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

REPLY TO
ATTENTION OF

Operations Division
Dredged Material Mangement Office

November 10, 1994

Dear Interested Party:

I would like to thank you for your interest and participation in the Puget Sound Dredged Disposal Analysis (PSDDA) sixth annual review, which culminated in the Annual Review Meeting (ARM) held on May 6, 1994, and hosted by the Environmental Protection Agency, Region 10. 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 and deliberations
7) final program clarification papers

On behalf of the PSDDA agencies I extend an apology for the lateness in transmitting these ARM minutes. The Environmental Protection Agency was responsible for finalizing the minutes this year as the hosting agency. Due to work loads and other work priorities, the finalization of the minutes was delayed. The PSDDA agencies will retain a contractor at next year's ARM, who will be responsible for documenting and finalizing the minutes, to ensure a timely transmittal to ARM attendees and interested public. Despite this delay, however, I would like to clarify that the PSDDA agencies effectively implemented all post ARM actions discussed at the ARM following the post Arm agency meeting.

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

Errata for ARM minutes

Please note that in **Appendix A (Post-ARM Summary Responses)**, agency responses to ARM issues are keyed to the 11 issues listed on page 8 of the minutes. Agency responses to issues 6 - 8 are summarized in **Appendix D (Summary of Modifications Made to the PSDDA Evaluation Procedures and Management Plans)** under the paragraph header: **Sixth ARM (May 6, 1994)**, located in paragraphs numbered 1 and 2.

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PSDDA SIXTH ANNUAL REVIEW MEETING MINUTES

1. The sixth Puget Sound Dredged Disposal Analysis (PSDDA) annual review meeting (ARM) was held at EPA Region 10 on Friday, May 6, 1994. The agenda for the meeting is provided as attachment 1 and the list of meeting attendees is provided as attachment 2.

2. Chuck Clarke, EPA Region 10 Regional Administrator, welcomed meeting attendees and provided introductory remarks. He had been head of Ecology when PSDDA was first implemented in 1988. He commented that he had heard of the PSDDA program while in the East and looks forward to seeing the Pacific Northwest used as a model. The program is cutting edge, challenging, and has a positive momentum that will be critical for future cleanup directions as well.

3. Brian Applebury, Seattle District Chief of Operations, introduced the ARM panel of agency representatives: David Kendall, Corps of Engineers - Seattle District; John Malek, Environmental Protection Agency - Region 10; Phil Hertzog, Washington Department of Natural Resources; and Greg Sorlie, Washington Department of Ecology. Keith Phillips represented Ecology for the afternoon session.

4. Brian Applebury reviewed the purpose 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 dk1:	Sixth Annual PSDDA Review Meeting
Ovrhd dk2:	Meeting Objectives and Purpose

5. David Kendall (Corps) reviewed a summary of the fifth annual review meeting, as well as commitments and accomplishments.

Ovrhd dk3:	Summary of Fifth Annual Review Meeting - Commitments and Accomplishments
Ovrhd dk4:	Commitments and Accomplishments (continued)
Ovrhd dk5:	Commitments and Accomplishments (continued)
Ovrhd dk6:	Commitments and Accomplishments (continued)
Ovrhd dk7:	Commitments and Accomplishments (continued)

6. Stephanie Stirling (Corps) provided a summary of PSDDA projects and testing activities for Dredging Year 1993, and a preview of DY 94 projects.

Ovrhd ss1:	PSDDA Project and Testing Activities
Ovrhd ss2:	DY93 PSDDA Evaluation Activities
Ovrhd ss3:	Project Definition
Ovrhd ss4:	DY93 Projects
Ovrhd ss5:	DY93 Project Initial Ranking
Ovrhd ss6:	DY93 Sampling Plans
Ovrhd ss7:	DY93 Chemical Testing
Ovrhd ss8:	DY93 Biological Testing
Ovrhd ss9:	DY93 Suitability Determinations
Ovrhd ss10:	DY93 Disposal
Ovrhd ss11:	DY94 Projects
Ovrhd ss12:	Rank vs Unit Testing Cost DY 92 & 93
Ovrhd ss13:	Average Cost per Dredged Material Managment Unit
Ovrhd ss14:	Total Project Sampling/Testing Costs
Ovrhd ss15:	PSDDA Program Retrospective: Number of Projects Evaluated
Ovrhd ss16:	PSDDA Program REtrospective: Number of Chemistry and Bioassay DMMUs Tested
Ovrhd ss17:	PSDDA Program Retrospective: Total Tested vs Suitable Volume
Ovrhd ss18:	PSDDA Program Retrospective: Average Sampling and Testing Costs

7. Phil Hertzog (DNR) provided an overview of disposal activity and related site monitoring for DY 93.

Ovrhd ph1:	Dredging Year 1993 Disposal Volumes
Ovrhd ph2:	Environmental Monitoring Questions
Ovrhd ph3:	Bellingham Bay - Side Scan Sonar
Ovrhd ph4:	Bellingham Bay - SVPS Stations
Ovrhd ph5:	Bellingham Bay - Sediment Chemistry and Bioassay Stations
Ovrhd ph6:	Bellingham Bay - Distribution of Dredged Material
Ovrhd ph7:	Display of Dredged Material Location
Ovrhd ph8:	Perimeter - Chemistry - Guideline - Organics
Ovrhd ph9:	Organics of Concern that Exceed Guideline Values
Ovrhd ph10:	Perimeter - Chemistry - Guideline - Metals
Ovrhd ph11:	Metals of Concern that Exceed Guideline Values
Ovrhd ph12:	Concentrations of PSDDA Chemicals of Concern
Ovrhd ph13:	1993 PSDDA Site Monitoring Bioassay Results, Bellingham Bay
Ovrhd ph14:	Cumulative Disposal Volumes (DY 1989-1993)

8. Public Comment and Questions.

Eric Johnson asked how accurate the original disposal volume estimations were and whether we need to update our estimations. Stephanie Stirling and Gene Revelas answered that the program is at about half the original estimated volumes. This is partially due to some dredged material being used for other purposes e.g. beneficial uses. (Reference also the post-ARM assessment of disposal volumes at each site relative to predicted volumes).

Teresa Michelsen asked how deep the SVPS camera goes and what other things you can see/measure in the photos. Dave Kendall answered that it depends on the grain size in the area. SVPS can go up to 20 cm. deep in softer sediments, and you can see successional stages.

Carl Kassebaum asked about placement of debris such as rip-rap at the PSDDA sites. He'd like to have a discussion about what's acceptable at the sites, and suggested that rip-rap should sink in the mud and therefore shouldn't be a problem. (See attached Response to Unresolved Issues).

Carl Kassebaum stated that costs for small projects can be very high, up to $20/cubic yard. He would like to see some relief for small projects and suggested dropping QA from some chemicals and/or requiring bioassays only. Dave Fox responded that PSDDA is developing a small project sampling and analysis plan. (Reference Response to Unresolved Issues).

Teresa Michelsen expressed concern about dredging in contaminated areas, including dealing with heterogenous material and how to interface Sediment Management Standards and PSDDA. Dave Kendall agreed that we need to work out the solutions to these issues together.

Teresa Michelsen commented that the PSDDA program is doing a good job of monitoring.

Dean Smith commented that the Navy in San Francisco went straight to bioassays for smaller projects and successfully reduced costs. He also commented that the Navy used a 12" by 12" grid during disposal to remove debris from dredged material. He suggested that the screening works, but you still have to watch out for midnight dumping of debris at sites.

Tom Mueller reminded everyone that debris is a problem for bottom trawlers and treaty fishing. Dave Kendall commented that the Muckleshoot Tribe has raised this as an issue in Elliott Bay and that it's an issue in Bellingham Bay where the site is less than 100' deep.

BREAK

9. Phil Hertzog (DNR) discussed disposal fees, challenges, and an overview of how the collected fees are used. The fee of .40 cents/cubic yard and other issues such as diversion of material from PSDDA sites to beneficial uses projects has resulted in a declining projected balance in the DNR account. DNR researched alternatives to the problem and has proposed to raise the fee for this dredging season to .50 cents/cubic yard. As monitoring is scaled back in the longer term, this fee may be reduced. Note: See Post-ARM Update enclosure.

