Day Three: September 13, 1996

Session Seven: Questions and Answers

After each session, there was an opportunity for questions and answers and group discussions pertaining to the speakers' presentations.

Q (Susan Svirsky, U.S. EPA Region 1): I would just like to make a couple of clarifying points, and perhaps the last one is a question for Larry Zaragoza to see if you have experienced what we have. First, in some parts of the country, we are doing ecorisk assessments with more frequency than human health risk assessments at this point because of the tailing off of issues related to human health. Now we are dealing with the tougher issues, and that leads into my second point concerning your slide. The number of sediment cleanups (14) is extremely misleading in that we have practiced avoidance behavior and put off the sediment cleanups to subsequent operable units for the sites. We are just now getting into the really tough problems, and we are going to be having a huge number of sediment-driven operable units to work with. I was wondering if that is your understanding as well?

Larry Zaragoza:

Our analysis included over 200 sites from all over the country. I would need to go back and see how many of those sites had final records of decision (RODs) at the time this analysis was done. I agree with you that basically we have found sediments to be very difficult to deal with. I have reviewed a lot of RODs and there are a number of them that have not yet dealt with the sediment issues because they were waiting for technological or other reasons. I am also encouraged by the comments you made that we are having more ecorisk assessments done. I think that is something probably everyone in this room is glad to hear.

Betsy Southerland:

Senator Levin is planning some amendments to the Superfund bill directed at encouraging more contaminated sediment cleanups. We do not know what the bill is going to look like, because they have not released the language yet. I know that was one of his prime concerns since he is from the Great Lakes area.

Q (Nelson Thomas, U.S. EPA, Office of Research and Development): Jim, 5 to 8 years ago your office was a leader in trying to deal with the whole subject of bioaccumulation. Now you say it is going to be 5 or 10 years before you can factor this information into the permitting process. Why do we need this 10- to 15-year delay to account for bioaccumulation in NPDES permits?

Jim Pendergast:

About six winters ago, I visited Nelson in Duluth to work with him to develop guidance on how to bring bioaccumulation into NPDES decisions. We can do things today if we are talking about bioaccumulation in the aqueous phase. When I was talking about 5 to 10 years in the future, I was referring to sediment bioaccumulation. What we have learned since that day in Duluth is that the fate and transport of sediments is a lot more difficult to grapple with than we originally thought. Back then we thought that it would work to add sediment into the model using a steady-state approach. When we did field studies in Lake Charles (LA) and the Blackstone River (MA and RI), the steady-state approach worked fine in the water column, but it did not work well in the sediment. Since then, we have learned from the modelers that the steady-state models do not deal well with sediments. Models for sediments must account for flooding events and other dynamic processes. That is the technology we need to develop. I think it is going to take 5 to 10 years to work that out in a way that is simple enough to put into a mass production process like NPDES permitting.

Q (Nelson Thomas): So, you do not see anything in the interim that will be able to handle bioaccumulation in the NPDES permits?

Jim Pendergast:

Not for the sediments.

Q (Phillip Rury, Arthur D. Little, Inc.): Tom, has EPA considered shifting this 90-day risk assessment burden to industry, which would put EPA in more of a review capacity? This might be a little more manageable.

Back

Tom Murray:

Yes, we are actually involved in that right now. One of the things we have been trying to do over the last few years, with some degree of success, is to make the various tools that we use available to industry. We recently did a pilot project with Kodak where we provided them with about six different modeling packages. They applied them within their own business to make decisions about what the environmental impacts might be for the chemicals they use in their photographic processes. They felt that the pilot was a great success since the models allowed them to make their own decisions. They do not have to come into our complex program and wait for a decision. We are going through a process this year and next year to build on that experience and distribute information to other chemical manufacturers. We will probably work with the Chemical Manufacturers Association and other trade associations to see about getting more people involved with this. We are also going through a data integration process within OPPT to bring together the arsenal of tools that we use and create a context to educate a broader audience on how we use them. We are planning to make this information available on the Internet so people can access it, learn how to use it, and begin applying the models themselves.

Maurice Zeeman:

The 90-day time frame is statutory. It is not something that we chose. Nevertheless, we have been very creative in doing things to meet that deadline. For example, because our group relies so heavily on structure-activity relationships (SARs), we have developed a PC program called ECOSAR that is available from the National Center for Environmental Publication and Information (NCEPI) in Cincinnati (OH). If you know the chemical class of a compound, it will predict the toxicity of that compound and produce a hazard profile. The program is a tool for making predictions, not a data base. We have made this program available to industry and they use it to determine whether or not they should submit a chemical. If they find out that a substance is going to be really toxic on a chronic basis, then they might decide not to submit it. We have already started to see safer chemicals being submitted to us from that application.

Q (Mick DeGraeve, Great Lakes Environmental Center): Craig, how do you determine what types of bioaccumulative chemicals might potentially be present in dredged material? What process do you use?

