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

REPLY TO
ATTENTION OF

JUN 21 1993

Operations Division

Dear Interested Party:

I would like to thank you for your interest and participation in the Puget Sound Dredged Disposal Analysis (PSDDA) fifth annual review, which culminated in the Annual Review Meeting (ARM) on 7 May 1993. Interaction with the public is vital to the success of the PSDDA program. Programmatic changes are effected only after the public has had an opportunity for involvement through the annual review process.

This letter transmits to you:

1) a summary of program changes
2) the minutes of the ARM
3) a list of ARM participants
4) overheads from ARM oral presentations
5) letters received before and after the ARM
6) the minutes of the post-ARM PSDDA agency meeting
7) final program clarification papers
8) a status report on dredged material management under the Shoreline Management Act
9) an errata sheet (page 3) to the Department of Ecology's *Sediment Cleanup Standards User Manual, Appendix G* or the Technical Memorandum entitled: *Organic Carbon Normalization of Sediment Data*, and an accompanying amendment entitled: *Clarification: Recommended Methods for Measuring TOC in Sediment.*

If you have questions on the enclosed information, please contact the Dredged Material Management Office at (206) 764-3768.

Sincerely,

Brian R. Applebury, P.E.
Chief, Operations Division

Enclosures

PSDDA Fifth Annual Review
Dredging Year 1992
Annual Review Meeting: May 7, 1993

Summary of Clarifications and Modifications
Made to the PSDDA Evaluation Procedures and Management Plans
(Full documentation can be found in Appendix D)

1. *Ampelisca abdita* or *Eohaustorius estuarius* may be substituted for *Rhepoxynius abronius* under certain conditions; see revised clarification paper, Species Substitution for the 10-day Amphipod Bioassay.

2. Site histories are required as part of sampling and analysis plans for PSDDA projects; see revised clarification paper, Site Histories in Sampling and Analysis Plans.

3. Method 5310B (slightly modified) from the 18th Edition of Standard Methods for the Examination of Water and Wastewater and SW-846 Method 9060 from Test Methods for Evaluating Solid Waste are recommended for use in lieu of the Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound (PSEP); see revised clarification paper, Recommended Methods for Measuring TOC in Sediments.

4. Ammonia and sulfides monitoring are required for the *Neanthes* 20-day biomass test. The minimum worm size which may be used is 0.5 mg (dry weight); see revised clarification paper, The *Neanthes* 20-day Bioassay - Requirements for Ammonia/Sulfides Monitoring and Initial Weight.

5. The $2,000 nonrefundable fee for DNR site-use permits no longer needs to be submitted at the time of permit application. This nonrefundable fee is required before DNR's final signature is affixed to the permit. Dredgers are encouraged to begin the permit application process earlier than they have in the past; see clarification paper, DNR Disposal Site Use Permit Acquisition Protocol.

6. The PSDDA non-dispersive sites have been authorized as sediment impact zones under the Sediment Management Standards; see clarification paper, PSDDA Non-Dispersive Disposal Sites are Sediment Impact Zones (per WAC Chapter 173-204).

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PSDDA FIFTH ANNUAL REVIEW MEETING MINUTES

1. The fifth Puget Sound Dredged Disposal Analysis (PSDDA) annual review meeting (ARM) was held at Seattle District on Friday, 7 May 1993. The agenda for the meeting is provided as attachment 1 and the list of meeting attendees is provided as attachment 2.

2. Lieutenant Colonel Rex Osborne, Seattle District's Deputy District Engineer, welcomed meeting attendees and provided introductory remarks. He established a context for the meeting by contrasting the lasting contributions and heroics of Alexander the Great and Hannibal with the hollow "pirate victories" of Pyrrhus. Like Alexander, the residents of Puget Sound have "launched a program which is lasting, which takes care of the needs of people (commerce) and the environment in a rational and sane way". "You have a model here and there are many lessons that can be learned from this program."

3. Brian Applebury, Seattle District Chief of Operations, introduced the ARM panel of agency representatives: Dave Kendall, Corps of Engineers-Seattle District; John Malek, Environmental Protection Agency-Region 10; Ann Essko, Washington Department of Natural Resources; and Keith Phillips, Washington Department of Ecology.

4. Brian Applebury reviewed the ground rules and objectives of the meeting. The meeting attendees were invited to review the agenda and submit to the panel in writing any additional issues which they would like to see discussed.

Ovrhd 1a:	Fifth Annual PSDDA Review Meeting - Meeting Objectives and Purpose

5. Dave Kendall (Corps) reviewed commitments made at the fourth annual review meeting, work completed since the last ARM and minor protocol clarifications. A signup sheet was started for those people interested in participating as members of the Regulatory Workgroup.

Ovrhd 2a:	Summary of Fourth Annual Review Meeting - Commitments and Accomplishments
Ovrhd 2b:	(continued)

6. Stephanie Stirling (Corps) provided a summary of PSDDA projects and testing activities for Dredging Year 1992, and a preview of DY93 projects. A change was made at the third ARM to move to biannual reporting so there are no formal reports from the agencies this year. Reports for the combined Dredging Years 1992 and 1993 will be compiled before the next ARM.

Ovrhd 3a:	PSDDA Project and Testing Activities - DY92
Ovrhd 3b:	DY92 PSDDA Evaluation Activities
Ovrhd 3c:	[DY92] Project Definition
Ovrhd 3d:	DY92 Projects
Ovrhd 3e:	DY92 Project Ranking
Ovrhd 3f:	DY92 Sampling Plans
Ovrhd 3g:	DY92 Chemical Testing
Ovrhd 3h:	DY92 Biological Testing
Ovrhd 3i:	DY92 Suitability Determinations
Ovrhd 3j:	DY92 Disposal
Ovrhd 3k:	DY93 Projects

7. Dave Kendall (Corps) provided an overview of DY92 monitoring at the Elliott Bay disposal site on behalf of Gene Revelas (DNR) who was unable to attend the meeting. [Gene Revelas provided additional comments which are found in square brackets in the following text.] Dave discussed the purpose for doing monitoring, the specific questions which are asked to ensure that site management objectives are

achieved and the sampling and testing elements which have been established to answer these questions. While bioaccumulation in organisms collected from gradient (transect) stations is called for in the PSDDA site monitoring program, there are no large infaunal organisms in the vicinity of the Elliott Bay disposal site. Therefore, tissue bioaccumulation is not conducted for Elliott Bay. [In its place, sediment chemistry measurements are made along the transect stations and contaminant concentrations are compared to baseline transect chemical values (this is analagous to the perimeter station approach). This revision to the site monitoring plan is described in PTI (1989).]

The vertical profile camera data indicated that all dredged material stayed on-site with coarser material at the center of the site, grading to fine sands, very fine sands, silts and clays at the periphery of the dredged material footprint.

Comparisons of chemical baseline (1988) and monitoring data (1990, 1992) indicate that disposal of PSDDA-tested material has improved the sediment quality on-site. Concentrations of mercury, in particular, have decreased dramatically. Loading calculations performed for dredged material disposed at the Elliott Bay site resulted in concentrations for metals which were similar to those actually detected on-site. Copper was an outlier with the concentration detected on-site approximately three times the concentration calculated from mass loading.

Chemical trigger levels, which were derived from the baseline data, were exceeded at perimeter stations for several chemicals, metals in particular. The four benchmark stations, which are located between the disposal site and the adjacent Elliott Bay shoreline to the north, east, south and west, were analyzed chemically to determine if the elevated chemistry at the perimeter stations was due to dredged material disposal or was the result of a bay-wide effect from some other source. The benchmark stations showed the same pattern of increasing concentrations between baseline and DY92 monitoring as was found at the perimeter stations. This indicates that some bay-wide influence other than dredged material disposal may be responsible for the elevated chemical concentrations at both the perimeter and benchmark stations.

In summary, the monitoring results indicated that all site management objectives were met and site management has been successful.

The status of the PSDDA Fund was reviewed and dredged material volumes likely to be disposed of at the PSDDA sites during dredging years 1994 and 1995 were projected.

Ovrhd 4a:	1992 Monitoring Overview
Ovrhd 4b:	PSDDA Disposal Site Monitoring Questions
Ovrhd 4c:	PSDDA Monitoring Elements
Ovrhd 4d:	Site Condition II Definition
Ovrhd 4e:	Elliott Bay PSDDA Disposal Site-Grain Size Major Mode
Ovrhd 4f:	Elliott Bay PSDDA Disposal Site-Dredged Material Footprint
Ovrhd 4g:	Concentrations of on-site metals - 1988, 1990, 1992
Ovrhd 4h:	Comparative Metals Concentrations Normalized to PSDDA SL
Ovrhd 4i:	Concentrations of on-site organics - 1988, 1990, 1992
Ovrhd 4j:	Comparative Copper Concentrations
Ovrhd 4k:	Comparative Antimony Concentrations
Ovrhd 4m:	Comparative Lead Concentrations
Ovrhd 4n:	Comparative Arsenic Concentrations
Ovrhd 4p:	Post-Disposal Monitoring Results-Elliott Bay 1992
Ovrhd 4q:	PSDDA Fund
Ovrhd 4r:	"Likely Projects" (>50,000 cy) DY '94-95
Ovrhd 4s:	[added] Elliott Bay PSDDA Disposal Site-Station Identification

Q - Morgan Bradley: Asked to see a figure showing the benchmark stations.

A - [added as Overhead 4s]

Q - Morgan Bradley: "Were any volumetric calculations done to determine whether the volume of dredged material found on-site equals the volume of material disposed?"

A - Dave Kendall: "Dredging research which has been done as part of the Dredging Research Program and large Corps dredging projects found that ninety-five to ninety-eight percent of dredged material stays on site. Only some two to three percent of dredged material can not be accounted for by disposal models."

Q - Morgan Bradley: "Is it possible that a plume had made it to the benchmarks and would explain [the elevated chemistry]?"

A - Dave Kendall: "I don't think so, based on the actual chemistry of the dredged material, in almost all cases the weighted mean averages showed that the concentrations of chemicals-of-concern were less than the screening level. This was confirmed by the on-site chemistry, which when compared to baseline, demonstrates that the sediment quality has been pretty good. Most of the material from the Duwamish [navigation channel] is pretty clean stuff; we've been using a lot of it for capping material on projects like Denny Way CSO and Pier 53. I'm convinced that the benchmark stations are far enough away from the site that we aren't seeing an effect from dredged material."

[Furthermore, the four benchmark stations which surround the site in different quadrants all show similar chemical elevation. It seems extremely unlikely that a dredged material plume would migrate from the site uniformly in all directions. The 1992 monitoring data, taken as a whole, point to a regional change in some sediment quality parameters.]

Q - Hiram Arden: "The trend that we seem to be seeing in elevated metals at the perimeter and benchmark stations...how many monitoring events and at what intervals is this based on? Has this been substantiated by more than one comparison?

A - Dave Kendall: "This is the first time we have triggered the need, other than baseline itself, to look at the benchmark chemistry. It would be interesting to go back and take a look at the [benchmark] samples which were collected as part of the 1990 partial monitoring but the samples probably no longer exist."

Q - Betsy Striplin: "Have you looked at any of METRO's monitoring data to see if they had any similar results?"

A - Dave Kendall: "The final monitoring report is forthcoming and we may be addressing some of this information. This trend raises some interesting questions and we would want to look into it a little further. If we are attempting cleanup in Puget Sound, this trend is just the reverse. This will probably provoke a lot of questions and concerns but I'm pretty sure it's not due to dredged material."

[It is also worth noting that although a regional pattern of increased sediment concentrations for

some metals (particularly copper) is evident from these data, the absolute concentrations being measured are still well below any established bioeffects concern level. For example, the highest copper value measured was 120 ppm which is more than a factor of three less than the state sediment quality standard.]

Q - John Vlastelicia: "Your slides show quite a bit of cleanup from '88 to '92, especially for mercury and DDT. What have the bioassay results shown?"

A - Dave Kendall: "The 1990 and 1992 results verified that Site Condition II was adhered to; there was no acute toxicity on-site."

Q - Paul Dinnel: "You mentioned that there are no tissue bioaccumulation samples being taken?"

A - Dave Kendall: "We have expended exhaustive amounts of effort to try to collect sufficient *Molpadia* and *Compsomyax* in Elliott Bay. We have been unsuccessful finding an infaunal organism with sufficient biomass to conduct tissue bioaccumulation tests. There was some evidence during 1992 monitoring that *Molpadia* is making a comeback around the disposal site, but we don't have the baseline bioaccumulation data to compare it to."

[As an alternative, we are measuring sediment chemistry along the transect stations and monitoring for elevations relative to baseline as we do at the site perimeter. Another alternative approach which the PSDDA agencies have begun discussing is a controlled bioaccumulation or mussel-watch-type approach. There may be some logistical problems in deploying caged animals in 300 feet of water, but these can probably be sorted out. Our view at this point, however, is that in the absence of any evidence of on-site impacts, expending lots of resources looking for potential far-field effects is not warranted.]

Q - Paul Dinnel: "Have you considered epibenthic organisms such as pandalid shrimp?"

A - Dave Kendall: "We would consider any organism of sufficient numbers and biomass to conduct bioaccumulation."

Q - Paul Dinnel: "You wouldn't, of course, collect any shrimp from a coring device."

A - Dave Kendall: "The problem with any mobile organism is that you don't know where it's been. We want something that's sedentary and that stays on-site; something which reflects what has been going on at the disposal site."

Q - Paul Dinnel: "I would guess that some key species of shrimp, such as side-striped, as I recall, don't really move that far.

A - Dave Kendall: "The problem though is that because they do move around some, I would be concerned that if they were hanging around an outfall and then moved out to the disposal site and that's where you collect them, you might end up pointing a finger at the dredged material instead of the outfall. It would be difficult in my mind to say what was responsible."

8. David Fox presented a status report on the Dredged Analysis Information System (DAIS), including a description of the system, modules completed since the last ARM and Geographical Information System

(GIS) development. DAIS development should be complete by the end of the federal fiscal year. Data entry for PSDDA projects is being performed by the Dredged Material Management Office until system development is fully completed and a user's manual written. A bulletin board has been set up and suggestions are welcome at to how to best utilize it.

Ovrhd 5a:	Dredged Analysis Information System (DAIS)
Ovrhd 5b:	DAIS [data types]
Ovrhd 5c:	DAIS Sampling Data
Ovrhd 5d:	DAIS Chemical Testing Data
Ovrhd 5e:	DAIS Biological Testing Data
Ovrhd 5f:	DAIS Administrative Data
Ovrhd 5g:	DAIS Reporting Capabilities
Ovrhd 5h:	New Modules
Ovrhd 5i:	GIS Development
Ovrhd 5j:	Future Modules
Ovrhd 5k:	DAIS Data Entry Screens
Ovrhd 5m:	DMMO is entering PSDDA data
Ovrhd 5n:	DAIS Bulletin Board
Ovrhd 5p:	Special Thanks

Q - Martin Payne: "Could you talk about how the GIS queries set up in DAIS link to the ARC/INFO GIS?"

A - David Fox: "For the GIS prototype set up by Dave Gustafson, a menuing system was created which ran canned routines. The querying is done in the background. We may run some ad hoc queries but probably most of them will be canned queries."

Q - Brett Betts: "I just wanted to add that Ecology is working at interfacing SEDQUAL and our WASP predictive modeling with ARC/INFO, so we want to talk to you and your programmer so we can dial in as much similarity as possible."

A - David Fox: "One of the reasons we went with ARC/INFO is that DNR and Ecology both use it, as does EPA".

9. Dave Kendall introduced the next four status reports, all of which relate to work which will culminate in products for review by the Regulatory Workgroup. As the Regulatory Workgroup chair, Dave will be sending out notices to members of the Workgroup who will be convening prior to next year's annual review meeting. The following status reports will present work and results which have not undergone thorough PSDDA-agency review. Any program modifications resulting from this work will be presented as formal issue papers at next year's ARM.

10. Tom Gries (Ecology) provided an overview of the status of the re-evaluation of Puget Sound Apparent Effects Thresholds (AETs). Ecology personnel involved in this work were introduced. Re-evaluations were conducted this past year for the amphipod mortality and sediment larval abnormality endpoints. Work on the benthic and Microtox AETs was postponed pending additional work on these two endpoints.

The re-evaluation of the amphipod and sediment larval AETs was a major effort, requiring quality assurance verification and input of large amounts of data. The completion of the DAIS-to-SEDQUAL data transfer module has helped facilitate this process. The reliability analysis which was conducted was computer-intensive and time-consuming.

Ovrhd 6a:	PSDDA Sediment Quality Values: Status of Re-evaluations
Ovrhd 6b:	Background History
Ovrhd 6c:	Re-evaluation Process

Kathryn Waldow (Ecology) reviewed the methods used to screen the biological data and the statistical methods used in the re-evaluation of AETs. Data screening mechanisms included lack of synoptic data and poor chemical or bioassay QA performance. Fourteen out of 87 surveys were excluded from use based on these screening mechanisms.

The amphipod decision rule used for AET recalculations differs slightly from that used in PSDDA. For each survey the reference sediment performance was validated. Performance standards for the reference sediments were established as 25 percent mortality and the 95th percentile for standard deviation (equal to 20 percent). In cases where the reference sediment failed to meet one of these performance standards the negative control was substituted. Only two of the eighteen Class 2 inspections had acceptable reference sediment performance so the use of negative control data proved useful. Altogether, the negative control was substituted for reference 43 times.

Performance of test sediments was then determined. Mortality less than or equal to 25 percent was indicative of a nonimpacted station. If the mortality was greater than this value a statistical comparison was made to reference. An F-test was performed to determine homogeneity of variance, which dictated the type of t-test to perform. A statistical difference was indicative of an impacted station. If there was no statistical difference, a statistical power evaluation was conducted to validate all nonimpacted stations.

For the larval bioassay there are three endpoints: mortality, abnormality and the combined endpoints. In 1986, only the abnormality endpoint was addressed. For the AET recalculations, only the abnormality endpoint has been looked at to date. Ecology is prepared to do AET calculations for the other endpoints as well, if it is determined by the PSDDA agencies that this would be fruitful.

The decision rule for the larval bioassay was similar to that for the amphipod bioassay. There was no clear documentation to support a maximum abnormality performance standard for reference sediments. Therefore, the only performance standard for reference sediments was a maximum standard deviation of six percent, which corresponds to the 95th percentile of existing data. For test sediments, no maximum abnormality limit existed as an indicator of an impacted station. Significant impacts were determined by a statistical comparison to reference, as in the amphipod test. Nonimpacted stations were verified through an evaluation of statistical power before being used in AET calculations.

Ovrhd 6d:	Methods of Determining "Hits" for Calculation of Amphipod and Larval AETs
Ovrhd 6e:	Reasons for Excluding a Survey, Batch, or Sample from the AET Recalculations
Ovrhd 6f:	Decision Rule for Amphipod Bioassay
Ovrhd 6g:	Reference Options
Ovrhd 6h:	[added] Larval Bioassay Mortality Endpoint
Ovrhd 6i:	[added] Larval Bioassay Abnormality Endpoint
Ovrhd 6j:	[added] Larval Bioassay Combined Endpoint
Ovrhd 6k:	Decision Rule for Larval Bioassay
Ovrhd 6m:	[added] Frequency Distribution for Larval Abnormality of Reference Samples
Ovrhd 6n:	Frequency Distribution for Larval Abnormality of Test Samples

Tom Gries summarized the results of the data gathering exercise undertaken by Ecology and the AET recalculations performed. The numbers of surveys and stations increased substantially from 1989

to 1993 for sediment chemistry, amphipod bioassays and larval tests using echinoderms. The bivalve larval database has actually diminished in size if treatments with less than five replicates are excluded.

The apparent effects threshold is the concentration of a chemical of concern above which there is always a response for the particular endpoint under consideration. The various scenarios for changing values which are possible when performing AET recalculations were discussed, along with possible ramifications on final AET values. Preliminary results were discussed but it was emphasized that these data still had to go through additional verification processes before being used to generate new AETs.

Reliability calculations include measures of sensitivity (the probability that an impacted station will be correctly identified) and efficiency (the ability to exclude false positives). Preliminary reliability calculations for the 1993 AETs indicate generally lower sensitivity than for the original AET calculations for both dry-weight and TOC-normalized AETs. There are several factors which may be affecting the sensitivity of the new AETs and some additional objective screening of the data may increase the sensitivity to a point where new AETs could be used in a regulatory mode.

Work remaining before new AETs could be promulgated for regulatory use was listed.

Ovrhd 6p:	Database Comparison
Ovrhd 6q:	AET approach: 4-Methyl phenol
Ovrhd 6r:	General Results
Ovrhd 6s:	Preliminary Observations
Ovrhd 6t:	[preliminary] Amphipod Results
Ovrhd 6u:	[preliminary] Larval Results
Ovrhd 6v:	Criteria Reliability
Ovrhd 6w:	Reliability: Preliminary Comparison (dry weight AETs)
Ovrhd 6x:	Reliability: Preliminary Comparison (TOC-normalized AETs)
Ovrhd 6y:	"Work Remaining"
Ovrhd 6z:	"Work Remaining" (continued)

Q - Betsy Striplin: "Why do you exclude subsurface data from the AET calculations?"

A - Tom Gries: "I don't really want to but the software demands it right now. The software will use only stations that are coded with zero as an upper sediment depth...From a theoretical standpoint I don't have any problem matching bioassay data with chemistry data even if it's ten feet below the surface, but it wasn't done initially. The data sets that were used initially were all 0-2 cm. I think that's why it was coded that way. That's actually something we would like to change. There are four years worth of PSDDA data, much of it subsurface and they're likely to be non-hits."

11. Sandra Manning (Ecology) presented work that has been done on the benthic endpoint used in the PSDDA site monitoring program. Presently, PSDDA compares abundance of major taxa to baseline. If there is significantly reduced abundance then a comparison is made to benchmark stations to determine whether dredged material disposal may be the cause or whether a bay-wide effect is occurring. If the abundance of major taxa is less than fifty percent of that at the benchmark stations, dredged material disposal is implicated.

A study was conducted since the last ARM in an attempt to identify benthic endpoints which might provide more useful data than the one currently used by PSDDA and the Sediment Management

Standards. The objectives of the study and the work done to date were summarized. A report entitled *Evaluation of Techniques for Assessing Benthic Endpoints for Use in Puget Sound Sediment Management Programs* was completed. The indices listed in the report were applied to a case study in Everett Harbor. The most accurate and consistent methods used in the case study were major taxa and species abundance and species richness. The least accurate and consistent were the diversity indices.

The second main task of the study this last year was a national benthic workshop. The benthic report was sent to a panel of experts prior to convening the workshop. The experts ranked the various benthic endpoints and provided written recommendations on which endpoints should be used in Puget Sound programs. These recommendations included identification to species level where possible, application of multiple indices, use of the triad approach, dropping diversity indices except the Swartz index and establishing benthic criteria for Puget Sound reference stations.

A final report will be released around the end of May which will include the first report as an appendix and will include a summary of the proceedings and recommendations of the workshop. Reports may be obtained by contacting Sandra Manning at the Department of Ecology (206-438-7514). Recommendations will go to the Regulatory Work Group. Stiplin Environmental Associates will be conducting work on the development of benthic reference criteria. This work will be completed by the end of the year.

Ovrhd 7a:	PSDDA Benthic Method
Ovrhd 7b:	Why Benthic Study Was Done
Ovrhd 7c:	Objectives
Ovrhd 7d:	What Has Been Done
Ovrhd 7e:	Report: Evaluation of Techniques for Assessing Benthic Endpoints for Use in Puget Sound Sediment Management Programs
Ovrhd 7f:	Locations of Sampling Stations for Everett Harbor Benthic Macroinvertebrates
Ovrhd 7g:	[added] Comparison of Test Results in Identifying Adverse Benthic Impacts
Ovrhd 7h:	National Benthic Workshop
Ovrhd 7i:	Comparison of Benthic Community Indices with Evaluation Criteria
Ovrhd 7j:	General Recommendations
Ovrhd 7k:	Specific Method Recommendations
Ovrhd 7m:	Final Report
Ovrhd 7n:	Future Work

Q - Carl Kassebaum: "Are these benthic methods used just for disposal site monitoring or are they going to be used to determine the suitability of material?"

A - Sandra Manning: "Under the Sediment Management Standards the benthic endpoint is used to determine if sediments are clean. Under PSDDA it is used just for monitoring at the disposal site."

12. Open discussion/public issues.

Site history

Q - Eric Johnson: "Can we get an introduction to the site history clarification paper? "

A - Stephanie Stirling: "The PSDDA agencies felt that we were seeing an uneven level of effort on the site histories in sampling and analysis plans and felt that this needed to be clarified. The level of effort should reflect the size and the complexity of the project, but need not be more than

a few pages. If no data are available, the efforts to obtain it should be noted in the sampling and analysis plan. Not all suggested sources need to be consulted; the list is provided to assist applicants."

Q - Eric Johnson: "Refresh my memory, does the PSDDA documentation have a site history guidance section?"

A - Dave Kendall: "It makes reference to the fact that site history is required as part of the sampling and analysis plan but it doesn't give you real specifics."

Q - Eric Johnson: "If it doesn't, I would suggest that we make this clarification paper slightly more detailed and make it clear how this is going to be used as guidance; for example, if it's a simple project you don't have to go into all this detail but if you're in a high-ranked area or it's a large project you may want to be warned that you're going to have to do a more sophisticated site history. So the dredging proponents have a little better idea about what to tell their consultants. I'm concerned about the open-ended nature of the clarification paper. It's not clear what is required of what size project."

Total Organic Carbon analysis method

Kathryn Bragdon-Cook (Ecology) stated that the TOC method clarification paper had some errors in it. The new method was documented by Teresa Michelson and the clarification paper presents reasons why this method is preferred over the PSEP method. Revised clarification papers are available [see Appendix D]. Kathryn also put together a fact sheet on the TOC protocol in anticipation of questions. The protocol is also included as Appendix G of Ecology's Sediment Cleanup Standards User's Manual.

Reference sediment grain size

Q - David Herick: "There seems to be some ambiguity in the determination of what is 'similar' grain size. In using the wet-sieving technique there is no criterion for what is similar grainsize."

A - David Fox: "There are no criteria but there are a couple of regression lines in use, both I believe developed by PTI. One is from the latest reference area performance report published in 1991; the other is from Carr Inlet work done previously. Some consultants are not using these regressions but are using the wet-sieving results to make direct comparisons, with estimated errors of 10-15 percent. We encourage people to collect a little bit on the coarse side rather than on the fine side."

Q - David Herick: "I don't really know if there's a need for a clarification on that or not. I haven't had any problems yet but it might be difficult at certain reference sites to find an appropriate match."

A - Dave Kendall: "We don't require it but it would certainly be useful for people to submit their wet-sieving results along with their laboratory data. We could run regressions and hopefully with a larger data set we could gain more predictability."

13. Justine Barton (EPA) presented results from work conducted on the technical review of acute bioassays. In the past year some contracting work was done by Tim Thompson and John Lunz of SAIC to address some questions related to the larval test. This work is meant to mesh with queries being directed at the DAIS database. This information will go to the Regulatory Workgroup.

