FOURTH PSDDA ANNUAL REVIEW MEETING MINUTES

1. The Fourth Puget Sound Dredged Disposal Analysis (PSDDA) Annual Review Meeting (ARM) was held at the Tacoma Inn in Tacoma, Washington on Friday, May 8, 1992. Ann Essko, Assistant Manager of the Division of Aquatic Lands, Washington Department of Natural Resources, welcomed those in attendance (listed in Enclosure 1). DNR's opening remarks are provided as Enclosure 2.

2. Brian Applebury, Chief of Operations Division, Seattle District, Army Corps of Engineers, was the meeting moderator. He introduced the ARM panel representing the PSDDA agencies, which included; Ann Essko, Mike Palko (Environmental Review and Sediment Management Section, Washington Department of Ecology), John Malek (Sediment Management Unit, EPA Region X) and Dave Kendall (Dredged Material Management Office, Seattle District, Army Corps of Engineers).

3. Brian Applebury next presented the meeting agenda (Enclosure 3). He then asked that any additional issues be submitted to the panel in writing either during the meeting or by May 22, 1992 in order for them to be considered for inclusion in the PSDDA program. [No additional issues were raised, but a comment letter from the Washington Public Ports Association (WPPA) was submitted (Enclosure 16)].

4. Brian presented an overview of the annual review process and meeting objectives. His overheads are provided as Enclosures 4a (Itinerary and Ground Rules for Meeting), 4b (Fourth Annual PSDDA Review Meeting Objectives), 4c (Purpose of Meeting) and 4d (Miscellaneous Notes). He added that the Corps of Engineers is proud to be a part of the PSDDA program.

5. Program Overview. David Kendall (Corps) presented the conclusions of the previous ARM meeting, the commitments made at the last ARM and the accomplishments or status of these commitments (Enclosures 5a-5d).

The program overview also included a description of the two annual PSDDA reports: the Dredged Material Evaluation Application Report (DMEAR) and the Management Plan Assessment Report (MPAR). This former was prepared jointly by the Corps' Dredged Material Management Office and the DNR's Division of Aquatic Lands. David Fox (Corps) summary of the DMEAR included the content of the report, DY 1991 PSDDA evaluation activities, DY 1991 projects, project ranking, DY 1991 sampling plans, chemical testing, biological testing, reference sediments, suitability decisions and DY 1991 Disposal. His presentation is summarized by enclosures 6a - 6r.

Encl.6a	Title Page
Encl.6b	DMEAR Report Content
Encl.6c	DY 1991 PSDDA Evaluation Activities
Encl.6d	DY 1991 Project Definition
Encl.6e	DY 1991 Projects
Encl.6f	DY 1991 Project Ranking
Encl.6g	DY 1991 Sampling Plans
Encl.6h	DY 1991 Chemical Testing

Encl.6i	DY 1991 Biological Testing
Encl.6j	DY 1991 Bioassay "Hits"
Encl.6k	DY 1991 Reference Sediments
Encl.6l	DY 1991 Suitability Decisions
Encl.6m	DY 1991 Disposal
Encl.6n	DY 1991 PSDDA Processing Time
Encl.6o	DY 1991 Chemistry Unit Cost Analysis
Encl.6p	DY 1991 Bioassay Unit Cost Analysis
Encl.6q	DY 1991 Project Cost Analysis: Project Size vs. Unit Cost
Encl.6r	DY 1991 Rank vs. Unit Testing Cost

Desiree Brown (Ecology) gave a brief, chapter-by-chapter overview of the Management Plan Assessment Report (MPAR) prepared by Ecology. She then summarized the more important points of the report, including the various monitoring efforts which took place during the dredging year. There was a physical monitoring of the Rosario Bay site to verify that dredged material did not accumulate at the site, a new benchmark station in Port Gardner was located and evaluated, and there was a special monitoring effort both in Port Gardner and Bellingham Bay. The latter was to assess the relationship between organism size and body burden of contaminants, and to re-evaluate the approach used to set bioaccumulation trigger levels. Desiree then focussed on the proposed PSDDA clarifications, status reports and proposed issue papers for DY 1991. She concluded with comments about the annual review process and how it compared to the process in previous dredging years. Her presentation overheads follow as enclosures 7a - 7e.

Encl.7a	Title Page
Encl.7b	DY 1991 Clarifications
Encl.7c	DY 1991 Clarifications (cont.)
Encl.7d	DY 1991 Status Reports
Encl.7e	DY 1991 Issue Papers

It was stated that two separate appendices to the MPAR would made available during the ARM. Appendices D (Revision of PSDDA Sediment Quality Values: A Status Report) and E (Dredging Year Literature Review) are included with this minutes package as enclosures 14 and 15, respectively.

Following her presentation, Desiree was asked a question about the "Data Submittals and Communication" clarification, proposed by the Corps (Reference MPAR p. A-15). Eric Johnson (WPPA) asked if there would be communication with the laboratories over the development of a red flag/data submittal checklist that the PSDDA agencies would assemble for the laboratories. Dave Fox (Corps) answered that the laboratories would definitely be asked for advice and comments to identify areas of concern. This would be an interactive process between the PSDDA agencies and the laboratories.

6. Gene Revelas (DNR) presented the first issue paper: "PSDDA Monitoring Plan and DY 1992 Elliott Bay Full Monitoring". Please refer to the MPAR, Appendix C, p. C-15) and the enclosures listed below.

Encl.8a	Title Page
Encl.8b	Environmental Monitoring Questions
Encl.8c	Monitoring Stations
Encl.8d	Guideline Values
Encl.8e	PSDDA Non-dispersive Disposal Site Monitoring History
Encl.8f	Post-disposal Monitoring Results: Elliott Bay 1990
Encl.8g	Post-disposal Monitoring Results: Port Gardner
Encl.8h	The Monitoring "Problems"
Encl.8i	Bioaccumulation
Encl.8j	1991 Bioaccumulation Study Results
Encl.8k	1991 Bioaccumulation Study Results (cont.)
Encl.8l	Proposed Changes to Bioaccumulation Approach
Encl.8	Perimeter Chemistry
Encl.8n	Proposed Changes to Perimeter Chemistry Approach
Encl.8o	Elliott Bay Disposal Site
Encl.8p	"Ghost of ARM Future"

Betsy Striplin (SEA) asked that if (the representative nature of) baseline concentrations were a concern, would the DNR proactively return to those sites to (resample and) supplement the baseline data? Gene responded that DNR had thought about that but that it depended on the funds made available for conducting monitoring.

She also asked if DNR would continue to define a station the same way for evaluating perimeter chemistry? She added that because DNR proposed replicate field sampling, would station locations still be measured with the same navigational accuracy or would DNR conceptually enlarge stations? Gene responded that for the June, 1992 monitoring event at Elliott Bay, the station definition would remain the same. DNR also planned to replicate samples taken from transect stations in Elliott Bay. Gene felt that, because the transect stations were fairly clumped, three replicates of each would enable assessing the various sources of heterogeneity across the area. DNR would then determine which variability factor(s) actually drive(s) the system.

7. Maria Peeler (Ecology) presented the second Issue Paper: "Implementation of the *Neanthes* 20-day Sediment Bioassay". Please refer to the MPAR, Appendix C, page C-1, and the following enclosures.

Encl.9a	Title Page
Encl.9b	PSDDA Commitments at the 1991 ARM
Encl.9c	Workplan Overview
Encl.9d	Workplan
Encl.9e	Studies
Encl.9f	Other On-Going Work
Encl.9g	National Status of *Neanthes* 20-day test
Encl.9h	Progress During Dredging year 1992
Encl.9i	Technical Committee
Encl.9j	Interlaboratory Comparison Study Results
Encl.9k	Experts Recommendations Were Based On....
Encl.9l	Experts Recommendations

Encl.9	Regulatory Interpretation Workgroup Discussion
Encl.9n	Proposed Action/Modification
Encl.9o	Interpretive Guidelines Include....
Encl.9p	Regulatory Interpretation
Encl.9q	PSDDA Bioassay Costs with Chronic Sublethal Test
Encl.9r	PSDDA Bioassay Costs with Acute Test
Encl.9s	PSDDA Interpretation/Kinds of Hits
Encl.9t	Comparison Between *Neanthes* 20-day and Amphipod Hits

(Note: The program director of each PSDDA agency, as a part of the formal implementation process for major PSDDA initiatives, is required to sign a letter citing concurrence with the program change. Letters of concurrence from each PSDDA agency, approving the issue paper as presented, are included as enclosure 17).

Eric Johnson (WPPA) commented that while the Washington State Sediment Management Standards (SMS) rule did adopt this testing protocol, he didn't believe this was adequate justification for its implementation in the PSDDA program. During the review and adoption process, he elaborated, a technical advisory committee agreed to the bioassay's use at the state level as part of the SMS. The advisory committee indicated that the PSDDA process should be used to make any changes in the PSDDA program. It would be a mistake to assume that the SMS process was directly relevant to or could replace the PSDDA process.

Eric also had a question about the test. He asked that with the inclusion of the new 20-day growth test, how did the PSDDA agencies know that the volumes of dredged material suitable for open-water disposal would not change substantially? Did the agencies verify that the regulatory "crossbar" was not being raised or lowered relative to the 10-day mortality test? If the agencies expected changes, would policy meetings be held to discuss acceptable site conditions?

Maria responded to Eric's question by explaining that to compare 10-day test and *Neanthes* 20-day test results would be like comparing apples and oranges. This was because the 10-day test measured mortality while the 20-day test measured changes in biomass over the long-term life of the worms. The latter test would indicate whether the worms survive well over a long period of time, whether they are likely to be able to normally reproduce.

She continued by saying that the decision to incorporate the *Neanthes* 20-day test was not "immediate". Nor was it a direct translation (from the SMS rule). Four options were discussed at the regulatory interpretation meeting. Incorporating the test by using the SMS regulatory interpretation guidelines was identified as being the best way to implement the test and remain consistent with the State laws. This decision was to be reviewed over the next year.

John Malek (EPA) added that there was a report completed earlier this year. which evaluated the range of response to contaminants of the *Neanthes* 20-day test

compared to the range of response of other bioassays. An review of these empirical data appears to indicate the "crossbar" remains in the same range.

Dave Kendall (Corps) added that were data sets where a comparative analysis between the *Neanthes* 10-day and 20-day test using the current PSDDA interpretation guidelines were assessed. The *Neanthes* 20-day showed more sensitivity relative to the 10-day acute mortality bioassay. Also, one of the laboratories ran the amphipod (*Rhepoxinius abronius*) test for a comparison with the *Neanthes* 20-day test. They found the amphipod test yielded two out of six "hits" while the *Neanthes* 20-day test yielded "hits" for the same two sediments. There was some indication of increased sensitivity with the *Neanthes* 20-day test because at least one other sediment would have shown a "minor" hit with the *Neanthes* 20-day test that was not demonstrated by the amphipod test results. Based on that and other data, in terms of sensitivity, the *Neanthes* 20-day test would appear to be intermediate between the amphipod and the sediment larval test. The sediment larval test appears to be the most sensitive bioassay in the PSDDA suite. It was Dave's opinion that there would not be a dramatic increase in the amount of dredged material that would be rejected for in-water disposals as a result of incorporating the *Neanthes* 20-day test.

Maria added that the 20-day test is only one in PSDDA's 4-bioassay suite. She stated it was her belief that a major shift in the volume of suitable versus unsuitable dredged material was unlikely because suitability decisions would always be based on the entire suite of bioassay responses.

A participant asked if feeding affected the sensitivity of the animals. He cited the fact that the worms aren't fed during the 10-day mortality test but are fed during the 20-day growth test. He speculated that this might make individual *Neanthes* in the 20-day test better able to withstand any negative effects of sediments. Dave Kendall responded that the primary endpoint of the *Neanthes* 20-day test was biomass, not mortality. The agencies intended to look at test mortality as part of the overall review of response data and would exercise best professional judgement during the review. For example, if all worms died during a *Neanthes* 20-day test and therefore no biomass measurement was possible, the PSDDA agencies wouldn't simply set this result aside.

Frank Dillon (Ebasco) commented that the sublethal bioassay would be more sensitive than the acute because it responded to much lower concentrations. Maria pointed out that the difference between the acute and sublethal endpoints is not necessarily more sensitivity. The former determined whether the worms would survive exposure to dredged material while the latter test assesses whether they continue to grow (increase biomass) over a longer period of time, at or near the normal rate, and presumably without adverse effects to reproduction. These were stated to be different in concept; they were considered two different response endpoints.

John Malek remarked that one expected to see a response to lower concentrations of contaminants in the *Neanthes* 20-day test. Indeed, this has tended to

be the case when results of both the 10-day test and the *Neanthes* 20-day test have been compared. In this respect, the *Neanthes* 20-day test was more "sensitive" than the 10-day test. However, he qualified his statement by saying that, in regulatory terms, the PSDDA interpretation was based on evaluation of a number of endpoint parameters and on the overall "weight of evidence". Looking at the sensitivity of the sublethal endpoint in that broader scale, John thought a greatly increased program sensitivity was not likely. PSDDA agencies recommend implementing a chronic test because it would enhance the ability of the test suite to assess the complex mixture of contaminants in sediments.

Pat Cagney (Corps) added that the Clean Water Act required examination of chronic effects as well as acute effects. Tom Mueller (Corps) added that, despite these remarks, there was no consensus within the Corps at this time on the readiness of this test for national implementation in a regulatory mode and how to interpret the "Evaluation of Dredged Material Proposed for Ocean Disposal-Testing Manual" or "Green Book" (EPA-503-8-91/001, Feb. 1991) in a regional framework. The Corps would continue to review the technical details of the test performance.

It was the opinion of John Malek (EPA), as a contributing author of the Green Book, that the test was ready for implementation. The framework guidance within the Green book recommended national biological testing guidance but allowed for regional flexibility. The PSDDA agencies therefore propose to use the test in the biological testing suite for dredged material evaluation as part of the State of Washington's water quality evaluation.

Dave Kendall added that part of the Corp's general concern was be that this was the first time a chronic test would be being routinely used. The PSDDA agencies only propose regional implementation and do not suggest the test is ready for national implementation. The framework guidance within the Green book recommends national biological testing guidance but allows for regional flexibility.

A question was raised about the testing costs for the *Neanthes* 20-day test. The consensus response was that the testing costs would be approximately the same as for the 10-day test, perhaps about $200.00 more per test.

9. Public Comment/Issue Paper. After reconvening from lunch, Eric Johnson (WPPA) provided some comments to the PSDDA agencies (Enclosure 16).

Eric suggested there should be more meetings and interactive discussions between the project proponents and the PSDDA agencies to cut down on confusion during the PSDDA process. He emphasized the need for more meetings prior to a proponent's submittal the project's Sampling and Analysis Plan (SAP). He said that there have been large projects where problems have arisen because of confusion among the different parties.

Brian Applebury said that the Corps was strongly supportive of increased interactions. He noted PSDDA was set up to be a cooperative process, adding that there has never been attempts to limit or exclude discussions with any party. Dave Kendall added that the PSDDA agencies are open to any project proponent coming in to clarify technical or programmatic problems. Dave said they encourage this in the earliest part of the process to prevent problems from arising later. Mike Palko (Ecology) said that was what PSDDA was all about. Phil Herzog (DNR) expressed a concern that while the PSDDA agencies encouraged more communication with the dredging proponents, this might overwhelm the agencies.

Eric also mentioned confusion over jurisdiction of the Shoreline Master Plan. He said the WPPA wants to ensure they do not end up with conflicts between a local jurisdiction's Shoreline Master Program and PSDDA's open-water disposal program and site. He went on to say that the Management Plan Technical Appendix (MPTA) addresses the Master Plan Program/PSDDA program conflict (Exhibit E, Phase I of MPTA). Eric wanted Ecology to ensure its Shoreline Unit included this exhibit as part of its guidance, and provide it to all local jurisdictions so that those authorities do not end up with an inconsistent program element as part of their plan. Eric asked that Ecology provide a status report at the next ARM on which local jurisdictions had incorporated Exhibit E of the MPTA guidance into their Master Program.

Mike Palko responded that amendments to the local shoreline programs are initiated by the local jurisdictions, adding that Ecology does not have the authority to mandate such changes. He explained Ecology uses the model exhibit whenever the opportunity presents itself. Ecology would also review any amendments to the Master Program to ensure that it was not inconsistent with the PSDDA program. Ideally, Ecology would like the Master Program to actually recognize PSDDA and provide for the management of dredged material within their jurisdictions. Mike stated that Ecology's Shoreline staff were aware of the problem but there were not many opportunities to make program amendments. Mike Palko agreed to provide a list of which jurisdictions have incorporated Exhibit E of the MPTA guidance into their Master Program at the 1993 ARM. He also agreed that it was important for people to acknowledge when the two programs work together.

10. Public Comment: Tim Thompson (Parametrix)

Tim had three technical issues to bring up to the PSDDA agencies.

A. He requested that the PSDDA agencies adopt the national ASTM standards, 70% normal larvae, 30% abnormal for the larval test. He believes that this standard would be a more accurate indicator of toxicity.

B. He wanted to see a clear cut mechanism for an applicant to approach the PSDDA agencies if they want to use a different bioassay organism when they have scientific and technical reasons for wanting to use an

alternate. He cited as an example using an alternate amphipod species to test toxicity in high-clay sediments, rather than *Rhepoxynius abronius*.

C. He also wanted clear guidance by the 1993 ARM on when, where and how to sample and test for dioxin. The applicants want to know how dioxin data will be used and the criteria that will be used for regulatory decisions.

11. Status Papers. Status reports comprised the remainder of the meeting.

12. Status of Dioxin Issues (John Malek/EPA). Refer to MPAR, Appendix A, page A-3.

As a followup to Tim Thompson's question, John stated currently there was no standard dioxin guidance for applicants. PSDDA relied on best professional judgement, on a case-by-case basis, and close coordination with the applicants. The PSDDA agencies would continue to look at the dioxin issue.

John stated that there were several EPA meetings this year that looked at the dioxin issue, but mostly from a water quality, risk assessment and human health standpoint. John said he was hopeful that guidance language would be available from EPA by July. Until this year, the biggest concern with dioxins and furans was the cancer risk factor. However, studies and data which have been generated suggest that is not as critical as previously believed. It has been suggested that the real threat of dioxin is with non-cancerous impacts, such as impairment of organ function (liver, kidney) and reproduction failures.

The only "guidance" that was available at this time, John continued, was that if dioxin is detected in an area, then there may be a problem. He said potential areas of concern included kraft pulp mills, sulfite pulp mills, and boatyards. The PSDDA agencies would continue to take an empirical approach to potentially contaminated sites, such as those used for the Navy Homeport Element II, 10th Street Boat Launch, 12th Street Marina and South Terminal projects in Everett. The results of the 10th Street Site and the 12th Street Marina project indicated that dioxins were not a concern there. An evaluation of the other projects will be done as the data becomes available. John hoped for better guidance in the next couple of years.

Bert Brun (Corps) asked if the number that Tom Elwell (Ecology) derived up for Grays Harbor was still being evaluated. John responded "maybe", and went on to say there were several national groups that were trying to approach the dioxin issue. They appear to have come up with different effects thresholds. The approach used in deriving the number for Grays Harbor was similar to the approach used by the EPA in Narragansett and the Corps of Engineers, New York district. The consensus of the experts seems to be that there is reason for concern when 2,3,7,8-TCDD exceeds 4 to 5 parts per trillion. Below that level, data reliability was an issue

Tim Thompson asked why there hasn't been any interim guidance available for the region while the national experts are still trying to arrive at an answer. He suggested that, although the number used for Grays Harbor was the subject of extreme debate, it should be used until studied further. That number should be part of the public process until it can be verified.

John again responded. He was not sure the number could be used regionally, both for technical and for political reasons. Beyond general guidance for a dredging project proponent to perform a tier 1 evaluation, there wasn't a number everyone can agree with. It might be necessary to reexamine past NPDES monitoring data. John continued, expressing PSDDA agencies' concern for the great expense of dioxin testing. He concluded by saying that for now, regulators would continue to use best professional judgement, on a case-by-case basis. The best source for this guidance would be the letter which the Corps routinely sends to the applicants with the approved sampling and analysis plans. John was hopeful that the information coming out of EPA headquarters in July will provide further guidance.

13. Status of the "Testing Manual: Evaluation of Dredged Material Proposed for Ocean Disposal", or "Green Book" (John Malek/EPA).

John reported the Green Book was available. This manual contained the regulatory framework for testing dredged material proposed for ocean disposal sites. Within this region, a regional communique was completed last year which extended the framework of the Green Book to a regional framework for testing of dredged material within the estuarine portions of 404 waters. It included topics such as using appropriately sensitive species, QA/QC requirements, and tiered testing. A companion manual, "The Inland Testing Manual for 404 Waters", was also being drafted. Together, the two manuals will set national guidelines for how to implement testing programs for dredged material, whether in 404 waters or 103 waters. The manuals will help to make the process more consistent, although disposal decisions will be made regionally. They will also help to facilitate transfer of technical information between regions.

14. Status of the Technical Review of the Acute Bioassays (J.Smith/EPA). Refer to the MPAR, Appendix B, p. B-1, and the enclosures listed below.

Encl.10a	Title Page
Encl.10b	Amphipod 10-day Mortality Test
Encl.10c	Amphipod Bioassay Status of Work
Encl.10d	Sediment Larval Combined Abnormality/Mortality Bioassay
Encl.10e	Larval Bioassay Status of Work
Encl.10f	Ammonia Effects Experiment
Encl.10g	Microtox 15-Minute Luminescence Test

EPA negotiated contracts to finalize work on the larval bioassays. Due to lack of funding and the recent implementation of the DAIS database, this work was postponed for completion until the 1993 ARM. However, Tim Thompsom

(Parametrix) had completed some initial laboratory work under the new contract looking at ammonia effects. Justine asked Tim to comment on his work to date.

Tim commented that ammonia seems to have the effect of retarding the development of the larvae. There was normal development going on, but it was delayed. How ammonia retards the development was not known.

Frank Dillon (Ebasco) commented that the un-ionized form of ammonia is toxic. He said that at lower pH ammonia is less toxic, at higher pH ammonia is more toxic. He suspects aeration altered the pH of the system and driving the equilibrium to the ionized, more toxic form.

Tim responded that because this was seawater, the experimental system was stable; there was no change in pH. He did not know how to explain the positive effect of aeration. It was noted that aeration did not reduce levels of ammonia. Other factors that may co-vary with ammonia were discussed, such as sulfides or methane. Tim concluded simply by saying that somehow aeration has the effect of ameliorating the developmental impairment that occurs in the presence of ammonium chloride.

Was it was possible to volatilize the ammonia by aerating because aeration will cause it to gas off faster? Tim answered that aeration will not drive it off that much because it is a relatively slow reaction. Looking at the ammonia data over time, there wasn't big differences in the amount of ammonia that were measured. The pH remained in the range of 7.9 - 8.2.

Peter Rude (Landau Associates) asked if in those experiments with ammonia were done in sediment. Justine responded that the experiments were not done in sediment. The experiments were done by spiking with ammonia and aerating some and not aerating others. The decrease in ammonia due to aeration was very slight.

Tim said that looking at the ammonia data, it should be possible to derive values for ammonia toxicity that could be used by the regulatory agencies to set aside anomalous larval data if you have an ammonia level that is of a particular magnitude. This could give some guidance. Dave Kendall said that they have used these relationships to set aside data when there is clear indication that ammonia had a strong influence on the outcome. Justine added that they have been doing this on a best professional judgement basis, and she hoped that the regulatory workgroup will result in clearer guidance.

The above work was performed with the sand dollar larvae. Oyster larvae will also be studied.

Justine mentioned that Jon Bennett of Ecology was evaluating Microtox as a possible freshwater sediment test. Ecology will combine those freshwater bioassay review efforts with those of PSDDA, and may convene a Microtox workshop this year. A representative from Microbics will be included at that workshop. Justine

will evaluate the solid-phase Microtox test because Microbics is making alterations in its recommended protocol.

15. Status of Regulatory Review of Bioassays (Dave Kendall/Corps). Refer to the MPAR, Appendix B, page B-5, and the enclosures listed below.

Encl.11a	Title Page
Encl.11b	Regulatory Definition
Encl.11c	Site Condition II Definition
Encl.11d	PSDDA Nondispersive Guidelines Biological Test Interpretation
Encl.11e	Problem Statement: Evaluation Factors for Regulatory Interpretation
Encl.11f	Ongoing Data Analysis Objectives: Corps and Ecology Data Managers
Encl.11g	Potential Biological Testing Program Refinements
Encl.11h	Regulatory Work Group Workplan for Regulatory Test Review

Dave covered factors that the regulatory work group will study, including technical and administrative factors, bioassay performance, ecological relevance of the bioassay endpoint, and the integration of multiple bioassay responses relative to dispersive/nondispersive interpretation guidelines. He stated the ongoing data analysis objectives of the PSDDA data managers, such as the evaluation of alternative endpoints, and the evaluation of reference area defaults. He predicted that there will be potential biological testing program refinements, such as changes to bioassay protocols, elimination of problematic bioassays and recommendations for an alternative test suite. Dave said that this work will be completed by the 1993 ARM.

16. Benthic Community Assessment and Interpretation (Brett Betts/ Ecology). Refer to the MPAR, Appendix B, p. B-7, and the enclosed overheads listed below.

Encl.12a	Background
Encl.12b	Problem Identification
Encl.12c	Ecology Study/Purpose of Workshop

It was explained that both the Sediment Management Standards (SMS) and PSDDA use benthic infaunal abundance to identify adverse effects to biological resources. The SMS defines a 50% reduction in major taxa compared to reference as an adverse effect. The PSDDA disposal site monitoring plan defines an adverse effect as being a 50% reduction in major taxa relative to baseline.

The experts' workshops for evaluating benthic community sampling/analysis/interpretation methods, originally planned for 1991, were postponed due to lack of funds. Ecology now plans to hold a national level workshop in November 1992. The purpose of the workshop will be to study collection and analysis methods, statistical power, species shifts/impacts versus use of major taxa for analysis, and interpretation endpoint options. The workshop will also look at the pros and cons of different evaluation and interpretation methods to decide which really works best for the conditions in Puget Sound. A report summarizing the issues and findings of the workshop will be completed in early 1993.

Pat Cagney (Corps) asked if the NOAA benthic status and trends data for reference stations would be included. Brett said that some will be used. They will use all data that is readily available and of comparable quality.

17. Reference Area Status Report (Brett Betts/Ecology, MPAR Appendix B, p.B-9).

Encl.13a	Background
Encl.13b	Problem Identification
Encl.13c	Future Actions

The "Reference Area Performance Standards for Puget Sound" report was finalized in September 1991. The focus of this study was on Carr Inlet, Holmes Harbor and Samish Bay. It identified performance standards for 14 chemicals and 6 bioassay endpoints. A 90th percentile by distribution was used in reference areas rather than a confidence interval to establish chemical and biological performance standards for those reference areas.

Recommendations for the performance standards were made for all of the bioassay endpoints except the oyster larvae test because of high mortalities. PSDDA will assess the final report, via the regulatory work group, to establish potential chemical and biological performance administrative defaults for designating acceptable reference area sediments. The PSDDA agencies will incorporate the final report reference areas data/recommendations into the ongoing review of the bivalve larval combined endpoint and Microtox test.

Tim Thompson (Parametrix) suggested that the agencies compile the existing data on reference stations and find ones that have worked well. Tim mentioned that Parametrix would be willing to compile a list of reference stations that have worked well. It is frustrating for the labs to report to a client that the reference samples did not work. Brett said much of this work was compiled in the final report.

18. Changes to the PSDDA Screening and Maximum Levels (Tom Gries/Ecology). Refer to the MPAR Appendix D, available separately as Enclosure 14, and the enclosures 14a - 14j.

Encl.14a	Re-evaluation of Sediment Quality Values: Ecology Responsibilities
Encl.14b	Conclusions from 1991 ARM
Encl.14c	Quality Assurance of Data
Encl.14d	Data Entry and Analysis Alternative
Encl.14e	Status of SEDQUAL
Encl.14f	Process Steps
Encl.14g	Additional Needs
Encl.14h	Related Activities
Encl.14i	Timeline for DY 1993
Encl.14j	Timeline for DY 1993 (cont.)

Tom began by reporting that enough sediment chemistry and biological data was added to Ecology's SEDQUAL database during the previous dredging year to

justify the recalculation of the AETs. However, due to incomplete quality assurance information, budget and resource limitations, the previous year's workplan was delayed. He mentioned other two related activities which effectively competed with AET workplan tasks -- cooperating with the Puget Sound Water Quality Authority to produce an update of the Puget Sound Environmental Atlas and an inventory of stations exceeding 1991 chemical or biological Sediment Quality Standards. Tom stated he believed completion of the workplan by the 1993 ARM is possible.

With regard to quality assurance information, Tom said Ecology has preferred data used for the re-evaluation of sediment quality values to be fully quality assured. Under PSDDA guidelines, submittal of complete QA information has always been required. In addition, the agencies approved a clarification in DY 1990 reiterating this requirement. However, very little of that data acquired during DY 1991 was accompanied by the full quality assurance information (QA2) deemed necessary for establishing new regulatory guidelines.

Ecology did attempt to obtain the full QA2 for the older as well as new data. Labs and dredging proponents were generally found to be cooperative, but archived QA2 data was often difficult and costly to retrieve. In addition, Ecology encountered resource limitations, contract problems, and inconsistent submittal of full QA2 packages for the DY 1991 PSDDA projects. Therefore, a decision was made by the PSDDA agencies that a different approach would be followed.

Preliminary re-evaluations of the AETs would be undertaken using data only partially quality assured (supported by QA1 information alone). If changes to the PSDDA SL/ML levels were indicated by results from a specific station during this process, then Ecology would obtain and review full QA2 information for that station/sample before making final recommendations. Tom suggested that, in order to facilitate the process, the PSDDA agencies meet to further discuss the re-evaluation strategy.

Tom stated he did not expect the AETs or PSDDA SLs/MLs to change dramatically because most of the additional data represented relatively clean areas (e.g. reference area studies, reconnaissance studies, dredging projects). AETs would be expected most likely to change if stations/samples from highly contaminated areas failed to indicate toxic effects in bioassay results.

One participant asked if the PSDDA agencies keep in mind that some of the organic compounds are fairly difficult to detect (e.g. due to interferences) when new screening levels were being recalculated. Tom responded that it was just for that reason that the PSDDA agencies, during the last two annual review cycles, changed screening levels for some chemicals. In past years, the need to revise certain screening levels (those which were close to detection limits) was usually initiated by a laboratory presenting the problem to the PSDDA agencies for consideration. If a different, higher screening level predicted toxicity as accurately as the current one, the revision was considered. Tom stated that PSDDA agency staff have observed fewer

instances where the sample detection limit is greater than the screening level, presumably due mostly to PSDDA having raised several screening levels.