Ovrhd ph15:	PSDDA Fund Disposal Fee = $0.40/cy
Ovrhd ph16:	PSDDA Fund Disposal Fee = $0.50/cy

10. Eric Gilman (DNR) discussed the status and expiration dates of PSDDA disposal site shoreline permits. DNR must reapply for permits every five years.

11. John Malek (EPA) stated that national sediment quality criteria (SQC) are continuing to be worked on by EPA. Five proposed criteria are out for review now. These are best professional guidance and are not enforceable standards unless a state adopts them. The state of Washington has adopted sediment quality standards which were approved by the Region. These standards are biological, with chemical approximations of levels where effects occur. Washington state and EPA have committed to evaluate the national criteria when they are finally adopted. Washington state has 47 chemical numbers while national EPA has five. Tom Gries has compared the EPA numbers to current state criteria. The EPA numbers could become part of the Washington standards. Another item of interest is that there is still no national guidance on dioxin. In late summer/early fall the Inland Testing Manual will be coming out in the Federal Register.

12. Public Questions and Comments.

Teresa Michelsen asked whether EPA draft national sediment quality criteria applied to marine and freshwater sediments. John Malek responded that the draft criteria apply to both, but that different numbers exist for each environment, just as for water quality criteria.

Brett Betts commented that EPA has calculated 90% confidence intervals, and then asked what EPA will be doing with the ranges. John Malek answered that EPA doesn't know yet. This is an implementation question and no implementation guidance has been provided to date. A workgroup will be created later this year to develop the guidance.

Brett Betts commented that Ecology has assembled a freshwater database and is evaluating development of freshwater AET's as part of an EPA grant. This work may be available for draft review later this year.

Sally Fisher referenced the Navy Pier D project and said that it is important to note that several of the dredged material management units had no or only a couple of SL exceedances. She suggested that cleaner sediments will dilute more contaminated sediments. This comment was made in response to Teresa Michelsen's earlier comments regarding contaminated sediments.

Eric Johnson asked about the relationship of EPA SQC and CERCLA cleanup and how they will be applied. John Malek replied that he is not sure if or how they will be applied and that implications are being evaluated. This issue will be looked at more closely after they are finalized.

Eric Johnson asked how the five SQC's compare to PSDDA SL's. John Malek answered that the numbers are pretty close. Generally they are higher, but it depends on several, not too obvious assumptions."

Eric Johnson asked whether Clallam County had any problems with the Port Angeles site since it hasn't been

used. Eric Gilman responded that this issue hasn't arisen, and that the SEPA checklist is being done for Port Angeles.

Eric Johnson asked why the shoreline permit renewals are being cut so close. Phil Hertzog responded that DNR staff was diverted to other activities during the year and this delayed renewals. These activities included resolving DNR's liability concerns, and DNR considered these to have priority over the PSDDA program.

Eric Johnson asked whether local jurisdictions have incorporated PSDDA into local land use plans. Keith Phillips replied that Ecology has tried to promote incorporation but locals have not been responsive.

Teresa Michelsen asked whether we should consider fees on beneficial uses to make up for DNR PSDDA monitoring funding shortfalls. Phil Hertzog replied that it would take statutory changes to transfer funds into the Dredging Fund if this were pursued. Dave Simpson asked whether DNR would close PSDDA sites due to lack of funds. Phil Hertzog replied that DNR cannot run deficits, and that DNR would be open to lawsuits if monitoring was not performed as agreed.

13. The order of presentations was altered from the agenda and Keith Phillps (Ecology) next discussed proposed agency directions for sediment management.

Ovrhd kp1:	Interagency Option Papers
Ovrhd kp2:	Sediment Management Issues-Clean Sediments
Ovrhd kp3:	Contaminated Sediments
Ovrhd kp4:	Issues: Beneficial Uses, Navigation, Cleanup
Ovrhd kp5:	Agency Head Charge
Ovrhd kp6:	The PSDDA Model
Ovrhd kp7:	General Conclusions: Options -- Recommendations
Ovrhd kp8:	Multiuser Confined Disposal Sites
Ovrhd kp9:	Beneficial Uses of Dredged Material: Issue -- Conclusions
Ovrhd kp10:	Achieving Sediment Cleanup
Ovrhd kp11:	Aquatic Habitat Planning
Ovrhd kp12:	Baywide Planning
Ovrhd kp13:	Option Paper Recommendations
Ovrhd kp14:	Interagency/Intergovernmental Agreement: "A Cooperative Sediment Management Program"
Ovrhd kp15:	Agreement Priciples
Ovrhd kp16:	Sediment Cleanup Strategy
Ovrhd kp17:	Action Plan for Multiuser Confined Disposal Site(s)
Ovrhd kp18:	Policies for Beneficial Use of Dredged Material
Ovrhd kp19:	Schedule

LUNCH.

14. Tom Gries then presented an update on the sediment quality value re-evaluation process and available interim results.

Tom began by reviewing commitments from the previous two PSDDA Annual Review Meetings. He outlined the overall re-evaluation process, including technical tasks, policy decisions and public participation, which would have to be completed prior to recommending adoption of new PSDDA maximum and screening levels. He then summarized the additional sediment quality data being used to recalculate Apparent Effects Threshold values. Some interim results were presented as tables of new amphipod and sediment larval AET's and their predictive reliability. Tom showed examples of how certain PSDDA MLs and SLs increased, while others decreased or did not change. He concluded by listing the analytical, policy and public review steps of the process which remained before PSDDA could adopt new numeric guidelines.

Ovrhd tg1:	Sediment Quality Value Re-evaluation: Process and Interim Results
Ovrhd tg2:	Background: Commitments from 1992-1993
Ovrhd tg3:	Bioassay data excluded form 1993 AET calculations
Ovrhd tg4:	Ecology's SEDQUAL database: status of synoptic chemistry/bioassay data
Ovrhd tg5:	How AETs are Computed
Ovrhd tg6:	Amphipod and Sediment Laral AETs Summary of Observed Changes
Ovrhd tg7:	New Highest AETs Comparison to PSDDA Maximum levels
Ovrhd tg8:	Comparison of PSDDA screening levels to some new HAETs/10 AND new LATTs
Ovrhd tg9:	Criteria Reliability
Ovrhd tg10:	The predicitive reliability of amphipod mortality AETs: comparison between 1993 and 1988 results
Ovrhd tg11:	The predictive reliability of larval abnormaity AETs: comparison between 1993 and 1988 results
Ovrhd tg12:	Stations exeeding 1993 PSDDA MLs/SLs vs som possible new PSDDA MLs/SLs
Ovrhd tg13:	Technical Tasks Remaining
Ovrhd tg14:	Non-technical/policy decisions, activities remaining

15. David Fox presented a summary of bioassay performance and changes to the PSDDA program based on experience and new information. At the last annual review meeting, a substitution guideline was adopted for the amphipod bioassay that allowed the use of *Ampelisca abdita* in place of *Rhepoxynius abronius* under certain conditions. *Ampelisca* performance, since last year's ARM, was reviewed. Side-by-side testing of the two amphipod species has provided support for the continued use of the substitution rule.

Experience with the Neanthes 20-day test since implementation in 1992 was also reviewed. This year's clarification paper, which changed the endpoint of this bioassay from biomass to growth, was discussed.

Work conducted by the Microtox technical work group this past year was reviewed. The PSDDA agencies and the Puget Sound Water Quality Authority met with Microtox practitioners and representatives of Microbics Corporation to discuss experience to date with this bioassay. Results of a solid-phase demonstration conducted by Microbics were also discussed.

Over the last two years, a great deal of work has been done on the sediment larval test. Non-treatment factors were examined in 1993, both in the laboratory by SAIC, and by the Dredged Material Management Office using the Dredged Analysis Information System (DAIS). Additional work was performed in 1994, using DAIS to examine variability in this bioassay. This latter work resulted in this year's clarification paper, which modified the performance standards for the larval test.