The work was conducted in three phases and a report, *Refinements of Current PSDDA Bioassays*, March 1993 (prepared by SAIC for USEPA), was published as a product of the work. A signup sheet was made available for those wanting a copy of the report. The report may be obtained by contacting Justine Barton (206-553-4974).

Phase I was a literature search with an annotated bibliography as a product.

In Phase II, the effects of ammonia on the larval test were investigated. The objectives were to establish the "no observed effects concentration" (NOEC), lethal concentrations (LCs) and effective concentrations (ECs) at different effects levels, and determine the effects of aeration on test results.

Some of the results from the Phase II work were presented as graphs from the report. Potential thresholds were developed by SAIC as recommendations for the Regulatory Workgroup to consider: 1) a sand dollar threshold of 0.04 mg/l unionized ammonia; 2) a sand dollar warning level at a NOEC of 0.014 mg/l unionized ammonia; and 3) a calculated value of 0.13 mg/l unionized ammonia for the oyster test, as a level to work with when looking at data in the DAIS database.

Phase IIIA objectives were to compare the sensitivity of oyster and sand dollars to varying grain sizes and test procedures, to compare responses to grain size and test procedures within species, and to investigate conditions under which false positives might occur due to suspended sediment in the beaker.

Sediments from Carr Inlet with a range of grain sizes were used in the Phase IIIA investigation. The three procedures investigated were the standard PSDDA test with a 4-hour settling time (aerated and unaerated), the PSDDA test with a 24-hour settling time (unaerated only), and the "Green Book" test using both the PSDDA counting method and the Green Book counting method.

Results from the report were presented. Dissolved oxygen levels dropped precipitously in all Green Book preparations resulting in 100% mortality. For both oyster abnormality and the sand dollar combined endpoint, the effects were greatest with the finest-grained sediment. The 4-hr aerated treatments showed the greatest effect with the finest-grained sediment, possibly due to resuspension of fines. Effects were generally low with coarser sediments. Echinoderm mortality was higher in the unaerated treatments. For sand dollars, the abnormality drove the combined endpoint.

Suggestions emanating from the Phase IIIA study included the potential importance of evaluating the effects of the clay fraction, the use of solids-normalized clay and silt fractions when interrogating the DAIS database, and the use of the sand dollar with fine-grained sediments.

The Phase IIIB investigation compared the interspecies sensitivity of sand dollars and oysters to contaminated sediments. Sediments with varying levels of metals and organics contamination were used, along with the range of test procedures used in Phase IIIA. Elliott Bay sediments (D1) with high PAHs and Duwamish West Waterway sediments (M1) with high metals were cut with clean Carr Inlet sediments of similar grain size to provide a range of contaminated sediments.

The M1 series showed the greatest response, especially in aerated treatments. In general, the D1 series did not produce much mortality or abnormality in either species. A dose response relationship generally held for the M1 series for all test procedures for oyster mortality. Sand dollar abnormality was significantly higher than the oyster mortality and also showed a dose response relationship to the M1 series. Abnormality drove the combined endpoint for sand dollars. Application of PSDDA interpretation criteria demonstrated that for the M1 series the oyster and sand dollar bioassays agreed in their assessment of toxicity in eight of nine cases. The oyster mortality and sand dollar combined endpoints were similar predictors of toxicity and exhibited similar response to the reference toxicants phenol and cadmium chloride.

Recommendations emanating from Phase IIIB include the use of the sand dollar as the primary test organism, continued use of the combined endpoint, and continued use of the 4-hr settling time with aeration. The oyster and sand dollar were deemed equivalent predictors of contamination and the oyster could continue to be used as a backup organism. These recommendations will be forwarded to the Regulatory Workgroup for consideration.

For the upcoming year Microtox will be the focus.

Ovrhd 8a:	"Refinements to Current PSDDA Bioassays"
Ovrhd 8b:	[added] Phase I: Literature Search
Ovrhd 8c:	Phase II: Ammonia Toxicity
Ovrhd 8d:	Test Overview [Phase II]
Ovrhd 8e:	Three Points
Ovrhd 8f:	Potential Thresholds
Ovrhd 8g:	Phase IIIA: Species Sensitivity Comparison to Clean Reference Sediments (Grain Size Effects)
Ovrhd 8h:	Test Overview [Phase IIIA]
Ovrhd 8i:	Two Points
Ovrhd 8j:	Suggestions
Ovrhd 8k:	Phase IIIB: Species Sensitivity Comparison to Contaminated Sediments
Ovrhd 8m:	Test Overview [Phase IIIB]
Ovrhd 8n:	Test Sediments
Ovrhd 8p:	Application of PSDDA bioassay criteria to Oyster and Echinoderm responses to the (M1) dilution series and treatments.
Ovrhd 8q:	[Untitled] Relationship between oyster mortality and the sand dollar combined endpoints
Ovrhd 8r:	Recommendations [Phase IIIB]
Ovrhd 8s:	Recommendations [continued]
Ovrhd 8t:	Oyster Ammonia & Time - Aerated Treatments
Ovrhd 8u:	Oyster Ammonia Vs Time - Unaerated Treatments
Ovrhd 8v:	Echinoderm Ammonia & Time - Unaerated Treatments
Ovrhd 8w:	Echinoderm Ammonia Vs - Aerated Treatments
Ovrhd 8x:	Oyster Ammonia Effects - Aerated Vs Unaerated Treatments
Ovrhd 8y:	Echinoderm Ammonia Effects - Aerated Vs Unaerated Treatments
Ovrhd 8z:	Oyster Mortality - Grain Size and Aeration Effects
Ovrhd 8aa:	Oyster Abnormality - Grain Size and Aeration Effects
Ovrhd 8bb:	Echinoderm Mortality - Grain Size and Aeration Effects
Ovrhd 8cc:	M1/CRR2 Series and Oyster Mortality
Ovrhd 8dd:	M1/CRR2 Series - Echinoderm Mortality
Ovrhd 8ee:	M1/CRR2 Series and Echinoderm Abnormality
Ovrhd 8ff:	D1/CRR4 Series - Oyster Mortality
Ovrhd 8gg:	D1/CRR4 Series - Echinoderm Mortality

Q - Paul Dinnel: "There are good reasons for the nonresponse seen for sea urchin and sand dollar mortality endpoint which are not that obvious. There are basic differences between echinoderm and oyster embryos. Oyster embryos are very small, you run them at 20 degrees;

at the end of the test you either find that they are normal or abnormal and you count them, or there may be a whole bunch missing; they've just disintegrated. The echinoderm embryo is very different; they're larger embryos, you're running the test at a colder temperature, and they have a fertilization membrane around them, they do not hatch out for a while. This tends to protect them. So what happens at the end of the test is you usually end up with all of them still there; they may be dead but they just haven't disintegrated. So you really run into a problem trying to tell if these are dead or just abnormal. So usually they get counted as abnormal because you can still see them. For that reason a recent ASTM protocol now uses only the abnormality endpoint. What it says is if the embryo fails to develop into a normal pluteus larva by the end of the test then it is counted as abnormal, period, for whatever reason."

A - Justine Barton: "Thanks Paul, I know that's been a topic of discussion in the past. Certain people strongly support the use of the abnormality endpoint. I would be interested in seeing that [ASTM] protocol. Is it out yet?"

A - Paul Dinnel: "This last week it went to main committee. There are some revisions which need to be made including better graphical endpoint sketches and photographs. I've got some that Dave Kendall provided which I believe originally came from Parametrix. The comments I received indicated that we need some better ones."

A - Justine Barton: "I know I promised to send you a copy of the report and I hope you will join us as part of the Regulatory Workgroup when we start hashing through some of these issues."

Q - Carl Kassebaum: "It appears from your research that grain size and ammonia are causing some impacts to these organisms."

A - Justine Barton: "They did cause impacts in these particular treatments but it must be kept in mind that, by design, the range of ammonia concentrations used in this experiment included concentrations high enough to cause toxicity. Whether or not these concentrations have been measured during PSDDA testing and might be implicated in producing false positives needs to be explored using the DAIS database."

Q - Carl Kassebaum: "That tends to track with what I've seen when we've run bioassays for some of these projects. Real fine silts and clays, high sulfides and ammonia, these tend to cause problems. I was wondering, has there been any talk internally about how to address this in a regulatory mode?"

A - Justine Barton: "It's been an issue for quite a while, that's why we decided to do this work and use the DAIS database. I think this will be addressed by the Regulatory Workgroup. Fall, as a date, has been tossed around but I thought we might be able to use some of this a little sooner; especially with the larval information. We all acknowledge that fine grain sediments have been a problem. It will be interesting to go back into the DAIS database and look at things like unionized ammonia, especially in relation to the threshold values suggested by this study."

14. David Fox discussed a reference sediment performance review which was conducted using the DAIS database. Reference sediments are used in bioassays to make statistical comparisons to project sediments and to block for nontreatment effects from factors such as grain size. There are reference sediment performance standards for each of the bioassays. Failure to meet these standards can result in possible

bioassay retests, reliance on results from the other bioassays, or the use of best professional judgement in the interpretation of test results.

Reference sediment performance has been tracked for each of the bioassays since the implementation of PSDDA. There have been six projects which encountered reference sediment performance problems in the amphipod test and fourteen for the sediment larval bioassay. None of the reference areas used to date in the PSDDA program have been immune to reference performance failures. Carr Inlet has had the highest number of failures but has also been used much more frequently than other reference areas.

The DAIS database was used to look for correlations between nontreatment factors and reference sediment performance. Nontreatment factors included bulk ammonia and sulfides, grainsize, and aqueous ammonia and sulfides for both the amphipod and sediment larval bioassays. In addition, SAIC had recommended investigating other nontreatment factors in the larval test, including silt and clay fractions normalized to solids content, and un-ionized ammonia.

Correlations were run with each of these factors. Amphipod mortality was correlated with many of these factors, especially with bulk sediment parameters. Many of these factors covary and it is not possible to determine cause and effect based on this analysis. As expected, amphipod mortality was correlated with the fines content of the sediment. It was discovered that the correlation with clay content was even stronger.

There was more variability in the larval results. For reference sediments there was no statistical correlation with any of the parameters analyzed. Only when the full set of PSDDA data was analyzed, including test sediments, did some correlations become evident. Seawater-normalized combined mortality and abnormality was correlated with several nontreatment parameters, including solids-normalized fines and clay.

This correlation analysis will be refined as necessary and results and recommendations will be forwarded to the Regulatory Workgroup for review. One immediate consequence of this work has been an increased emphasis on the necessity for good field collection methodology when collecting reference sediments. A recommended reference sediment sampling protocol was presented.

Ovrhd 9a:	Reference Sediment Performance Review
Ovrhd 9b:	Reference Sediment Performance Standards
Ovrhd 9c:	Potential Consequences of Exceeding Guidelines
Ovrhd 9d:	PSDDA Reference Sediment Performance [by year]
Ovrhd 9e:	PSDDA Reference Sediment Performance [by site]
Ovrhd 9f:	DAIS Review - Nontreatment Factors - Amphipod
Ovrhd 9g:	DAIS Review - Nontreatment Factors - Sediment Larval
Ovrhd 9h:	Bulk sulfides versus amphipod mortality - reference sediments
Ovrhd 9i:	Percent fines versus amphipod mortality - reference sediments
Ovrhd 9j:	Percent clay versus amphipod mortality - reference sediments
Ovrhd 9k:	Bulk sulfides versus amphipod mortality - all DAIS data
Ovrhd 9m:	Percent fines versus amphipod mortality - all DAIS data
Ovrhd 9n:	Percent clay versus amphipod mortality - all DAIS data
Ovrhd 9p:	Bulk sulfides versus larval effective mortality - reference sediments
Ovrhd 9q:	Aqueous ammonia versus larval effective mortality -reference sediments
Ovrhd 9r:	Solids-normalized fines versus effective mortality - reference sediments
Ovrhd 9s:	Solids-normalized clay versus effective mortality - reference sediments
Ovrhd 9t:	Bulk sulfides versus larval effective mortality - all DAIS data
Ovrhd 9u:	Aqueous ammonia versus larval effective mortality -all DAIS data

Ovrhd 9v:	Solids-normalized fines versus effective mortality - all DAIS data
Ovrhd 9w:	Solids-normalized clay versus effective mortality - all DAIS data
Ovrhd 9x:	PSDDA Reference Sediment Performance; Statistically Significant Correlations - Amphipod
Ovrhd 9y:	PSDDA Reference Sediment Performance; Statistically Significant Correlations - Sediment Larval
Ovrhd 9z:	[Untitled] Conclusion
Ovrhd 9aa:	Reference sediment sampling protocol

Q - Tim Thompson: "Did you look at unionized ammonia?"

A - David Fox: "I went into DAIS and used the table values in SAIC's report to estimate the unionized ammonia levels for all larval data. In no instance was there an exceedance of the 0.04 mg/l threshold recommended by SAIC. I would like to go back and use the spreadsheets provided by Tim Thompson to calculate the actual unionized ammonia levels and do a regression analysis. For right now though we haven't seen anything at those levels which might be causing a problem."

Q - Pete Rude: "I noticed you left out TOC from your analyses."

A - David Fox: "I looked at it but didn't see any correlation at all so I dropped it. I can go back in though and look at it again and produce scatterplots for TOC."

Q - Pete Rude: "Did your scatterplots show all the reference areas together? Did you look at the individual reference areas separately?"

A - David Fox: "All the reference areas were shown together. The only place we could perhaps look at an individual reference area is Carr Inlet. None of the other reference areas have been used often enough to have sufficient data to work with."

Q - Betsy Striplin: "The advantage of collecting reference sediment in the biologically active zone is that you would probably be picking up sediments with lower sulfides which would enhance the performance, the con being that most of the [test] samples that are being collected for PSDDA are going to be anoxic, therefore you are introducing an additional variable when you're looking at the test sediment results. You may be seeing toxicity there due to sulfides and you don't have an appropriate control anymore in your reference sediment. So you're actually adding some variability which you're not going to be able to account for."

A - David Fox: "That's an excellent point. What we would like to see in an ideal world is that the TOC would be the same, the grain size distribution would be the same, all these different nontreatment parameters are there present at the same concentrations; and that's ideally what we would strive for, but in the real world of regulatory testing, the best we've been able to do is get a good grain size match. In order to be environmentally protective, we've got to have a reference sediment that performs well and at this stage we're not at a point where we can take the effects of all those nontreatment factors into account."

Q - Betsy Striplin: "It seems like we've got so much reference sediment data already, especially for Carr Inlet where we know it's an appropriate reference area, it's not contaminated. It almost seems like it is more important to collect a reference sample which is deep and comparable to your test sediment, especially from Carr Inlet. The evaluation should be apples-to-apples instead of apples-to-oranges. I understand what you're saying; it's important for the reference to pass some sort of criteria, but if you go to an area that we know is clean, and we have a large

database now, it just seems that it might be more important to re-evaluate those reference area performance standards so that we can be sure that in our tests we are seeing an actual effect, if that's what's truly happening, versus an effect from sulfides or ammonia."

A - David Fox: "If we could do that I would be all for it. It's just a matter of getting from here to there."

15. John Malek (EPA) discussed the status of the Inland Testing Manual and EPA's Sediment Management Strategy. The Inland Testing Manual is a companion testing manual to the "Green Book". Work has been ongoing for the last year and a half. The Science Advisory Board will be reviewing in June. Internal EPA and Corps review is scheduled for sometime in the May-July time frame. Public notification in the Federal Register will take place no sooner than November of 1993 pending the SAB and field reviews.

There are deficiencies in the Green Book QA/QC section. EPA and the Corps are jointly going back to correct these deficiencies and a QA/QC guidance document will be forthcoming. Only chemical QA/QC will be addressed initially due to resource limitations, but bioassay QA/QC guidance will follow. Internal Corps/EPA review is scheduled for late summer or early fall of 1993. The goal is to make this document available to the public concurrent with the Inland Testing Manual.

EPA and the Corps realized they had no broadly agreed-upon bioassay protocols. Only some protocols are standardized in ASTM. There are protocols being used successfully by different regions of the country but there has been no attempt to standardize. EPA funded some work aimed at protocol standardization with interlaboratory groundtruthing of these protocols. There is a preliminary draft out which includes both freshwater and marine species. Peer review will be conducted within EPA in early June with publication scheduled by the Office of Science and Technology for Fall 1993. These protocols would then be forwarded to EPA's Cincinnati laboratory for approval as standard methods.

Work continues on development of sediment quality criteria for five nonpolar organic chemicals-of-concern. The Science Advisory Board reviewed it a year-and-a-half ago and EPA has responded to their comments. The criteria are now undergoing a "red-border review" which is an internal EPA review. The Office of Science and Technology is working on compiling the work and responses of these various elements and the criteria are scheduled to appear in the Federal Register in June 1993. It is more likely that this will actually happen in September or October.

Parallel work is being conducted for sediment quality criteria for metals. A document is in preparation which will provide guidance on metals normalization to acid volatile sulfides. This document will be presented to the SAB in Fall 1993 and will include criteria for five or six metals. Publication in the Federal Register is projected for Spring 1994.

An outline of EPA's Sediment Management Strategy was reviewed by the public last summer. Workshops were held on the East Coast and Great Lakes. EPA has been working on comments received. The actual strategy is now being written and will attempt to tie together details from each of EPA's individual programs such as ocean dumping, 404 and Superfund. An internal review is ongoing with a briefing of the EPA Administrator scheduled for August 1993. Federal Register publication should occur sometime between September 1993 and January 1994.

The EPA and Corps of Engineers published a document providing a framework for evaluating the environmental effects of dredged material management alternatives. The framework was an attempt to mesh the alternatives analysis requirements under 103 and 404. It has been published as a loose-leaf notebook to allow easy revisions.

Revisions to the Ocean Dumping Act may be forthcoming, with the intent of getting the 103 and 404 programs more in alignment. Hopefully what will come out of the revisions of the regulations is that the 103 regulations will become more consistent with what is required under 404(b)(1). It's not necessarily going to make a big difference in Puget Sound but in Grays Harbor where there are both 103 and 404 sites it may make a difference.

There have been discussions concerning reauthorization of RCRA. The issue with regard to PSDDA is whether it will apply to dredged material.

Region 2 and New York District are trying to come to grips with a wide-spread dioxin problem. The National Resources Defense Council is suing over disposal of dioxin-containing sediments at an ocean disposal site. EPA and the Corps got together to put out guidance related to dioxin. A scope was developed to produce a framework for dealing with problem chemicals such as dioxin. A steering committee and task force have been assembled. The objective is to put together some preliminary guidance by the end of Summer 1993. A policy paper will be put together as well as a guidance manual.

Ovrhd 10a:	Inland Testing Manual
Ovrhd 10b:	National Sediment Initiatives-QA/QC Guidance Manual
Ovrhd 10c:	National Sediment Initiatives-Standardized Bioassay Methods
Ovrhd 10d:	National Sediment Initiatives-Sediment Quality Criteria (organics)
Ovrhd 10e:	National Sediment Initiatives-Sediment Quality Criteria (metals)
Ovrhd 10f:	National Sediment Initiatives-EPA's Sediment Management Strategy
Ovrhd 10g:	National Sediment Initiatives-Alternatives Framework
Ovrhd 10h:	National Sediment Initiatives-Alternatives Framework [point of contact]
Ovrhd 10i:	National Sediment Initiatives-Reauthorizations and Reg Revisions
Ovrhd 10j:	Dioxin Contaminated Sediments (for Tim Thompson)
Ovrhd 10k:	Dioxin Contaminated Sediments (continued-1)
Ovrhd 10m:	Dioxin Contaminated Sediments (continued-2)
Ovrhd 10n:	Dioxin Contaminated Sediments (continued-3)

Q - Carl Kassebaum: "Once the sediment quality criteria are published, does PSDDA automatically have to comply?"

A - John Malek: "No. The way that EPA interprets these is nothing more than water quality criteria for sediments. They have no legal standing. Where they gain their teeth is when the states make them standards, after they are approved as standards by EPA. The state of Washington already has sediment quality standards. Keith [Phillips], what was the agreement that was made regarding what would happen when the national criteria are established?"

A - Keith Phillips: "We've always been in the position that when these numbers come out, if they're comparable in reliability, or more reliable, in terms of sensitivity and efficiency, than the ones we already have, we will plug them in and use them. When they become final we will develop a plan, just like the AET process, and if they work better we will incorporate them during our annual review (of our sediment management standards) and use them. We will bring the same issue back to the PSDDA agencies. If they're more reliable than the AETs then we should start using them. So it will be through the annual review process."

Q - Tom Mueller: "Do the revisions to the Ocean Dumping Act include changes on which law affects which body of water?"

A - John Malek: "No, there would be no changes to the authorizations for different bodies of water. The changes would affect the testing of material for a determination of suitability."

Q - Tom Mueller: "There are differences in how the two acts are carried out. EPA has more control over 103."

A - John Malek: "After a lot of discussion and argument we've come to realize that there are a lot more similarities between the two laws than there are differences. There may indeed be legal differences but when you start looking at what the two laws were intended to do in terms of management of dredged material it comes down to interpretation."

Q - Eric Johnson: "Will the revisions to the MPRSA regs address the eventuality of marine sanctuaries and possible conflicts with PSDDA sites?"

A - John Malek: "No, that's outside of EPA's jurisdiction. We are working with NOAA to try to come to some basic understanding about how this will procedurally happen. I'm hopeful because at least in the Pacific Northwest we've been able to open some pretty good communication among the sanctuary people and the Corps and EPA."

Q - Eric Johnson - "What exactly is the legal status going to be of EPA's National Sediment Management Strategy. Will it have the weight to undermine any of the agreements that Region 10 has made in this region with things like the Sediment Management Standards or PSDDA? "

A - John Malek: "The potential is always there. I don't foresee anything in the near future which is going to undermine what we're doing. Things are working pretty well out here."

Q - Tim Thompson - "Where are you in terms of the regional manual for ocean dumping?"

A - John Malek - "The regional manual for testing of dredged material became a requirement as a result of the development of national guidance. It was incumbent upon local programs to work out agreements about how they were going to do things. We already have a lot of guidance locally, the PSDDA documents and PSEP for example. We don't need to put more documents together necessarily. What we're focusing on is 'how are we going to manage out sites', and ultimately 'who's going to pay for it?'. We're working on that as a priority. Sometime when we get that all figured out we'll come back to the regional manual."

16. Tom Mark (Ecology) spoke about dredged material management under the Shorelines Management Act. The plan called for the amendment of local shoreline master programs to accommodate PSDDA. Not much has been done to date. Ecology has provided guidance to local governments in their Shoreline Management Guidebook concerning the incorporation of PSDDA into local programs. The guidebook is a compendium of best management practices and was first published three years ago. A second edition will be coming out soon which includes an update for dredged material management.

It is likely however that local governments may choose not to amend their shoreline master programs to accommodate dredged material management. Currently, the Growth Management Act is

attracting most of the attention. Amendments of master programs is very time-consuming, both of the local and Ecology staff. Unless there is a good reason for local government to take on an issue, they are unlikely to do so.

The second reason local governments may not take on this task is because all the PSDDA disposal sites already have local shoreline permits. However, the first two permits are set to expire this year and applications are being made to renew those permits. As that process is undertaken problems could possibly develop.

Another reason why local governments may not be willing to take on this issue is that Ecology's analysis has shown very little incompatibility between the Shorelines program and PSDDA. The process has enough flexibility that permits have been issued in the past and should continue to be able to be issued in the future.

17. Dave Kendall concluded the meeting by listing the recommendations coming out of the fifth annual review meeting:

a) The Regulatory Workgroup will look at the new ASTM guidance on the interpretation of the echinoderm test (ie abnormality).

b) The Regulatory Workgroup will provide recommendations aimed at reducing false positives in the bioassays.

c) The Regulatory Workgroup will review the recommendations emanating from the Benthic Experts Workshop.

d) The PSDDA agencies will share information relative to the apparent bay-wide increases in metals concentrations in Elliott Bay with appropriate state and federal agencies.

e) The site history clarification paper will by revised to provide clearer guidance. Requirements will be based on the size of a project and proximity to sources of contamination.

f) Clearer guidance will be provided for matching test and reference sediment grain size. Reference sediment collection methods will be disseminated.

g) The Regulatory Workgroup will review reference area performance requirements.

h) Information on shoreline permit renewals will be presented as a status report at the next annual review meeting. The status report will include a review of any problems which arise during the renewal process.

Attendees were informed that additional written comments could be submitted until 21 May 1993. Minutes will be mailed to meeting participants within 45 days. The sixth annual review meeting will be hosted by EPA in Spring 1994.

Ovrhd 11a: Fifth Annual PSDDA Review Meeting [wrap-up]

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

May 7, 1993
Final Agenda

MORNING SESSION

Coffee (8:30-9:00am):

Introduction and Overview (9:00-9:30am):

Greeting : LTC Rex Osborne, Deputy District Engineer, Seattle District

Meeting Objectives: Brian Applebury, Chief Operations Division, Seattle District.

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

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

Overview of PSDDA Project/Testing Activities: (Stephanie Stirling, Corps)

Disposal Site Monitoring Overview (Gene Revelas, DNR)

Discussion and Public Comment on above topics (10:15-10:30am)

Break (10:30-10:45am):

Presentation of Status Papers[1] by PSDDA Agencies (10:45-11:40am):

Dredged Analysis Information System/GIS Development (David Fox, Corps)

AET Recalculation (Tom Gries and Kathryn Waldow, Ecology)

Benthic Experts Workshop Recommendations (Sandra Manning, Ecology)

Discussion and Public Comment on above topics (11:40-12:00am):

Lunch (12:00-1:00pm):

AFTERNOON SESSION

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

Discussion on Public Issue Papers (2:00-2:15pm)

Break (2:15-2:30pm)

Discussion on Clarifications Papers and continuation of Status Reports[1] by PSDDA Agencies (2:30-3:30pm):

Technical Bioassay Review (Justine Barton, EPA)

Reference Area Performance Review (David Fox, Corps)

Inland Testing Manual (John Malek, EPA)

EPA Sediment Management Strategy (John Malek, EPA)

Dredged Material Management under the Shoreline Managment Act (Tom Mark, Ecology)

Discussion and Public Comment on above topics (3:30-3:45pm).

Summary and Closing (3:45-4:00pm)(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 21, 1993.

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[1] Status reports on the Neanthes 20-Day Test and Regulatory Bioassay Review will not be presented; written summaries of these activities were mailed out with the ARM invitation letter. Any questions concerning these Status reports should take place during the general discussion and answer period commencing at 3:30 pm.

Attachment 2

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FIFTH ANNUAL PSDDA REVIEW MEETING

MEETING OBJECTIVES AND PURPOSE

- Obtain public input on proposed minor changes to the PSDDA Management Plan per Clarification Papers mailed out with Meeting Announcement
- Discuss Disposal Site Management Changes.
- Discuss Status Reports on Important Ongoing Actions.