Steve Mayer (North Creek Analytical) asked what the PSDDA agencies do when they receive a wet weight detection limit that is below the SL and then when the labs correct for dry weight it exceeds the SL? Tom responded by saying that the sample detection limit which proponents/laboratories must meet equal the screening level values, which are on a DRY WEIGHT basis. For the example Steve cited, biological testing would still be required. Dave Fox added that the Corps has always required getting detection limits on a dry weight basis.

Tim Thompson asked for an update on the status of changing SEDQUAL to make it compatible with DAIS. Tom responded by reaffirming the commitment to link the two systems. The Corps has worked to make their data quickly amendable to SEDQUAL and that effort should be completed this coming summer. In the long term, Ecology is still considering several options. Ecology did not purchase the source code needed to modify SEDQUAL; Ecology currently relies on the developer for upgrades and changes to SEDQUAL. One option would be to use SEDQUAL mainly for its analytical capabilities and actually hold the data in another database, such as DAIS.

19. Conclusion of Meeting. Brian Applebury concluded the meeting by summarizing the concerns of the participants that were raised over the course of the Annual Review Meeting. These included:

- The implementation of the *Neanthes* 20-day bioassay into the PSDDA suite will be conducted under the PSDDA process.
- The PSDDA agencies are available for consultations to the public at any time should questions or confusion arise during the course of a project.
- Ecology will promote PSDDA consistency with the Shoreline Master Plan and will provide a list of jurisdictions that are consistent with Exhibit E of EPTA.
- PSDDA will provide LC50 guidelines specifications for ammonia for bioassays.
- The agencies will better define a protocol for bioassay species substitution for use in the PSDDA program.
- The PSDDA agencies will reconsider the 10% abnormality issue to make the Sediment Larval test consistent with ASTM protocol, which specifies 30%.

- The PSDDA agencies will coordinate "red flag" issues with the labs (see clarification, MPAR, Appendix A, A-15)

- **The PSDDA agencies will re-examine the "reason to believe" dioxin issue in Everett Harbor after all the testing data is provided to the agencies.**

- **The PSDDA agencies require the submittal of all QA2 information for all projects.**

Brian then closed the meeting, thanked attendees for their participation, and thanked the Department of Natural Resources for hosting this years Annual Review Meeting.

Unresolved issues discussed at a post-ARM meeting are presented in enclosure 18.

PSDDA ANNUAL REVIEW MEETING ATTENDANCE

Enclosure 1

NAME	AFFILIATION	PHONE*
Brian Applebury	Corps of Engineers - Seattle	764-3431
Pat Cagney	Corps of Engineers - Seattle	764-3624
Linda Cox	Corps of Engineers - Seattle	764-3654
Dave Fox	Corps of Engineers - Seattle	764-3768
Dave Kendall	Corps of Engineers - Seattle	764-3768
Tom Mueller	Corps of Engineers - Seattle	764-3495
Stephanie Stirling	Corps of Engineers - Seattle	764-3768
Brett Betts	Department of Ecology	459-6824
Desiree Brown	Department of Ecology	493-2931
Tom Elwell	Department of Ecology	459-6053
Tom Gries	Department of Ecology	438-7706
Russ McMillan	Department of Ecology	459-6814
Mike Palko	Department of Ecology	493-6237
Maria Peeler	Department of Ecology	493-2932
Keith Phillips	Department of Ecology	459-6143
Stewart Lombard	Dept. of Ecology/Manchester	895-4649
Dale Van Donsel	Dept. of Ecology/Manchester	895-2038
Ann Essko	Department of Natural Resources	586-2790
Phil Hertzog	Department of Natural Resources	586-2827
Judy Hockett	Department of Natural Resources	753-0263
Richard Phipps	Department of Natural Resources	753-4288
Gene Revelas	Department of Natural Resources	586-2893
John Malek	EPA Region X	553-1286
Justine Smith	EPA Region X	553-4974
Ricardo Marroquin	North Creek Analytical	481-9200
Steve Mayer	North Creek Analytical	481-9200
Bob Stuart	EVS	(604) 328-4118
J. van der Leelie	EVS	(604) 986-4331
Dean C. Smith	U.S. Navy	(415) 244-3728
Joe Weikel	AM Test	885-1664
Michael Wheeler	PSWQA	493-9176
Jane Sexton	PTI Environmental Services	643-9803
Roger Kadeg	Ebasco Environmental	451-4600
Frank Dillon	Ebasco Environmental	451-4661
Eric Johnson	Wash. Public Ports Association	943-0760
Peter Rude	Landau Assoc	778-0907
Katie Downi	CH2M Hill	453-5000

*Area Code (206) unless otherwise noted

Enclosure 1

PSDDA ANNUAL REVIEW MEETING ATTENDANCE

NAME	AFFILIATION	PHONE*
Liz Anderson	Analytical Resources, Inc	621-6490
John Hicks	Analytical Resources, Inc	621-6490
Randy Dyer	RZA AGRA	820-4669
Sandra Browning	SAIC	485-5800
Betsy Striplin	Striplin Environmental Assoc.	866-8343
David W. Templeton	Hart Crowser	324-9530
Dawn Wulf	Shannon & Wilson, Inc.	633-6839
Cliff Whitmus	Pentec Environmental, Inc.	775-4682
John Vlastelicia	Ogden, Brennen, & Assoc.	(503) 223-8254
Peter McCormick	Ecochem, Inc.	233-9332
Tim Thompson	Parametrix, Inc.	455-2550
Jay Spearman	Spearman, Assoc.	820-1739
Tom Wang	Hartman, Assoc.	382-0388
Thomas Cammarata		633-3783

*Area Code (206) unless otherwise noted

PUGET SOUND DREDGED DISPOSAL ANALYSIS ANNUAL REVIEW MEETING
FRIDAY, MAY 8, 1992
TACOMA INN

Enclosure 2

Greeting and Opening Remarks (0900-0915): Ann Essko, Assistant Division Manager, Division of Aquatic Lands, Washington Department of Natural Resources

INTRODUCTION

Good morning and welcome to the fourth Annual Review Meeting of the PSDDA Dredged Material Management Program. The Washington Department of Natural Resources is proud to be this year's host. We and the other PSDDA agencies thank you for taking the time to be here.

PSDDA is an innovative dredged material management program that is subject to periodic modification and refinement due to its dynamic technical nature. The annual meeting is an important part of this review process. This forum is designed to foster communication between PSDDA technical staff, other state and federal agency personnel, the dredging community and their consultants, laboratory practitioners, and other interested parties, such as the Tribes, environmentalists, and concerned citizens.

This is the first PSDDA Annual Review Meeting to be hosted by the Department of Natural Resources. As perhaps the "lowest-profile" member of the PSDDA agency team, I want to take this opportunity to:

I) Describe DNR's overall mission as steward of Washington state-owned aquatic lands as it relates to dredged material management;

II) Briefly discuss DNR's specific PSDDA role and function; and

III) Explain DNR's approach to sediment management issues by focusing on how we analyze proposals for fill and capping projects on state-owned lands.

While this last topic is presently beyond the scope of the PSDDA program, it is evident that such uses of dredged material are a timely issue throughout Puget Sound. DNR believes the PSDDA program, or a process resembling PSDDA, needs to address this issue in the near-term and we feel this is an effective forum to present our general policy on this topic.

I. DNR's Division of Aquatic Lands is the steward of Washington's aquatic lands, that is, all intertidal and subtidal marine and fresh waters owned by the state of Washington. This includes the eight PSDDA open-water disposal sites. It is the division's stated mission to "manage aquatic lands for the current and future citizens of the state to sustain long-term ecosystem and economic viability... and the benefits derived

from them."

More broadly, DNR acts as steward of the public trust. Public trust doctrine holds that the land between the tides and under navigable waters is inalienably dedicated to public use. This doctrine is over 1,500 years old and can be traced back through the foundation of Washington State and the United States to the laws of England and the statutes of the Roman Empire.

Our goal as steward is the preservation of values inherent in the public trust, that is, preserving ecologically healthy aquatic lands where people can swim and fish as well as conduct water-dependent commercial activities. DNR manages state-owned aquatic lands for the public benefit by:

- Encouraging public use and access;
- Fostering water-dependent uses;
- Ensuring environmental protection; and
- Properly managing renewable resources.

Dredging and dredged material disposal are activities that benefit the public trust by fostering water-dependent uses. However, environmentally unsound dredging and dredged material disposal practices can severely impact renewable resources and the public use of aquatic lands. DNR views the PSDDA program as an effective means of balancing these divergent public benefits and needs.

II. DNR's specific functions within the PSDDA program include:

- Participating in PSDDA committees and workshops that develop or refine sediment evaluation and disposal site monitoring guidelines;

Reviewing dredging site sediment characterizations and dredged material suitability decisions;

- Directing disposal site chemical and biological environmental monitoring, as well as supporting the physical monitoring efforts directed by the Corps; and

- Issuing disposal site use permits, and along with the Corps, ensuring compliance with disposal permit conditions.

In regards to this last item, I understand that a Puget Sound-wide, GPS-based, computerized compliance barge monitoring system will go "on-line" this summer. The development and acquisition of this system has been funded predominately by the Corps with support from DNR.

DNR sees several challenges ahead related to sediment management issues in Puget Sound which are beyond the current scope of PSDDA. These challenges revolved around how we, as a society, choose to deal with contaminated sediments.

For example, the state of Washington currently faces multiple millions of dollars of potential liability for the cleanup of contaminated sediments on state-owned lands. DNR is currently trying to balance this new and exponentially growing priority with our established priorities, such as effective dredged material management in programs such as PSDDA.

III. To illustrate the underlying principles which may affect how DNR sets its priorities in the years to come, I'd like to use the remaining time to detail DNR's policy on the use of state-owned aquatic lands for fill projects. By fill projects, I refer to the full range of possible project designs from subtidal capping of contaminated sediments with clean dredged material to near-shore, contained, disposal of dredged contaminated sediments creating uplands.

In recent months, many of you have run into this policy first-hand, and actually, these "run ins" have helped us fully define it. Given the current state-of-the-art in sediment remediation, this issue will remain with us for some time and it will continue to involve many of the players assembled here. Moreover, as mentioned, we believe that either PSDDA will need to expand its scope to address this issue in the near-term, or a PSDDA-like process will need to be initiated for dealing, both in technical and regulatory terms, with these projects. As an example, DNR is currently working on eight fill projects affecting state-owned lands which are in various stages of planning or implementation.

DNR has identified seven issues that we must evaluate when we are asked to review a fill or capping proposal. As DNR staff have repeatedly stressed in recent months, analysis of these issues tends to require a bay or estuary-wide perspective, rather than a site-specific review. I will briefly describe each of these issues:

1). Harbor Area Restrictions

The use of established harbor areas is restricted by the state constitution to wharves, docks, and other conveniences of navigation and commerce. In addition, the state is to maintain maximum control of harbor areas and its ability to convey their use is restricted. DNR must analyze the degree to which any of these harbor area principles are violated by a particular project. This analysis must take into account both present site uses and potential future needs.

2) State Statutes and Regulations

DNR is mandated to "Provide a balance of public benefits for all citizens of the state". This includes:

- Public access;
- Water-dependent uses;

Enclosure 2

- Environmental protection;
- Renewable resource utilization; and
- Income generation

Fill projects vary in their impacts on this balance. For example, a project might benefit a project proponent, but not the public at large when all the factors are considered.

3). Environmental Issues.

As steward, DNR has concerns about habitat and sediment contamination. On the habitat issue, DNR shares the view that there be "no net loss". In addition, we would emphasize that created habitat be placed in the most effective place based on a bay-wide assessment. Once placed, habitat-creating fill is not likely removed easily. Therefore, careful evaluation is needed to determine the most beneficial location for the permanent alteration of public land.

With respect to contamination, state liability for past contamination is a major concern. As a landowner, the state is potentially liable under state and federal superfund laws for cleanup of contaminated sites. As an example, at Eagle Harbor, the cleanup of the west harbor could cost up to $30 million. The state could be liable for all or part of this cost. The magnitude of these potential economic liabilities in conjunction with the fact that fill projects are frequently proposed for contaminated areas means that DNR must carefully analyze and deal with all potential liability issues.

Related to this is the fact that at this time the preferred remediation for a contaminated aquatic site is often capping with clean dredged material. The problem for DNR is that this remedy leaves contaminants on-site, rather than removing and/or treating them. This is not to say that DNR does not agree that, in many instances, capping is the preferred remediation alternative when environmental protection and cost effectiveness are considered, but DNR's concern is whether does this solution serves the public benefit in the long-term.

Finally, multi-user confined disposal sites may be problematic because contamination from a variety of sources may be placed on public land, thereby increasing the state's and the taxpayers' liability.

4). Economics.

DNR sees two economic issues relative to fill projects.

First, given the economic pressures to:

- Create uplands on public aquatic lands;
- Leave contaminated sediments in-place, i.e., cap rather than remove and treat;
- Establish multi-user confined disposal sites on public land.

DNR must address the philosophical question on the role the consumption of public resources should play in local or private economic development.

The second economic issue is related to DNR's revenue-generating base. Much of DNR's stewardship activities are funded by income generated from public land. Certain major fill projects can significantly reduce these revenues and dramatically affect our ability to carry out our job as steward.

5). Land Management Flexibility.

Fills are a prime example of a present land use which may not ever be economically removable on a large scale. Because DNR manages land on behalf of future citizens, careful assessment is needed before we allow a "permanent" use for public land.

6). Cumulative Impacts and Planning.

The trend is for projects on or near public aquatic lands to propose use of that land for habitat mitigation, contaminated sediment fill, or public access <u>on a site-by-site basis</u>. This approach may result in aquatic lands being used in a piecemeal fashion to satisfy one-time, local interests. Instead, DNR espouses a more comprehensive approach which takes into account bay-wide and statewide interests and environmental needs. In Elliott and Commencement Bays, DNR has taken the lead in initiating such an approach. But we also look to local project sponsors for leadership in this regard. We believe that significant local involvement is critical to the long-term success of this comprehensive planning approach.

7). Public Trust Doctrine.

As alluded at the beginning of this talk, the public trust doctrine states that the public has an easement over aquatic lands and that the public land is to be held in trust on behalf of the state's citizens. In its fullest development, DNR's stewardship role likely requires full analysis of the six issues just described for any project involving the alteration of public lands.

Enclosure 2

DNR must explore each of these issues before a fill project on public land can be authorized. We cannot overemphasize the importance of bay-wide planning in the analysis of these issues and believe that both our agency colleagues and local project proponents must adopt a similar bay-wide and, if appropriate, even statewide, approach to when planning such projects.

Despite all this, let me close by saying that DNR is not out to unnecessarily hold up the beneficial uses of dredged material in Puget Sound. DNR will strive to be pro-active in advocating thoughtful cost-effective solutions to complex sediment management issues. In addition, in forums such as this one and in day-to-day interactions, DNR staff will continue to alert potential project proponents of the considerations just described. Similarly, we expect proponents (and our fellow agencies) to bring us into the process as early as possible when state-owned lands are involved. Finally, DNR will continue to seek out a lead role in facilitating good interagency cooperation and decision making.

The PSDDA program is a good example of the importance of cooperation in finding workable solutions to complex problems. Dealing with contaminated sediment issues in Puget Sound in the coming years should prove even more challenging. DNR believes PSDDA can be an effective template for tackling this critical issue and we look forward to working closely with all of you in the months and years ahead.

Thank you.

Puget Sound Dredged Disposal Analysis (PSDDA)
Annual Review Meeting -- May 8, 1992
Dredged Material Management Year 1991
(June 16, 1990 - June 15, 1991)

May 8, 1992
Final Agenda

Enclosure 3

MORNING SESSION

Introduction (9:00-9:30):

Greeting: Ann Essko, Assistant Division Manager, Division of Aquatic Lands, Washington Department of Natural Resources.

The Annual Review Process and Meeting Objectives: Brian Applebury, Chief, Operations Division, Corps of Engineers (Meeting Moderator).

Program Overview (9:30-10:15):

Conclusions of Previous Annual Review Meeting, Actions Taken (David Kendall/Corps)

Summary of the Dredged Material Evaluation Application Report (David Fox/Corps)

Summary of the Management Plan Assessment Report (Desiree Brown/Ecology)

Presentation of Status Reports and Issue Papers Identified by PSDDA Agencies

Issue Papers (10:15-11:15am):

Supplemental Monitoring Studies/Proposed Changes to Monitoring Plan (Gene Revelas/DNR)

Neanthes 20-Day Issue Paper (Maria Peeler/Ecology)

Discussion and Public Comment on above topics (11:15-11:45am).

Lunch (11:45-1:00pm)

Enclosure 3

AFTERNOON SESSION

Public Comments/Issue Papers (1:00-2:15pm)

Status Papers (2:15-4:00pm)

Dioxin in Sediments: Program Update, Sampling and Analysis Guidelines (John Malek/EPA)

Status of Ocean Disposal Guidance Manual and 404 Testing Manual (John Malek/EPA)

Acute Bioassays: Technical Review and Status Report (Justine Smith/EPA)

Regulatory Review of Bioassays (David Kendall/Corps)

Benthic Community Assessment and Interpretation (Brett Betts/Ecology)

Changes to the PSDDA Screening and Maximum Level Values (Tom Gries/Ecology)

Reference Area Status Report (Brett Betts/Ecology)

Discussion and Public Comment on above topics (4:00-4:30pm).

Summary and Closing (4:30-4:45pm)(Brian Applebury/Corps)

a) Issues to which PSDDA agencies will respond before the next annual review meeting.

b) Written comments may be submitted following the ARM, but must be submitted to the PSDDA agencies by May 22, 1992.

ITINERARY AND GROUND RULES FOR MEETING

1. CALL MEETING TO ORDER, INTRODUCE ANN ESSKO, ASSIST. DIVISION MANAGER, DIVISION OF AQUATIC LANDS/WDNR
2. INTRODUCE PSDDA AGENCY PANEL MEMBERS: ECOLOGY (MIKE PALKO), DNR (ANN ESSKO), EPA (JOHN MALEK), CORPS (DAVID KENDALL)
3. STATEMENT OF MEETING OBJECTIVES. PRESENT OVERVIEW OF AGENDA. ALSO ANNOUNCE THAT ANYONE WISHING TO PRESENT AN ISSUE OR PUBLIC COMMENT, AND NOT ON THE FINAL AGENDA, SHOULD SUBMIT THE WRITTEN COMMENT TO THE PANEL NOW TO GET ON THE AGENDA.
4. GENERAL HOUSEKEEPING: LOCATION OF BATHROOMS. COFFEE, TEA, FRUIT PROVIDED IN BACK. DUE TO FULL AGENDA THERE WILL BE NO SCHEDULED BREAKS EXCEPT LUNCH. PLEASE GET UP AND MOVE ABOUT AS NEEDED. LUNCH WILL BE AT YOUR OWN DISCRETION (SUGGESTIONS PROVIDED!)
5. OVERVIEW OF PREVIOUS ANNUAL REVIEW MEETING, CONCLUSIONS ACTIONS TAKEN; DAVID KENDALL (CORPS)
6. PROGRAM OVERVIEW FOR DREDGING YEAR 1991 ACTIONS; DESIREE BROWN (ECOLOGY) AND DAVID FOX (CORPS).
7. ISSUE PAPERS (30 MINUTES EACH WITH 15 MINUTES FOR DISCUSSION AND QUESTIONS).
8. PUBLIC COMMENTS/ISSUE PAPERS WILL FOLLOW THE ISSUE PAPERS AFTER LUNCH.
9. STATUS REPORTS WILL COMMENCE AT 2:15 p.m. IT IS OUR EXPECTATION TO CONCLUDE THE ANNUAL REVIEW MEETING IN A SINGLE DAY.
10. SUMMARY/CLOSING: PANEL WILL PREPARE SUMMARY OVERHEAD OF COMMITMENTS/ISSUES. WRITTEN COMMENTS WILL BE ACCEPTED THROUGH MAY 22, 1992.

Enclosure 4a

Enclosure 4a

FOURTH ANNUAL PSDDA REVIEW MEETING

MEETING OBJECTIVES

✓ THE MEETING IS HOSTED BY THE WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES AND ADDRESSES PSDDA ACTIVITIES DURING DREDGED MATERIAL MANAGEMENT YEAR 1991 (JUNE 16, 1990 - JUNE 15, 1991).

Enclosure 4b

Enclosure 4b

FOURTH ANNUAL PSDDA REVIEW MEETING

MEETING OBJECTIVES

✓ THE PURPOSE OF THE MEETING IS TO:

1. OBTAIN PUBLIC INPUT ON PROPOSED CHANGES TO THE PSDDA MANAGEMENT PLAN DISCUSSED IN ECOLOGY'S MANAGEMENT PLAN ASSESSMENT REPORT

2. DISCUSS DISPOSAL SITE MANAGEMENT CHANGES.

3. DISCUSS ADJUSTMENTS UNDER CONSIDERATION TO THE PSDDA PROGRAM ON SPECIFIC ISSUES.

4. DISCUSS STATUS REPORTS ON IMPORTANT ONGOING ACTIONS.

Enclosure 4c

Enclosure 4c

FOURTH ANNUAL PSDDA REVIEW MEETING

- ✓ ADDITIONAL WRITTEN COMMENTS ON ISSUES MAY BE SUBMITTED UNTIL MAY 22, 1992.

- ✓ SUMMARY MINUTES OF THE ANNUAL REVIEW MEETING WILL BE AVAILABLE AND MAILED TO MEETING PARTICIPANTS WITHIN 30-45 DAYS FOLLOWING THE MEETING.

- ✓ THE FIFTH ARM WILL BE HELD DURING APRIL 1993, AND HOSTED BY SEATTLE DISTRICT CORPS OF ENGINEERS.

Enclosure 4d

Enclosure 4d

SUMMARY OF THIRD ANNUAL REVIEW MEETING: COMMITMENTS MADE AND ACCOMPLISHMENTS

- ✓ ALL PUBLIC COMMENTS, EITHER VERBAL OR WRITTEN WERE CONSIDERED, AND PSDDA AGENCY RESPONSES TO POST ARM ISSUES ARE REFLECTED IN THE MINUTES OF THE ARM.
- ✓ COMMITMENT TO CONTINUE PSDDA REVIEW MEETINGS ANNUALLY. BIENNIAL REPORTS FOR DREDGING YEARS 92 AND 93 WILL BE PRODUCED DURING FALL 1993.
- ✓ DATA SUBMISSION REQUIREMENTS CLARIFIED.
- ✓ BIOASSAY HOLDING TIME EXTENDED TO 8-WEEKS FOR SEDIMENTS.

Enclosure 5a

Enclosure 5a

SUMMARY OF THIRD ANNUAL REVIEW MEETING: COMMITMENTS MADE AND ACCOMPLISHMENTS

✓ ML/SL ADJUSTMENTS: SL ADJUSTMENTS IMPLEMENTED FOR SIX CHEMICALS. SIGNIFICANT IMPROVEMENTS TO BOTH DAIS AND SEDQUAL DATABASES. AET RE-EVALUATION CALCULATIONS HAVE BEEN DELAYED DUE TO STAFF CUTS AND HEAVY WORKLOADS. HOWEVER, THIS COMMITMENT WILL BE COMPLETED BY THE FIFTH ARM.

✓ NEANTHES 20-DAY BIOASSAY: SIGNIFICANT PROGRESS HAS OCCURRED ON THE DEVELOPMENT OF THIS BIOASSAY. TWO TECHNICAL EXPERTS WORKSHOPS, AND A REGULATORY EXPERTS WORKSHOP WERE HELD, RESULTING IN AN ISSUE PAPER TO BE DISCUSSED AT THIS YEAR'S ARM.

✓ QA2 DATA SUBMITTAL REQUIREMENTS CLARIFIED.

SUMMARY OF THIRD ANNUAL REVIEW MEETING
COMMITMENTS MADE AND ACCOMPLISHMENTS (CONTINUED)

✓ DEFINITION OF SIGNIFICANT BENTHIC COMMUNITY EFFECTS. THE NATIONAL/ REGIONAL EXPERTS WORKSHOP WILL BE COMPLETED IN 1992. THE STATUS OF THIS WORK WILL BE DISCUSSED DURING THE ARM.

✓ IMPLEMENTATION OF SAMPLING AND ANALYSIS PLAN (SAP) TEMPLATE TO FACILITATE SAP PREPARATION AND APPROVAL PROCESS.

✓ DREDGED ANALYSIS INFORMATION SYSTEM (DAIS) DEVELOPMENT ACTIONS:
(1) IMPLEMENTATION OF NEW DATA INPUT SCREENS (FACILITATING COST EFFECTIVE EVALUATION OF TESTING DATA UTILIZING QA AND DATA ANALYSIS AND REPORTING MODULES.

(2) GIS DEVELOPMENT (ARC/INFO) ONGOING.

(3) ELECTRONIC BULLETIN BOARD IMPLEMENTATION BY END OF MAY TO BETA TEST DAIS REPORTING AND DATA TRANSFER CAPABILITIES TO AGENCIES AND PUBLIC.

Enclosure 5c

Enclosure 5c

SUMMARY OF THIRD ANNUAL REVIEW MEETING
COMMITMENTS MADE AND ACCOMPLISHMENTS (CONTINUED)

- ✓ TECHNICAL REVIEW OF ACUTE BIOASSAYS. STUDIES ARE ONGOING TO ADDRESS VARIOUS PERFORMANCE ISSUES RELATIVE TO THE AMPHIPOD, SEDIMENT LARVAL BIOASSAY, AND MICROTOX BIOASSAY, AND ARE NOT YET COMPLETED. THE STATUS OF THESE STUDIES WILL BE DISCUSSED LATER DURING THE ARM.

- ✓ REGULATORY REVIEW OF BIOASSAYS. TECHNICAL STUDIES AND REGULATORY REVIEW STUDIES OF PSDDA ACUTE BIOASSAY ARE ONGOING. STATUS REPORTS ON TECHNICAL AND REGULATORY REVIEW OF PSDDA BIOASSAYS WILL BE DISCUSSED LATER DURING THE ARM.

- ✓ EFFECTS OF GRAIN SIZE, AMMONIA, AND SULFIDES ON AET REVISIONS. THESE ANALYSES DELAYED PENDING COMPLETION OF TECHNICAL AND REGULATORY REVIEW OF BIOASSAYS. IT IS EXPECTED THAT RESOLUTION OF THIS ISSUE WILL BE CLARIFIED BY THE FIFTH ARM.

