Appendix I

NSI Data Evaluation Approach Recommended at the National Sediment Inventory Workshop, April 26-27, 1994

The original proposed approach for the integration and evaluation of NSI sediment chemistry and biological data was developed at the Second National Sediment Inventory Workshop held on April 26 and 27, 1994, in Washington, D.C. The proposed workshop approach was modified, however, to address inconsistencies found in trying to implement the approach and to address the concerns of the many experts in the field of sediment quality assessment who commented on the workshop approach. This appendix presents the NSI data evaluation approach developed by the April 1994 workshop participants. The actual approach that EPA used in the NSI data evaluation is presented in Chapter 2. A list of workshop participants is provided at the end of this appendix.

Using the approach recommended by workshop participants, sediment sampling stations could be placed into one of the following five categories based on an evaluation of data compiled for the NSI:

- High probability of adverse effects to aquatic life or human health
- Medium-high probability of adverse effects to aquatic life or human health
- Medium-low probability of adverse effects to aquatic life
- Low probability of adverse effects to aquatic life or human health
- Unknown probability of adverse effects to aquatic life or human health.

Using the workshop approach, contaminated sediment sampling stations could be placed into one of the five categories based on an evaluation of the following types and combinations of data:

- Sediment chemistry data alone
- Toxicity data alone
- Tissue residue data alone
- Sediment chemistry and tissue residue data
- Sediment chemistry and histopath-ological data
- Sediment chemistry, sediment toxicity, and tissue residue data.

The overall approach developed by workshop participants is summarized in Table I-1 and is described below.

High Probability of Adverse Effects to Aquatic Life or Human Health

Based on the evaluation approach proposed by the April 1994 workshop participants, a sampling station could be classified as having a high probability of adverse effects to aquatic organisms or human health based on sediment chemistry data alone, toxicity data alone, tissue residue data alone, or a combination of sediment chemistry and tissue residue or histopathological data.

Table I-1. Original Approach Recommended by NSI Workshop (April 1994)

Category of Sampling Station Classifications	Data Used to Determine Classifications				
	Sediment Chemistry (sampling station is identified by any one of the following characteristics)		**Tissue Residue/ Histopathology**		**Toxicity**
High Probability of Adverse Effects to Aquatic Life or Human Health	Sediment chemistry values exceed sediment draft quality criteria for any one of the five chemicals for which criteria have been developed by EPA (based on measured TOC)	**OR**	Human health thresholds for dioxin or PCBs are exceeded in resident species (not a consensus agreement—participants evenly divided on this issue)	**OR**	Toxicity demonstrated by two or more acute toxicity tests (one of which must be a solid-phase nonmicrobial test)
	OR Sediment chemistry values exceed all relevant AETs (high), ERMs, PELs, and SQALs for any one chemical (can use default TOC)				
	OR Sediment chemistry values >50 ppm for PCBs				
	OR Sediment chemistry TBP exceeds FDA action levels, EPA risk levels, or wildlife criteria	**AND**	Tissue levels in resident species exceed FDA action levels or EPA risk levels, or wildlife criteria	____	_____
	OR Elevated sediment chemistry concentrations of PAHs	**AND**	Presence of fish tumors	__	_____
Medium-High Probability of Adverse Effects to Aquatic Life or Human Health	Sediment chemistry values exceed at least two of the sediment upper screening values (i.e., ERM, SQAL, PEL, high AET) (can use default TOC)	**OR**	Tissue levels in resident species exceed FDA action levels or wildlife criteria	**OR**	Toxicity demonstrated by a single-species toxicity test (solid-phase, nonmicrobial)
	OR Sediment chemistry TBP exceeds FDA action levels or wildlife criteria				
Medium-Low Probability of Adverse Effects to Aquatic Life	Sediment chemistry values exceed one of the lower screening values (ERL, SQAL, TEL, lower AET) (can use default TOC and AVS)	**OR**	_____	____	Toxicity demonstrated by a single species toxicity test (elutriate-phase, nonmicrobial)
Low Probability of Adverse Effects to Aquatic Life or Human Health	No exceedance of lower screening values **AND** No sediment chemistry TBP exceedances of FDA action levels or wildlife criteria	**AND**	Tissue levels in resident species are lower than FDA action levels or wildlife criteria	**AND**	No toxicity demonstrated in tests using at least two species and at least one solid-phase test using amphipods
Unknown	Not enough data to place a site in any of the other categories.				

For a sampling station to be classified as one with a high probability of adverse effects based on sediment chemistry data alone, at least one of three criteria must be met: (1) sediment chemistry values exceed the sediment quality criteria (SQCs) developed by EPA for acenaphthene, dieldrin, endrin, fluoranthene, or phenanthrene; (2) sediment chemistry values exceed all appropriate screening values for a given chemical (i.e., high apparent effects thresholds (AETs), effects range-medians (ERMs), probable effects levels (PELs), and sediment quality advisory levels (SQALs)); and/or (3) sediment chemistry values exceed 50 ppm for polychlorinated biphenols (PCBs). When comparing sediment chemistry values to the SQCs, measured total organic carbon (TOC) must be used. Workshop participants suggested using default TOC values in the comparison of sediment chemistry values to SQALs if actual measured TOC values are not available. However, if default TOC values are used in a comparison of sediment chemistry measurements to SQCs, the highest that a sampling station could be classified would be medium-high potential for adverse effects.