1a

SUMMARY OF FOURTH ANNUAL REVIEW MEETING COMMITMENTS AND ACCOMPLISHMENTS

- All public comments, either verbal or written were considered, and PSDDA Agency responses to ARM issues are reflected in the minutes of the 4th ARM mailed out to participants or interested parties.
- PSDDA DAIS submittal requirements and "Red Flag" Checklist have been clarified with labs and implemented
- PSDDA consistency with Shoreline Management Act/Shoreline Master Program has elucidated and will be discussed during the ARM.
- Successful implementation of 20-day Neanthes biomass test in test suite during past dredging year
- Minor protocol clarifications requiring ammonia/sulfide monitoring, and minimum initial weight specifications for the 20-day Neanthes test.
- Species substitution for amphipod bioassay clarified
- Technical studies have been completed on sediment larval bioassay establishing LC50/EC50 guidelines for ammonia

2a

SUMMARY OF FOURTH ANNUAL REVIEW MEETING COMMITMENTS AND ACCOMPLISHMENTS (continued)

- National Benthic Workshop held in November 1992, draft report, final report in preparation
- DAIS Bioassay Performance Review has been completed and will be discussed at ARM
- DAIS development almost complete, electronic bulletin board has been implemented, GIS development ongoing

2b

PSDDA PROJECT AND TESTING ACTIVITIES

Dredging Year 1992

June 16, 1991
to
June 15, 1992

3a

DY92 PSDDA EVALUATION ACTIVITIES

Ranking Determinations	12
Sampling Plan Review	18
Data Review/ Suitability Determination	13

22 Total Projects 2,489,203 cubic yards

3b

PROJECT DEFINITION

DY 92 projects are defined as those projects for which the PSDDA agencies made suitability determinations between 16 June 1991 and 15 June 1992, or for which sampling and testing was completed and the application for open-water disposal was withdrawn.

16 projects

1,443,003 cubic yards

3c

DY92 PROJECTS

- Day Island Yacht Club - Tacoma
- 10th Street Boat Ramp - Everett
- 12th Street Barge Channel - Everett
- LaConner Boatworks
- Lott Olympia Treatment Plant Outfall
- Morton Marine - Seattle
- Cedar River Delta - Renton
- American President's Line - Seattle
- Terminal 5 - Seattle
- Terminal 91 - Seattle
- Blair Waterway - Tacoma
- Shell Oil - March Point
- U.S. Navy KB Dock - Keyport
- U.S. Navy Pier D - Bremerton
- USACE/Port of Bellingham O&M
- USACE Duwamish O&M

3d

DY92 PROJECT RANKING

Rank	Project
Low	1
Low-Moderate	4
Moderate	10
High	10

3 projects had dual rankings

3e

DY92 SAMPLING PLANS

- 18 projects
- 2,636,733 cubic yards
- 444 field samples
- 155 dredged material management units

3f

3g

DY92 CHEMICAL TESTING

- 10 of 12 projects had screening level exceedances
- 235 screening levels were exceeded
- 28 maximum levels were exceeded
- Total LPAH and total HPAH were exceeded most often
- Two projects (Bellingham O&M and Terminal 91) accounted for 173 SL exceedances and all ML exceedances

3h

DY92 BIOLOGICAL TESTING

- 10 projects required biological testing
- Tiered testing was conducted for 6 projects
- 72 dredged material management units were tested

DY92 Disposal

- Elliott Bay 242,241 cubic yards
- Rosario Strait 165,150 cubic yards

3j

DY92 SUITABILITY DETERMINATIONS

- 12 projects
- 83 chemical analyses
- 54 biological analyses
- 16 DMMU failed (83,039 cubic yards)

3i

3k

DY93 PROJECTS

- 18 projects
- 7 suitability determinations
- 818,000 cubic yards

PSDDA 1992 MONITORING OVERVIEW AT THE ELLIOTT BAY SITE

4a

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.

4d

4c

PSDDA MONITORING ELEMENTS

Station Type	Variables Measured	Monitoring Questions
Onsite	SVPS. Chemistry, Toxicity	2
Perimeter	SVPS, Chemistry	1
Gradient	SVPS, Benthic infauna, Bioaccumulation	3
Benchmark	All, most archived	1, 2, 3

4b

PSDDA DISPOSAL SITE MONITORING QUESTIONS

1. Does the deposited dredged material stay onsite?
2. Is the biological effects condition for nondispersive site management exceeded at the site due to dredged material disposal?
3. Are unacceptable adverse effects occuring to biological resources immediately offsite due to dredged material disposal?

4e

Elliott Bay PSDDA Disposal Site

Grain Size Major Mode

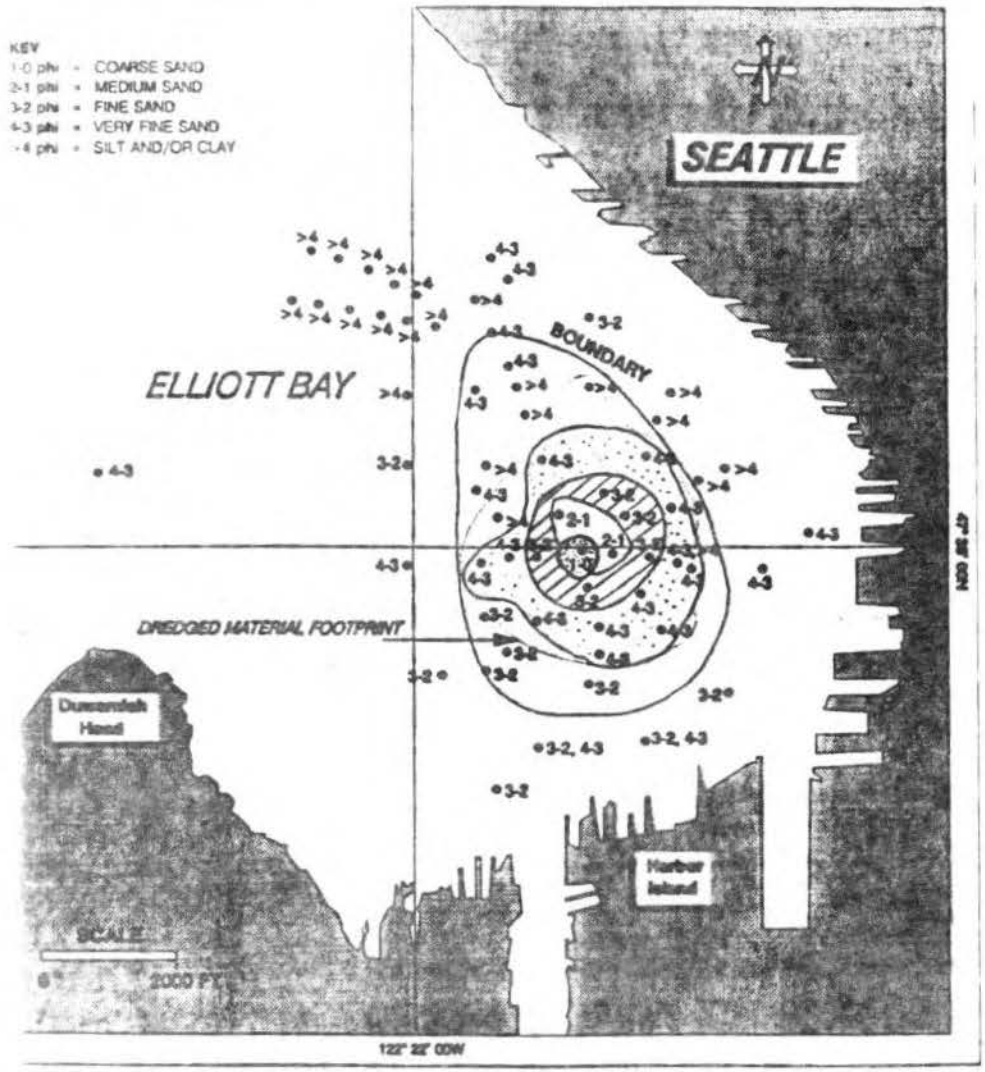


Figure 3-6. The spatial distribution of grain size major modes measured in the 1992 SVPS survey at the Elliott Bay PSDDA disposal site. All measurements are in Udden-Wentworth phi units. Contours illustrate the coarsening of grain-size towards the site center.

4f

Elliott Bay PSDDA Disposal Site

Dredged Material Footprint

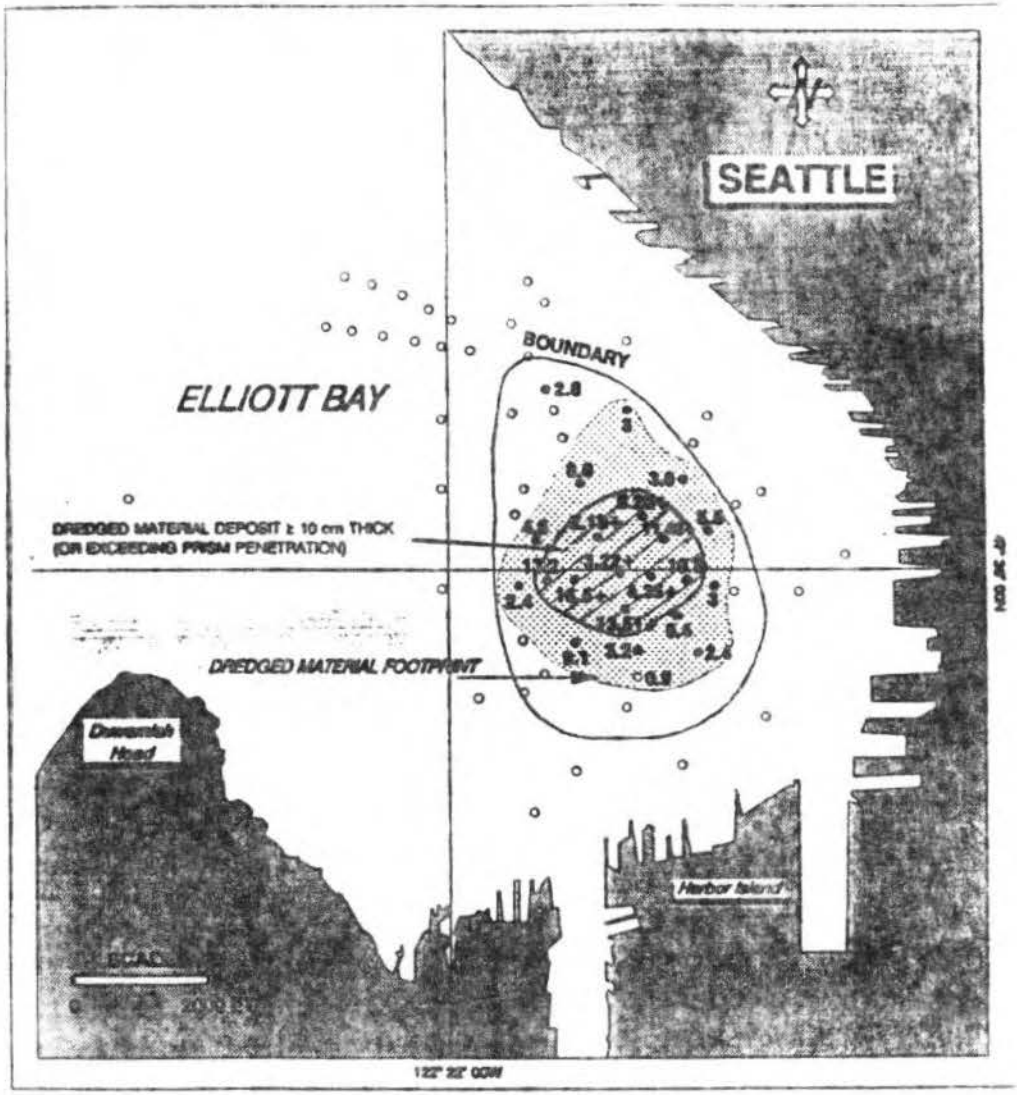


Figure 3-1. The dredged material footprint observed during the 1992 SVPS survey of the Elliott Bay PSDDA disposal site. Deposit thicknesses are reported in cm. Measurements followed by a "+" indicate a minimum value as dredged material extended beyond prism penetration.

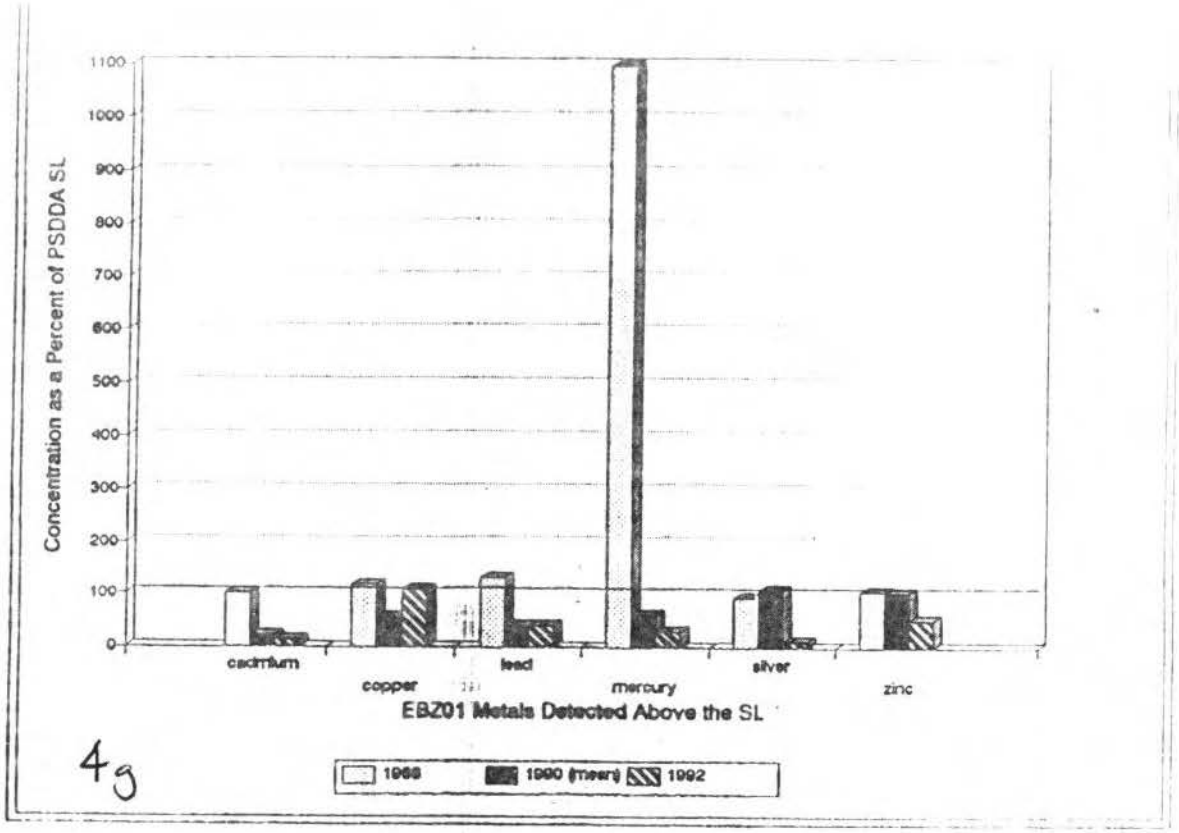


Figure 4-5. Concentrations of EBZ01 metals detected above the PSDDA SL in the baseline (1988), partial monitoring (1990), and full monitoring (1992) surveys expressed as a percentage of the SL (the solid line).

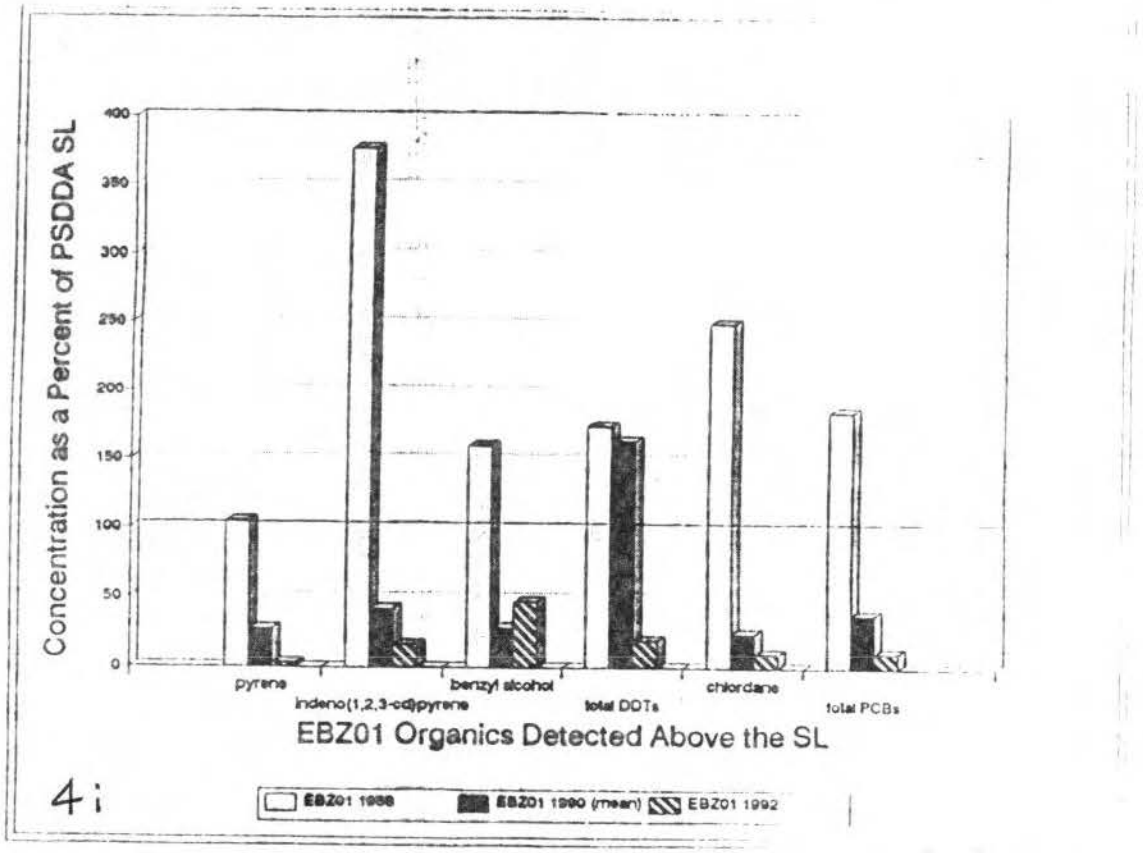


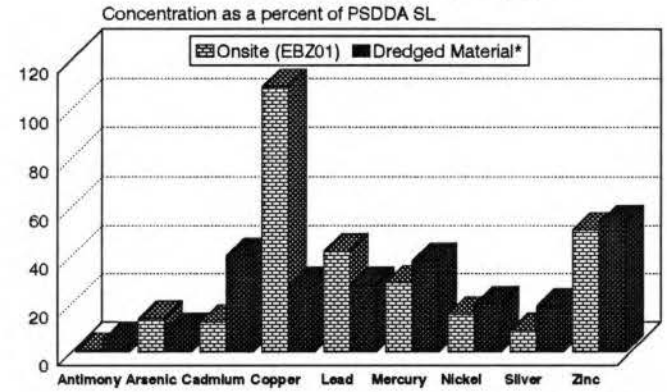
Figure 4-7. Concentrations of EBZ01 organic compounds detected above the PSDDA SL in the baseline (1988), partial monitoring (1990), and full monitoring (1992) surveys expressed as a percentage of the SL (solid line).

POST-DISPOSAL MONITORING RESULTS - Elliott Bay 1992

VARIABLE	GUIDELINES / ACTIONS	CONCLUSIONS
SVPS mapping	No DM on perimeter / no action	DM on site
On-site chemisry	<< ML / no action	< Site Condition
On-site bioassays	No "hits" / no action	< Site Condition
Perimeter / transect chemistry	Exceeds / data review + benchmark analyses	Not due to DM
Transect benthos	No change / no action	No adverse offsite biological effects

4p

Comparative Metals Concentrations Normalized to PSDDA SL Onsite versus Dredged Material*

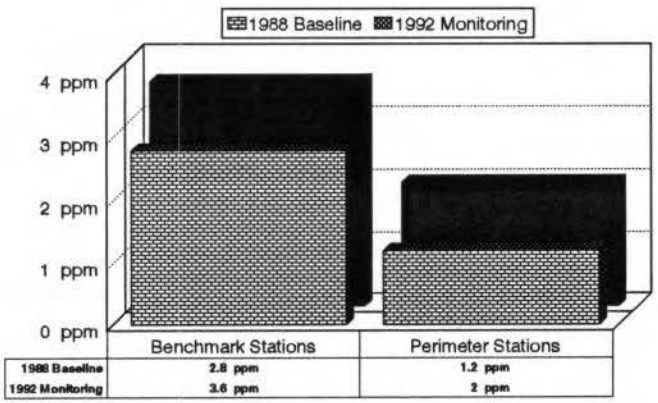


* Loading Calculations based on Weighted Mean Concentrations for all DMMU

4h

4K

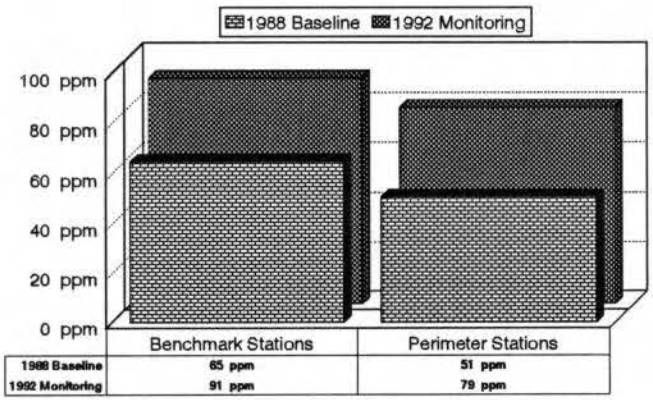
Comparative Antimony Concentrations



PSDDA SL = 20 ppm

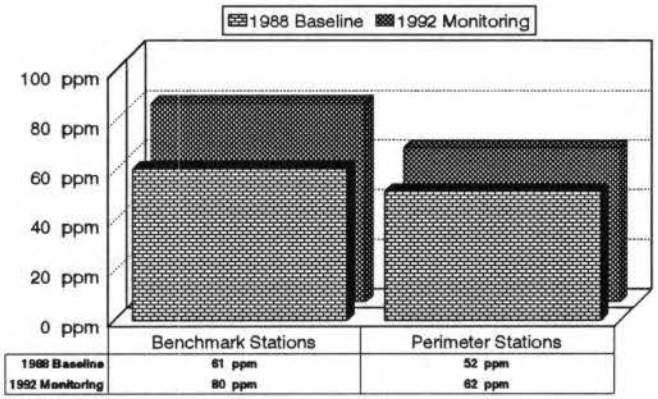
4j

Comparative Copper Concentrations



PSDDA SL = 81 ppm

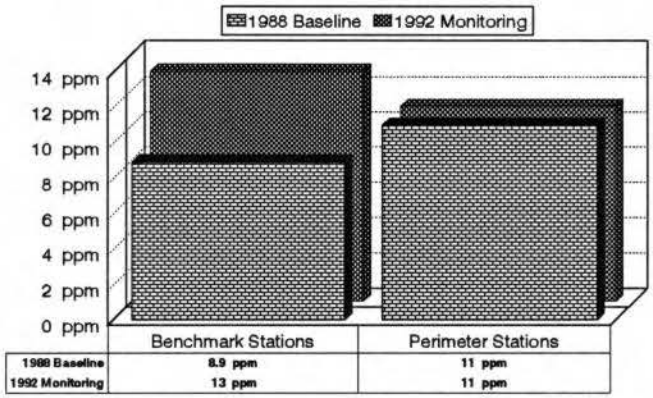
Comparative Lead Concentrations



PSDDA SL = 66 ppm

4m

Comparative Arsenic Concentrations



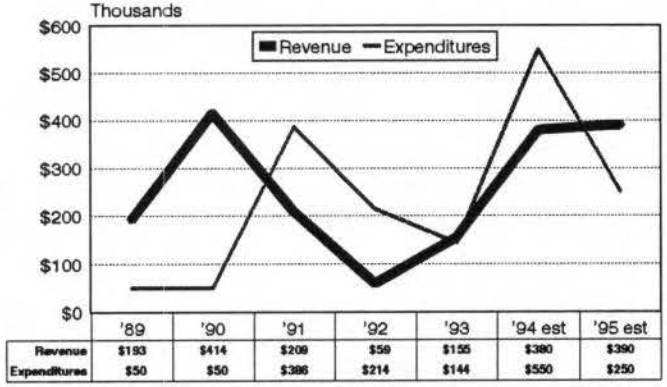
PSDDA SL = 57 ppm

4n

4q

PSDDA FUND

Disposal Fee - $0.40 / cy



Total Revenues: $1,800,000; Total Expenditures: $1,664,000

4r

"LIKELY PROJECTS" (> 50,000 cy) DY' 94 - 95

PROJECT	VOLUME	DREDGING YEAR (DY)
Blair Waterway	160,000 cy?	94
Lower Snohomish	460,000 cy	94
POE, S. Terminal	75,000 cy?	95
Harbor Point	225,000 cy	94
U.S.Navy, Element II	110,000 cy	94
U.S. Navy, Norton	115,000 cy	95
U.S. Navy, Pier D	70,000 cy	94
Jones Marina	500,000 cy	95

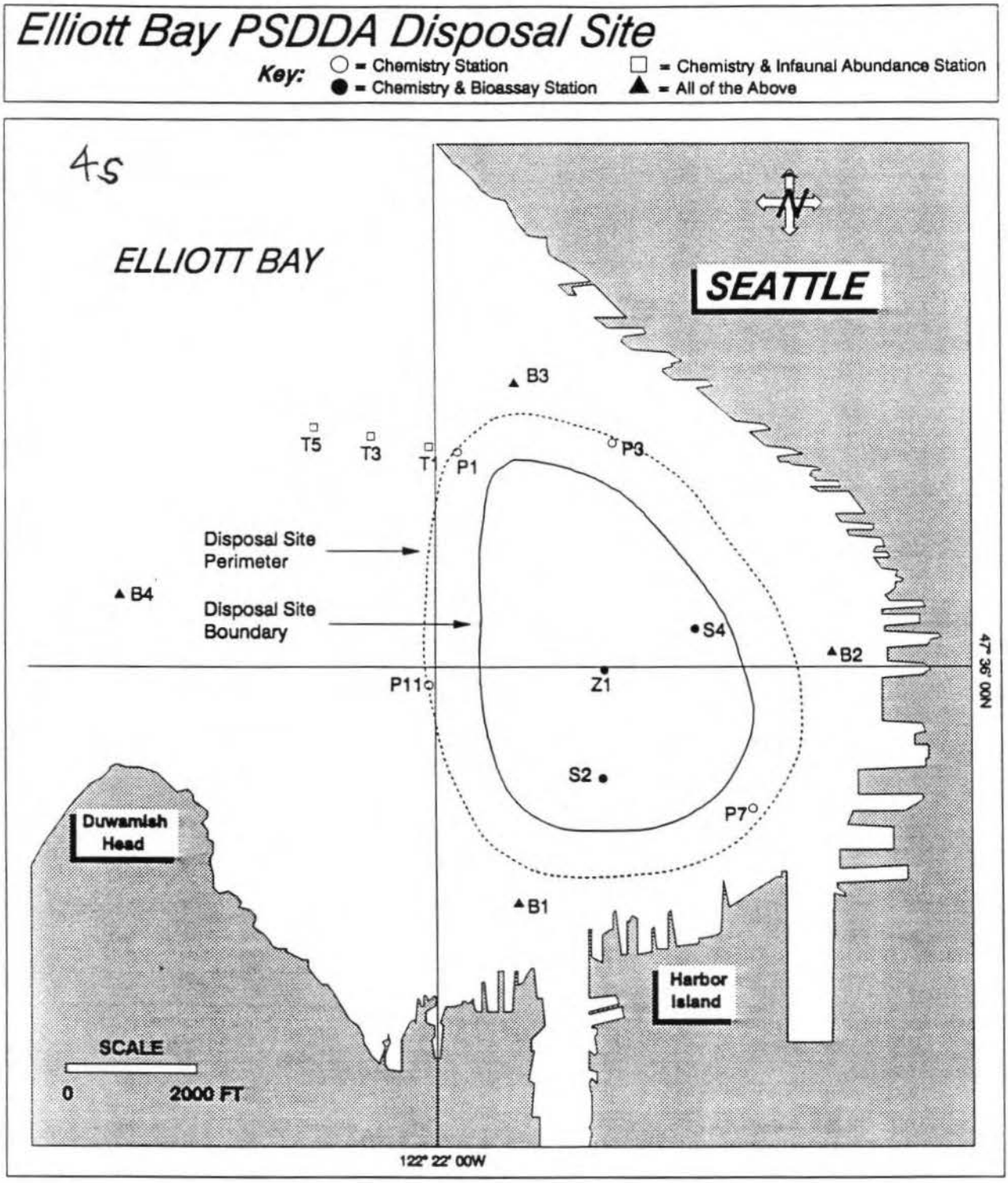


Figure 3-2. Sediment chemistry, bioassay, and benthic infauna stations occupied in Elliott Bay in 1992. B4 lies just west of the grid shown.

