COMMENTS ON SMS RULE REVISIONS – HUMAN HEALTH AND BACKGROUND ISSUES
DRAFT SUMMARY OF ADVISORY GROUP FEEDBACK – GENERAL CONCEPTS, LON KISSINGER, 4/20/10

1. NEED TO DOCUMENT COMPARISON OF RISK BASED SEDIMENT CLEANUP STANDARDS TO BACKGROUND CONTAMINANT LEVELS

Ecology's current efforts to establish sediment quality standards protective of human health are oriented towards remediation of areas with sediment bioaccumulative chemicals of concern (BCoCs) that are elevated above some estimate of background. The basis for this approach is that risk based levels of BCoCs in sediments are below regional and potentially natural background levels.

> *While this assumption is likely true in many cases, the current SMS rule revision effort needs to document the validity of this assumption by developing risk and background based contaminant levels and comparing them.*

Comparisons might be done on a sediment or tissue basis. Background will need to be developed for multiple areas. Risk based standards may be above natural but below regional background. Consideration of limits of quantitation for analytical methods is also of importance.

Material of relevance to defining this process is documented in:

- Section 2.3 of the Oregon Department of Environmental Quality's Guidance for Assessing Bioaccumulative Contaminants of Concern in Sediment (2007).
- Chapters 6 and 8 of the Sediment Evaluation Framework of the Pacific Northwest (2009)
- A variety of WA Dept. of Ecology (WA DOE) materials prepared for the Agency's last efforts to revise the sediment management standards (PTI 1995a, WA DOH 1995, WA DOE 1997)

1.1. WHAT CHEMICALS SHOULD BE EVALUATED?

A first question is what contaminants are to be addressed in developing human health risk based sediment cleanup standards? The Sediment Evaluation Framework (SEF) for the Pacific Northwest (RSET 2009) utilized the BCoC list developed by Hoffman (2007) in determining what chemicals needed to be considered. The contaminants of greatest concern had the following properties:

- A K_{ow} value indicating bioaccumulation
- They have human or ecological health risks
- They have been detected in sediments and/or tissues with sufficient frequency to be of concern.

The following SEF table (RSET 2009) indicates the highest priority BCoCs for various U.S. Army Corps of Engineers Districts in the Pacific Northwest

Table 8-1: Regional Bioaccumulative Chemicals of Concern (BCoCs) Lists			
Chemical	U.S. Army Corps District:		
	Seattle	Portland	Walla Walla
Arsenic	X		X
Lead	X		X
Mercury	X	X	X
Selenium	X	X	X
Tributyltin	X	X	
Fluoranthene	X	X	X
Fluorene		X	
Pyrene	X	X	X
Hexachlorobenzene	X	X	X
Pentachlorophenol	X		X
Total Chlordanes	X	X	X
DDTs – Total	X	X	X
Dieldrin		X	
Total Endosulfans		X	
Gamma-HCH (lindane)		X	
Methoxychlor		X	
Total PCB (Aroclors)	X	X	
Total PCB (Congeners)	X	X	
Dioxins/Furans	X	X	X

Hoffman (2007) also prepared additional lists of BCoCs that were a lower priority to address.

Chemicals of concern identified by the Puget Sound Partnership may also be of interest (e.g. polybrominated diphenyl ethers, perfluoro compounds, etc). ODEQ (2007) identified cadmium as a compound of concern.

> *Ecology must determine which of these or other chemicals it wishes to consider in evaluating sediment human health risk issues, in particular comparison of background and risk based levels.*

Ecology's SMS revision efforts in the 1990s focused on classes of non-polar organics (e.g. PCBs, dioxins/furans, and secondarily carcinogenic polycyclic aromatic hydrcarbons (cPAHs)).

1.2. DEFINING BACKGROUND AND DATA NEEDED TO CHARACTERIZE BACKGROUND

The area over which background is to be determined must be selected. Another important question is how background will be characterized (e.g. the average, median, a percentile, a tolerance limit on a percentile). The nature of the comparison between a risk based concentration and background will likely influence how background is characterized. Considerations of area and the nature of the risk based standard – background comparison will determine what background data are needed.