DREDGED MATERIAL EVALUATION APPLICATION REPORT

DREDGING YEAR 1991

June 16, 1990
to
June 15, 1991

Enclosure 6a

Enclosure 6a

Enclosure 6b

DMEAR REPORT CONTENT

- Combined report format for DY91:

  ✓ Corps' Dredged Material Evaluation Application Report

  ✓ DNR's PSDDA Disposal Site Use Report

  ✓ Ecology's Upland Disposal Report

DY91 PSDDA EVALUATION ACTIVITIES

ACTIVITY	PROJECTS
Ranking Determination	18
Sampling Plan Review	9
Data Review/Decision	10

25 Total Projects; 2,983,923 cubic yards

Enclosure 6c

Enclosure 6c

Enclosure 6d

DY91 PROJECT DEFINITION

DY91 projects are defined as those projects for which the PSDDA agencies made suitability decisions between 16 June 1990 and 15 June 1991, or for which sampling and testing was completed but the application for open-water disposal subsequently withdrawn:

- 12 Projects
- 1,020,047 cubic yards

DY91 PROJECTS

- Anchor Cove Marina-Anacortes
- Ash Grove Cement-Seattle
- B.P. Oil Refinery-Ferndale
- Chevron USA-Point Wells
- Hulbert Mill-Everett
- Hurlen Construction-Seattle
- Redmond, et al-Bainbridge Island
- Port of Silverdale
- Tristar Marine-Seattle
- U.S. Oil Refinery-Tacoma
- USACE Keystone Harbor
- USACE Swinomish Channel

Enclosure 6e

Enclosure 6e

Enclosure 6f

DY91 PROJECT RANKING

RANK	PROJECTS
LOW	1
LOW-MODERATE	3
MODERATE	4
HIGH	5

USACE Keystone had a dual LM/H rank

DY91 SAMPLING PLANS

- 10 projects
- 912,100 cubic yards
- 155 field samples (4-foot core sections)
- 53 dredged material management units (DMMUs)

Enclosure 6g

Enclosure 6g

Enclosure 6h

DY91 CHEMICAL TESTING

- 7 of 10 projects had screening level exceedances
- 25 of 60 screening levels were exceeded
- HPAHs, LPAHs and Dibenzofuran exceeded screening level most often
- Acenaphthene, Anthracene, Fluorene, Phenanthrene, Fluoranthene, Pyrene and Dibenzofuran exceeded maximum level in at least two projects
- Significant QA problems for two projects

DY91 BIOLOGICAL TESTING

- 7 projects required biological testing
- Tiered testing was conducted for only two of these projects
- 26 dredged material management units were tested
- 2 projects required retesting

Enclosure 6i

Enclosure 6i

Enclosure 6j

DY91 BIOASSAY "HITS"

Bioassay	DMMU	2-Hit	1-Hit
Amphipod	15	1	1
Sediment Larval	14	1	4
Juvenile Infaunal	10	1	1
Microtox	15	0	0

DY91 REFERENCE SEDIMENTS

REFERENCE AREA	PROJECTS
Carr Inlet	4
Samish Bay	1
Sequim Bay	1

Enclosure 6k

Enclosure 6k

Enclosure 61

DY91 SUITABILITY DECISIONS

- 10 Projects
- 803,547 cubic yards
- 40 chemical analyses
- 15 biological analyses
- 6 DMMUs failed (22,300 cubic yards)

DY91 DISPOSAL

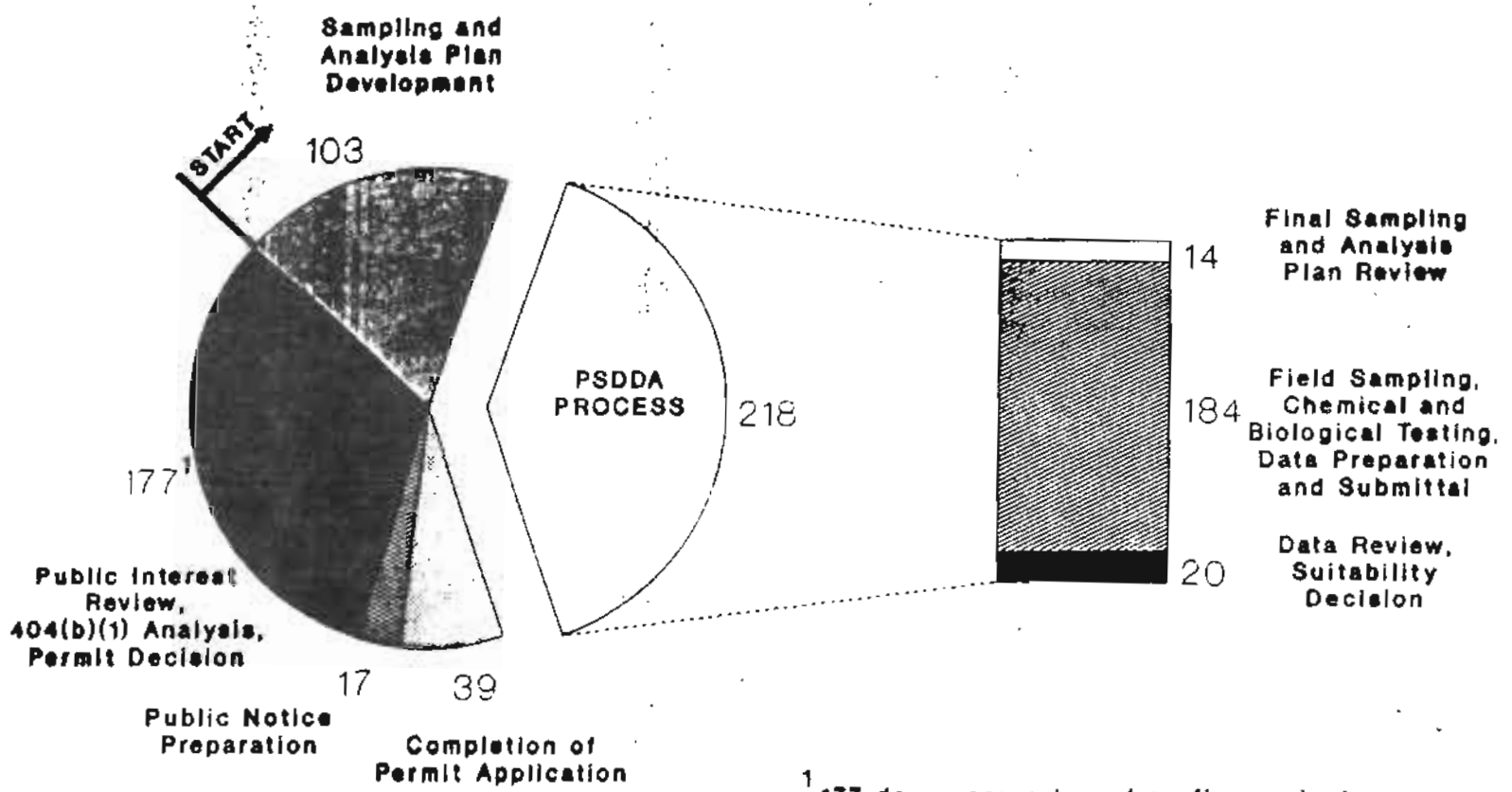
SITE	VOLUME
Commencement Bay	10,548
Elliott Bay	12,000
Port Gardner	17,261
Rosario Strait	566,694
Upland-PSDDA	11,100
Upland-Other	12,650

Enclosure 6m

Enclosure 6m

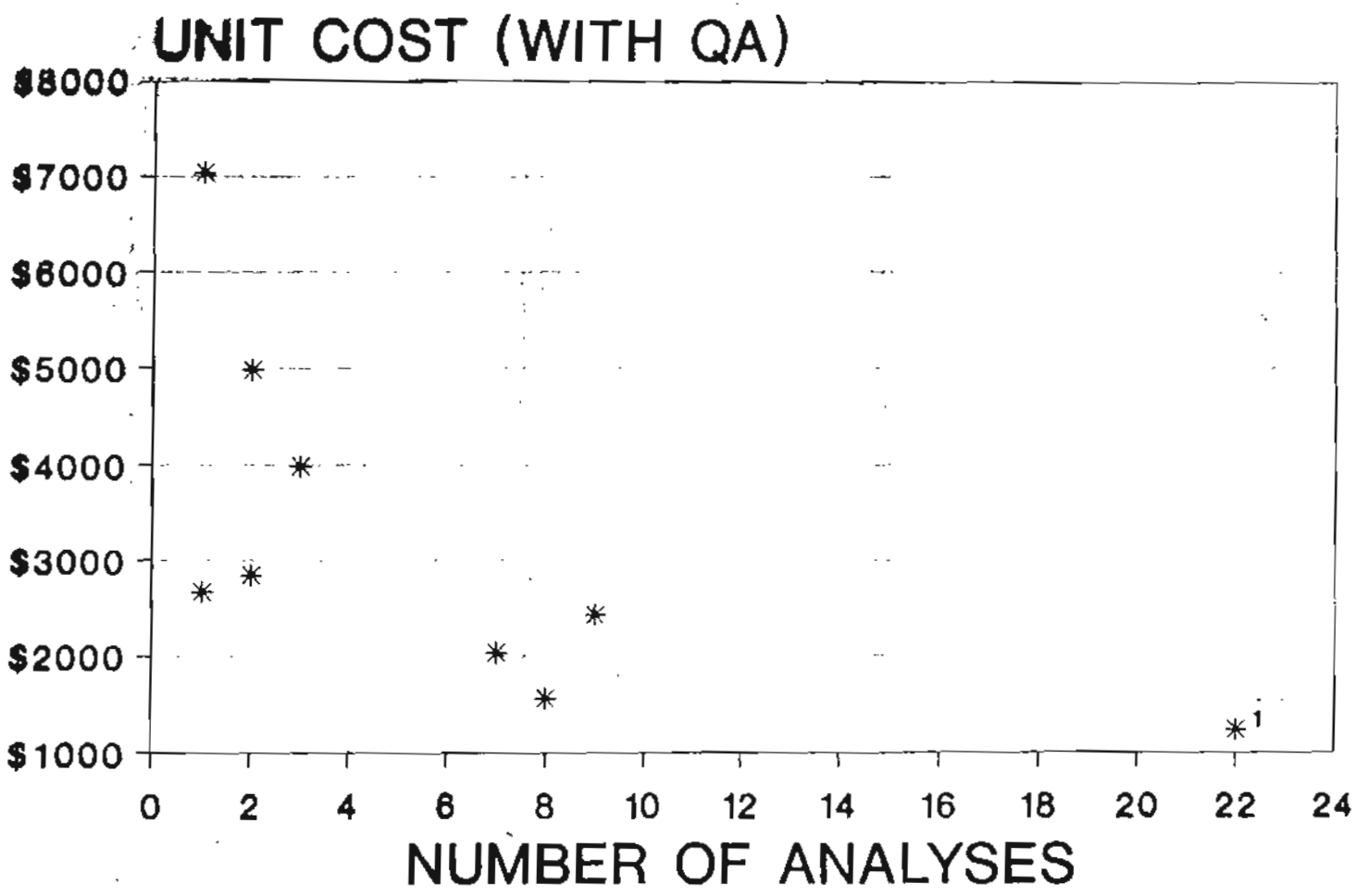
Enclosure 6n

DY91 PSDDA PROCESSING TIME



[1] 177 day average based on five projects from DY91 which had received permits by 1 October 1991

DY 91
CHEMISTRY UNIT COST ANALYSIS



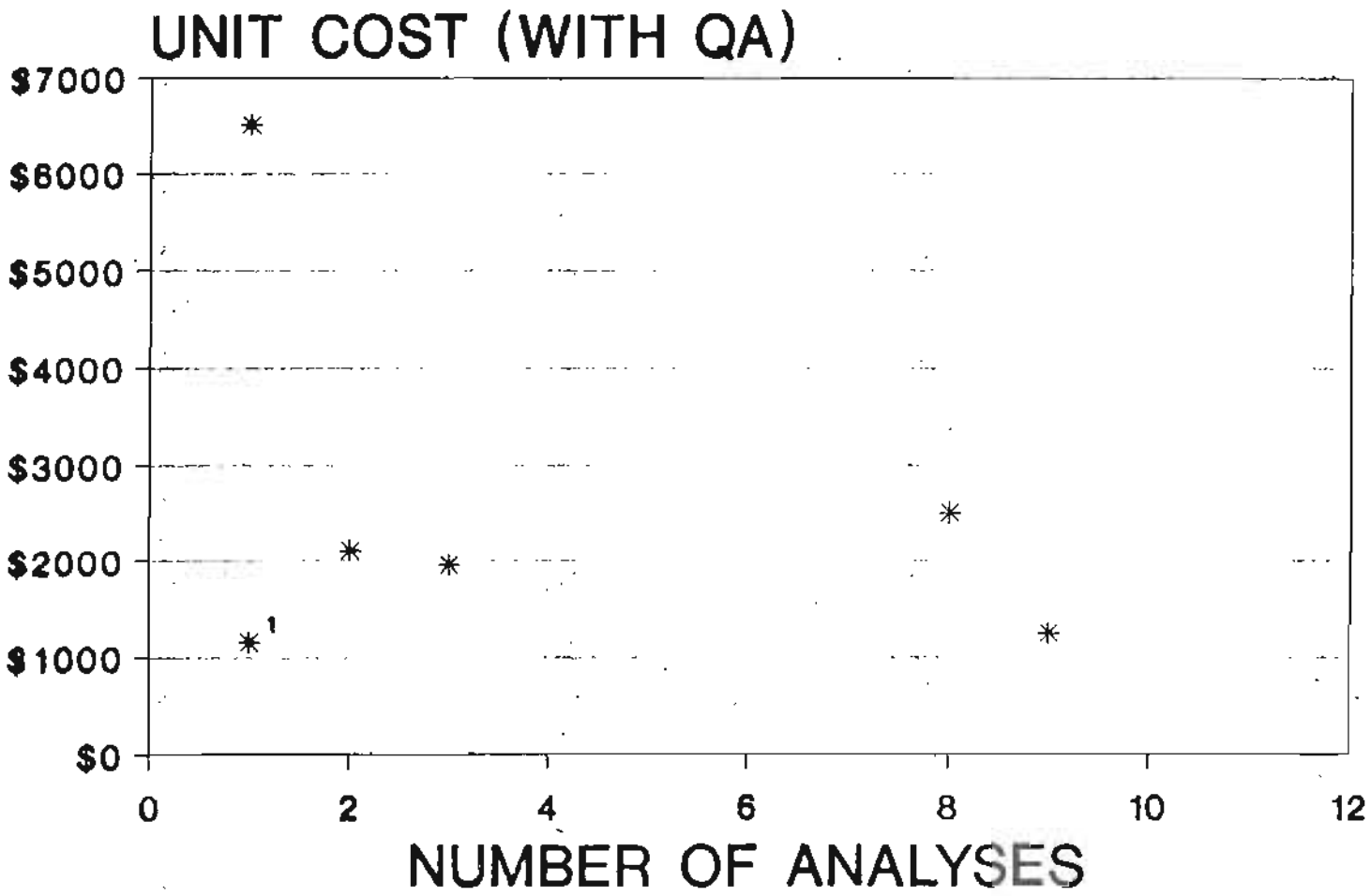
[1] BP Oil - no volatiles, pesticides or PCBs for 16 of 22 analyses

Enclosure 60

Enclosure 60

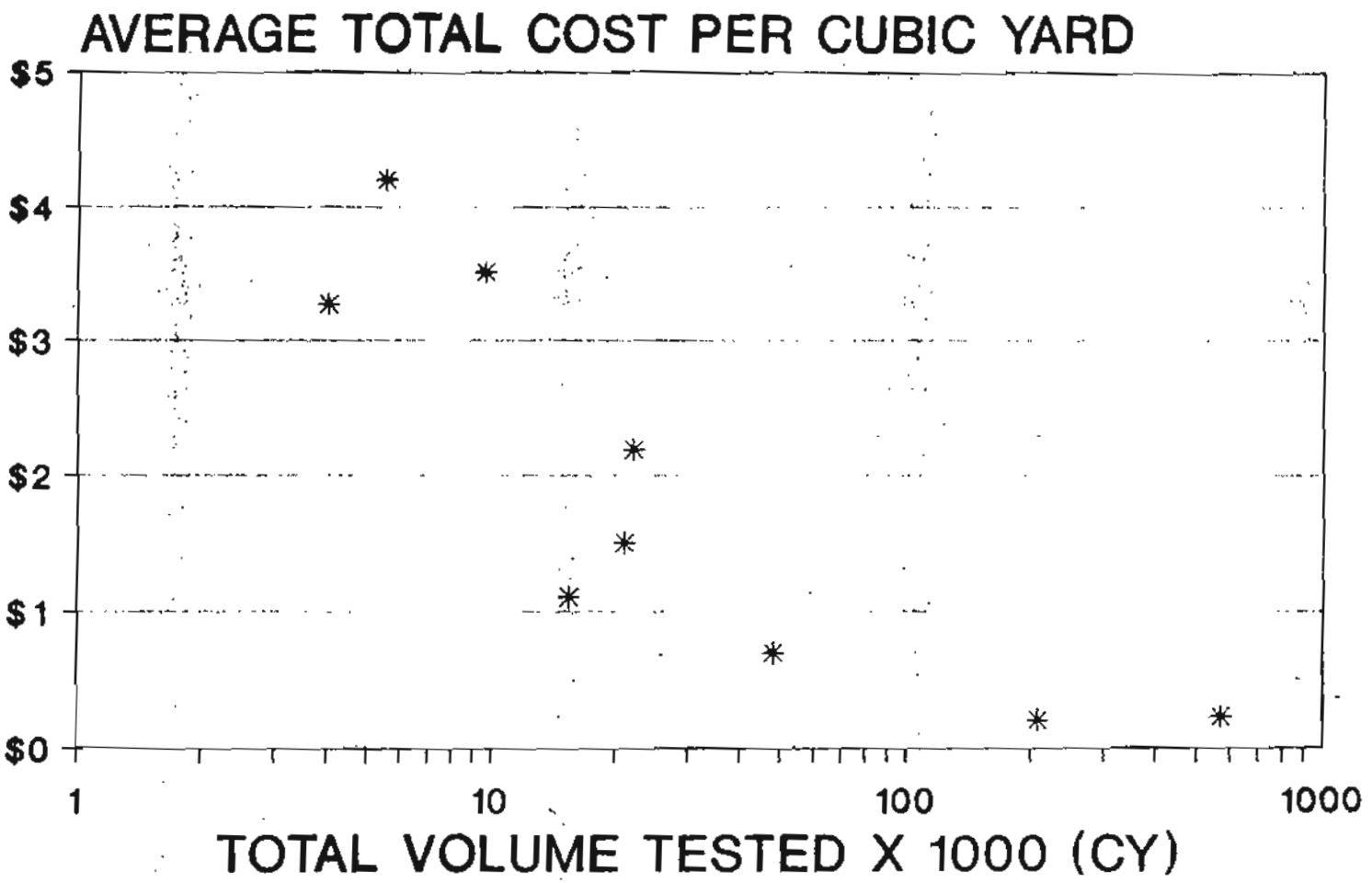
Enclosure 6p

DY91
BIOASSAY UNIT COST ANALYSIS



[1] Hurlen Construction - only Microtox and amphipod bioassays

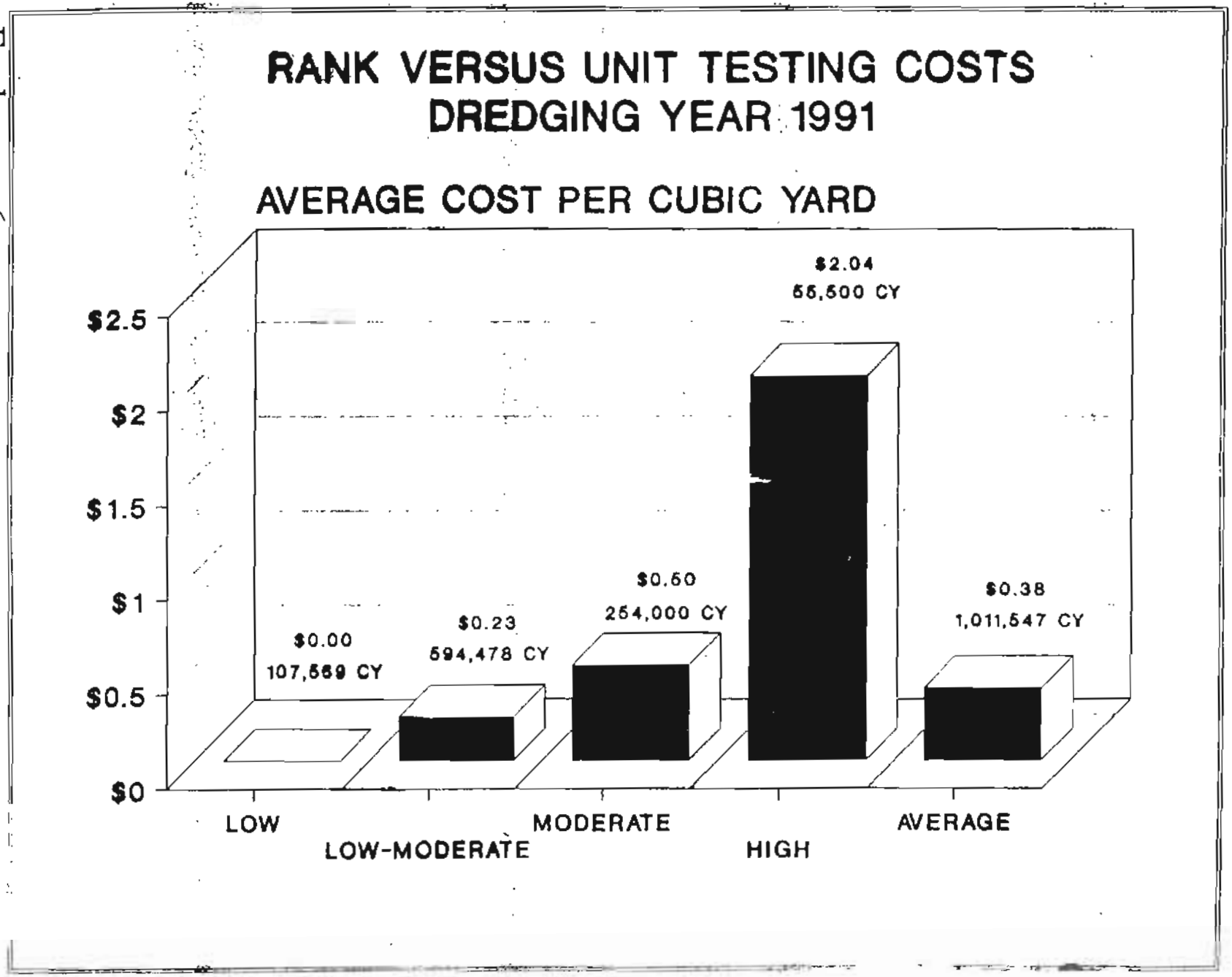
DY91 COST ANALYSIS
PROJECT SIZE VERSUS UNIT COST

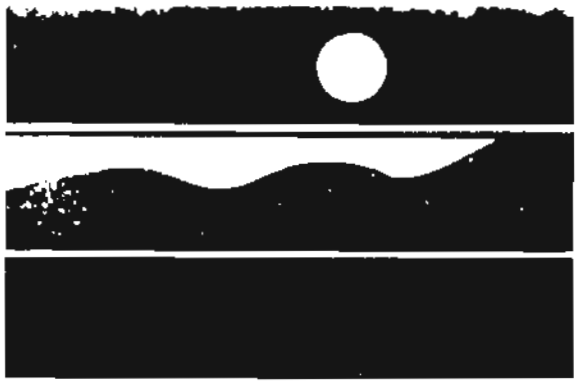


Enclosure 6q

Enclosure 6q

Enclosure 6r





Washington State
Department of
Ecology

Puget Sound Dredged Disposal Analysis: Management Plan Assessment Report

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Dredged Material
Management Year 1991
(June 16, 1990 -- June 15, 1991)

Enclosure 7a

Enclosure 7a

Enclosure 7b

Puget Sound Dredged Disposal Analysis
Dredging Year 1991 Clarifications

- **Benefits of Analysis of Acid Volatile Sulfides (AVS)**
- **Update to PSDDA Sampling Requirements for Dioxins and Furans**
- **Use of Selective Ion Monitoring (SIM) Analysis: Quality Assurance/Control Requirements**
- **Alteration to the Juvenile *Neanthes* 10-Day Mortality Bioassay: Use of Static Protocol**

Puget Sound Dredged Disposal Analysis
Dredging Year 1991 Clarifications

- **Update of Laboratory Accreditation Program**
- **Methods of Improving Communication and Data Submittals**
- **New Data Entry Interface: Dredged Analysis Information System (DAIS)**
- **Results of Relocation of Port Gardner Benchmark Station**

(2 of 2)

Enclosure 7c

Enclosure 7c

Enclosure 7d

Puget Sound Dredged Disposal Analysis Dredging Year 1991 Status Reports

- Technical Review of Acute Bioassays Required by PSDDA
- PSDDA Suite of Bioassays: Regulatory Interpretation
- Benthic Community Interpretation
- Puget Sound Reference Area Performance Standards
- Changes to the PSDDA Screening and Maximum Level (SL/ML) Values

Puget Sound Dredged Disposal Analysis
Dredging Year 1991 Issue Papers

- **Implementation of the *Neanthes* 20-Day Sediment Bioassay**
- **Application of the PSDDA Monitoring Plan and DY 1992 Elliott Bay Full Monitoring**

Enclosure 7e

Enclosure 7e

PSDDA ARM 1992

DISPOSAL SITE MONITORING ISSUE PAPER

I. REVIEW MONITORING APPROACH

II. REVIEW MONITORING RESULTS

III. DETAIL BIOACCUMULATION AND PERIMETER CHEMISTRY ISSUES AND PROPOSED CHANGES

ENVIRONMENTAL MONITORING QUESTIONS

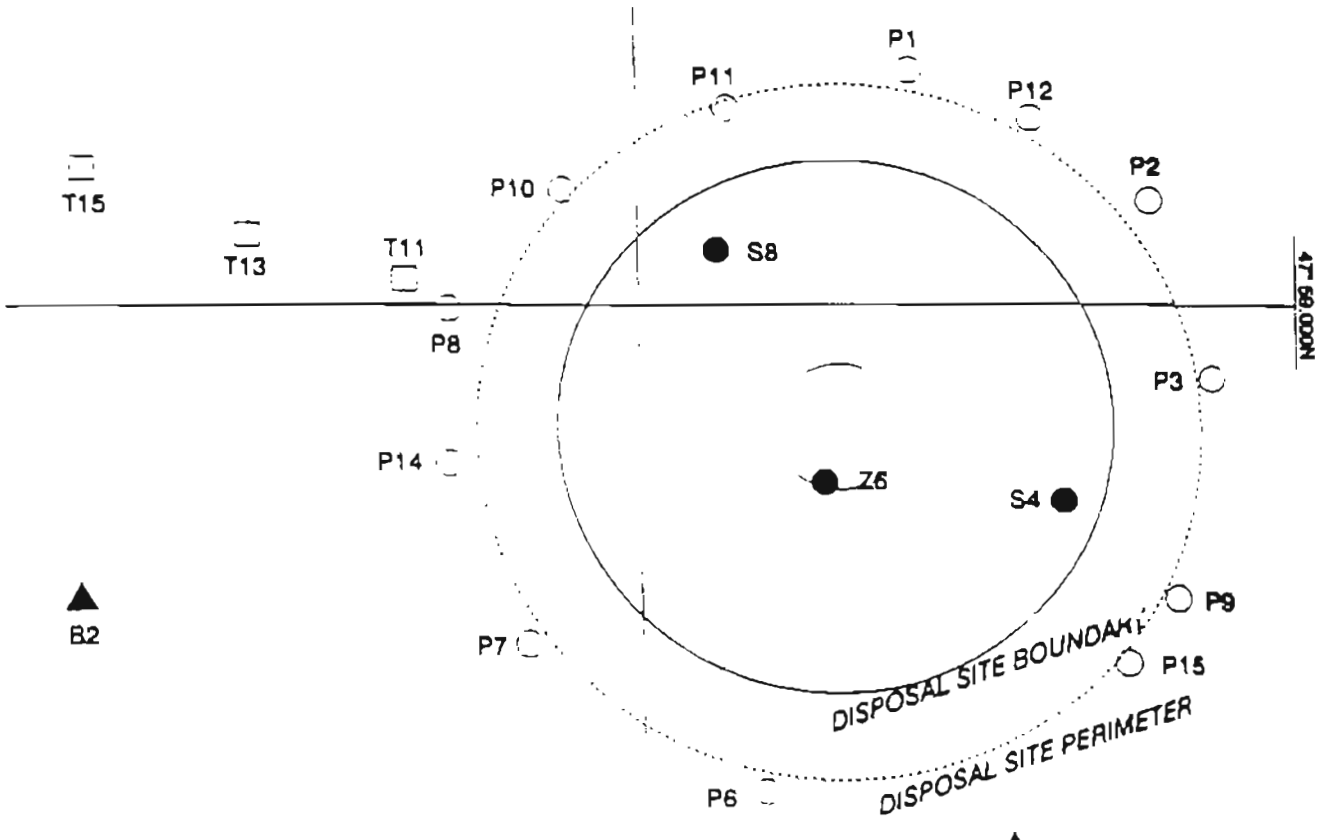
1. DOES DEPOSITED DREDGED MATERIAL STAY ONSITE?

2. IS THE BIOLOGICAL EFFECTS CONDITION FOR NON-DISPERSIVE SITE MANAGEMENT EXCEEDED AT THE SITE DUE TO DREDGED MATERIAL DISPOSAL?

3. ARE UNACCEPTABLE ADVERSE EFFECTS OCCURRING TO BIOLOGICAL RESOURCES IMMEDIATELY OFFSITE DUE TO DREDGED MATERIAL DISPOSAL?

MONITORING STATIONS

STATION TYPE	VARIABLES MEASURED	MONITORING QUESTIONS ANSWERED
ONSITE	SVPS, CHEMISTRY, TOXICITY	2
PERIMETER	SVPS, CHEMISTRY	1
GRADIENT	SVPS, BENTHIC INFAUNA BIOACCUMULATION	3
BENCHMARK	ALL, MOST ARCHIVED	1, 2, AND 3



Enclosure 8c

Enclosure 8c

Enclosure 8d

GUIDELINE VALUES

VARIABLE	STEP 1	STEP 2
MAPPING	OVER 3cm DREDGED MATERIAL AT PERIMETER LINE	FURTHER ASSESSMENT TO DETERMINE FULL EXTENT
ONSITE CHEMISTRY	EXCEED ML VALUE	COMPARE BASELINE AND MONITORING BENCHMARK DATA
PERIMETER CHEMISTRY	ORGANICS EXCEED 1.47 TIMES BASELINE; METALS EXCEED 1.25 TIMES BASELINE	COMPARE BASELINE AND MONITORING BENCHMARK DATA
BIOASSAY	EXCEED TOXICITY GUIDELINE VALUE	COMPARE BASELINE AND MONITORING BENCHMARK DATA
BENTHIC INFAUNA	ABUNDANCE LESS THAN 1/2 BASELINE	COMPARE BASELINE AND MONITORING BENCHMARK DATA
BIOACCUMULATION	ORGANICS EXCEED 5 TIMES BASELINE; METALS EXCEED 2 TIMES BASELINE	COMPARE BASELINE AND MONITORING BENCHMARK DATA

PSDDA
NON-DISPERSIVE DISPOSAL SITE
MONITORING HISTORY

SPRING 1988	BASELINE SURVEYS AT ELLIOTT BAY, COMMENCEMENT BAY, AND PORT GARDNER SITES
SPRING 1989	BASELINE SURVEYS AT BELLINGHAM BAY AND ANDERSON-KETRON SITES
SPRING/ SUMMER 1990	FULL MONITORING AT PORT GARDNER, PARTIAL MONITORING AT ELLIOTT BAY, SUPPLEMENTAL BASELINE SURVEY AT BELLINGHAM BAY
SPRING 1991	BIOACCUMULATION SPECIAL STUDY IN PORT GARDNER AND BELLINGHAM BAY, NEW BENCHMARK RECONNAISSANCE IN PORT GARDNER
SPRING 1992	FULL MONITORING IN ELLIOTT BAY

Enclosure 8f

POST-DISPOSAL MONITORING RESULTS
ELLIOTT BAY 1990

VARIABLE	STEP 1 GUIDELINE COMPARISON	STEP 2 ACTION TAKEN	STATUS/ CONCLUSION
SVPS MAPPING	OK	NONE	DM REMAINED ON-SITE
ON-SITE CHEMISTRY	OK	NONE	NO EXCEEDANCE OF SITE CONDITION
ON-SITE BIOASSAYS	OK	NONE	NO EXCEEDANCE OF SITE CONDITION
PERIMETER CHEMISTRY	EXCEEDANCE	DATA REVIEW	EXCEEDANCES NOT DUE TO DISPOSAL, INVESTIGATE APPROACH

POST-DISPOSAL MONITORING RESULTS
PORT GARDNER 1990

VARIABLE	STEP 1 GUIDELINE COMPARISON	STEP 2 ACTION TAKEN	CONCLUSION/ STATUS
SVPS MAPPING	DM WEST OF SITE BOUNDARY	FURTHER SVPS MAPPING TO FULLY DEFINE	REVISE DISPOSAL MODEL INCORPORATING DM PHYSICAL CHARACTERISTICS
ON-SITE CHEMISTRY	OK	NONE	NO EXCEEDANCE OF SITE CONDITION
ON-SITE BIOASSAYS	OK	NONE	NO EXCEEDANCE OF SITE CONDITION
PERIMETER CHEMISTRY	EXCEEDANCE	DATA REVIEW	EXCEEDANCES NOT DUE TO DISPOSAL, INVESTIGATE APPROACH
TRANSECT BENTHOS	EXCEEDANCE	COMPARE WITH BENCHMARK	CHANGE NOT DUE TO DISPOSAL
TRANSECT BIOACCUMULATION	EXCEEDANCE	DATA REVIEW	SPECIMEN SIZE NOT CONTROLLED. CONDUCT SPECIAL STUDY.