Craig Vogt:

We go out and take a sample of dredged material, run a bulk chemistry analysis on it, determine what kind of chemical contaminants are there, and then take the next step of looking at the bioaccumulation.

Q (G. Fred Lee, G. Fred Lee & Associates): The Mud Dump Site has been studied a number of times. The last I heard, they have not found a problem after dumping from 5 to 10 million cubic yards a year for how many years?

Mario Del Vicario:

The Mud Dump Site has been an area for historical use since the 1930s. We have measured background levels for sediment chemistry and tissue analysis, both in the site and in areas outside the site that are not influenced by disposal in the site. What we have found is certain levels of contamination out there. Do we find terrible things going on? As far as bioaccumulation measurements go, a lot of the sediment and the tissue data are not at levels that you would say are startling, considering that a lot of material went out years ago without our having the knowledge that contaminants were even in the material. Dioxin is the classic example. Millions of cubic yards of dioxin-contaminated material went out to that disposal site in the past. We do not see tremendous accumulations out there in worm, lobster, or fish tissue. We do see accumulations, but not what you would expect based on what you would see if you went to our Superfund site. What we have seen when we go out to areas surrounding the Mud Dump Site are places where toxicity test results, particularly for amphipods, indicate that Category III material is sitting on the bottom. We plan to do remediation using Category I material to improve the areas where we see high levels of toxicity or accumulation. The Category I material will consist of clean dredged material from the harbor, and maybe some sand, depending on benthic community structure. I believe that much of the problem here is a perceived problem. Newspapers in the Northeast have described the terrible dilemma with sediment contaminants in the New York area. I think a lot of the news coverage was exaggerated, but unfortunately, we now have to prove that each regulatory decision made by EPA and the Corps of Engineers results in safe disposal of dredged material. That is why we need the science.

Q (G. Fred Lee): The science should be based on what you find at the site and not extrapolated from some other place.

Mario Del Vicario:

Well, we do look at the site conditions to make decisions, but part of what we have done in the last 10 years is use capping as a tool to minimize bioaccumulation at the site. I feel it has been a very effective tool.

Q (Betsy Southerland): I am going to have the panelists tell us their biggest problem with using bioaccumulation data today in their regulatory programs and what high priority needs they have to improve their use of bioaccumulation data. Then I am going to open it up to the audience to address what the future needs are. It is important to document this discussion because ORD is currently preparing its next big grant proposal for contaminated sediments. Any high priority needs that you identify at this conference will be included in the request

for application (RFA) for the grant. They will also be incorporated into the ORD Research Strategy to direct the use of their own in-house resources. If the panel does not mention a high priority need that you have perceived after listening to the discussion in the past two days, please speak up and let us add this issue to the priorities. I will ask Mario Del Vicario to begin.

Mario Del Vicario:

A critical need for the Dredged Material Program is to ensure that the information we have available to help us make decisions is truly supportable and defensible. We have been able to apply work completed on food chain multipliers and trophic models to generate information for decision-making in our program. We need to continue to use information like that and work to make the information better. We also need to continue to improve how we are looking at chronic values, aquatic effects data, dose-response relationships, and concentration effects data. A concern I have is being able to make good regulatory decisions without someone having to pay for elaborate and expensive tests when we can perhaps develop simpler ways to get a better, quicker answer. To the extent possible, we should attempt to provide easier ways for people to get decisions.

Tom Murray:

I think, programmatically speaking, we have very few barriers. If I had to describe some of the problems that we might have with the use of bioaccumulation information, one would be obtaining information that has good QA/QC. We are dealing directly with industry and with their economy in terms of producing and manufacturing chemicals. We want to try to provide as reasonable an assessment as we can. When you move into problematic areas such as bioaccumulation and sediment toxicity, it becomes more questionable. We are looking both for the availability of data and for good quality information. I know there is probably a lot of information in the EPA Regions and states that we do not have access to. It would be nice to figure out how to get those data. Another problem we have is that, unlike programs in the Regions, states, and the Office of Water to some extent, we do not do site-specific analyses. In some instances, we go into a particular area and do an analysis. If bioaccumulation data are available there, we might be able to use them. Much of the work we do on a chemical is really more of a generic population-type estimate, where we are looking at manufacturing/processing user sites all across the country. The sediment situations may differ at these sites and we are trying to come up with a generic answer. That would cause a problem for us with the bioaccumulation data.

Q (Betsy Southerland): Tom, when you say you need more data, do you want tissue residue effects levels in aquatic life, wildlife, and humans, or bioaccumulation factors and fate and transport information?

Tom Murray:

All of the above. We basically are scavengers looking for a way to get good information in our hands. Any and all of that data would be helpful.

