MTS Task Force Presentation

Application of Risk Assessment

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In this symposium we have focused on risk and human safety. I've been asked to briefly describe how the U.S. Army Corps of Engineers addresses concerns about the environmental risks of dredging and disposal of dredged material. The Corps has had the responsibility for maintaining navigation channels in this country for about 200 years. Currently, maintaining navigation channels nationwide requires the Corps, or those whom we permit, to dredge about 400 million yd^3 (305.8 million m^3) of sediment every year. That's enough dredged material to bury Washington, D.C., under 6 ft (1.8 m) of sediment, what some consider a potential beneficial use.

The challenge faced by the Corps and the U.S. Environmental Protection Agency, with whom we jointly manage the dredging program, is how to manage 400 million yd^3 of sediment in an environmentally responsible manner. Because of the physical and chemical properties of sediment, pollutants introduced into aquatic systems will accumulate in sediment. We are required by federal statute and regulation to assess the potential risk the dredged material may pose to human health or the environment when we make decisions about where to place that material.

Environmental risk is defined as the probability of undesirable effects resulting from exposure to known or expected stressors. In our case, the expected stressor is the chemical mixture in harbor sediments.

There are a number of benefits to using environmental risk assessment in decision making. Risk assessment provides a framework for synthesis and integration of large data sets; the data sets used as the basis for dredged material management decisions have become very large. We're looking at risk assessment as a way to effectively manage the environmental data we collect to support decision making.

In its environmental application, risk assessment acknowledges the ever-present existence of uncertainty in decision making and promotes the application of methods for describing the impact of uncertainty on decision making. The decision-making processes should be transparent—that is, the assumptions made during analysis of potential risks should be readily visible to those who evaluate the decisions. Risk assessment also provides measures for doing comparative analysis, which is particularly important considering that in many cases managers are asked to decide among a range of disposal options for the dredged material. The risk associated with each of those alternatives will not be equal. So being able compare the alternatives is a very powerful tool.

The two federal statutes that govern dredging and placement of dredged material, the Marine Protection Research and Sanctuaries Act and the Clean Water Act, contain language that suggests the need for using risk-based approaches. Words such as "unacceptable," "possibility," and "potential" suggest that using risk-based techniques is consistent with federal regulations governing the disposal of dredged sediment.

The approach we currently use to evaluate dredged material is consistent with risk assessment, but we are looking for ways to improve this testing framework. We use a tiered approach for reaching our decisions (see Figure 1). We progress through the tiers only as far as necessary to gain sufficient information to reach a decision about how the material should be managed. By moving

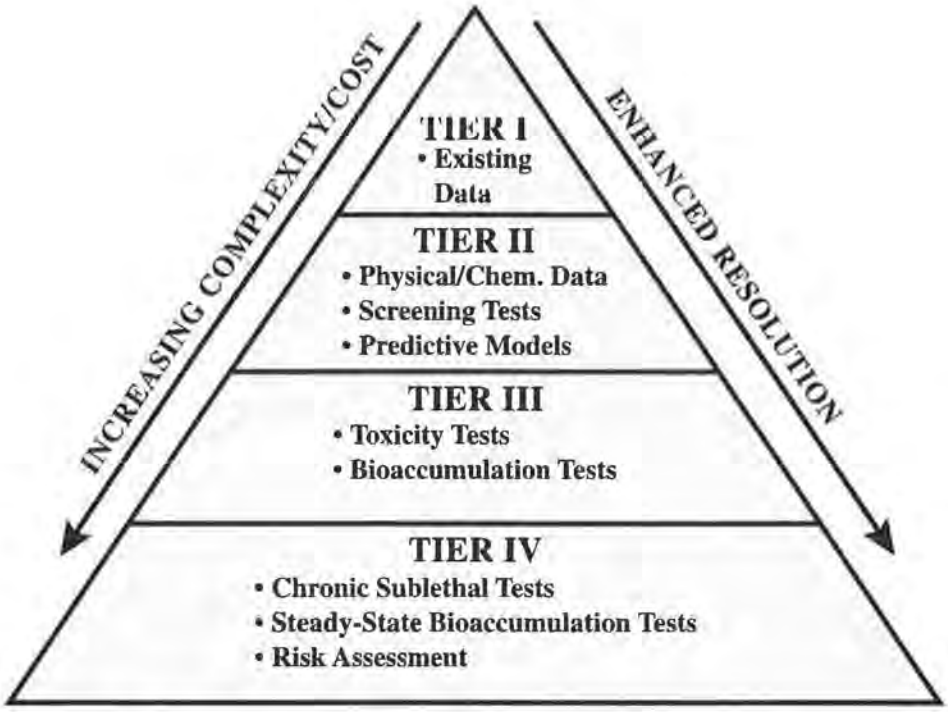

FIGURE 1 The tiered approach for reaching decisions.

