lawrence Island have disproportionate health problems that may be associated with exposures to chemical contamination from the formerly used defense sites and long-range transport, including cancers, diabetes, reproductive problems, thyroid disease, nervous and immune system disorders, and learning disabilities. Actions are needed to protect the health and well-being of present and future generations, the lands, waters, and traditional subsistence way of life of the Yupik people. Climate warming exacerbates the mobilization and transport of persistent organic pollutants (POPs) from local and distant sources in the Arctic. Synergistic effects of climate warming and increasing levels of contaminants in the Arctic threaten food security and the survival of the Yupik people.

As we discussed, we are concerned about the contamination and environmental health issues associated with the formerly used defense sites on St. Lawrence Island at Northeast Cape and Gambell. The island's military installations and residents served important strategic roles during the Cold War. However, when the bases were shut down, large quantities of hazardous wastes and debris were left behind. At Northeast Cape, massive fuel spills, PCBs, pesticides, heavy metals, asbestos, and solvents were dumped on the surface or buried in unlined landfills that are leaching to the Suqitughneq (Suqi) River and coastal waters. The village at Northeast Cape was displaced after the military contaminated the area and cannot be re-established until effective remedial measures are implemented and finalized.

At Gambell, the wastes, including fuels, solvents, unexploded ordnance, and metal debris were buried in the unconsolidated gravel which forms the foundation of the village. At Gambell, we are concerned about the vulnerability of the shallow (about 10 feet) aquifer that

USEPA SF



1616498

serves as the community water source. We are also concerned that the school and residential areas are located on areas overlying military contamination. The toxic waste dumps on St. Lawrence Island have devastated the lands and waters, and have continued to affect the traditional food gathering and health for more than 50 years.

In addition to the military contamination, the Yupik people of St. Lawrence Island are also suffering from the contamination that arrives on wind and ocean currents into our region via long-range transport. As you know, the Arctic has become a hemispheric sink for POPs that travel hundreds and thousands of miles northward on wind and ocean currents, where they accumulate in the bodies of wildlife and people of the north. This contamination harms our traditional foods and the health of our people. Arctic Indigenous peoples carry some of the highest levels of these contaminants in their bodies. The chemicals include legacy chemicals such as PCBs and DDT, as well as currently used industrial chemicals and pesticides such as brominated flame retardants, fluorinated substances, and endosulfan. We ask for your support in preventing the production and release of these chemicals through reform of our federal laws, the Toxic Substances Control Act (TSCA) and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). We also ask for U.S. participation and leadership internationally through the Stockholm Convention on Persistent Organic Pollutants (POPs). It is only through national and international actions that we can protect the health of the peoples of the Arctic.

U.S. leadership is critical to the success of international efforts to eliminate the world's most dangerous substances. We are eager to work with the Environmental Protection Agency, Department of State, and Congress to enact legislation that reflects the precautionary spirit and scientific rigor of the Stockholm Convention and enable swift action by the U.S. on POPs chemicals. We are committed to ensure ratification of a strong, protective treaty.

The Preamble of the Convention recognizes the special vulnerability of Arctic Indigenous Peoples and states: "*Acknowledging that the Arctic ecosystems and indigenous communities are particularly at risk because of biomagnifications of persistent organic pollutants and that contamination of their traditional foods is a public health issue.*" Some Arctic Indigenous populations have shown "levels of contaminants in blood and breast milk [that are] higher than those found anywhere else on the Earth." This recognition inspired the negotiation of the Stockholm Convention, as noted in the preamble, and must now motivate the Convention's strong implementation. This is not an abstract issue for the Yupik people and other Arctic Indigenous peoples—it affects their daily lives and the health of future generations. They depend on traditional foods from the land and sea for their physical, cultural, and spiritual well-being—foods that are contaminated with POPs chemicals. Our own community-based research has found high levels of such POPs chemicals as PCBs and other "legacy" chemicals in the traditional foods and blood serum of the Yupik people. The most recent Arctic Monitoring and Assessment Programme report also raises concerns about increasing levels of "new" POPs chemicals in the Arctic such as the polybrominated diphenyl ethers (PBDEs) and perfluorinated substances. With the rapid decline of sea ice, scientists predict greater atmospheric loading of such chemicals as endosulfan into the marine environment. We must take swift national and international actions to eliminate the production and use of

these chemicals that threaten the integrity of ecosystems and public health in the Arctic and around the globe.

The people of St. Lawrence Island need your help to move forward and to renew their way of life. We want to ensure that Northeast Cape is safe and healthy for the restoration of the Suqi River watershed and re-establishment of the village. Our research in the Suqi River watershed indicates the presence of PCBs, pesticides, polycyclic aromatic hydrocarbons associated with past fuel spills, polybrominated diphenyl ethers (PBDEs), and heavy metals. In Gambell, we must also ensure protection of the drinking water source, the school, and residential areas.

We request your support to ensure proper regulatory oversight, enforcement, and funding for characterization and responsible cleanup of the formerly used defense sites. This includes provisions for use of innovative clean-up technologies relevant to the Arctic, accountability to the leadership of the communities of Savoonga and Gambell, government-to-government consultation with Tribes, and citizen participation in remedial decisions. Tribes, as sovereign governments, must have the right to determine clean-up standards and serve as official parties to the Records of Decision. We also request your support to achieve restoration and removal of the contamination rather than premature closures, partial excavations, natural attenuation, and/or land use controls. We request the following actions to address and prevent further health and environmental effects of military contamination on St. Lawrence Island.

Specifically, the matters of primary urgency for your attention and action include:

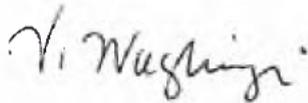
- Complete removal of the solid and hazardous waste materials at the Northeast Cape Site 7 landfill;
- Removal and treatment of the White Alice site soils and groundwater to effectively remove associated contaminants;
- Removal/remediation of contaminants in the Northeast Cape Main Complex soils and groundwater, as well as on-going monitoring to ensure safe drinking water supplies;
- Effective remediation and long term monitoring of the Suqi River drainage basin sediments and surface water (fuels and PCB contamination);
- Complete removal or destruction of the contaminants identified at the former village site at Northeast Cape;
- Restoration of the Suqi River watershed and shallow groundwater resources within the area of the Main Complex and up-gradient regions of the Main Complex to ensure adequate and safe drinking water at Northeast Cape;
- Removal of contaminant sources at the village in Gambell including those up-gradient from the municipal water supplies and those beneath the residential areas, the school and community buildings;
- Long term, bi-annual monitoring of contaminants of concern within the municipal water supply areas;
- Establishment of a safe drinking water source at Gambell that is up-gradient of the contaminated sites; and
- Institute the tribes as official signatories/Parties to any Records of Decision (RODs).

- Protect the health of children and other vulnerable populations in Alaska and elsewhere through reform of the Toxic Substances Control Act (TSCA) and the federal pesticide law (FIFRA). Include provisions to: 1) phase out persistent, bioaccumulative toxics (PBTs), and chemicals that harm health; 2) require safe substitutes and solutions; 3) give the public and workers the full right-to-know and participate; and 4) require prior, comprehensive safety data for all chemicals.
- Take swift, bold measures to substantially reduce the greenhouse gases to protect communities of the Arctic from climate change impacts.
- U.S. participation and leadership is critical to the success of international efforts to eliminate the world's most dangerous substances that threaten the north/Arctic. Ensure passage of strong, effective implementation legislation for the ratification of the Stockholm Convention, the international, legally-binding treaty on POPs.

Again, we very much appreciate your time in meeting with the delegation. ACAT is a non-profit organization that empowers individuals and tribes throughout Alaska who are seeking assistance with toxic contamination issues that affect the health of people and the environment. We look forward to working with you to address the concerns of the Yupik people of St. Lawrence Island.

If you have any questions or need additional information, please do not hesitate to contact us directly or to reach us through our Washington D.C. representative—The Raben Group (contact: Ellie Collinson at (202) 587-4935 or ecollinson@rabengroup.com).

