

# **Health Consultation**

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**M/V KUROSHIMA OIL SPILL**

**UNALASKA, ALASKA**

**MAY 17, 1999**

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

## **Health Consultation: A Note of Explanation**

An ATSDR health consultation is a verbal or written response from ATSDR 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 which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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**HEALTH CONSULTATION**

**M/V KUROSHIMA OIL SPILL**

**UNALASKA, ALASKA**

**Prepared by:**

**Alaska Department of Health and Social Services  
Division of Public Health, Epidemiology Section  
in Cooperative Agreement with the  
Agency for Toxic Substances and Disease Registry**

## **Introduction**

In April 1998, data on the levels of polycyclic aromatic hydrocarbons (PAHs) in subsistence foods in the zone of the M/V Kuroshima oil spill became available. The Alaska Department of Environmental Conservation (ADEC) requested assistance from the Alaska Department of Health and Social Services (ADHSS), Epidemiology Section, regarding the human health implications of the data. The ADEC requested assistance in the development of a risk assessment strategy, and asked the Epidemiology Section to make a public health evaluation of whether subsistence foods in the spill-impacted area were safe to eat. This health consultation was prepared to address that question.

## **Background**

On November 26, 1997, the M/V Kuroshima spilled an estimated 39,000 gallons of a heavy bunker C fuel oil into the intertidal areas of Summer Bay on Unalaska Island, Alaska (Figure 1). The spill impacted beaches traditionally harvested for subsistence foods by local community members. An initial survey of black chitons, bay mussels, limpets and green sea urchins collected on December 12, 1997, revealed elevated concentrations of polycyclic aromatic hydrocarbons (PAHs) in some of the sampled food species. This prompted additional sampling events for a more comprehensive evaluation of subsistence food safety in the spill area.

Two additional sampling events occurred in 1998. During the period March 31 through April 2, 1998, subsistence foods were sampled at five locations in order to investigate the spatial extent of oil contamination (Figure 1). Three mussel and three urchin samples were collected from each of two beaches to the east and two beaches to the west of the Summer Bay rock outcrop. At the Summer Bay rock outcrop, which was thought to be most heavily impacted by oil, chitons, snails, limpets and clams were collected in addition to mussels and urchins. A final round of sampling was performed in July 1998 in order to assess temporal trends of PAH concentrations in subsistence foods.

## **Methods and Data**

Analysis of data from the first and last sampling events (December 1997 and July 1998 respectively) was limited to an examination of the trend of total PAH contamination in subsistence resources over time. Mussels contained higher PAH levels than did the other subsistence resources sampled, and Summer Bay was the most contaminated location that was sampled. Therefore, sampling efforts focused on this location and biota, and data were only available for all three time points for mussels at Summer Bay. PAH levels steadily declined in Summer Bay mussels during the period December 1997 through July 1998 (Table 1).

The primary purpose of this health consultation was to perform a more detailed assessment on the data from the most comprehensive sampling period (March 31 through April 2, 1998). In the absence of federal standards for PAH constituents in foods, a strategy was needed in order to interpret the public health significance of measured PAH concentrations. Samples were evaluated for their overall carcinogenic potency by calculating benzo(a)pyrene (BaP) equivalents from the PAH data. Specifically, the carcinogenic potency of each PAH congener was expressed relative to BaP and then summed for an overall estimate of BaP-like activity.

Calculations of risk based on BaP equivalents were performed using the criteria of four different agencies/entities. The four methods were from the State of Maine Julie N spill (1), the State of California fuel oil spill in Humboldt Bay (2), the FDA assessment of the Exxon Valdez Oil Spill (EVOS) (3), and a calculation of BaP equivalents based on a 1993 EPA guidance document (4). Risk assessment outcomes varied depending on which method was used. The methods varied with regard to BaP toxic equivalency factors, exposure assumptions, the de minimus cancer risk (i.e.,  $1 \times 10^{-5}$  or  $1 \times 10^{-6}$ ), and the cancer "potency" or "slope" factor (Table 2). Calculations were only performed for the mussel sample of highest total PAHs from each of the five sites, a strategy designed to evaluate the "worst case scenario".