For a sampling station to be classified as having a high probability of adverse effects based on a combination of sediment chemistry and tissue residue data, sediment chemistry theoretical bioaccumulation potential (TBP) and tissue levels in resident, nonmigratory species must exceed FDA tolerance/action/guidance levels, EPA risk levels, or EPA wildlife criteria. Workshop participants also recommended that a sampling station be classified as having a high probability of adverse effects if fish tumors are present in resident species and elevated sediment chemistry concentrations for polynuclear aromatic hydrocarbons (PAHs) are present.

The workshop participants were evenly divided on whether a sampling station could be classified as having a high probability of adverse effects based solely on the exceedance of human health screening values for dioxins or PCBs in resident fish species. Participants did agree that benthic community data in combination with sediment chemistry data could be used in the future, but not for the current evaluation, to classify sediment sampling station. Methods are currently not adequate to establish a direct causal relationship between benthic community changes and sediment contamination at specific sampling stations without additional data.

For a sampling station to be classified as having a high probability of adverse effects based on toxicity data alone, toxicity must be demonstrated by two or more acute toxicity tests, at least one of which must be a solid-phase, nonmicrobial test.

Medium-High Probability of Adverse Effects to Aquatic Life or Human Health

Workshop participants suggested that a sampling station could be classified as having a medium-high probability of adverse effects on aquatic life or human health based on sediment chemistry data alone, toxicity data alone, or tissue residue data alone.

For a sampling station to be classified as having a medium-high probability of adverse effects based on sediment chemistry data alone, the station must meet at least one of two criteria: (1) sediment chemistry values exceed at least two of the sediment chemistry upper screening values (i.e., appropriate ERMs, SQALs, PELs, or AET-highs) or (2) sediment chemistry TBP values exceed FDA tolerance/action/guidance levels or EPA wildlife criteria. In the comparison of sediment chemistry values to SQALs, default TOC values can be used.

A sampling station could also be classified as having a medium-high probability of adverse effects if toxicity is demonstrated by a single-species, nonmicrobial toxicity test using the solid phase as the testing medium or if actual fish tissue residue levels exceed FDA tolerance/action/guidance levels or EPA wildlife criteria.

Medium-Low Probability of Adverse Effects to Aquatic Life

Workshop participants suggested that a sampling station could be classified as having a medium-low probability of adverse effects to aquatic life based on either sediment chemistry data alone or toxicity data alone. A sampling station could be classified as having a medium-low probability of adverse effects if sediment chemistry values exceed at least one of the lower sediment chemistry screening values (i.e., ERL, TEL, SQAL, or AET-low). Workshop participants suggested that default TOC and AVS values could be used. To classify a sampling station as having a medium-low probability of adverse effects, toxicity would be demonstrated by a single-species, nonmicrobial toxicity

test using the elutriate phase as the test medium. Workshop participants did not propose any human-health-related criteria for placing a sampling station in the medium-low probability of adverse effects category.

Low Probability of Adverse Effects to Aquatic Life and Human Health

Using the workshop approach, for a sampling station to be classified as having a low probability of adverse effects on aquatic life and human health, all of the following criteria must be met: (1) there are no exceedances of the lower sediment chemistry screening values (i.e., ERL, TEL, SQAL, or AET-low); (2) there is no toxicity demonstrated in tests using at least two species and at least one solid-phase test using amphipods; (3) there are no TBP exceedances of FDA tolerance/action/guidance levels and EPA wildlife criteria; and (4) tissue levels of resident species are below FDA levels and EPA wildlife criteria.

Unknown Probability of Adverse Effects

Sampling station of unknown probability for causing adverse effects are those stations for which there are not enough data to place them in any of the other categories. Sediments at the sampling stations might or might not cause adverse impacts to aquatic life or human health.

Modifications to Workshop Approach

The approach for evaluating NSI data recommended by the April 1994 workshop participants provides the framework for the final evaluation approach actually used to evaluate the NSI data. Workshop participants had less than 4 hours to reach consensus on their recommendations for the approach following a day and a half of debate covering many challenging issues. As a result, some of the specific issues concerning how data were to be evaluated to place sampling stations into the five categories remained unresolved. For example, "elevated sediment chemistry concentrations of PAHs" together with the presence of fish tumors is one criterion for placing a sampling station in the high probability of adverse effects category. However, how "elevated" do sediment chemistry concentrations of PAHs have to be to meet this criterion? As another example, sediment chemistry values that exceed all relevant AETs, ERMs, PELs, and SQAL values for any one chemical are sufficient to place a sampling station in the high probability category, and exceedance of any two of these values is sufficient to place a sampling station in the medium-high probability category. But what if there are only two relevant screening values for comparison for a given contaminant? Does a sampling station at which both values are exceeded for a given chemical belong in the high or medium-high probability category?

A significant modification in the final approach used to evaluate the NSI data was the reduction in the number of categories from five to three, eventually combining the medium-high and medium-low categories and the low and unknown categories proposed in the workshop approach. In addition, the following evaluation parameters were dropped from the final approach:

- Sediment chemistry values > 50 ppm for PCBs

  – Expert reviewers of the methodology believed that this parameter was not necessary; i.e., a sampling station that was targeted as a higher probability for adverse effects by this parameter would already have been targeted at a much lower concentration using other parameters.

- Elevated sediment chemistry concentrations of PAHs and presence of fish tumors

  – Available fish liver histopathology data in the NSI are very limited; therefore, this evaluation parameter was not considered further.

In the final approach adopted for the evaluation of the NSI data, the EPA wildlife criteria were not included in the TBP and fish tissue residue parameters. Reviewers of the methodology felt that the wildlife criteria values were overly conservative for this screening assessment and thus could not be used to distinguish potentially highly contaminated sampling stations from only slightly contaminated station. A separate analysis of wildlife criteria was, however, conducted.

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