Ovrhd df1:	PSDDA Suite of Bioassays
Ovrhd df2:	Amphipod Bioassay
Ovrhd df3:	Ampelisca Data
Ovrhd df4:	Rhepoxynius vs Ampelisca
Ovrhd df5:	Reference Toxicant Data
Ovrhd df6:	Neanthes Data
Ovrhd df7:	Neanthes 20-day Mean Initial Weight
Ovrhd df8:	Neanthes Clarification Paper
Ovrhd df9:	Microtox
Ovrhd df10:	Technical Work Group Meeting - July 1993
Ovrhd df11:	Microbic Solid-Phase Demonstration
Ovrhd df12:	Sediment Larval Bioassay
Ovrhd df13:	PSDDA Reference Sediment Performance
Ovrhd df14:	Sediment larval Bioassay
Ovrhd df15:	SAIC Laboratory Investigation
Ovrhd df16:	SAIC Recommendations
Ovrhd df17:	SAIC Recommendations (continued)
Ovrhd df18:	Analysis of Non-treatment Factors
Ovrhd df19:	Examiniation of Variability
Ovrhd df20:	Current Performance Standards
Ovrhd df21:	Seawater Control Performance: Mean, Mean Effective Mortality, Standard Deviation

Ovrhd df22:	Clarification Paper
Ovrhd df23:	Performance Standard Adjustment
Ovrhd df24:	Adjustments to Ensure Statistical Power
Ovrhd df25:	Reality Check

16. Public Questions and Comments.

Nancy Musgrove asked if Tom Gries looked at the impact of including or excluding the Commencement Bay data set from his calculations. Tom Gries replied that this has not been done.

Teresa Michelsen commented that the original AET's were calculated using oysters, which are now combined with echinoderms. She asked whether AET's have been calculated based on echinoderms only. Tom Gries responded that the reliabilty was similar to the original oyster data.

Teresa Michelsen asked whether any other work on microtox protocols is ongoing.

Margaret Stinson commented that EPA nationally is looking at a microtox solid-phase test round robin.

Tim Thompson suggested that microtox be removed from the PSDDA suite of tests. He suggested suspending the test, establishing a time table for a decision, and then permanently removing microtox if indicated. Tim stated that there is a discrepancy between PSDDA's power analysis and those he has performed. Sally Fisher also suggested removing microtox from the PSDDA suite.

Teresa Michelsen commented that microtox responds well to higher contamination and in freshwater tests. She is reluctant to remove the test totally.

Charlie Wisdom asked whether coefficient of variance (COV) should be used instead of standard deviation (SD).

Eric Johnson asked whether the PSDDA program should be the forum for discussing human health criteria. Keith Phillips responded that all sediment programs should be discussing human health criteria and their implications.

17. Presentation of Public Issue Papers.

Carl Kassebaum believes that the PSDDA program should expand to deal with contaminated sediment issues such as the South Terminal project. The program has the expertise and is ahead of the curve relative to the rest of the country. The program should be getting word out to the rest of the world. He also suggested that we should be setting up semi-annual technology exchange meetings relative to contaminated sediments management.

Steve Cappellino commented on the larval test and said that the new PSEP performance standard does not include abnormality. A lot of test results are thrown out because of abnormality in cases where mortality is low and should be acceptable. Tim Thompson agreed with this comment.

Eric Johnson suggested combining review of all the sediment management programs including options papers, SMS, contaminated sediments, PSDDA, etc. into two days including one technical day and one policy day.

Mike Salazar (NOAA Bioeffects Branch (206) 526-4343) presented an issue paper on use of in situ bioassays such as transplanted mussels and their potential use in the PSDDA monitoring suite. His suggestions to PSDDA include:

- incorporate in situ bioassays
- measure bioaccumulation and bioeffects
- evaluate overlying water
- conduct pilot study

Ovrhd ms1:	Approach
Ovrhd ms2:	Beyond the Triad
Ovrhd ms3:	Previous Work
ovrhd ms4:	Bivalve Exposure
Ovrhd ms5:	In situ bioassays
Ovrhd ms6:	Suggestions to PSDDA

Cliff Whitmus asked about depth limitations for this method. Mike Salazar said that he has only seen data down to about 200', and suggested a pilot study in shallow water.

Eric Johnson asked why PSDDA should take on another test with its additional complications and expense. Mike Salazar replied that it is redundant to do chemistry and bioassays both before and after disposal -- what you really want to measure is where contamination is going after disposal.

Cliff Whitmus asked whether in situ bivalves could be used at dredging sites. Mike Salazar replied that this has been done in some cases.

Nancy Musgrove commented that caged mussels look at both bioaccumulation and biological effects.

Teresa Michelsen commented that this technique could be more useful for confined disposal facilities -- looking at effects of porewater, etc. for use in risk assessment.

BREAK.

18. David Kendall presented refinements to bioaccumulation testing.

Ovrhd dk8:	Issue Paper
Ovrhd dk9:	The Current PSDDA Program
Ovrhd dk10:	Interpretive Guidance
Ovrhd dk11:	Current Guidance
Ovrhd dk12:	1994 Draft Inland Testing Manual
Ovrhd dk13:	Rationale for testing two species
Ovrhd dk14:	The 1991 "Greenbook"
Ovrhd dk15:	Species Characteristics to be considered
Ovrhd dk16:	Table 13 - Candidate Test Species...
Ovrhd dk17:	Problem Identification
Ovrhd dk18:	Proposed Action/Modificaiton

Teresa Michelsen asked whether bioaccumulation is run with the bioassays. Dave Kendall replied that bioaccumulation is done only when bioaccumlation triggers are exceeded for a given chemical of concern.

Teresa Michelsen asked why bioaccumulation is not run on Neanthes used in the biomass test. Dave Kendall said that he would have to check with Tom Dillon (Waterways Experiment Station) on this possibility, however, the biomass is likely not adequate for running the analyses. Tim Thompson commented that 300-500 worms are needed to have enough biomass.

Tim Thompson asked whether there is any allowance for using in situ organisms for analysis of bioaccumulation at a dredging site. Dave Kendall and John Malek responded that there is guidance, however, in situ bioaccumulation is considered a Tier IV not a Tier III test.

Tim Thompson commented that regionally only EVS and Margaret Stinson at Manchester can do flow-through tests, so caged mussels might be more cost-effective. One could also take the modeling option. John Malek replied that the model used is for theoretical bioaccumulation potential, but that it is a Tier II test.

Mike Salazar commented that Teresa's point is good, and that we should try to use one organisum for both bioeffects and bioaccumulation.

19. The group then went over issues requiring a response from the PSDDA program based on the discussions of the day, and committed to actions to address each issue. See the attached post-ARM summaries (Appendix A) addressing these issues.

- 1. Actual v. Predicted Volumes at PSDDA sites (Eric Johnson)
  - the PSDDA agencies will review
- 2. Debris at PSDDA sites (Carl Kassebaum)
  - the PSDDA agencies will revisit
- 3. Relief (testing) for small projects (Carl Kassebaum)
  - the PSDDA agencies will reexamine current small projects criteria
- 4. Revisit microtox; develop time table to fix or drop (Tim Thompson)
  - the PSDDA agencies will revisit
- 5. Combine PSDDA and SMS sediment policy and technical annual review meeting (Carl Kassebaum, Eric Johnson, Teresa Michelsen)
  - good idea, the PSDDA agencies will explore this option with Brett Betts at Ecology
- 6. Drop larval abnormality performance standard (Steve Cappellino)
- 7. Look at power analysis (Tim Thompson)
- 8. Look at COV v. SD (Charlie Wisdom)
  - PSDDA agencies will review
- 9. For monitoring replace toxicity testing with insitu test/exposure (Mike Salazar)
  - PSDDA agencies will discuss
- 10. Discuss human health implications as part of PSDDA forum (Eric Johnson)
- 11. Discuss alternative strategies for bioaccumulation (Mike Salazar, Tim Thompson)

20. Brian Applebury then closed the meeting and reminded participants that written comments may be submitted through May 20th.