Jim Pendergast:

Like Tom Murray's program, the NPDES Program does not have any legal regulatory barriers, but there are three data gaps that I see. First, we need to find a better way of being able to identify existing and future potential bioaccumulative problems. When Craig Vogt was asked how they determine the pollutants for the dredged material program, he responded that they use chemistry. That approach would not be practical for the NPDES Program where we must work with hundreds of thousands of chemicals. Instead, we are working with the Office of Research and Development to develop a screening methodology. We currently have a draft guidance that needs some refinements, but it is about 95 percent complete. We need to finish the guidance and get it distributed. Second, we need to have a better handle on the fate and transport of sediments. For programs involving remediation or dredging, you can identify where the pollutants are and determine appropriate ways to remove and dispose of the contaminated material. For TSCA programs, you work with a facility to keep pollutants from being released into the environment. But in the NPDES Program, we are working with mixtures and multiple sources in attempting to regulate close to 300,000 sources. We must be able to use fate and transport to link the sources with the problems, and we need a tool to do that. If possible, we need to develop something more simplistic than the WASP model that is a little bit easier to run and a little less data intensive. We began to develop this tool 3 or 4 years ago, but we need more time to complete the effort. The last problem is trying to look at things holistically. It is much easier to get data on point sources. Getting data on nonpoint sources can be more difficult. You have to put all that information together to try to get the picture of what we need to do. We really have to start using geographic information systems (GIS) more widely to determine what goes into the watershed and what sources are contributing to the predominant problems. A lot of work has already been done in this area, but much more still needs to be done. It will take some time not only to fit together the existing pieces of the puzzle, but also to fill in the missing puzzle pieces.

Larry Zaragoza:

I see a couple different needs for the Superfund Program. One is the kind of work Mike Kravitz is undertaking to understand the meaning of different testing. This will be very useful. It is difficult when you have several tests available, but you are not really sure how to interpret the results and determine what is significant. Traditionally, we have tended to look to other offices for guidance on that issue. Another issue for our program is determining

how the significant risks in the water column or sediments compare with risks in other media. We would like to be consistent in the way that we are addressing risks for a particular site. If we find that we are much more sensitive in one medium than another, we need to balance how we are addressing all the factors we consider. Better science could help us balance those factors, even with the added complication of having to incorporate cost/benefit analyses into our evaluations. Finally, there is the issue of what to do with contaminated sediment once it has been identified at a site. If it is dredged, the material may be difficult to dispose of. This is an issue because there are a lot of sites in our program with contaminated sediments.

Q (Betsy Southerland): Are you talking about developing new remedial technologies or improving existing technologies for remedial alternatives like capping or disposal in confined disposal facilities (CDFs)?

Larry Zaragoza:

I am talking about all those things. There are problems with existing technologies to deal with contaminated materials. Not only are there limitations in terms of places that can hold the sediments, but there are also debates about what would be an appropriate disposal site. And the question has been raised about whether CDFs are an appropriate place for disposal of certain types of sediments. We have been involved in intensive discussions on all of these issues. It is really important to have an open dialogue on this subject now, because Superfund legislation is being considered for reauthorization and it is likely that the reauthorization package will include amendments to address a number of different issues. One set of amendments will target facilitating the process for addressing contaminated sediments. It will probably include a research component that can help us resolve outstanding issues. But the cost/benefit question will come up again if we focus more on sediments or the water column than on soil.

Maurice Zeeman:

I will begin and end with the same question, "What sediment and bioaccumulation data?" I say that because a lot of monitoring is being done today for the same chemicals we have been looking at for over thirty years. These typically include organochlorine insecticides, PAHs, PCBs, dioxins, furans, and heavy metals. The Toxics Release Inventory, which was established as a result of Superfund, required industry to report on their emissions for only 300 chemicals. The reporting requirement focused on chemicals that were highly toxic, but not necessarily persistent and bioaccumulative. In the late 1980's, industry reported several billion pounds of emissions for just 300 of the 75,000 existing chemicals. These reports indicate that a lot of chemicals are being released into the air or water. Not all of them will necessarily be a problem, but a fair portion could end up in the sediment. We need to move beyond looking at the usual suspects. My group is responsible for conducting ecotoxicity assessments, but we rarely have bioaccumulation data to use in these assessments. We have a tiered testing approach in our program for both new and existing chemicals. We require testing for acute toxicity and if we think a chemical is likely to bioaccumulate, we move to chronic toxicity testing. There are cases, especially for high log P chemicals, where acute toxicity testing may not always be appropriate. In these cases, we need to consider moving right to chronic toxicity testing. So, I go back to my original question, "What sediment and bioaccumulation data?"

