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DMMP CLARIFICATION PAPER

METALS BCOC LIST

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INTRODUCTION

Currently eleven of the twelve metals and organometallic compounds on the DMMP's Chemicals of Concern (COC) list have associated bioaccumulation triggers and are on the List 1 of bioaccumulative contaminants of concern (BCOCs). The original bioaccumulation triggers were developed over 20 years ago based on the best available sediment monitoring and risk assessment information (PSDDA, 1988). In 1998, the DMMP presented the rationale and general approach for re-evaluating bioaccumulation testing and interpretation which included revising the list of bioaccumulative contaminants required for analysis (Malek and Gries, 1998; Hoffman, 1998). In 2003 the BCOCs were organized into lists as follows:

- **List 1 -** is the primary list of bioaccumulative contaminants of concern. Analysis for these 20 chemicals in sediments (and potentially tissues) is required to determine dredged material suitability. List 1 replaced the list of bioaccumulative compounds that were in effect at the time.
- **List 2 -** is the candidate list of bioaccumulative contaminants. Analysis of List 2 chemicals will be decided on an as-needed basis depending on the specifics of the project. List 2 chemicals will also be evaluated by the DMMP as part of disposal site monitoring and other special projects.
- **List 3** – are chemicals that are potentially bioaccumulative but do not meet the criteria to be placed on any of the other lists. Many of the List 3 chemicals have been highlighted in the scientific literature as potentially bioaccumulative, but of unknown human/ecological toxicity. The List 3 chemicals will only be considered for analysis if there is a project-specific reason to believe that they may be present. It is expected that updates to the BCOC database will have the greatest implications for List 3 chemicals.
- **List 4** – are chemicals that are not currently considered by the DMMP to be bioaccumulative based on the criteria used to develop these lists. A majority of the chemicals that were placed on List 4 have low octanol-water partitioning coefficients (Log $K_{ow} < 3.5$). The remaining chemicals were placed on this list because of a preponderance of regional information showing that they rarely (if ever) occur in sediments and tissues at levels of toxicological relevance.

The criteria that were used to develop these lists included metrics of bioaccumulative potential (Log K_{ow}), regional occurrence in sediments and tissues, and ecological and human toxicity.

This approach proved effective for prioritizing organic compounds, but resulted in the placing all but one of the metals (antimony) on List 1. The agencies agreed that alternative criteria should be developed for metals that explicitly consider their bioavailability and propensity to biomagnify up the food chain. However, the status of metals has not changed since their original listing, and all have remained on List 1 since 2003.

List 1 Bioaccumulative Chemicals of Concern (metals only)

CHEMICAL	METHOD INFORMATION	LOG K_{ow}	BT (dry wt basis[2])
METALS			
Arsenic	SW846 M.6020	N/A	507.1 mg/kg
Cadmium	SW846 M.7131	N/A	*11.3 mg/kg*
Chromium	SW846 M.6020	N/A	*267 mg/kg*
Copper	SW846 M.6020	N/A	*1027 mg/kg*
Lead	SW846 M.7421	N/A	*975 mg/kg*
Mercury	SW846 M.7421	N/A	1.5 mg/kg
Nickel	SW846 M.6020	N/A	370 mg/kg
Selenium	SW846 M.7740	N/A	*3 mg/kg*
Silver	SW846 M.7761	N/A	6.1 ug/kg
Zinc	SW846 M.6010	N/A	*2783 ug/kg*
ORGANOMETALLIC COMPOUNDS			
Tributyltin (interstitial water)	Krone/Unger	3.7-4.4	0.15 ug/L

PROBLEM IDENTIFICATION

Existing monitoring data from Puget Sound as well as the scientific literature no longer support the listing of most divalent metals as List 1 bioaccumulative chemicals of concern in the Puget Sound region. EPA evaluated bioaccumulative metals in 2000, and determined that only mercury and arsenic were likely to biomagnify based on both laboratory and field studies (EPA, 2000). The following information was considered in the re-evaluation of these metals' BCOC listing:

1. **Cadmium, chromium, copper, nickel, silver, and zinc:** These metals do not have methylated or organic forms, making them unlikely to biomagnify, a conclusion which is supported by the EPA 2000 study. Additionally the new Sediment Evaluation Framework was unable to develop target tissue levels for these compounds for the protection of either wildlife or human health (SEF, 2009), and therefore would have no target tissue levels against which to evaluate the bioaccumulation testing results.

2. **Lead:** The Sediment Evaluation Framework lists this metal as having wildlife target tissue levels but no human target tissue levels. Wildlife TTLs for deep water sites are 7.8 ppm wet weight for protection of individuals (ESA protective level) and 40 ppm wet weight for

protection of populations. Target tissue levels for protection of aquatic life are 0.4 ppm wet weight for marine systems. Examination of 943 marine tissue data in the EIM database indicated approximately 28% of the data exceeded the 0.4 ppm wet weight level protective of marine aquatic life, but there is only one exceedance of the ESA protective levels (a mussel sample in Sinclair Inlet, at 12 ppm wet weight).

3. **Arsenic**: Arsenic has established human target tissue levels, and 96% of all tissue data in EIM exceed this value. Exceedances are based on detected concentrations of arsenic. Currently available scientific literature indicates that while arsenic does biomagnify, the source of the arsenic (water vs sediment) varies from region to region and between species (Meador et al., 2004; Waring and Maher, 2005).

4. **TBT:** TBT's ability to bioaccumulate was addressed in previous issue papers (Michelson 1996), where data was presented indicating that TBT is a bioaccumulative compound of concern.

PROPOSED ACTION/MODIFICATION

Based on the data presented above, the DMMP agencies propose to modify the current listing of the metals as follows:

Cadmium, chromium, copper, nickel, silver and zinc will be removed from the BCOC List 1 and moved to List 4. These compounds will no longer have bioaccumulation triggers associated with them, but will continue to be analyzed in project and disposal site monitoring sediments as part of the standard COC evaluations. These compounds would no longer be evaluated for bioaccumulation by the DMMP as part of disposal site monitoring.

Lead will remain on List 1 due to the lack of paired sediment and tissue data to either support or not support the re-listing of lead, and in consideration of the high tissue concentrations found in Puget Sound. The bioaccumulation trigger (BT) for lead will be re-assessed at a later date.

Arsenic will remain on List 1 due to the high tissue concentrations found in Puget Sound and the scientific uncertainty of whether bioaccumulation is driven primarily by water or sediment. The BT for arsenic will be re-assessed at a later date.

Selenium, mercury and TBT will remain on the metals BCOC list 1, without modification. Their bioaccumulation triggers will be re-assessed at a later date.

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