Puget Sound Dredged Disposal Analysis (PSDDA)
Annual Review Meeting
Dredged Material Management Year 1993
(June 16, 1992 - June 15, 1993)

EPA Region 10, 12th Floor, Conference Room 12A

May 6, 1994
Final Agenda

MORNING SESSION

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

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

Greeting : Chuck Clarke, Regional Administrator, U.S. Environmental Protection Agency

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 (Phil Hertzog, DNR)

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

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

Presentation of Status Reports by PSDDA Agencies (10:45-11:30am):

- PSDDA disposal fee reassessment (Phil Hertzog, DNR)
- Permitting PSDDA Sites (Eric Gilman, DNR)
- Draft EPA national sediment quality criteria (John Malek, EPA)

Discussion and Public Comment on above topics (11:30-11:45am):

Lunch (11:45-1:00pm):

AFTERNOON SESSION

Continuation of Status Reports (1:00-2:00pm)

- 1994 update and evaluation of Puget Sound AETs (Tom Gries, Ecology)
- PSDDA agency options for addressing contaminated sediments issues (Keith Phillips, Ecology)
- Technical review of PSDDA bioassays (David Fox, Corps)

Discussion and Public Comment on above topics (2:00-2:15pm):

Presentation of Issue Papers by the Public (2:15-3:00pm)

Discussion on Public Issue Papers (3:00-3:15pm)

Break (3:15-3:30pm)

Presentation of an Issue Paper by the PSDDA agencies (3:30-3:50pm)

- Refinements to bioaccumulation testing requirements (David Kendall, Corps)

Public Comment on the Clarification Papers presented in the PSDDA Biennial Report (3:50-4:20pm):

Summary and Closing (4:20-4:30pm)(Brian Applebury, Corps)

- Issues to which PSDDA agencies will respond before the next annual review meeting.
- Written comments may be submitted following the ARM, but must be submitted to the PSDDA agencies by May 20, 1994 for consideration.

Attendees of the Sixth PSDDA Annual Review Meeting
May 6, 1994
(listed alphabetically)

Brian Applebury	Seattle Dist. Corps	764-3431
Celia Barton	DNR	902-1086
Brett Betts	Ecology	407-6914
Jim Brigham	GEO Engineers	986-4331
Kevin Brix	Parametrix, Inc.	822-8880
Steve Cappellino	Parametrix, Inc.	822-8880
Lee Carfioli	ETC Laboratory	885-0083
Linda Cox	Seattle Dist. Corps	764-3654
Sally Fisher	GEO Engineers	471-0379
David Fox	Seattle Dist. Corps	764-6550
Mark Fugiel	Am Test Inc.	885-1694
Eric Gilman	DNR	902-1068
Tom Gries	Ecology	407-6910
Bill Halbert	GEO Engineers	471-0379
Elima Halstrum	Tetra Tech	883-1912
David B. Hericks	Beak Consultants	823-6919
Phil Hertzog	DNR	902-1066
Eric Johnson	Washington Ports Ass.	943-0760
Carl Kassebaum	Hartman Associates	382-0388
David Kendall	Seattle Dist. Corps	764-3768
Sharon Koch	Summit Techology	622-0222
Jim Laughlin	Metro Environmental Lab	407-6907
Therese Littleton	Seattle Dist. Corps	764-3600
Stewart Lombard	Ecology	895-4649
Mike Lynch	Univ. of Washington	367-5352
John Malek	EPA	553-1286
Sandra Manning	Ecology	407-6765
Ricardo Marroquin	North Creek	481-9200
Teresa Michelsen	Ecology	649-7257
Patrick Moore	Sanders & Associates	828-8998

Tom Mueller	Seattle Dist. Corps	764-6695
Nancy Musgrove	Roy F. Weston	521-7674
Dale Norton	Ecology	407-6765
Bonnie Orme	MC CLWV	285-6521
Maria Peeler	Ecology	407-7529
George Perry	Metro Environmental Lab	684-2399
Keith Phillips	Ecology	407-6907
Jim Reese	CENPD	326-3778
Gene Revelas	Striplin Env. Associates	866-2336
Pete Rude	Landau Associates	778-0907
Bruce W. Rummel	URS Consultants	224-4525
Lisa Saban	Roy F. Weston, Inc.	521-7686
Mike Salazar	NOAA	526-4343
Carol Sanders	Sanders & Associates	828-8998
Dave Simpson	Peratrovich Nottingham & Drage	624-1387
David Slater	Analytical Technologies	228-8335
Kerry Slattery	Harding Lawson	622-0812
Greg Sorlie	Ecology	
Jay Spearman	J. Spearman Cons. Engr.	820-1739
Jennifer Stewart	EVS Consultants N.V.	471-0379
Bob Stuart	EVS Consultants	217-9337
Margaret Stinson	Ecology	871-8821
Stephanie Stirling	Seattle Dist. Corps	764-6945
Francis Sweeney	Parametrix, Inc.	822-8880
Tracy Yerian	Sound Analytical	922-2310
Tim Thompson	SAIC	521-7686
Laura Weiss	Ecology	407-8337
Michael Wheeler	PSWQA	407-7316
Cliff Whitmus	Pentec Environmental	775-4682
Charles Wisdom	Beak Consultants	825-6919

PSDDA 1994 ARM
Appendix A: Post-ARM Summary Responses

1. Actual v. Predicted Volumes at PSDDA sites
See the following page which provides a five year retrospective analysis of site use and estimated future capacity.

Site Capacity Retrospective

The following summary addresses the five year retrospective analysis of site use and estimated future capacity at each site. The Phase II Disposal Site Selection Technical Appendix (Page II-206, Paragraph 10.3) provides an estimate of site capacity for a generic nondispersive site, which is estimated to be approximately 9,000,000 cubic yards. Over the five years of PSDDA implementation approximately 2,378,200 cubic yards total have been placed at all eight sites, averaging 518,217 cubic yards per year.

Nondispersive Disposal Site	Cumulative Volumes (CY)	Average Volume (CY/YR)	15-Year Predictions MPR Phase I/II (CY)	Percent of 15-Year Prediction	Estimated Time to Exceed Site Capacity[1] (Years)
Port Gardner (1989-1993)	1,118,835	223,767	8,243,000	13.6	40
Elliott Bay (1989-1993)	389,065	77,813	10,525,000	3.7	>50
Bellingham Bay (1990-1993)	32,883	8,221	1,181,500	2.8	>50
Commencement Bay (1989-1993)	17,548	3,510	3,929,000	0.45	>50
Anderson/Ketron Island (1990-1993)	10,197	2,549	785,000	1.3	>50
SUBTOTALS:	1,568,528	315,860	24,763,500	6.3	N/A
Dispersive Disposal Site	**Cumulative Volumes (CY)**	**Average Volume per Year (CY/YR)**	**15-Year Predictions MPR Phase I/II (CY)**	**Percent of 15-Year Prediction**	**Estimated Time to Exceed Site Capacity[2] (Years)**
Rosario Strait (1990-1993)	787,030	196,758	1,801,000	43.7	N/A
Port Townsend (1990-1993)	22,642	5,661	687,000	3.3	N/A
Port Angeles (1990-1993)	0	0	285,000	0	N/A
SUBTOTALS:	809,672	202,419	2,773,000	29.2	N/A
GRAND TOTALS:	2,378,200	518,279	27,536,500	8.6	N/A

1/ Site capacity estimated in Phase II Disposal Site Selection Technical Appendix for nondispersive sites is approximately 9,000,000 cubic yards.

2/ Actual site capacity for dispersive sites is not limited, assuming complete dispersal of dredged material off site.

2. Subsequent to the PSDDA ARM, the PSDDA agencies discussed the debris issue in the context of the Port of Seattle's Terminal 30 Apron Rehabilitation Project, where approximately 200-300 cy of rip rip covered and was mixed with proposed dredged material. Agency concerns about debris disposal, particularly rip rap, at the Elliott Bay site in this case focussed on three issues:

(1) Impacting the ability to effectively conduct onsite monitoring of dredged material (e.g. SVPS and onsite chemistry/bioassays),
(2) Placing debris at the site may create an "attractive nuisance" (rocky bottom, "terra firma"), thereby attracting species purposely avoided in the site designation process, and
(3) Disposing of rip rap may impact two documented historical ship wrecks, the "A.J. Fuller" and "Multnomah" located south east and north of the dump zone of the Elliott Bay site, respectively.