Craig Vogt:

There are a lot of needs for the Dredged Material Management Program. Mario Del Vicario summarized some of those needs very well, but I am going to expand on them in terms of tissue residue effects levels, chronic tests, and fate and transport models. We basically need more information to be able to get better answers for several important program questions. For example, we have a site designated in the ocean for disposal of dredged material. When dredged material is dumped there, where does it go? Does it stay on the site or does it move to another location? Better fate and transport models would help us answer these questions. The Dredged Material Management Progam is moving into a more formalized process for risk assessment that will involve looking at exposure, characterizing risk and managing based on the risk assessment results. We have the Green Book and the Inland Testing Manual, but we need help on exposure and exposure analyses. We also need to determine what tissue residue effects levels mean on an ecological scale. Without that type of information, decision-making gets difficult. As we continue to develop the science, we can rely more fully on science as the basis for decision-making, rather than politics and misinformation that has influenced public perception. The public currently considers the oceans to be a sacred place where nothing should be dumped. But disposal of dredged material at ocean sites is a very minor source of contaminants that enter the ocean compared to other sources such as surface water runoff and some point source discharges. It is a matter of balance and how you achieve that balance. I would like to see better risk assessments conducted for the various media. We can use this additional information to involve stakeholders and together make more scientifically sound decisions for managing dredged material.

Betsy Southerland:

I would like to open the panel discussion up to the audience. Please state your name and affiliation before you begin to address the panel.

Q (Susan Svirsky, U.S. EPA Region 1, Superfund Program): Maurice Zeeman, do you have analytical

methods available for some of these chemicals that are outside the normal sweep of what we look for? If so, can you make them available to us so we can further our analytical capability and look for some of them?

Maurice Zeeman:

I am a biologist, so I am not a good source of information about analytical chemistry. Let me refer you to Bob Boethling of my office for that information. But I do know, for example, that chlorinated paraffins are compounds like PCBs that are a messy mixture of chemicals. The analytical chemistry for these mixtures can be very complex. I am convinced that these chemicals are extremely hazardous to organisms in the environment, but manufacturers are producing hundreds of millions of pounds of them each year worldwide. Some limited monitoring data from a few places around the world indicate that they are causing problems. However, there are a fair number of more simple compounds where the analytical methodology should not be so complex to develop and apply.

Betsy Southerland:

Susan, there are two studies I am aware of that might provide some useful information for you. One was a study that Bob Huggett conducted with the Virginia Water Control Board when he was still at the Virginia Institute of Marine Science. It was a big study where they collected sediments downstream of some urban industrial areas and analyzed the chemicals in the sediments using some kind of library scan. They were able to identify over 300 compounds that were persisting in the sediments. You can locate literature on the study to see what method they used. There is also the screening procedure for wastewater being developed by our Duluth laboratory that Jim Pendergast mentioned earlier. For this procedure, wastewater is fractionated based on octanol-water partition coefficients and the fractions are run across a library scan to identify any potential bioaccumulatives that could be in a waste stream. They are doing some additional testing before they release the protocol.

Steve Cibik, ENSR:

We have come a long way in taking the "pseudo" out of pseudo science and replacing it with good science, especially with recent developments for BCFs, bioaccumulation, trophic modeling, and food chain modeling. We made a big advance when EPA issued the Wildlife Exposure Handbook to help standardize risk assessments. What we need now is better information on tissue residue values, because I heard that we are approaching a factor of 2 or 3 in accuracy for many of these things, but adding one safety factor to a risk assessment will give you a factor of 5 or 10. Decisions in risk assessment have to be based on good tissue residue values. We already have a lot of aquatic toxicity numbers available. I hope EPA will be able to help develop more information for wildlife. We need tissue residue values for both terrestrial and avian wildlife.

Q (Catherine Fox, U.S. EPA, Office of Enforcement and Compliance Assurance): The 1992 mandate of the Water Resources Development Act (WRDA) called for the development of the National Sediment Inventory, a national data base which is now available. Many of you have evaluated it to identify hot spots based on a number of factors, including fish tissue data. What we can do right now is to look at these hot spots based on fish tissue data, and for the various programs, to address the current sources of contaminants to prevent the discharge of these contaminants from point sources, nonpoint sources, and sediments. I have looked at this using a GIS and found some really interesting things that are happening right now with discharges. I would like to go upstream and look at the sediments. I am asking the panel to consider this as a need that we could address now. We have the people and we have a lot of the tools. Jim Pendergast looked at this 5 years ago. He probably knows a lot that could help us now. This is an area of interest for enforcement and I am requesting assistance from other offices.

Tom Murray:

As Maurice has mentioned, there are many chemicals on the inventory that OPPT has not had a chance to look at. OPPT is setting up a priority system to look at these chemicals. A couple of things are happening in OPPT right now to advance that process. One is that we are moving away from a single chemical approach to life and trying to look at chemicals as use clusters or clusters of chemicals that might be found in a product. We have developed some systems within our organization to help us set those priorities. For example, we are looking at indoor air sources as one system. We are ranking various chemicals in this system to figure out which indoor air chemical products or chemical products that might lead to indoor air problems are the most important to look at. We have also developed the use cluster scoring system to look at a variety of information and help identify what areas or what chemicals we should focus on. Catherine, maybe we can help generate more information about the sediment contaminants you are concerned about. We could perhaps consider a cluster of chemicals that may find its way into sediments or tissue and factor that additional area into our priority-setting process.

