Comments On
Portland Remedial Investigation
Appendix F: Baseline Human Health Risk Assessment
Appendix G: Baseline Ecological Risk Assessment

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Baseline Human Health Risk Assessment

I. Document Summary

The Baseline Human Health Risk Assessment (BHHRA) describes potential risks to human health for those populations using the Portland Harbor Superfund Site. The media considered as human exposure pathways are beach sediment, in-water sediment, surface water, groundwater seep, fish tissue and shellfish tissue. The toxicity values as a result of these exposures were calculated for individual contaminants as well as mixtures. The risk assessment does recognize that chemicals "are commonly present as mixtures in the environment" and can target the same endpoint. The chemicals that were included in the mixture evaluation were (with a semicolon separating each mixture group) chlordanes; DDD, DDE and DDTs; endosulfans; PCBs; dioxins and furans. The concentrations of the isomers or the congeners present in the mixtures were totaled to find the slope factors and/or reference doses. For dioxin-like PCBs, dioxins and furans, the total toxic equivalents were calculated. Fish and shellfish consumption had the highest hazard indices, with PCBs as the "primary risk driver."

Along with fish and shellfish tissues, Tribal consumption of fish presents hazard indices over 1 (Figure E-2) as well as risks above the target cancer risk range. Since the document states that there is no information on a human population that regularly consumes shellfish, the risk assessment considered fish the primary exposure pathway. Risks to children were taken into account for recreational beach use, with exposure pathways being surface water and beach sediment. The beach sediment adherence factor was 10 times greater than the one for residential soil, likely because of saturation and texture. Information on children's fish consumption is limited, so the BHHRA used a Fish Consumption Survey conducted by Columbia River Inter-tribal Fish Commission to estimate their ingestion rate, finding a ratio of 0.42 to adult ingestion rates. A computer model was used to assess risks to children from lead ingestion. Tribal children consumed fish at higher rates, so the hazard indices were adjusted up.

II. Statement on cumulative risk and chemical mixtures

Multiple chemicals in risk assessment has been, and will continue to be, one of the more significant challenges for conducting quantitative risk assessment, either human health or ecological. The challenges are discussed in EPA documents (see

EPA. 2003. Framework for Cumulative Risk Assessment. EPA/600/P-02/001Fand EPA 2007 Concepts, Methods and Data Sources for Cumulative Health Risk Assessment of Multiple Chemicals, Exposures and Effects: A Resource Document EPA/600/R-06/013F) and in some peer reviewed publications (e.g., J.A. Foran and S.A. Ferenc, eds. 1999. Multiple Stressors in Ecological Risk Assessment. SETAC Press, Pensacola, FL). Some chemicals occur in multiple forms of congeners, and can be treated similarly for toxicological purposes, creating a quantitative ranking for each member in the group. This approach is used for dioxins, furans, PCBs, PAHs, DDTs, endosulfans and some other groups of compounds, often organic chemicals. The greater problem is dealing with the effects of chemicals that are dissimilar, or with stresses that are completely different. Chemicals that are quite different but act on the same endpoint (such as methyl mercury and PCBs) may be treated in a way that adds the effects together, providing there are dose-response equations for each/all chemicals.

The greatest challenge is combining and evaluating the effects from stresses that fall in various categories, including chemical, physical, biological and even psychosocial. In ecological systems, for example, the effects of heavy metal exposure during low oxygen (hypoxia) are greater than the response during normoxia. Toxic chemicals tend to have a greater impact on animals that are malnourished than on well-fed animals. Ecosystems that have been disturbed (by cutting forests, plowing fields, etc) are more susceptible to alterations from invasive species than are ecosystems that have not been so disturbed. All of these conditions must be taken into account for a comprehensive evaluation of the site or ecosystem's or human receptor's likely reaction to pollution.

Human social and cultural systems are also part of the response matrix to chronic stress combined with discrete exposures. EPA has been developing methods and approaches to address cumulative risks for human and ecological systems, though the conceptual work on human cumulative risk assessment seems farther along (see EPA. 2003. Framework for Cumulative Risk Assessment. EPA/600/P-02/001Fand EPA 2007 Concepts, Methods and Data Sources for Cumulative Health Risk Assessment of Multiple Chemicals, Exposures and Effects: A Resource Document EPA/600/R-06/013F). The issue in cumulative risk assessment is that the impacts of specific individual stresses are magnified in those situations with weakened social and cultural systems and that psychological stress is a component of total risk that has to be considered in an environmental risk assessment.

III. General Comments

ESC agrees with EPA that the BHHRA oversimplifies the uncertainties associated with risk assessments, almost overshadowing real data with comments about how conservative the BHHRA is.