The outcome of deliberations were that for this project only, a steel grid with a mesh size of 24" by 24" would be required to separate large rip rap debris from clean dredged material. Large chunks of rip rap could not be broken into smaller pieces in order to fit them through the grid. The rip rap would be disposed at the center of the dump zone, with special care to avoid disposal at the southeast and northern flanks of the dump zone. In order to document the impact of the "de minimus" disposal of 200-300 cy of rip rap at the Elliott Bay site, the PSDDA agencies will conduct a side scan survey of the site following disposal of the Terminal 30 material. If this survey documents evidence that rip rap is present at the site, and potentially providing substrate suitable for attracting nuisance species, or otherwise adversely impacting management of the site, future clarification concerning rip rap and steel grid mesh size allowable for unconfined open-water disposal will be made more conservative/protective. The PSDDA agencies are considering the Terminal 30 project to be test case in developing policy guidance on this issue for future implementation. Policy will also differ depending on the disposal site under consideration.

3. The PSDDA agencies will examine the issue of small project costs. A review of costs for all small projects will be completed, and alternatives for remedy will be presented at the next Annual Review Meeting.

4. The PSDDA agencies have suspended use of the saline Microtox test for Dredging Year 1995. During this time period, the agencies ask that applicants collect sufficient sediment for Microtox testing. This sediment will be used by the agencies for running the saline extract and solid phase Microtox tests in a side-by-side study. The results of these Microtox tests will not be used for decision-making. A national "round-robin" Microtox study is underway, and the result of the PSDDA agency testing and the national study will (hopefully) shed some light on the tests' utility for regulatory decision-making. DNR will be spearheading the review effort on the Microtox test, and results will be reported at the next Annual Review Meeting.

5. The PSDDA agencies agree that a PSDDA/SMS annual review process is timely. Given the recent signing of the Interagency Agreement, which extends the focus of PSDDA towards the management of contaminated sediment, a forum for an integrated and consolidated review now exists. In addition, since 1995 does not include preparation of a Biennial Report, next year could serve as a trial for the development of the first PSDDA/SMS annual review conference. The PSDDA agencies will discuss scheduling, logistics, and topics for review. The consolidated annual review process will be documented in a new appendix to the Interagency Agreement.

9. Monitoring background. Part of the selection criteria for the eight PSDDA sites was that they be generally removed from natural resource and human resource amenities at risk. Moreover, the disposal guidelines selected for implementation carefully considered allowable effects to onsite and offsite resources. The disposal guidelines at nondispersive sites allow minor adverse effects to onsite biota and no adverse effects to offsite biota. Six years of monitoring have supported the biological effects disposal guidelines implemented and have demonstrated general compliance with the site management objectives. Monitoring of tissue levels in selected infaunal offsite and downcurrent species (i.e., *Molpadia* and *Compsomyax*) have not shown any demonstrable increases in tissue burdens of chemicals of concern attributable to dredged material disposal.

The purpose of monitoring at the sites is to provide accountability and assurances back to the public that the evaluation procedures used to evaluate dredging projects are appropriate and protective of human and ecological health. The current monitoring approach involves evaluating the onsite toxicity of dredged material using the same biological testing suite used to evaluate each dredging site relative to the biological effects disposal guidelines. Six years of monitoring conducted at the nondispersive sites have documented the appropriateness of the current toxicity testing suite and have shown that material placed at the PSDDA sites has generally been below biological effects concern levels (i.e., screening levels).

The PSDDA agencies are receptive to alternative strategies for measuring toxicity and continually reassess the performance of the current biological testing suite to evaluate dredged material toxicity. *In situ* bioassays with caged mussels or other suitable species may be an acceptable alternative to the current monitoring approach with laboratory bioassays, but would certainly be more costly. The agencies are receptive to conducting a trial or test with the *in situ* approach at one of the PSDDA disposal sites (e.g., Elliott Bay) to evaluate its usefulness as a practical alternative or adjunct to bioassays. However, the PSDDA agencies are concerned with flat or falling disposal fee revenues used to fund the chemical and biological monitoring. Any major adjustments to the biological effects monitoring assessment tools would have to be evaluated for both technical data provided and cost effectiveness, before changes to the monitoring plan could be proposed by the PSDDA agencies.

10. The Department of Ecology's developing policies on human health sediment criteria will have implications for numerous programs. Based on Ecology's progress, human health criteria development may be a topic for the 1995 PSDDA/SMS combined annual review conference. In an attempt to consolidate the group of stakeholders, Ecology will consider looking at the PSDDA mailing list to obtain key interested parties for input to the criteria development process. The implications for the forthcoming human health sediment criteria on the dredging, sediment cleanup, and source control programs must be carefully considered and discussed. The PSDDA agencies, Ecology staff, and interested parties will work together to address the impact to dredging, and on incorporation of this issue into the 1995 annual review conference.

11. In considering alternative approaches to testing dredged material for human health and ecological effects concerns, the agencies must ensure compliance with national guidance on appropriate testing requirements under the draft Inland Testing Manual (Clean Water Act) and "Green Book" (Marine Protection, Research and Sanctuaries Act) for both inland (404) and ocean (103) disposal. Current national guidance for conducting bioaccumulation tests call for initially conducting a table top evaluation of theoretical bioaccumulation potential in tier II based on sediment chemistry. The PSDDA program assesses "reason to believe" trigger levels for chemicals of concern as an initial screen and trigger for conducting 28 day laboratory bioaccumulation tests in tier III. *In situ* tests for bioaccumulation may be considered as an option in tier IV evaluations.

DNR PSDDA Site Use Proprietary Fee

Philip J. Hertzog

During the PSDDA annual Review Meeting (ARM) on May 6, 1994, the Department of Natural Resources (DNR) provided information on the need to increase the current PSDDA disposal site proprietary use fee from $0.40/cubic yard (cy) to $0.50/cy. The increase was required to cover DNR's PSDDA site management and monitoring costs over the next three fiscal years. After the ARM, DNR met with the Ports Association and with the PSDDA agencies to explore alternatives to the fee increase.

The Ports Association and PSDDA agencies agreed to reduce the fee increase to $0.45/cy in combination with cuts in PSDDA site monitoring of approximately $50,000 over the next three years. Based on current site use projections, the PSDDA agencies agree that only a partial monitoring event for the Commencement Bay site would occur in the spring of 1995, followed by a full monitoring in 1996 instead of two full events. A partial monitoring event will also occur at the Elliott Bay site in the spring of 1996.

The PSDDA EIS envisioned intensive post disposal site monitoring during the first several years of the program, but allowed for a scaling back of monitoring if no unexpected impacts occurred. PSDDA post disposal site monitoring over the last five years has shown no unanticipated impacts and verified the effectiveness of pre-dredging evaluation procedures. Given the site monitoring results, the PSDDA agencies have determined that monitoring can be slightly reduced as described above and in accordance with the EIS.

On June 7, 1994, the State of Washington's Board of Natural Resources approved an emergency rule amendment to increase DNR's PSDDA proprietary disposal site use fee from $0.40/cy to $0.45/cy effective June 8, 1994, for 120 days. DNR also initiated a permanent rule change to keep the fee increase permanent. The permanent rule change will undergo public review with a public hearing scheduled in October.

The PSDDA agencies and the Ports Association recognize that the fee increase does not solve long-term funding problems for monitoring of the disposal sites. The agencies and Ports Association plan to evaluate other alternatives and will report on progress at the next ARM.

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

Dr. David Kendall
Dredged Material Management Office
U.S. Army Corps of Engineers
P.O. Box 3755
Seattle, Washington 98124-2255

29 April 1994

Dear Dr. Kendall:

The purpose of this letter is to (1) comment on the new echinoderm larval development criteria presented in the March 1994 PSDDA Biennial Report, and (2) request that a brief period of time be scheduled at the forthcoming PSDDA Annual Review Meeting for its discussion.