Enclosure 8g

Enclosure 8g

THE MONITORING "PROBLEMS"

PERIMETER CHEMISTRY
FIELD BIOACCUMULATION

BOTH OF THESE INVOLVE:

[BL] * T_R = G.V.

[M] VERSUS G.V.

Enclosure 8h

BIOACCUMULATION

TRIGGER LEVELS OF 2X FOR METALS AND 5X FOR ORGANICS ESTABLISHED USING BEST PROFESSIONAL JUDGEMENT.

BASELINE:

SINGLE TISSUE REPLICATE COLLECTED PER STATION FOR MOLPADIA/COMPSOMYAX, "ALL" SIZES USED.

1990 MONITORING:

TWO TISSUE REPLICATES COLLECTED PER STATION, ONLY SPECIMENS > 2" USED.

GUIDELINE EXCEEDANCES FOR SEVERAL METALS (Ar, Ni, Zn), BUT NOT CONSISTENT BETWEEN REPLICATES, CONCENTRATIONS DECREASE TOWARD SITE

1991 STUDY:

THREE REPLICATES FOR EACH OF THREE SIZE CLASSES, MOLPADIA IN PORT GARDNER, COMPSOMYAX IN BELLINGHAM BAY

LOOK AT SIZE/BODY BURDEN RELATIONSHIP

REVISIT TRIGGER VALUES AND APPROACH

Enclosure 8i

1991 BIOACCUMULATION STUDY RESULTS

ORGANICS UNDETECTED, SO ANALYSIS LIMITED TO METALS

SIZE ISSUE

SIZE/BODY BURDEN RELATIONSHIP EVIDENT, BUT VARIED BETWEEN METALS AND BETWEEN SPECIES

Species	Metals Positively Correlated by Size
Molpadia	Antimony, Arsenic*, Cadmium, Mercury
Compsomyax	Cadmium, Lead, Silver*

* These metals were over 4X more concentrated in large specimens relative to small

∴ SIZE IMPORTANT TO CONTROL

Enclosure 8j

PROPOSED CHANGES TO BIOACCUMULATION APPROACH

1. COLLECT/ANALYZE ONLY MEDIUM MOLPADIA (8-12CM) AND ONLY LARGE COMPSOMYAX (>6.0CM)

SIZE (N=3)	MOLPADIA VARIANCE	COMPSOMYAX VARIANCE
SMALL	6.76	0.37
MEDIUM	2.69	16.74
LARGE	15.80	0.25

2. CALCULATE INDIVIDUAL TRIGGER LEVELS FOR EACH METAL AND SPECIES (COMPLETE BEFORE '93 MONITORING, NO BIOACCUMULATION IN '92)

IN ADDITION, REVIEW NON-PSDDA DATA SETS TO ASSESS 5X TRIGGER FOR ORGANICS AND DEGREE OF COMPOUND-TO-COMPOUND VARIABILITY

1991 BIOACCUMULATION STUDY RESULTS

TRIGGER LEVEL ISSUE

TRIGGER LEVEL IS A FUNCTION OF:

- SIGNIFICANCE LEVEL (SET AT 0.80)
- # OF STATIONS/REPLICATES (BOTH SET AT 2)
- VARIABILITY OF THE DATA (CV)

BASED ON 1991 DATA, 2X MAY BE AN APPROPRIATE TRIGGER FOR ALL METALS COMBINED

CV [TOTAL METALS] = 41%

INDIVIDUAL METALS

	ARSENIC	MERCURY	ZINC	SILVER
CV	56%	56%	78%	133%

∴ TRIGGER EXCEEDANCES FOR <u>INDIVIDUAL</u> METALS WOULD OCCUR AT LOWER POWER LEVEL, I.E., A LOWER PROBABILITY THAT AN "EXCEEDANCE" REPRESENTS A REAL ENVIRONMENTAL CHANGE

PERIMETER CHEMISTRY

TRIGGER VALUES (80% CONFIDENCE INTERVAL) ORIGINALLY SET AT 1.25X FOR METALS AND ORGANICS. REVISED ORGANICS TRIGGER TO 1.47X IN 1990 FOLLOWING ASSESSMENT OF ACTUAL WITHIN-STATION CHEMICAL HETEROGENEITY.

BASELINE SURVEY:

SINGLE REPLICATES OBTAINED AT VARIABLE NUMBER OF PERIMETER STATIONS:

CB/EB N = 12
BB/AK N = 4
PG N = 5

DUE TO LACK OF [BL] FOR THE TWELVE FULL MONITORING STATIONS, "[BL]" FOR STATIONS OCCUPIED FOR THE FIST TIME DURING POST-DISPOSAL MONITORING MUST BE "ESTIMATED" FROM THE [BL]s MEASURED AT THE CLOSEST ADJACENT STATIONS.

1990 MONITORING:

PERIMETER CHEMISTRY EXCEEDANCES OBSERVED AT BOTH EB AND PG, PREPONDERANCE OF EVIDENCE INDICATED NOT DUE TO DM DISPOSAL:

- SVPS MAPPING NOT CORROBORATE
- WITHIN-STATION REPLICATES INCONSISTENT
- COMPOUNDS OBSERVED AT PERIMETER NOT MEASURED IN THE DREDGED MATERIAL AND VICE VERSA

PROPOSED CHANGES TO PERIMETER CHEMISTRY APPROACH

1. FORMALLY ADOPT THE REVISED TRIGGERS OF 1.47X FOR ORGANICS, BUT REVISIT FOLLOWING 1992 MONITORING (SEE ITEM 2).

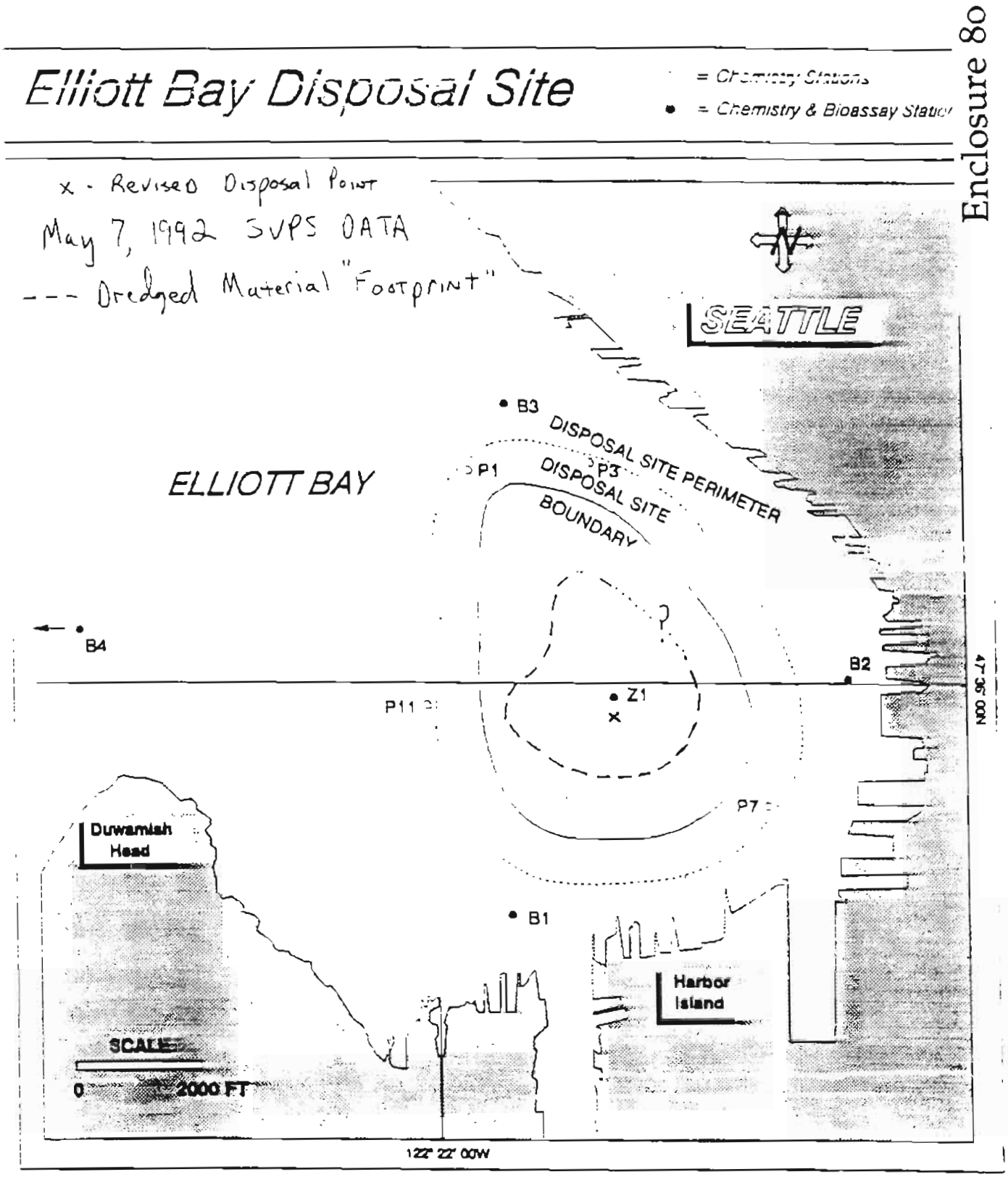
2. FOR FULL MONITORING SCHEME, CONVERT THE TWELVE UNREPLICATED PERIMETER STATIONS INTO FOUR TRIPLICATED STATIONS.

   ADVANTAGES:

   - WITHIN-STATION REPLICATES WILL ADD TO WEIGHT-OF-EVIDENCE APPROACH IN ASSESSING EXCEEDANCES
   - BOTH WITHIN AND AMONG STATION VARIABILITY ASSESSED, OVER TIME MAY BE ABLE TO REDUCE LEVEL OF EFFORT
   - ALLEVIATES NEED TO "ESTIMATE" BASELINE CONCENTRATIONS AT STATIONS NOT ACTUALLY OCCUPIED

   DISADVANTAGES:

   - SPATIAL COVERAGE REDUCED, BUT AVAILABILITY OF SVPS DATA WILL ALLOW FLOATING STATIONS TO BE PLACED AS NEEDED (A STEP 2 SVPS MANAGEMENT DECISION)


Elliott Bay Disposal Site
= Chemistry Stations
= Chemistry & Bioassay Station
x - Revised Disposal Point
May 7, 1992 SVPS DATA
--- Dredged Material "Footprint"
SEATTLE
B3
DISPOSAL SITE PERIMETER
P1
P3
DISPOSAL SITE
BOUNDARY
ELLIOTT BAY
B4
B2
Z1
P11
P7
Duwamish
Head
B1
Harbor
Island
SCALE
0
2000 FT
122° 22' 00W
47° 36' 00N

"GHOST OF ARM FUTURE"

GUIDELINE VALUES ARE DETERMINED BY:

$$[BL] * TR = G.V.$$

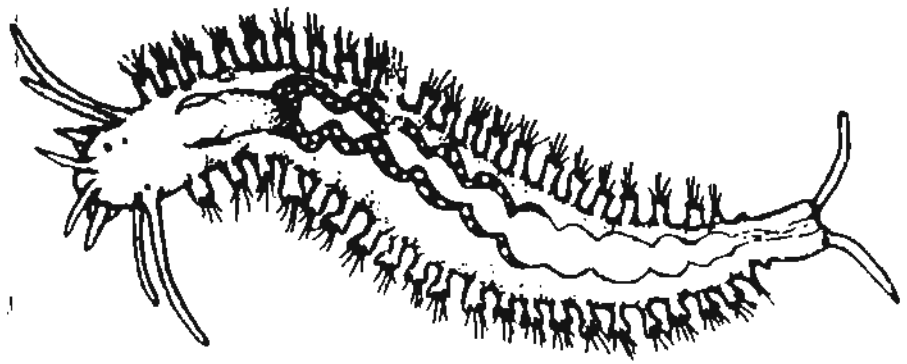
TO DATE, WE'VE FOCUSED LARGELY ON WHETHER THE TRIGGER VALUES ARE APPROPRIATE.

BUT THE [BL] IS EQUALLY IMPORTANT IN SETTING THE GUIDELINE VALUE.

BASELINE TISSUE AND PERIMETER CHEMISTRY CONCENTRATIONS ARE BASED ON UNREPLICATED MEASUREMENTS MADE AT EACH STATION AT ONE POINT IN TIME.

HOW REPRESENTATIVE ARE THESE NUMBERS OF THE ACTUAL CHEMICAL CONCENTRATIONS AT EACH SITE ?

AS LONG AS DREDGED MATERIAL REMAINS ON-SITE, SOME [BL]s MAY WARRANT REFINEMENT AS THE POST-DISPOSAL MONITORING DATABASE GROWS.



Neanthes 20-day Bioassay
Issue Paper Presentation

PSDDA Annual Review Meeting
1992

Prepared by Maria Peeler, Department of Ecology, on behalf of the PSDDA agencies

Enclosure 9a

Enclosure 9b

PSDDA Commitments in 1991 ARM Included

- Continued studies with the Neanthes test to determine its utility for assessment of effects from dredged material disposal

- Assessment of Neanthes test and other alternative tests, as appropriate, to determine best available methods for measuring sublethal effects such as impairment to animal growth and reproduction

- Improvement in the PSDDA evaluation procedures, including range of effects, in its suite of bioassay tests by June 1992

Neanthes Workplan Overview

- Scoping
- Technical Team
- Data Summary
- Field Application of Tests
- Interlaboratory Studies
- Public Review

Enclosure 9c

Enclosure 9d

Neanthes Workplan

1991								1992			
May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr

→ **Identify Technical Team members**
→ **Prepare Study Scope**

→ **Convene Technical Team**
→ **Review Proposed Studies**

→ **Field Application of Tests**
→ **Interlab Studies**

→ **Draft Technical Issue Paper**

→ **Public Technical Review Workshop**

→ **Final Draft Issue Paper**

→ **Present at PSDDA Annual Meeting**

Neanthes Studies

- PSDDA Sublethal Test Demonstration. 1988.
- Comparison of Bioassays for Assessing Toxicity in Puget Sound. 1989.
- Interim Protocol for Juvenile *Neanthes* Bioassay, Draft Report. 1989.
- Evaluation of Growth as an Indicator of Toxicity in Marine Organisms. 1989.
- Development of a *Neanthes* Sediment Bioassay for Use in Puget Sound, Draft Report. 1990.
- Protocol for Juvenile *Neanthes* Bioassay, Draft Report. 1990.
- *Neanthes* Long-Term Exposure Experiment: Relationship Between Juvenile Growth and Reproductive Success. 1990.
- *Neanthes* Long-Term Exposure Experiment: Further Evaluation of the Relationship Between Juvenile Growth and Reproductive Success. 1991.

Enclosure 9e

Enclosure 9e

Enclosure 9f

Other On-Going *Neanthes* Work

- ASTM Protocol Review
- Corps of Engineers Waterways Experiment Station Studies
- Studies by Peter Chapman, et al.
- Studies by Environmental Research Lab, Narragansett, R.I.

National Status of *Neanthes* 20-Day Test:

ASTM Guidelines

- Letter written March 27, 1992 by Don Reish, Chair of the ASTM sediment toxicity tests committee, providing status of Neanthes 20-day bioassay guidelines.
- Members of the committee include Robert Scott Carr, Tom Dillon, Mike Johns, Joseph LeMay, and Dave Moore.
- Review and comments of guide were completed in February 1991, with revisions and second balloting in September 1991.
- In November 1991, at the Seattle sediment committee meeting additional suggestions were made to improve the guide, none substantial.
- Balloting of the full committee is planned by winter 1992, ready for full vote at the ASTM meeting in Pittsburg in April 1993. Guide expected to be published in the 1993 ASTM issue of volume 11.04.
- Test is being used in Oregon, California, British Columbia, Nova Scotia, and EPA's Gulf Breeze lab, Florida.

Enclosure 9g

Enclosure 9g

Enclosure 9h

Progress During Dredging Year 1992

- ★ presented worplan at 1991 ARM
- ★ draft scope of work submitted to experts
- ★ convened technical experts July 9, 1991
- ★ incorporated experts' recommendations
- ★ collected sediment samples
- ★ conducted interlab study on field sediments
- ★ completed draft report
- ★ convened technical experts November 8, 1991
- ★ prepared experts Position Paper

Neanthes Technical Committee

***Present November 8, 1991**

Dr. Ted Dewitt	**Hatfield M.S.C.**	**Newport, OR**
Cathy McPherson (representing Dr. Peter Chapman)	**EVS**	**Vancouver, B.C.**
Dr. John Scott	**EPA Research Lab/SAIC**	**Narragansett,R.I.**
Dr. Don Reish	**California State University**	**Long Beach, CA**
Dr. Phil Oshida	EPA Region IX	San Francisco, CA
Dr. Chris Ingersoll	F&W Service	Columbia, MO
Dr. Jack Gentile	EPA Research Lab	Narragansett, R.I.
Dr. Ed Casillas	**N.M.F.S.**	**Seattle, WA**
Dr. Tom Ginn	**PTI**	**Bellevue, WA**
Dr. Jack Word	Battelle N.W	Sequim, WA
Dr. Dave Moore (Representing Dr. Bob Engler)	**Corps WES**	**Vicksburg, MS**
Dr. Mike Johns	**PTI**	**Bellevue, WA**
Dr. Carol Pesch	EPA Research Lab	Narragansett, R.I.
Dr. Michael Salazar	NOAA (NRDA)	Seattle, WA

Enclosure 9i

Enclosure 9i

Enclosure 9i

Interlaboratory Comparison Study Results

- Chemistry documented low levels of contaminants in the control, as well as the two reference sediments
- Chemistry in the other test sediments were contaminated with both organic compounds and metals
- The six labs tested the survival and change in dry weight. One lab also tested toxicity using Rhepoxynius
- Each lab successfully completed the test
- Had good agreement among the labs for the response variables (80% agreement)
- LC50 values within range

Experts Recommendations Were Based On:

- refining the protocol as experience is gained
- gaining more experience with Puget Sound samples
- considering other approaches to compare the test to others
- investigating alternative chronic/sublethal endpoints
- researching the ecological relevance of the test in Puget Sound, or finding an alternative chronic/sublethal method which uses a species indigenous to this region
- pursuing research and considering alternative endpoints, organisms, and/or alternative tests

Enclosure 9k

Enclosure 9k

Enclosure 91

Experts' Recommendations

- The test is technically ready
- Adopt the juvenile *Neanthes* 20-day test for one full dredging year as part of PSDDA suite of bioassays
- Collect data during that year, track and tabulate it to determine relative sensitivity of the test and its performance within the suite
- Use data results from DY93, the test can then be considered for permanent use
- Discontinue of the 10-day juvenile *Neanthes* acute bioassay, because the 20-day test allows dual endpoints (biomass and mortality)

Regulatory Interpretation Workgroup Discussion

- ★ Majority agreed with the experts' recommendations.

- ★ Several dissented. Concerns included lack of availability of worms (single suplier), possible additional technical development required, premature to use the test as a regulatory tool at this time, and current requirements under the "Green Book".

- ★ Current PSDDA review process ensures consideration of test improvements as they develop, as well as consideration of other bioassays.

- ★ Four alternatives were proposed, including "no action" .

Enclosure 9m

Enclosure 9m

Proposed Action/Modification

- Incorporate the juvenile *Nenathes* 20-day bioassay as integral part of suite during DY 93.

- The juvenile *Neanthes* 10-day bioassay will no longer be required.

- The test interpretation used in Washington State's Sediment Management Standards will be used as regulatory interpretation for PSDDA decisions.

- The test data will be reviewed at the end of DY 93 to determine the test's future utility and interpretation, at the same time the other bioassays used by PSDDA are assessed.

Interpretive Giuidelines include:

1) Performance guidelines: control less than 10% mortality, reference mean biomass at least 80% of the control's mean biomass.

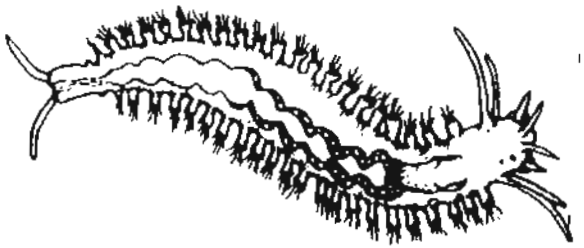
2)"Two-hit" response guideline: test has mean biomass of less than 70% of reference, and test biomass is statistically different (1-tailed Student t-test, alpha = 0.05) from reference biomass.

3)"One-hit" response guideline: test has mean biomass of less than 50% of reference, and the test biomass is statistically different from reference biomass.

Enclosure 9o

Enclosure 9p

Regulatory Interpretation

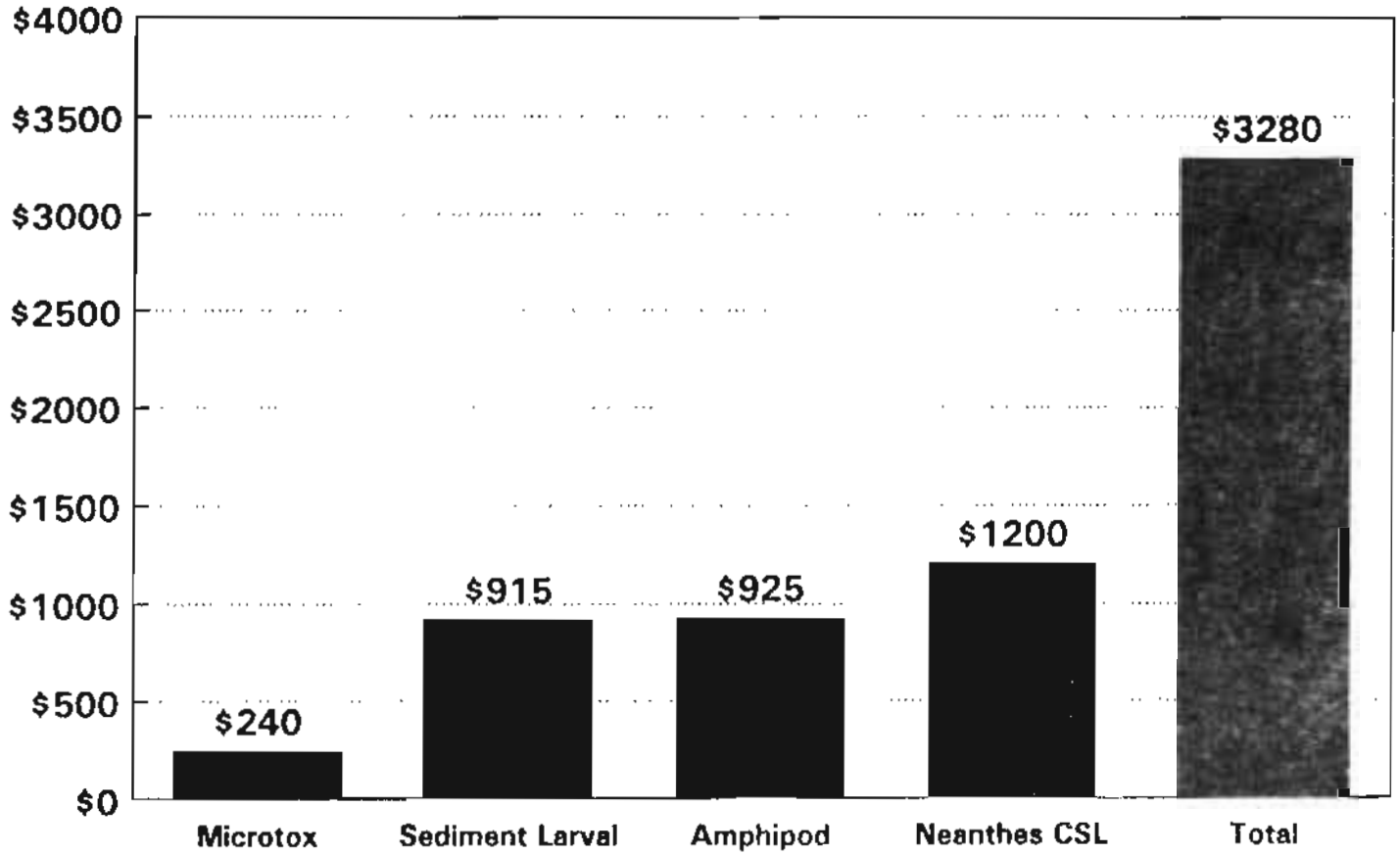


10 gram
(reference)
= clean

7 gram
("two-hit")
= somewhat bad

5 gram
("one-hit")
= bad

PSDDA Bioassay Costs
With Neanthes Chronic Sublethal Test



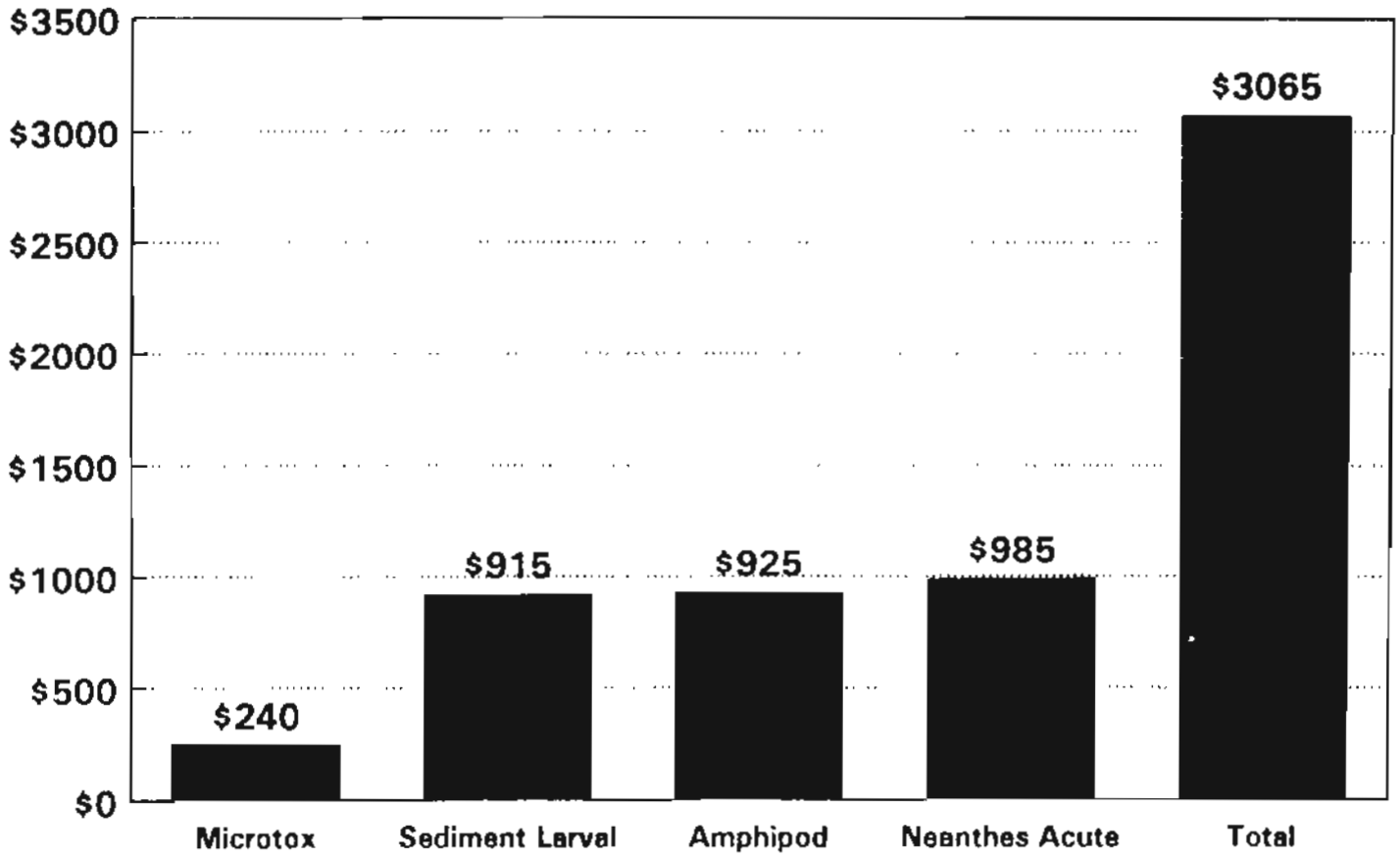
Costs shown are mean total costs per sample based on 3 laboratories and a 5-sample project.

Enclosure 9q

Enclosure 9q

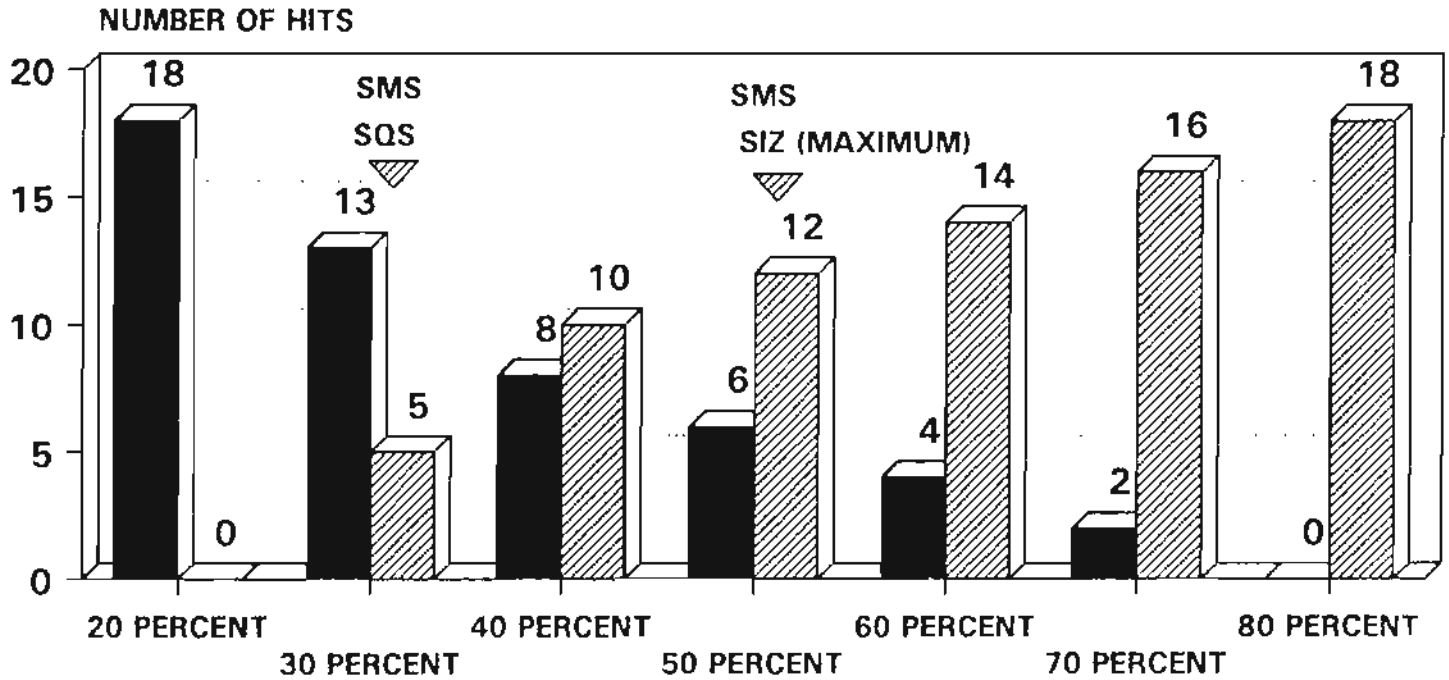
Enclosure 9r

PSDDA Bioassay Costs
With Neanthes Acute Test



Costs shown are mean total costs per sample based on 3 laboratories and a 5-sample project.