to the next tier you are trying to resolve specific deficiencies in your data set. But as you move through the tiers your data set becomes more complex and you also have incurred greater costs associated with collecting the additional information. So there is a balance that should be sought. Don't move to the next tier unless you need to in order to reach a decision.

Our current approach contains the essential elements for conducting risk assessment. We assess exposure—that is, the likelihood that some organism, whether it is a human or a fish, is likely to come in contact with the contaminants in the material. We also evaluate the effects that may occur once an organism is exposed to those materials, whether that effect is cancer in humans or an effect on an ecological receptor.

Environmental risk assessment includes three major phases: problem formulation, analysis of effects of exposure, and characterization of risk. The problem formulation stage generally involves developing a conceptual model that describes the parameters and the pathways associated with a particular scenario. An analysis phase follows, which basically consists of collecting numbers and crunching those numbers to describe potential routes of exposure and the nature of any adverse effects. Finally, there is a characterization phase, which allows us to bring this information together for the purpose of decision making.

The Corps of Engineers currently has a research program called the Dredging Operations Environmental Research (DOER) Program. It's an 8-year, $32 million research program that has a risk focus area as one of its components.

The purpose and scope of this focus area is to provide guidance on doing risk assessment and managing environmental risks in the dredging program. The risk guidance we develop in this program will supplement, not replace, the existing guidance we have. What is referred to as a full-scale environmental risk assessment in most cases would remain a tier 4 exercise. The most effective application of risk assessment will be for those projects in which conditions or parameters are somewhat atypical.

Risk assessment can also be effectively used as a research tool for resolving the complex issues involved in assessing and predicting the environmental impacts of dredging. We are currently using risk assessment as a way to prioritize how to use our research funds in helping to resolve and clarify the dominant uncertainties.

Up to this time our evaluations have focused on small temporal and spatial scales (Figure 2). Societal and regulatory concern is focused in the upper right-hand portion of Figure 2, where the temporal scales are longer and the spatial scales are larger. Projecting effects from short-term, local scales up to long-term, regional scales is a complex process that will require using models and other risk-based techniques.

We tend to focus much of our technical attention at very small scales. For example, we focus a lot of our attention on the bioavailability of the contaminant or the

amount of contaminant absorbed to sediment particles that is actually "available" to cause effects in an organism. However, most of our concerns about impacts are at much larger scales.

The processes that operate at large scales, which is where the regulations focus our concern, are quite a bit different than the processes that lend themselves to convenient study in a laboratory setting, which is our primary source of data. Risk-based approaches are required to make these jumps in scale.

We produced a summary of a workshop we conducted last year on risk assessment and dredge material management that was attended by a broad cross section of people from academia and the federal and private sectors. Improving dredge material management decisions with uncertainty analysis describes the major sources of uncertainty in our current evaluation framework. This document will be used to focus our research efforts to reduce the uncertainty associated with our management decisions. This year we are working on two guidance documents for conducting human and ecological risk assessments in aquatic and upland environments.

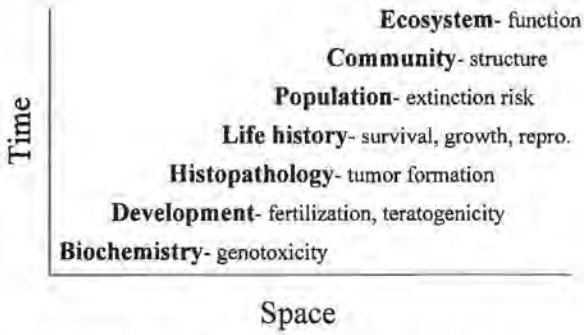

FIGURE 2 Scales of relevance for extrapolating effects.

In conclusion, we expect to derive a lot of benefit from the application of risk assessment and expect that risk concepts will form the basis for future regulatory revisions within our program.