After discussing the matter with David Fox, I learned that the Corps decided to "tighten" the criteria (from 50% survival/10% abnormality to 70% survival/10% abnormality for the seawater controls) because there had been very few test failures listed in the DAIS system. In actuality, I would bet that a large percentage of the tests probably did fail the initial round of testing (mainly due to high abnormality), but that the Corps only received the data when acceptable criteria were met. By this I am not implying that the criteria should be made less stringent, only that the regulations be changed for the right reasons. As you are well aware, during the certain times of the year it is a real gamble trying to find test organisms with viable gametes for testing. During these times our laboratory will occasionally observe abnormality about the 10% maximum criteria resulting in test failures while we are searching for viable organisms. Perhaps the Corps should begin requiring the labs to report the number of test set-ups for each test with their reports. This may allow the Corps to gather information to account for seasonal effects in the biological testing portion of the PSDDA program. For example, are DMMU's more prone to fail the bioassays if they are not tested during peak spawning periods for the test organisms?

My second point of contention concerns the release of the new PSEP Bioassay Protocols (dated April 1994) in which the criteria for the echinoderm larval development test has been changed to read that at least 70% of the controls must reach the four-arm pluteus stage. Although it is still reported, this new criteria does not evaluate abnormality as an independent measure for test viability, but instead looks at the combined mortality/ abnormality endpoint. We feel that this is a much more accurate procedure for evaluating test acceptability and would like to propose that the PSDDA agencies consider it for immediate inclusion.

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The new criteria would still meet the objectives of the test design, and it would also ensure that reasonable data are not discarded and excess funds wasted. Consider the following two datasets as an example:

$T_{initial}$ Count = 250 larvae

Dataset 1 =	187 total survivors 16 abnormal	Dataset 2 =	245 total survivors 30 abnormal
Therefore =	75% survival 9% abnormality	Therefore =	98% survival 12% abnormality
Result =	Test passes PSDDA		Test fails PSDDA
PSEP =	68% normal survivors Test fails PSEP	PSEP =	86% normal survivors Test passes PSEP

As you can see, the new criteria are actually more stringent; however, do not place as much emphasis on the abnormality requirements, which are usually the cause for test control failures. Rarely are test results deemed unacceptable because of poor survival, but rather by abnormality percentages slightly over the 10% upper limit. We at Parametrix would like to respectfully request that this issue be given a brief moment for discussion at the Annual Review Meeting. I think you will find that several others working under the PSDDA program will agree with our recommendation. Similar comments from other researchers are presented in the latest mailing for the PSEP protocols. I can provide these if you do not yet have a copy yourself.

If you have any questions about this information, or would like to discuss our proposal, please feel free to call me at 822-8880.

Sincerely,

PARAMETRIX, INC.

Steve Cappellino

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Paige Miller
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Patrick Jones
Executive Director

June 1, 1994

Ann Essko
Assistant Division Manager
Aquatic Resources Division
Department of Natural Resources
PO Box 47027
Olympia, WA 98504-7027

Dear Ms. Essko,

The Washington Public Ports Association and several of its individual members have been working recently with you and your staff to develop revenue projections and cost estimates for the monitoring and management of the Puget Sound Dredged Disposal Analysis (PSDDA) open water dredged material disposal sites. Port districts remain very supportive of the PSDDA program. Our entire state benefits from the commerce and navigation activities that these open water dredged material disposal sites support.

As you know, the disposal fees for the use of these sites are currently set at $0.40 per yard and the revenues are deposited in the dredged material disposal site account, through RCW 79.90.560. To date the $0.40 per yard disposal fee has been adequate for managing these sites, since it has been coupled with large-scale use of the sites and some state general fund support.

But the recent withdrawal of general fund support, as well as the diversion of some dredged material to non-PSDDA beneficial uses, has caused the PSDDA site account to dip dangerously low. We all have a vital interest in keeping this program financially healthy.

Unfortunately, it is not possible to raise significant new revenues simply by raising the disposal fee. This is because much of the very clean material destined for these sites can be disposed of in other manners, such as beach nourishment, capping, habitat creation, etc. Simply raising the fees actually encourages less use of the sites, and even less revenue for the fund.

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This creates a strategic funding problem for the program. The PSDDA agencies and key external stakeholder groups need to discuss potential solutions to this problem. Any solution will probably need to address additional outside revenue sources, such as renewed legislative appropriations, federal appropriations, fund transfers, fees for federal site use or fees for beneficial uses. (Note: these are general ideas only, and are not necessarily endorsed by port districts).

I encourage the Department of Natural Resources, as the manager of the PSDDA sites, to convene a meeting of the relevant interests in order to discuss this problem, as well as potential solutions.

Our Association looks forward to working with you as we cooperatively address this issue.

Yours truly,

WASHINGTON PUBLIC PORTS ASSOCIATION

Eric D. Johnson

Eric D. Johnson
Environmental Affairs Director

c: Puget Sound Ports
Keith Phillips, Department of Ecology
John Malek, Region 10 Environmental Protection Agency
Dave Kendall, Seattle District Corps of Engineers, DMMU

JAY W SPEARMAN
CONSULTING ENGINEER

- MARINE
- STRUCTURAL
- ENVIRONMENTAL PERMITS

(206) 820·1739
820·1740
FAX 820·8475
12040 - 98TH AVE. NE, SUITE 200
KIRKLAND, WASHINGTON 98034

June 24, 1994

Department of the Army
Seattle District, Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98124-2255

FAX: 764-3308

Attention: Dr. David Kendall

Subject: PSDDA Annual Meeting Comments

Gentlemen:

My experience with PSDDA over several years has led to the following comments on the subject discussed at the 1994 annual meeting. In the interest of brevity, I will limit my comments.

1. **Interferences:** There continues to be a problem with detection limits below SL's for some chlorinated compounds. This needs to be given wider recognition and policies need to be established on more than a case-by-case basis. This is an area of potential research.

2. **Detection Limits:** I am concerned that lab quality control and detection limits are weak links underlying the data base. I believe greater scrutiny is appropriate. Perhaps new policies or procedures are necessary. Solid documentation is required showing that detection limits are actually being met. I am not convinced that all labs are on an equal footing with regard to this.

3. **Microtox Test:** As the test is presently specified, I feel it should be abandoned. This is based in part on my experience. In its present configuration, the test is more an indicator of chemistry than biological response of other organisms. Perhaps the test could be modified. However, my recommendation is to eliminate the test until it proves its applicability for PSDDA.

4. **Reference Samples:** Pooling effort for a comprehensive standardized reference sediment study is a productive idea that should not be forgotten. The need for project-by-project reference sediment collection is something that should be eliminated over time.

Thank you for this opportunity to comment. If there are any questions, don't hesitate to contact me.

Very truly yours,

Jay W. Spearman/LMS

Jay W. Spearman, Consulting Engineer

JWS/lms

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Summary of Modifications Made to the
PSDDA Evaluation Procedures and Management Plans

The following changes have been made since publication of the documents which established the sediment evaluation and site management guidelines for the PSDDA program: Evaluation Procedures Technical Appendix-Phase I (June 1988) and Management Plan Report-Phase II (September 1989):

Sixth ARM (May 6, 1994)

1. The seawater control and reference sediment performance standards for the larval test have been revised. The seawater control combined mortality and abnormality must be less than or equal to thirty percent (changed from fifty percent). The seawater control abnormality performance standard has been eliminated (formerly ten percent). The reference sediment combined mortality and abnormality (seawater-normalized) must not exceed thirty-five percent (changed from twenty percent). See revised clarification paper, Interim Revised Performance Standards for the Sediment Larval Bioassay, Sixth ARM Minutes, June 1994.

2. Modifications have been made to the interpretation of larval data to increase statistical power. The alpha level used when performing one-tailed t-tests has been changed from 0.05 to 0.10. For non-hits, the power must be greater than 0.6. See revised clarification paper, Interim Revised Performance Standards for the Sediment Larval Bioassay, Sixth ARM Minutes, June 1994.