DAIS

Dredged Analysis Information System

5a

DAIS

- sampling
- chemical and biological testing
- disposal site monitoring
- administrative

5b

5c

DAIS

Sampling Data

- station coordinates
- sampling methods
- compositing

5d

DAIS

Chemical Testing Data

- chemicals of concern
- sediment conventionals
- grain size
- QA/QC

DAIS

Biological Testing Data

- PSDDA bioassays
- field and laboratory bioaccumulation
- water quality
- reference toxicant

5e

DAIS

Administrative Data

- regulatory milestones
- suitability determinations
- dredged material volumes
- sampling and testing costs

5f

5g

DAIS

Reporting Capabilities

- QA/QC
- guideline exceedances
- data summaries
- disposal site use
- administrative tracking

5h

DAIS

New Modules

- administrative
- QA/QC and summary reports
- SEDQUAL transfer
- Bioaccumulation

DAIS

GIS Development

- PC ARC/INFO
- Sun SPARCstation IPX GX Graphics Workstation
- ARC/INFO 6.1

5i

DAIS

Future Modules

- GIS queries
- physical monitoring
- benthic

5j

5k

DAIS

Data Entry Screens

√ Clipper interface

√ menu-driven

√ user friendly

5m

DAIS

Data Entry

√ DMMO will enter data for now

DAIS

Bulletin Board

- bulletin board number - 764-3676
- call DMMO at 764-3768 with suggestions

5n

DAIS

Special Thanks

- Dave Gustafson
- Glen Salts

5p

PSDDA Sediment Quality Values: Status of Re-evaluations

T. H. Gries, K. H. Waldow, K. Bragdon-Cook,
D. D. Turner, A. Martin Payne

Department of Ecology
Olympia, Washington

6a

6b

Background/History

1986:
Development of Sediment Quality Values for Puget Sound

1988:
Update and Evaluation of Puget Sound AET

1989-1991:
Changes to 7 PSDDA screening levels, but insufficient new sediment quality data/supporting QA for calculating new AETs

1992-1993:
Preliminary amphipod mortality and larval abnormality AETs

6c

Re-evaluation Process

- Select data sets with acceptable amphipod/larval data results
- Interpret biological effects, perform statistical analysis
- Calculate AETs and reliability, compare to 1988 values
- Screen *a posteriori* for anomalous stations, pattern analysis
- Recalculate, conduct "impact analysis"
- Recommend changes to PSDDA Regulatory Work Group

Method of Determining "Hits" for Calculation of Amphipod and Larval AETs

Prepared by Kathryn Horntvedt Waldow
for the PSDDA agencies
on May 7, 1993

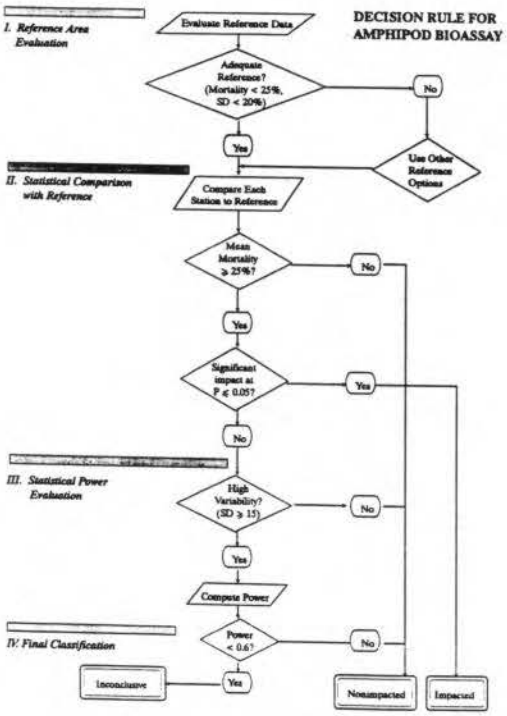
6d

Reasons for Excluding a Survey, Batch, or Sample from the AET Recalculations

- ★ Data is not synoptic.
- ★ Survey fails chemical QA requirements.
- ★ Data is not available for a batch which performed poorly and was hence re-run.
- ★ Negative control fails PSEP guidelines.
- ★ Sample has less than 5 replicates.
- ★ Sample is classified as inconclusive in data analysis.

6e

6f



6g

REFERENCE OPTIONS:

- ★ Use only those study-specific reference stations that pass the criteria (1988, 1993)
- ★ Use historical data
- ★ Collect new data
- ★ Use standard reference data
- ★ *Use the negative control data (1993)*

Conventions for Larval Bioassay Data Entry

I. **Mortality Endpoint**

A. SeaWater (Negative) Control:

1. Init_Value = stocking density = average number of larvae introduced to individual chamber or beaker at beginning of SeaWater Control test, if available. If not available? CONTACT SOURCE LAB!

2. Final_Value = total number of survivors in each replicate (normal + abnormal) at end of SeaWater Control test.

B. Positive Control:

1. Init_Value = average total number of survivors (over all replicates) at end of SeaWater Control test.

2. Final_Value = total number of survivors in each replicate (normal + abnormal) at end of Positive Control test.

C. Test Sediment Samples:

1. Init_Value = average total number of survivors (over all replicates) at end of SeaWater Control test.

2. Final_Value = total number of survivors in each replicate (normal + abnormal) at end of Sediment Sample test.

Note: The Positive Control and Sediment Sample mortality endpoint Init_Values factor out mortality due to causes other than contamination.

6h

II. **Abnormality Endpoint**

A. SeaWater (Negative) Control:

1. Init_Value = total number of survivors in each replicate (normal + abnormal) at end of SeaWater Control test.

2. Final_Value = total number of normal survivors in each replicate at end of SeaWater Control test

B. Positive Control:

1. Init_Value = total number of survivors in each replicate (normal + abnormal) at end of Positive Control test.

2. Final_Value = total number of normal survivors in each replicate at end of Positive Control test

C. Test Sediment Samples:

1. Init_Value = total number of survivors in each replicate (normal + abnormal) at end of Sediment Sample test.

2. Final_Value = total number of normal survivors in each replicate at end of Sediment Sample test

Note: The abnormality endpoint Init_Value is the same as the corresponding mortality endpoint Final_Value.

6i

6j

III. **Combined Abnormality/Mortality Endpoint**

A. SeaWater (Negative) Control:

1. Init_Value = stocking density = average number of larvae introduced to individual chamber or beaker at beginning of SeaWater Control test.

2. Final_Value = total number of normal survivors in each replicate at end of SeaWater Control test

B. Positive Control:

1. Init_Value = average total number of normal survivors (over all replicates) at end of SeaWater Control test.

2. Final_Value = total number of normal survivors in each replicate at end of Positive Control test

C. Test Sediment Samples:

1. Init_Value = average total number of normal survivors (over all replicates) at end of SeaWater Control test.

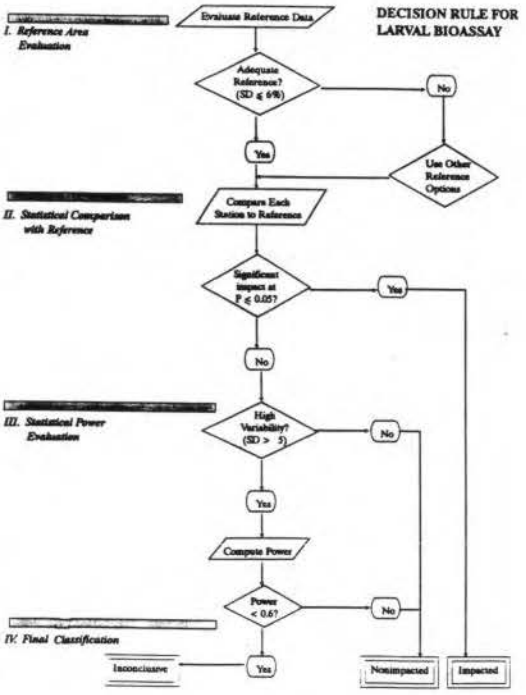
2. Final_Value = total number of normal survivors in each replicate at end of Sediment Sample test

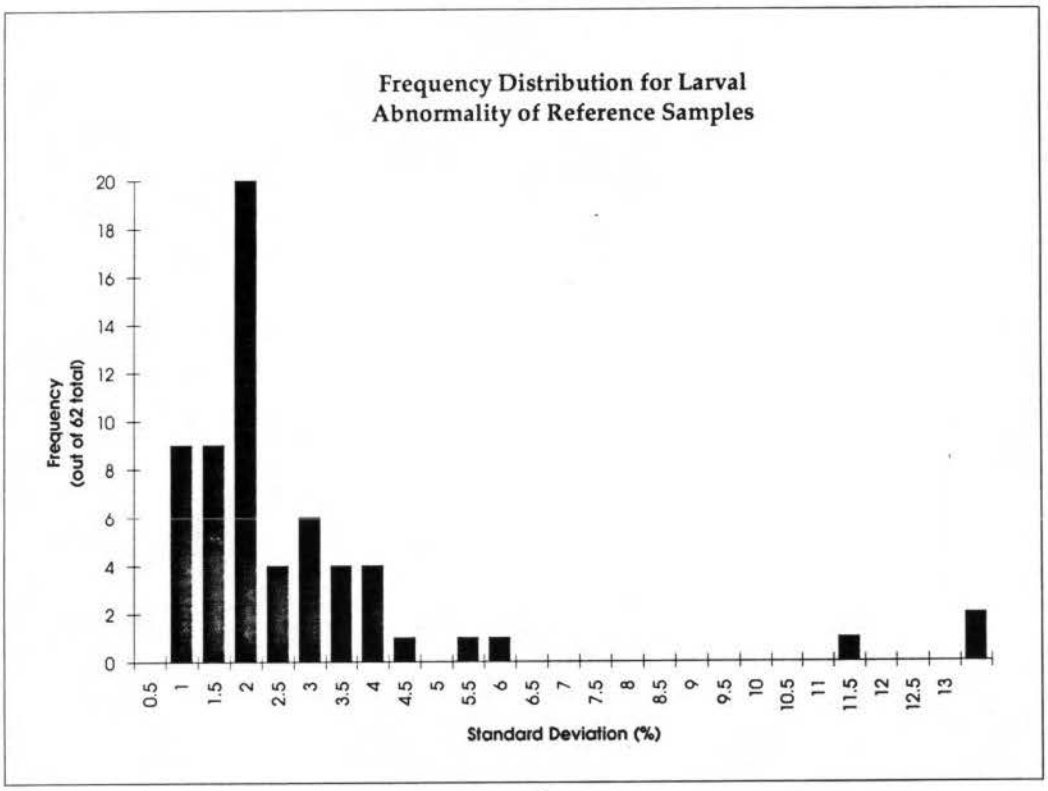
Notes: The Positive Control and Sediment Sample combined endpoint Init_Vals factor out mortality and abnormality due to causes other than contamination.

A combined endpoint has the same Final_Value as the corresponding abnormality endpoint.

Since the mortality and combined endpoint Init_Values are averages, the resulting percent mortality and percent combined mortality and abnormality may be negative numbers.

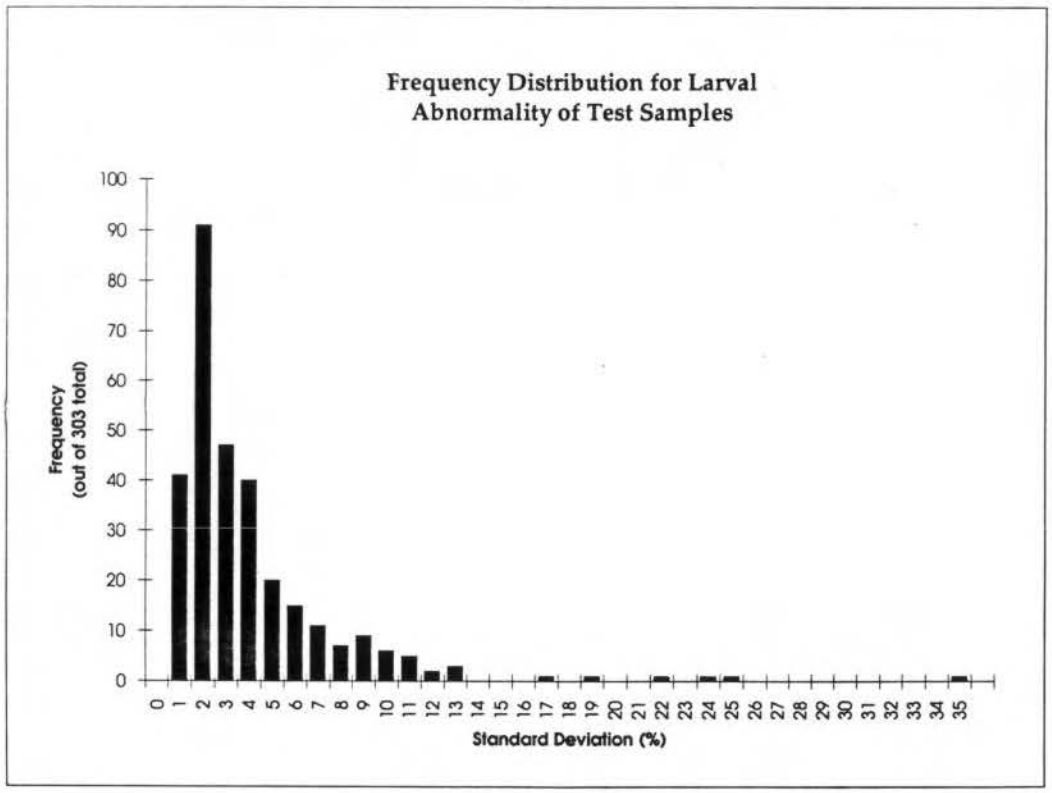
6k




Frequency Distribution for Larval
Abnormality of Reference Samples
Frequency
(out of 62 total)
0
2
4
6
8
10
12
14
16
18
20
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
10.5
11
11.5
12
12.5
13
Standard Deviation (%)

6m

6n


Frequency Distribution for Larval
Abnormality of Test Samples
Frequency
(out of 303 total)
0
10
20
30
40
50
60
70
80
90
100
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
Standard Deviation (%)

General Results

Type of Result Individual Chemical AET	Possible Effect/Impact
New AET qualified	None
New AET not qualified, < old unqualified AET	None
New AET not qualified, < old qualified AET	?
New AET not qualified, equals old qualified AET	Add chemical of concern?
New AET not qualified, > old unqualified AET	New AET (if reliability comparable)

6r

DataBase Comparison

	SEDQUAL 1989	SEDQUAL 1993
Sediment Chemistry Surveys/Stations	23/1021	137/2203
"Synoptic" Surveys/Stations:		
Amphipod	9/287	70/887
Bivalve	2/56	3/31
Echinoderm	0/0	31/252

6p

Preliminary Observations

- New amphipod AETs:
  - enhanced database
  - "similar" to 1988 AETs
- Limitations to 1986 Oyster AETs:
  - 2 surveys, 1 urban bay
  - duplicates only
- Limitations to new Bivalve larvae abnormality AETs:
  - 3 surveys
  - wider, but perhaps not representative, distribution
  - 5 replicates per station/sample
  - lower than 1986 Oyster AETs
- New Echinoderm AETs:
  - 31 surveys, 252 stations/samples
  - good geographic distribution
  - "similar" to 1986 Oyster AETs

6s

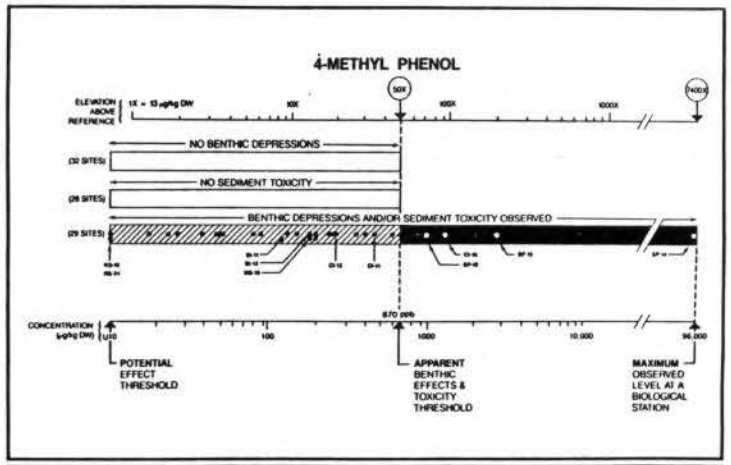
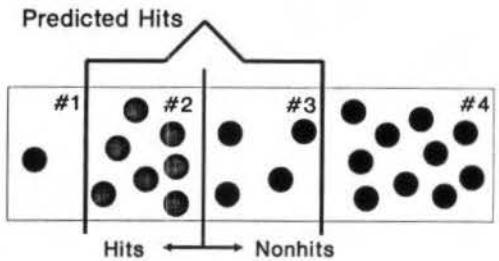


Figure 8. AET approach: 4-Methyl phenol (dots in lowest bar designate stations from Tetra Tech, 1985).

6q

Criteria Reliability



Sensitivity = ● / (● + ●) = 88%

Efficiency = ● / (● + ●) = 64%

Overall Reliability = (● + ●) / (● + ● + ● + ●) = 81%

6v

Chemical of Concern	1988 Amphipod AET	1993 Amphipod AET	Ratio 1993/1988 AETs
Mercury	2.1	7.3	3.48
Phenanthrene	6,900	21,000	3.04
HPAH (ppb)	69,000	110,000	1.59
Pyrene	16,000	24,000	1.50
Benz(a)anthracene	5,100	14,000	2.75
Chrysene	9,200	21,000	2.28
Benzofluoranthenes	7,800	15,000	1.92
Benzo(a)pyrene	3,000	8,200	2.73
Indeno(1,2,3-c,d)pyrene	1,800	4,700	2.61
Benzo(g,h,i)perylene	1,400	3,100	2.21
Di-n-butyl phthalate	1,400	1,800	1.29
Pentachlorophenol	360	400	1.11
Dibenzofuran	1,700	2,000	1.18
p,p'-DDE	15	22	1.47
p,p'-DDD	43	65	1.51

6t

DRAFT

Reliability: Preliminary Comparison

Dry Weight AETs	Sensitivity	Efficiency	Overall Reliability
1988 Amphipod AETs	58%	100%	85%
1993 Amphipod AETs	~ 30%	100%	~ 85%
1986 Oyster AETs	88%	100%	96%
1993 Bivalve AETs	~ 80%	100%	~ 80%
1993 Echinoderm AETs	~ 40%	100%	~ 60%

6w

Chemical of Concern	1988 Oyster AET	1993 Bivalve AET	1993 Echinoderm AET	1993 Combined/ 1988 Oyster AET
Naphthalene	2,100		2,900	1.38
Benzofluoranthenes	3,600		4,700	1.31
Dibenzo(a,h)anthracene	230		630	2.74
Benzo(g,h,i)perylene	720		1,000	1.39
4-Methylphenol	670	1,500	1,100	2.24
Dibenzofuran	540		850	1.57
p,p'-DDT	>6		32	

6u

DRAFT

Reliability: Preliminary Comparison

TOC-Normalized AETs	Sensitivity	Efficiency	Overall Reliability
1988 Amphipod AETs	45%	100%	80%
1993 Amphipod AETs	~ 30%	100%	~ 85%
1986 Oyster AETs	~ 70%	100%	~ 90%
1993 Bivalve AETs	78%	100%	79%
1993 Echinoderm AETs	~ 35%	100%	~ 55%

6x

"Work Remaining"

- ☹ Final screen of amphipod/larval reference samples
- ☺ Exclusion of subsurface test samples
- ☹ Obtain additional TOC data
- ☺ Screen for chemically anomalous stations
- ☹ Perform "pattern analysis"
- ☺ Remove "rare" chemicals from new AETs prior to final reliability analyses

6y

6z

"Work Remaining"

- ☹ Calculate final AETs, reliability
- ☺ Propose and test new PSDDA MLs/SLs
- ☹ Perform analysis of "impacts", ie, compare previous PSDDA project results to new MLs/SLs
- ☺ Calculate new benthic AETs and their reliability
- ◘ (The light at the end of the tunnel)

PSDDA BENTHIC METHOD

Monitoring of Disposal Sites

Abundance of Major Taxa
- Polychaetes
- Molluscs
- Crustaceans
- Miscellaneous (other)

Abundance Significantly < Baseline

Reduced by >50% from Reference

7a

WHY BENTHIC STUDY WAS DONE

Environmental Protection

Desire and Commitment to Improve SMS and PSDDA Methods

Address Concerns, Questions and Issues of 1990 and 1991 PSDDA ARM

7b

7c

OBJECTIVES

1) Identify and summarize the technical methods used to assess benthic community effects in regulatory programs;

2) Evaluate the adequacy of effects endpoints and analytical methods with respect to identifying benthic impacts

3) Provide recommendations regarding improvements to the selection, analysis, and interpretation of benthic effect endpoints used in the management of Puget Sound sediments.

7d

WHAT HAS BEEN DONE

1) SUMMARY REPORT OF EXISTING METHODS

2) NATIONAL BENTHIC WORKSHOP

3) FINAL SUMMARY REPORT WITH RECOMMENDATIONS

1) REPORT:

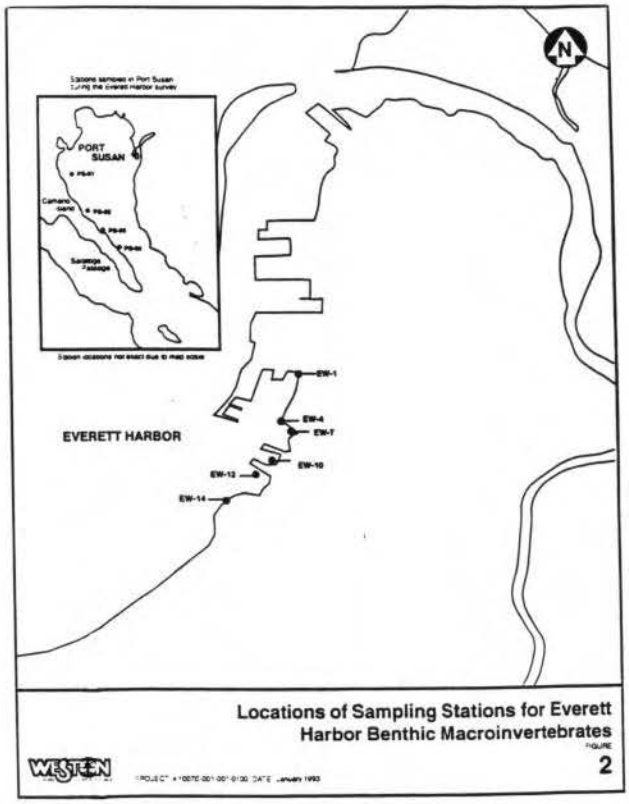
Evaluation of Techniques for Assessing Benthic Endpoints for Use in Puget Sound Sediment Management Programs

Summary of indices used in a regulatory setting

Pros and cons

Case Study - Everett Harbor

7e



7f

7g

Table 3—Comparison of test results in identifying adverse benthic impacts

Station	Conclusion Based on Numeric Criteria: Total	Crustacean Abundance	Mollusc Abundance	Polychaete Abundance	Richness	Conclusion Based on Best Professional Judgement: H'	J and D	SDI	ITI	Pollution sensitive taxa (%)	Pollution tolerant taxa (%)
EW 01	*	-50%*	-50%*	-50%*	*	stressed	stressed	stressed	stressed	stressed	stressed
EW 03	*	-50%*	-50%*	*	*	stressed	stressed	stressed	stressed	stressed	stressed
EW 07	*	NS	-50%*	-50%*	*	unstressed	moderately stressed	moderately stressed	stressed	stressed	moderately stressed
EW 10	*	-50%*	-50%*	*	*	stressed	stressed	stressed	stressed	stressed	stressed
EW 12	*	*	-50%*	NS	NS	unstressed	moderately stressed	moderately stressed	unstressed	unstressed	unstressed
EW 14	NS	NS	-50%*	NS	NS	unstressed	unstressed	unstressed	unstressed	stressed	unstressed

* Significantly different compared to reference
NS Not significantly different compared to reference
-50% Less than 50% of the reference abundance

7h

2) NATIONAL BENTHIC WORKSHOP

Panel members:

Dr. Richard Swartz
Environmental Protection Agency, Oregon

Dr. Peter Chapman
EVS Consultants, Vancouver, B.C. Canada

Dr. Robert Diaz
Virginia Institute of Marine Science, Virginia

Ms. Nancy Musgrove
Roy F. Weston Consultants, Washington

Dr. Jeff Hyland
Arthur D. Little, Massachusetts

Dr. Bruce Thompson
Aquatic Habitat Institute, California

TABLE 1. COMPARISON OF BENTHIC COMMUNITY INDICES WITH EVALUATION CRITERIA

Index	Evaluation Criteria: Sensitivity	Objectivity	Ease of Interpretation	Reference Area Comparison	Cost Effectiveness
Indicator species	H	H	H	Yes	M & H
Species level abundance	M to H (H')	H	M+	Yes	M
Infaunal Index	M to H (H')	H-	L to M	Yes	H
Richness	M to H (H')	M	M+	Yes	H
Total abundance	M	M	M+	Yes	H
Major taxa abundance	M	M	M+	Yes	H
Biomass	M	M	M	Yes	L,M
Diversity, evenness, dominance	L to H	L to H	L to H	Yes	L to H

* Codes used by panel members to rank benthic community indices:

L low
M medium
H high.

