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December 1, 1999

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Dear Michael:

Thank you for the opportunity to review the document entitled, ***Comments of General Electric Company on Volume 2E - Baseline Ecological Risk Assessment: Hudson River PCBs Reassessment RI/FS*** (General Electric Company, LWB Environmental Services, Ltd., and Quantitative Environmental Analysis, Inc. 1999; hereafter referred to as GEC *et al.* 1999). In conducting this review, I have explicitly focussed on the information presented in the section, ***The Sediment Effects Concentrations (SECs) are not Reasonable Estimates of PCB Toxicity to Benthic Invertebrates Either Individually or as a Population*** (Section 4.0).

In the subject document, GEC *et al.* (1999) indicate that the SECs that were developed by NOAA (1999) should not be used as toxicity reference values (TRVs) in the baseline ecological risk assessment because:

- the SEC values have no causal basis; and,
- direct relationships between benthic community productivity and the productivity of higher trophic levels cannot be demonstrated.

In addition, GEC *et al.* (1999) question the applicability of the SECs because "the meaning and utility of the pre-existing SECs is the subject of considerable scientific debate, the authors of several of these methods have warned against their use as risk assessment tools, the no-effects data are not properly considered, the pre-existing SEC values are mostly based on data from sediments for which PCBs have not been shown to be the dominant or only contaminant of concern, and the spiked sediment toxicity study of Swartz *et al.* (1988) [is improperly used] as a validation of the SEC values." Each of these specific comments are addressed in the following sections.

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First, GEC *et al.* (1999) indicate that direct relationships between benthic community productivity and the productivity of higher trophic levels cannot be demonstrated. This statement is counter-intuitive. Countless studies have been published in the scientific literature which indicate that higher trophic levels in the food web are directly dependent on benthic community productivity. While there are a number of other factors that can also influence the productivity of higher trophic levels (e.g., predation, water-borne contaminants, etc.), those species that rely on benthic production for most or all of their energy requirements will necessarily be adversely affected if that food source is removed or reduced in abundance.

Some of the comments included in the GEC *et al.* (1999) document also indicate that the authors do not have a complete understanding of the sediment quality guidelines (SQGs) that were used to derive the SEC values. For example, GEC *et al.* (1999) indicate that the TEL/PEL values were promulgated by the Ontario Ministry of the Environment. This statement is incorrect. The TEL/PEL values were promulgated by Environment Canada. In addition, GEC *et al.* (1999) indicate that the TEL and PEL values were not used in an appropriate manner for deriving the consensus-based SECs (i.e., they were used in a manner that is contrary to the guidance provided by the authors). In this respect, GEC *et al.* (1999) correctly indicated that the Canadian SQGs (i.e., TELs) are intended to define contaminant concentrations below which adverse effects are unlikely to occur. For this reason, the TELs were used to calculate the threshold effect concentrations (TECs). However, GEC *et al.* (1999) failed to mention that the PELs are intended to identify the concentrations of contaminants above which adverse effects are likely to occur (CCME 1999). Therefore, in contrast to the statements made by GEC *et al.* (1999) it is appropriate to use the PELs to calculate the mid-range effect concentrations (MECs). Additionally, GEC *et al.* (1999) indicated that the SEC approach does not properly consider the no-effects data. This statement is also incorrect for several reasons. First, many of the underlying SQGs explicitly consider the distribution of the no-effects data in the derivation of the guideline values (e.g., TEL/PEL values, AETs, NECs, etc.). In addition, both the effects and no-effects data were used to evaluate the predictive ability of the SECs.

GEC *et al.* (1999) indicate that the authors of several of these methods have warned against the use of SQGs as risk assessment tools. However, none of the reports cited by GEC *et al.* (1999) provide any such warning regarding the use of SQGs in ecological risk assessments. In contrast, several of these authors have evaluated the SQGs and determined that they provide an accurate basis for predicting the effects of sediment-associated contaminants on sediment-dwelling organisms (Long *et al.* 1995; Long *et al.* 1998; Ingersoll *et al.* 1996; MacDonald *et al.* 1996; Long and MacDonald 1998; MacDonald and Ingersoll In review). In fact, several of the recently published papers by these authors provide a basis for identifying the probability of observing sediment toxicity

using the SQGs (Long and MacDonald 1998; Field *et al.* 1999). As such, these guidelines are directly applicable to the ecological risk assessment process. Moreover, these guidelines have been recommended for use in ecological risk assessments by a panel of experts that was assembled by the Society of Environmental Toxicology and Chemistry (Ingersoll *et al.* 1997) and by several of the authors of these guidelines (Long and MacDonald 1998; Field *et al.* 1999). Therefore, GEC *et al.* (1999) seems to be out of step with the most recent guidance on the application of SQGs in ecological risk assessments.