## **Discussion**

Levels of PAHs of potential concern were only identified in mussel samples from two of the five sampling points: the Summer Bay rock outcrop and Humpy Cove (Table 3). Of the three risk assessment methods with evaluation criteria, mussels from those two areas only exceeded PAH levels of concern with use of the California criteria. The California criteria are very conservative due to their inclusion of C1-chrysenes in the BaP equivalent summation, their de minimus cancer risk of  $1 \times 10^{-6}$ , and their high cancer potency factor. It is the policy of the State of Alaska to utilize a de minimus cancer risk of  $1 \times 10^{-5}$  in risk assessments (5). This substitution alone would have caused the mussel samples not to fail the California criteria.

### **ATSDR Child Health Initiative:**

ATSDR's Child Health Initiative recognizes that the unique vulnerabilities of children demand special emphasis in communities faced with contamination of water, soil, air, or food.

Children might have been potentially exposed to PAHs at this site if they consumed subsistence resources from spill-affected beaches. If a pregnant woman consumed food containing PAHs, the fetus could have been exposed since most PAHs and their metabolites cross the placenta because of their lipid solubility (6). Other sources of PAH exposure not related to this site include cigarette smoke and consumption of smoked foods.

The PAH levels in subsistence resources at this site were unlikely to adversely affect child health. PAHs in subsistence resources were at levels below health concern, as calculated in this risk assessment. Also, the time period of exposure was likely much shorter than that assumed in the three risk assessment models used in this health consultation. These risk assessments assumed consistent consumption over many years, but the actual consumption at this site would have been much shorter. The subsistence resources are available only seasonally, and the PAH levels in food had already declined rapidly over time and will probably continue to do so.

### **Conclusions:**

Based on the calculations described in this health consultation, it is our opinion that PAHs in mussels and other sampled subsistence resources in the Kuroshima spill area were not present at levels of health concern. A special advisory based on PAH contamination is not necessary in the area.

Levels of PAHs in subsistence food resources have declined steadily since the oil spill, and may continue to do so. Therefore, any risk of health impacts associated with exposure to PAHs through consumption of subsistence resources in the spill zone should either remain constant or decline over time.

Because of Paralytic Shellfish Poisoning (PSP) concerns, an ongoing advisory existed in the state against the gathering and consumption of shellfish except at approved beaches. The Summer Bay area should be re-posted as soon as possible to warn the public about the dangers of PSP. The health hazard from PSP is considered to be much more serious than any health hazards associated with PAH exposure at the levels found in mussels in the area.

It was not possible to comment on the presence of or health implications of constituents other than PAHs that might have been in the spilled oil.

### **Recommendations:**

- Issue consumption advice similar to that given following the Exxon Valdez oil spill. Specifically, statements that subsistence gatherers should avoid consumption of foods on which oil can be seen, smelled or tasted would be appropriate. These recommendations, developed by the EVOS oil spill health task force, present a conservative approach and are appropriate for the protection of public health.
- Re-post the beach to warn the public about the dangers associated with Paralytic Shellfish Poisoning.

**References:**


1. Interdepartmental memorandum from Phil Kemp, Maine Bureau of Health, to Seth Barker, Maine Dept. of Marine Resources, dated March 13, 1998.
2. Memorandum from the State of California Health and Welfare Agency, Dept. of Health Services, December 18, 1997.
3. Bolger, M., Henry, S.H., and Carrington, C.D. Hazard and risk assessment of crude oil contaminants in subsistence seafood samples from Prince William Sound. American Fisheries Society Symposium 18:837-843, 1996.
4. U.S. Environmental Protection Agency. Provisional guidance for quantitative risk assessment of polycyclic aromatic hydrocarbons. EPA/600/R-93/089, July 1993.
5. Alaska Department of Environmental Conservation. Risk Assessment Procedures Manual for Method 4.0, Section 3.2.5. May 4, 1998.
6. Agency for Toxic Substances and Disease Registry. Toxicological profile for Polycyclic Aromatic Hydrocarbons (PAHs). Atlanta: U.S. Dept. of Health and Human Services, Public Health Service, 1995.