7i

GENERAL RECOMMENDATIONS:

Identification to species level

Apply multiple indices

Integrative assessments including chemistry and biology are necessary (triad)

Drop diversity indices

Define reference conditions for Puget Sound

7j

7K

SPECIFIC METHOD RECOMMENDATIONS:

Chapman

Species Richness
Total Abundance
Species Abundance
Numerical Dominance
Biomass
Triad

Thompson

Richness
Abundance
Biomass
Swartz Diversity Index
Triad

Musgrove

Multiple Methods
Species Richness
Community Composition
Swartz Diversity Index
Infaunal Index

Diaz

Multiple Methods
Biomass
Richness

Swartz

Richness
Infaunal Index
Indicator Species
Species Abundance
Dominance
Triad

Hyland

Multiple Methods
Species Abundance
Taxa Abundance
Infaunal Index

7m

3) FINAL REPORT

Summary of research and conclusions from the first report

Summary of recommendations, discussions and results of the workshop

FUTURE WORK

PSDDA agencies evaluate the recommendations

Determine if changes need to be made

Proposed changes reviewed by a regulatory work group

Striplin Environmental Assoc.
Reference Sites

7n

PHASE II: AMMONIA TOXICITY

- Establish No Observed Effects Concentration (NOEC)

  Lethal Concentration 20%, 30%, 50%
  Effective Concentration 20%, 30%, 50%

- Effects of aeration on test results

TEST OVERVIEW

- Test dilution series using ammonium chloride:
  sand dollars 0-10 mg/L
  oysters 0-40 mg/L

- Aerated and Unaerated

- Measurements at 0, 4, 24, and 48 hours

- Test ends when >90% of seawater control reaches pluteus larval or D-shaped stage

"REFINEMENTS TO CURRENT PSDDA BIOASSAYS"

Phase I. Literature Search

Phase II. Ammonia Effects

Phase IIIA. Species Sensitivity Comparison to Grain Size

Phase IIIB. Species Sensitivity Comparison to Contaminated Sediment

PHASE I: LITERATURE SEARCH

- Oyster and sand dollar comparability and sensitivity to ammonia, grain size, or presence of sediment in vessel.

- Annotated bibliography

PHASE IIIA: SPECIES SENSITIVITY COMPARISON TO CLEAN REFERENCE SEDIMENTS (GRAIN SIZE EFFECTS)

- Compare sensitivity to varying grain sizes and test procedures
- Within species response comparison to varying grain sizes and test procedures
- Establish some conditions under which larval methods may be susceptible to false positives due to suspended sediment in chamber

TEST OVERVIEW

Targeted test range:
<30%, 45-60%, 65-75%, and >85% fines

Three basic procedures:

- PSDDA 4 Hour Settlement (20 g/L sediment), aerated and unaerated
- PSDDA 24 Hour Settlement, unaerated
- Green Book (1 part sediment/4 parts water), stirred 30 min, settle 30 min
  - PSDDA count
  - Green Book count

THREE POINTS:

- Abnormality can include larval forms that are embryologically correct...if fails to achieve the same developmental stage as control, scored as abnormal
- %Mortality calculated separately from %Abnormality to distinguish LC and EC responses
- Use of unionized ammonia values, dependant on temp., salinity, pH

POTENTIAL THRESHOLDS

- Sand dollar 0.04 mg/L unionized ammonia (applies to abnormality, not an acute value for mortality)
- Sand dollar warning level at NOEC 0.014 mg/L unionized ammonia
- Oyster insufficient dose response, however, geometric mean is 0.13 mg/L unionized ammonia

PHASE IIIB: SPECIES SENSITIVITY COMPARISON TO CONTAMINATED SEDIMENTS

- Determine if oysters and sand dollars:

  have equivalent responses to the same contaminated sediment

  are equivalent in predicting sediment toxicity in PSDDA

- Compare various test protocols & sediment toxicity predictions

TEST OVERVIEW

Six contaminated sediments over five test procedures

Chose two contaminated sediments and diluted them by 50% and 75% with Carr reference sediment from Phase IIIA locations

Contaminated sediment:
- site D1 in Elliott Bay (high LPAH, HPAH)
- site M1 Duwamish West Waterway (metals)

TWO POINTS:

Mortality is the combined mortality/abnormality endpoint.

DO levels in the Green Book preparations resulted in 100% mortality.

SUGGESTIONS:

- Evaluate importance of clay fraction relative to silt fraction when using %fines to evaluate grain size impacts
- Explore use of %solids information to calculate actual amount of silt and clay in the container as grams of material per liter
- Use sand dollar in fine-grained (relatively high silt and clay) sediments

Table IIIB-4. Application of PSDDA bioassay criteria to Oyster as Echinoderm responses to the (M1) dilution series and treatments.

STATION	MEAN	STANDARD DEVIATION	COMPUTED t	CRITICAL t	STATISTICAL SIGNIFICANCE	20% OVER CONTROL	30% OVER REF
			PERCENT MORTALITY				
OYSTERS							
SW	0	0					
CARR2	0	0					
OM14UA	41.5	10.4	13.95	1.77	•	○	•
OM54UA	34.4	8.6	15.06	1.78	•	○	•
OM24UA	18.3	8.8	7.83	1.77	•		
OM14A	61.1	7.2	26.48	1.77	•	○	•
OM54A	44.7	8.8	17.60	1.77	•	○	•
OM24A	35.9	8.8	14.15	1.77	•	○	•
OM124UA	15.5	18.3	2.18	1.77	•		
OM524UA	25.1	13.0	7.45	1.77	•	○	
OM224UA	18.4	10.3	6.40	1.80	•		
OM1G	60.0	3.5	53.17	1.77	•	○	•
OM5G	32.6	7.3	16.93	1.77	•	○	•
OM2G	17.9	15.0	3.60	1.78	•		
OM1GP	45.3	8.8	17.97	1.77	•	○	•
OM5GP	55.2	12.6	14.09	1.77	•	○	•
OM2GP	8.4	8.4	2.63	1.77	•		
ECHINODERMS							
SW	0	0					
CARR2	15.4	9.6					
EM14UA	46.7	7.8	5.35	1.77	•	○	•
EM54UA	28.6	22.1	.99	1.77			
EM24UA	19.1	12.6	.36	1.77			
EM14A	99.0	1.8	15.32	1.77	•	○	•
EM54A	84.0	10.2	8.01	1.77	•	○	•
EM24A	49.9	15.1	4.44	1.77	•	○	•
EM124UA	12.2	8.9	-.44	1.77			
EM524UA	4.5	7.9	-2.12	1.77			
EM224UA	1.7	5.4	-3.56	1.77			
EM1G	96.5	1.7	14.73	1.77	•	○	•
EM5G	67.0	14.5	6.31	1.77	•	○	•
EM2G	15.1	18.6	-.40	1.77			
EM1GP	99.6	.7	17.18	1.77	•	○	•
EM5GP	56.1	12.2	5.69	1.77	•	○	•
EM2GP	35.0	14.0	2.90	1.77	•	○	

O = oyster
E = echinoderm

M = M1
D = D1

1 = 100%
5 = 50%
2 = 25%

4UA = 4 hour unaerated
4A = 4 hour aerated

24UA = 24 hour unaerated
G = Green Book
GP = Green Book/PSDDA

TEST SEDIMENTS

M1
M1C2 50/50
M1C2 25/75
C2

D1
D1C4 50/50
D1C4 25/75
C4

8n

8p

- 4 Hour settlement with aeration recommended for regulatory program
- 24 Hour settlement least accurate

Relationship between oyster mortality and sand dollar mortality as predictors, consistent with reference toxicant data using phenol and $CdCl_2$.

As toxicant concentrations increased had fewer oyster larvae and more abnormal sand dollar larvae.

RECOMMENDATIONS

- Oyster and sand dollar equivalent predictors of contamination under PSDDA program
- Sand dollar recommended as primary test organism (sensitivity over the M1 series range, Phase IIIA showed less sensitivity to increased silt/clay, native, gravid adults all year, easier handling/spawning
- Continue use of combined mortality/abnormality endpoint

FIGURE II-3 ECHINODERM AMMONIA &. TIME
UNAERATED TREATMENTS

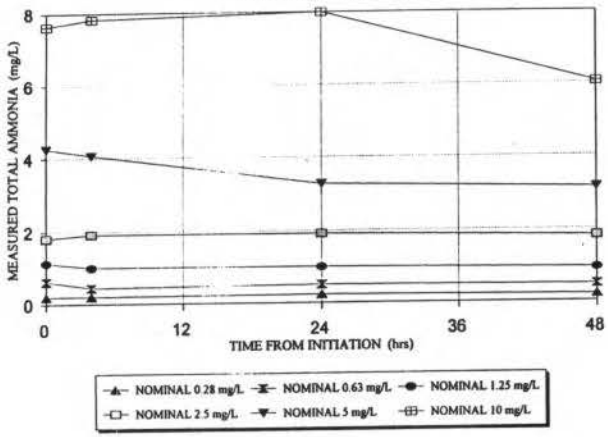


FIGURE II-1 OYSTER AMMONIA & TIME
AERATED TREATMENTS

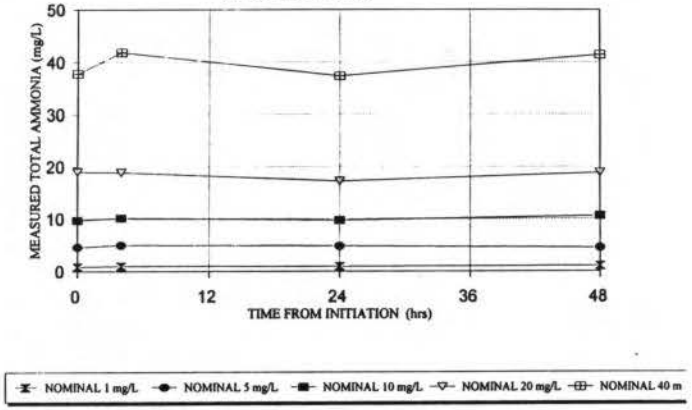


FIGURE II - 4. ECHINODERM AMMONIA VS.
AERATED TREATMENTS

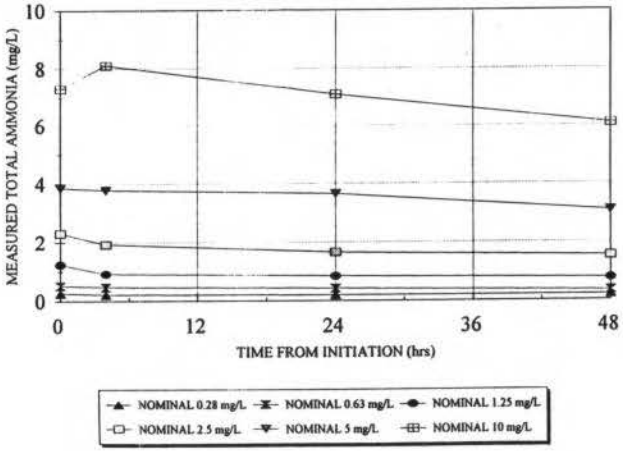


FIGURE II - 2 OYSTER AMMONIA VS. TIME
UNAERATED TREATMENTS

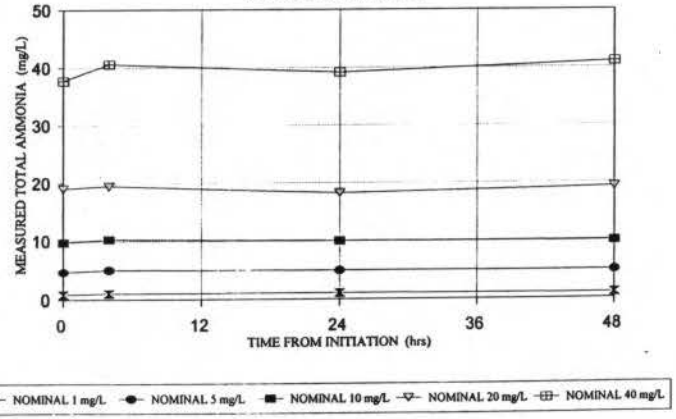


Figure IIIA-1. Oyster Mortality
Grain Size and Aeration Effects

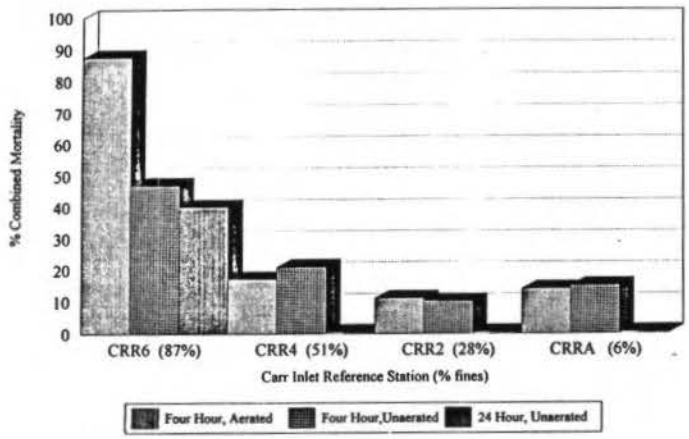


Figure IIIA-2. Oyster Abnormality
Grain Size and Aeration Effects

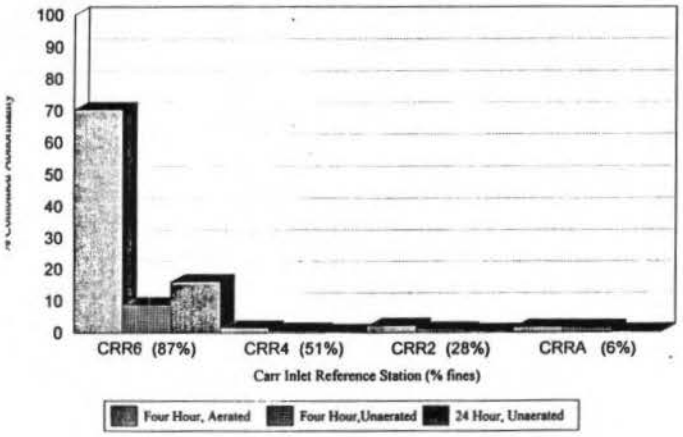


FIGURE II-5. OYSTER AMMONIA EFFECTS
AERATED VS. UNAERATED TREATMENTS

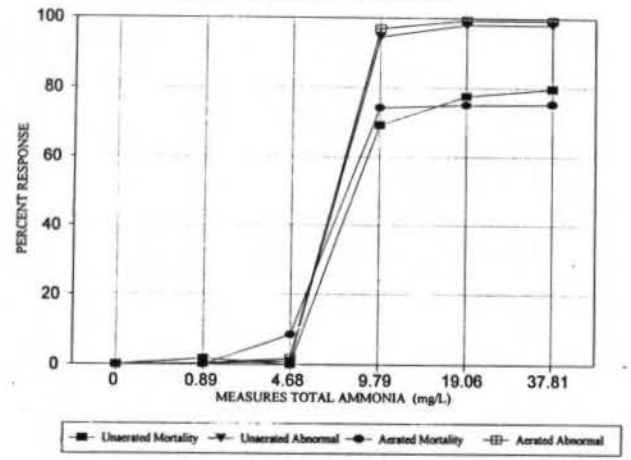
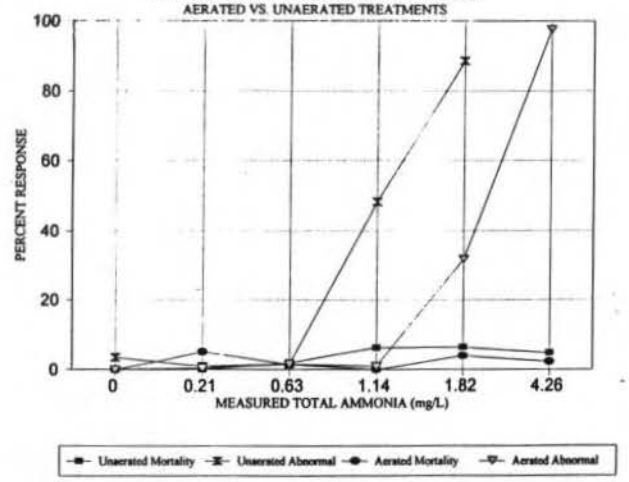
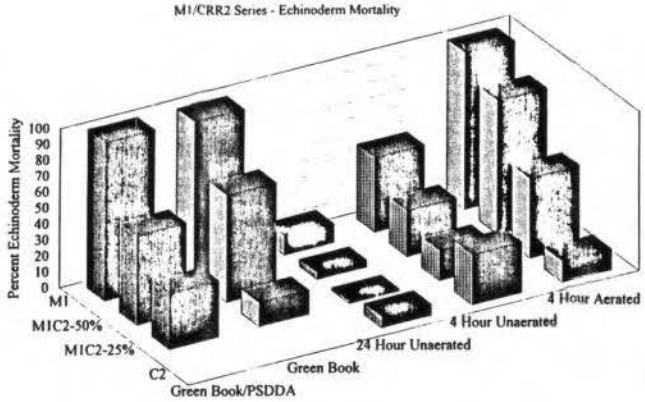


FIGURE II-6 ECHINODERM AMMONIA EFFECTS
AERATED VS. UNAERATED TREATMENTS



Phase IIIB, Figure 2

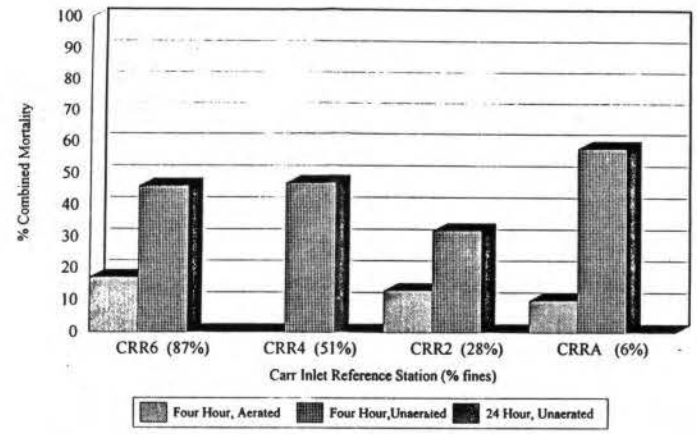
M1/CRR2 Series - Echinoderm Mortality



88d

Figure IIIA-3. Echinoderm Mortality

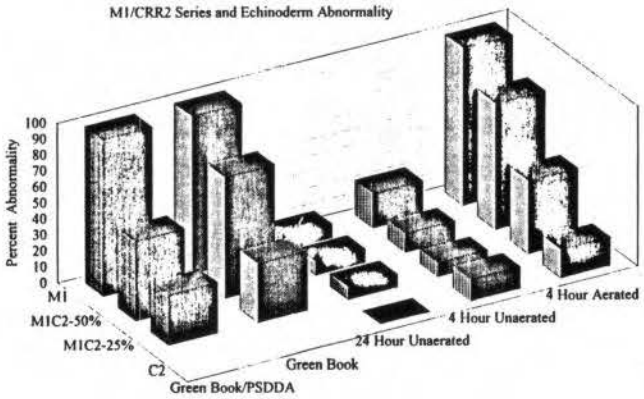
Grain Size and Aeration Effects



88b

Phase IIIB, Figure 3

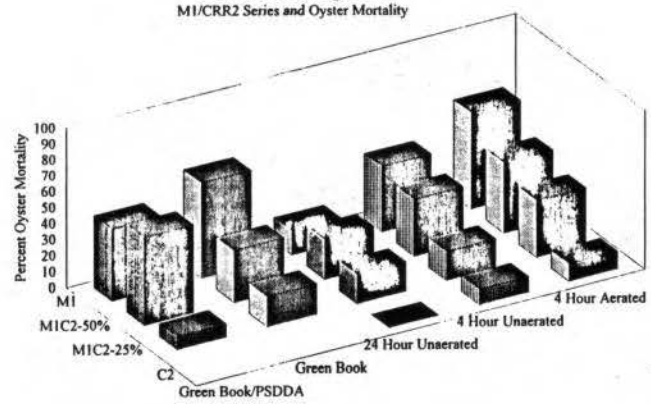
M1/CRR2 Series and Echinoderm Abnormality



88e

Phase IIIB, Figure 1

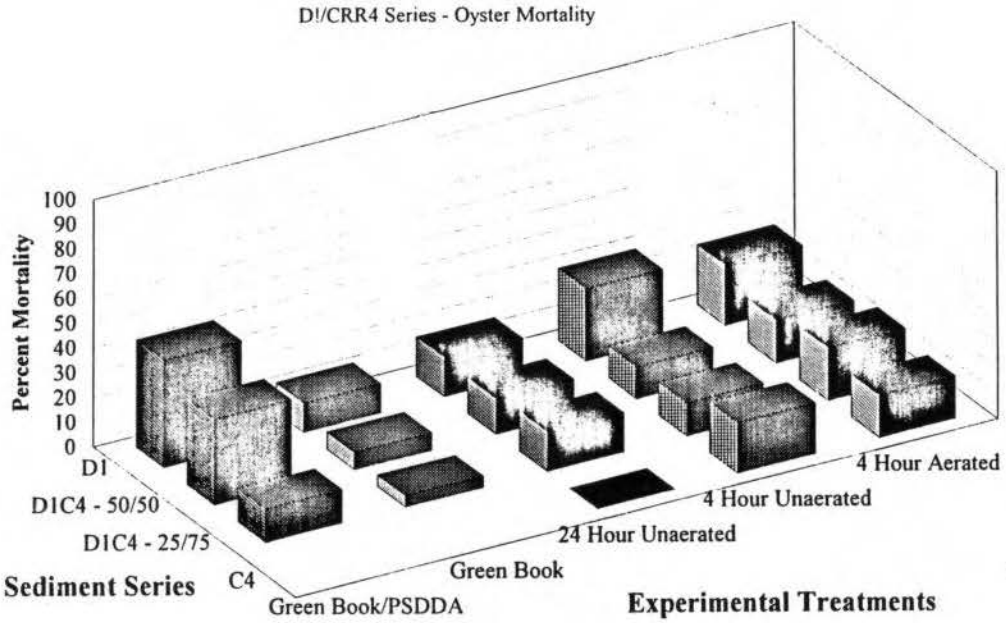
M1/CRR2 Series and Oyster Mortality



88c

Phase IIIB, Figure 4

D!/CRR4 Series - Oyster Mortality

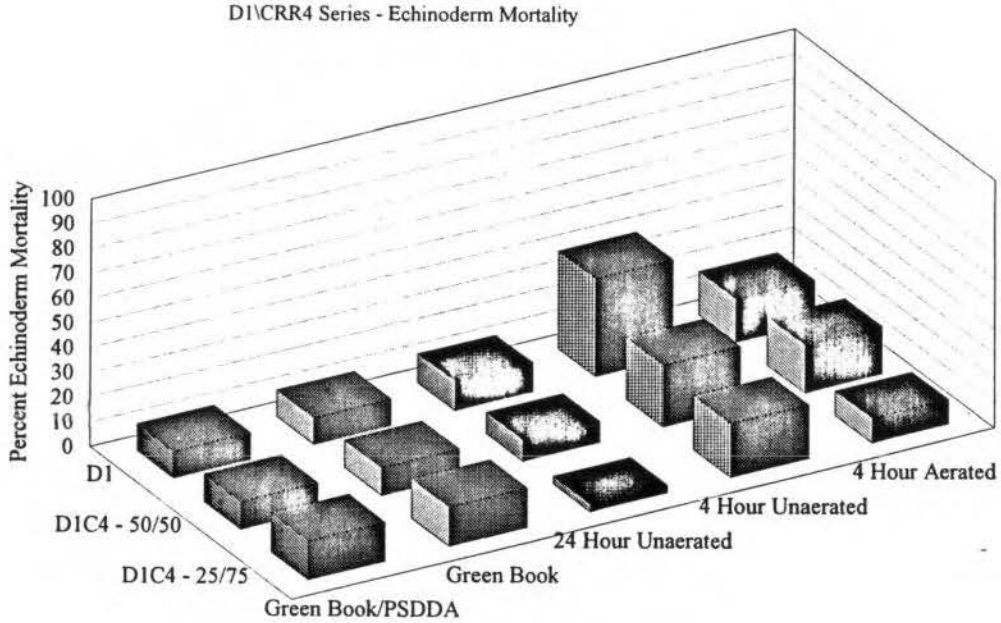


8ff

8gg

Phase IIIB, Figure 5

D1\CRR4 Series - Echinoderm Mortality



Reference Sediment Performance Review

9a

Reference Sediment Performance Standards
PSDDA Bioassays

- Amphipod - 20% over control
- Sediment Larval - 20% seawater-normalized effective mortality
- Neanthes - 80% of control biomass
- Microtox - 20% blank-corrected light diminution

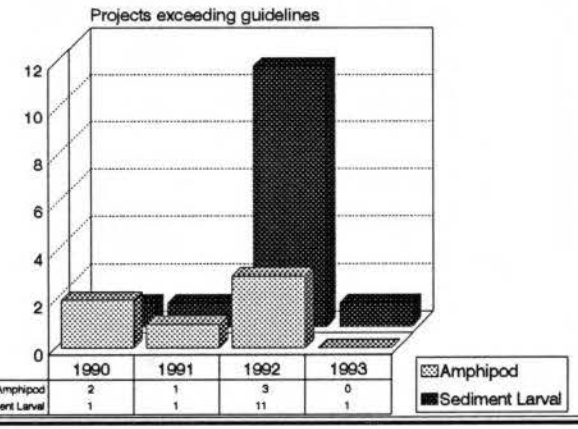
9b

Potential Consequences of Exceeding Guidelines:

- Retest required
- Rely on the other bioassays
- Interpret the data using BPJ

9c

PSDDA Reference Sediment Performance
Guideline exceedances

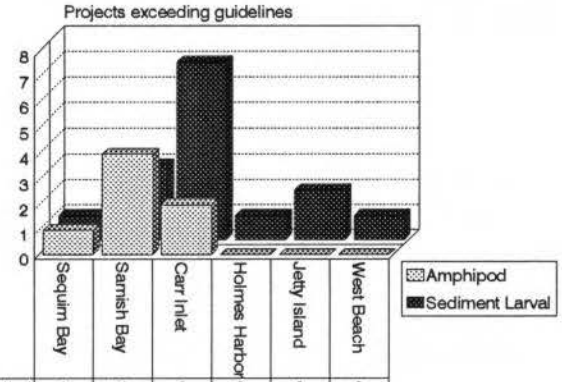


	1990	1991	1992	1993
Amphipod	2	1	3	0
Sediment Larval	1	1	11	1

9d

PSDDA Reference Sediment Performance

Guideline exceedances



	Sequim Bay	Samish Bay	Carr Inlet	Holmes Harbor	Jetty Island	West Beach
Amphipod	1	4	2	0	0	0
Sediment Larval	1	3	7	1	2	1

