

# Letter Health Consultation

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BUDD INLET UPDATE

OLYMPIA, WASHINGTON

DECEMBER 11, 2008

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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LETTER HEALTH CONSULTATION

BUDD INLET UPDATE

OLYMPIA, WASHINGTON

Prepared By:

Washington State Department of Health  
Under Cooperative Agreement with the  
U.S. Department of Health and Human Services  
Agency for Toxic Substances and Disease Registry



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## Letter Health Consultation

November 21, 2008

TO: Alan Yarbrough  
Agency for Toxic Substances and Disease Registry

FROM: Lenford O'Garro  
Washington Department of Health

SUBJECT: Budd Inlet Health Consultation update – Olympia, Washington

### Statement of Issues:

The health consultation for Budd Inlet, Olympia Washington was finalized by the Agency for Toxic Substances and Disease Registry (ATSDR) on July 28, 2008. This is an addendum to the Budd Inlet health consultation because the polycyclic aromatic hydrocarbons (PAHs) data in the document was based on total organic carbon and not on total sediment. This Letter Health Consultation will be included in the ATSDR file with the original document as an addendum.

### Background:

Budd Inlet is located in southern Puget Sound, near the city of Olympia, Washington. Historically, the southern portion of Budd Inlet has supported wood product industries, recreational marinas, and boat industries. It is also the home of the Port of Olympia. Several sites are listed on Ecology's "Confirmed and Suspected Contaminated Sites List" as contributing contaminants to Budd Inlet (for example – dioxin from the former Cascade Pole site). Budd Inlet is divided into East and West Bays by a small peninsula which extends from the southern point. The Olympia Harbor federal navigation channel and turning basin are maintained in inner West Bay. The northern portion or the North Inlet is lined with residential properties [1].

## **Discussion:**

Contaminants of concern (COC) in sediment were determined by employing a screening process. Maximum sediment contaminant levels were screened against health-based soil comparison values. Several types of health-based comparison or screening values were used during this process. Comparison values such as the CREG and EMEG offer a high degree of protection and assurance that people are unlikely to be harmed by contaminants in the environment. For chemicals that cause cancer, the comparison values represent levels that are calculated to increase the risk of cancer by about one in a million. These types of comparison values often form the basis for cleanup. In general, if a contaminant's maximum concentration is greater than its comparison value, then the contaminant is evaluated further.

Standard human health assessment for cancer and non-cancer risk was carried out using the formulas in appendix A and results are shown in tables A2 and A3. This is an addendum to the Budd Inlet health consultation because the polycyclic aromatic hydrocarbons (PAHs) data in the document was based on total organic carbon and not on total sediment.

Changes to the original document dated July 28, 2008, are as follows:

1. Theoretical cancer risk estimates for exposure to cPAHs in sediments range from 3 cancers estimated per 10,000,000 exposed to 9 cancers estimated per 10,000,000 exposed or insignificant.
2. Updated values for PAH and evaluation of PAH data (Tables 1, A2 and A3).
3. The removal of the following statement on page 17: In general, cPAHs make up the bulk of the cancer risk from exposure to sediment. Although exposure to cPAHs may occur, the magnitude is likely to be considerably less than the estimated minimum background exposure from sources in food, water, air, sediment, and soil. Many areas of Budd Inlet are already under Ecology Agreed Orders. The Orders require a remedial investigation and feasibility study (RI/FS) be conducted to guide the selection of a cleanup remedy.
4. The removal of conclusion # 3.