Sincerely,



Vi Waghiyi
Environmental Health and Justice
Program Director



Pamela K. Miller
Executive Director

cc Senator Lisa Murkowski
 Senator Mark Begich

Add to citation/reference
JOURNAL

ORGANOCHLORINE AND METAL CONTAMINANTS IN TRADITIONAL FOODS FROM ST. LAWRENCE ISLAND, ALASKA

Gretchen Welfinger-Smith¹, Judith L. Minholz², Sam Byrne³, Vi Waghiyi³, Jesse Gologergen⁴, Jane Kava⁴, Morgan Apatiki⁵, Eddie Ungott⁵, Pamela K. Miller³, John G. Arnason², David O. Carpenter¹

¹Institute for Health and the Environment, University at Albany, Rensselaer, New York

²Department of Earth and Atmospheric Sciences, University at Albany, Albany, New York

³Alaska Community Action on Toxics, Anchorage, Alaska

⁴Native Village of Savoonga, Alaska

⁵Native Village of Gambell, Alaska, USA

Marine mammals (bowhead whale, walrus, and various seals) constitute the major component of the diet of the Yupik people of St. Lawrence Island, Alaska. St. Lawrence Island residents have higher serum concentrations of polychlorinated biphenyls (PCB) than in the general U.S. population. In order to determine potential sources, traditional food samples were collected from 2004 to 2009 and analyzed for PCBs, three chlorinated pesticides, and seven heavy metals (mercury, copper, zinc, arsenic, selenium, cadmium, and lead). Concentrations of PCB in rendered oils (193–421 ppb) and blubber (73–317 ppb) from all marine mammal samples were at levels that trigger advisories for severely restricted consumption, using U.S. Environmental Protection Agency (EPA) fish consumption advisories. Concentrations of pesticides were lower, but were still elevated. The highest PCB concentrations were found in polar bear (445 ppb) and the lowest in reindeer adipose tissue (2 ppb). Marine mammal and polar bear meat in general have PCB concentrations that were 1–5% of those in rendered oils or adipose tissue. PCB concentrations in organs were higher than meat. Concentrations of metals in oils and meats from all species were relatively low, but increased levels of mercury, cadmium, copper, and zinc were present in some liver and kidney samples. Mercury and arsenic were found in lipid-rich samples, indicating organometals. These results show that the source of the elevated concentrations of these contaminants in the Yupik population is primarily from consumption of marine mammal blubber and rendered oils.

2
0
Did we do
this before
INT 9th?

Downloaded by

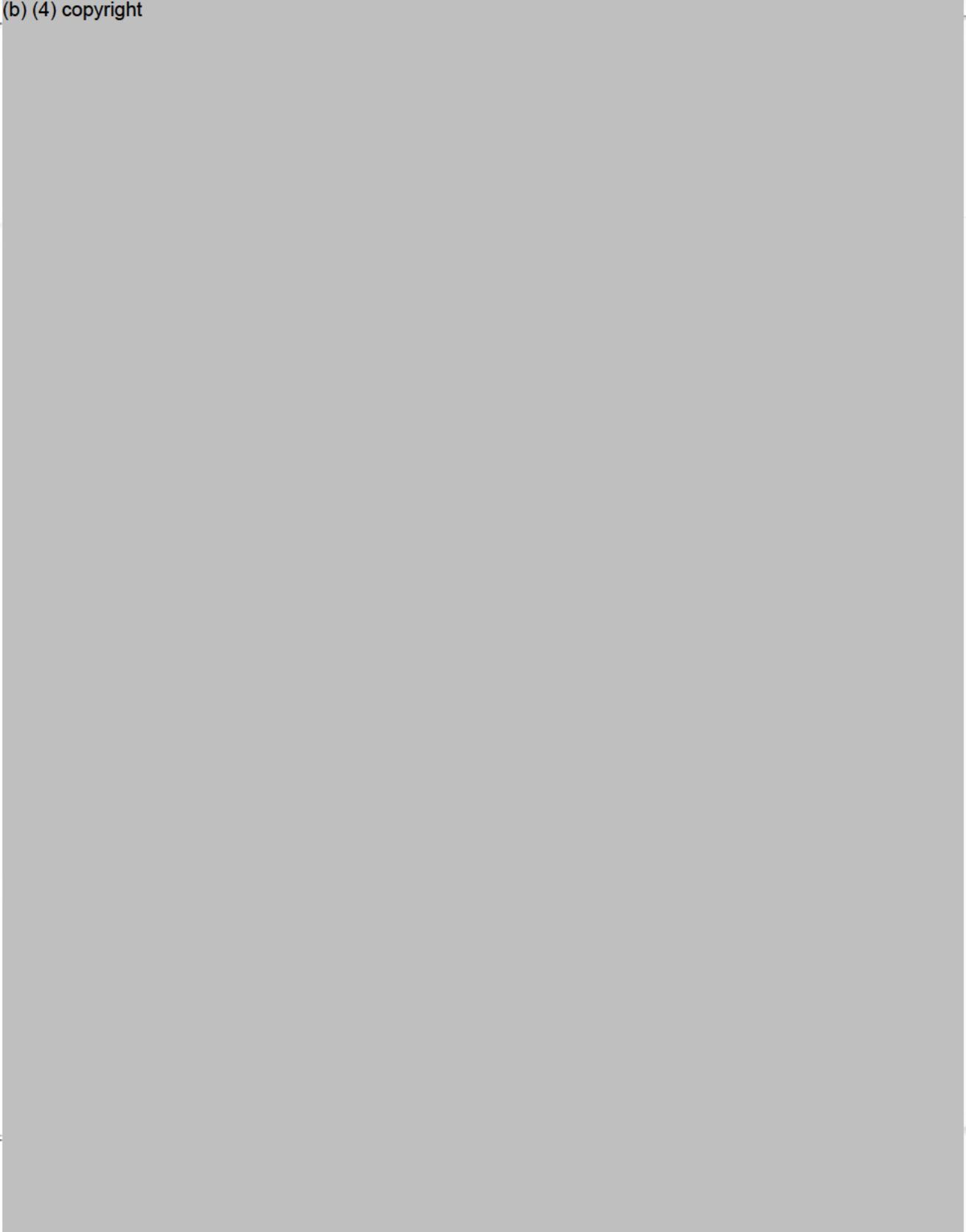
(b) (4) copyright

Received 8 February 2011; accepted 5 May 2011.
This study was supported by U.S. EPA grant R831043 to the Alaska Community Action on Toxics (Environmental Contaminants in Food Stuffs of Siberian Yupiks from St. Lawrence Island) and by the Institute for Health and the Environment of the University at Albany. Present address for Judith L. Minholz is Northeast Analytical, Pace Analytical Services, Schenectady, New York; present address for John Arnason is Wadsworth Center, New York State Department of Health, Albany, NY 12201.
Address correspondence to David O. Carpenter, Institute for Health and the Environment, University at Albany, 5 University Place, Rensselaer, NY 12144, USA. E-mail: carpent@uamail.albany.edu

