APPENDIX D: Developing PEC-Qs

The following description of the origin and use of PEC-Qs is taken from the March 2005 MPCA Environmental Bulletin Article (MPCA 2005) entitled, "Comparison of Surficial Sediment Quality in the St. Louis River Area of Concern, MN/WI, with Other North American Sites".

Origin of the Use of PEC-Q's in the St. Louis River Estuary

The Minnesota Pollution Control Agency (MPCA), Wisconsin Department of Natural Resources (WDNR), Fond du Lac Band, U.S. Army Corps of Engineers, consultants for government agencies and responsible parties, and other federal and academic organizations have conducted a number of investigations to assess sediment quality conditions in the lower St. Louis River AOC, particularly since 1990. As part of the Remedial Action Plan (RAP) process for the St. Louis River AOC, stakeholders identified a need to compile the sediment quality data collected from the St. Louis River in a database format. A matching sediment chemistry and toxicity database was completed in 2000 to support an evaluation of the predictive ability of numerical sediment quality targets (SQTs) in the St. Louis River AOC (Crane *et al.* 2000, 2002). In 2003, the matching sediment chemistry/toxicity database, as well as additional sediment chemistry, sediment toxicity, bioaccumulation, and physical parameter data collected since 1990 were compiled into a sediment quality database.

To support subsequent data analyses, the available surficial sediment chemistry data for the selected areas of interest were collated. Mean probable effect concentration quotients (PEC-Qs) were calculated. The MPCA has adopted consensus-based probable effect concentrations (PECs) for 28 chemicals as Level II sediment quality targets (SQTs) for the St. Louis River AOC (Crane *et al.* 2000, 2002). These mean PEC-Qs were calculated using the procedures recommended by USEPA (2000) and outlined in Crane *et al.* (2000, 2002) for the integration of total PAHs, total PCBs, and selected metals. In brief, mean PEC-Qs were calculated as follows:

$$\text{PEC-Q} = \frac{\text{chemical concentration (dry wt.)}}{\text{corresponding PEC value}}$$

$$\text{Mean PEC-Q} = (\text{mean PEC-Q}_{\text{metals}} + \text{PEC-Q}_{\text{Total PAHs}} + \text{PEC-Q}_{\text{Total PCBs}})/n$$

Where n = number of classes of chemicals for which sediment chemistry data were available (i.e., 1 to 3).

Mean PEC-Qs, in the form of Level I and Level II SQTs, are used to evaluate the potential effects of contaminated sediments on benthic invertebrates in the selected areas of interest. The Level I SQTs are intended to identify contaminant concentrations below which harmful effects on sediment-dwelling organisms are unlikely to occur. Crane *et al.* (2000) recommended a Level I SQT of 0.1 for mean PEC-Qs. The Level II SQTs are intended to identify contaminant concentrations above which harmful effects on sediment-dwelling

organisms are likely to occur frequently or always. Crane *et al.* (2000) recommended a Level II SQT of 0.6 for mean PEC-Qs.

The potential for observing adverse effects on benthic invertebrates was evaluated by dividing the sediment samples into three groups. Samples with mean PEC-Qs below 0.1 were included in a low risk group. Samples with mean PEC-Qs of >0.1 and < 0.6 were included in a moderate risk group, while those with mean PEC-Qs of > 0.6 were included in a high risk group.