**Table 1.** Maximum concentrations of PAHs detected in sediment within Budd Inlet in Olympia, Washington.

Compounds	Maximum Concentration (ppm)	Comparison Value (ppm)	EPA Cancer Class	Comparison Value Reference	Contaminant of Concern (COC)
2-Methylnaphthalene	0.18	200		RMEG	No
Acenaphthene	2.0	3000		RMEG	No
Acenaphthylene	0.12	2000*	D		No
Anthracene	3.0	20000	D	RMEG	No
Benzo(ghi)perylene	0.29	2000*	D		No
Dibenzofuran	1.95 U	290	D	Region 9	No
Fluoranthene	0.92	2000	D	RMEG	No
Fluorene	1.7	2000	D	RMEG	No
Naphthalene	0.71	30000	C	IM EMEG	No
Phenanthrene	6.2	2000*	D		No
Pyrene	0.83	2000	D	RMEG	No
Benzo(a)anthracene	0.49	0.62	B2	Region 9	cPAH
Benzo(a)pyrene	0.48	0.1	B2	CREG	cPAH
Benzo(b)fluoranthene	0.59	0.62	B2	Region 9	cPAH
Benzo(k)fluoranthene	0.22	6.2	B2	Region 9	cPAH
Chrysene	0.55	62	B2	Region 9	cPAH
Dibenz(a,h)anthracene	0.073	0.1**		CREG	cPAH
Indeno(1,2,3-cd)pyrene	0.31	0.62	B2	Region 9	cPAH
Total cPAH TEQ	0.69	0.1	B2	CREG	Yes

\* Fluoranthene RMEG value was used as a surrogate

\*\* Benzo(a)pyrene CREG value was used as a surrogate

Total cPAH TEQ – sum of all carcinogenic polycyclic aromatic hydrocarbons (cPAH) toxic equivalent (TEQ), all cPAH in COC are added using the TEQ approach to obtain Total cPAH TEQ.

## Conclusion

Since the theoretical cancer risk calculated is insignificant, conclusion # 3 in the previous Budd Inlet health consultation is not applicable.

## Recommendations

- No additions to previous recommendations at this time

Please feel free to contact Lenford O’Garro (360) 236-3376 or 1-877-485-7316 if you have any questions about this memo.

## References

1. Washington State Department of Ecology: Sediment characterization study Budd Inlet, Final Data Report. March 2008. Prepared for the, Lacey, WA. Prepared by Science Applications International Corporation, Bothell, WA
2. National Center for Environmental Assessment. Exposure Factors Handbook Volume 1 – General Factors EPA/600/P-95/002Fa: U.S. Environmental Protection Agency; August 1997.

## Appendix A

This section provides calculated exposure doses and assumptions used for exposure to chemicals in sediments at the Budd Inlet site. Three different exposure scenarios were developed to model exposures that might occur. These scenarios were devised to represent exposures to a child (0-5 yrs), an older child, and an adult. The following exposure parameters and dose equations were used to estimate exposure doses from direct contact with chemicals in soil.

### Exposure to chemicals in soil via ingestion, inhalation, and dermal absorption.

**Total dose** (non-cancer) = **Ingested dose + inhaled dose + dermally absorbed dose**

#### Ingestion Route

$$\text{Dose}_{\text{(non-cancer (mg/kg-day))}} = \frac{C \times CF \times IR \times EF \times ED}{BW \times AT_{\text{non-cancer}}}$$

$$\text{Cancer Risk} = \frac{C \times CF \times IR \times EF \times CPF \times ED}{BW \times AT_{\text{cancer}}}$$

#### Dermal Route

$$\text{Dermal Transfer (DT)} = \frac{C \times AF \times ABS \times AD \times CF}{ORAF}$$

$$\text{Dose}_{\text{(non-cancer (mg/kg-day))}} = \frac{DT \times SA \times EF \times ED}{BW \times AT_{\text{non-cancer}}}$$

$$\text{Cancer Risk} = \frac{DT \times SA \times EF \times CPF \times ED}{BW \times AT_{\text{cancer}}}$$

#### Inhalation of Particulate from Sediment Route

$$\text{Dose}_{\text{non-cancer (mg/kg-day)}} = \frac{C \times SMF \times IHR \times EF \times ED \times 1/PEF}{BW \times AT_{\text{non-cancer}}}$$

$$\text{Cancer Risk} = \frac{C \times SMF \times IHR \times EF \times ED \times CPF \times 1/PEF}{BW \times AT_{\text{cancer}}}$$

**Table A1.** Exposure assumptions used for exposure to cPAHs, PCBs, and dioxin in sediments from Budd Inlet, Olympia, WA.