9e

DAIS Review

Nontreatment factors - Amphipod

- Bulk ammonia
- Bulk sulfides
- Grainsize
- Aqueous ammonia
- Aqueous sulfides

9f

DAIS Review

Nontreatment factors - Sediment Larval

- Bulk ammonia
- Bulk sulfides
- Grainsize
- Aqueous ammonia
- Aqueous sulfides

Additional factors recommended by SAIC:

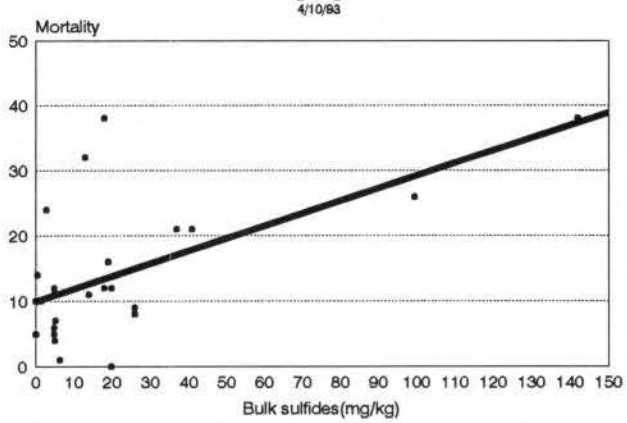
- Total-solids-normalized grainsize
- Un-ionized ammonia

9g

PSDDA Bioassay Review

Amphipod

4/10/93



r = .574; r (.01) = .470; df = 27
(reference sediment; some outliers removed)

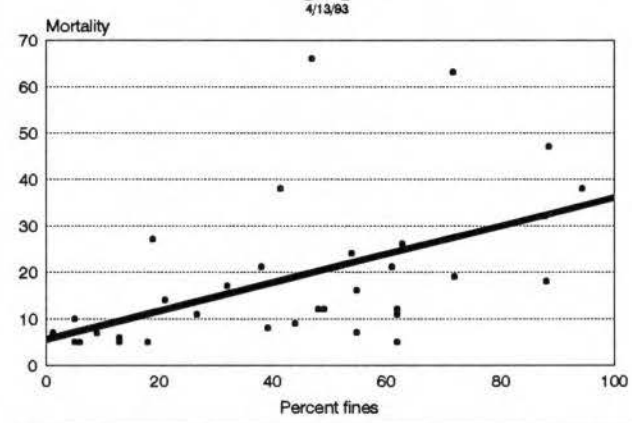
c:\bio_rev\amphipod\bsul_v_m.wk1
c:\bio_rev\amphipod\bsl3_v_m.prs

9h

PSDDA Bioassay Review

Amphipod

4/13/93



r = .518; r (.01) = .437; df = 32
(reference sediment; some outliers removed)

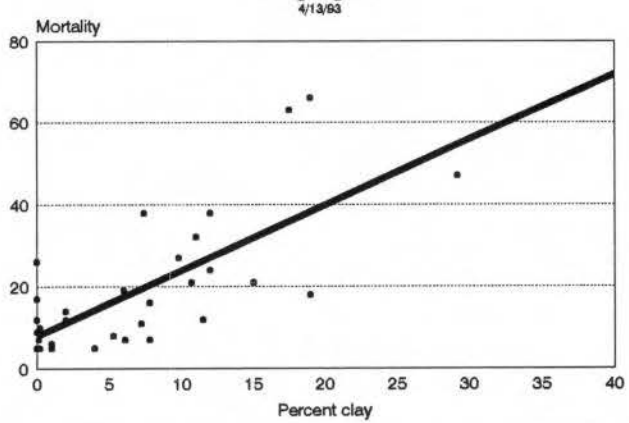
c:\bio_rev\amphipod\gs_vs_mr.wk1
c:\bio_rev\amphipod\fines2.prs

9i

PSDDA Bioassay Review

Amphipod

4/13/93



r = .725; r (.001) = .538; df = 32
(reference sediment; some outliers removed)

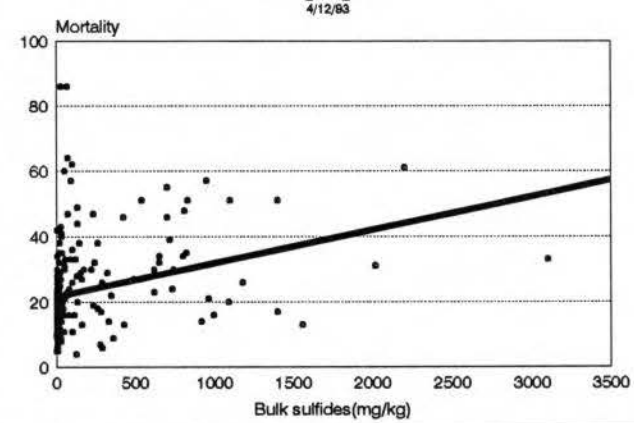
c:\bio_rev\amphipod\gs_vs_mr.wk1
c:\bio_rev\amphipod\clay2.prs

9j

PSDDA Bioassay Review

Amphipod

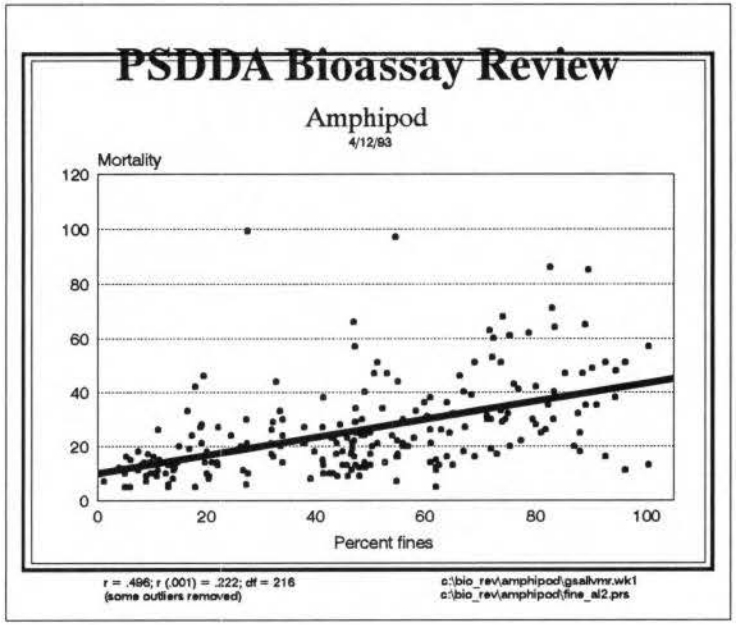
4/12/93



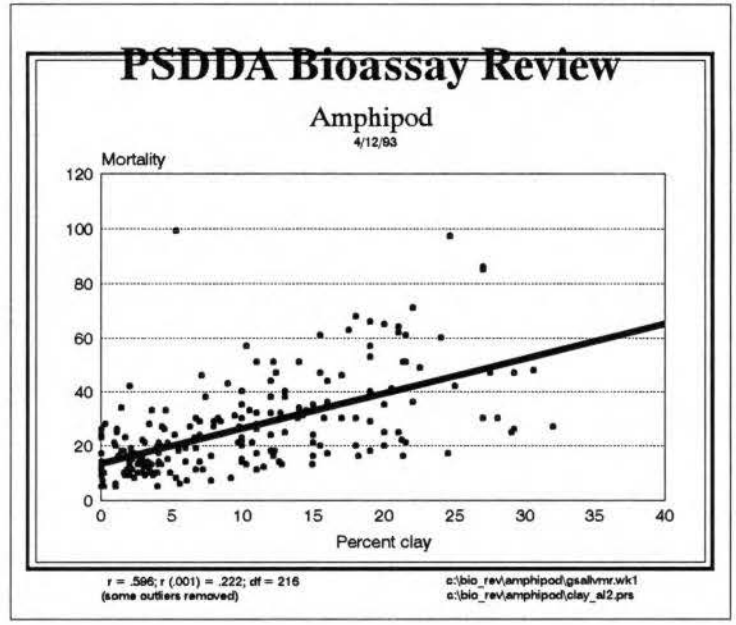
r = .292; r (.001) = .233; df = 195
(some outliers removed)

c:\bio_rev\amphipod\bsal_v_m.wk1
c:\bio_rev\amphipod\bsal3v_m.prs

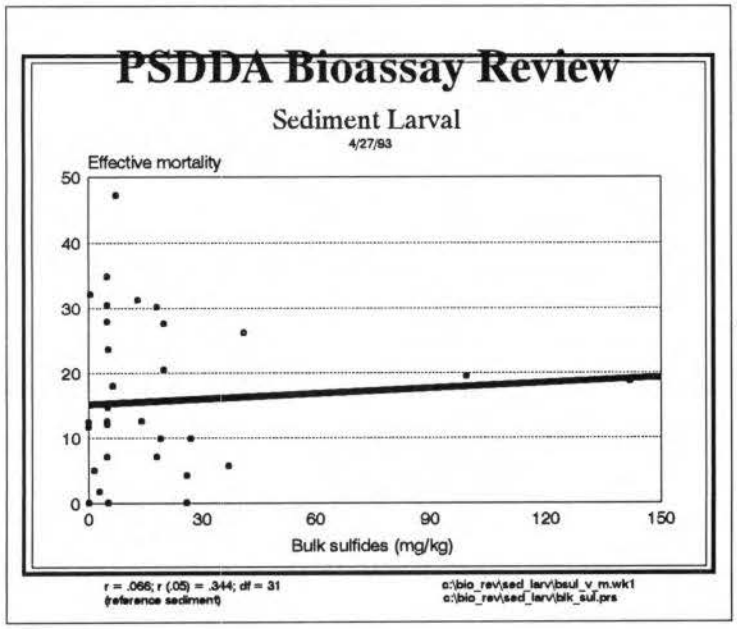
9k


PSDDA Bioassay Review
Amphipod
4/12/93
Mortality
120
100
80
60
40
20
0
0
20
40
60
80
100
Percent fines
r = .496; r (.001) = .222; df = 216
(some outliers removed)
c:\bio_rev\amphipod\gsallvmr.wk1
c:\bio_rev\amphipod\fine_al2.prs

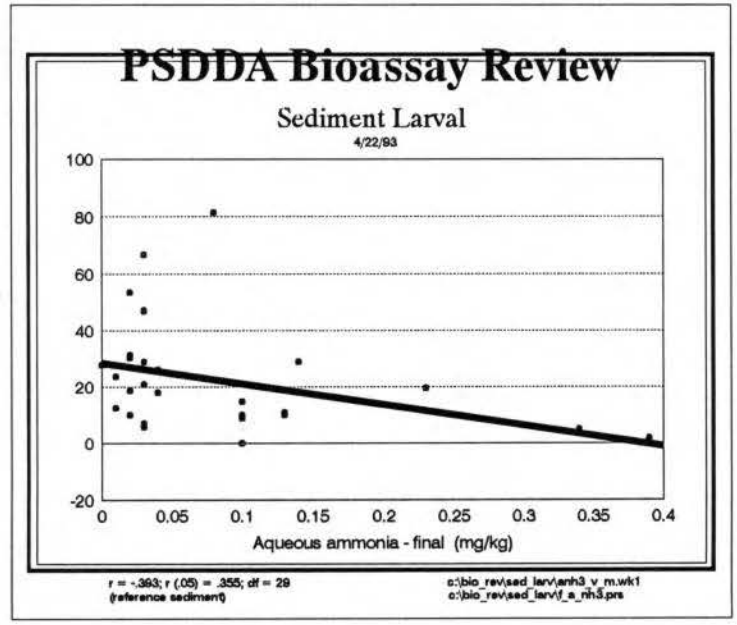
9m


PSDDA Bioassay Review
Amphipod
4/12/93
Mortality
120
100
80
60
40
20
0
0
5
10
15
20
25
30
35
40
Percent clay
r = .596; r (.001) = .222; df = 216
(some outliers removed)
c:\bio_rev\amphipod\gsallvmr.wk1
c:\bio_rev\amphipod\clay_al2.prs

9n


PSDDA Bioassay Review
Sediment Larval
4/27/93
Effective mortality
50
40
30
20
10
0
0
30
60
90
120
150
Bulk sulfides (mg/kg)
r = .066; r (.05) = .344; df = 31
(reference sediment)
c:\bio_rev\sed_larv\bsul_v_m.wk1
c:\bio_rev\sed_larv\blk_sul.prs

9p

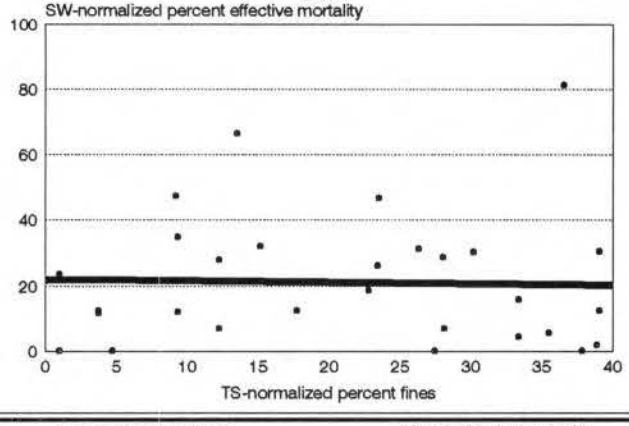

PSDDA Bioassay Review
Sediment Larval
4/22/93
100
80
60
40
20
0
-20
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
Aqueous ammonia - final (mg/kg)
r = -.393; r (.05) = .355; df = 29
(reference sediment)
c:\bio_rev\sed_larv\anh3_v_m.wk1
c:\bio_rev\sed_larv\f_a_nh3.prs

9q

PSDDA Bioassay Review

Sediment Larval

4/22/93



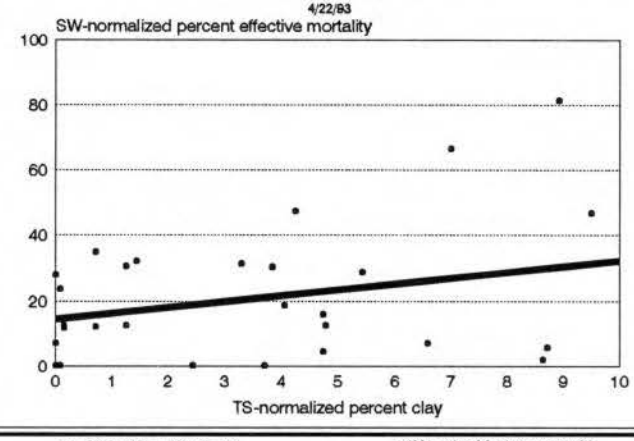
r = .028; r (.05) = .361; df = 28
(reference sediment; some outliers removed)

c:\bio_rev\sed_larv\ngs_v_em.wk1
c:\bio_rev\sed_larv\n_fines2.p

PSDDA Bioassay Review

Sediment Larval

4/22/93



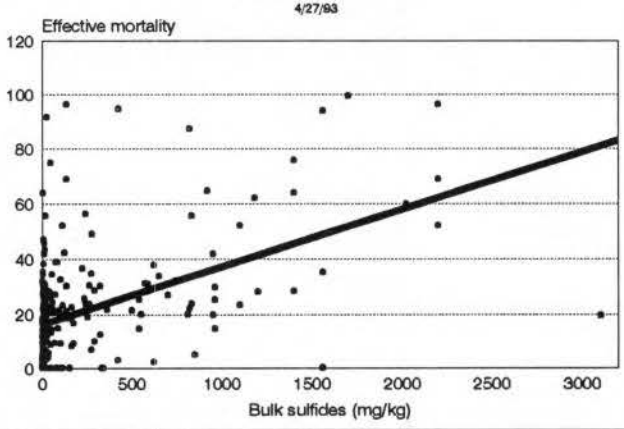
r = .286; r (.05) = .361; df = 28
(reference sediment; some outliers removed)

c:\bio_rev\sed_larv\ngs_v_em.wk1
c:\bio_rev\sed_larv\n_clay2.pr

PSDDA Bioassay Review

Sediment Larval

4/27/93



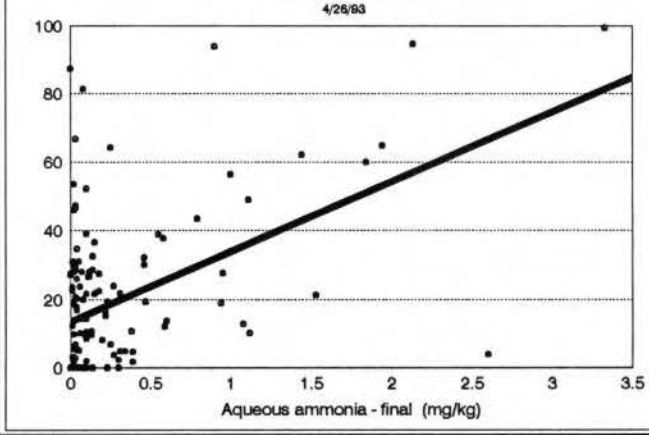
r = .477; r (.001) = .212; df = 237
(all DAIS data)

c:\bio_rev\sed_larv\bsulalvm.wk1
c:\bio_rev\sed_larv\bsulalvm.prs

PSDDA Bioassay Review

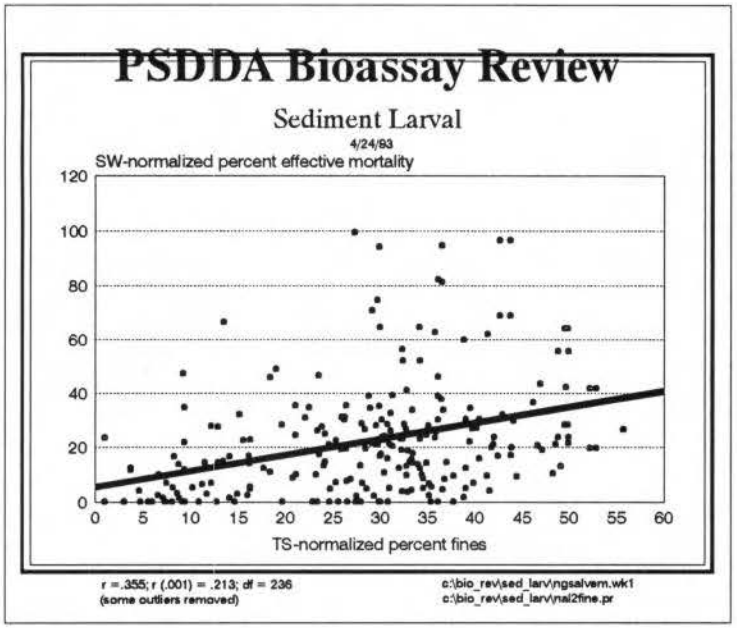
Sediment Larval

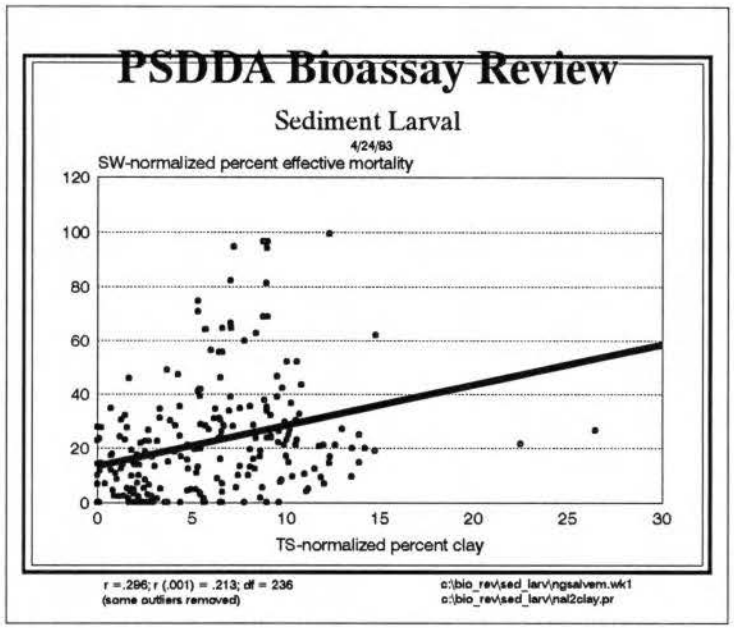
4/26/93

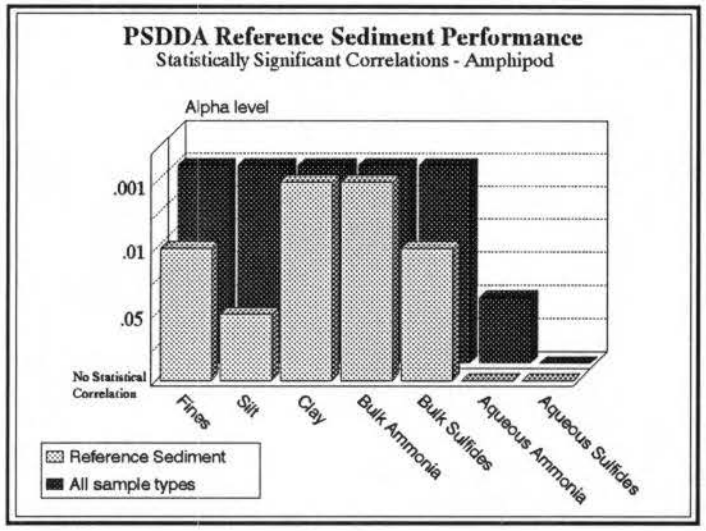


r = .471; r (.001) = .273; df = 142
(all DAIS data)

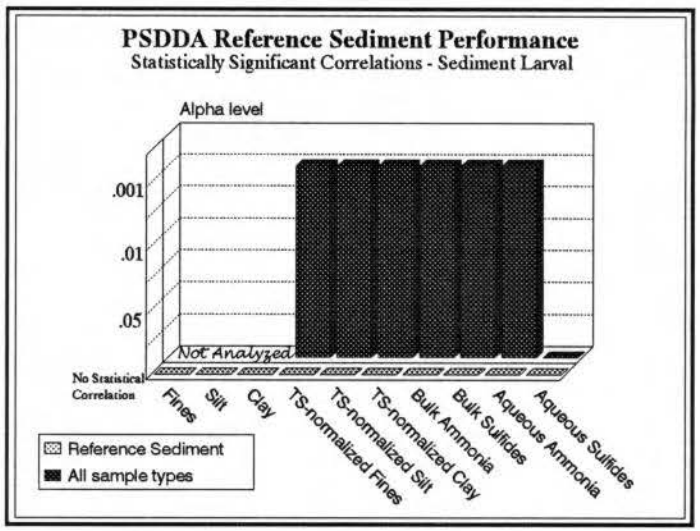
c:\bio_rev\sed_larv\anh3alvm.wk1
c:\bio_rev\sed_larv\fallanh3.prs


PSDDA Bioassay Review
Sediment Larval
4/24/93
SW-normalized percent effective mortality
120
100
80
60
40
20
0
0 5 10 15 20 25 30 35 40 45 50 55 60
TS-normalized percent fines
r = .355; r (.001) = .213; df = 236
(some outliers removed)
c:\bio_rev\sed_larv\ngsalvem.wk1
c:\bio_rev\sed_larv\nal2fine.pr


PSDDA Bioassay Review
Sediment Larval
4/24/93
SW-normalized percent effective mortality
120
100
80
60
40
20
0
0 5 10 15 20 25 30
TS-normalized percent clay
r = .296; r (.001) = .213; df = 236
(some outliers removed)
c:\bio_rev\sed_larv\ngsalvem.wk1
c:\bio_rev\sed_larv\nal2clay.pr



9x



9y

Analysis of the effects of nontreatment factors on bioassay responses will be refined where necessary and the results provided to the regulatory workgroup along with any recommendations for program modifications

—■—

9z

Reference Sediment Sampling Protocol

- Use experienced personnel
- Follow PSEP protocols
- Sample from biologically active zone
- Avoid anoxic sediment below RPD horizon
- Use wet-sieving method
- Fix sulfides sample with zinc acetate

9aa

NATIONAL SEDIMENT INITIATIVES STANDARDIZED BIOASSAY METHODS

- Preliminary Draft completed: includes both marine and freshwater species.
- June 2-3 National Meeting: Peer Review.
- OST Publication in Fall 1993.
- Submittal to EPA-Cincinnati for approval as EPA standard method.

10c

INLAND TESTING MANUAL

- EPA Science Advisory Board (SAB) review: June 1993
- Internal EPA and Corps review May-July 1993
- Federal Register notice of availability: No sooner than November 1993.

10a

NATIONAL SEDIMENT INITIATIVES SEDIMENT QUALITY CRITERIA (Five Non-polar Organics)

- The Five: Acenaphthene, Dieldrin, Endrin, Fluoranthene, Phenanthrene.
- April 93: EPA "Red Border Review" completed.
- EPA OST working on responses.
- Federal Register appearance scheduled June 1993.

10d

NATIONAL SEDIMENT INITIATIVES QA/QC GUIDANCE MANUAL

- Scope: Chemical Analysis only.
- Draft being prepared by Contractor, modelled on Region 10 PSEP documents.
- EPA/Corps review scheduled late Summer to Fall 1993.
- Hope to available concurrent with Inland Testing Manual

10b

NATIONAL SEDIMENT INITIATIVES
ALTERNATIVES FRAMEWORK

- "Evaluating Environmental Effects of Dredged Material Management Alternatives - A Technical Framework"
- Available February 1993.
- Consistent Framework to meet substantive and procedural requirements of NEPA, CWA, and MPRSA.

109

NATIONAL SEDIMENT INITIATIVES
SEDIMENT QUALITY CRITERIA
(Metals/AVS)

- Methods Document in preparation.
- Methods review by Science Advisory Board scheduled Fall 1993 (Nov?); specific metals criteria will be included.
- Federal Register appearance of specific criteria expected Spring 1994.

10e

NATIONAL SEDIMENT INITIATIVES
ALTERNATIVES FRAMEWORK

- Contact:

Framework Mailing List
c/o Ms Billie Skinner
CEWES-EP-D
USACE, Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

10h

NATIONAL SEDIMENT INITIATIVES
EPA'S SEDIMENT MANAGEMENT STRATEGY

- Internal Draft completed (150 pages)
  - Specific Program details
  - Responses to last summer review comments.
- EPA review leading to briefing of EPA Administrator in August 1993.
- Federal Register appearance September 1993 - January 1994.

10f

DIOXIN-CONTAMINATED SEDIMENTS
(Continued)

- Purpose:
- Policy direction from EPA and Corps managment.
- Provide EPA/Corps field offices a framework to assure consistent and technically-sound decisionmaking for dioxin.
- Develop model framework for dealing with other problematic contaminants in the future.

10K

DIOXIN-CONTAMINATED SEDIMENTS
(Continued)

- Scope:
- Address policy and technical questions.
- Immediate v. longer term needs.