(b) (4) copyright



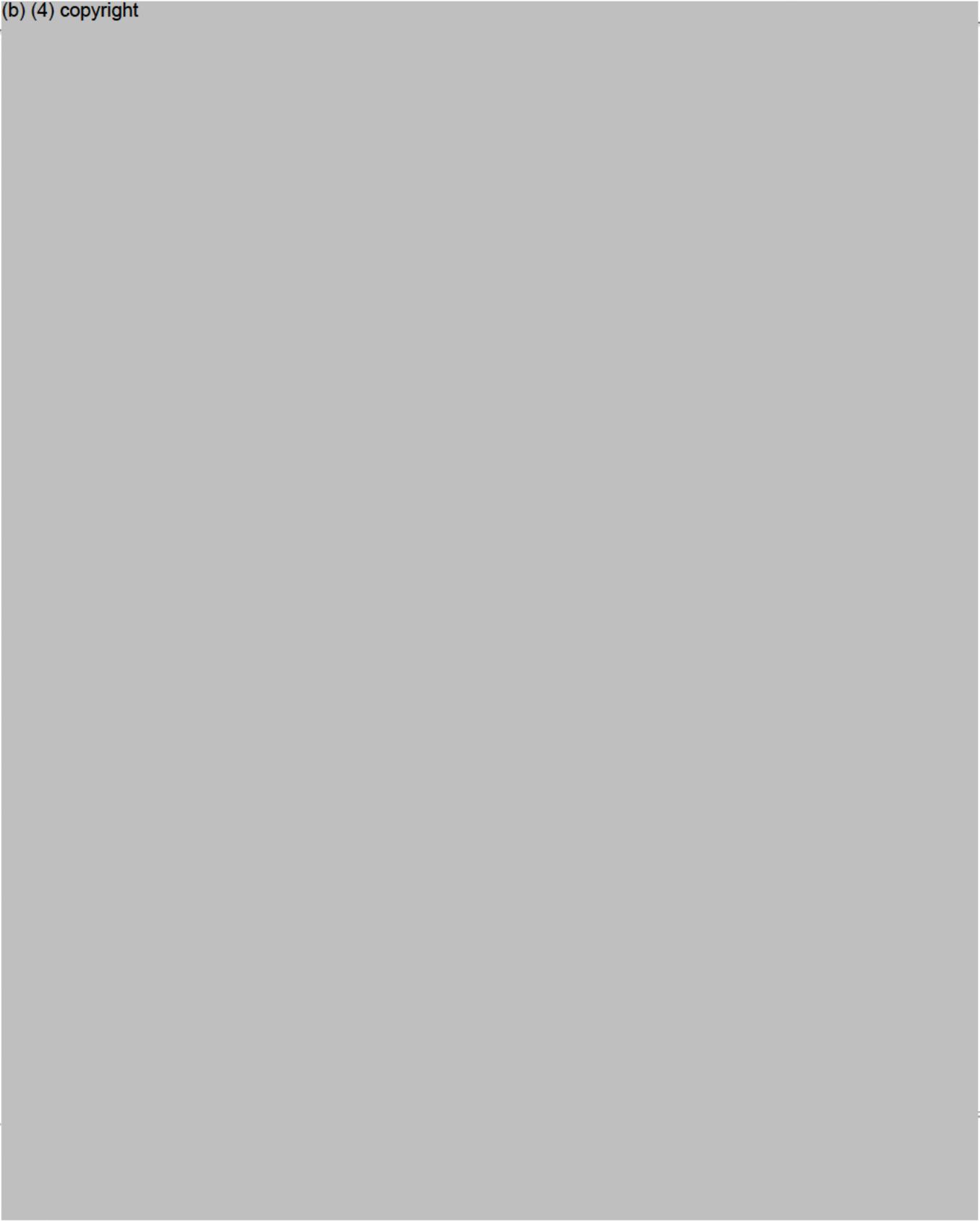
(b) (4) copyright



(b) (4) copyright



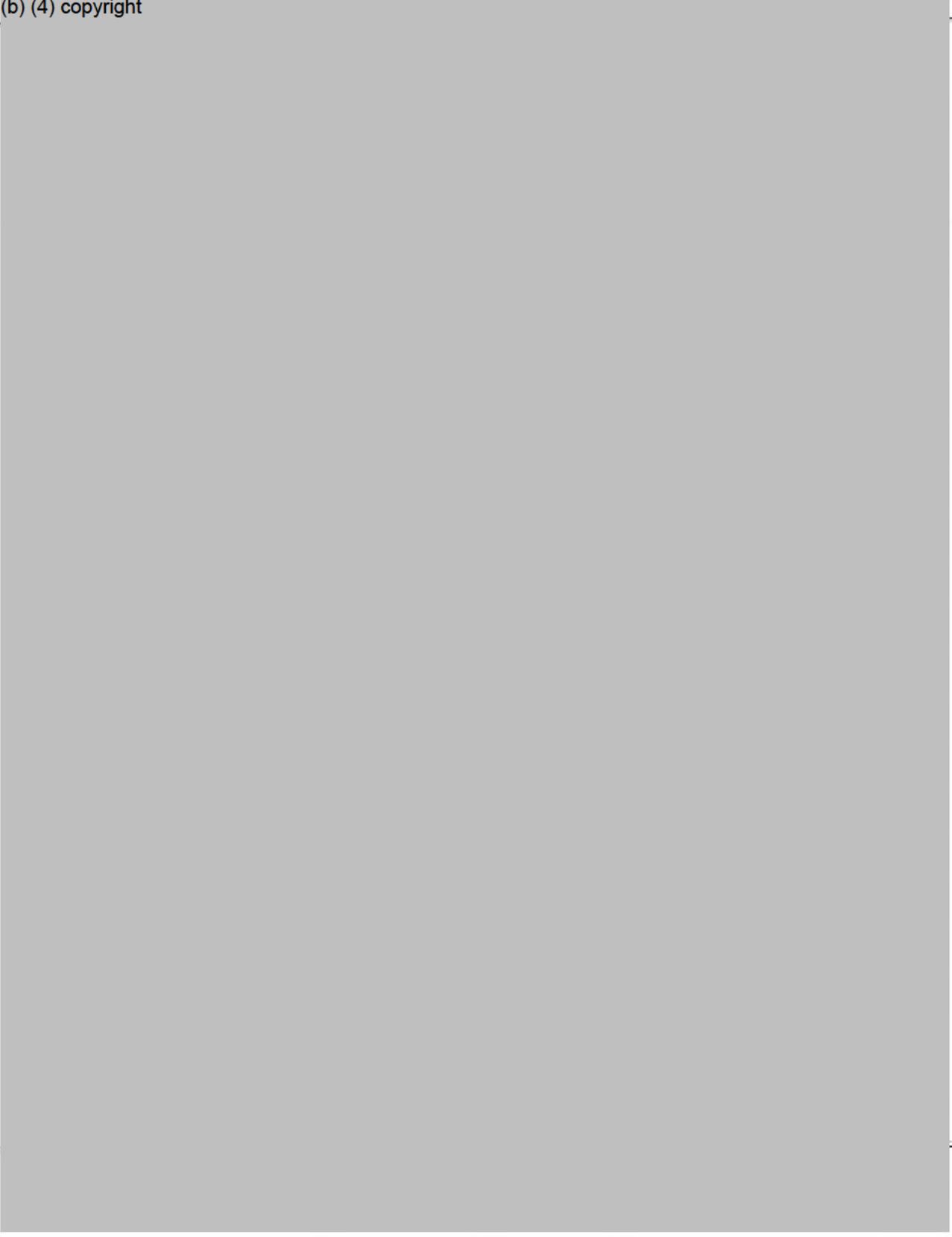
(b) (4) copyright



(b) (4) copyright



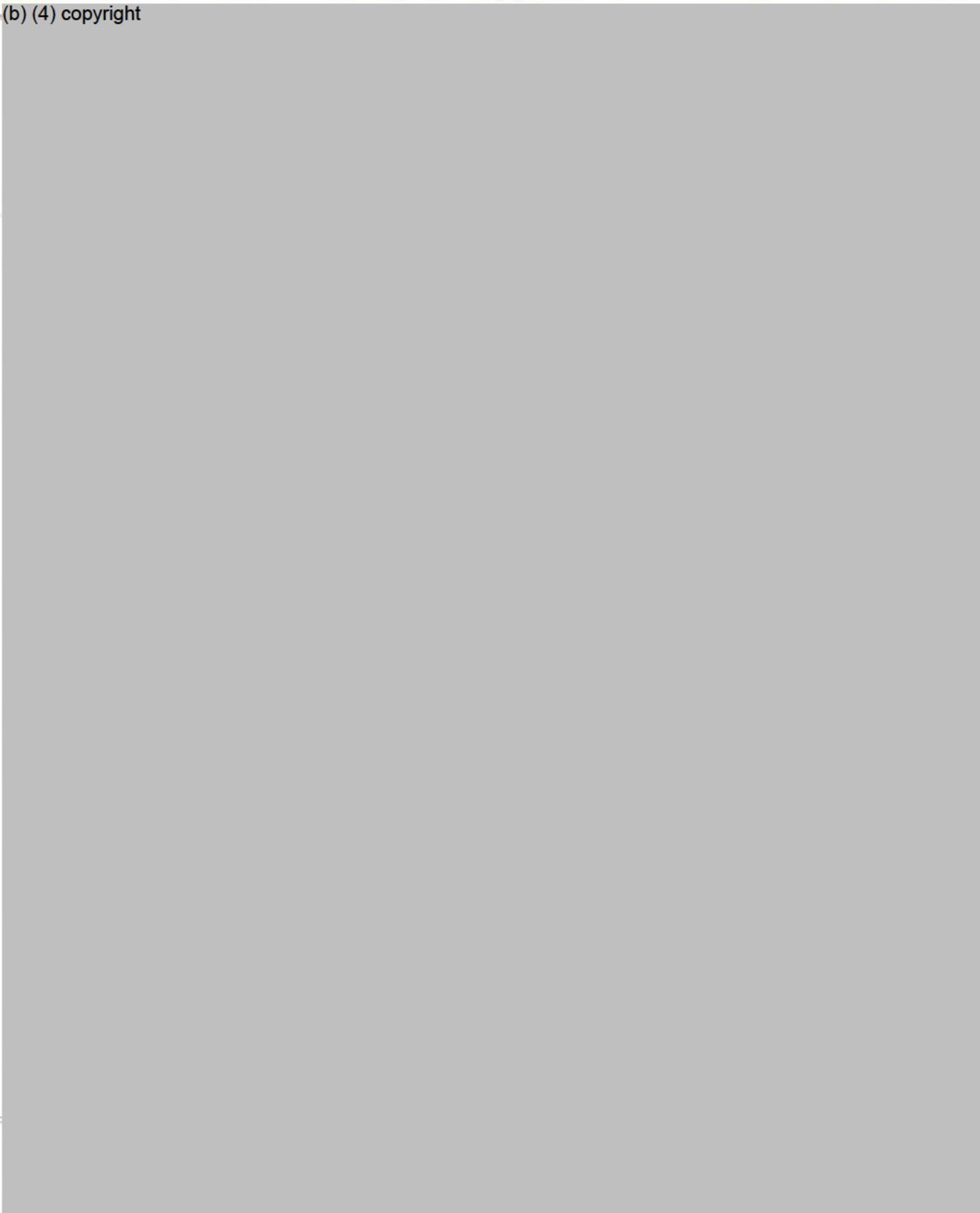
(b) (4) copyright



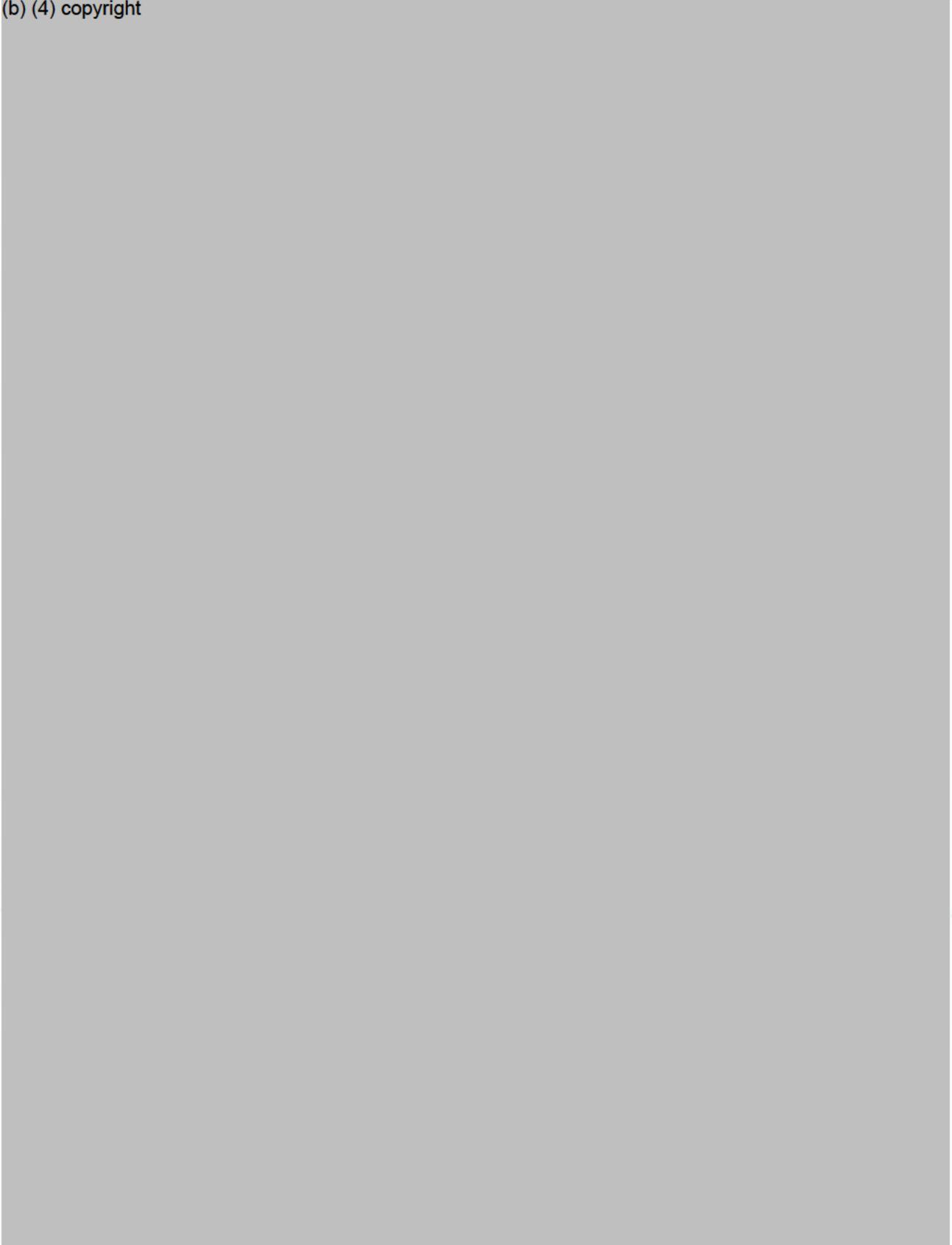
(b) (4) copyright



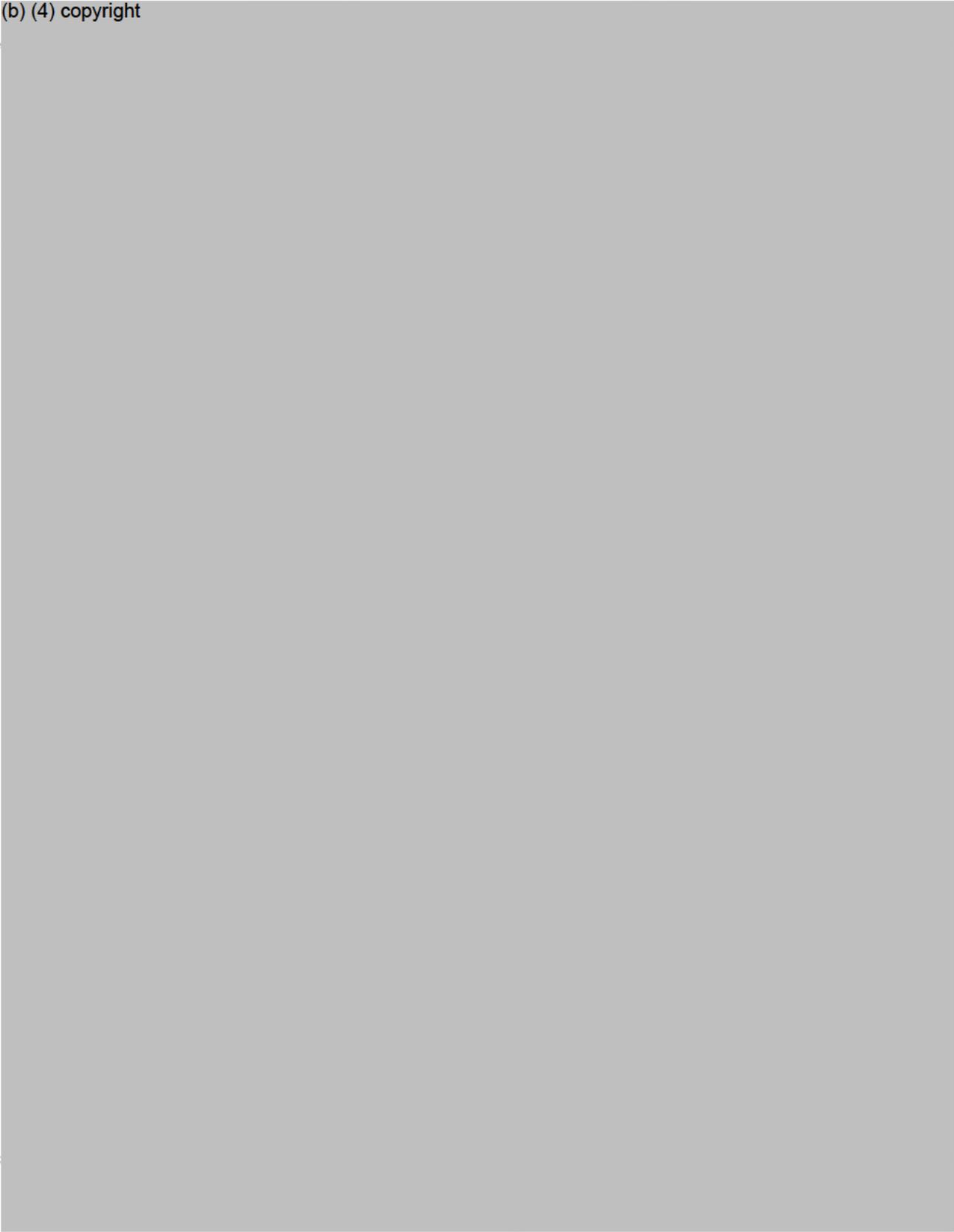
(b) (4) copyright



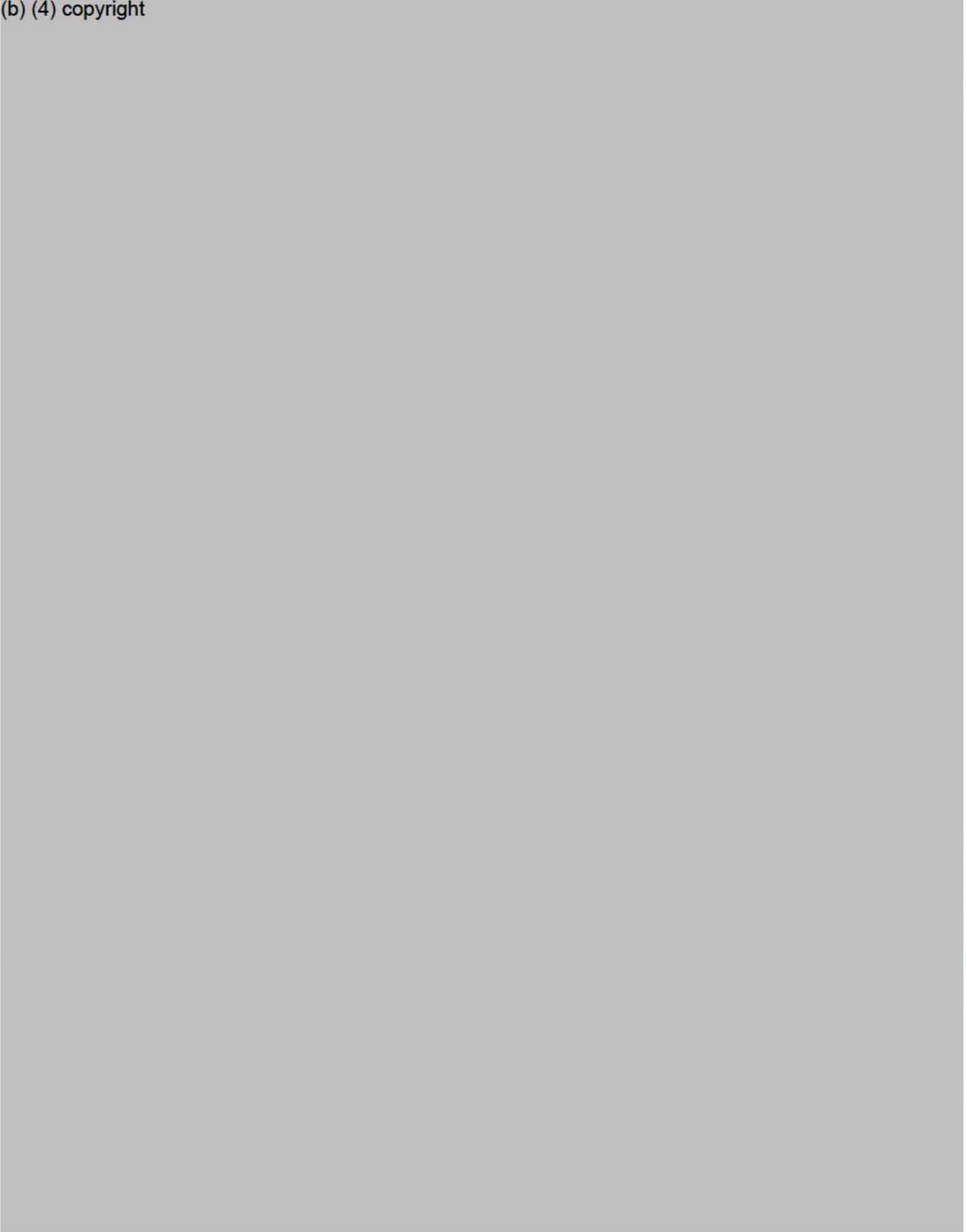
(b) (4) copyright



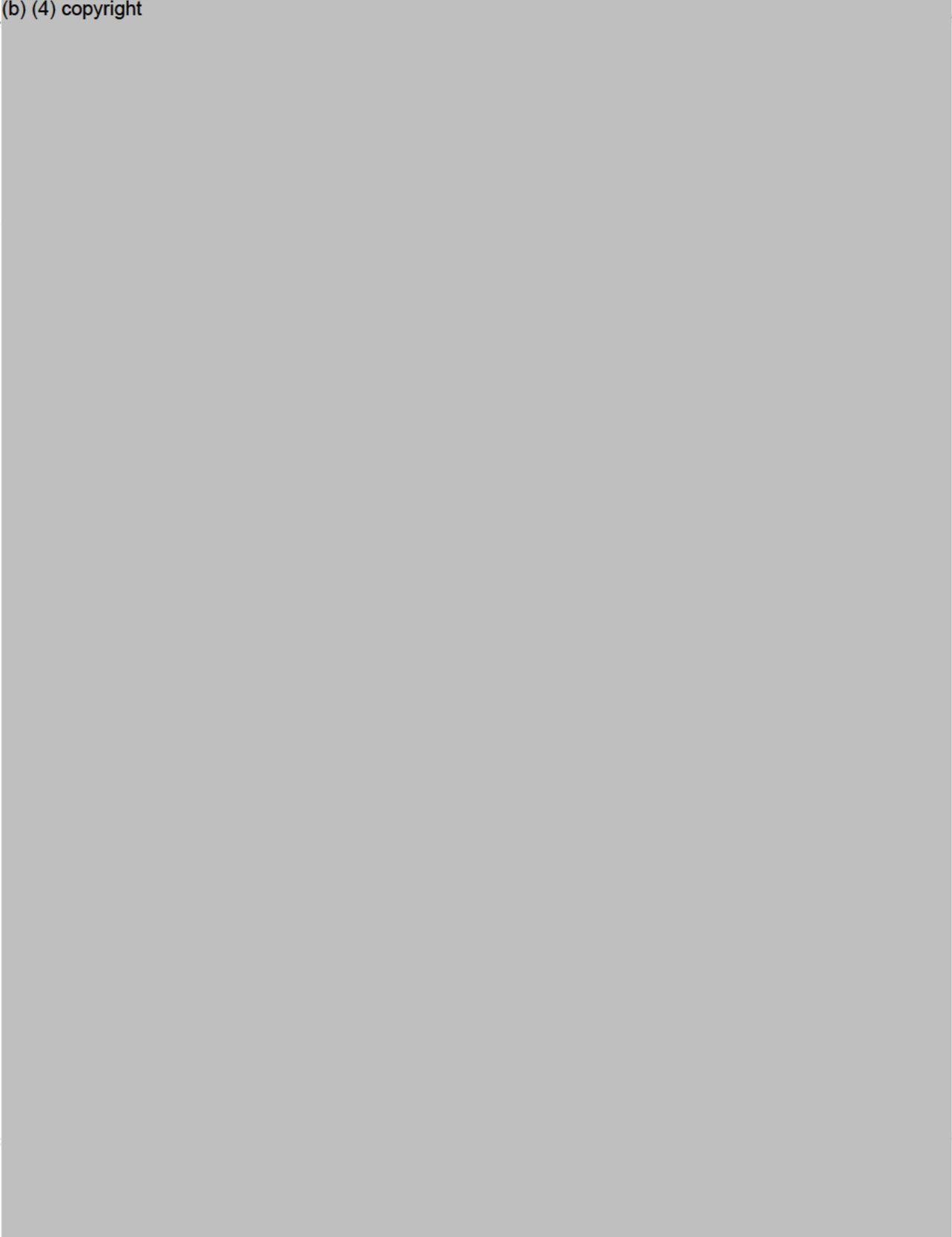
(b) (4) copyright



(b) (4) copyright



(b) (4) copyright



(b) (4) copyright



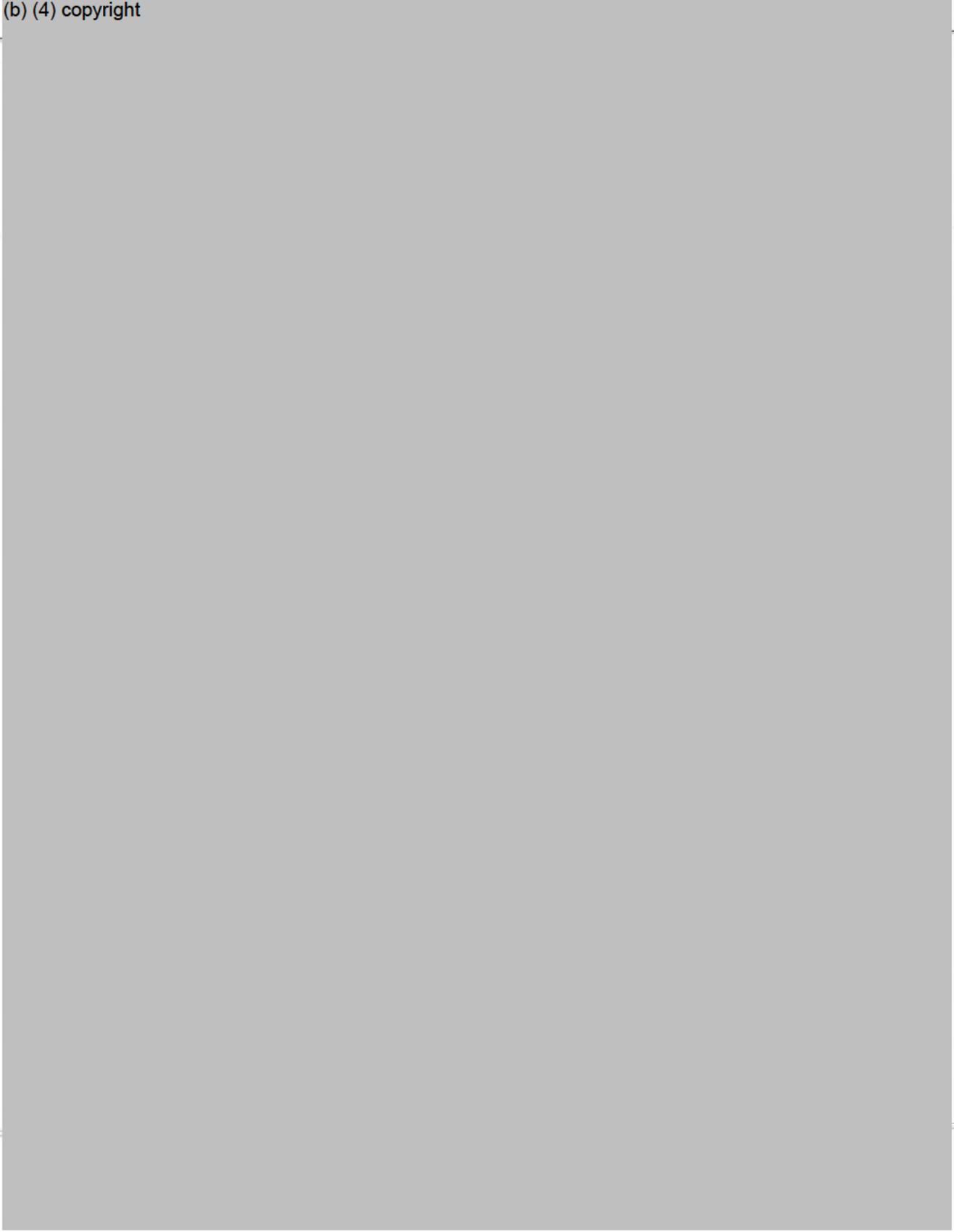
(b) (4) copyright



(b) (4) copyright



(b) (4) copyright



(b) (4) copyright



(b) (4) copyright



(b) (4) copyright



State of Alaska
Epidemiology



Bulletin

Recommendations
and
Reports

Department of Health and Social Services
Joel Gilbertson, Commissioner

Division of Public Health
Karen Pearson, Director

Section of Epidemiology
John Middaugh, MD, Editor

3601 C Street, Suite 540, PO Box 240249, Anchorage, Alaska 99524-0249 (907) 269-8000
24-Hour Emergency Number 1-800-478-0084

<http://www.akepi.org>

Volume No. 7 Number 1
February 6, 2003 2

PCB Blood Test Results from St. Lawrence Island

Recommendations for Consumption of Traditional Foods

Statement from the Alaska Division of Public Health

