Conclusions Regarding the Performance of SQGs in the Los Angeles Region

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March 30, 2004

Conclusions from the SQG evaluation project:

1. **The relationship between the bulk sediment concentration of specific contaminants and toxicity is complex and variable.**

   Examination of the CSTF database for acute amphipod toxicity and the bulk concentration of individual contaminants shows that is a large region of overlap between the concentrations associated with toxic and nontoxic samples. Even at the extremes of the concentration range, very few samples are consistently toxic or nontoxic.

2. **The chemical-specific SQGs evaluated in this study are unreliable predictors of toxicity when they are used in isolation.**

   Guidelines such as the ERL, ERM or those based on other empirical approaches reflect the statistical distribution of the data but do not represent thresholds for cause and effect. Individual chemical-specific guidelines based on equilibrium partitioning theory for organics are expected to provide a better estimate of the potential for toxicity, but they do not appear to be reliable predictors of sediment toxicity to amphipods in the Los Angeles area.

   The independent application of chemical-specific SQGs such as the ERL or ERM provides little reliability for predicting the occurrence of sediment toxicity. For example, the performance of the ERM is actually improved when DDT data is not used in the assessment and bulk PAH and PCB concentrations appear to have very little relationship to the occurrence of toxicity in the LA area.

3. **All of the SQG approaches evaluated in this study have a poor ability to discriminate between toxic and nontoxic samples when chemical concentrations are at low-moderate levels.**

   Examination of the data distribution plots for individual contaminants of the mean SQG quotient show an intermediate region where a wide range of toxicity is observed at the same concentration. The chemical concentrations of the majority of sediments in the LA CSTF area of interest fall within this category. This variation is likely due to combination of factors, such as differences in contaminant bioavailability, variations in contaminant mixtures, artifacts from sample handling or storage, and test organism variation. Use of SQGs, and probably toxicity tests, in this region are likely to produce variable results.

4. **Empirical SQGs such as the ERM and SQG-Q1 can provide reasonably accurate predictions regarding the toxicity of a sediment samples when approaches that incorporate the presence of multiple contaminants are used and the sediments contain relatively low or relatively high contamination levels.**

   Some empirical SQGs make the correct prediction about 85% of the time when the mean quotient approach is used. This application of the mean quotient methodology was

further refined in the regional use paper to identify optimum application thresholds for use in the LA area. These analyses indicated that two SQG methods, ERM and SQG-Q1, performed better on average than the other SQGs evaluated.

5. **No single SQG approach has been identified that provides high performance in all desired aspects of use.**

   Due to the high uncertainty in biological effects associated with moderate contamination levels, the SQGs examined in this study were unable to provide both high efficiency and high sensitivity or specificity. Thus, a determination of which attributes are most important is needed before an SQG application method can be determined.

6. **Regional differences in contamination patterns are present in the LA CSTF area of interest that impact SQG performance.**

   Within the Southern California Bight, regional differences in the extent and concentration of several contaminants of concern exist. Two examples are DDT (high off Palos Verdes and in the Consolidated Slip) and chlordane (high near stormwater discharges in embayments). Other differences are also evident between southern California and other coastal areas of the United States (PAHs for example). Regional differences in the performance of SQGs have also been shown and these differences have been associated with specific constituents (e.g., DDT) in some cases.

7. **The performance of SQGs can be improved through the use of regional application thresholds.**

   The analyses conducted in this study have identified the tools that can be used to objectively compare SQG performance and identify those that perform best. The efficiency of some SQGs was improved through the use of modified application thresholds that were based on contamination characteristics of the LA region.

8. **Development of regional SQGs has the potential to improve overall performance, but substantial uncertainty is likely to remain.**

   A limited effort to develop regional SQGs was made in this project, but the results indicated that it is a productive direction for the future. AETs based on southern California data were developed and demonstrated to have higher efficiency than similar values developed using data from Washington. SQGs developed from southern California data using the floating percentile approach also yielded improved performance, but insufficient data were available to validate the results.

9. **A quantitative and integrative method for SQG application, such as the mean quotient, is preferable over a categorical approach (e.g., number of guideline exceedances).**

   Both the number of SQG exceedances and mean SQG quotient has been shown to have utility in predicting the occurrence of toxicity. Counts of the number of guideline exceedances offer an advantage in simplicity of calculation relative to more quantitative approaches. However, an integrative approach such as the mean SQG quotient provides substantial advantages, such as the ability to include more information on the relative

concentration of each contaminant, less sensitivity to missing data, and the ability to fine tune the application threshold (i.e., quotient value of concern) for optimum performance.