> *Ecology must consider the area over which background is determined, how to describe background and how to compare background to a risk based concentration.*
>
> *Ecology must consider the availability of sediment and tissue data and the resources needed to collect additional data.*

The 2008 Bold survey data provide an excellent data set for evaluation of "natural" background levels of PCBs, dioxins/furans, and carcinogenic PAHs (cPAHs). Surveys of sediment quality in Puget Sound (WA DOE 1992, 1999, 2002) may also provide valuable information. WA DOE Environmental Assessment Program staff Maggie Dutch and Sandra Aasen have participated in evaluating contaminant levels in Puget Sound sediments. Consultation with Jim West and Sandie O'Neill with NOAA's National Marine Fisheries Service would be a good starting point for obtaining fish tissue data. Queries of Ecology's Environmental Information Management System will also likely be useful.

1.3. DEFINING RISK BASED TARGET TISSUE CONCENTRATIONS

Risk based tissue levels are a function of a number of exposure variables including: seafood consumption rate, fraction of seafood affected by sediment contamination, exposure duration, inclusion of anadromous species in the consumption rate, and risk level. EPA Region 10's Framework for Selecting and Using Tribal Fish and Shellfish Consumption Rates for Risk-Based Decision Making at CERCLA and RCRA Cleanup Sites in Puget Sound and the Strait of Georgia (U.S.EPA Region 10 2007) discuss many of these issues and relevant Puget Sound tribal seafood consumption surveys (Toy et al. 1996, Suquamish 2000). The SEF (RSET 2009) and ODEQ's 2007 guidance touch on these points.

> *Ecology must decide how to compute risk based sediment cleanup levels.*
>
> *The SMS rule revision effort should coordinate with the MTCA rules revision committee's efforts to evaluate fish consumption and related exposure parameters.*

1.4. DERIVING SEDIMENT CONCENTRATIONS FROM RISK BASED TARGET TISSUE CONCENTRATIONS

The standard approach for developing risk based sediment cleanup levels would be to employ computation of a risk based target tissue level followed by use of a BSAF to develop a sediment cleanup level (RSET 2009, PTI 1995a, ODEQ 2007, WA DOH 1995).

Several approaches for deriving protective BSAFs to develop screening level human health risk based sediment cleanup levels have been employed. Many of them derive from a WA DOH (1995) report developing log K_{ow} –BSAF relationships for the following organism – non-polar organic compound class pairings.

finfish and PCBs,
finfish and dioxins/furans
shellfish and PCBs
shellfish and PAHs

WA DOE (PTIa 1995) used 90% UCLs on log K_{ow} –BSAF relationships derived from the WA DOH (1995) report. The actual WA DOH (1995) report suggested use of 75th percentile BSAF values for log K_{ow}s in 0.5 increment steps. ODEQ (2007) followed the WA DOH 75th percentile approach.

An alternate source for BSAFs is the U.S. Army Corps of Engineers Environmental Effects Residue Database (ERED), http://el.erdc.usace.army.mil/ered/

It has been specifically noted that developing BSAFs for metals and polar compounds is problematic (ODEQ 2007, RSET 2009, PTI 1995b)

1.5. POTENTIAL CONSERVATISM IN COMPARISONS OF SCREENING RISK BASED SEDIMENT CONTAMINANT LEVEL TO BACKGROUND IN CASES WHERE SOURCE CONTROL/RECONTAMINATION IS NOT AN ISSUE

In the event that all of the following are true:

- Background is determined to be greater than a srcreening risk based sediment contaminant level
- Remediation to background is deemed to be excessively resource intensive
- Recontamination and source control are not issues

It may be useful to consider site specific estimates of bioaccumulation. Such methods include collection of synoptic tissue and sediment samples, in situ organism placement, or laboratory bioaccumulation testing (ODEQ 2007, RSET 2009, Burkhard 2000 and 2006, Burkhard et al. 2003)

2. COMMENTS ON A HOT SPOT REMEDIATION, NATURAL RECOVERY, SOURCE CONTROL APPROACH

I acknowledge that such an approach is necessary. I strongly agree that Ecology needs to needs to conduct post cleanup/source control monitoring to monitor seafood consumption

risk reduction and to assist in better understanding the relationship between sediment remediation and tissue contaminant levels.

3. Direct Contact Risks

Generally, indirect seafood consumption risks exceed direct contact risks. However, the spatial scales of direct contact risks may differ from indirect exposure pathways. For example, seafood consumption risks would be based on sediment concentrations over an entire water body while children's beach play or tribal clamming risks would be evaluated over intertidal sediments. Some consideration should be given to incorporating consideration of direct contact risks into Ecology's approach. The human health risk assessment for the Lower Duwamish Waterway (LDWG 2007) provides a discussion of the most plausible sediment direct contact exposures.

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