Betsy Southerland:

Enforcement actions based on data in the National Sediment Inventory or fish advisory data base must be based on the fate and transport modeling which Jim Pendergast mentioned earlier. There is a lot of concern that it would be difficult to take the ambient data and trace it back to a source. None of the data that we have either in the sediment inventory or in our fish advisory data base will prove cause and effect. We need additional studies to be able to take the presence of a contamination problem and

work it back to a responsible source. If that responsible source is a point source in violation of permit limits on those toxicants, then it certainly would be appropriate to take an enforcement action. But again, the ambient information in our data bases will not allow you to link to sources. You will have to demonstrate cause and effect from additional studies.

Jim Pendergast:

I would like to add one other thing to that. Catherine, you may want to talk with Louise Wise in the Office of Wetlands, Oceans, and Watersheds. She helps chair a Division Director group on watersheds. All of the Office of Water divisions are working to try to figure out how to do things on a watershed basis, so we avoid the sector-by-sector approach and try to look at things holistically. A Minnesota example can illustrate one of the reasons why this is important when you are dealing with fish advisories and sediments. There are a number of lakes in Minnesota with fish advisories for mercury, but no identifiable point source for mercury. Mercury may be transported into the area in the air and deposited in the lakes when it rains. You should start to address these issues with the watershed group.

Q (John Haggard, General Electric Company): Robert Paulson brought up a new term that I think is particularly appropriate for sites where companies with liability and regulatory agencies are dealing with difficult sediment problems. That term is potentially reasonable parties or PRPs. We are one of the PRPs at a number of these sites and we clearly have concerns with the liability management. How do we manage these problems in a cost-effective way? These sites are presenting unique problems to regulatory agencies, because there are no simple solutions to sediment problems. Where are you going to put this vast volume of contaminated material? What is science telling us about what we can really achieve? What damage might we cause by removing the material? There is a lot of positive research going on to help reduce the uncertainty. This is very important to industry since we would like to see some actual benefits from the money expended. I would like to make a recommendation related to a chart Larry Zaragoza presented that showed the basis for decisions at sediment sites. I was surprised to see that 9 of the 14 sites involved risk-based decisions. We have looked at 80 or 90 contaminated sediment sites and found that only about a dozen have gone through a record of decision process and some remediation. When we look at sites, we can rarely figure out the basis for the decision. Documentation on these sites is a serious problem. In addition, when we look at how well the technology performed, we see clear problems with dredging. I would recommend strongly to this group that you look at the capabilities of the technology within a comparative risk framework at these contaminated sediment sites. It is an important issue that I hope somebody will take a shot at.

Betsy Southerland:

A group from our Office of Research and Development laboratory in Cincinnati, Ohio just informed me that they are organizing the National Conference on Management and Treatment of Contaminated Sediments to be held during May 1997 in Cincinnati. They are inviting speakers to present a series of case studies ranging from bench-scale remediation projects to full-scale remediation efforts. They are also inviting a large variety of vendors to display and demonstrate new equipment developed for remediation projects and equipment that has proven successful for previous projects. The conference will be a good opportunity to hear about experiences with sediment remediation. Since a number of the case studies will involve Superfund sites, we can request that the speakers include details in their presentations about how they reached the decision for remediation and how they determined the volume of sediment for removal.

Larry Zaragoza:

I think that one of the things we need to do is to begin operating in an environment where people can actually see the logic and consistency behind a particular program. We have been confronted by a whole host of challenges in the area of contaminated sediments. Susan Svirsky raised some of the issues in her earlier comments about people avoiding dealing with sediment problems to date because of these challenges. But for sediment sites that have been addressed, these efforts might be considered successful if all the parties involved in the site agree to clean it up and the community is pleased about the actions being taken at the site. That is very different from having a national profile that shows you benefits information and consistency in cleanup levels across the country. As a result of looking at how we have operated as a program and hearing comments like yours, we are seeking to collect that information in a more systematic and consistent manner. We have already collected some information, but we are trying to do a better job of obtaining more information. I think you can expect that in the future more comprehensive information about our sites will be readily available.