GEC *et al.* (1999) are correct in their observation that the pre-existing SEC values (they are actually referring to SQGs) are mostly based on data from sediments for which PCBs have not been shown to be the dominant or only contaminant of concern. As a result, it is possible to develop correlations between PCB concentrations and adverse biological effects using the data that have been collected at most of these sites (i.e., the resultant SQGs are considered to be correlative rather than causally-based). By assembling SQGs that were developed using multiple approaches and unique underlying data sets, it is possible to develop consensus-based SECs that reflect the agreement among the existing SQGs. The fact that the existing SQGs are comparable, in spite of the differences in calculation methods and underlying data sets, increases the level of confidence that they are correctly identifying the concentrations of PCBs below which adverse effects are unlikely to be observed and above which adverse effects are likely to be observed. However, these characteristics, by themselves, are not sufficient to demonstrate that PCBs are causing or substantially contributing to sediment toxicity at concentrations above the two upper SECs (i.e., the MEC and EEC). For this reason, three other evaluations of the SECs were conducted, including assessing their predictive ability, assessing their comparability with equilibrium partitioning-based SQGs, and assessing their comparability to the chronic toxicity thresholds that have been estimated from the results of dose-response studies.

The results of these three additional evaluations indicate that the SECs for PCBs that were developed by NOAA (1999) reflect causal rather than correlative effects. More specifically, the results of the predictive ability evaluation demonstrate that the SECs can be used to accurately classify freshwater, estuarine, and marine sediments as toxic and not toxic. These results can also be used to determine the likelihood that a particular sediment sample will be toxic (i.e., based on PCB concentration alone). This feature is important for conducting ecological risk assessments. The consensus-based SECs were also evaluated to determine if they were comparable to equilibrium partitioning-based SQGs and the results of spiked sediment toxicity tests (i.e., dose-response studies); both of these latter assessment tools provide a means of identifying the concentrations of sediment-associated contaminants that are likely to cause sediment toxicity. The results of that analysis indicated that the consensus-based SECs are comparable to the equilibrium partitioning-based SQGs that have been published in the scientific literature and to the

chronic toxicity thresholds that have been estimated from the results of spiked sediment toxicity tests. This agreement between the consensus-based SECs, the equilibrium partitioning-based SQGs, and the results of spiked sediment toxicity tests indicates that the SECs are causally-based.

GEC *et al.* (1999) argued that the results of the Swartz *et al.* (1988) study were used improperly in the evaluation of the SEC values. This is an interesting argument because Dr. R. Swartz was involved in the development and evaluation of the SEC values and has co-authored a paper on this topic (MacDonald *et al.* In press). Therefore, it is unlikely that Dr. Swartz would concur with GEC *et al.* (1999) regarding the use of his spiked sediment toxicity test results in the evaluation of the SECs.

GEC *et al.* (1999) also used the Swartz *et al.* (1988) study results to estimate a chronic toxicity threshold of 8 mg/kg DW for PCBs in sediments from the Thompson Island Pool [i.e., which has an average total organic carbon (TOC) of 2%]. This estimated chronic toxicity threshold for this location was then compared to the TEC and the EEC from NOAA (1999). The results of this comparison were then used to suggest that the SECs significantly overstate the toxicity of PCBs. However, this logic is flawed for several reasons. First, GEC *et al.* (1999) used the nominal concentrations of PCBs to estimate their chronic toxicity thresholds for PCBs; measured concentrations were substantially lower than the nominal concentrations in this study. Second, Swartz *et al.* (1988) did not report the concentrations of TOC in the test sediment; therefore, the level of TOC used in the GEC *et al.* (1988) calculations were estimates only, based on other information that was reported in the paper. Third, there is some uncertainty about the application of partitioning model at low levels of TOC. Additionally, the chronic toxicity thresholds that were estimated by GEC *et al.* (1999), if correct, would only apply to one location on the Hudson River. Such thresholds would not support the type of ecological risk assessment that needed to be conducted on the river. Finally, Swartz *et al.* (1988) demonstrated that PCB-contaminated sediments tended to be more toxic when they also contain other chemical substances. This fact was not considered by GEC *et al.* (1999) in the estimation of chronic toxicity thresholds for the Thompson Island Pool. Therefore, the resultant thresholds are unlikely to be relevant for identifying the concentrations of PCBs that are likely to cause or substantially contribute to sediment toxicity in the Hudson River.

Thank you again for the opportunity to review the subject draft. I hope that these review comments provide a helpful perspective on the GEC *et al.* (1999) document. Cheers and best wishes.

Don MacDonald,
President

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