INTERPRETATION INFLUENCES ON NUMBERS AND KINDS OF HITS (SINGLE TAILED t-TEST)



SMS = SEDIMENT MANAGEMENT STANDARDS
SQS = SEDIMENT QUALITY STANDARD
SIZ = SEDIMENT IMPACT ZONE

Enclosure 9s

Enclosure 9s

COMPARATIVE NEANTHES 20-DAY AND AMPHIPOD BIOASSAY UTILIZING INTERLABORATORY DATA FOR INTERPRETATION.

STATION/SAMPLE	NEANTHES 20-DAY INTERPRETATION[1]	AMPHIPOD 10-DAY ACUTE[2]
TODD SHIPYARD	NO HIT = 2 2-HIT = 2 1-HIT = 2	2-HIT
25/75 (CI/EB)	NO HIT = 2 2-HIT = 1 1-HIT = 3	2-HIT
50/50 (CI/EB)	NO HIT = 3 2-HIT = 2 1-HIT = 1	NO HIT
EAST WATERWAY	NO HIT = 5 2-HIT = 1	NO HIT
WEST WATERWAY	NO HIT = 5	NO HIT
YAQUINA BAY	NO HIT = 4 2-HIT = 1	NO HIT

[1] Washington State Sediment Management Standards (SMS) interpretation:

NO HIT = test biomass > 80% of control, or ≥ 70% and ≤ 130% of reference sediment.

2-HIT = test biomass between < 70% and 50% of reference sediment, and statistically significant from reference.

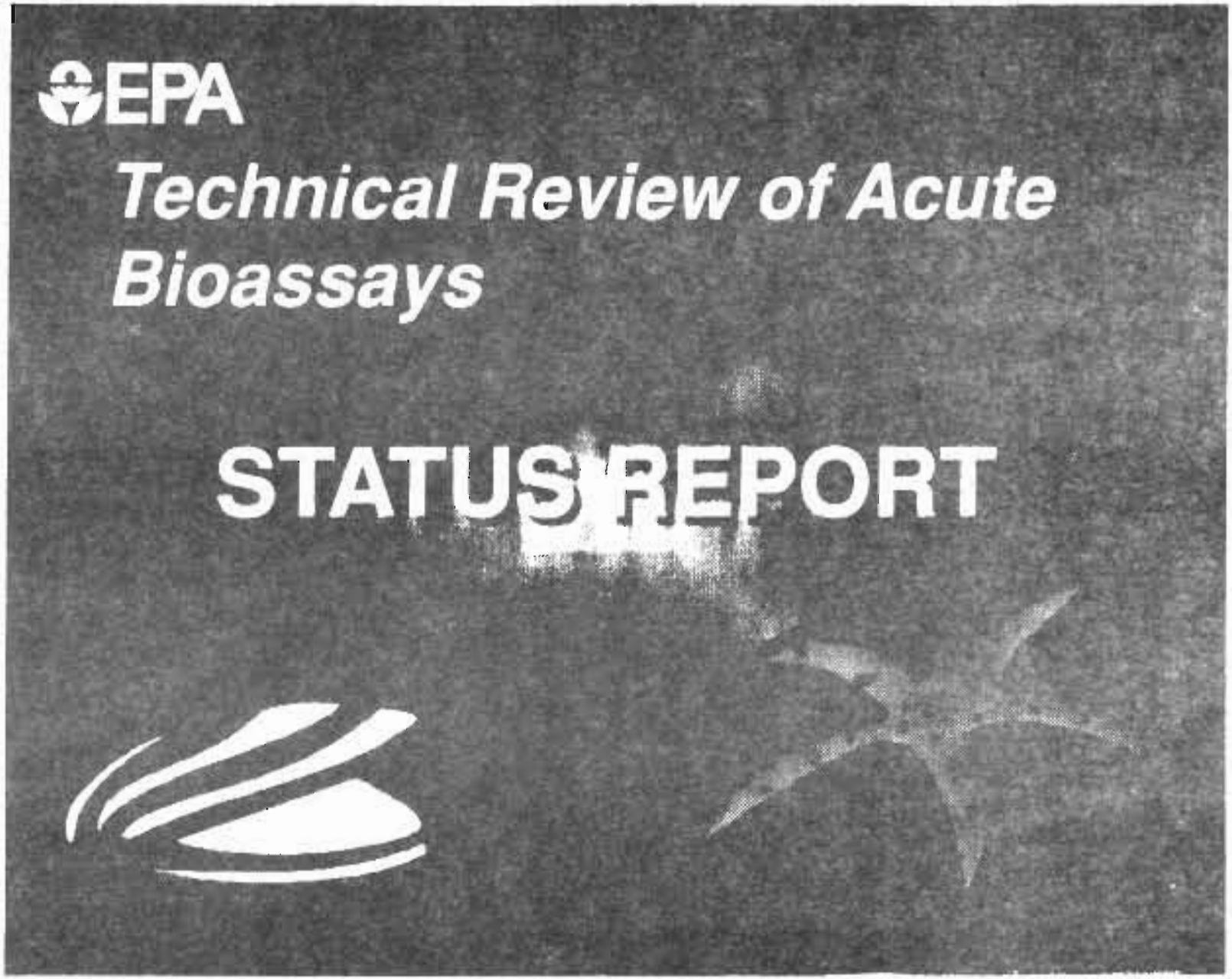
1-HIT = test biomass < 50% of reference sediment, and statistically significant from reference.

[2] PSDDA nondisperisve site interpretation:

NO HIT = test sediment less than 20 percent absolute over control.

2-HIT = test sediment mortality < 30 percent over reference, and statistically significant from reference.

1-HIT = test sediment mortality ≥ 30 percent over reference, and statistically significant from reference.



Enclosure 10a

Enclosure 10a

Enclosure 10b

EPA

Amphipod 10-Day Mortality Test:

Effects of fine grained sediment, ammonia and sulfides on mortality;

Establishing administrative defaults for reference sediment samples; and

Use of reburial as a test endpoint.

EPA

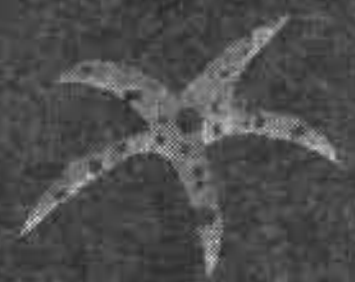
Amphipod Bioassay Status of Work

DAIS data entry

Regression analyses of grain size, ammonia and sulfides, with amphipod toxicity;

Recommendations on establishment of administrative defaults for reference sediments; and

Analyses of the reburial endpoint.



Enclosure 10c

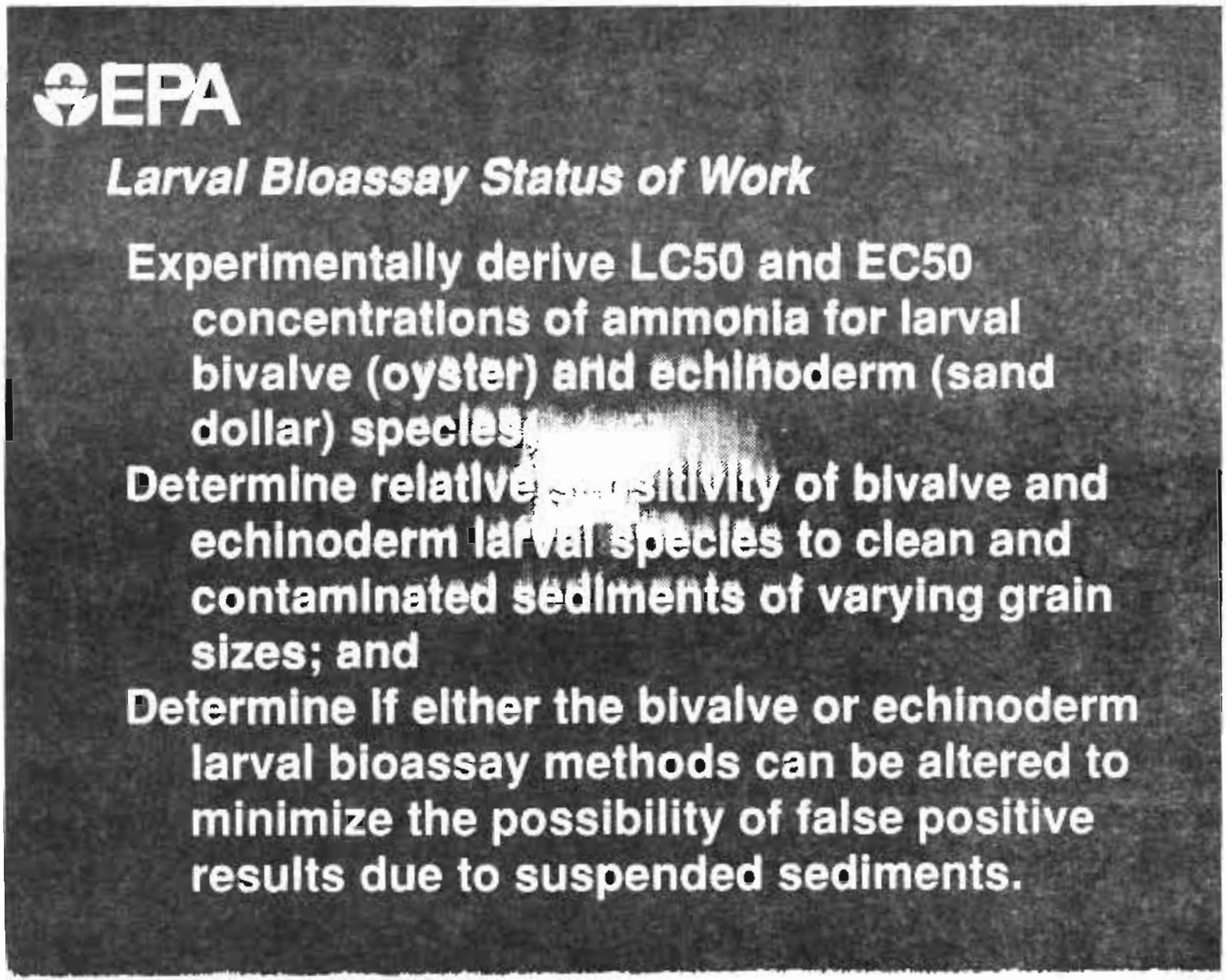
Enclosure 10c

Enclosure 10c

EPA

Sediment Larval Combined Abnormality/Mortality Bioassay:

- Toxic effects of ammonia/sulfides and effects of aeration;
- Relative merits of elutriate v. solid phase test;
- Comparative sensitivity of bivalve and echinoderm species; and
- Difference between using abnormality alone or combined abnormality/mortality endpoint.



Enclosure 10e

Enclosure 10e

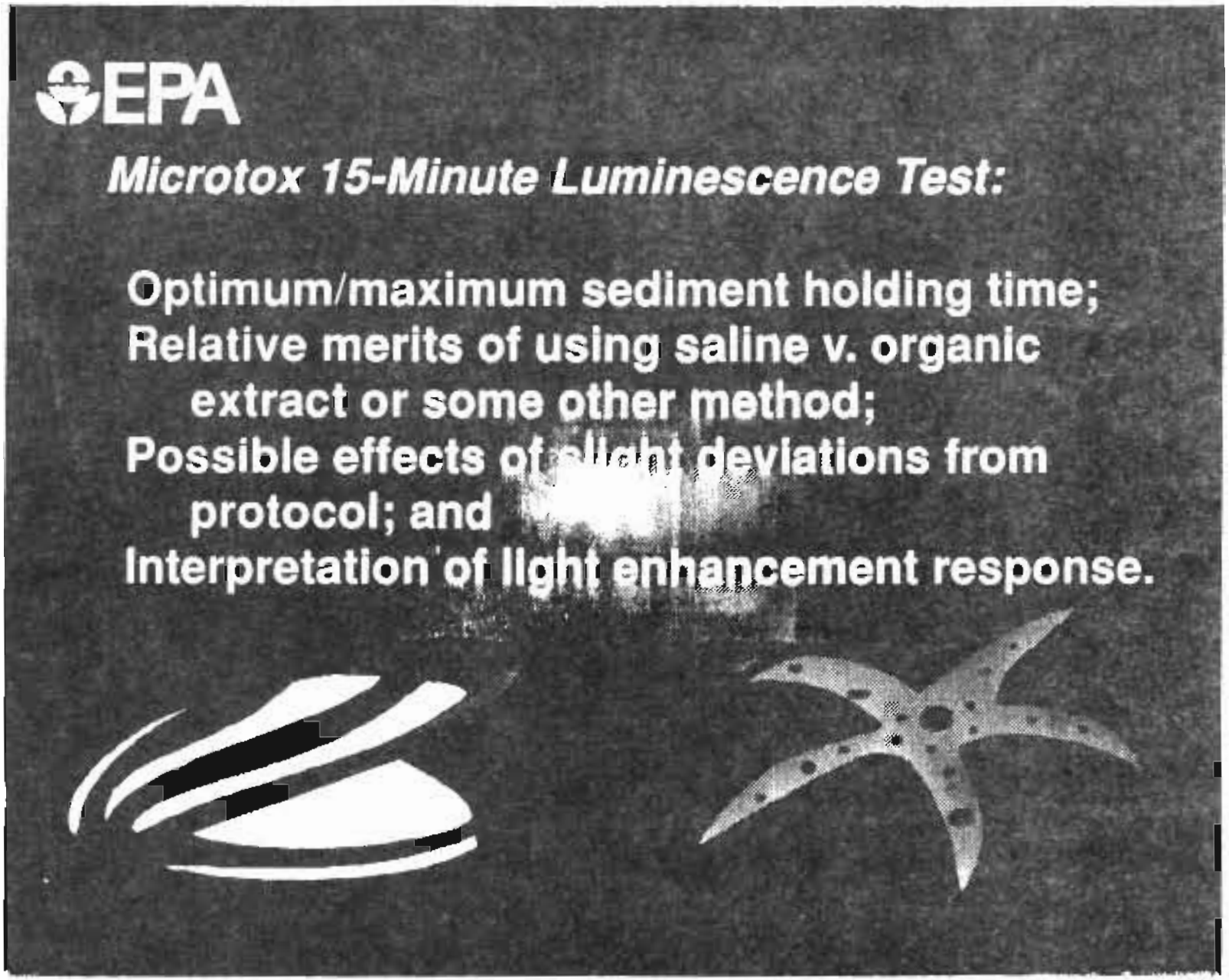
3/12/92

DRAFT

Enclosure 10f

Ammonia Effects experiment, Dendraster excentricus

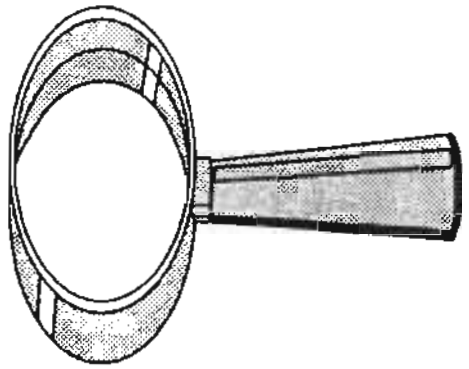
Nominal NH3 Concentration (mg/L)	Un-Aerated		Measured NH3 (mg/L)				Aerated		Measured NH3 (mg/L)			
	% Mortality	% Abnormality	To	Ti	T24	T48	% Mortality	% Abnormality	To	Ti	T24	T48
Control	3.5	10.6	---	---	0.02	0.02	0.0	1.9	---	---	0.02	0.03
0.275	3.6	13.4	0.21	0.21	0.24	0.20	1.3	2.3	0.27	0.22	0.20	0.20
0.625	7.0	10.7	0.63	0.45	0.51	0.48	0.0	3.3	0.52	0.48	0.43	0.34
1.25	9.4	11.2	1.14	1.01	1.01	0.94	0.2	2.9	1.24	0.92	0.84	0.76
2.5	57.1	52.4	1.82	1.92	1.92	1.82	26.1	29.8	2.32	1.93	1.66	1.52
5.0	99.7	91.2	4.26	4.07	3.29	3.15	99.7	90.7	3.86	3.79	3.66	3.07
10.0	99.7	90.2	7.64	7.84	8.00	6.05	99.8	90.4	7.32	8.12	7.11	6.08



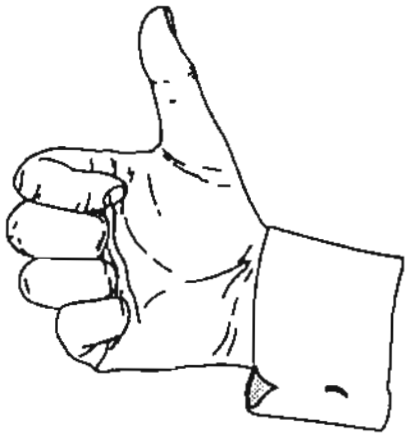
Enclosure 10g

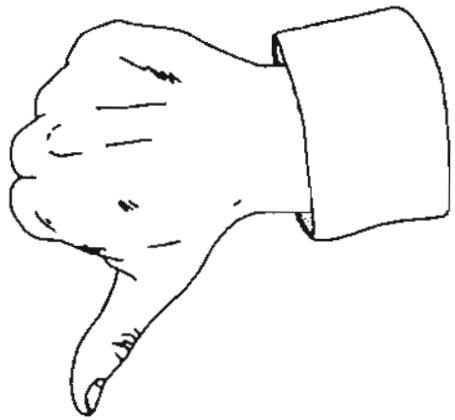
Enclosure 10g

PSDDA PROGRAM



REGULATORY REVIEW





OF BIOASSAYS

Enclosure 11a

Enclosure 11a

Enclosure 11b

REGULATORY DEFINITION

THE CLEAN WATER ACT SECTION 404(b)(1) GUIDELINES SPECIFY THE TYPES OF POTENTIAL ADVERSE EFFECTS TO THE AQUATIC ENVIRONMENT THAT MUST BE CONSIDERED WHEN MAKING REGULATORY DECISIONS ON DREDGED MATERIAL DISPOSAL.

* PERSISTENCE AND PERMANENCE OF EFFECTS, INCLUDING SHORT- AND LONG-TERM EFFECTS ON AQUATIC COMMUNITIES

* POTENTIAL FOR SUBLETHAL EFFECTS SUCH AS IMPAIRMENT TO ANIMAL GROWTH AND REPRODUCTION

SITE CONDITION II DEFINITION

"MINOR ADVERSE EFFECTS, DUE TO CHEMICALS OF CONCERN IN DREDGED MATERIAL, ON BIOLOGICAL RESOURCES" AT THE DISPOSAL SITE (EPTA, 1988).

MINOR EFFECTS ARE DEFINED AS POTENTIAL CHRONIC SUBLETHAL EFFECTS, BUT NO SIGNIFICANT ACUTE TOXICITY WITHIN THE SITE, OR ITS DILUTION ZONE.

Enclosure 11c

Enclosure 11c

Enclosure 11d

PSDDA NONDISPERSIVE GUIDELINES
BIOLOGICAL TEST INTERPRETATION

- TWO HIT: FOR AMPHIPOD, JUVENILE INFAUNAL SPECIES, SEDIMENT LARVAL BIOASSAY OR MICROTOX: ANY TWO BIOASSAY MEAN RESPONSES THAT ARE STATISTICALLY SIGNIFICANT, GREATER THAN 20% OVER CONTROL, AND LESS THAN OR EQUAL TO 30% OVER REFERENCE SEDIMENT.

- ONE HIT: FOR AMPHIPOD, JUVENILE INFAUNAL SPECIES OR SEDIMENT LARVAL BIOASSAY: ANY ONE BIOASSAY RESPONSE STATISTICALLY SIGNIFICANT, GREATER THAN 20% OVER CONTROL, AND GREATER THAN 30% OVER REFERENCE SEDIMENT.

PROBLEM STATEMENT
EVALUATION FACTORS FOR REGULATORY INTERPRETATION

- TECHNICAL AND ADMINISTRATIVE FACTORS
- BIOASSAY PERFORMANCE (FREQUENCY/SUCCESS IN SUITABILITY DECISIONS)
- ECOLOGICAL RELEVANCE OF THE BIOASSAY ENDPOINT (MORTALITY, ABNORMALITY, REBURIAL, LIGHT DIMINUTION/LIGHT ENHANCEMENT, BIOMASS/GROWTH)
- INTEGRATION OF MULTIPLE BIOASSAY RESPONSES RELATIVE TO NONDISPERSIVE / DISPERSIVE INTERPRETATION GUIDELINES (SUITABILITY DECISION FOR DREDGED MATERIAL MANAGEMENT UNIT)

Enclosure 11e

Enclosure 11e

Enclosure 11f

ONGOING DATA ANALYSIS OBJECTIVES

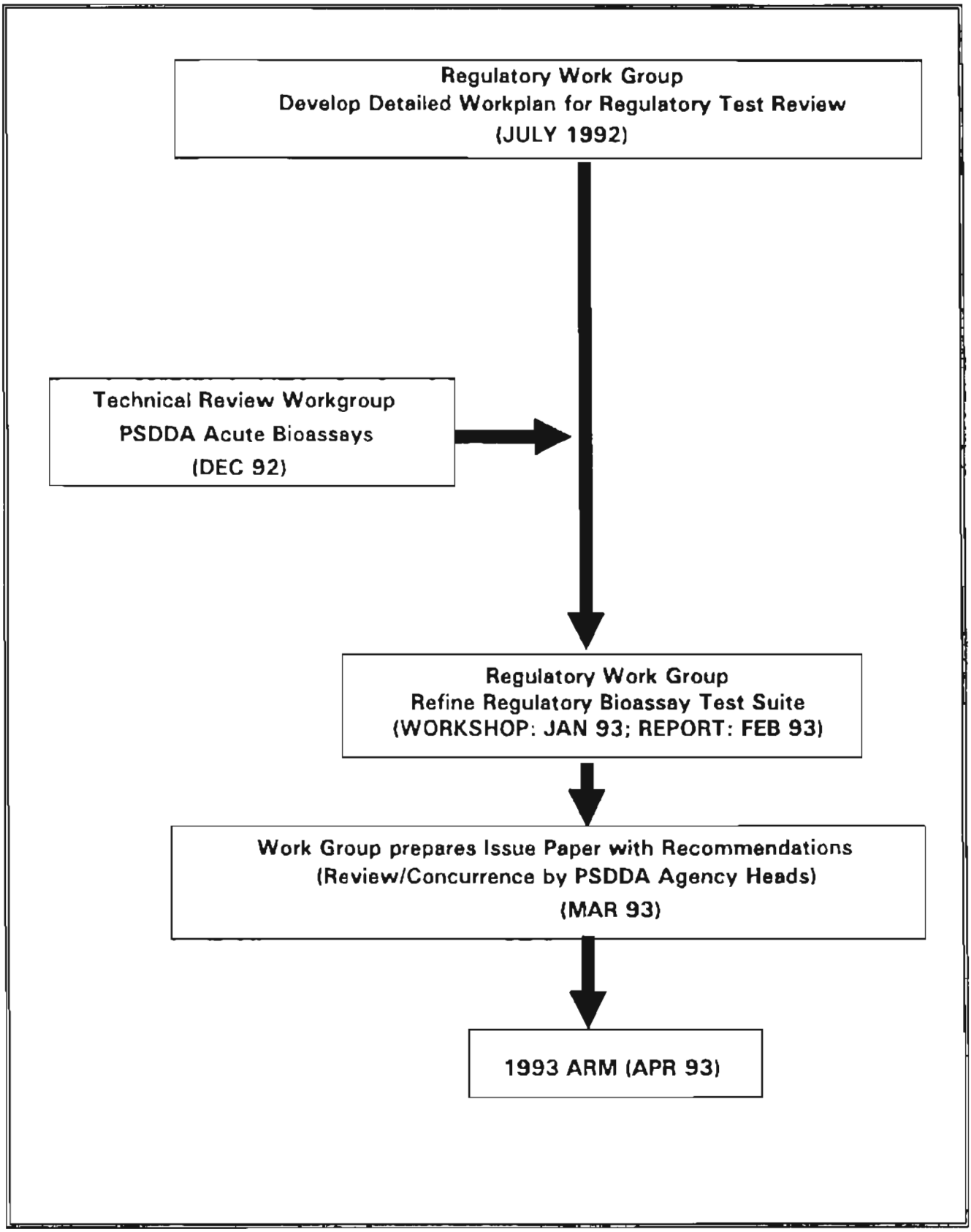
CORPS AND ECOLOGY DATA MANAGERS

- TO EVALUATE ALTERNATIVE ENDPOINTS
- TO EVALUATE REFERENCE AREA POINT DATA TO ESTABLISH REFERENCE AREA DEFAULTS FOR SPECIFIC BIOASSAYS
- TIME TABLE TO COMPLETE THESE ANALYSES IS DECEMBER 1992

Enclosure 11g

POTENTIAL BIOLOGICAL TESTING PROGRAM REFINEMENTS

- MAKE CHANGES TO PROTOCOLS FOR INDIVIDUAL TESTS
- RECOMMEND ALTERNATIVE ENDPOINTS
- ELIMINATE PROBLEMATIC BIOASSAYS
- RECOMMEND ALTERNATIVE TEST SUITE



Enclosure 11h

Puget Sound Dredged Disposal Analysis
1992 Annual Review Meeting

Status Report
BENTHIC COMMUNITY INTERPRETATION

Ecology Study

Convene a benthic experts workshop in November 1992. The PSDDA agencies will be invited to attend. Activities to prepare, conduct and report on the workshop include:

- ❒ Data identification and evaluation;
- ❒ Evaluation of interpretive methods;
- ❒ Mapping of benthic data stations in Puget Sound;
- ❒ Identification of key technical and regulatory issues;
- ❒ Draft and final reports

Enclosure 12a

Enclosure 12a

Enclosure 12b

Puget Sound Dredged Disposal Analysis
1992 Annual Review Meeting

Status Report
BENTHIC COMMUNITY INTERPRETATION

Background

SMS and PSDDA use benthic infaunal abundance to identify adverse effects to biological resources:

SMS - Sediment Quality Criteria - 50% reduction in a major taxa: Crustacea, Mollusca, and Polychaeta compared to reference

PSDDA - Disposal site impacts - 50% reduction in major taxa relative to baseline

Puget Sound Dredged Disposal Analysis
1992 Annual Review Meeting

Status Report
BENTHIC COMMUNITY INTERPRETATION

Problem Identification

Key technical issues have been raised regarding:

- ❒ Collection and analysis methods, e.g., screen size, identification to what taxa level;
- ❒ Statistical power, e.g., number of replicates;
- ❒ Species shifts/impacts vs use of major taxa for analyses; and
- ❒ Interpretation endpoint, e.g., increased sensitivity.

Enclosure 12c

Enclosure 12c

Puget Sound Dredged Disposal Analysis
1992 Annual Review Meeting

Status Report
Results of Puget Sound Reference Area Study

Background

- September 1991 final report titled "Reference Area Performance Standards for Puget Sound" identifies performance standards for 14 chemicals and 6 bioassay endpoints
- Focus of 1991 study on Carr Inlet, Holmes Harbor and Samish Bay
- Approach based on June 1989 "Interim Performance Standards for Puget Sound Reference Areas" and July 1989 EPA Science Advisory Board recommendations

Enclosure 13a

Enclosure 13a

Enclosure 13b

Puget Sound Dredged Disposal Analysis
1992 Annual Review Meeting

Status Report
Results of Puget Sound Reference Area Study

Problem Identification

- To what extent should PSDDA use the bioassay performance standard recommendations, e.g., as administrative defaults?

- To what extent should PSDDA use the chemical performance standards, e.g., to guide selection of acceptable reference areas?

- How should PSDDA use the available reference area station data to guide future activities, e.g., grain size, unacceptable chemical contamination?

Puget Sound Dredged Disposal Analysis
1992 Annual Review Meeting

Status Report
Results of Puget Sound Reference Area Study

Future Actions

- ❒ Assess final report for identification of potential biological performance administrative defaults.
- ❒ Develop a performance standard for the bivalve larvae combined endpoint pending PSDDA's review/modification of test.
- ❒ Incorporate final report reference area data/recommendations into the ongoing review of the Microtox test.

Enclosure 13c

Enclosure 13c

Enclosure 14

APPENDIX D

Management Plan Assessment Report
Dredging Year 1991

Revision of PSDDA Sediment Quality Values: A Status Report

T. H. Gries
Washington Department of Ecology
May 1992

Enclosure 14

STATUS REPORT

REVISING PSDDA CHEMICAL DISPOSAL GUIDELINES: A STATUS REPORT

Prepared by Tom Gries (Ecology, 206/438-7706) for the PSDDA agencies.

INTRODUCTION/BACKGROUND.

The original database developed by PTI Environmental Services, Inc. (1), for use by Ecology in its sediment management programs, contained 23 Puget Sound surveys dating from 1980 to 1988. Twenty of these contained sediment chemistry, bioassay and/or benthic abundance data (Table D-1). The most recent Apparent Effects Thresholds (AETs) (2) were based upon:

- the eleven surveys which measured both the sediment concentrations of chemicals of concern and biological effects, i.e. "synoptic", data;
- specific biological test interpretive endpoints; and
- a step-wise set of standardized statistical procedures for evaluating biological effects.