Maurice Zeeman:

We also have to realize that there has been a bias in many cases for "we have to do something" action. Certainly in the past, there have been cases where actions other than removal were appropriate. An example that comes to mind is the case in Triana, Alabama where people were being exposed to high levels of DDT. The highest levels were found on an Army base that produced a lot of DDT. The Army Corps of Engineers solution was to reroute part of the river and cover the most contaminated areas with topsoil. That may not have been the best solution, but it was the most cost-effective approach under the circumstances. I have been teaching a course in

environmental toxicology at the National Institutes of Health (NIH) since 1982. One of the things I have found really remarkable with that experience is how ignorant we can become over time. I have asked my classes recently about what happened with the Kepone spill in the James River, and virtually nobody is aware of the incident any more. Many people think the problem has gone away. It was going to cost many millions of dollars to dredge after the spill, so the lower river was closed to a number of activities and allowed to recover naturally with deposition of clean sediments. It is a solution that has worked over time. But, Bob Huggett has presented results of studies that show Kepone-contaminated sediments have been moving out into Chesapeake Bay. All we need is the right kind of hurricane to redistribute these sediments for the problem to occur all over again.

Q (Helder Costa, Inchcape Testing Services, Aquatec Laboratory): Several EPA-sponsored studies have shown close associations between alkylated PAHs in petroleum-influenced systems and adverse effects to benthic organisms and habitat. In the Delaware Estuary, for instance, the alkylated PAHs accounted for typically 50 to 70 percent, or even 80 percent, of the total PAH loading. I want to comment that we can only begin to understand the importance of PAHs as a chemical compound class when we begin to consider the alkylated PAHs in petroleum-influenced systems.

Betsy Southerland:

I know that Rick Swartz from our laboratory in Newport, Oregon will soon be publishing a total PAH analysis based on narcosis effects. He is trying to help us analyze PAHs as a whole chemical group instead of having to consider each PAH with its individual toxicity.

*Q (Helder Costa): I particularly applaud the work Rick Swartz has done in developing the sum PAH model and publishing the results in the SETAC journal (*Environmental Toxicology and Chemistry, *Vol. 14, No. 11, pp. 1977-1987, 1995). In his paper, he acknowledged the importance of alkylated PAHs in petroleum-influenced regimes as a temporary limitation to the model.*

Betsy Southerland:

An individual from the Metropolitan Washington Council of Governments has conducted some studies that show PAHs are coming not only from products of combustion, but also from ground water contaminated by leakage from automobiles and other sources. That is new information to me in terms of sources.

Q (John Zambrano, New York State Department of Environmental Conservation): If we agree that contaminated sediments are a problem that we want to do something about, we are going to have to know the relative amounts of various sources of contamination. We also need to know whether past contaminants that we may not be able to do much about are circulating within the system, or whether new contaminants are being introduced by current sources. Could these sources be point sources that we are not regulating sufficiently such as stormwater or combined sewer overflows? Could land runoff or atmospheric deposition be contributing to the problem? It seems to me that unless you know the amounts from various sources, you will not be able to make intelligent decisions within the Superfund Program, the NPDES Program, or the Dredged Material Program. I think we need to do more sampling and modeling to get that information.

Larry Zaragoza:

Your comment is very well taken. I agree that it is worthwhile to have that kind of information. For a Superfund site, we would specifically look for that kind of information to see what is going on at the site level. But that only speaks to a particular site. It does not tell you about what is going on in the rest of the country. Sediment assessment generally needs to be site-specific, but that complicates comparing a site to other sites across the country.

Betsy Southerland:

The best mass balance study done to date that I know of was the work conducted for PCBs on the Fox River in Wisconsin. I think they had a budget of about $15 million for monitoring. I know that EPA programs are trying to look at mass balances, particularly in the Office of Air and Radiation. The air program has worked with us in preparing their second report to Congress on deposition of air pollutants to the Great Waters. They are trying to do large-scale mass balances for substances like mercury and PCBs to determine how much mercury and PCB contamination can be attributed to air emissions.

Q (Don Porcella, Electric Power Research Institute): I have enjoyed this conference very much. There have been some new approaches developed and presented here, particularly the food chain modeling. Will these approaches be incorporated into future analyses? All the approaches we have heard about include the concept of models. For example, a bioassay is a physical model as opposed to a mathematical model. I think it is really important to do groundtruthing for these models, as well as to address the "So what?" question Gil Veith raised at the beginning of the conference. This question particularly relates to Fred Lee's comment about whether there has in fact been any damage in the New York Harbor area from dredged material disposal.

Mick DeGraeve:

I just want to reinforce the importance of what Betsy Southerland and Jim Pendergast mentioned about finalizing the screening procedure for bioconcentratable contaminants. Larry Burkhard, who is in the audience, is the principal author of the method. One thing that Betsy and Jim did not mention is that the method works not only for effluents in water, but also for tissues and sediments.

In terms of some of the dredging-related issues, it can be applied to address the likelihood of bioconcentratable contaminants being present in sediments and certainly in tissues. We have used the procedure commercially to address some very interesting questions and it has worked quite well.

Q (Betsy Southerland): Have you used it on sediments or just wastewater?

Mick DeGraeve:

We have used it on sediments. I am glad that efforts are going forward to finalize it.