Parameter	Value	Unit	Comments
Concentration (C)	Variable	mg/kg	Maximum detected value
Conversion Factor (CF)	0.000001	kg/mg	Converts contaminant concentration from milligrams (mg) to kilograms (kg)
Ingestion Rate (IR) – adult	100	mg/day	Exposure Factors Handbook [2]
Ingestion Rate (IR) – older child	100		
Ingestion Rate (IR) - child	200		
Exposure Frequency (EF)	52	Days/year	One days a week
Exposure Duration (Ed)	30 (5, 10,15)	years	Number of years at one residence (child, older child, adult yrs).
Body Weight (BW) - adult	72	kg	Adult mean body weight
Body Weight (BW) – older child	41		Older child mean body weight
Body Weight (BW) - child	15		0-5 year-old child average body weight
Surface area (SA) - adult	5700	cm <sup>2</sup>	Exposure Factors Handbook
Surface area (SA) – older child	2900		
Surface area (SA) - child	2900		
Averaging Time <sub>non-cancer</sub> (AT)	1825	days	5 years
Averaging Time <sub>cancer</sub> (AT)	27375	days	75 years
Cancer Potency Factor (CPF)	7.3	mg/kg-day <sup>-1</sup>	Source: EPA
24 hr. absorption factor (ABS)	0.13 0.14	unitless	Source: EPA (Chemical Specific) PAH PCBs
Oral route adjustment factor (ORAF)	1	unitless	Non-cancer (nc) / cancer (c) - default
Adherence duration (AD)	1	days	Source: EPA
Adherence factor (AF)	0.2	mg/cm <sup>2</sup>	Child, older child
	0.07		Adult
Inhalation rate (IHR) - adult	15.2	m <sup>3</sup> /day	Exposure Factors Handbook [2]
Inhalation rate (IHR) – older child	14		
Inhalation rate (IHR) - child	8.3		
Soil matrix factor (SMF)	1	unitless	Non-cancer (nc) / cancer (c) - default
Particulate emission factor (PEF)	1.45E+7	m <sup>3</sup> /kg	Model Parameters

**Table A2.** Non-cancer hazard calculations resulting from exposure to cPAHs in sediments from Budd Inlet, Olympia, WA.

Contaminant	TEQ Concentration (ppm) (mg/kg)	Scenarios	Estimated Dose (mg/kg/day)			Total Dose	RfD/ MRL/ LOAEL (mg/kg/day)	Total Dose/ (RfD/ MRL/ LOAEL)
			Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates			
cPAH	0.69	Child	1.31E-6	4.94E-7	9.07E-11	1.80E-6	1.0E+1	0.0000002
		Older Child	2.40E-7	1.81E-7	5.60E-11	4.12E-7		0.00000004
		Adult	1.37E-7	7.08E-8	3.46E-11	2.07E-7		0.00000002

**Budd Inlet Sediment Exposure Route – Cancer**

**Table A3.** Cancer hazard calculations resulting from exposure to cPAHs in sediments from Budd Inlet, Olympia, WA.

Contaminant	Concentration (ppm)	EPA cancer Group	Cancer Potency Factor (mg/kg-day <sup>-1</sup> )	Scenarios	Increased Cancer Risk			Total Cancer Risk
					Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	
Total cPAH TEQ	0.69	B2	7.3	Child	6.38E-7	2.40E-7	4.42E-11	8.78E-7
				Older Child	2.33E-7	1.76E-7	5.45E-11	4.09E-7
				Adult	1.99E-7	1.03E-7	5.05E-11	3.03E-7

## Certification

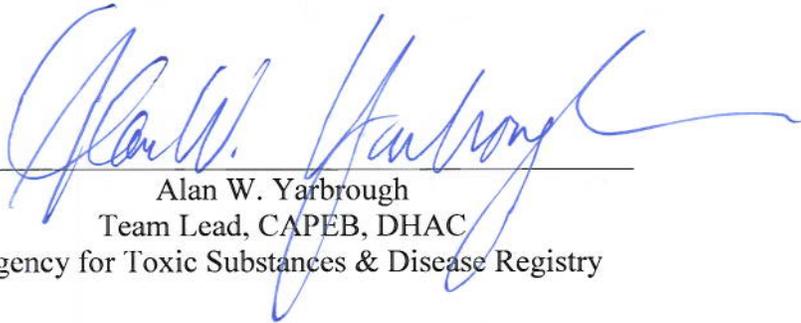
The Washington State Department of Health prepared this Letter Health Consultation under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodology and procedures existing at the time the health consultation was initiated. Editorial review was completed by the Cooperative Agreement partner.



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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.



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