The study does not look at the effects of mixtures that target the same end point among the groups. In other words, PCBs, dioxins, and DDT are probable human carcinogens, but the total slope factors for the chemicals are not summed.

While the BHHRA does take into account the weight and differential exposure duration and pathways for children, it does not use the EPA's *Child-Specific Exposure Factors Handbook* (2008); instead it calculates the values using estimates from past studies. The Child-Specific Exposure Factors Handbook is the most recent guidance on how to evaluate risk for children and should be the primary resource for exposure factor information for populations aged 21 and younger.

The BHHRA takes into account the cumulative effects of multiple non-carcinogenic chemicals by dividing the EPA Regional Screening Levels by 10 as required by EPA Region 10 (2007a). These modified RSLs were used as the screening values, with the exception of EPA RSLs noted as being based on maximum or saturation.

For chemicals that were evaluated as mixtures in the BHHRA, the concentrations of the individual isomers or congeners that comprise the mixtures were summed to calculate the exposure point concentrations (EPCs) for the mixtures, as described in Attachment F2. The chemicals evaluated as mixtures are described in Attachment F2 as well, and include: PCBs, endosulfans, chlordanes, DDTs, DDDs, DDEs, and 2,3,7,8-TCDD TEQs (as well as xylenes, dioxin-like PCB congeners). When dealing with mixtures, it is important to consider combination of isomers within a group, like the BHHRA did. However, it is also important to consider mixtures of various groups of chemicals, for instance being exposed to PCBs *and* DDTs.

If the BHHRA could quantitatively add all of the factors that it categorizes as unknowns or quantitative uncertainties, the risks would increase. In other words, the BHHRA states that these uncertainties cannot be incorporated into the risk assessment simply because they cannot be quantified, and they are thus under representing the risk. For example, if the populations who consume shellfish were quantified, risks would increase. Additionally, the absence of toxicological data for certain chemicals does not mean that the effect of a chemical is subsequently absent. These effects, even if very small, still exist and cannot be discounted.

Towards the end of the BHHRA, the document includes several risk management decisions that are outside the bounds of the purpose of this report. ESC agrees with the EPA's determination that this information is not applicable to the BHHRA.

IV. Specific Comments

2.3.1 Sediment

The residential screening level for soil ingestion rates were calculated for children between 1 and 6 years old and for others 7 to 31 years old for both cancer and noncancer endpoints. The document does not explain, however, why no distinction was made for children between 7 and 18 years of age. EPA's *Child-Specific Exposure Factors Handbook* establishes the following standard age categories: birth to <1 month, 1 to <3 months, 3 to<6 months, 6 to <12, 1 to <2 years, 2 to <3 years, 3 to <6 years, 11

to <16 years, and 16 to <21 years. In addition, there is a second guidance document *Guidance on Selecting Age Groups for Monitoring and Assessing Childhood Exposures to Environmental Contaminants* (US EPA, 2005a) that may be an appropriate resource to use in determining the best risk scenario for children on-site.

3.5.1.6.3 Fish Consumption (by Tribal Fishers)

An active adult, such as a tribal fisher, needs about 126 grams of protein per day. With about 20 grams of protein per 100 grams of fish, a person completely dependent upon fish as his or her protein source would need to consume around 600 grams of fish. The BHHRA bases the risk characterization on 175 grams per day, which is significantly lower than what a tribal fisher's diet may require, even if he or she only gets half his or her daily protein from fish.

5.2.8.2 Risk Characterization of Lead: Fish

Lead is not a common contaminant in fish tissues because it does not accumulate. The fact that it is present means these fish are getting a regular, elevated dose. As such, consumers will be getting a regular dose if they are eating the fish. For this reason, the risk assessment for lead ingestion rates should be as protective as possible.

The risk assessment has determined that a lead ingestion rate of 0.5mg/kg of fish tissue is protective of tribal children's health and 2.6 mg/kg for other child-aged consumers. According to the Center for Disease Control and the EPA, there is no safe blood lead level for children. A growing body of scientific research is indicating that blood lead levels under 10 mg/kg have health impacts on children. It is possible to run the IEUBK model with a smaller value representing the standard to determine the risk level based on more conservative standards. The risk assessment would be more protective of Portland's child-aged populations if it took this information into consideration.

7.2.4 Potentially Complete and Insignificant Exposure Pathways

The document does not justify why tribal fishers, in-water workers, dockside workers, and fishers were excluded from the surface water risk assessment. This pathway may not pose as large a risk to these populations as others. However, the risk remains. The document should quantify the risks to these populations by answering the questions about these populations habits, e.g. whether fishers wade into the water, fish from boats, launch boats, etc. Based on the chemicals known to be at this site, the risk assessment should not disregard the inhalation pathway for transients, recreational beachgoers, hypothetical future residents, and divers.