Jim Pendergast:

My focus at EPA has been primarily on wastewater. But for one year in the 1980s, I worked with the Superfund Program. While I was there, it would have really helped to have had that methodology available to assess sediments at Superfund sites. The guidance also includes information about integrating fish tissue data in the decision-making process to determine whether or not there is a problem. We tried to make it a one-stop document to deal with multimedia.

Q (Lynn McCarty, L.S. McCarty Scientific Research & Consulting): My opinions are entirely my own since I do not represent an agency. There are two areas I would like to comment on. The first one is technical. If you continue to go down the toxicological route, you are eventually going to have to deal with molar units. Since toxicology is a function of the number of molecules of a compound, not its weight, you will find that many relationships that would be obscured by using weight-based measures will become much clearer when you use molar weight. The second issue is a philosophical one at the very end of the scale of what we are talking about today. I was pleased to hear Dr. Patton indicate in her discussion that both science and policy are included in the EPA risk assessment process. That is an explicit recognition of something that I think a number of people have realized for a long time, but it is an important distinction. We must keep the science and the policy separate or at least identify them as such. In this whole process of becoming open and transparent, making this distinction is particularly important. What we are trying to do in this whole exercise is risk management. We are trying to achieve some sort of environmental protection. As scientists, we need technical decision criteria to do that and to fit into the decision-making process. In other words, we need to be able to define what a significant adverse effect is. It is great to say that we have to protect the environment, but when it comes down to scientific measurements, what does that mean? We have some difficulties because we are trying to define future problems from an existing problem perspective and from a modeling perspective. The objective of risk assessment is providing information to make choices among alternatives. So, what is the framework? What are the effects that we are concerned about and what are the alternatives that we are choosing among? Developing information for risk assessments involves specific goals that change from the research emphasis being presented here to regulatory utility. If we do not have risk management directions that are framed in technical terms, we cannot make decisions. That is what this is all about. This is a policy issue, and the science is guiding the decisions. I found the list of questions Dr. Southerland provided for the speakers to be very useful because it addressed many of the important technical issues. Unfortunately, I do not think we have coalesced those into a useful decision-making framework. I would like to encourage the panel and EPA to consider that, because I think that many of the people at this meeting are looking for very specific directions. What is it that we want to do, and how can the science that we have available help us in making the decisions and choosing among those alternatives?

Alex Lechich:

As a scientist regulator, I sometimes feel that research scientists do not carry the same burden as we do, so I do not have any qualms about trying to lay a little more weight on their shoulders. In terms of the data bases that are being developed for the specific effects, I think it would be helpful to go beyond just assembling, compiling, and presenting this information. Have the people who are most familiar with the studies and the data itself become involved where there are conflicts. In some cases, we can look at the data and make fairly clear decisions. In other cases where the results conflict with each other, it would be nice to have the people closest to those studies review them and provide a recommendation as to where to go from there.

Phillip Rury, Arthur D. Little, Inc.:

I would like to thank and commend all of the people who contributed to this excellent conference. It is probably one of the better conferences I have been to in many years. I would also like to say that I feel it is long overdue and I hope that we can see a sequel to this very soon. In terms of some of the gaps that I see and the future research needs that some of the speakers have identified, those same gaps were reflected in the presentations here. I would hope that we could address them in future conferences. I would implore everyone to look in these directions. In a kind of evolutionary-speak sense, perhaps our research needs to crawl up onto the land again. The aquatic focus of this conference was obvious, but I am concerned that issues such as amphibian bioaccumulation are not being addressed. The questions concerning wetland species also need to be addressed more vigorously. For example, the data base presentations at this conference specifically excluded amphibians with the exception of tadpoles. We have found this lack of information on amphibians to be a major constraint in several risk assessments. Mink food chain exposure models, for example, are highly sensitive to the frog elements in the diet. We also have a dearth of bioaccumulation factors. Several that do exist are quite

high and they are driving the cleanup goals. I would also like to get on my soapbox about the lack of integration of ecological and human health risk assessment. I would hope that maybe in another 10 or 20 years, as the pace of regulatory change proceeds, that we might see a shift to an ecosystem-level approach to risk assessment that includes consideration of both human health and ecological risks. This approach should allow us to realize some efficiencies of costs and some enhancements of understanding by integrating humans into an ecosystem risk assessment as a mandatory indicator species in every case.