The PSDDA Management Plan requires sediment quality values used as chemical disposal guidelines, e.g., maximum levels (MLs) and screening levels (SLs), to be re-evaluated each dredging year (3). During the DY 1989 annual review process, PSDDA agencies identified insufficient additional sediment quality data to warrant this effort, and therefore proposed collecting additional data during DY 1990 before re-evaluating MLs and SLs (4). Additional sediment quality data sets were obtained and reviewed during DY 1990, but it was discovered that the required quality assurance information (QA) was generally incomplete (5). As a result, three actions were taken at the 1991 ARM:

- PSDDA agencies collectively clarified the already existing requirement to submit full quality assurance packages, including "QA2" information (6), along with project reports and permit applications (7).
- Ecology stated it would attempt to collect missing QA information associated with older as well as recent data sets; and
- Ecology proposed a schedule for obtaining data, obtaining QA information, resolving dilemmas of alternative bioassay interpretive endpoints, data entry, recalculation of AETs and recommending any changes to PSDDA MLs/SLs.

Despite insufficient QA preventing re-evaluation of the entire SEDQUAL database and suite of chemicals of concern for AETs and PSDDA chemical disposal guidelines, seven SLs were changed during the last two years of PSDDA

implementation (5,7). These changes were made largely at the request of laboratories which had difficulties achieving sample detection limits less than or equal to the respective PSDDA SLs, and did not result in a loss in overall predictive reliability.

Status of Quality Assurance

After the 1991 ARM, Ecology investigated the availability and feasibility of obtaining the QA2 information associated with older dredging projects. An example of the letters Ecology sent to dredging project managers is provided as Attachment 1. Project managers and/or prime contractors were found to be willing to authorize release of the required laboratory QA data to Ecology. In turn, many project managers sent letters to the appropriate laboratories with which they had contracted for services (e.g., Attachment 2), and requested they cooperate with Ecology's efforts to obtain the necessary QA information.

This effort met with limited success, however. One reason for this was that several laboratories indicated it would require a prohibitive amount of staff and/or instrument time to retrieve archived QA2 documentation, or to recreate each analytical run from backup tapes. A second factor was that the laboratories were no longer contractually bound to provide these data to the dredger. Therefore, they found it difficult to commit the resources needed to retrieve the QA2 information without adequate compensation.

Ecology was able to issue a limited-scope contract for QA review services during the summer of 1991. The QA review took place during the summer, and involved approximately 24 stations in Elliott Bay where Seattle METRO had collected and analyzed sediment samples.

Also, the recent DY 1990 clarification requiring QA2 data submittals for all new dredging projects was not completely effective; some of the DY 1991 dredging projects still lacked the QA2 information. The PSDDA agencies are concerned about non-compliance with PSDDA guidelines after a program clarification was made in a public forum. One possible recourse which may be discussed by PSDDA agencies is to withhold suitability decisions until such time as the QA2 information is submitted. However, it is hoped that the DY 1991 clarification on improved communication and data submittals (8) and other measures will ensure submittal of full QA2 information, and that discussing additional action will not be necessary.

Those few projects which have submitted QA2 packages to Ecology have submitted generally complete and reasonably organized ones. However, a detailed QA2 checklist is being developed, as part of the same DY 1991 clarification mentioned above, in order to facilitate uniformity of expectations and presentation of future QA2 packages.

Status of Database Update

The frequent lack of full QA has caused Ecology to somewhat alter its strategy for re-evaluating sediment quality values. And, while Ecology has followed the

general data entry procedure recommended by PTI (1) where only data meeting the full PSDDA QA2 guidelines were admitted to the SEDQUAL database, it always recognized there would be need to admit QA1 data as well. These data could be used, for example, in a different regulatory setting, such as to establish a list of sites exceeding Sediment Quality Standards. So, more recently, data which meet only QA1 guidelines have been admitted to SEDQUAL. In the event that data having only partial QA suggest changing AETs, MLs and/or SLs, full QA2 information would still be required prior to actually recommending changes.

Since June 1989, when Ecology obtained the original SEDQUAL database and software, numerous additional sediment data sets have been obtained and reviewed. These are presented in Table D-2, together with data types, QA and data entry status, etc. There are now approximately 1500 stations and 1600 samples in the SEDQUAL database (Table D-2), representing a 50% and 60% increase, respectively, over the original database. Synoptic surveys, which numbered 11 in 1989 for the Update of Puget Sound AETs (2), now number approximately 37 – nearly a four-fold increase. AETs can now be based on 456 amphipod, 246 benthic, 201 larval, and 190 Microtox samples. Many of these samples are from areas located in relatively clean areas of Puget Sound. These should not drive changes to AETs/PSDDA disposal guidelines. Stations/samples in contaminated areas showing no evidence of biological effects area ones which may cause AETs to change. However, preliminary "hit/no-hit" determinations indicate that contaminated stations/samples usually have demonstrated a toxic response in one or more bioassays.

Progress on Re-evaluating Chemical Disposal Guidelines

As a result of the 1991 ARM, Ecology has obtained most of the raw, supporting data for the 11 surveys used to generate the 1986 and 1988 AETs. PSDDA agencies have discussed both the need to check the influence of conventionals on this historical data and the interpretive endpoints to be used for AET analysis (below). Ecology still is acquiring, reviewing and entering additional data sets. It has nearly completed a preliminary analysis of the amphipod test toxicity and benthic abundance "hit/no-hit" classifications. Larval and Microtox test result have not all been interpreted, or, in the case of some original data sets, reinterpreted.

PROBLEM IDENTIFICATION

The QA difficulties described at the 1991 ARM and in the INTRODUCTION/ BACKGROUND section of this status report remain. Funds are not available (or practical) for reimbursing individual labs or private contractors to re-acquire archived records and/or recontruct analytical runs and convert to paper records. Ecology resources for review of QA2 are limited, but adequate if all QA2 packages were complete and readily available. Ecology has inadequate resources for QA2 acquisition AND review.

During the past six months, Ecology has learned of enough additional sediment quality data (e.g., related to recent remedial investigations) that a major data

set identification/acquisition effort is planned for May through June of this year (see timeline in STATUS OF WORK).

Additional Process Steps

The dredgers continue to request that a "pattern analysis", similar to that presented in the DY 1990 Dredged Material Evaluation Application Report (5) be added to the process of re-evaluating AETs and completed prior to proposing changes to MLs/SLs be made. Also, should PSDDA MLs/SLs be changed, PSDDA agencies foresee the need to assess the implications of those new guideline values to the dredging program.

Other Related Activities

Since the 1991 ARM there have been other significant but related tasks which have effectively competed for Ecology resources. Work on one of these (1992 Update of the Puget Sound Environmental Atlas) has been completed. As of the date of the 1992 ARM, the second competing task – an inventory of sites in Puget Sound which exceed the Sediment Quality Standards – will be more straightforward and require less time to complete than the complex process of recalculating all new AETs.

STATUS OF WORK

There are at least four phases of work related to re-evaluating PSDDA sediment quality values:

- data preparation (acquisition, review and entry);
- data analysis (re-evaluating biological effects "hit/no-hit" data, calculating AETs and reliability, deriving PSDDA MLs and SLs from AETs; and
- conduct pattern analysis and assess implications of new guideline values to the dredging program; and
- issue paper development (internal decision-making process, draft and finalization of issue paper, and presentation at 1993 ARM).

The first two steps are ongoing. All are presented here as a timeline table, together with a breakdown of individual tasks and subtasks (Table D-3). Briefly, data preparation will be completed (QA at least to QA1 level) by July 1, ALL data analysis will be completed by November, and the issue paper will be finalized by February 1993.

REFERENCES

1. PTI. 1989. SEDQUAL User's Guide, version 2.0. Developed for the Washington Department of Ecology by PTI Environmental Services and Tetra Tech, Bellevue.

2. EPA. 1988. Sediment Quality Values Refinement: Volume I. 1988 Update and Evaluation of Puget Sound AET. Prepared for the U.S. Environmental Protection Agency by PTI Environmental Services and Tetra Tech, Bellevue.

3. PSDDA. 1988. Management Plan Report Phase I - Central Puget Sound.

4. Ecology. 1990. Management Plan Assessment Report for Dredged Material Management Year 1989.

5. Ecology. 1991. Management Plan Assessment Report for Dredged Material Management Year 1990.

6. PTI. 1989. Data Validation Guidance Manual for Selected Sediment Variables. Edited Draft Report. Developed for the Washington Department of Ecology by PTI Environmental Services.

7. EPA. 1991. Minutes to 1991 PSDDA Annual Review Meeting.

8. Ecology. 1992. Management Plan Assessment Report for Dredged Material Management Year 1991.

SURVEY	SURV_NAME	YEAR	LEAD AGENCY
ALKI	1982 ALKI Survey	1984	Municip. of Metropolitan Seattle (METRO)
CBBLAIR	Commencmnt Bay RI Blair Waterway Dredge	1984	WA Dept. of Ecology, U.S. EPA Region X
CBMSQS	Commencement Bay RI Main Sed. Qual. Sur.	1984	WA Dept. of Ecology, U.S. EPA Region X
CBPRELIM	Commencement Bay RI Prelim. Survey 1984	1984	WA Dept. of Ecology, U.S. EPA Region X
DUWAM84	1984 Duwamish Head Survey	1984	Municip. of Metropolitan Seattle (METRO)
DUWAM85	Duwamish Head Baseline Survey, '85-'86	1985	Municip. of Metropolitan Seattle (METRO)
DUWRIV1	PSDDA Duwamish River I data set.	1985	U.S. Army Corps of Engineers
DUWRIV2	PSDDA Duwamish River II data set.	1985	U.S. Army Corps of Engineers
EBCHEM	1985 Elliott Bay sediment survey	1985	U.S. EPA Region X
EHCHEM	Eagle Harbor sediment chemistry survey	1985	WA Dept. of Ecology
EIGHTBAY	1985 Puget Sound Eight-Bay survey.	1985	
EPA8283	1982-83 EPA survey of Duwamish River	1982	U.S. EPA Region X
EVCHEM	1985 Everett Hbr. chem. & biota data.	1986	U.S. EPA Region X
EVERETT1	Data from EIS for Navy home-port project	1985	U.S. Navy
GAMPONIA	Gamponia survey of Elliott Bay	1985	Municip. of Metropolitan Seattle (METRO)
MALINS	1980 NOAA OMPA-19 survey of Elliott Bay.	1980	NOAA
NOAA84	Benthic Surveillance 1984	1984	NOAA
PSDDA1	PSDDA Phase I baseline survey	1988	Washington Department of Ecology
TPPS	TPPS Preliminary survey	1981	Municip. of Metropolitan Seattle (METRO)
TPPS3AB	TPPS Phase III A & B	1982	Municip. of Metropolitan Seattle (METRO)

Table D-1. Contents of Ecology's SEDQUAL database as of June 1989; 20 surveys containing sediment chemistry and/or biological data. Surveys from 1980 to 1988.

DataBase Contents	Original SEDQUAL DataBase June 1989	Current SEDQUAL Database May 1992
Surveys with sediment chemistry, bioassay, and/or benthic abundance data	20	>60
Chemistry Stations	987	>1600
Chemistry Samples	975	>2000
Synoptic Surveys	11	>40
Amphipod Samples	287	>460
Benthic Abundance Samples (not including station replicates)	201	>250
Microtox Samples	56	>190
Sediment Larval Samples	50 (oyster)	>200 (several species)

Table D-2. Comparison between Ecology's original and current sediment quality database. Current numbers of stations and samples are conservative approximations due to high rate of data input though June 1992.

Task	Projected Time of Completion
Data Set Acquisition	June 1992
Analysis of Sites Exceeding Sediment Quality Standards	July 1992
Inventory of Sites	August 1992
Biological Analyses for Calculating Apparent Effects Thresholds (AETs)	September 1992
AETs, Reliability Analysis	November 1992
Pattern/Impact Analysis	December 1992
Recommendations for new MLs/SLs to PSDDA agencies	January 1993
Issue Paper	February 1993
Presentation at Annual Review Meeting	March - May 1993

Table D-3. Re-evaluation of sediment quality values: a work plan. Proposed time frames for completion of individual tasks related to the re-evaluation of sediment quality values.

Subject: Release of Quality Assurance Data from Past Dredging Projects

The purpose of this letter is to obtain permission from the to review and obtain copies of required laboratory quality assurance information which we did not receive with recent dredging project data submittals.

The Department of Ecology is charged by the Puget Sound Dredged Disposal Analysis (PSDDA) program to annually recalculate its sediment quality values using the most recent and fully-validated Puget Sound sediment quality data. Many of these data are from dredging projects permitted by the U.S. Army Corps of Engineers (Seattle District) under Section 404 of the Clean Water Act.

Ecology has the final chemistry results for Corps-permitted projects from dredging years 1989-1991. However, we lack certain of the chemical quality assurance (QA) information which PSDDA requires for all data used to recalculate the sediment quality values. For example, instrument calibration data, gas chromatograms and mass spectra associated with the original sediment chemistry sample analyses are typically missing.

It is for this reason that we ask that you authorize your contract lab, to make available to us the chemical QA information which we lack from the (fall 1989) for review and/or copying. We will work with the lab to minimize any disruption this request may cause.

Ecology and the PSDDA agencies want to make it absolutely clear that suitability decisions which have been made will not be altered based on this review of quality assurance information. The information may serve to exclude some data from Ecology's sediment quality database. Or, PSDDA agencies may use additional fully-validated data to revise the current sediment quality values to more predictive/ reliable ones for future regulatory use.

We greatly appreciate your cooperation in our efforts to fully validate your dredging project data for use in recalculating PSDDA sediment quality values. We will contact you soon after receipt of this letter to 1) briefly discuss this with you further, and 2) ask that you provide written authorization to so they will release the quality assurance information we seek.

If you should have any questions about having make these QA data available to us, please feel free to discuss this matter with Tom Gries of my staff (206/438-7706).

Sincerely,

Mike Palko
Department of Ecology
Environmental Review and Sediment
Management Section
MS PV-11
Olympia, WA 98504

The Department of Ecology has contacted our office to obtain information your firm complied on our behalf for the expansion project. They (D.O.E.) are required annually to calculate sediment quality values using the most recent data available. The is one of the areas needed to close out their report for the Puget Sound Dredged Disposal Analysis (PSDDA) program. The recognizes this effort and wants to support D.O.E. in concluding their annual report.

I hereby authorize your firm to provide the Chemical QA information from the project to D.O.E. for their review and/or copying. I believe D.O.E. will be contacting your office directly concerning the information needed.

If you have any questions concerning the information D.O.E. will require, contact Tom Gries (Environmental Review & Sediment Management Section; D.O.E.) at (206) 438-7706. If you have any other questions, please contact my office at your convenience.

Thank you for your help and assistance on this matter.

Sincerely,

Re-Evaluation of Sediment Quality Values
Ecology Responsibilities

- Obtain and assure quality of new sediment chemical and biological data
- Re-evaluate PSDDA Maximum and Screening Levels (MLs/SLs)
- Present results and recommendations at PSDDA Annual Review Meeting (ARM)

Enclosure 14a

Enclosure 14a

Enclosure 14b

Re-Evaluation of Sediment Quality Values
Conclusions from 1991 ARM

- Additional quality assurance (QA) needed
- Ecology would attempt to obtain full QA
- PSDDA clarification requiring submittal of full QA packages
- Timeline proposed for obtaining and assuring quality of new data, evaluating biological effects, calculating Apparent Effects Thresholds (AETs) and recommending any changes to existing PSDDA MLs/SLs

Re-Evaluation of Sediment Quality Values
Quality Assurance of Data

- Dredging project proponents cooperative
- Laboratories generally found cooperative
- Archived QA data (paper or tape) difficult and/or costly to retrieve
- Limited PSDDA agency (Ecology) resources
- Inconsistent submittal of full QA packages

Enclosure 14c

Enclosure 14c

Enclosure 14d

Re-Evaluation of Sediment Quality Values
Data Entry and Analysis Alternative

- Ecology preference for full QA prior to re-evaluation of sediment quality values
- Full QA information difficult to obtain
- Decision made to admit data with partial QA, allowing preliminary re-evaluation of AETs, PSDDA MLs/SLs and overall reliability
- If changes indicated, based on incomplete QA, obtain and review full QA information before final recommendation

Re-Evaluation of Sediment Quality Values
Status of SEDQUAL

Original SEDQUAL	SEDQUAL, Spring 1992
20 sediment chem. surveys	57 chemistry surveys
987 chemistry stations	1500+ chemistry stations
975 chemistry samples	2000+ chemistry samples
11 synoptic surveys:	36 synoptic surveys:
287 amphipod samples	456 amphipod samples
201 benthic abund. samples	246 benthic samples
56 Microtox samples	190 Microtox samples
50 larval samples (oyster)	201 larval samples (>1 sp.)

Enclosure 14e

Enclosure 14e

Enclosure 14f

Re-Evaluation of Sediment Quality Values
Process Steps

- PSDDA process of re-evaluating MLs/SLs:
    - Calculate new AETs
    - Set ML as High AET
    - Recommend SL (1/10th ML or other)
    - Pattern analysis
    - Evaluate impacts of changes
    - Final recommendations

Re-Evaluation of Sediment Quality Values
Additional Needs

- Consensus on biological interpretations for calculating AETs
- Pattern Analysis: sample distribution in relation to actual AETs, MLs, SLs
- Process for PSDDA agencies to review Ecology's recommended changes to MLs/SLs
- Assessment of potential impacts of any changes proposed

Enclosure 14g

Enclosure 14g

Enclosure 14h

Re-Evaluation of Sediment Quality Values
Related Activites

- Update of Puget Sound Environmental Atlas (EPA/PSEP/PSWQA)

- Puget Sound Water Quality Management Plan:

  - Inventory of sites exceeding 1991 chemical or biological Sediment Quality Standards (173-204 WAC)

Re-Evaluation of Sediment Quality Values
Timeline for DY 1993

- Data preparation complete by July 1
- ALL data analysis for inventory of sites exceeding 1991 Sediment Quality Standards complete by late July
- Inventory complete by August 1
- ALL remaining data analysis for recalculating AETs complete (September)

9a

Enclosure 14i

Enclosure 14j

Re-evaluation of Sediment Quality Values
Timeline for DY 1993

- AETs, reliability analysis complete (November)
- Pattern and impact analyses complete (December)
- Recommendations for new MLs/SLs to PSDDA agencies (January)
- Issue Paper complete (February)
- Presentation at ARM (mid-March -- early May)

Appendix E

Dredging Year 1991 Literature Review

A literature review of the dredging year is a required component of the PSDDA Management Plan Assessment Report. This review is an important tool to assess the current technology that may be applicable to PSDDA.

Publications containing information pertinent to dredged material management, sediment testing, and the fate and effects of chemical and sediments were requested from several regulatory and technical sources. National computerized databases were also utilized. From an initial list of several hundred references, 27 were selected as potentially containing issues of interest to the PSDDA agencies. Copies of all of the articles were obtained.

The topics and information are usually well summarized in the abstract of the article. However, some articles present details that aren't in the abstract, but are pertinent to PSDDA. This information is presented after the abstract.

In the opinion of the PSDDA agencies, the information in the literature doesn't warrant raising any new issues at this time. The disposal site monitoring, biological tests, and tiered testing approach used by PSDDA reflect the current state of the art in terms of technical as well as management approach and is consistent with national practices. Rather, we would like to highlight research trends in dredged material management as well as other technical issues that are discussed in the articles. A short summary of these issues follows.

Cost controlling measures are a continuing concern for the PSDDA agencies. Several articles addressed cost saving measures with regard to testing and dredging. Specific subjects included the goals of the "Dredging Research Program" (DRP), practices and problems associated with overloading dredge hoppers and scows, guidelines for vegetative erosion control and various sampling and regulatory approaches, such as compositing, and tiered testing. Several of the cost controlling measures are currently included in the PSDDA protocols. The PSDDA agencies will continue to actively evaluate appropriate cost controlling measures.

Several alternatives for the **evaluation of dredged material** were discussed. Specific subjects included the effect of sediment spatial variance and collection method on two species of Cladoceran, in-situ bioassessment, bioassessment methods that represent several levels of biological organization, testing procedures for PAHs and research on the Microtox bioassay.

Numerous articles addressed **methods of monitoring of dredged material** for aquatic disposal sites. The literature discussed development of computer models that predict the movement, consolidation, erosion and resuspension of disposed material as it falls through the water column and eventually settles. The articles also described instruments that can be used for physical and biological monitoring.

Managing problems and procedure topics were also discussed in the literature. These topics ranged from WES-sponsored research into a better overall managing system to area-specific accounts of managerial practices. Again, the PSDDA agencies are already considering or practicing the advice and conclusions mentioned in the literature.

Copies of the following articles are available from the PSDDA agencies. Please contact Desiree Brown (206/493-2931) of the Department of Ecology if you wish to receive a copy of one or more of these articles.

Site Demonstration of the CF Systems Organic Extraction Process. Staley L.J.; Valentinetti R.; Mcpherson J. Risk reduction Eng. Lab., U.S. Environ. Protection Agency, Cincinnati, OH. J Air Waste Manage Assoc 40 (6). 1990. 926-931.

The CF Systems Organic Extraction Process was used to remove PCBs from contaminated sediment dredged from the New Bedford Harbor. This work was done as part of a field demonstration under EPA's Superfund Innovative Technology Evaluation (SITE) program. The purpose of the SITE program is to provide an independent and objective evaluation of innovative waste remediation processes. The purpose of this paper is to present the results of the SITE demonstration of this technology. Results of the demonstration tests show that the system, which uses liquefied propane, successfully removed PCBs from contaminated sediments in New Bedford Harbor. Removal efficiencies for all test runs exceeded 70 percent. Some operational problems occurred during the demonstration which may have affected the efficiency with which PCBs were removed from the dredged sediment. Large amounts of residues were generated from this demonstration project. Costs for using this process are estimated to be between $150/ton and $450/ton. Disposal of residues is not included in this cost.

As demonstrated by the CF systems economic model, the costs associated with operating this process were affected by several models. These are as follows:

1. The on-stream factor. Fluctuations in this variable significantly affected costs. A decrease in on-stream factor from 85% to 70% increased the cost by 20%.
2. Waste Pretreatment Elimination in the waste pretreatment step to decrease the solids content can result in a 30% savings. Therefore, if the waste is already a pumpable slurry to which no additional water need be added, using this process would be more effective. This savings occurs as a result of reduced volumetric throughput, reduced equipment sizes,and elimination of some pre- and post- treatment steps. Eliminating the need to dilute the waste feed reduces the cost more than any other variable in the economic model.
3. Extraction Unit Costs. Costs specific to the extraction unit account for 53% to 68% of total remediation costs using this process.
4. Sediment excavation and pre- and post- treatment costs. These costs account for 28% to 41% of the total remediation costs.

Regulatory Evaluation of Petroleum Hydrocarbons in Dredged Material: Proceedings of a Workshop Held in Vicksburg, Mississippi on 15-17 March 1988 (Final rept) Clarke, J.U.; Jarvis, A.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab. Report No.: WES/MP/EL-90-11 Jul 90, 138p

A 3-day workshop on the regulatory interpretation of petroleum hydrocarbons in dredged material was conducted at the US Army Engineer Waterways Experiment Station (WES), Vicksburg, Ms. The workshop was held at the request of US Army Engineer Districts, Chicago and New York, and followed an earlier (1986) workshop regulatory evaluation of petroleum hydrocarbons in dredged material. This report is a detailed summary of the second workshop proceedings. Workshop participants, representing government agencies, private industry, and academia, were selected for their expertise in environmental chemistry and biological effects of polycyclic aromatic hydrocarbons

(PAH). The primary objective of the workshop was to develop guidance on scientific interpretation of potential impacts of PAH. Prior to the workshop, participants were asked to submit written answers to specific questions in a provided questionnaire. The questionnaire was divided into three sections: (1) a reexamination of the recommendations of the 1986 PAH workshop, (2) sediment analyses and biological testing for PAH, and (3) the biological effects of PAH. This testing approach should not be considered the final answer to regulatory evaluation of PAH contaminated dredged material, but only as a direction in which Corps Districts may proceed for the present. Considerably more research and information are needed to develop a detailed, comprehensive testing approach for PAH in sediment.

Fifteen priority pollutant PAHs that the workshop participant identified is similar to the PAH chemicals of concern in PSDDA with the exception that they do not include naphthalene. Naphthalene was not included on the participants list because it is considered to be too volatile to give accurate analytical results and too water soluble to persist in sediments. It was felt that a high level of naphthalene would be manifested as mortality in acute toxicity tests (naphthalene is not biologically important in terms of chronic toxicity). Other PAH pollutants, such as the alkyl-, nitrogen- and sulfur-substituted PAH, could have major toxicological importance but require more research before it can be determined whether representative compounds from these classes should be added to the list. The group recommended against analysis for metabolites of PAHs in a routine regulatory program until more research is completed and analytical methods are better established.

Animals having limited ability to metabolize PAH, such as bivalve and mollusc, will generally experience low acute toxicity due to PAH. In assessing the potential for bioaccumulation, organisms that have limited or no ability to metabolize PAH should be used, however these tests can't be compound specific because there are hundreds of compounds in sediment that can cause adverse effects. Aquatic organisms that feed at the sediment surface or are deposit feeders will have maximum exposure to sediment associated PAH. Suggested organisms appropriate for acute toxicity testing include *Mysidopisis, Palaemonetes, Nereis,* and amphipods. Suggested organisms appropriate for bioaccumulation tests include *Macoma* and *Yoldia.*

Biological tests that need to be refined and standardized include assays for carcinogenity, genotoxicity, reproductive effects, and photoinduced toxicity. Many of these adverse effects are probably caused by PAH metabolites rather than the parent (untransformed) compounds. Benz[a]anthracene, chrysene, benzo[a]pyrene, bibenzo[a,h]anthracene, benzo[b&k]fluoranthene have demonstrated carcinogenicity in mammalian systems.

Reliance on biological tests rather than numeric guidelines for PAH in sediment is necessitated by current lack of understanding of the complex factors influencing bioavailbility and toxicity. However, chemical analysis is nonetheless important for interpretation of contaminant tissue residues in organisms exposed to that sediment.

PAHs occur in the sediments and the surface microlayer, but in numerous surveys in New York it was found that it was difficult to measure any PAH 1 m above the bottom or anywhere in the water column. It was suggested that in a regulatory program, one of

the first evaluations should be a measure of immediate bioavailibility, i.e. potential for bioaccumulation.

Most participants agreed that sediment tests for chronic effects should include some assessment of reproduction, such as a partial life cycle test. However, it became obvious that there is no single, specific, sublethal test or even a suite of tests that all participants could agree on at this time. But they did agree on characteristics of a good sublethal test: quick, cheap, use benthic infaunal organisms that are easy to culture and representative of species at the disposal site, assesses lifecycle effects, and produces results that can be related to field organisms and impacts. The participants agreed that using solid phase exposures in the biological tests is vastly preferable to using extract of water fraction.

The Effects of a Contaminated Dredged Material on Laboratory Populations of the Tubicolous Amphipod Ampelisca abdita. Scott K. John and ; Redmond Michele S. Science Applications Inc, Narragansett, RI, ASTM Aquatic Toxicology & Hazard Assessment 12th Conf, Sparks, NV, Apr 24-26, 1988, pp 289(15).

Short-term and full life-cycle toxicity tests were conducted with the benthic amphipod, ampelisca abdita, in assessing the hazards associated with disposal of dredged materials from black rock harbor, ct. The sensitivity of the amphipod's chronic endpoints to a range of contaminated suspended particulate concentrations was investigated. Growth and intrinsic rate of population growth were impaired at all sediment exposures during long-term, 56-d tests. In all cases, the reduction in population growth rate was a function of slower growth of females, causing a longer time to maturity, which was coupled with a reduced egg production at maturity. (3 Diagrams, 16 references, 7 tables)

It is well recognized that acute toxicity data generated from 96-h exposure periods, while useful, are insufficient to identify acceptable concentrations that do not adversely affect growth and reproduction. This limitation has been addressed by the development of chronic toxicity tests designed to assess pollutant effects on survival, growth and reproduction over long periods of exposure, often an entire life cycle. Unfortunately, these chronic effects are measured at the individual organism level of biological organization and are not coupled in a predictive manner to response.

The chronic experiments were designed to simulate the fringe areas of a dredged material mound where suspended sediments are the primary route of exposure. Long term, chronic exposures examined the biological responses to mixtures of contaminated and noncontaminated sediments in the suspended phase with the sediments reduced or fully oxidized.

In the results the amphipod fecundity was affected more dramatically by exposure to oxidized sediments. In both exposures, there were survival problems in the second generation juveniles that were not apparent in the first generation. The results suggest that the long-term exposure of the maturing females to contaminated sediments may affect the viability of developing embryos.

The primary biological response to these sediments is slower growth. Slower growth delayed maturation, increasing the time to first reproduction and decreasing the size of

breeding females. The implication to the population is slower numbers of young being produced over a longer time period, therefore forcing the population out of synchrony with natural breeding cycles which are normally temperature and food-source dependent.

Evaluation of the Toxicity of Marine Sediments and Dredge Spoils with the Microtox Bioassay. Ankley Gerald T., Michigan State Univ, East Lansing; Hoke Robert A.; Giesy John P.; Winger Parley V. Chemosphere, 18(9-10, 1989. pp 2069(7).

The toxicity of sediment and dredge spoil elutriates from several potentially contaminated sites in Mobile Bay, Alabama, and Pascagoula Bay, Mississippi, was evaluated with the Microtox bioassay. The test identified sediment and dredge materials as having slight to moderate toxicity. However, interpretation of toxicity patterns was highly dependent on the type of water used for elutriate preparation and for the assay. Six of the 11 samples were toxic in the distilled deionized water system, while only two were toxic when local seawater was used. (1 Map, 17 references, 3 tables)

Patterns of toxicity were dependent on the type of water used to prepare the elutriates and perform the sample dilutions. Generally, samples prepared and tested using the gulf of Mexico seawater exhibited the same or lesser toxicity than samples prepared and tested in osmotically-adjusted distilled deionized water. This trend was observed both with elutriates of sediment samples and with three reference toxicants.

It is essential that careful consideration be given to a logical choice of test water. The authors believe that the use of the Microtox assay with test solutions of differing osmolarity may prove to be useful for establishing probable causes of observed toxicity.