- Process:
- EPA/Corps Managers Steering Committee
- Task Group

10M

NATIONAL SEDIMENT INITIATIVES REAUTHORIZATIONS & REG REVISIONS

- Revisions to MPRSA (Ocean Dumping Act) Regulations (40 CFR 220-229)
- Reauthorization of Clean Water Act (CWA)
- Reauthorization of Resource Conservation and Recovery Act (RCRA)

10L

DIOXIN-CONTAMINATED SEDIMENTS
(for Tim Thompson)

- Proposal to dispose dioxin-contaminated sediments from New York Harbor at an EPA-designated ocean site threatened with litigation.
- Joint EPA/Corps effort to develop framework for managing dioxin-contaminated dredged materials.

10J

FIFTH ANNUAL PSDDA REVIEW MEETING

- Additional written comments on issues may be submitted until May 21, 1993.
- Summary minutes of the Annual Review Meeting will be available and mailed to meeting participants within 45 days following the meeting.
- The Sixth Annual Review Meeting will be held during Spring 1994, and hosted by the Environmental Protection Agency (Region X)

11a

10a

DIOXIN-CONTAMINATED SEDIMENTS (Continued)

- **Schedule and Products:**
  - **Task Group formed, first meeting April 27-28; scoping.**
  - **Steering Committee formed by end May.**
  - **Preliminary guidance (draft) end of Summer 1993; review process to be defined; supplemented as necessary.**
  - **Policy Paper for EPA/Corps Management.**
  - **Guidance manual: Spring 1994.**

Parametrix, Inc.

Consultants in Engineering and Environmental Sciences

5808 Lake Washington Blvd. N.E. Kirkland, WA 98033-7350
206-822-8880 • Fax: 206-889-8808

May 5, 1993

to: David Kendall and David Fox

from: Rick Cardwell (Parametrix)

subject: **Fifth Annual PSDDA Review Meeting :**
Species Substitution for the 10-day Amphipod Bioassay
Total Sulfide Measurement in Neanthes Test
Recalculation of AETs

Species Substitution for the 10-day Amphipod Bioassay

I wanted to comment on the referenced amphipod test. While agreeing with the proposal and its concept, I had a question:

- Do we know (have quantified) the relative sensitivities of these amphipod species?

Since it is known that species within a specific genera are more similar in sensitivity to toxicants than species within different genera, families, orders, etc., then one would assume that changing species could influence the results.

Does the Corps possess information on the relative sensitivities of these species to one or more reference toxicants? If it does not, requiring the proponent to test at least two reference toxicants with both species (*Rhepoxynius* and the substitute) would start generating the database.

While I wholeheartedly support allowing some flexibility in species selection, I think we need to gather the data needed to compare results from different species.

Total Sulfides Measurement in Neanthes Test

Would more definition of the *total sulfide measurement* lessen the chance of misunderstanding? In the first paragraph, last line under Problem Identification, it is stated that hydrogen sulfide concentrations should be ≤ 3.0 mg/L. Shouldn't the statement read "the total sulfides concentration should be ≤ 3.0 mg/L"? Although hydrogen sulfide (H_2S) is indeed the toxic moiety, it is my understanding it can only be estimated from a total sulfides measurement using a thermodynamic equation. Toxic concentrations of H_2S are in the low micrograms per liter range. Also, I recollect reading a publication suggesting that not all sulfides are the same, so I recommend specifying the specific analytical methods that are acceptable.

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Recalculation of AETs

We would like to propose modifying the statistical analyses conducted to derive AETs. Two years ago, we evaluated the statistical basis of the AETs and believe we identified several areas of improvement. We made a presentation to the Corps and Ecology and coordinated with Tom Gries. We have a publication in draft form that discusses the basis of our analysis. If everyone is aware of our perspectives, then no further comments are necessary. If you would like further information, please advise.

I hope it will be possible for you to see our new laboratory. Steve Cappellino, our laboratory director, has really created a first-class facility since he took over last year. Please call if you wish to discuss any of my comments (822-8880). Keep up the good work!

cc: Steve Cappellino

WASHINGTON PUBLIC PORTS ASSOCIATION

May 17, 1993

Port of Allyn
Port of Anacortes
Port of Bellingham
Port of Benton
Port of Bremerton
Port of Brownsville
Port of Camas-Washougal
Port of Centralia
Port of Chehalis
Port of Chelan County
Port of Clarkston
Port of Columbia
Port of Coupeville
Port of Dewatto
Port of Douglas
Port of Edmonds
Port of Ephrata
Port of Everett
Port of Friday Harbor
Port of Garfield
Port of Grandview
Port of Grapeview
Port of Grays Harbor
Port of Hoodsport
Port of Illahee
Port of Ilwaco
Port of Kahlotus
Port of Kalama
Port of Kennewick
Port of Keyport
Port of Kingston
Port of Klickitat
Port of Longview
Port of Lopez
Port of Manchester
Port of Mattawa
Port of Moses Lake
Port of Olympia
Port of Othello
Port of Pasco
Port of Pend Oreille
Port of Peninsula
Port of Port Angeles
Port of Port Townsend
Port of Poulsbo
Port of Quincy
Port of Ridgefield
Port of Royal Slope
Port of Seattle
Port of Shelton
Port of Silverdale
Port of Skagit County
Port of Skamania County
Port of South Whidbey Island
Port of Sunnyside
Port of Tacoma
Port of Tahuya
Port of Vancouver
Port of Wahkiakum Co. #1
Port of Wahkiakum Co. #2
Port of Walla Walla
Port of Warden
Port of Waterman
Port of Whitman County
Port of Willapa Harbor
Port of Woodland

Executive Committee
Paige Miller
President
John Givens
Vice President
Arch Miller
Secretary
Richard Harris
Treasurer
Robert McCrorie
Past President

Patrick Jones
Executive Director

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

Dear Mr. Applebury,

This letter contains the formal comments of the Washington Public Ports Association regarding the fifth annual review meeting of the Puget Sound Dredged Disposal Analysis (PSDDA) program. It supplements the verbal comments we provided at the meeting on May 7th.

As a general observation, it is apparent that there remains a high level of interest in the topic of open-water dredged material disposal, given the good attendance at a meeting that was technical in nature. We reaffirm our support for review meetings to gauge the success of the PSDDA program, and to discuss changes in dredging or disposal policies.

Our first specific comment relates to the clarification of expectations for site histories in sampling and analysis plans. As we mentioned at the meeting, the clarification paper should be modified to correct its open-ended nature, and to account for the potential difficulty in obtaining some information.

In particular, the paper should indicate that site histories do not need to exceed two or three pages in length, even for a large project. There should also be better defined guidelines for small versus larger projects, as well as a clear statement that proponents need not re-gather data that is already in PSDDA agency files. (A simple reference to these information sources should be sufficient.) Finally, there should be allowance for information sources that are not reasonably attainable by a proponent, such as private information from nearby manufacturers, tax status of private entities or spill events that were not recorded or otherwise made known to the project proponent.

Our second comment relates to the incorporation of PSDDA-suggested language into the local Shoreline Master Programs of relevant local jurisdictions. We appreciate the efforts to date of the Department of Ecology in this regard, but urge a more thorough report at the next meeting on the status of the reissuance of the disposal site shoreline permits, as well as any major jurisdictions whose Shoreline Master Programs may present problems for dredging sites.

P.O. Box 1518 • Olympia, Washington 98507 • (206) 943-0760 • Fax 753-6176 • 1501 Capitol Way • Suite 304

Finally, we appreciate the work that has been done to date on the pattern analysis that we have outlined in past annual review meetings, and we look forward to working with Mr. Gries and the Department of Ecology as they continue this work this summer and fall.

Thank you very much for this opportunity to comment.

Yours truly,

WASHINGTON PUBLIC PORTS ASSOCIATION

Eric D. Johnson

Eric D. Johnson
Environmental Affairs Director

Parametrix, Inc.

Consultants in Engineering and Environmental Sciences

5808 Lake Washington Blvd. N.E. Kirkland, WA 98033-7350
206-822-8880 • Fax: 206-889-8808

MEMORANDUM

to: Dr. David Kendall

Date: 9 June 1993

from: Steve Cappellino

re: Ammonia and sulfide measurements for the 20-day *Neanthes* test

Last month at the PSDDA annual review meeting, I think I mentioned to you that I had a concern over the recent changes in the PSDDA requirements for T_{final} ammonia and sulfide (A/S) measurements. At the time, I questioned the validity of measuring the final A/S concentrations at the end of the test, after six significant (approx. 30%) water changes.

My hypothesis was that, by day 20, the A/S levels would be much lower than at the beginning of the test (for example on days 3-6) due to the continuous flushing that would be occurring with each water change. Attached are the results of an experiment we conducted during testing of the PSDDA-Bellingham Bay monitoring program sediments with SAIC to evaluate my hypothesis.

What we did was simple - measure the A/S concentrations during each water change throughout the 20-day *Neanthes* test. The results were quite interesting and tend to support my hypothesis. You will notice that in all cases, except for the West Beach control, the ammonia concentrations peaked by days 3-6, and then dropped dramatically. I should note that during this test we saw tremendous growth in our controls (from 1.0 mg/worm to 18.1 mg/worm) over the 20-day period. The test sediments produced worms on the order of 14 mg/worm, hence the rising ammonia levels in the West Beach samples may have been caused simply by excretory products from the rapidly growing worms. The sulfide levels remained below the detection limits in all samples.

I hope you will agree that this information at least raises some questions about the scientific validity of this change in water quality monitoring for the *Neanthes* biomass test. My reason for conducting the experiment was not to question the Corps' decision to change the A/S requirements, but to assist in ensuring that the most appropriate measurements are taken. If you have any questions or comments, please call me at 822-8880 to discuss these results in further detail.

cc: S. Sterling
D. Fox

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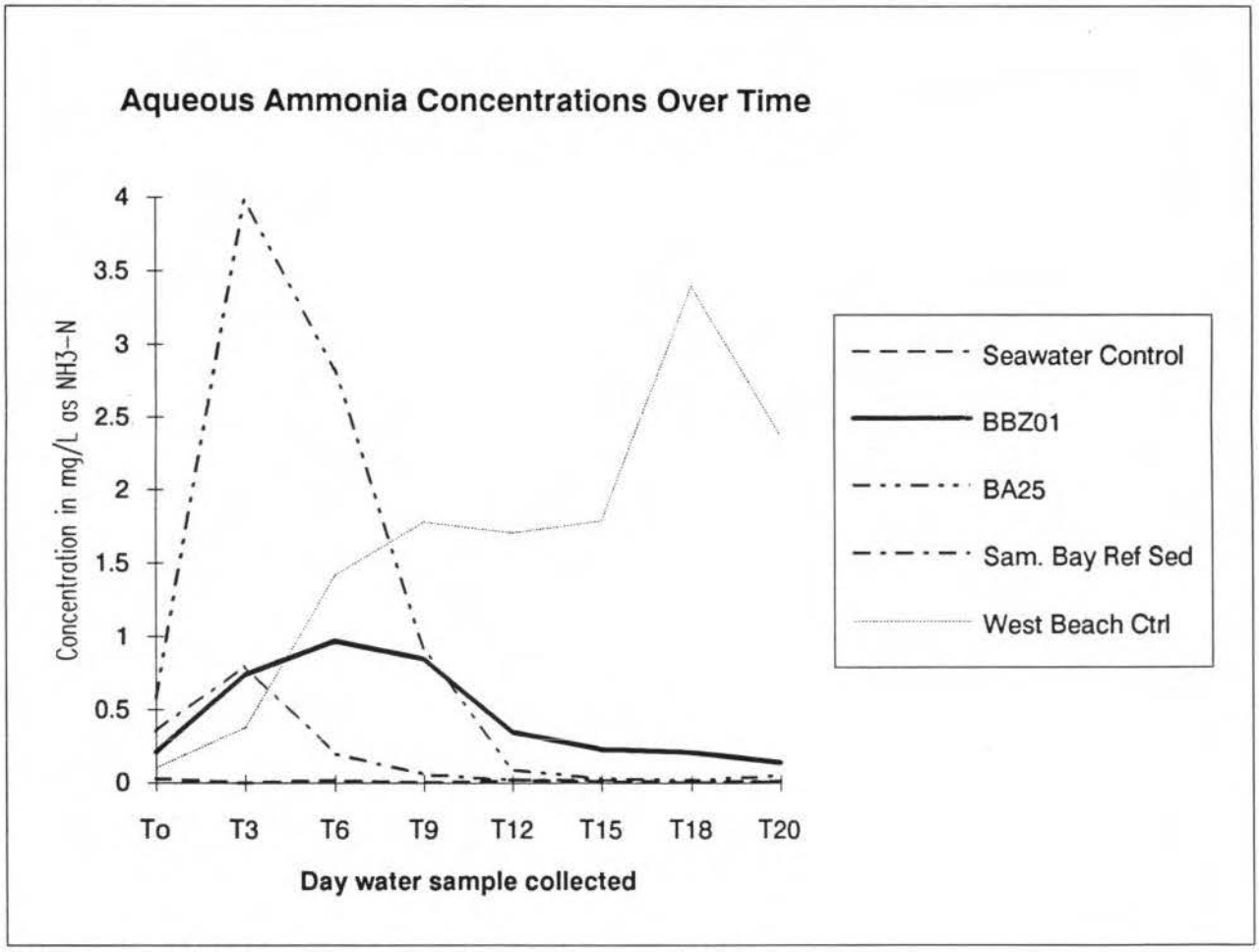
Ammonia and Sulfide Concentrations Over Time for the 20-Day Neanthes Test conducted on the Bellingham Bay PSDDA Sediments.

	Aqueous Ammonia (ppm as NH3-N)							
	To	T3	T6	T9	T12	T15	T18	T20
Seawater Control	0.03	---	0.02	---	0.02	0.01	---	0.01
BBZ01	0.21	0.74	0.97	0.85	0.35	0.23	0.21	0.14
BA25	0.58	3.98	2.83	0.91	0.09	0.03	0.02	0.05
Sam. Bay Ref Sed	0.35	0.8	0.2	0.06	0.02	0.02	0.01	0.01
West Beach Ctrl	0.1	0.38	1.42	1.78	1.71	1.79	3.4	2.38

	Aqueous Total Sulfide (ppm)							
	To	T3	T6	T9	T12	T15	T18	T20
Seawater Control	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
BBZ01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
BA25	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sam. Bay Ref Sed	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
West Beach Ctrl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01



Appendix C
PSDDA Agency Post-ARM Meeting
25 May 1993

The PSDDA agencies met to discuss commitments emanating from the annual review meeting and to resolve outstanding issues:

1) It was agreed that the PSDDA agencies need to address the issue of how PSDDA and the State of Washington Sediment Management Standards will use the sediment quality criteria being developed by EPA. Concerns expressed by the dredging community at the ARM need to be addressed.

2) The PSDDA agencies are concerned about the apparent increase in some metal concentrations in the Elliott Bay basin. The PSDDA agencies have, and will continue to, provide multi-year monitoring data to the appropriate parties, including the Department of Ecology's Urban Bay Action Program and METRO, so that other programs working in the bay are aware of this issue and can begin to address it. It was noted that the Puget Sound Ambient Monitoring Program has not found increased levels of copper similar to those found during PSDDA monitoring. One explanation for this discrepancy is that the PSAMP stations are all in shallow water, not in the central basin where the PSDDA disposal site is located. It was suggested that perhaps with the ban on tributyl tin as the active ingredient in antifouling marine paints, the use of copper compounds may be on the upswing. Another potential source of copper is automobile brake components, which were formerly make of asbestos.

3) Comments received at the ARM and in a letter from Eric Johnson of the Washington Public Ports Association (Appendix B) on the site history clarification were discussed. A revised clarification paper was distributed to the agencies for review and is included in Appendix D.

4) The Regulatory Workgroup was discussed at length. To enhance the efficiency of the process it was decided that each bioassay should be handled separately relative to any technical work which remained to be done. A small technical workgroup (open to the public) would be tasked to complete outstanding work remaining for each bioassay. The remaining technical work was outlined:

Microtox:

a) Review existing data in the DAIS database
b) Review protocol and technical information from Microbics
c) Convene a meeting among Microtox practitioners, Microbics and the workgroup
d) Conduct work on the solid-phase Microtox test

Amphipod:

a) Review existing data on the effects of nontreatment factors (eg grain size)
b) Review the performance standards for reference sediments
c) Refine guidelines for species substitution
d) Draft technical recommendations for review by acknowledged experts

Larval:

a) Review existing data in the DAIS database
b) Review SAIC's report vis a vis the existing data
c) Provide recommendations relative to non-treatment factors, etc.

Technical recommendations formulated by these technical work groups would be submitted for review to the larger Regulatory Workgroup. The Regulatory Workgroup would be responsible for compiling final recommendations for presentation as an issue paper at the next ARM. Scheduling for the technical work groups and the Regulatory Workgroup was discussed.

5) Work remaining on Apparent Effects Thresholds (AET) recalculations was discussed. Ecology will complete their work on the amphipod and larval AETs before starting on the Microtox, *Neanthes* and benthic AETs. The work of the regulatory workgroup may affect what is done with the Microtox and benthic AETs; there is a much smaller database for the *Neanthes* database than for the other endpoints so *Neanthes* should not take much time. A decision to recalculate the AET for Microtox will be made based on the outcome of the technical review of that bioassay. It was recommended that alternatives for calculating the benthic AETs be provided to a panel of experts for comparison with the current method. The mechanism used in the recalculation of AETs also needs to be examined to determine whether reliability can be improved.

6) In response to the interest expressed at the annual review meeting and the letter submitted by Eric Johnson of the Washington Public Ports Association (Appendix B), a revised status report will be prepared by Tom Mark of Ecology's Shoreline Management Section which addresses dredged material management under the Shoreline Management Act (Appendix D).

7) In response to a letter from Rick Cardwell of Parametrix (Appendix B), data addressing the comparative sensitivities of *Rhepoxynius abronius, Ampelisca abdita* and *Eohaustorius estuarius* will be included with a revised clarification on species substitution for the amphipod test (Appendix D).

[The following issues were addressed subsequent to the post-ARM meeting]

8) While the agencies agreed that standardizing the analytical method for sulfides monitoring was a good idea (see Rick Cardwell's letter - Appendix B), there was insufficient staff time available to address this issue before mailing the ARM proceedings. This work will be deferred to dredging year 1993 and will be included with the other technical issues being addressed as part of the regulatory review of PSDDA bioassays.

9) Rick Cardwell's letter also addressed the statistical basis of the AET calculations and asked the agencies to respond to modifications proposed by Parametrix. When the decision was made to recalculate AETs, the PSDDA agencies agreed that Ecology's initial re-evaluation of screening and maximum levels (SLs/MLs) should be made using methods fundamentally the same as the ones used in 1988. Those methods were documented and were the subject of widespread review and discussion. The agencies believed this approach would require the least staff effort and would be relatively noncontroversial.

The Department of Ecology and the PSDDA agencies are aware of Parametrix' perspectives on the methodology currently used to calculate AETs, and will consider additional analyses when the current work is completed and again opened to peer and public review. Parametrix and other interested parties are welcome to become involved in that process.

Ecology anticipates that a draft document, detailing the methods used to re-evaluate amphipod and larval AETs and Ecology's findings, will be sent to the PSDDA agencies for review in August. A second draft, revised in response to PSDDA agency comments, will then be made available to other agency personnel and interested parties on or about October 1. A tentative date of October 21 has been set for a public forum, whose format has yet to be defined. Comments and recommendations from that forum may lead to additional analyses. Finally, the Regulatory Work Group will review the completed work and determine how the new AETs will affect the PSDDA sediment quality guidelines.

10) In response to the letter received from Steve Cappellino of Parametrix (Appendix B) the clarification paper addressing ammonia and sulfides monitoring in the *Neanthes* biomass test was revised (Appendix D). Monitoring, in addition to that required at test initiation and termination, is recommended (especially on days 3 and 6).

APPENDIX D

FINAL CLARIFICATION PAPERS
Dredging Year 1992

and

a revised status report:

Dredged Material Management
under the
Shoreline Management Act

CLARIFICATION

SPECIES SUBSTITUTION FOR THE 10-DAY AMPHIPOD BIOASSAY

Prepared by David Kendall (Corps of Engineers, 206/764-3768) for the PSDDA Agencies

INTRODUCTION

The PSDDA program currently specifies the use of *Rhepoxynius abronius* as the test species for the 10-day amphipod bioassay. Over four years of PSDDA program experience have shown this organism to be a reliable bioassay species for assessing biological effects of dredged material. However, this experience has also shown this organism to be sensitive to dredged material exhibiting high percentages of fine-grained sediment. Additionally, the PSEP amphipod bioassay protocol states "*Rhepoxynius abronius* is appropriate for sediments with interstitial water salinity of ≥ 25 parts per thousand (ppt)". It recommends the use of *Eohaustorius estuarius* to assess sediments when interstitial water salinities are below 25 ppt.

PROBLEM IDENTIFICATION

The quantitative relationship of *Rhepoxynius abronius* survival in reference sediments of varying grain sizes has been described by DeWitt et al (1988). For example, a regression equation (upper 95 percent confidence limit) describing this relationship predicts a mortality of 23.7 percent with 70 percent fines (DeWitt et al, 1988).

Regulatory experience with *Rhepoxynius* exposed to sediments of varying grain size distributions has confirmed its sensitivity to sediments exhibiting high percentages of fine-grained sediments (i.e. greater than about 60 percent clay/silt). This sensitivity to fine-grained sediments can lead to false positive results in dredged material quality assessments. False positive results confound regulatory interpretations, especially when reference sediment performance guidelines are exceeded, and ultimately lead to a PSDDA agency decision to either retest or apply best professional judgement to the interpretation of dredged material suitability for unconfined open-water disposal.

Assessing dredged material in tidally-influenced rivers, where interstitial salinities fall below 25 ppt may lead to test performance problems with *Rhepoxynius*, unless interstitial salinities are adjusted as recommended by PSEP (higher than 25 ppt) prior to initiating the test.

A number of amphipod species in addition to *Rhepoxynius* are approved in national guidance for dredged material testing under the Ocean Dumping testing manual ("Greenbook") and the draft "Inland (404) Testing Manual". Two of these species have been used in Puget Sound previously, have ASTM protocols (ASTM 1991), and appear to be less sensitive to fine-grained sediment than *Rhepoxynius*. These are *Ampelisca abdita* and *Eohaustorius estuarius*. *Ampelisca* has been utilized over the past year in non-PSDDA areas such as Grays Harbor to assess dredged material with high percent fines (approaching 95 percent) in lieu of *Rhepoxynius*. The results of these tests were satisfactory in assessing the suitability of dredged material for unconfined open-water disposal. *Eohaustorius* is common in Pacific

Coast estuaries, and would be a suitable species to test fine-grained dredged material when interstitial salinities are lower than 25 ppt.

PROPOSED ACTION/MODIFICATION

The PSDDA program will allow the flexibility to substitute *Ampelisca abdita* for *Rhepoxynius* when testing dredged material exhibiting high percentages of fines (i.e. greater than 60 percent). In estuaries, where interstitial salinities range from 2 to 25 ppt, the estuarine amphipod *Eohaustorius estuarius* may be substituted for *Rhepoxynius* when testing fine-grained dredged material. However, *Rhepoxynius* will remain the preferred amphipod species for coarser-grained sediments. Any proposed species substitutions for the amphipod bioassay must be coordinated with the Dredged Material Management Office, and approved by the PSDDA agencies, prior to testing.

REFERENCES

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Amphipod Sensitivity

The relative sensitivities of the three amphipod species, *Rhepoxynius abronius*, *Ampelisca abdita*, and *Eohaustorius estuarius* have been assessed through numerous regional and national studies that have generally shown them to be appropriately sensitive relative to other species routinely used in solid phase bioassay tests to assess contaminated sediments, including dredged material (Swartz et al., 1985; DeWitt and Swartz, 1987; Plesha et al., 1987; DeWitt et al., 1989; Pastorok and Becker, 1989; Word et al., 1989; Scott and Redmond, 1989; ASTM, 1990, etc.). Moreover, all three species are designated as Corps/EPA nationally recommended species for solid phase testing for Section 404 evaluations using the draft "Inland Testing Manual" and for Section 103 evaluations for ocean disposal utilizing the "Greenbook".

The following table illustrates comparative amphipod sensitivity to two chemicals and generally shows that *Rhepoxynius* and *Ampelisca* are relatively similar in sensitivity to these two chemicals. Populations of *Rhepoxynius* from West Beach, Whidbey Island, Washington appear to be more sensitive to cadmium then those reported by Swartz et. al. (1985) for Yaquina Bay, Oregon. *Eohaustorius* appears to be about one tenth as sensitive as *Rhepoxynius* to cadmium. *Eohaustorius* sensitivity to Fluoranthene was similar to *Ampelisca* and *Rhepoxynius* (within a factor of 2). The comparative lower sensitivity of *Eohaustorius* to one metal (cadmium) should not preclude its usefulness as an appropriately sensitive bioassay species because it has been shown to be a relatively sensitive organism in assessing whole sediment toxicities. The bioassay endpoint response measured integrates the interactive effects of all chemicals in the sediment on any particular species.

Chemical	*Rhepoxynius abronius* (96 hour LC50)	*Ampelisca abdita* (96 hour LC50)	*Eohaustorius estuarius* (96 hour LC50)	References
Cadmium Chloride (mg/L of Cd)	Mean = 0.83 ± 0.45 Range = 0.15 - 1.61 n = 38 West Beach	Mean = 0.55 ± 0.46 Range = 0.05 - 1.44 n =11		PSDDA Program (DAIS database)
	1.61 Yaquina Bay, Oregon			Swartz et.al. (1985)
	0.92 (0.68 - 1.25)	0.33 (0.29 - 0.36)	9.33 (7.2 - 12.09)	ASTM, 1990 (E 1367-90)
Fluoranthene (μg/L)	6.6		13.8 - 15.1	DeWitt and Swartz (1987)
	5.1		10.6	DeWitt, et al. (1989)
		3.3 - 9.9		ASTM, 1990 (E 1367-90)

A 1989 EPA/PSEP interbioassay comparison study (Pastorok and Becker, 1989) showed that *Rhepoxynius* and *Eohaustorius* mortality was a sensitive endpoint for both species when exposed to sediment dilution series from Elliott Bay, Commencement Bay and Eagle Harbor. In this study both amphipod species were found to be highly sensitive to Eagle Harbor sediments. The study ranked the sensitivity of various bioassays as follows (highest to lowest): Microtox organic extract test > echinoderm embryo test > Microtox saline extract > *Rhepoxynius* = *Eohaustorius* mortality > *Neanthes* biomass > *Neanthes* mortality > *Rhepoxynius* reburial > *Eohaustorius* reburial > Geoduck mortality = echinoderm chromosomal abnormality.

Additionally, EPA (Office of Science and Technology / Office of Research and Development) has funded technical studies this year to further assess the relative sensitivity of four amphipod species to contaminated sediments including the above three species. This effort will also assess amphipod sensitivity to nontreatment factors such as grain size, ammonia, and salinity tolerance. The results of these studies will be evaluated by the PSDDA agencies when they become available in the fall of 1993.