10. **The use of the ERL offers little benefit over the ERM for assessing the potential for acute sediment toxicity.**

    Analyses of the CSTF database using ERLs yields similar results to those obtained for the ERMs. When a mean quotient approach is used to interpret the data, both ERLs and ERMs have about the same ability to distinguish between nontoxic and toxic samples at low levels of contamination. Several ERLs (e.g., arsenic, copper, and nickel) are at or below naturally occurring background concentrations, which limits their utility for identifying contaminant concentrations of concern.

Recommendations from the CSTF sediment thresholds subcommittee:

1. **SQGs should not be used deterministically for making disposal suitability decisions.**

   The high degree of uncertainty associated with applying SQGs to the majority of sediment types present in the LA region limits precludes their use as the sole factor in determining the suitability of sediment for aquatic disposal. In addition, national policy for regulating open water disposal prevents the use of SQGs as a substitute for biological testing.

2. **SQGs may be used, but are not required, to provide additional lines of evidence to the decision-making process.**

   SQGs provide a reliable measure of sediment quality for some sediment types and their use may assist applicants, regulators, or other groups in assessing the ecological risk of sediment disposal. If available, the results of SQG comparisons should be considered along with other information when making disposal suitability decisions.

3. **All available LOE (e.g., toxicity, SQGs, bioaccumulation) should be considered for making disposal suitability decisions.**

   All measurements used to evaluate the potential ecological risk of dredged sediments have limitations that may result in erroneous conclusions. Data and analyses from all available sources should be considered in the evaluation, provided that the measurements were conducted using methods recommended by the CSTF, specified in the regulatory guidance, or established in the scientific literature.

4. **The mean ERM quotient (with DDT value) should be used to assess the potential that a sediment sample lacks acute toxicity.**

   The ERM quotient is preferable to other SQG approaches that were shown to perform just as well because more chemicals of concern are included in the calculation. Standardized guidance for calculating the mean ERM quotient and interpreting the results to estimate the likelihood that a sample is nontoxic should be developed by the CSTF. This guidance should include the ERM values, method of calculation, and tables that relate the result to the probability of a sample being nontoxic.

5. **The mean ERM quotient, including a revised total DDT value, should be used to assess the potential that a sediment sample is acutely toxic.**

   The ERM quotient is preferable to other SQG approaches that were shown to perform just as well because more chemicals of concern are included in the calculation. Standardized guidance for calculating the mean ERM quotient and interpreting the results to estimate the likelihood that a sample is toxic should be developed by the CSTF. The CSTF should include a revised value for DDT in the calculation method if it can be shown to improve SQG performance.

6. **CA AETs should be used as an additional line of evidence for making disposal suitability decisions.**

   Regional AETs provide a tool to identify individual contaminant concentrations that are almost certain to result in toxicity. The use of AETs in conjunction with a SQG quotient is likely to provide greater confidence in evaluating the potential for sediment toxicity. The existing CA AETs developed for the CSTF should be revised based on calculations using all available acute toxicity data (offshore and bays).

7. **Maintain and update the CSTF sediment quality database and periodically evaluate SQG performance and AET values.**

   The CSTF should require its contractors to submit the data from future characterization studies and surveys in an electronic format that is compatible with the CSTF sediment quality database.

8. **Incorporate improved analytical chemistry methods that relate to bioavailability in the dredged material evaluation process.**

   Variation in contaminant bioavailability is believed to be a substantial factor in the high uncertainty observed when SQGs are applied to sediments that contain low-moderate chemical concentrations. Analytical chemistry methods that provide information that can be used to improve estimates of chemical bioavailability should be identified and included in future sediment characterization studies. These methods might include TOC characterization, acid volatile solids concentration, and measures of contaminant partitioning.

9. **Incorporate new and improved toxicity test methods that provide better sensitivity and relevance to ecological effects.**

   Most toxicity tests used in sediment characterization studies only measure acute effects resulting from short-term exposure. Biological tests that provide a more realistic exposure scenario, improved ecological relevance, or greater sensitivity should be identified and included in future sediment characterization studies. These tests might include long-term exposures, more sensitive species/endpoints, or bioaccumulation risk assessment models.

Future meeting action item:

The EPA and Army Corps of Engineers will brief the CSTF on how bioaccumulation data are currently evaluated for evaluating disposal suitability. The briefing should address both direct toxicity and trophic level effects.