ISSUE PAPER

REFINEMENTS TO PSDDA POST DISPOSAL MONITORING GUIDELINES

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INTRODUCTION

One of the objectives of PSDDA post-disposal monitoring is to examine changes in sediment contaminant concentration over time, and to ensure that the sediment quality of areas surrounding the disposal site are not being degraded. This determination involves the comparison of pre-determined baseline values and post-disposal sediment concentrations using site specific guideline values. The guideline values were derived by multiplying baseline concentrations by trigger values, 1.25X for metals, and 1.47X for organics. Post-disposal monitoring indicates several metal and organic compounds have exceeded their respective chemical guideline values at some disposal sites. It is often difficult to determine the underlying cause for these exceedances. These exceedances may be the result of a variety of factors, such as analytical variance, drift of contaminated sediment, or area-wide changes in sediment quality as a result of off-site contamination or as the result of the natural spatial heterogeneity of the sediment. The treatment of these trigger-level exceedances has become a difficult implementation issue. Perimeter chemistry guideline values have been exceeded in virtually every monitoring program since 1990 (SAIC 1991, 1992, 1993a, 1994). In each of these instances the conclusion has been reached that exceedances were false alarms. However, once these guidelines are exceeded, considerable effort must be expended by the PSDDA agencies and the monitoring consultant to demonstrate that these exceedances are not leading to long-term adverse effects at the disposal sites or surrounding areas as a result of disposal activity.

PROBLEM IDENTIFICATION

The existing trigger/guideline values have not proven to be an effective tool for site management. Sample preparation and laboratory analytical procedures used to develop the sediment chemical guideline values were derived using different techniques than those used in present monitoring, or in the PSDDA program in general. The differences include different sediment extraction volumes, instrument clean-up and calibration procedures, and miscellaneous quality assurance problems originally designed to yield the lowest possible detection limits. In addition, there is some uncertainty in the variability of guideline values based upon the *ad hoc* use of non-detected values. When the guidelines were developed, the use of undetected values was not consistent, and these values were often ignored or used dependent upon their number and relation to the detected values (SAIC 1993b). Guideline values were derived from non-replicated baseline concentrations. An individual baseline value cannot adequately characterize the chemical composition of sediments at a particular station. There is also some question regarding the statistical procedures used to establish guideline values. Coefficients of variance were pooled across chemicals, using a questionable statistical formula to calculate the exceedance factor, and using an "uncertainty factor" in extrapolating

baseline chemistry from old to new monitoring stations (SAIC 1993b). The PSDDA agencies and others feel that the chemical guideline triggers should be replaced by another method for evaluating changes in perimeter chemistry.

PROPOSED ACTION/MODIFICATION

In their presentation to the PSDDA agencies on the results of the recent post-disposal monitoring at Port Gardner (Nov. 94), SAIC suggested a variety of refinements related to this issue. SAIC recommended that chemical and biological conditions at the perimeter stations be evaluated during environmental monitoring using both time trends analyses and comparisons to the State's Sediment Management Standards (SMS) (Chapter 173-204 WAC). The Sediment Quality Standards (SQS) would replace the guideline values as indicators of potential off-site adverse effects due to dredged material disposal, triggering additional benthic infaunal analyses or bioassays as required. Time trend analysis could be incorporated into the monitoring program to provide a measure of whether the overall effects of chemicals of concern are gradually increasing over time before the SQS are exceeded. An example of time trend analysis was presented by SAIC in the 1994 Port Gardner report (SAIC 1994). Following recommendations in the *PSDDA Perimeter Chemistry Trigger Approach Assessment* (1993b), Port Gardner perimeter chemistry values were compared over time to baseline as a ratio of the PSDDA SL. Simple bar charts provided quick visual, intuitive assessments of the off-site conditions. Time trend analysis can be done using SL or SQS screens to evaluate specific trends in concentrations of chemicals of concern (COC).

SAIC suggested the PSDDA agencies should discontinue the use of guideline values in their current form for assessing off-site chemical effects. Procedures presently used to determine if the COC have increased at perimeter locations surrounding PSDDA disposal sites in Elliott Bay and Port Gardner have led to conclusions that are not supported by the results of physical and biological monitoring.

A critical analysis of these chemistry evaluation procedures leads to a suggestion that the statistical foundation underlying the current approach is flawed and responsible for indications that dredged material disposal activities have increased chemical concentrations outside the disposal sites, resulting in time consuming analysis by the PSDDA agencies.

SAIC recommends that the PSDDA agencies replace the current method with a classical hypothesis testing approach. That we carry out the testing on individual chemicals, but combine significance levels for an overall test of the null hypothesis that the dredged material has not moved, and that concentrations have not increased. They suggest that we carry out a statistical test (e.g. t-test) comparing baseline and post-disposal concentrations, determine the significance level and combine p-values for a test of the global null hypothesis that the changes across chemicals are due to chance.

The PSDDA agencies propose instituting time trend analysis and perimeter statistical comparison to the SL as a means of determining off-site effects of dredged material.

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