Toxicity Assessment of Dredged Materials: Acute and Chronic Toxicity as Determined by Bioassays and Bioaccumulation Tests. Proceedings of the International Seminar on the Environmental Aspects of Dredging Activities. Melzian, B.D., Environmental Research Lab., Narragansett, RI. Proceedings of the International Seminar of the Environmental Aspects of Dredging Activities, Nantes, France, November 27-December 1, 1989, Session 1, p49-64. Report No.: EPA/600/D-91/066; ERLN-1123, c1990, 25p

Whenever dredged materials are disposed into the ocean, the potential effects of the materials on human health, fishery resources, and marine ecosystems may range from being negligible or unmeasurable to important. Because these effects may differ greatly at each dredged material extraction or disposal site, each site must be evaluated on a case-by-case basis. In the United States, the manual entitled Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters: Implementation Manual for Section 103 of Public Law 92.532 (Marine Protection, Research, and Sanctuaries Act of 1972) (the 'Implementation Manual' or 'Green Book') was published in 1977 to give guidance on determining the potential biological effects caused by dredging operations. The Green Book provides detailed guidance on the conduct of the required bioassays on the liquid, suspended particulate, and solid phases of a dredged material. In addition, guidance is given on how to conduct the bioassays and bioaccumulation tests. The U.S. Environmental Protection Agency (EPA) recently published a manual that gives guidance on the appropriate length of the bioaccumulation tests (i.e., 28 days), recommended test

species, and conduct of the tests. In the past, the U.S. Food and Drug Administration's 'Action Limits' and international fish and shellfish standards have occasionally been used in the interpretation of dredged material bioaccumulation data. Even though they may be useful in some cases, there are limitations to using Action Limits and international standards when evaluating bioaccumulation test data.

The EPA concluded that the 28-day exposure period for bioaccumulation testing will usually result in tissue concentrations within 80% of the steady state values, especially for important pollutants such as PCBs and DDT.

There are three principal characteristics that all bioaccumulation test species should possess. First, all test species should ingest sediment, Research has shown that ingested sediment is the major uptake route of compound with high n-octanol/water partition coefficients. Second, the test species should be sufficiently hardy in order to survive the duration of the test with minimum mortality. Third, the species should be of suitable size and wet weight to ensure that the detection limits are as slow as possible. Based on EPAs evaluation, five species were recommended as test species. These species are the polychaetes *Nereis diversicolor, Neanthes (Nereis) virens,* and the bivalves *Macoma nasuta, Macoma balthica,* and *Yoldia limatula.*

Bioassessment Methods for Determining the Hazards of Dredged Material Disposal in the Marine Environment. Gentile, J.H.; Pesch, G.G.; Scott, K.J.; Nelson, W.; Munns, W. R. Environmental Research Lab., Narragansett, RI. Published in In situ Evaluations of Biological Hazards of Environmental Pollutants, p31-47 1990. Prepared in cooperation with Woods Hole Oceanographic Institution, MA., and Science Applications International Corp., Narragansett, RI.

Approximately 325 million cubic meters of sediment are dredged annually for navigation purposes in the United States. Of this, 46 million cubic meters are disposed of annually in the ocean. Decisions regarding the ocean disposal of dredged material result, in large part, from bioassessment-based estimates of contaminant exposure and ecological impacts. Predictions of impacts for an individual dredging project are estimated from laboratory determinations of the magnitude, bioavailability, bioaccumulation, and hazards (toxicity) of dredged material contaminants. Disposal site management of individual and multiple dredging projects requires monitoring for contaminant transport, availability and accumulation in biota, and the hazards to ecologically and commercially important populations. Because of their importance, suites of bioassessment methods representing several levels of biological organization have been proposed for predicting and assessing the hazards resulting from the ocean disposal of dredged material.

The biological responses used to assess hazard included: sister chromatid exchange, a measure of genotoxicity that was used to infer bioavailbility and detect the hazard of mutagenic and carcinogenic contaminants, histopathological changes in principle organ systems, biochemical assessment of adenylate energy charge, physiological changes in energetics, measures of somatic growth and reproduction, long term population growth rates, recruitment, recolonization and succession in benthic communities. A description of these biological responses follows:

Adenylate Energy Charge (AEC) is of interest in measuring stress effects because of their central role in energy transformations and regulation of metabolic processes. However, the conclusion was that AEC was neither a useful *in situ* of stress nor laboratory predictor of potential hazard.

The application of sister chromatid exchange (SCE) to polychaete worms and mussels has created a practical tool for studying genetic problems in marine environments. The frequency of SCE increased in organisms exposed to dredged sediments, declined when worms were held in the lab in clean sediments, but increased to field levels upon re-exposure to dredged sediments.

Detected changes in histopathology in several species upon exposure to dredged sediments were observed. The incidence of pathology involving the gastrointestinal tract and gills was directly proportional to the dredged sediment exposure concentration in the laboratory in M. edulis.

Energetics was measured using the scope for growth index (SFG). Upon exposure to contaminated sediments, the changes noted in the SFG were due primarily to a depression in clearance rates (feeding). However, absorption efficiencies, respiration rate, and ammonia excretion were not significantly related to dredged material exposure.

Growth, reproductive and population responses showed a significant and reproducible impairment of function with increasing exposure to dredged material. Somatic growth, reproduction, and population growth rate were the most sensitive responses measured.

Benthic recolonization and community structure were impaired either for longterm or short term, perhaps due to differences in grain size. In addition to analyzing the infaunal populations from sieved grab samples, a vertical imaging technique, REMOTS, was used as a rapid reconnaissance method for sampling benthic mosaics, resolving fine structure of sedimentary fabric, and characterizing successional patterns.

The conclusion is that there is a need for multicompartment models that link subcellular and cellular responses to the whole organism. The data obtained in this study clearly demonstrate that knowledge of the relationships between responses can provide valuable insight into mechanisms of toxic action which then can be used to explain the toxic responses observed at other levels of organization.

In-situ Bioassessment of Dredging and Disposal Activities in a Contaminated Ecosystem Toronto Harbor Ontario Canada. Munawar M.; Norwood W.P.; Mccarthy L.H.; Mayfield C.I. Dep. Fisheries and Oceans, Great Lakes Lab. Fisheries and Aquatic Sci., Ecotoxicol. Div., Can. Cent. Inland Waters, Burlington, Ont. Munawar, M., et al. (Ed.). Developments in Hydrobiology, vol. 54. Environmental Bioassay Techniques and Their Application; 1st International Conference, Lancaster, England, UK, July 11-14, 1988. Xiv+680p. Kluwer Academic Publishers: Dordrecht, Nnetherlands; Boston, Massachusetts, USA. Illus. Maps. Isbn 0-7923-0498-5. 0 (0). 1989 (1990). 601-618.

Dredging, dredge spoil disposal, and effluent disposal loads have severely degraded the water quality in Toronto Harbor, Ontario, Canada. Size-fractionated primary productivity

experiments demonstrated the impact of contamination and nutrient enrichment. Microplankton/netplankton productivity was found to be enhanced, while ultraplankton productivity was inhibited. This trend is attributable to interactions between ameliorating nutrients and toxic pollutants as well as to the differential sensitivity of natural phytoplankton size assemblages to the bioavailable chemical regime. In situ environmental techniques applied were effective and sensitive, and have great potential in the assessment of the ecotoxicology of stressed environments. (5 Graphs, 1 map, 19 references, 5 tables)

The results of this study indicated that dredging caused changes in nutrient and trace metal concentrations. Generally, a decrease in some nutrient concentrations was observed. Production per biomass (p/b) quotients were generally enhanced by dredging and sometimes regained initial levels observed prior to the commencement of dredging. Pprduction per biomass quotients were generally enhanced by dredging and sometimes regained initial levels observed prior to the commencement of dredging operations.

Sediment elutriates, made from the dredged sediments collected from the barges, severely inhibited offshore phytoplankton primary productivity. Thus, there is potential that these sediments will be toxic to natural offshore phytoplankton populations.

It is apparent that both dredging and disposal activities are instrumental in resuspending the bottom sediments. Consequently, changes are made to the productivity of indigenous phytoplankton of the harbor, a fundamental process in sustaining the foodweb. The results indicate that the observed enhancement and inhibition of primary productivity may be the result of complex nutrient/contaminant interactions were not operating under the same conditions as the *in situ* experiments. The indigenous population may also be adapted to such perturbations in the harbor, unlike the sensitive offshore phytoplankton whose primary productivity was severely inhibited.

It was not possible to isolate, in the natural environment, effects of turbidity and the subsequently reduced light penetration which resulted after each dredging and disposal activity. The light penetration was measured before and after each activity, indicating an increased turbidity which could inhibit in situ primary productivity. However, since enhancement rather than inhibition was generally observed in their results, it seems that turbidity may not be a limiting factor.

The Toronto Harbor project has been instrumental in developing, on a large scale, *in situ* bioassessment technology and understanding the complexities of the harbor ecosystem. The techniques applied were successful in elucidating the impact of nutrients and contaminants. The results clearly suggest the need for such *in situ* procedures in addition to complementary assays. The results from the field provide realistic but different conclusions compared to the laboratory assays with sediment elutriates.

Assessment of Dredged Material Toxicity in San Francisco Bay (Final rept). Dillon, T.M.; Moore, D.W. Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab. Report No.: WES/MP/EL-90-20 Nov 90, 42p.

This report is designed to address concerns regarding the potential toxicity of dredged material from San Francisco Bay and to provide input into the San Francisco District's Long-Term Management Strategy for dredged material disposal. To this end, a review of the regulatory history of dredged material management within San Francisco Bay and the development of sediment toxicity tests to assess dredged material is provided. Included in this discussion is a national overview of sediment toxicity, as well as the toxicity of San Francisco Bay sediments. Information gaps are identified and prioritized. Finally, specific research hypotheses are posed that will allow selected technical questions to be addressed by direct experimental examination.

USA Army Corps of Engineers Dredged Material Testing Procedures. Wright T.D.; Saunders L.H. Contaminant Mobility Regulatory Criteria Group, Environmental Lab., U.S. Army Engineer Waterways Experiment Stn., Vicksburg, MS. Environ Prof 12 (1). 1990. 13-17.

The U.S. Army Corps of Engineers has statutory authority to regulate the disposal of dredged material in waters of the Unites States under the Clean Water Act and in the oceans under the Marine Protection, Research and Sanctuaries Act. In carrying out this authority, the Corps has conducted over $100 million of research on dredging and the disposal of dredged material. As required by domestic law and the International London Dumping Convention, the suitability of dredged material for open-water disposal is determined by an ecological effects-based approach rather than consideration of the concentrations of chemical contaminants in the sediments. The rationale for this is that dredged material is a complex mixture of many substances whose bioavailability and potential interactions cannot be predicted merely on the basis of the concentrations of the chemicals of concern. This effect-based approach consists of acute toxicity bioassays which address the benthic and water column environments and contaminant uptake bioassays, which provide information on the potential for bioaccumulation. The procedures followed by the Corps in accordance with U.S. Environmental Protection Agency regulations have significant potential for the evaluation of sediments in general. However, it must be recognized that the disposal of dredged material is usually an instantaneous event (hopper dredges, dump scows), or very short-term (hydraulic pipeline). Thus, acute, rather than chronic, effects are of primary concern.

Environmental Evaluations for Deepening of Richmond Harbor and Santa Fe Channels. Task 4, Chemistry Program. Brown, B.; Kohn, N.P.; Crecelius, E.A.; Ward, J.A.; Bjornstad, B.N. Battelle Pacific Northwest Labs., Richland, WA. Sponsor: Department of Energy, Washington, DC. Report No.: PNL-7614 Sep 90, 233p

Richland, California is an important commercial port in San Francisco Bay. The San Francisco District of the US Army Corps of Engineers (USACE) plans to increase the depth of Richmond Harbor and Santa Fe Channels to -38 feet Mean Lower Low Water (MLLW) to accommodate deep-draft commercial vessels. The total volume of dredged material is expected to be approximately 1.4 million cubic yards. The options for disposal

of the dredged material are aquatic disposal and upland disposal. The purpose of this study was to develop a database on chemical compounds in the dredged material to assist with determination of disposal methods and the need for additional testing. This purpose was accomplished through an extensive field sampling program followed by chemical analysis of samples. Field sampling involved collection of core samples from Santa Fe and Richmond Harbor Channels. Cores were shipped to Battelle/Marine Sciences Laboratory,where they were subsampled for chemical analysis and/or archived by freezing. All sediment and water samples were analyzed for priority pollutants, including metals, organotins, base/neutral semivolatile organic compounds, chlorinated pesticides and PCBs, herbicide acids, and acidic phenols. Sediment samples were also analyzed for oil and grease and total organic carbon. Organophosphorus pesticides and dioxins and furans were measured in selected sediment samples from Richland Harbor Channel and from both sediment and water samples from Santa Fe Channel. 21 refs., 10 figs.,60 tabs.

Ecological Evaluation of Proposed Discharge of Dredged Material from Oakland Harbor into Ocean Waters (Phase 1 of -42-foot project). Word, J.Q.; Ward, J.A.; Strand, J.A.; Cullinan, V.I.; Crecelius, E.A., Battelle Pacific Northwest Labs, Richland, WA. Sponsor: Department of Energy, Washington, DC. Report No.: PNL-7484 Sep 90, 383p.

The US Army Corps of Engineers (USACE), San Francisco District, was authorized by the Water Resources Development Act of 1986 (Public Law 99-662) to deepen and widen the navigation channels of Inner and Outer Oakland Harbor, California, to accommodate modern deep-draft vessels. To help provide the scientific basis for determining whether Oakland Harbor sediments are suitable for offshore disposal, the Battelle/Marine Sciences Laboratory collected sediment cores from 20 stations in Oakland Harbor,evaluated the cores geologically, analyzed sediment for selected contaminants, conducted a series of solid phase toxicity tests with four sensitive marine invertebrates (Macoma nasuta, Nephtys caecoides, Ampelisca abdita, and Rhepoxynius abronius), and assessed the bioaccumulation potential of sediment-associated contaminants in tissues of M. nasuta. Toxicological test results indicate that none of the sediment from the channel-area stations (CH-1 - CH-7), the Merritt Sand samples (MS-1 and MS-2), or the reference sediment sites (PR-C and PR-F) resulted insignificant sediment toxicity to the four species tested. Sediment treatments showing no significant sediment toxicity as well as no significant bioaccumulation included CH-5, MS-1, MS-2, PR-coarse, and PR-fine. Stations that showed little or no significant sediment toxicity, but significant bioaccumulation included SS-2-L (PAHs); TS-1-L (Cu, PAHs,PCBs, tributyltin, and DDE); TS-1-U (tributyltin); TS-5-U (PAHs, PCBs, DDE,and tributyltin); SS-1-U (PB, PAHs, and PCBs); SS-5-L (PAHs, PCBs, and DDE); CH-6 and CH-7 (PAHs, PCBs, and DDE); Ch-4 and CH-1 (Cr), CH-3(DDE).

Dredging Operations Technical Support Program. Guidelines for Physical and Biological Monitoring of Aquatic Dredged Material Disposal Sites (Final technical rept). Fredette, T.J.; Nelson, D.A.; Clausner, J.E.; Anders, F.J. Army Engineer Waterways Experiment Station, Vicksburg, MS, Environmental Lab. Report No.: WES/TR/D-90-12 Sep 90 46p

This report is a preliminary set of guidelines for physical and biological monitoring of aquatic uncontaminated dredged material disposal sites. The need for guidelines on this

subject was one of the items identified at the August 1985 Long-Term Management Strategy Workshop sponsored by the Water Resources Support Center. The resulting guidelines are intended to serve as a working document that can be periodically improved as experience dictates. Emphasis is placed on the establishment of concise objectives and hypotheses, the use of multidisciplinary approaches to developing monitoring programs, and the provision of results that a relevant and useful to site managers. A tiered step-wise procedure to develop a monitoring program is presented, along with a summary of the basic tools and techniques for biological and physical analyses. More detailed information is available in Selected Tools and Techniques for Physical and Biological Monitoring of Aquatic Dredged Material Disposal Sites.

The physical capacity of a subaqueous disposal site and the consolidation characteristics of the dredged material mound must be evaluated. Computer programs (e.g. MOUND) can be used to successfully predict the consolidation of soft soil mounds. This program can also predict the gains in shear strength which are to be expected as consolidation proceeds. However, the soft dredged materials will not develop the shear strength comparable to typical soils.

Although some improvements in the current testing methods and data analysis procedures will provide needed refinements, the laboratory methods and procedures presently in use provide consolidation characteristics for dredged material which can be used to accurately predict the performance of dredged material disposal areas.

The design of subaqueous mounds can significantly affect the amount of settlement to be expected in the mound material.

Although mound behavior can be analyzed for initial planning purposes by using a one-dimensional analysis, the two-dimensional effects involved in mound consolidation should be investigated. A two dimensional approach should be developed for detailed site analysis. This will become more important as one uses the disposal site over the years.

After information is gained into the process of mound formation and the resulting mound shape, this process should be coded for computer analysis. This new code should be combined with the program MOUND and the best hydraulic model for resuspension/ erosion to form a single comprehensive computer model for analyzing subaqueous mound formation and behavior.

In the opinion of the author, the time-release diffusion rates of various contaminants into the water column from the sediments needs to be studied further.

Selected Tools and Techniques for Physical and Biological Monitoring of Aquatic Dredged Material Disposal Sites (Final technical rept). Fredette, T.J.; Nelson, D.A.; Miller-Way, T.; Adair, J.A.; Sotler, V.A. Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab. Report No.: WES/TR/D-90-11 Sep 90, 106p

Monitoring of aquatic dredged material disposal sites may require a variety of physical and biological tools and techniques. Chemical monitoring tools and techniques are not

discussed in this report since this document does not address chemically unsuitable material. In the tiered approach discussed in the companion report ('Guidelines for Physical and Biological Monitoring of Aquatic Dredged Material Disposal Sites'), the lower level tiers may examine primarily physical changes at a site. Changes in physical environment, such as mounding, can result in a navigation hazard or lead to changes in the biological community (e.g., burial), which necessitates biological monitoring. Design of a monitoring program must consider what equipment to use and at what spatial and temporal frequency to sample. These factors will be determined by the level of information required for the question being addressed, given present technical, monetary, regulatory, and political considerations.

Dredging Operations Technical Support Program. Methodology for Analysis of Subaqueous Sediment Mounds. Poindexter-Rollings, M.E. TECH. REP. U.S. ARMY ENG. WATERWAYS EXP. STN., 1990, 122 pp. REPORT NO.: WES/TR/D-90-2

This study developed an analysis method to investigate the behavior of the created subaqueous sediment mounds. Emphasis was placed upon the physical aspects of mound behavior, although the method also includes chemical and biological aspects. The physical aspects of the method were applied to four field sites at which dredged material mounds have been created. The procedure successfully predicted the physical behavior of the constructed dredged material mounds. This method of analysis provides a useful tool for evaluation of subaqueous disposal sites and the dredged material mounds created within these sites; it is equally applicable to analysis of contaminated and uncontaminated dredged material mounds.

Dredging Operations Technical Support Program. User's Guide for Models of Dredged Material Disposal in Open Water. Johnson, B.H. 0664843% , 1990., 105 pp. NTIS Order No.: AD-A219 765/5, REPORT NO.: WES/TR/D-90-5

Mathematical models that account for the physical processes determining the short-term fate of dredged material disposed at open-water sites provide estimates of suspended sediment concentrations in the receiving water and the initial deposition pattern and thickness of material on the bottom. Two such models were developed under the US Army Corps of Engineers Dredged Material Research Program to handle both instantaneous dumps and continuous discharges. The use and limitations of each are presented along with theoretical discussions. Example applications are given in the appendices to illustrate the setup of input data and the display of output from the models.

These models simulate movement of the disposed material as it falls through the water column, spreads over the bottom, and finally is transported and diffused as suspended sediment by the ambient current. There are three kinds:

1.The instantaneous dump model DIFID (Disposal From an Instantaneous Dump) is designed to simulate movement of the disposed material from an instantaneous dump which falls as a hemispherical cloud. In this model a single cloud that maintains a hemispherical shape during convective descent is assumed to be released. The cloud is expected to be a dense liquid therefore a buoyant thermal analysis is appropriate. The

entrainment coefficient associated with the entrainment of ambient fluid into the descending hemispherical cloud is assumed to vary smoothly between its value for a vortex ring and the value for turbulent thermals. see the text for further comparison between the methods. The latest version of DIFID has been applied in connection with the recent modeling of dredged material disposed in Puget Sound.

2.DIFCD (Disposal From a Continuous Discharge) model is designed to compute the movement of material disposed of in a continuous fashion at a constant discharge rate. It can be applied to pipeline disposal operations in which the discharge jet is below the water surface or perhaps to the discharge of material from a single bin of a hopper dredge.

3.DIFHD (Disposal From a Hopper Dredges) model is designed for the continuous opening of doors until the material is disposed of.

In all three models the behavior of the material is assumed to be separated into three phases: convective descent, dynamic collapse , and passive transport diffusion.
All three models require that the dredged material be broken into various solid fractions with a settling velocity specified for each fraction. Input data can be grouped into (a) description of the ambient environment at the site (b) characteristics of the dredged material, (c) data describing the disposal operation and (d) model coefficients.

A wide range of ambient conditions are allowed in model computations. Conditions ranging from those found in relatively shallow and well mixed bays and estuaries to stratified two- layer flow fields can be handled. Bottom topography can be entered as a constant value or can be varied from one grid to another. Two options of ambient current may be selected.

Even though the effect of a bottom slope has been incorporated, a basic limitation still exists in that the bottom can only slope in one direction over the collapsed region i.e., bottom collapse on a "mound" where the collapsing cloud runs down the sides is not treated. Another major limitation of these models is the assumption that once solid particles are deposited on the bottom, they remain there. Therefore these models should be only over time frames in which erosion of the newly deposited material is insignificant.

Dredging Operations Technical Support Program. Methods of Determining the Long-Term Fate of Dredged Material for Aquatic Disposal Sites. Dortch, M.S.; Hales, L.Z.; Letter, J.V.; McAnally, W.H. TECH. REP. U.S. ARMY ENG. WATERWAYS EXP. STN., 1990, 205 pp. NTIS Order No.: AD-A219 763/0, REPORT NO.: WES/TR/D-90-1

To manage an open-water dredged material disposal site, it is essential to know the physical capacity of the site (i.e., how much material should be dumped at the site and what the capability is of the material to remain onsite under various environmental conditions of waves and currents). Long-term management of aquatic disposal sites also requires an understanding of how much area the disposal mound encompasses, when the mound encroaches on the site boundaries, how much material leaves the site, and perhaps where the material ultimately goes. The purpose of this report is to identify

methods that can be used to develop information concerning the long-term fate of dredged material disposed at aquatic sites.
report dealt with the longterm fate of dredged material in disposal sites (erosion, resuspension through years).

Direct application of models that predict longterm management needs of aquatic disposal sites to specific sites can be very costly. Because multiyear, continuous simulations are not economically feasible, a capability for providing longterm guidance must be developed. The common technical approach is to combine a series of short-term simulations into longterm estimates for a specific site.

However, many studies do not have sufficient funding to warrant even these short-term simulations at a specific site. Therefore there is a need for developing a means of economically applying general information to specific sites from a series of short-term numerical simulations of sediment transport at generic sites under a variety of conditions.

This can be accomplished by separating work into 4 tasks:
1. Definition of the range of site characteristics likely to be encountered at a field site.
2. A series of generic disposal sites should be developed for sediment transport modeling from the results of the first task.
3. As the generic simulations are completed, nomographs and the computerization of techniques should be developed
4. Evaluate the nomograph approach by application to specific field sites and further refinement of the approach. In the interim, steadystate and time and rate dependent analytical methods for estimating erosion and mound size could be further developed.

The approach outlined above is probably the most cost-effective, yet technically defensible, means of evaluating erosional characteristics the disposal site. To address questions concerning the transport paths and redeposition issues, analytical plume models could be programmed for use on microcomputers.

Other future research that would provide better means of evaluating the capacity of disposal sites includes the following:

a. Improved techniques for more accurate measurement of deposition and erosion rates are needed.
b. Better physical descriptions are needed for the armoring process in sediment beds and for the variation of fine sediment characteristics with time and stress history.
c. Improved techniques are required for determining the critical shear stress of fine cohesive sediments.

Consolidation and Contaminant Migration in a Capped Dredged Material Deposit. Brannon J.M.; Poindexter-Rollings M. E. U.S. Army Eng. Waterways Exp. Stn., Vicksburg, MS. Sci. Total Environ., 91(0), 1990. pp 115-126.

The effectiveness of capping contaminated dredged material was investigated in a subaqueous depression in the Duwamish Waterway in Seattle, Washington. Field studies were conducted to evaluate the consolidation of the capped material as well as the

movement of contaminants from the dredged material into the uncontaminated cap material. Results showed that most of the dredged material consolidation at this site occurred during the first 2 weeks following capping. Monitoring of contamination concentrations in the capped deposit for 18 months showed no movement of contaminants from the dredged material into the capping material.

Recent laboratory studies have shown that a presence of a 50 cm cap of sand, silt or clay was sufficient to prevent the transfer of contaminants from the dredged material into the biota in the overlying water, even in the presence of bioturbation by large numbers of polychaetes. Additional information on sediment consolidation was obtained from the tiered settlement plates installed at the disposal site prior to filling. Measurements of changes in thickness of the separate layers is possible with this design. The plates also provided a means of monitoring any erosion of the cap since the sandy capping material underwent only minimal consolidation.

The sediment/cap interface was identified visually using the cores that were sampled. The interface is easy to see because of the color and textual differences between the cap (sand) and the dredged material(sandy clay).

Moisture content testing indicated that the content was different between the dredged material and the cap material, a reflection of the differing types of material. According to the moisture data, a definant interface existed between the dredged material and the capping material for the 18 months the capping operation was monitored.

The relatively rapid completion of settlement and dissipation of all excess pore water pressures is attributed to the thinness and initial density of the compressible layer, in conjunction with the presence of a significant surcharge load and location of the compressible material between the two sand layers. The small amount of settlement (76mm) which occurred at the mound indicates that very little movement of pore water associated contaminants will occur. Since consolidation was initially rapid then slowed, if major contamination was to occur, it would have occurred during the initial phases of the study.

There is little reason to suspect that the cap material will be substantially eroded from the site. Results showed approximately 2.5cm change in cap thickness during the entire monitoring program. This change in cap thickness occurred almost immediately after placement.

Consolidation of the dredged material forced pore water into the cap material. However, the data indicated that contaminants in the dredged material didn't migrate into the cap material in detectable quantities. Burrowing organisms, if present, had not penetrated the cap at sufficient depth to mix the contaminated material with the cap material.

Effects of Hopper Dredging and Sediment Dispersion Chesapeake Bay, USA. Nichols M.; Diaz R.J.; Schaffner L.C. Va. Inst. Marine sci., Coll. William and Mary, Gloucester Point, VA. Environ. Geol. Water Sci., 15(1), 1990. pp 31-44.

Hopper dredging operations release suspended sediment into the environment by agitation of the bed and by discharge of overflow slurries. Monitoring of turbidity and suspended sediment concentrations in central Chesapeake Bay revealed two plumes: (1) an upper plume produced by overflow discharge and (2) a near-bottom plume produced by draghead agitation and rapid settling from the upper plume. The upper plume dispersed over 5.7 km2 extending 5,200 meters form the discharge point. Redeposited sediment accumulated on channel flanks covering an area of 6.4 km2 and reached a thickness of 19 cm. Altogether dredging redistributed into the environment an estimated 100,000 tons of sediment or 12 percent of the total material removed. Near-field concentrations of suspended sediment, less than 300 m from the dredge, reach 840 to 7,200 mg/L or 50 to 400 times the normal background level. Far-field concentrations persist 34 to 50 percent of the time during a dredging cycle (1.5 to 2.0 h). The overflow discharge plume evolves through three dispersion phases: (1) convective descent, (2) dynamic collapse, and (3) long-term passive diffusion (Clark and others 1971). The bulk of the material descends rapidly to the bottom during the convective descent phase, whereas the cloud that remains in suspension is dispersed partly by internal waves. Although suspended sediment concentrations in the water column exceed certain water quality standards, benthic communities survived the perturbation with little effect.

A surface profile imaging camera system (SPI) was used to determine in situ thickness of deposited sediment as well as sediment structure, textual, and compositional variations.

Cluster and ordination data analysis of the benthic data did not reveal a clear relationship among stations or evidence of distribution data patterns of resident species that could be related the thickness of the dredged material layers deposited or distance from the channel. Several reasons may explain why macrobenthic assemblages in the vicinity of the channel were not obviously affected by deposition of dredged material: 1. the dredged material was not contaminated by anthropogenic pollutants, 2. the grain size of the material was the same as natural background sediments, 3. the rate of deposition was low, 4. the species in the bay are generally short lived, exhibit flexible life history stages and have high motilities.

Dredging Operations Technical Support Program: Engineering Design and Environmental Assessment of Dredged Material Overflow from Hydraulically Filled Hopper Barges in Mobile Bay, Alabama (Final rept). Clarke, D.G.; Homziak, J.; Lazor, R.L.; Palermo, M.R.; Banks, G.E., Army Engineer Waterways Experiment Station, Vicksburg, MS Hydraulics Lab. Report No.: WES/MP/D-90-4 Sep 90, 354p.

Barge overflow was investigated as a cost-effective option for future dredging needs in Mobile Bay, Alabama. Tests of hopper barge loading characteristics with overflow operations were conducted in Mobile Bay. In theory, overflow would allow denser materials to settle within the barge while less dense materials were shunted overboard. Increased density of barge-held materials would then translate to cost savings via a reduced requirement for transport to a distant approved disposal site. Thus, one major

objective of the study was an engineering evaluation of equipment performance during the tests. A second major objective was to obtain field data for an assessment of the environmental consequences of overflow. In support of both objectives, modeling studies were performed to simulate overflows that would be associated with routine dredging operations. Eight separate tests were conducted. Three tests occurred at a site in lower Mobile Bay, and five tests at an upper bay site. Three tests (one lower bay, two upper bay) involved dredging in maintenance materials, and five tests (two lower bay, three upper bay) involved new work or deepening materials.

Evaluation of Loading and Dredged Material Overflow from Mechanically Filled Hopper Barges in Mobile Bay, Alabama (Final rept). Palermo, M.R.; Zappi, P.A. Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab. Report No.: WES/MP/EL-90-16 Sep 90, 21p

Large mechanical dredges with clamshell buckets are being used for the new-work dredging. Hopper barges are loaded with the dredged material and transported by tug to the disposal site. Mechanical dredging is also the most likely technique for future maintenance. The economic loading of the hopper barges and the potential environmental impact associated with barge overflow during loading are important issues. Keywords: Barge scow, Clamshell, Dredged material, Dredging, Loading, Mechanical dredging, Mobile Bay, Alabama.

In the opinion of the authors, discussions should be initiated with concerned resource agencies to fully balance the environmental concerns associated with overflow and the potential for long term economic advantages of over flow for future maintenance dredging.