**Preparer of Report**

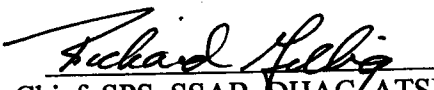
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## CERTIFICATION

This Health Consultation for the M/V Kuroshima Oil Spill - Summer Bay Beach was prepared by the State of Alaska Department of Health and Social Services, Division of Public Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated.

  
for Technical Project Officer, SPS/SSAB, DHAC, ATSDR

The Division of Health Assessment and Consultation (DHAC), ATSDR has reviewed this health consultation and concurs with its findings.

  
Chief, SPS, SSAB, DHAC, ATSDR



**Table 1. Total PAHs in Summer Bay Mussels**

<b>Collection Period</b>	<b>Mean Total PAHs*</b>	<b>Number of Samples</b>
December 1997	8,567 ppb	3
April 1998	1,922 ppb	3
July 1998	137 ppb	3

**\* parts per billion (ppb) wet weight**

**Table 2. Four methods of risk assessment for PAHs**

	Maine - Julie N <sup>b</sup>	Cal - Humboldt Bay <sup>c</sup>	FDA - Exxon Valdez <sup>d</sup>	EPA guidance <sup>e</sup>
<i>TEF<sup>a</sup> for:</i>				
Benzo(a)pyrene	1.00	1.00	1.000	1.000
Benzo(a)anthracene	0.10	0.10	0.014	0.100
Benzo(b)fluoranthene	0.10	0.10	0.110	0.100
Benzo(k)fluoranthene	0.01	0.10	0.070	0.010
Chrysene	0.01	0.01	0.013	0.001
Dibenzo(a,h)anthracene	1.00	0.36	4.050	1.000
Indeno[1,2,3-cd]pyrene	0.10	0.10	0.250	0.100
Pyrene	n/a	n/a	0.130	n/a
Fluoranthene	n/a	n/a	0.020	n/a
C1-chrysenes	n/a	1.00	n/a	n/a
Benzo[g,h,i]perylene	n/a	n/a	0.030	n/a
<i>Evaluation Criteria:</i>				
Pass (safe)	<16 ppb	<5 ppb	<17 ppb	n/a
Warning	>16 but <50 ppb	>5 but <34 ppb	>17 but <120 ppb	n/a
Fail (unsafe)	>50 ppb	>34 ppb	>120 ppb	n/a
<i>Exposure assumed for:</i>				
Long term (lower standard)	30 years	2 years	lifetime	n/a
Shorter term (higher standard)	10 years	2 years	10 years	n/a
<i>Consumption rate:</i>				
	13.6 g/day	50 g/day (low stnd) 7.5 g/day (high stnd)	2 g/day	n/a
<i>Excess cancer risk:</i>				
	1x10 <sup>-5</sup>	1x10 <sup>-6</sup>	1x10 <sup>-6</sup>	n/a
<i>Cancer potency factor for BaP (per mg/kg/day):</i>				
	7.3	9.5	1.75	correct range is 4.5 - 11.7; geometric mean is 7.3

- a: Toxic Equivalency Factor (relative toxicity in comparison to Benzo(a)pyrene)
- b: Reference 1, Maine Bureau of Health
- c: Reference 2, California Dept. of Health Services
- d: Reference 3, U.S. Food and Drug Administration
- e: Reference 4, U.S. Environmental Protection Agency EPA/600/R-93/089

**Table 3. Benzo(a)pyrene equivalents (ppb wet weight) and risk assessments for mussel sample with highest total PAHs from each location April 1998**

Location	Benzo(a)pyrene equivalents <sup>a</sup> (risk assessment result <sup>b</sup> )			EPA guidance
	Maine - Julie N	Cal - Humboldt Bay	FDA - Exxon Valdez	
1 - 1.0 miles west of Second Priest Rock	0.84 (P)	2.60 (P)	1.44 (P)	0.81 (na)
2 - Second Priest Rock	0.47 (P)	2.65 (P)	0.84 (P)	0.46 (na)
3 - Summer Bay Rock Outcrop	6.00 (P)	70.2 (F)	10.6 (P)	5.83 (na)
4 - Humpy Cove	5.00 (P)	58.4 (F)	8.52 (P)	4.87 (na)
5 - Morris Cove	0.88 (P)	6.04 (W)	1.16 (P)	0.86 (na)