Contributed by: Lori Verbrugge, Ph.D.
Tracey Lynn, D.V.M., M.S.
John Middaugh, M.D.
Scott Arnold, Ph.D.

Introduction

Recently, the Alaska Community Action on Toxics (ACAT) released a report entitled “Contaminants in Wildlife and People of St. Lawrence Island, Alaska: A Report to the Communities of Savoonga and Gambell.” ACAT issued a related press release on October 2, 2002, entitled “Elevated Levels of Harmful PCB’s Found in People of Saint Lawrence Island, Attributed to Exposure at Military Site.” This resulted in a front page article in the Anchorage Daily News (“Toxic PCB levels soar above norm in St. Lawrence Island Natives,” Anchorage Daily News, October 3, 2002) and other media coverage.

Researchers for the project from the State University of New York shared their data from human blood tests with the Alaska Division of Public Health (ADPH), enabling us to examine their results. Our review of the data has led us to conclude that the polychlorinated biphenyl (PCB) concentrations detected in St. Lawrence Island village residents are similar to other Alaska Native populations that have been assessed, as well as to other arctic populations (AMAP, 1998).

The ADPH is concerned that the media coverage associated with ACAT’s report may lead St. Lawrence Island residents and other Alaska residents to fear that their traditional foods are contaminated and unsafe to eat. Subsistence diets rich in fish and marine mammals offer numerous health, social, cultural, and economic benefits. Proven health benefits include protection from cardiovascular disease and diabetes, and improved maternal nutrition and neonatal and infant brain development. In the judgment of the ADPH, as well as the larger international arctic scientific community (AMAP, 1998), the known benefits of fish and marine mammal consumption far outweigh the controversial potential adverse health effects from contaminants found in those foods. We have also reviewed the wildlife data presented in the ACAT report and agree with the report’s statement that “St. Lawrence Island foods are generally much less contaminated than foods from other areas of the Arctic.”

The ADPH supports the clean-up of military contamination on Northeast Cape. The purpose of this Bulletin is to provide a balanced and thorough evaluation of the PCB blood test results from St. Lawrence Island residents to clarify issues related to the public health interpretation of the data.

Public Health Evaluation

The ADPH assembled a team of scientists including medical epidemiologists and toxicologists to review the data from the study and to provide interpretation and public health advice to the communities on St. Lawrence Island.

Due to the known characteristics of PCBs, higher concentrations are expected in older individuals compared to younger persons. In order to provide the appropriate context for the PCB concentrations detected in residents of St. Lawrence Island, comparisons must be made between persons of the same sex and age. Media statements that PCBs “soar above norm” in St. Lawrence residents were based on comparisons to dissimilar populations. For example:

- The ACAT report states that “women from St. Lawrence Island had significantly higher PCB concentrations (7–9 ppb) than women from the Aleutian and Pribilof Islands (2 ppb).” It is important to note that the cited Aleutian/Pribilof Island data were from women of childbearing age, while the St. Lawrence Island study focused on older people (the women’s ages were 38–75 years). Therefore, no scientifically sound comparison can be made between these particular groups;
- Similarly, the St. Lawrence Island data cannot be directly compared with the United States national average of 0.9–1.5 ppb (parts per billion). The national average encompassed a younger age distribution and did not include groups that rely on subsistence foods.