In conclusion, the three amphipod species discussed above are considered by the PSDDA agencies to be appropriately sensitive species to evaluate dredged material in Puget Sound and in other areas such as Grays Harbor and Willapa Bay. The agencies will allow the substitution of *Ampelisca* and *Eohaustorius* (for interstitial salinities < 25 ppt), when appropriate to alleviate the apparent grain size sensitivity of *Rhepoxynius* noted by DeWitt, et. al. (1988) and the PSDDA program (ARM 1993 minutes, see presentation by David Fox). The PSDDA agencies will continue to monitor the performance and relative sensitivities of all bioassays in the test suite used to evaluate dredged material. Recommendations for program changes in the standard bioassay testing suite will be made when appropriate through the Annual Review Meeting process.

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[1]Available at the Dredged Material Management Office

CLARIFICATION

SITE HISTORIES IN SAMPLING AND ANALYSIS PLANS

Prepared by Stephanie Stirling (Corps, 206-764-3768) for the PSDDA agencies

INTRODUCTION

The history of a project area plays a pivotal role in project evaluation and sampling plan development. The purpose of the site history is to document past and present sources of potential contamination to dredged material proposed for open water-disposal. A site history characterizes known activity at the dredging site, in near-shore areas, and on adjacent properties. It identifies past activities, and describes the type of contamination which may have resulted from those activities.

PROBLEM IDENTIFICATION

Sampling and analysis plans vary widely in the adequacy of background information provided. Failure to provide sufficient information can slow the review process and can result in an unnecessarily conservative decision on the part of the PSDDA agencies. Current site histories do not reflect the same level of effort for each project.

PROPOSED ACTION/ MODIFICATION

The following outline identifies the type of information that may be necessary in a site history. The type and amount of information will vary according to the size and complexity of the project. Smaller projects in areas of lower concern will require less information. For most projects, site histories do not need to extend beyond two to three pages. A reasonable effort should be made to obtain data. It is recognized that certain types of data may not be readily available but the effort to obtain it should be documented. Information available in PSDDA agency files does not need to be regathered, but should be referenced and summarized. Emphasis should be placed on those activities which took place since the last dredging cycle, and any previous sampling data is crucial to the site history and should be summarized in the sampling and analysis plan.

The site history for a large, complicated project should include:

a map showing site's location, size, water sources, outfalls, and sensitive areas

current site use

industrial processes at or near the site (and hazardous substances used/generated)

outfall information, such as location, type, volume, NPDES data, spill events

history of site ownership and land uses, including facility location and description

adjacent property use, especially those up-gradient or upcurrent/upstream

site characteristics that could affect movement of contaminants

results of any previous sampling and testing

any dredging activity and data/information from that activity

There are a wide variety of information sources for site histories. Potential sources of information for site histories include: current and previous property owners; aerial photographs (past and present); real estate and Sanborn fire insurance maps; zoning, topographic, water resource, and soil maps; agency records, such as NPDES permit files, contaminated site lists (state and federal), aquatic leases, previous permits, etc.; land use records; tax assessor records (and photos); knowledgeable persons at or near the site (managers, employees, adjacent property owners); and city atlases (Kroll and Metsker). Not all sources are needed for all projects, and the type and extent of sources consulted will vary.

Smaller projects and those with less complicated source histories would generally require less documentation but should always include enough information to enable the PSDDA agencies to adequately address sampling and testing issues. Dredging applicants or their consultants should contact the Dredged Material Management Office (206-764-3768) to determine the level of effort required for their specific project. The DMMO will coordinate with the other PSDDA agencies as necessary to determine project-specific requirements.

CLARIFICATION

RECOMMENDED METHODS FOR MEASURING TOC IN SEDIMENTS

Prepared by Kathryn Bragdon-Cook (Ecology, (206) 493-2931) for the PSDDA agencies.

INTRODUCTION

Current PSEP protocols for measuring total organic carbon (TOC) in sediment call for drying a sediment sample at 70 degrees C in order to minimize the loss of volatile organic compounds. HCl is then added to the dried sample to remove inorganic carbon and dried again at 70 degrees C. The sample is then combusted using cupric oxide fines as a catalyst at 950 degrees C. A preweighed, ascarite-filled tube is used to capture the resulting CO_2 upon combustion. The tube is then weighed once more to determine the concentration of CO_2 which is used to calculate the TOC in percent dry weight based on total solids in the sample.

Ecology's Technical Information Memorandum, "Organic Carbon Normalization of Sediment Data", recommends Methods 5310A-D, slightly modified, from the 18th Edition of Standard Methods for the Examination of Water and Wastewater (Franson, 1992). These include a wet chemical oxidation method (5310D) and a combustion method (5310B), both using infrared detection (IR). The Department of Ecology Manchester Environmental Laboratory recommends Method 5310B for measuring TOC in wastewater or, with some modification, in sediments. Test Methods for Evaluating Solid Waste (EPA 1986) SW-846 Method 9060 also references Standard Methods for the Examination of Water and Wastewater for measuring TOC levels of solid and hazardous waste.

These methods require some modification for measuring TOC in sediment. Standard Method 5310B calls for the sample to be treated with HCl to convert inorganic carbon to CO_2 which is then purged using purified gas. The sample is homogenized and diluted as necessary. A portion is injected with a blunt-tipped syringe into a heated reaction chamber (packed with a catalyst) of a carbon analyzer using infrared detection. Needle size is selected to be consistent with particle size. Some accredited laboratories have adapted this technique to sediment by drying the sample at 70 degrees C and using an instrument attachment to the carbon analyzer designed specifically for sediment samples (Dohrman sludge/sediment boat sampler attachment, Model 183, for use with the Dohrman DC-80 TOC analyzer). The sample is then combusted and organic carbon in the sediment converted to CO_2 and transported in carrier gas streams to be measured by an infrared detector.

Method 5310D describes the wet-oxidation method where the sample is acidified and purged as above and oxidized with persulfate in an autoclave from 116 to 130 degrees C. Again, the resultant CO_2 is measured by infrared spectrometry. Adaptation of this method to sediments may be problematic. Reagents and analytical techniques may be adjusted by the laboratory, however, to increase oxidation of organic carbon in sediments.

The carbon analyzer/infrared detection used in these methods identifies characteristic spectral fingerprints as light in the infrared spectrum passes through various molecules. This instrument offers greater sensitivity than the ascarite-filled tube collector for measuring low levels of CO_2.

PROBLEM IDENTIFICATION

The combustion method dries the sediment sample at 70 degrees C to minimize the loss of organic compounds, but 70 degrees C is not enough to drive off all of the moisture in the sample. A minimum temperature of 104 degrees C is needed to ensure a truly dry sample for total solids calculations. At 104 degrees C, however, a significant loss of volatile organics occurs.

In addition, the ascarite-filled tube used to detect CO_2 in the PSEP method is less sensitive than the infrared detector of the standard methods, limiting accurate detection of low TOC concentrations. Comparative data between the two methods are not yet available.

PSDDA Reports, Development of Sediment Quality Values for Puget Sound, lists the 50%, 75%, and 90% TOC percentile concentrations for Puget Sound at 1.31%, 2.30%, and 4.50% respectively. TOC levels for individual test sites, however, vary greatly with some concentrations well below these averages. Low level detection of TOC in these areas is less accurate using the PSEP method.

Because the Ecology sediment clean up program and PSDDA program may overlap on projects, the need exists for consistency in the method used to measure TOC in sediments.

PROPOSED ACTION/MODIFICATION

Standard Method 5310B and SW-846 Method 9060 provide for more sensitive measurement of TOC concentrations in sediment. SW-846 Method 9060 (as modified by Laucks Laboratories for example) can detect TOC in sediments below 0.1%. Analytical precision for the PSEP method is not given in the protocols. For these reasons, utilization of Method 5310B or SW-846 Method 9060 using infrared detection is strongly recommended. Under conditions described below the PSEP method is acceptable.

Based on the lack of analytical error data for the PSEP method and greater instrument sensitivity of the combustion/IR method, the following guideline is given.

Prior to method selection, consideration should be given to the condition of the test site regarding probable TOC levels. When possible, historical data of particular sites should be reviewed to identify probable TOC concentration ranges.

When TOC concentrations are above 2% either method described could be used. Standard Method 5310B or SW-846 Method 9060 should be used for areas where TOC levels below 2% are likely. PSDDA applicants should state in their sampling and analysis plan which method for measuring TOC in sediment is proposed and provide detailed justification.

To correct for true dry weight with either method, the corresponding total solids analysis should be run twice, once at 70 degrees C and once at 104 degrees C, and the TOC calculation based on dry weight at 104 degrees C.

This document serves as an addendum to Ecology's Technical Information Memorandum (TIM) noted above. An errata sheet to replace page 3 of this TIM can be obtained by calling the Department of Ecology at (206) 459-6013.

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CLARIFICATION

THE *NEANTHES* 20-DAY BIOASSAY - REQUIREMENTS FOR AMMONIA/SULFIDES MONITORING AND INITIAL WEIGHT

Prepared by David Fox (Corps of Engineers, 206/764-3768) for the PSDDA agencies.

INTRODUCTION

The PSDDA agencies implemented the *Neanthes* 20-day biomass test at the beginning of Dredging Year 1993. At that time no formal requirements were established for ammonia/sulfides monitoring or initial worm weight. The *Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound* (PSEP 1991) include ammonia and sulfides as optional measurements. The PSEP-recommended starting weight for individual worms is 0.5-1.0 mg (dry weight), which corresponds to an age of 2-3 weeks post-emergence.

PROBLEM IDENTIFICATION

Nontreatment factors such as ammonia and sulfides can affect the results of sublethal bioassays such as the *Neanthes* biomass test. When such nontreatment effects occur, water quality monitoring measurements are essential in determining the factors contributing to the expressed effect. The Waterways Experiment Station[1] has made the following recommendations regarding the *Neanthes* biomass test: 1) measured total ammonia levels in tests with N. arenaceodentata should be ≤ 10 mg/L (overlying water) and 2) measured total sulfides concentrations should be ≤ 3.0 mg/l (overlying water).

Worm size is also a critical factor and can affect handling errors and growth rate at the beginning of the test.

PROPOSED ACTION/MODIFICATION

The PSDDA agencies are instituting the requirement to conduct ammonia and sulfides monitoring at the beginning and end of the *Neanthes* 20-day biomass test. In addition, there is evidence that aqueous ammonia may reach its maximum value nearer the beginning of the test (Cappellino, 1993). Therefore, it is highly recommended that ammonia and sulfides monitoring also be conducted prior to the first and second water renewals. The minimum worm size that may be used is 0.5 mg (dry weight). While it is recommended that the starting weight be less than 1.0 mg, the PSDDA agencies are not establishing this as a requirement at this time due to the logistics involved in obtaining worms from the supplier.

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CLARIFICATION

DNR DISPOSAL SITE USE PERMIT ACQUISITION PROTOCOL

Prepared by Gene Revelas (DNR, 206-902-1086) for the PSDDA agencies

INTRODUCTION

To dispose of dredged material at a PSDDA open-water disposal site, a dredging proponent needs to obtain a Department of Natural Resources' (DNR) disposal site use permit. This land use authorization is a contractual agreement between the permittee and the State which identifies, among other things, the disposal site, the period of authorized use, positioning and reporting requirements, and disposal site use fees and payment schedules. From the time that an applicant submits a site use permit application and the $2000.00 non-refundable permit fee, the Department requires four to six weeks to process and execute the permit.

PROBLEM IDENTIFICATION

Since PSDDA implementation, numerous dredgers (and their agents) have submitted applications to obtain DNR disposal site use permits within a week or two of their target dredging date. DNR has been responsive in these instances, but this practice cannot continue, especially given the increasing number of permit applications received each dredging year. One objective of this clarification is to remind the regulated community that DNR requires a minimum of four weeks to process a site use permit.

PROPOSED ACTION/MODIFICATION

To help effect a more timely submittal of DNR permit applications, DNR will modify its fee payment requirements beginning in June 1993 (Dredging Year 1994). The $2000.00 non-refundable fee will no longer need to be submitted with the permit application. Instead, DNR will accept disposal site permit applications without the initial fee anytime following documentation of the required PSDDA suitability decision. DNR will completely process the permits minus the Department's final signature. Then, upon receipt of the $2000.00 non-refundable fee, the document will be executed. It is hoped that this procedural change will allow proponents to apply for disposal site use permits well in advance of their anticipated dredging/disposal dates without risking the initial permit fee.

This modification will be detailed in a revised DNR site use permit application form which will be available in May 1993.

CLARIFICATION

PSDDA NON-DISPERSIVE DISPOSAL SITES ARE SEDIMENT IMPACT ZONES (per WAC Chapter 173-204)

Prepared by Gene Revelas (DNR, 206-902-1086) and Brenden McFarland (Ecology, 206-438-7620) for the PSDDA agencies

INTRODUCTION

The PSDDA program established an allowable environmental site condition for the five, non-dispersive, open-water disposal sites. This site condition, originally termed Site Condition II, allows "minor adverse effects" on biological resources at the site due to chemicals of concern. "Minor" effects are defined as potential chronic and sublethal effects within the site or its dilution zone; significant, acute effects are not allowed (PSDDA, 1988a, 1989). PSDDA sediment quality interpretive criteria are designed to satisfy this disposal site condition. Post-disposal site monitoring is conducted to verify that the site condition is maintained (PSDDA, 1988b, 1989).

PROBLEM IDENTIFICATION

In March 1991, the Washington Department of Ecology (Ecology) promulgated the Sediment Management Standards (SMS, Chapter 173-204 WAC). Under the SMS rule, dredged material and fill discharge activities are subject to the sediment source control standards of WAC 173-204-400, 410 and 420. The SMS requirements for dredging and dredged material disposal sites include the PSDDA testing requirements by reference. In addition, the SMS rule states that the PSDDA dredged material disposal sites shall be authorized as "sediment impact zones" (SIZs) via administrative orders issued under authority of the state Water Pollution Control Act, Chapter 90.48 RCW. To date, disposal site monitoring has not indicated exceedance of SMS conditions requiring a SIZ, therefore Ecology has not issued SIZ authorizations for the PSDDA non-dispersive disposal sites.

PROPOSED ACTION/MODIFICATION

To address potential future disposal site conditions, Ecology will issue SIZ authorizations for the five, non-dispersive, PSDDA disposal sites by April 30, 1993. These disposal sites are located in Commencement Bay, Elliott Bay, Port Gardner, Bellingham Bay, and between Anderson and Ketron Islands. The SIZ authorizations will be issued as an administrative order(s) under authority of Chapter 90.48 RCW. These authorizations will cite pertinent PSDDA references as conditions and require sediment quality conditions after closure to meet the SMS rule "no adverse effects" long-term management goal.

The SMS rule allows no greater than "minor adverse effects" within authorized SIZs which is consistent with the PSDDA disposal site condition criteria, i.e., maximum allowable impacts are defined as "minor adverse effects". Therefore, no change in site management will be necessitated by the issuance of SIZ authorizations for the PSDDA non-dispersive, disposal sites.

REFERENCES

Puget Sound Dredged Disposal Analysis. 1988a. Evaluation Procedures Technical Appendix, Phase I (Central Puget Sound). June 1988.

Puget Sound Dredged Disposal Analysis. 1988b. Management Plan Report -Unconfined Open-Water Disposal of Dredged Material, Phase I (Central Puget Sound). June 1988.

Puget Sound Dredged Disposal Analysis. 1989. Management Plan Report -Unconfined Open-Water Disposal of Dredged Material, Phase II (North and South Puget Sound). September 1989.

STATUS REPORT

DREDGED MATERIAL MANAGEMENT UNDER THE SHORELINE MANAGEMENT ACT

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POLICY OF THE SHORELINE MANAGEMENT ACT

Three concepts form the policy basis of the SMA:

> 1) Preferred Use. Shoreline areas should be reserved for those uses and activities that require a shoreline location or where there is significant public benefit from the use or activity having a shoreline location.
>
> 2) Resource Protection. All shoreline uses should be established and managed in a manner that minimizes environmental damage and or interference with public use.
>
> 3) Public Involvement. The public should have the opportunity to be involved in all decisions regarding shoreline uses.

In considering any shoreline use, all of these concepts must be addressed and no one is superior to the others. It can also be said that while these are strongly held policies they are not absolute.

APPLICABILITY TO PSDDA

Dredging of waterways and berthing areas is an important subsidiary of navigation and water dependent commerce in Washington State. Navigation and water dependent commerce are among the most basic of preferred uses and so this linkage provides a strong basis for a conclusion that as a general matter dredged material disposal related to navigational maintenance or improvement may be considered a preferred use.

As indicated above, being a preferred use only grants entree to consideration of how, where and if a use can be established and conducted in a manner that minimizes harm to environmental resources or interference with public uses. As a general matter, the PSDDA program appears to address this issue quite well for Puget Sound.

The SMA public involvement policy is carried out through extensive public involvement requirements applicable to the master program amendment process and the permit process. Among other issues, these requirements allow expression of concerns about conflicts between state and local policy or about the validity of scientific conclusions. These concerns may or may not have a sound basis but must be addressed in an appropriate manner by those responsible for making a shoreline amendment or permit decision.

ECOLOGY INVOLVEMENT

It is through the amendment and permit review processes that the Shorelands Program steers local decision making toward consistency with the SMA by the use of adopted guidelines, advice, information, financial assistance and only when absolutely necessary, use of overriding authority. Ecology also uses these processes to encourage local government to consider issues of consistency with the plans, programs and objectives of other local, state and federal agencies and interests.

Legally, Ecology has the authority to adopt mandatory guidelines for inclusion in local master programs on a broad range of subjects and from almost any perspective that can be considered necessary to achieve consistency with the SMA. Even without adopted guidelines we have broad authority to require local government to be consistent with the SMA in its actions on both master program and permit issues. Although Ecology has broad authority to mandate, it is most effective in influencing local government decisions by providing good advice and information that local government can use when they need it to solve a real problem, and by convincing them that addressing issues such as dredging and dredged material management before it becomes a controversial issue may avoid future problems.

The PSDDA process provides the "good information" on dredged material management. Consequently the Shorelands Program issued our Shorelines Management Guidebook in 1990 which incorporates guidance on dredging and dredged material disposal that closely parallels and directly references PSDDA. We see the Guidebook as a compendium of good advice. It is not adopted as state shoreline policy. It does provide a baseline from which local government can start in the development of new or reconsideration of existing shoreline management policies.

Experience with the guidebook to date indicates that it is being used extensively. Over 500 copies were printed and distributed and demand continues. Master program amendments tend to be long processes at the local level even on limited subjects but we are seeing a steadily increasing number of amendments that come directly from the guidebook or clearly started from it. We will be publishing a revised and updated 2nd Edition in the summer or fall of 1993.

STATUS OF SELECTED LOCAL MASTER PROGRAMS WITH REGARD TO DREDGED MATERIAL DISPOSAL

Clallam County:

Policy: Deposition of dredged materials in water areas should be allowed primarily for habitat improvement, to correct problems of material distribution adversely affecting fish and shellfish resources, or where the alternatives of depositing materials on land is more detrimental to shoreline resources than depositing in water area.

Regulations: Deposition only at approved disposal sites, only at sites and in a manner as will minimize turbidity, degradation of water quality and the disruption of fish, shellfish and wildlife habitats.

Environment Regulations: Prohibited in the Natural and Conservancy designations; Permitted in the Rural only for habitat enhancement purposes; Permitted in the Suburban and Urban environments.

Jefferson County:

Policy: Deposition of dredged materials in water areas should be allowed primarily for habitat improvement, to correct problems of material distribution adversely affecting fish and shellfish resources, or where the alternatives of depositing materials on land is more detrimental to shoreline resources than depositing in water area. Dredged material disposal sites in water areas should be selected in cooperation with the Washington State Departments of Natural Resources, Game and Fisheries.

Regulations: Depositing of dredged materials in water areas shall be allowed only: a) for wildlife habitat improvement; b) to correct problems of material distribution adversely affecting fish and wildlife resources; c) when the alternatives of depositing material on land is more detrimental to shoreline resources than depositing it in water areas; d) in dredged material disposal areas authorized and delineated by the state and county; or e) for the enhancement of geohydraulic shore processes by beach feeding.

Kitsap County:

Policy: Depositing of dredged materials in water areas should be allowed primarily for habitat improvement, to correct problems of material distribution adversely affecting fish and shellfish resources, or where the alternatives of depositing materials on land is more detrimental to shoreline resources than depositing in water area.

Regulations: Depositing of dredged materials in water areas shall be allowed only at approved disposal sites.

Environment Regulations: Permitted Use in the Urban, Semi-Rural and Rural Environments; Conditional Use in the Conservancy Environment; Prohibited in the Natural Environment.

Mason County:

Regulations, Policy: Dredged material, when not deposited on land, shall be placed in spoils deposit sites in water areas to be identified by the County. Depositing of dredged materials in water areas shall be allowed only for habitat improvement, to correct problems of material distribution adversely affecting fish and shellfish resources, or where the alternatives of depositing materials on land is more detrimental to shoreline resources than depositing in water areas.

Environment Regulations: Permitted use in association with permitted widening or deepening of navigation channels or to facilitate channel clearance and improvement in the Urban-Industrial, Urban-Residential, Urban Commercial, Urban Water, Rural and Conservancy Environments. Prohibited in the Natural Environment.

Thurston County:

Policy: Deposition of dredged materials in water areas should be allowed for habitat improvement, to correct problems of material distribution adversely affecting aquatic populations, or when a site has been approved by the Interagency Open Water Disposal Site Evaluation Committee (WAC 332-20-166).

Regulations: Dredged material shall not be deposited in water unless: a) the operation improves habitat; b) the site has been approved by the Interagency Open Water Disposal Site Evaluation Committee (WAC 332-20-166); or c) the disposal of spoils will increase public recreational benefits.

Environment Regulations: Sites for deep water disposal of dredged spoils are a permitted use in the Natural-Aquatic Environment (applies to all salt water areas in excess of 10 fathoms).

Pierce County:

Regulations: Deep water spoil disposal shall be done only at approved disposal sites and only when material meets EPA criteria for deposit in open waters.

Environment Regulations: Dredged material disposal is a permitted use in the Urban, Rural Residential and Rural Environments. Deep water disposal sites are permitted in the Conservancy Environment. Prohibited in the Natural Environment.

Seattle:

Regulations: ...dredged material disposal shall be designed to include reasonable mitigating measures to protect aquatic habitats and to minimize adverse impacts such as turbidity, release of nutrients, heavy metals, sulfides, organic materials or toxic substances, dissolved oxygen depletion, disruption of food chains, loss of benthic productivity and disturbance of fish runs and important biological communities. Open water disposal of dredged materials shall be allowed only at designated disposal sites.

Snohomish County:

Policy: Deposition of dredged materials in water areas should be allowed primarily for habitat improvement, to correct problems of material distribution adversely affecting fish and shellfish resources, or where the alternatives of depositing materials on land is more detrimental to shoreline resources than depositing in water areas. Approve new dredging projects only when accompanied by an acceptable plan for the long range disposal of dredged spoils created by the project and its continued maintenance.

Environment Regulations: Permitted at designated sites in the Urban, Suburban, Rural, and Conservancy Environments.

Everett:

Policy: Placement of dredged spoils shall be conducted in a manner which minimizes the damage to areas within the context of our shoreline resources....and the impact on water quality, ecological systems and natural resources. Depositing of dredged materials in water areas should be allowed only for the improvement of habitat, or where the alternatives of depositing materials on land is more detrimental to shoreline resources than depositing it in the water.

Environment Regulations: Dredged spoil disposal is a permitted use in the Urban Environment, a conditional use in the Conservancy Recreation Environment if used for beach enrichment, prohibited in the Conservancy Resource Protection Environment and a conditional use in the Diverse Resource Management Area.

Island County:

Policy: Control dredging to minimize damage to existing ecological values and natural resources of both the area to be dredged and the area for deposit of dredged materials.

Environment Regulations: Dredging and Filling are conditional uses in the Aquatic Environment.

San Juan County:

Policy: 1) Dredging should be controlled to minimize damage to the natural resources and systems of the area to be dredged and the area to receive the dredged materials. 2) The depositing of dredged spoils in water areas should be permitted only for habitat improvement, to correct problems of materials distribution adversely affecting fish and shellfish resources, or where significant adverse impact will not result; 3) In identifying spoils disposal sites in water areas, the county should seek the assistance of the State Department of Fisheries, Game and Natural Resources and the University of Washington Friday Harbor Laboratories.

Environment Regulations: Spoils disposal is a permitted use in the Aquatic Environment only at sites approved by the State Department of Fisheries, Game and Natural Resources and the University of Washington Friday Harbor Laboratories.

Skagit County:

Policy: Review of proposals for dredging and dredged spoil disposal should assess: a) the value of the...site in their present state...or future potential uses including but not limited to aquaculture, fish, shellfish, and wildlife research and resource preservation, commercial fishing and recreation opportunities. All dredged spoil disposal operations should comply with the water quality standards, guidelines, and regulations of federal, state and local agencies. Proposals for dredged spoil disposal projects should include a thorough analysis by qualified personnel of the quality and characteristics of the material...Deposition of dredged materials in water should be discouraged except when the alternatives of depositing materials on land is more detrimental to shoreline resources and uses than depositing in water area.

Environment Regulations: Dredged Spoil Disposal is a conditional use in the Aquatic Environment.

Whatcom County:

Policy: Because of the high probability of water quality and biologic resource problems from disposal, dredged spoils should not be deposited in shallow offshore areas or natural wetlands. Suitable land or open water sites should be selected in cooperation with other public agencies including the County Health Board, Port of Bellingham, adjacent local governments, Lummi Nation, Nooksack Tribe, State departments of Natural Resources, Fisheries, Ecology, Wildlife and the federal Environmental Protection Agency and Corps of Engineers. Spoil disposal in open navigable water may be less consistent with this program than land disposal, and should be permitted only under one or more of the following conditions: a) land disposal is infeasible, less consistent with this program, or prohibited by law. b) off shore biologic habitat will be protected, restored, or enhanced; c) adverse effects on water quality or biologic resources from contaminated bottom materials will be mitigated; d) shifting and dispersal will be minimal; e) water quality will not be adversely affected.

STATUS OF SHORELINE PERMITS FOR PSDDA SITES

Port Gardner, City of Everett; issued August 3, 1988; expires August 3, 1993.

Commencement Bay, Pierce County; issued August 17, 1988; expires August 17, 1993.

Elliott Bay, City of Seattle; issued January 5, 1989; expires January 5, 1994.

Bellingham Bay, Whatcom County; issued October 10, 1989; expires October 10, 1994.

Port Townsend, Clallam County; issued January 23, 1990; expires January 23, 1995.

Rosario Strait, Skagit County; issued March 20, 1990; expires March 20, 1995.

Port Angeles, City of Port Angeles; issued March 23, 1990; expires March 23, 1995.

Anderson/Ketron Island, Pierce County; issued Sept. 7, 1990; expires Sept. 7, 1995.