7.2.5.1 Exposure Parameters for Sediment Exposure Scenarios

The document defines adherence factor as dermal contact with sediment in this section, although the term is first mentioned earlier in section 3.5.1.4. It would help the reader if when a term is first used, the definition followed immediately after, rather than later in the document.

8.1.1.2 Shellfish Consumption

ESC agrees with EPA that shellfish consumption cannot be excluded from the risk assessment without a more thorough investigation into potential populations that may eat shellfish from the Portland Harbor. This assessment only pertains to current or past populations who may eat shellfish. The assessment should consider future populations as well, who may eat shellfish at a later date and could be exposed.

8.1.1.3 Direct Exposure to In-water Sediment

The document indicates that the risks associated with exposure to in-water sediment were estimated differently for each ½-river mile segment and for the total Study Area. This assessment should be corrected to treat the full site area. Apportioning risks to ½-river mile segments of the river makes a series of assumptions of human behaviors (where populations use the river, how long, where populations do not use the river) that are not justified in this document.

Tables 5-2 and 5-3

These tables did not analyze the chronic daily intake for noncancer risk calculations for Total PCB TEQ. The noncancer risks stem from a shorter exposure time such as months or a few years, whereas cancer typically develops over many years. This omission is a problem because PCBs have impacts on neurological, developmental, reproductive and immune systems. The risk assessment should include an analysis of chronic daily intake for both cancer and noncancer risks to serve as a comprehensive assessment of the risks posed by PCBs.

Baseline Ecological Risk Assessment

I. Document Summary

The Baseline Ecological Risk Assessment (BERA) was designed to determine if deleterious effects from the hazardous waste in the Portland Harbor are ongoing. For threatened or endangered species, the study incorporated the assessment endpoint of protection at the individual organism level. For all other organisms, the population is the endpoint, per EPA practice. Water quality criteria were calculated based on the 5th percentile of a species sensitive distribution, an approach deemed acceptable for protecting threatened and endangered aquatic species, including salmon, sucker, minnow and fairy shrimp species. A No Observed Adverse Effect Level was developed for threatened or endangered bird species. The Bald Eagle was the only avian species included in this category. Portland's Audubon Society also lists the Peregrine Falcon, a species that uses the Site as habitat, as recovering threatened or endangered species – therefore the BERA should assess the Peregrine Falcon using the No Observed Adverse Effect Level as well.

II. General Comments

The BERA document is well organized and clearly outlined. It assesses the risks to benthic invertebrates, including the community as a whole, and bivalves and crayfish.

The BERA also chooses appropriate representative species. It considers survival, growth and reproduction of organisms, although it does not make mention of immunological effects.

The screening process for the chemicals of interest is rigorous and comprehensive.

The BERA does not address endpoints at individual levels for all species at the site. The issue with this approach is that existence of a population does not necessarily signify a *healthy* population. A majority of the population could be ill, but still able to reproduce, and thus the numbers of the population may not represent the real effects from the chemicals on these animals.

ESC agrees with EPA that mercury poses an unacceptable risk but should not have been ruled out in the BERA as a watershed management problem – that is a risk management decision and outside the scope of this document's purpose.

ESC agrees with EPA that the BERA should have compared measured concentrations to those suggested in EPA guidelines.

III. Specific Comments

Section 3.2 Refined Conceptual Site Model

Only threatened and endangered species were protected at the individual organism level. Other species were protected at the population level, but the risk assessment, especially since it already has the data on risks to individuals, should specifically address the effects on reproduction, development and immunology of individuals. Even if the population as a whole is deemed healthy, it does not mean each organism is fit.

Attachment 5: Section 5.0 Surface Water

The risk assessment for wildlife does not include Chemicals of Potential Concern (COPCs) in surface water. Birds and mammals, however, will likely be exposed to these chemicals in the surface water through ingestion and dermal contact, thus putting their health at risk. The BERA would be more thorough if it included the full range of exposure routes for each of the receptors. While the impacts from these exposure routes may not show up across the entire population, they may still affect an individual's health in a detrimental way, and the risk assessment should also take into account impacts on individuals.

Attachment 5: Section 6.0 Transition Zone Water

The BERA also did not consider COPCs in transition zone water (TZW) for wildlife. TZW is typically located on the shore zone when there is groundwater pushing into the river and mixing with river water. These zones are especially of concern for aquatic-dependent omnivores (the mink and river otter). Footnote #105 states that ingestion of, and contact with, water are classified as insignificant pathways in EPA's

Conceptual Site Model. This pathway could, however, still pose significant harm to individuals, if not whole populations. It should not be discounted in the risk assessment.