When the St. Lawrence Island data are compared with data from other studies of Alaska Natives of the same sex and age, the results are similar. For example:

- When the PCB concentrations detected in the blood of St. Lawrence Island residents are individually plotted by age, they fall within the range of values measured in Aleutian/Pribilof Island residents (Middaugh et al, 2001) (Figure 1). The mean concentration of PCBs in St. Lawrence Island residents over 35 years of age is not significantly different from the mean concentration of PCBs in Aleutian/Pribilof Island residents over 35 years of age ($p = 0.08$, t-test with unequal variances; Figure 2). Descriptive statistics for the two studies are presented in Table 1.
- PCB concentrations detected in St. Lawrence Island women (mean age 54 years; mean PCB concentration 6.84 ppb) were similar to the mean PCB concentration reported for 131 Alaska Native women of comparable age from throughout the state (mean age 57 years; mean PCB concentration 7.56 ppb) (Rubin et al, 2001) (Figure 3).

Figure 1. Comparison of PCB blood test results from 5 Aleutian/Pribilof Island Villages (1999) and St. Lawrence Island (2002).

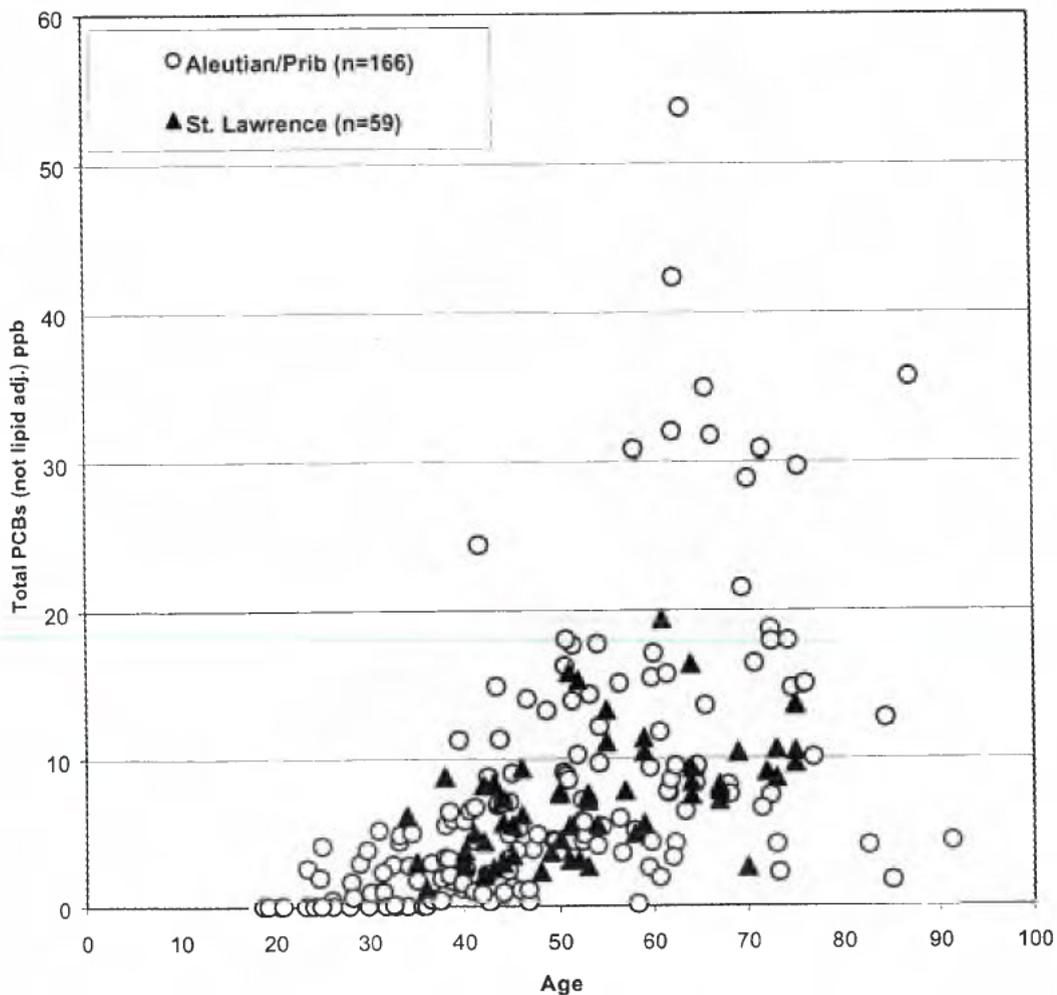


Figure 2. Comparison of PCB blood test results from persons 35 years and older from 5 Aleutian/Pribilof Island Villages (1999) and St. Lawrence Island (2002).

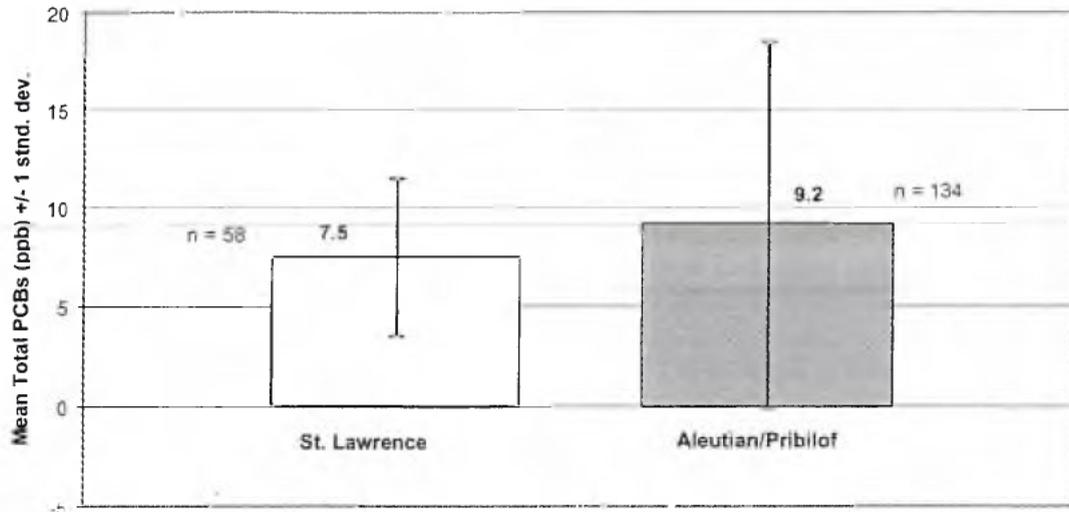


Figure 3. Comparison of PCB blood test results in St. Lawrence Island women and other Alaska Native women of similar age.

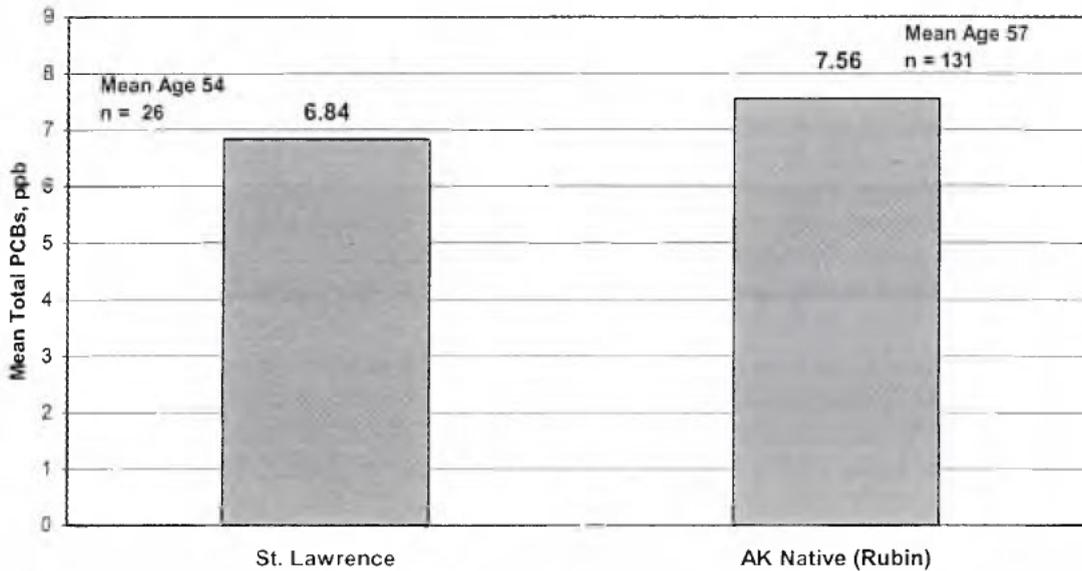


Table 1. Summary of Total PCBs (ppb, not lipid adj.) from St. Lawrence Island and 5 Aleutian/Pribilof Island Villages.

