

# **EPA Response to Integral Consulting Inc. Memorandum**

## ***Response to EPA Question 1***

**Dated August 30, 2019**

Response dated September 6, 2019

Following is the United States Environmental Protection Agency's (EPA's) response to the document titled *Response to EPA Question 1* (Memorandum) prepared by Integral Consulting Inc. (Integral) on behalf of the Portland Harbor Pre-Remedial Design Group (Pre-RD Group).

### **EPA Response**

EPA disagrees with the conclusions in the Memorandum that the differences in study design between the remedial investigation and feasibility study (RI/FS) and pre-design investigation and baseline sampling (PDI/BL) programs do not influence temporal comparisons of surface area weighted average concentrations (SWACs) between the two datasets. Consistent with EPA's comments on the *PDI Evaluation Report* (AECOM Technical Services [AECOM] and Geosyntec Consultants, Inc. [Geosyntec] 2019), EPA considers the temporal comparisons of RI/FS and PDI/BL SWACs to be estimates for the following reasons.

The PDI/BL stratified random sampling (SRS) surface sediment samples were randomly placed within grid cells of known area for the express purpose of developing a statistically unbiased baseline dataset for the long-term monitoring program. The data use objectives pertaining to the SRS surface sediment samples are listed in Section 1.3 of the pre-design investigation (PDI) work plan and are as follows (Geosyntec 2017):

1. Implement investigation baseline sampling to update existing sitewide data
2. Gather data to be used as part of baseline dataset for future long-term monitoring

The SRS surface sediment sample grid cells are distributed throughout the Portland Harbor Superfund Site (site) from river mile (RM) 1.9 to RM 11.8. The placement of the grid cells and SRS surface sediment samples was done to ensure sitewide coverage for the unbiased baseline dataset. The stratified random sampling design allows the data to have a known statistical bias that can be calculated. This bias can be adjusted based on the spatial weighting of the grid cell areas and the number of samples in the shoals versus the navigation channel, leading to the calculation of unbiased SWACs. Assuming the stratified random sampling design is repeated as part of the long-term monitoring program, statistically robust temporal rates of change can be calculated from these unbiased SWACs.

The RI/FS surface sediment data consist of samples that were collected for delineating the nature and extent of contamination and for developing the baseline risk assessments, as detailed in Section A5.2 and Appendix A of the *Round 2 Quality Assurance Project Plan* (Integral and Windward Environmental, LLC [Windward] 2004). As stated in the Memorandum, the sitewide RI/FS surface sediment samples were not located in a stratified random grid but rather were located in areas of low sample density. The RI/FS sampling program did not contain a data use objective of collecting an unbiased baseline dataset. Therefore, these data represent a non-random and partially random sampling scheme as defined in EPA (1996), which will likely produce a biased estimate of the mean.

While spatial weighting of datasets with unknown bias (e.g., RI/FS data) using interpolation methods such as natural neighbor and Thiessen polygons can reduce the bias when calculating means, the resulting SWACs still contain some measure of uncertainty (Kern 2009). Uncertainty in the RI/FS data was assessed during the feasibility study (FS) and is summarized in FS Appendix I (EPA 2016). Uncertainty in the natural neighbor and Thiessen polygon interpolated PDI/BL data was not presented in the *PDI Evaluation Report* (AECOM and Geosyntec 2019) and cannot be assessed at this time.

Assessing temporal change in sediment concentrations is necessary to measure the progress of the remedy toward attaining site cleanup levels. However, due to the different data use objectives and study designs, unknown bias in the RI/FS data, and uncertainties with interpolation-based SWACs, temporal comparisons between the RI/FS and PDI/BL data should be considered estimates. These estimates can provide a qualitative understanding of how contaminant concentrations in surface sediment have changed since the RI/FS data were collected. Statistically robust rates of temporal change can be calculated by comparing SWACs developed from the baseline SRS surface sediment samples and future long-term monitoring sample data that replicates the stratified random design.

## References

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