3. Bioaccumulation testing now requires two species (formerly one): 1) adult facultative deposit-feeding bivalve, *Macoma nasuta*, and 2) deposit-feeding adult polychaete, *Nereis virens* or *Arenicola marina*. See issue paper, Refinements to Bioaccumulation Testing Requirements: Adoption of Second Test Species for Consistency with National Guidance, Sixth ARM Minutes, June 1994.

4. Applicants considering beneficial use projects are encouraged to coordinate with the PSDDA agencies and other resource agencies early in the evaluation process. See clarification paper, Coordination and Testing of Dredged Material for Beneficial Uses Projects, Sixth ARM Minutes, June 1994.

5. To prevent the release of exotic species into the environment, bioassay laboratories are expected to meet the disposal requirements identified by Ecology's toxicity test protocols, PSEP protocols, and other regulatory requirements, as well as best management practices developed by the Department of Fisheries and Wildlife. See clarification paper, Restriction on Exotic Species Importation, Sixth ARM Minutes, June 1994.

6. The endpoint of the *Neanthes* 20-day test has been changed from biomass to growth. The mean individual growth rate will be expressed in mg dry weight/day by normalizing for initial weight and test duration. See clarification paper, *Neanthes* 20-day Bioassay - Interpretation Clarifications: Adoption of Growth Endpoint; Stimulatory Effect and Dispersive Interpretation Guidelines, Sixth ARM Minutes, June 1994.

7. *Ampelisca abdita*, or other "alternative technologies", may be used for testing conducted under the State of Washington Sediment Management Standards on a case-by-case basis by: 1) providing Ecology a written request and justification documentation for advance review and approval, and 2) providing Ecology with follow-up test results, data reports, etc. See clarification paper, Use of Alternate Technologies under the Sediment Management Standards, Chapter 173-204 WAC, Sixth ARM Minutes, June 1994.

Fifth ARM (May 7, 1993)

1. *Ampelisca abdita* or *Eohaustorius estuarius* may be substituted for *Rhepoxynius abronius* for testing conducted for PSDDA under certain conditions. See revised clarification paper, Species Substitution for the 10-day Amphipod Bioassay, Fifth ARM Minutes, June 1993.

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, Fifth ARM Minutes, June 1993.

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 quantitation of total organic carbon (TOC) 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, Fifth ARM Minutes, June 1993.

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, Fifth ARM Minutes, June 1993.

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 (at least six weeks before the permit is needed). See clarification paper, DNR Disposal Site Use Permit Acquisition Protocol, Fifth ARM Minutes, June 1993.

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), Fifth ARM Minutes, June 1993.

Fourth ARM (May 8, 1992)

1. The *Neanthes* 10-day mortality test was replaced by the *Neanthes* 20-day chronic/sublethal test in the standard suite of PSDDA bioassays. See issue paper, Implementation of the *Neanthes* 20-Day Sediment Bioassay, Puget Sound Dredged Disposal Analysis: Management Plan Assessment Report, March 1992.

2. Changes to disposal site monitoring plans:

   - new perimeter chemistry guideline or "trigger" values of 1.25 x for trace metals and 1.47 x for organic COCs.

   - replacement of the twelve, unreplicated perimeter chemistry stations, established as part of the full monitoring sampling grid, by four stations with three field replicates each.

   - PSDDA monitoring data will be compared to both the program's established interpretive criteria and the State Sediment Management Standards.

   - the PSDDA disposal site monitoring contractor will be required to report the Limit of Quantitation (LOQ) associated with each sample/compound analyzed.

   - only medium *Molpadia* (8-12 cm) and large *Compsomyax* (> 6.0 cm) will be used to assess field bioaccumulation.

   - individual tissue concentration trigger levels for each metal and bioaccumulation species will be used.

   See issue paper, PSDDA Monitoring Plan and DY 1992 Elliott Bay Full Monitoring, Puget Sound Dredged Disposal Analysis: Management Plan Assessment Report, March 1992 and Enclosure 8, Disposal Site Monitoring Issue Paper, Fourth ARM Minutes, July 1992.

3. Increased communication during development of sampling and analysis plans, and during sampling and testing, is recommended, a list of "red flag" problems was distributed to laboratories; a check list for data submittals was prepared by DMMO. See clarification paper, Improved Communication and Data Submittals, Puget Sound Dredged Disposal Analysis: Management Plan Assessment Report, March 1992.

4. The use of Selective Ion Monitoring method (SIM) for analyzing sediment organic COCs is allowed under certain circumstances. See clarification paper, Selective Ion Monitoring (SIM) Analysis: Quality Assurance/Control Requirements, Puget Sound Dredged Disposal Analysis: Management Plan Assessment Report, March 1992. (See PSDDA QA/QC Workshop (1991) entries for additional information on the use of SIM).

5. Station PGB09 replaced station PGB02 as the second Port Gardner benchmark station and will be sampled as part of future monitoring efforts in Port Gardner. See clarification paper, Relocation of Port Gardner Benchmark Station, Puget Sound Dredged Disposal Analysis: Management Plan Assessment Report, March 1992.

Third ARM (May 2, 1991)

1. When deep native sediments need to be tested, the requirement to sample to the maximum depth of the dredging prism may be relaxed by a collective decision of the PSDDA agencies through the application best professional judgment. See clarification paper, Modifications to Sampling Requirements for Deep Native Sediments, Puget Sound Dredged Disposal Analysis: Management Plan Assessment Report, March 1991.

2. All labs that run chemical and biological tests for the PSDDA program must be accredited by the State of Washington. See clarification paper, Environmental Laboratory Accreditation, Puget Sound Dredged Disposal Analysis: Management Plan Assessment Report, March 1991.

3. Some recommended holding times for chemical analysis of unfrozen sediments were changed. See Appendix D, Revised Modifications to Holding Times for PSDDA Chemical Analyses, Third ARM Minutes, July 1991.

4. Chemical QA guidelines were changed. See clarification paper, Modifications to the Chemical Testing Quality Assurance Guidelines, Puget Sound Dredged Disposal Analysis: Management Plan Assessment Report, March 1991, but reference Appendix E, Modified Table for Interstandard QA Limit Comparisons, Third ARM Minutes, July 1991, for a revised table noting QA limit comparisons.

5. Requirements for PSDDA quality assurance/control (QA/QC) data needed by the Department of Ecology were included in the clarification paper, Submittal of PSDDA Quality Assurance/Control (QA/QC) Data, Puget Sound Dredged Disposal Analysis: Management Plan Assessment Report, March 1991, and the Sampling and Analysis Plan prototype from the Dredged Material Management Office, Corps of Engineers.

6. PSDDA agencies require the collection and reporting of amphipod reburial data. See clarification paper, PSDDA Requirement to Collect and Report Amphipod Reburial Data, Puget Sound Dredged Disposal Analysis: Management Plan Assessment Report, March 1991.

7. Changes were made to the echinoderm embryo sediment bioassay for test temperature, test duration, test endpoint and test termination. See clarification paper, Echinoderm Embryo Sediment Bioassay Protocol Clarifications, Puget Sound Dredged Disposal Analysis: Management Plan Assessment Report, March 1991.

8. Minor changes to the monitoring program for disposal sites included immediate sulfides and volatiles analysis at benchmark stations, an accelerated sediment vertical profiling system schedule and a new benchmark station in Port Gardner. See clarification paper, Environmental Monitoring Program Refinements, Puget Sound Dredged Disposal Analysis: Management Plan Assessment Report, March 1991.

9. Specific locations within the Port Gardner and Elliott Bay disposal sites were given where dredged material should be disposed; for Port Gardner it is in the center of the site and for Elliott Bay it is approximately 300 feet south of the center of the site. Also physical characteristics of the dredged material going to Port Gardner site will be reviewed prior to disposal. See clarification paper, Management of the Port Gardner and Elliott Bay Sites, Puget Sound Dredged Disposal Analysis: Management Plan Assessment Report, March 1991.

10. Changes to program review reports have been made. See issue paper, PSDDA Requirements for Program Review Reports and Meetings, Puget Sound Dredged Disposal Analysis: Management Plan Assessment Report, March 1991.

