

# Critical Review of Mercury Sediment Quality Values (SQV) for Protection of Benthic Invertebrates

Phyllis C. Fuchsman<sup>1</sup>, Elisa Bizzotto<sup>2</sup>, Miranda H. Henning<sup>1</sup>, Mary Sorensen<sup>1</sup>, Victor S. Magar<sup>1</sup>, Fabio Colombo<sup>2</sup>

<sup>1</sup>Ramboll Environ USA; <sup>2</sup>Ramboll Environ Italy, V. Vincenzo Lancetti 43, Milan, Italy Phone: +39-02 0063091

E-mail: ebizzotto@ramboll.com

**Introduction:** Mercury is a naturally occurring element that has been released from geologically stable forms into the environment through human activities. Mercury biomagnifies through the food web, and also has the potential for direct toxic effects on lower trophic levels, including benthic invertebrates.

Risks posed to benthic invertebrates by chemicals in sediment are often initially screened by comparing chemical concentrations in sediment to sediment quality values (SQVs; also known as sediment quality guidelines or sediment quality benchmarks).

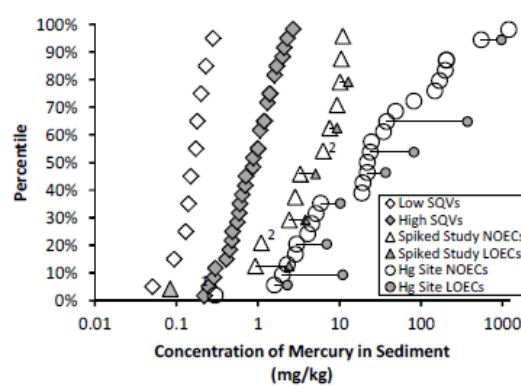
SQVs are often developed as paired concentrations of chemicals in sediment, typically with a lower bound statistic that is believed to be associated with the absence of an effect (i.e., no effect) and an upper bound statistic that is believed to be associated with an adverse effect. During the presentation, we will present a recent reviews of mercury SQVs developed for characterizing mercury risks to benthic invertebrates (Conder et al., 2013). For comparison, data relevant to understanding causal relationships between mercury concentrations and sediment toxicity were also reviewed.

**Results:** Among the 40 sediment quality values (SQVs) available for mercury, nearly all are “cooccurrence” SQVs derived from databases of paired chemistry and benthic invertebrate effects data from field-collected sediment samples. Co-occurrence SQVs are not derived in a manner that reflects a concentration-response relationship for mercury because multiple potentially toxic chemicals and other stressors often co-occur with mercury in the datasets used to derive SQVs.

Co-occurrence SQVs (0.05-2.7 mg/kg) were generally one to two orders of magnitude lower than LOECs, NOECs, and EC50s observed in mercury-spiked toxicity studies (0.08-10.5 mg/kg) and mercury site investigations (0.3-1,200 mg/kg) (Figure 1). Additionally, there is a high degree of overlap between co-occurrence SQVs and naturally-occurring mercury levels in sediment to which benthic invertebrates have adapted over the millennia. Mercury co-occurrence SQVs do not reflect effect thresholds for benthic invertebrates and should not be used to characterize or manage risks at sediment sites; the spiked sediment and mercury site

data compiled in our review provide a more useful alternative information source.

Further research is needed to refine mercury effect thresholds, provide better tools for measuring mercury exposure and bioavailability.



**Fig. 1:** Co-occurrence sediment quality values (SQVs) compared to effect/no effect concentrations of mercury in mercury-spiked and mercury site sediment. Horizontal lines connect bounded no observed effect concentrations (NOECs) and lowest observed effect concentrations (LOECs).

**References:** Conder J.M., Fuchsman P.C., Grover M.M., Magar V.S., Henning M.H. Critical Scientific Review Of Mercury Sqvs For The Protection Of Benthic Invertebrates. *Environ Toxicol Chem.* 2015 Jan;34(1):6-21. doi: 10.1002/etc.2769. Epub 2014 Nov 12