Burt Shephard, URS Greiner, Inc.:

There are two areas I would like to comment on. One is to respond to the remarks about the data bases. I think those of us who are putting the data bases together are very much aware of the conflicting data. You might not see it at the first level of building the data bases, but I think that shortly thereafter you will see some attempt by those of us putting the data bases together to resolve conflicts. Some of the data quality issues are very important to us. Some of the data are not very good, but some are excellent. Initially, we will be putting out summaries of the data with a lot of data qualifiers saying how things were done and let the end users make their own judgments about whether the data is good or bad for their own purposes. I certainly concur with the comments and think we will be making some efforts to resolve some of the conflicts within the data at some point down the road. Second, before we can really define a contaminated sediment, we need to know something about what an uncontaminated sediment is. There were some talks here about defining background reference area sediment concentrations. Within the risk assessment area, that is a very large need right now. The guidance today within the various EPA Regions for defining background or reference area concentrations is inconsistent. I think it is very important to have a defined statistical guidance that describes how to compile reference area data and compare site data to it to see if the site data are exceeding the reference or background data to a degree that indicates contamination problems. The RCRA guidance documents on statistical comparisons are the best ones that I have seen within EPA. They look at sample mean comparisons between sites and background areas. They also have, for lack of a better term, a hot spot out on the tail of the distribution to see if very high concentrations fall within a distribution or within a confidence limit of a distribution. I think some consistency with comparing backgrounds or calculating backgrounds would be very useful to everyone who has to do risk assessments.

Q: (Malcolm Watts, Zeneca, Inc.): I want to support the comments that have been made by Fred Lee, Lynn McCarty, and John Haggard. Lynn McCarty asked, "What do we want to do and how does science help us?" What we want to do is to maintain or clean up the environment. That is pretty obvious. We are all breathing out carbon dioxide and contributing to global warming. Shall we all remove ourselves from the planet? Clearly not. I suggest that it is a matter of cost-effectiveness. How much does it cost and what are the benefits? Fred Lee said this morning that there seemed to be very little damage from the New York Harbor dredging. So, I question the costs. I also question the effectiveness versus the benefits. I would like your comments on cost-effectiveness and the extent to which we have tried to look at the costs of doing nothing and the benefits of doing something.

Betsy Southerland:

We did do a few case studies where we looked at the costs and benefits of remediation. I am sure everyone here is aware that the science of analyzing benefits is an area where we lack monetization methods. We have three tiers of benefits analysis that we do for environmental projects. The first tier, which is a qualitative discussion of benefits, is the one we generally have to use. If you have more data you can move up to tier two, which is a quantitative description of benefits. Only at the third tier do you have monetization of benefits. No matter which of our programs is doing a regulation or other action, we always have a tough time at EPA doing monetization of benefits, whereas monetization of costs is a very well-defined area. We have disagreements with the regulated community about our cost estimates, but we have plenty of procedures to provide us with costs. At any rate, when we have done cost/benefit analyses on some remediation projects, we have been able to demonstrate that the benefits have met or exceeded the cost of the remediation. There were studies at three Superfund sites where the costs were in the area of $25 million to $50 million for the sediment remediation and the benefits were at or above $50 million. Those are the only cases that I know of where the focus has been on calculating the costs and benefits of sediment cleanup. Since they have state water quality sediment standards, Washington State is doing similar work.

Larry Zaragoza:

I did not want to give any site-specific information, but I did want to say that Superfund is not a cost/benefit statute. In making the request that decisions be put into a cost/benefit framework, I think you need to look at what the legislative direction is for the program. Basically, each of our programs has a different framework and a different legislative history. We are supposed to administer each program based on what the law says. We should also coordinate among programs to be efficient and to learn from each other. The last Congress had a lot of discussion about costs and benefits, and I expect that we are going to see that reflected in the next set of legislation. I would also like to reinforce what Betsy Southerland said about the monetization of benefits. Quantifying benefits in monetary terms is not something we have done a lot of. It is controversial, so that will make it challenging in many cases to develop a number that

may be accepted. There are a number of issues in this area that will continue to be debated.

Maurice Zeeman:

As Mother Nature says, "Pay me now or pay me later, but a lot more later." If the Great Lakes area is any example, the time frame for many ecological concerns is decades. If you are talking about the need to know this week how much it is going to cost and what the benefits are, you are going to end up with nearly intractable problems. The Chesapeake Bay is another example. We are seeing examples around us of problems where their scope and scale is virtually beyond all the small management and cost/benefit decisions we are making. I concur with what the prior two people said. We are getting better at it, but so far the environment has been virtually free. That is the reason that it is so contaminated.

Betsy Southerland:

If there is no further discussion, I will close this session with a few summary remarks. I want to reiterate that the future needs raised by speakers and other participants in this conference will be factored into ORD research planning and included in our bioaccumulation report. If you are not already on the mailing list, I also want to remind you to sign up for the *Contaminated Sediments News*, a newletter that we produce and distribute from our office. We will provide follow up information for several things mentioned during this conference in future issues of our newsletter.

It has been tremendously informative and enjoyable for all of us that have worked for more than a year to organize this conference. We especially appreciate the commitment of all the speakers and moderators to continue working with us when we had to reschedule the conference due to the Federal furlough in the fall of 1995. It was a challenge we were finally able to overcome. We thank you for your interest and participation in this conference. My staff will be available after the conference to listen to any additional comments and suggestions you may have before you leave. Again, thank you for coming. We will be keeping in touch with you through the *Contaminated Sediments News*.

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