Dredging Research Program: Practices and Problems Associated with Economic Loading and Overflow of Dredge Hoppers and Scows (Final rept) Palermo, M.R.; Randall, R.E. Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab. Corp. Report No.: WES/TR/EL-DRP-90-1 Oct 90, 54p

Dredge hoppers and scows are commonly filled past the point of overflow to increase the load. Some Corps of Engineers Districts routinely allow overflow to increase the load, while others do not because of actual or perceived environmental and/or economic reasons. No formal Corps policies or regulations governing overflow have been established, mainly because the required studies have not been performed. A survey of District practices indicates that the question of economic loading and overflow is governed by both project-specific considerations and restrictions imposed by resource agencies. Of 21 Districts with significant hopper or scow workloads, 14 reported restrictions on overflow. The majority of the restrictions were requested or imposed by resource agencies because of environmental concerns. In no case were project-specific data on overflow environmental effects available to support the need for restrictions or to technically justify overflow. Keywords: Barges, Water quality, Scows, Turbidity.

The factors influencing the character of scow overflow are intensity of dredging, degree of water entrainment during excavation, length of time of overflow, and care with which material is placed into the scow.

The overflow of hopper dredges is beneficial when sand is the predominant material because the settling velocity is high enough for the sand to rapidly settle in the hopper dredge during the short filling time. The practice of overflowing when dredging silt and clay with conventional equipment and procedures is questionable because the sediment particle sizes are smaller and settling velocities are lower, which tend to cause the solids to stay in suspension longer. The studies on fine sediments go both ways.

The potential environmental effects due to scow overflow are increased water column turbidity/suspended solids concentrations, depression of dissolved oxygen, release of particle associated contaminants and aesthetic concerns.

Managing Dredged Materials, Engler Robert M. USACE, Vicksburg, VA, Oceanus, Summer 90, v33, n2, p63(7)

Dredged material is a mixture of sand, silt, and clay, and can include rock, gravel, organic matter, and contaminants from a wide range of agricultural, urban, and industrial sources. The short- and long-term chemical, physical, and biological impacts of open-water placement of dredged spoil have been determined by large investigations at numerous sites. The sediment characteristics that most affect the mobility and biological availability of dredged materials are particle size, organic matter content, amount and type of ions, amount of iron and manganese, oxidation/reduction potential, ph, and salinity. For sediments that have been determined to represent a high environmental risk, placement methods favoring containment of potentially toxic substances should be considered. (3 Diagrams, 6 photos)

Clean material has many beneficial uses. These include the development and enhancement of wetlands, and aquatic and wildlife habitat; beach nourishment; land development; offshore mound and island construction; agriculture; mariculture and construction aggregate. The benefits of such positive uses are significant and should receive the highest priority in dredged material management policy.

Much of the dredged material removed during harbor and channel maintenance dredging contains a high proportion of organic matter and clay and is biologically and chemically active. It is usually anoxic and may contain some sulfide. These conditions favor effective immobilization of many contaminants provided that the dredged material is not subject to mixing, resuspension, and transport induced by waves or currents. Course textured sediments that have a low organic content are much less effective in immobilizing metal and organic contaminants.

No simple solution to the placement of dredged material exists, but with proper management, the aquatic environment can offer a logical alternative to land-based sites. The approach of carefully managing open water sites should be considered a primary management solution to a perplexing problem.

Water Resources: Problems in Managing Disposal of Material Dredged from San Francisco Bay. GAO Report RCED-90-18, Nov 89 (76).

USACE estimates that during fy 89-95, about 74.6 million cubic yards of material will need to be dredged from San Francisco Bay and that most of it will be dumped at ocean or bay disposal sites. Needed disposal sites have not been designated because the USACE San Francisco district has not completed required environmental studies. The delay is based on EPA's finding that the district made questionable assumptions about safety in deciding not to study potential disposal sites beyond the continental shelf. Problems have been found in testing guidance, USACE's quality assurance program, inspections, and monitoring efforts which indicate that the district does not have adequate assurance that environmental damage at existing disposal sites is within acceptable levels. (2 Graphs, 4 maps, 2 photos, 3 tables)

Dredging Operations Technical Support Program: Considerations for Reducing the Cost of Testing Dredged Material (Final rept). Pennington, J.C.; Higgins, T.R.; Folsom, B.L.; Brandon, D.L. Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab. Report No.: WES/TR/D-90-7 Apr 90, 25p.

The high cost of chemical analyses and bioassays of dredged material makes it necessary for decision makers to limit testing to that which will sufficiently characterize the sediment to evaluate a selected disposal alternative. This report offers guidance for limiting the amount of testing necessary and considers other factors that could potentially reduce the cost of testing dredged material. The importance of an initial site evaluation to reduce the extent of dredged material testing is stressed. Unless a reason to believe that contamination exists can be established through examination of historical data and other site characteristics, no testing is warranted. The need for testing can sometimes be eliminated by examination of regulatory criteria for categorical exclusions, i.e., circumstances under which no testing is required. Additional cost savings can sometimes be generated during the scoping process by amelioration of the concerns of interested parties prior to preparation of an environmental impact statement. Tiered testing as presented in the Federal Standard is recommended as a cost-reduction approach to material evaluation. The principal advantage of tiered testing is that it can be stopped when sufficient information has been acquired to make a decision regarding the suitability of a given disposal alternative.

Reducing Costs and Improving the Industry: Goals of the Dredging Research Program of the United States. Sheall, I.L. U.S. Army Eng. Waterw. Exp. Stn., Vicksburg, MS. J. COAST. RES., vol. 7, no. 2, pp. 535-542, (1991).

The following is an overview of the U.S. Army Corp of Engineers Dredging Research Program conducted at the U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. The article consists of background information, the managerial structure and the specific work units of the Dredging Research Program.

The COE founded the "Dredging Research Program" (DRP), whose primary mission is to reduce the cost of dredging operations through more effective management and technical methods without increasing the potential risks to the environment or lessening the quality of the CORPS projects. It is managed by the Coastal Engineering Research Center at the Waterways Exp. Center in Vicksberg, Miss. It coordinates research on several aspects of

dredging operations. To more effectively manage this effort the research program was separated into 5 technical problem areas:

1. Analysis of dredged material placed in open water. Among its research projects, the DRP is studying the modeling of hydrologic forces. The program has found that they are a vital factor in avoiding potential environmental impacts and improving the probability of the material remaining at the site where it was originally placed, thus reducing the quantity and expense of required maintenance dredging.

2. Material properties related to navigation and dredging. By using the results from the problem area of material properties, field personnel can determine whether a channel actually needs dredging or whether the physical conditions present actually are showing a false bottom and dredging is not really required. This aids in the selection the correct type of dredge.

3. Dredge plant equipment and system processes. DRP is bringing the latest equipment and innovative management systems to the nations dredging effort to improve technical and economic efficiencies. Improvements in dredging equipment efficiency in such equipment as dragheads in various types of dredged material are being investigated. Cost reduction in nearshore or beach placement is being studied by looking at direct pumpout onto the beach and nearshore placement of material which uses natural forces present to place material on the beach.

4 Vessel positioning, surveying controls and dredge monitoring systems. Reduction in money spent needlessly because dredging vessels were out of position and dredging in the wrong location or cutting deeper then necessary is the goal of much of the research in this problem area. Other work in this area includes improving the measurement of the amount of material actually being dredged to ensure that the government is actually getting its moneys worth.

5. Management of dredging operations. This technical problem area is developing method for providing better information to field personnel in order to make more timely, efficient, and economical decisions throughout the duration of a dredging project. This research includes developing a model of dredging project activities to be used in evaluating the effects of decisions and project changes, developing guidance for optimizing the use of open water sites, and improving dredging cost estimating techniques.

These results are distributed to field offices and industry through proactive and innovative technology transfer program.

The DRP is a far-reaching and aggressive program that is utilizing the experience and expertise gained from the Corps' long involvement in dredging to make improvements in dredging technology and management practices. In view of its primary goal of reducing costs,the DRP is bringing the latest equipment and innovative management systems to the nation's dredging effort with a view of improving technical and economic efficiencies.

Dredging Operations Technical Support Program. Update of the Corps' Environmental Effects of Dredging Programs (FY 89). Engler, R.M.; Patin, T.R.; Theriot, R.F. MISC. PAP. U.S. ARMY ENG. WATERWAYS EXP. STN. , 1990, 35 pp NTIS Order No.: AD-A218 753/2. REPORT NO.: WES/MP/D-90-2

This report presents a broad program-level overview and documentation of the FY 89 activities of the environmental effects of dredging programs. The current thrusts of the programs are field assistance through the Dredging Operations Technical Support (DOTS) program technical assistance aspects, research through the Wetlands Research Program and the Long-term Effects of Dredging Operations Program, and field verification/ demonstration through the DOTS dredged material management aspects. These programs comprise the majority of the studies involved in evaluating the environmental effects of dredging and dredged material disposal.

The following high-priority field-directed technology needs are underway at this time within the dredged material management aspects of the DOTS program:
1. Automated Dredging and Disposal Alternative Management System (ADDAMS): provides the field with tools for designing, evaluating and managing site-specific and area wide dredged material disposal alternatives.
2. Guidelines for biological and physical monitoring of aquatic disposal.
3. Beneficial uses of dredged material.
4. Seasonal restrictions on dredging.
5. Optimizing dredging and dredged material disposal.
6. Decision making application software
7. Framework for comprehensive analysis of migration pathways (CAMP) in confined disposal facilities (CDF).
8. Dredged material chemical costing reduction.

Specific areas of research presently addressed in the Long-Term Effects of Dredging Operations (LEDO) program include the following:
1. Bioaccumulation and biomagnification in the aquatic environment.
2. Development and assessment procedures to reduce adverse impacts.
3. Animal bioassay procedures.
4. Effluent Quality.
5. Sediment Geochemistry.

The Dynamics of Community Succession in Subtidal Soft Bottoms off Brittany France. Hily C.; Glemarec M. Laboratoire d'Oceanographie Biologique, Faculte des Sciences, Universite de Bretagne Occidentale, Brest Cedex, France. Oceanol Acta 13 (1). 1990. 107-116.

The study of different sites during long-term monitoring or after initial perturbations (dredgings, oil-spills...) reveals recolonization scenarios which do not differ greatly from each other despite different time-scales. The concept of ecological groupings based on sensitivity to hydrocarbons and to organic matter overload permits interpretation of the successional dynamics models of Connell and Slatyer in a highly fluctuating environment. In the first example, perturbation by intensive dredging, followed recolonization, in the hypertrophic muddy areas of the rade de Brest is described. The second example

describes the total disappearance and gradual recovery of macrofauna after an oil-spill in the Abers of Northern Brittany. The third example concerns stable muddy areas of South Brittany, where biogenic modifications by autogenic processes of the entire areas can be observed over a 25-year scale. The successional scenarios allow for five phases (A: latency phase; B: opportunist proliferation; C: maximal diversity; D: monospecific monopolization; and E: ectonal phase). Each phase is driven to the next by a predominating mechanism: facilitation, tolerance or inhibition. This descriptive approach suggests that biotic interactions are important factors on the functional relationships relevant for succession. Biotic interactions have to be considered, even if they are not proven by an experimentally based approach.

Effects of Change in Turbidity and Phosphate Influx on the Ecosystem of the Ems Estuary as Obtained by a Computer Simulation Model. Degroodt E.G.; De Jonge V. N. Delft Hydraulics, Delft, Neth. 18Th Symposium of the Estuarine and Brackish-Water Sciences Association, Newcastle Upon Tyne, England, UK, August 29 - September 2, 1988. Hydrobiologia, 195(0), 1990. pp 39-48.

In the Ems estuary the gradients in the concentration of nutrients and in turbidity (the factors that mainly determine the amount of carbon assimilated by phytoplankton) are steep. The effects of changing the turbidity in the estuary and the amount of phosphate discharged by the rivers Ems and Westerwoldsche Aa were analyzed, using the simulation model developed by BOEDE (Biological Research Ems-Dollard estuary). The results of several sensitivity runs were compared with the standard run.

A 50% reduction of turbidity led to a strong increase in phytoplanton biomass, especially in the inner parts of the estuary where turbidity is high. On average, the effects are two to three times larger for the inner part than for the outer part of the estuary. When the turbidity doubles the opposite occurs resulting in a significant decrease of phytoplankton biomass in the upper reaches. In the lower reaches of the estuary a 50% reduction in the river discharge of phosphate is largely compensated for by changes in phosphate transport from the North Sea. This results in a nearly unchanged primary reduction in the lower reaches as compared with the standard run.

In the upper reaches a 50% reduction of phosphate loads results in a strongly reduced primary production. In general, the zooplankton groups (copepods and microzooplankton) are influenced less than the phytoplankton. Benthic fauna is hardly influenced, except for filter feeders; which are strongly affected by the total density of the particles, a parameter which also is directly related to turbidity.

WASHINGTON PUBLIC PORTS ASSOCIATION

Enclosure 16

May 15, 1992

Mr. Brian R. Applebury
Acting Chief, Operations Division
Seattle District
U.S. Army Corps of Engineers
P.O. Box 3755
Seattle, WA 98124-2255

Dear Mr. Applebury,

This is a comment letter on the Puget Sound Dredged Disposal Analysis (PSDDA) program, submitted though the public comment mechanism of the 1992 PSDDA Annual Review. These comments are intended to formalize the verbal comments made by the Washington Public Ports Association at the Annual Review on May 8, 1992.

Our first comment relates to the pattern analysis work being performed by the Washington Department of Ecology (WDOE), at the original request of the port districts. We are pleased to hear that WDOE is continuing to work on this issue. We understand that this work will be finished in December 1992, and that a coordination meeting with WPPA will be held this fall.

Our second comment is that we strongly believe that the new 20-day chronic Neanthes bioassay test should only be incorporated in the PSDDA process after a very careful review of its effects on the overall PSDDA program. While we support solid scientific progress on a test to measure chronic benthic effects, we remind the PSDDA agencies that a new chronic test must be carefully reviewed prior to its permanent incorporation into the formal PSDDA suitability decision process.

With this understanding, we support the one-year probation for the 20-day Neanthes test, in order to gauge the test's impacts on overall volumes determined suitable for open-water disposal, testing costs, laboratory compliance, and other issues. We must also remember that although this test has been incorporated into the State of Washington's sediment management standards, it was done so with the understanding that any subsequent applicability to PSDDA would be debated through the PSDDA Annual Review process. (See Washington Administrative Code 173-224-410)

Enclosure 16

P.O. Box 1518 • Olympia, Washington 98507 • (206) 943-0760 • Fax 753-6176 • 1501 Capitol Way • Suite 301

We also wish to reiterate our comment at the Annual Review clarifying that project proponents are welcome to meet with PSDDA agency review staff at any time to discuss issues relating to their project. These meetings can prevent miscommunications or misunderstandings regarding agency expectations, especially on large or complicated projects.

Finally, we ask that the Department of Ecology give a progress report at the 1993 Annual Review on local government's incorporation of the model shoreline master program element contained in Exhibit E of the PSDDA Management Plan Technical Appendix.

Thank you for this opportunity to comment. Please call me at (206) 943-0760 if you have any questions.

Yours truly,

WASHINGTON PUBLIC PORTS ASSOCIATION

Eric D. Johnson
Environmental Specialist

c: John Malek, EPA
Mike Palko, WDOE
Ann Morgan, WDNR
Puget Sound port districts

Environmental Protection Agency
1200 Sixth Avenue Seattle WA 98101
Idaho Oregon Washington

EPA

Reply to ATTN of: WD-128

JUN 2 6 1992

Colonel Walter J. Cunningham
Corps of Engineers
Post Office Box C-3755
Seattle, Washington 98124-2255

Enclosure 17

Dear Colonel Cunningham:

This letter replies to your letter of June 19, 1992, and provides the concurrence of Region 10, Environmental Protection Agency (EPA) to implement the 20-day *Neanthes* bioassay for dredged material evaluation as part of the Puget Sound Dredged Disposal Analysis (PSDDA) program.

Region 10, EPA, is one of the agencies responsible for developing and implementing the PSDDA program. With the other PSDDA agencies (U.S. Army Corps of Engineers, Washington State Departments of Ecology and Natural Resources), we participated in the development work for this sediment evaluation test and in the expert and administrative review during the last three years that have resulted in the recommendation by technical staff that the *Neanthes* 20-day biomass bioassay be included as an integral part of the suite of bioassay tests currently used to evaluate sediment quality. This test would replace the presently-used 10-day *Neanthes* test.

Under the PSDDA program, the 20-day test would undergo a "trial" period of one dredging year, beginning with dredging year 1993 (June 16, 1992 - June 15, 1993). This trial period will allow the PSDDA agencies to determine the performance of this test as part of the suite of bioassays and to ascertain any efficiency or sensitivity changes. At the end of the trial period, an issue paper will be prepared and presented at the fifth Annual Review Meeting. It is our understanding and expectation that the 20-day test will continue to be used routinely after the trial period unless our mutual experience suggests otherwise.

The *Neanthes* 20-day test has been adopted by the State of Washington as part of their sediment quality standards (Sediment Management Standards, Chapter 173-204 WAC), which have also been approved by EPA as part of the State of Washington's Water Quality Standards. We regard the test as an appropriate tool for the assessment of sediment quality, including the regulatory determination of suitability of dredged material for unconfined open-water disposal. As such, we expect it to be a positive addition to the suite of bioassays already in routine use in this region. EPA will consider the results of the *Neanthes* 20-day test with the other bioassays in our determination of the suitability of dredged material for unconfined open-water disposal and compliance with the Section 404(b)(1) Guidelines.

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As we have noted in past discussions with your staff, EPA does not regard the use of this test as providing the final word on chronic or sublethal effects of potentially contaminated sediments. EPA labs, often in conjunction with Corps labs, are continuing to work on other potential tests that appear to have promise (e.g., amphipod chronic-sublethal endpoints), but are not as far along as the *Neanthes* 20-day test. We have great expectations that these other tests will provide better tools for sediment evaluation and regulatory use than those we presently have. As improved bioassay tests and other regulatory tools come along, EPA will continue to seek their inclusion into regional programs. EPA staff and management will continue to work with the Corps and the State of Washington to promote and enhance our leadership position in managing dredged material.

If there are any questions, please contact John Malek, Regional Dredging and Ocean Dumping Coordinator, at (206) 553-1286.

Sincerely,

for Dana A. Rasmussen
Regional Administrator

cc: Chuck Clarke, Ecology
Brian Boyle, DNR

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P O BOX C-3755
SEATTLE, WASHINGTON 98124-2255

REPLY TO ATTENTION OF

JUN 19 1992

Operations Division

Dana A. Rasmussen, Administrator
Environmental Protection Agency,
Region X
1200 Sixth Avenue
Seattle, Washington 98101-3188

Dear Ms. Rasmussen:

The technical staffs of the four Puget Sound Dredged Disposal Analysis (PSDDA) agencies (U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, Washington State Departments of Ecology and Natural Resources) are recommending the implementation of the 20-day Neanthes bioassay for dredged material evaluation. The recommendation is based on test development work to date, and the input of technical experts, the regulated community and the public. The Seattle District, U.S. Army Corps of Engineers, one of the agencies responsible for implementing the PSDDA program, agrees with technical staff of our four PSDDA agencies that the juvenile Neanthes 20-day biomass bioassay should be included as an integral part of the suite of bioassays currently used. This bioassay would be required for a "trial" period of one dredging year, beginning with dredging year 1993 (June 16, 1992 - June 15, 1993).

During the one-year "trial" period, the test will be used in the biological testing suite of the PSDDA program to evaluate the suitability of dredged material for unconfined openwater disposal as part of the State of Washington's water quality evaluation. The Neanthes 20-day test has been adopted by the State of Washington as part of their sediment quality standards (Sediment Management Standards, Chapter 173-204 WAC), which were recently approved as part of the State's Water Quality Standards, and are now part of the State's regulatory program. The "trial" period will allow us to verify in an operational mode that the test meets expectations of the PSDDA program. The 10-day Neanthes mortality test would no longer be required.

To implement this test we need the official concurrence of the four PSDDA agencies. Consistent with the established procedures of the PSDDA program, agreement by all four PSDDA agencies is required before this change in the PSDDA dredged material evaluation procedures can be implemented. Accordingly, you are asked to indicate your agency's concurrence by June 30, 1992, so that we can advise those proposing to do testing of the changed requirement as soon as possible.

During the one year "trial period" our agencies will evaluate data pertaining to the test's use, performance and sensitivity in the biological testing suite. An issue paper will be prepared summarizing results and presenting the basis for adopting the test for long-term use. The issue paper will be presented at the fifth Annual Review Meeting in April/May 1993.

I will be happy to answer any questions you have, or your staff may contact Dr. David R. Kendall, Chief of the Dredged Material Management Office at (206) 764-3768.

Sincerely,

Walter J. Cunningham
Colonel, Corps of Engineers
District Engineer

Enclosure

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Mail Stop PV-11 • Olympia, Washington 98504-8711 • (206) 459-6000

June 29, 1992

Colonel Walter J. Cunningham
District Engineer, Seattle
U.S. Corps of Engineers
Post Office Box C-3755
Seattle, WA 98124

Dear Colonel Cunningham:

The Washington Department of Ecology is pleased to concur with the other Puget Sound Dredged Disposal Analysis (PSDDA) agencies to the incorporation of the 20-day growth Neanthes bioassay, a chronic/ sublethal test, as part of the PSDDA suite of bioassays.

Ecology agrees the test will be implemented beginning June 15, 1992 for a one year "trial period." At the end of this year, the PSDDA agencies will assess its performance and decide whether the test should be incorporated in the suite of bioassays on a permanent basis.

If there are any additional coordination or implementation needs, please call me at (206) 459-6168 or contact Greg Sorlie, Program Manager for Central Programs at (206) 459-6037.

Sincerely,

Fred Olson

FOR Chuck Clarke
Director

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX C-3755
SEATTLE, WASHINGTON 98124-2255

REPLY TO ATTENTION OF

Operations Division

JUN 19 1992

Mr. Charles Clark, Director
Washington State Department of Ecology
Mailstop PV-11
Olympia, Washington 98504

Dear Mr. Clark:

The technical staffs of the four Puget Sound Dredged Disposal Analysis (PSDDA) agencies (U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, Washington State Departments of Ecology and Natural Resources) are recommending the implementation of the 20-day Neanthes bioassay for dredged material evaluation. The recommendation is based on test development work to date, and the input of technical experts, the regulated community and the public. The Seattle District, U.S. Army Corps of Engineers, one of the agencies responsible for implementing the PSDDA program, agrees with technical staff of our four PSDDA agencies that the juvenile Neanthes 20-day biomass bioassay should be included as an integral part of the suite of bioassays currently used. This bioassay would be required for a "trial" period of one dredging year, beginning with dredging year 1993 (June 16, 1992 - June 15, 1993).

During the one-year "trial" period, the test will be used in the biological testing suite of the PSDDA program to evaluate the suitability of dredged material for unconfined openwater disposal as part of the State of Washington's water quality evaluation. The Neanthes 20-day test has been adopted by the State of Washington as part of their sediment quality standards (Sediment Management Standards, Chapter 173-204 WAC), which were recently approved as part of the State's Water Quality Standards, and are now part of the State's regulatory program. The "trial" period will allow us to verify in an operational mode that the test meets expectations of the PSDDA program. The 10-day Neanthes mortality test would no longer be required.

To implement this test we need the official concurrence of the four PSDDA agencies. Consistent with the established procedures of the PSDDA program, agreement by all four PSDDA agencies is required before this change in the PSDDA dredged material evaluation procedures can be implemented. Accordingly, you are asked to indicate your agency's concurrence by June 30, 1992, so that we can advise those proposing to do testing of the changed requirement as soon as possible.

During the one year "trial period" our agencies will evaluate data pertaining to the test's use, performance and sensitivity in the biological testing suite. An issue paper will be prepared summarizing results and presenting the basis for adopting the test for long-term use. The issue paper will be presented at the fifth Annual Review Meeting in April/May 1993.

I will be happy to answer any questions you have, or your staff may contact Dr. David R. Kendall, Chief of the Dredged Material Management Office at (206) 764-3768.

Sincerely,

Walter J. Cunningham
Colonel, Corps of Engineers
District Engineer

Enclosure

Brian Boyle
Commissioner of Public Lands

July 8, 1992

Colonel Walter J. Cunningham
US Army Corps of Engineers
PO Box C-3755
Seattle, WA 98124-2255

Dear Colonel Cunningham:

This letter is official concurrence that the Washington State Department of Natural Resources (DNR) fully supports the "trial" implementation of the 20-day Neanthes bioassay in the Puget Sound Dredged Disposal Analysis (PSDDA) program for dredging year 1993 (June 16, 1992 - June 15, 1993).

The DNR has been an active participant in the evaluation of the 20-day Neanthes bioassay. DNR staff agrees with their PSDDA agency colleagues and the technical experts that this test is ready for implementation as part of PSDDA's biological testing suite for the evaluation of dredged material for unconfined open-water disposal. DNR also agrees with the trial period approach which will allow PSDDA technical staff to verify in operational mode that the test meets program expectations.

The PSDDA program has proven to be an effective dredged material management program. The DNR believes a major reason for this success is the Program's emphasis on technical refinement and improvement. The development and trial implementation of the 20-day Neanthes test is a prime example of PSDDA's innovative focus. The DNR looks forward to our continued participation in the PSDDA program.

Sincerely,

Brian J. Boyle
Commissioner of Public Lands

BB:gr

c: Chuck Clarke, Ecology
Dana Rasmussen, EPA Region X
Phil Hertzog, DNR

Department of Natural Resources
Olympia, Washington 98504
(206) 753-5337

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O BOX C-3755
SEATTLE, WASHINGTON 98124-2255

REPLY TO ATTENTION OF

JUN 19 1992

Operations Division

Mr. Brian Boyle
Commissioner of Public Lands
Washington State Department of Natural Resources
Olympia, Washington 98504

Dear Mr. Boyle:

The technical staffs of the four Puget Sound Dredged Disposal Analysis (PSDDA) agencies (U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, Washington State Departments of Ecology and Natural Resources) are recommending the implementation of the 20-day Neanthes bioassay for dredged material evaluation. The recommendation is based on test development work to date, and the input of technical experts, the regulated community and the public. The Seattle District, U.S. Army Corps of Engineers, one of the agencies responsible for implementing the PSDDA program, agrees with technical staff of our four PSDDA agencies that the juvenile Neanthes 20-day biomass bioassay should be included as an integral part of the suite of bioassays currently used. This bioassay would be required for a "trial" period of one dredging year, beginning with dredging year 1993 (June 16, 1992 - June 15, 1993).

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To implement this test we need the official concurrence of the four PSDDA agencies. Consistent with the established procedures of the PSDDA program, agreement by all four PSDDA agencies is required before this change in the PSDDA dredged material evaluation procedures can be implemented. Accordingly, you are asked to indicate your agency's concurrence by June 30, 1992, so that we can advise those proposing to do testing of the changed requirement as soon as possible.

During the one year "trial period" our agencies will evaluate data pertaining to the test's use, performance and sensitivity in the biological testing suite. An issue paper will be prepared summarizing results and presenting the basis for adopting the test for long-term use. The issue paper will be presented at the fifth Annual Review Meeting in April/May 1993.

I will be happy to answer any questions you have, or your staff may contact Dr. David R. Kendall, Chief of the Dredged Material Management Office at (206) 764-3768.

Sincerely,

Walter J. Cunningham
Colonel, Corps of Engineers
District Engineer

Enclosure

POST-ARM MEETING ISSUE RESOLUTION SUMMARY

On May 28, 1992, representatives from the PSDDA agencies met to discuss Annual Review Meeting (ARM) issues that required additional interagency discussion and clarification. A summary of decisions/actions from this meeting are discussed below.

- **RE-EVALUATION OF ACID VOLATILE SULFIDES (AVS) CLARIFICATION (refer to DY 1991 MPAR, Appendix A, Page A-1).**

  The PSDDA agencies agreed to temporarily withdraw the clarification requiring analysis of AVS. The agencies will continue to gather AVS data through PSDDA monitoring projects, Superfund site characterizations, and other data sources. The agencies will assess AVS data during the 1992 dredging year in hopes of having more information for the 1993 ARM.

- **ACCEPTABLE REFERENCE STATIONS LIST (refer to ARM Minutes, Paragraph 17).**

  A list of acceptable reference stations will be available by the 1993 ARM. This will be based on additional review of the Puget Sound Reference Area Report, queries in the SEDQUAL and DAIS databases, and communication with the laboratories.

- **LC50 GUIDELINES FOR AMMONIA FOR BIOASSAYS (refer to ARM Minutes, Paragraph 12).**

  As a part of the acute bioassay review, LC50 specifications are being experimentally evaluated to establish guideline values for *Crassostrea gigas* and *Dendraster excentricus*. Literature searches will be conducted to evaluate LC-50 specifications for ammonia for the amphipod 10-day mortality test (*Rhepoxynius abronius, Ampelisca abdita,* and *Eohaustorius estuarius*).

- **ALTERNATIVE SPECIES PROTOCOL (refer to ARM Minutes, Paragraph 10).**

  The PSDDA agencies will include a clarification at the 1993 ARM regarding the requirements for the use of an alternative test species in the PSDDA suite.

- **SEDIMENT LARVAL BIOASSAY ABNORMALITY ISSUE (refer to ARM Minutes, Paragraph 10).**

  It was pointed out that ASTM currently specifies 30% abnormality as an interpretive endpoint. In the context of PSDDA's broad review of bioassays, the Puget Sound Estuary Program's guideline of 10% abnormality will be reconsidered for use by the PSDDA program.

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- COORDINATION OF "RED FLAG" ISSUES (refer to ARM Minutes, **Paragraph 5).**

  The PSDDA agencies will confer with the laboratories during the development of the list of "red flag" problems that will require additional contact with the DMMO.

- **SHORELAND MANAGEMENT PLAN CONSISTENCY (refer to ARM Minutes, Paragraph 9).**

  The PSDDA agencies will provide a list of the local jurisdictions that are consistent with PSDDA by the 1993 ARM.

- **PSDDA CONSULTATIONS (refer to ARM Minutes, Paragraph 10).**

  The PSDDA agencies will encourage applicants to contact them in any phase of a dredging project to clarify the PSDDA process and avoid potential problems.

- **QA2 INFORMATION SUBMITTAL REQUIREMENTS.** The PSDDA program requires submittal of all QA2 information. This will be included on the checklist of data submittals to ensure that complete data packages are submitted.