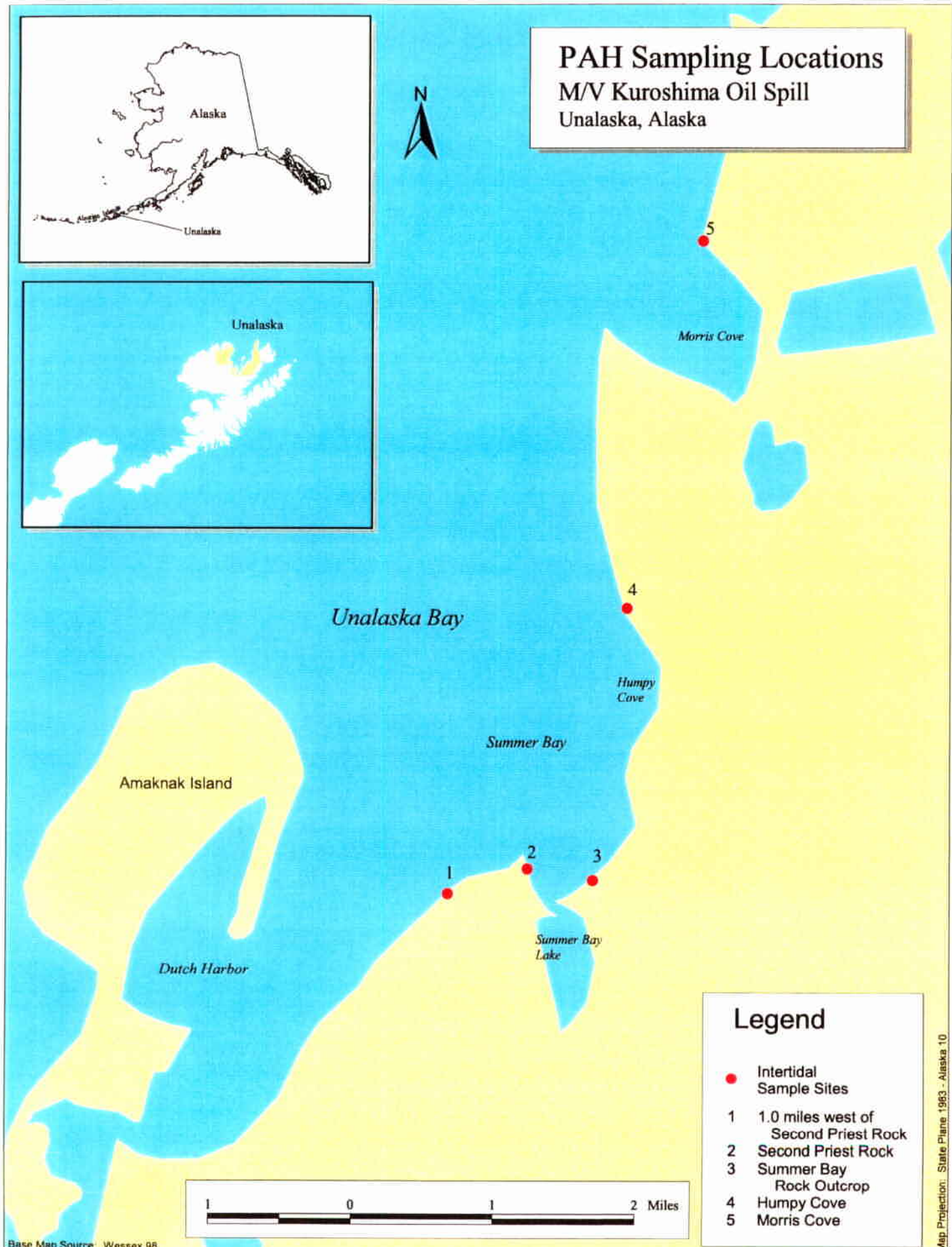
a: See Table 2 for TEFs and evaluation criteria

b: P = pass, W = warning, F = Fail, n/a = not applicable

# PAH Sampling Locations

## M/V Kuroshima Oil Spill

### Unalaska, Alaska



### Legend

- Intertidal Sample Sites
- 1 1.0 miles west of Second Priest Rock
- 2 Second Priest Rock
- 3 Summer Bay Rock Outcrop
- 4 Humpy Cove
- 5 Morris Cove



Base Map Source: Wessex 98

Map Projection: State Plane 1983 - Alaska 10