Age group	MEN						WOMEN					
	St. Lawrence			Aleutian/Pribilof			St. Lawrence			Aleutian/Pribilof		
	Mean	Median	n	Mean	Median	n	Mean	Median	n	Mean	Median	n
25-34	6.1	6.1	1	2.2	1.6	13			0	1.2	0.4	9
35-44	4.3	4.4	7	4.7	3.2	21	5.0	3.7	7	4.0	2.3	25
45-54	6.6	5.8	10	8.7	7.9	14	6.4	5.4	9	7.5	5.4	19
55-64	11.1	10.8	8	13.4	8.5	17	9.1	8.9	4	10.6	8.3	12
65-74	9.4	9.5	4	12.1	14.7	9	7.0	8.0	5	21.8	23.8	8
75+	11.3	10.5	3	16.6	15.0	5	13.6	13.6	1	11.4	7.1	4

The atmospheric transport and deposition of man-made pollutants to the circumpolar region is well documented (AMAP, 1998). As described above, the PCB blood concentrations detected in the tested St. Lawrence Island residents are similar to other subsistence-reliant people throughout Alaska. Therefore, it is likely that a major source of PCB exposure at St. Lawrence Island is from global contamination through the food chain. The ADPH does not find sufficient evidence in the ACAT report to support its conclusion that the concentrations of PCBs detected in the blood of St. Lawrence Island residents are a result of exposures specifically at Northeast Cape.

ACAT's study was designed to be a preliminary assessment of PCB concentrations in older residents of St. Lawrence Island. As such, it cannot support generalized comparisons among the three St. Lawrence Island groups studied for the following reasons:

- The subjects were not randomly selected, and older persons were preferentially tested. Conclusions can not be extrapolated to the younger age groups that were not sampled;
- The number of persons studied is very small. In many of the location-specific age-groups, there were no persons, or only one or two, and the maximum number tested in any location-, age- and sex-specific group was only 6 persons;
- The magnitude of the mean differences between the 3 location-specific groups is small, and therefore unlikely to be of biological significance.

The press release of October 2, 2002 reported that "the presence of a non-persistent PCB congener in the blood of several people with camps at Northeast Cape indicates on-going exposure." While intriguing, the identity of the detected chemical, tentatively identified as PCB 22, has not yet been confirmed by definitive mass spectrometry methods; in addition environmental media have not been examined for this chemical in order to investigate potential sources or pathways of exposure. More information is needed, including verification of the chemical's identity, before anyone can draw conclusions about the public health implications of its presence in some members of the Northeast Cape group. If the chemical's identity is verified to be PCB 22, it should be noted that this congener has been identified in water and zooplankton in other areas of the Alaskan and Canadian Arctic (Hoekstra et al. 2002).

One goal of public health is to evaluate the potential for adverse health effects in the most sensitive members of the population. As with many chemicals, the developing fetus is the most sensitive to the potentially harmful effects of PCBs. In the Aleutian/Pribilof Islands, we found low concentrations of PCBs in women of childbearing age (median 2 ppb), and we would predict that concentrations in younger women (and men) on St. Lawrence Island would be similarly low.

Breast-feeding provides optimal infant nutrition, enhances the infant immune system, and promotes strong mother-child bonding (WHO, 2002). The ADPH agrees with the World Health Organization and other health experts that the known benefits of breast-feeding far outweigh the theoretical risks associated with exposure to trace contaminants in breast milk. The results of a recent study of Alaska Native infants living in the Yukon-Kuskokwim River Delta, where traditional foods are heavily used, highlights one of the many benefits of breastfeeding. The risk of severe respiratory syncytial virus disease was significantly reduced in infants who were breast-fed (Bulkow et al. 2002). ADPH strongly encourages the women of St. Lawrence Island to breast-feed their babies.

Conclusions and Recommendations

After reviewing (a) the available information on the benefits of traditional foods, (b) the controversial potential adverse health effects from contaminants at the concentrations found in those foods, and (c) the scientific evidence for health effects associated with PCB blood concentrations in the range detected in St. Lawrence Island residents, the ADPH provides the following conclusions and recommendations:

1. The ADPH supports the clean-up of military contamination on Northeast Cape as an important priority. As the State's regulatory authority, the Alaska Department of Environmental Conservation should continue to direct and guide clean-up activities at the site, including risk assessments, clean-up decisions, and remediation activities, with the continued collaboration of the communities of Gambell and Savoonga and the Norton Sound Health Corporation.
2. While the ADPH recognizes that it is ultimately up to each individual to make his or her own dietary choices, our goal is to provide balanced scientific information and public health expertise to help people make informed choices.

After reviewing the available information, the ADPH has determined that the PCB concentrations measured in St. Lawrence Island residents are unlikely to cause adverse health effects. While clear toxic effects have been demonstrated at high PCB doses, scientific controversy remains regarding possible subtle effects at low doses. However, the overall weight of evidence supports the conclusion that no adverse health effects would be expected at the PCB concentrations measured in this study. These concentrations are in the expected range for a population with a healthy northern subsistence lifestyle centered on fish and marine mammal consumption (AMAP, 1998). No further medical evaluation or follow-up associated with PCB exposure is warranted for any of the persons tested.

Subsistence diets rich in fish and marine mammals offer numerous health, social, cultural, and economic benefits. Proven health benefits include protection from cardiovascular disease and diabetes, and improved maternal nutrition and neonatal and infant brain development. Changes or restrictions in the subsistence diet of the villages are not justified or recommended. We recommend that St. Lawrence Island residents continue to consume their subsistence foods. The known benefits of fish and marine mammal consumption far outweigh the controversial potential adverse health effects from contaminants at the concentrations found in those foods.

3. The women of St. Lawrence Island are strongly encouraged to breast-feed their babies. Breast-feeding provides optimal infant nutrition, enhances the infant immune system, and promotes strong mother-child bonding (WHO, 2002). The ADPH agrees with the World Health Organization and other health experts that the known benefits of breast-feeding far outweigh the theoretical risks associated with exposure to trace contaminants in breast milk.

This statement has been endorsed by the following agencies and organizations:

Alaska Department of Environmental Conservation
Alaska Department of Health and Social Services
Alaska Native Tribal Health Consortium
Aleutian/Pribilof Islands Association, Inc.
North Slope Borough
University of Alaska Fairbanks

References

AMAP, 1998. AMAP Assessment Report: Arctic Pollution Issues. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway. xii+859 pp.

Bulkow LR, Singleton RJ, Karron RA, and Harrison LH. 2002. Risk Factors for Severe Respiratory Syncytial Virus Infection Among Alaska Native Children. *Pediatrics* 109:210-216.

Department of Child and Adolescent Health and Development, World Health Organization. 2002. Child and Adolescent Health and Development Progress Report, 2000-2001. Available online at http://www.who.int/child-adolescent-health/New_Publications/Overview/WHO_FCH_CAH_02.19pdf (accessed January 29, 2003)

Hoekstra PF, O'Hara TM, Teixeira C, Backus S, Fisk AT, Muir DCG. 2002. Spatial trends and bioaccumulation of organochlorine pollutants in marine zooplankton from the Alaskan and Canadian Arctic. *Env Tox Chem* 21:575-583.

Middaugh J, Verbrugge L, Haars M, Schloss M, Yett G. Assessment of Exposure to Persistent Organic Pollutants (POPs) in 5 Aleutian and Pribilof Villages. Final Report, amended as of 12/27/01. State of Alaska Epidemiology *Bulletin*, Recommendations and Reports Vol. 5 No. 5, December 27 2001.

Rubin CH, Lanier A, Socha M, Brock JW, Kieszak S, Zahm S. 2001. Exposure to persistent organochlorines among Alaska Native women. *Int J Circumpolar Health* 60:157-169.

State of Alaska
Epidemiology



Bulletin

Recommendations
and
Reports

State of Alaska, Section of Epidemiology
PO Box 240249
Anchorage, AK 99524-0249

PRSR STD
U.S. POSTAGE
PAID
ANCHORAGE, AK
PERMIT NO. 1034