11. The holding time for sediments undergoing biological testing was extended from six to eight weeks. See issue paper, Modifications to Holding Time for Biological Testing, Puget Sound Dredged Disposal Analysis: Management Plan Assessment Report, March 1991.

12. All chemistry and biological data must be submitted to PSDDA agencies. This data is to be submitted whether or not tiered testing procedures would have required biological testing. See paragraph 14, New Issue, Applicant Data Submittal, Third ARM minutes, July 1991.

13. Six screening levels were changed to ameliorate detection limit problems. See enclosure 95, Recommended Changes to Selected PSDDA Screening Levels, Third ARM minutes, July 1991.

Second ARM (April 11-12, 1990)

1. Other potential reference sediment collection sites may be used instead of the standard sites, if biological tests are initially run using the proposed reference area along with an already recognized reference area and/or chemistry (PSDDA contaminants of concern) analysis is performed for the proposed area. See attachment 9, Activities to Provide Better Reference Areas, Second ARM minutes, July 1990.

2. PSDDA recommends wet-sieving reference sediments in the field to ensure a good grain size match with the dredged material being tested; this method is described in attachment 9, Wet Sieving Method for Percent Fines to Match Test Sediments and Reference Sediments, Second ARM minutes, July 1990 (See Dredged Material Management Office, Corps of Engineers, for a revised version of the graph found in the ARM minutes).

3. Sediment conventional parameters will be run on all reference samples: ammonia and total sulfides will be measured as water quality parameters in the amphipod bioassay, *Neanthes* bioassay, and the sediment larval bioassay. See attachment 10, Requirement for Analyzing for Sediment Conventionals in Reference Areas and Water Quality in Bioassays, Second ARM minutes, July 1990.

4. The screening level for pentachlorophenol has been raised to 100 ppb. See attachment 11, Screening Level Adjustment for Pentachlorophenol, Second ARM minutes, July 1990.

5. The saline microtox bioassay is added to the biological testing requirements for small projects. See attachment 18, Reduced Testing Requirements for Small Projects above "No Test" Volume: Biological Testing Requirements For Nondispersive Disposal Sites, Second ARM minutes, July 1990.

6. Clarifications to the protocol and disposal guidelines regarding the microtox bioassay have been made; light enhancement is considered non-toxic (from a regulatory perspective); PSDDA interpretation will be based on the 5 replicates at the highest concentration; a reference sediment must be run with each batch; a test response which is more than 20 percent below and statistically different from the reference will be considered a hit; a batch is initiated by the hydration of a vial of freeze-dried bacteria; the holding time for reconstituted bacteria is 2 hours. See attachment 19a, Microtox Bioassay -- Clarifications to Protocol and Disposal Guidelines, Second ARM minutes, July 1990.

First ARM (February 21-22, 1989) - Modifications approved at this review meeting were incorporated into the PSDDA Management Plan Report - Phase II (September 1989).

PSDDA Chemistry QA/QC Workshop (January 24, 1991)

1. Alternate methods for lowering detection limits were discussed and dual column gas chromatography was recommended over "selective ion monitoring" (SIM); if SIM is used the data must be flagged with a qualifier code before it is entered into the database. See 3.B.(1 & 2), Single Ion Method and GC/Dual Column Confirmation, Summary and Conclusions of the PSDDA Chemistry QA/QC and PSDDA Streamlining Workshop held on January 24, 1991 at Seattle District, MFR, March 25, 1991. (See fourth ARM entries for additional information on the use of SIM).

2. There are two available organic CRMs, (i.e., Standard Reference Material 1974 (mussel tissue: Mytilus edulis) and Standard Reference Material 1941 (Dry-Marine Sediment), that should be used to help validate the accuracy and precision of tissue and sediment PAH (polycyclic aromatic hydrocarbons) analyses. See 3.C.(4), Certified Reference Material, Summary and Conclusions of the PSDDA Chemistry QA/QC and PSDDA Streamlining Workshop held on January 24, 1991 at Seattle District, MFR, March 25, 1991.

3. Decontamination protocols should be followed and when decontaminating sampling equipment either isopropanol or methanol followed by a hexane rinse should be used. See 4.A.3., Decontamination of Equipment, Summary and Conclusions of the PSDDA Chemistry QA/QC and PSDDA Streamlining Workshop held on January 24, 1991 at Seattle District, MFR, March 25, 1991.

PSDDA Bioassay Workshop (July 10, 1990)

1. When the amphipod bioassay is performed, sexually dimorphic mature male/female amphipods should be avoided. See 5 and 10A, Summary and Conclusions of the PSDDA Bioassay Workshop held on July 10, 1990 at Seattle District, MFR, July 20, 1990.

2. When the *Neanthes* 10-day bioassay test is performed, worms larger than 5 mm need to be used. See 7 and 10B, Summary and Conclusions of the PSDDA Bioassay Workshop held on July 10, 1990 at Seattle District, MFR, July 20, 1990.

3. When the microtox test is performed, the dilution series is only required if the test sediment response (5 replicates at highest concentration) is statistically significant relative to the reference. See 8 and 10C, Summary and Conclusions of the PSDDA Bioassay Workshop held on July 10, 1990 at Seattle District, MFR, July 20, 1990.

4. Reference sediment samples should be collected subtidally; grain size should be matched with test sediments through the use of wet-sieving in the field and the positions of reference area samples should be accurately reported to facilitate future use of satisfactorily performing stations. See 6 and 10E, Summary and Conclusions of the PSDDA Bioassay Workshop held on July 10, 1990 at Seattle District, MFR, July 20, 1990.

5. All echinoderm bioassays should be run at 15°C. A minimum test duration of 48 hours was established. No test should be initiated with less than 90 percent fertilization. Initial counts should include all eggs (fertilized and unfertilized). A recommended protocol for terminating the test was established. The test should run until at least 90 percent of the pluteus larvae are well developed with deeply invaginated preoral arms in the sacrificial seawater control. See 9, Summary and Conclusions of the PSDDA Bioassay Workshop held on July 10, 1990 at Seattle District, MFR, July 20, 1990.

PSDDA Larval Protocol Workshop (June 15, 1989). Modifications approved at this workshop were incorporated into the PSDDA Management Plan Report - Phase II (September 1989).

REVISED CLARIFICATION PAPER

INTERIM REVISED PERFORMANCE STANDARDS FOR THE SEDIMENT LARVAL BIOASSAY

Prepared by David Fox and Therese Littleton (Corps of Engineers, 206/764-6550) for the PSDDA agencies.

INTRODUCTION

Bioassays are used in the PSDDA program to assess toxic and chronic sublethal effects of sediments proposed for dredging with open-water disposal. Performance standards for both negative controls and reference sediments are used to ensure the validity of test results. At the time the sediment larval bioassay was instituted for use in the PSDDA program, high mortalities were being experienced in the bivalve test and the performance standard for the negative seawater control combined mortality and abnormality (effective mortality) was set at fifty percent.[1] The reference sediment seawater-normalized effective mortality was set at twenty percent, which matched the reference sediment performance standard in the amphipod test. Five years have elapsed since the implementation of the PSDDA sediment larval test and a review of the compiled data has provided the PSDDA agencies the opportunity to re-examine the performance standards for this bioassay.

PROBLEM IDENTIFICATION

The current PSDDA guideline for reference sediment seawater-normalized effective mortality is twenty percent. Under this guideline, a large percentage of reference data has been rejected from use in decision-making under the PSDDA program. When this occurs, the PSDDA agencies must require a retest, set aside the test results and make a decision based on the results from the other bioassays, or rely on best professional judgment in interpreting the data.

Using the PSDDA bioassay data residing in the Dredged Analysis Information System (DAIS), frequency distributions for effective mortality and abnormality in the seawater controls (Figure 1), and effective mortality in test sediments and reference sediments (Figure 2), were derived. The distributions of effective mortality for the test and reference sediments are similar and overlap to a great degree. This result was not unexpected, since a relatively small fraction of the sediments tested under PSDDA have exhibited significant toxicity. However, the mortality distribution of larvae in both reference sediments and test sediments exhibits a degree of variability not anticipated when the sediment larval test was first implemented. The performance standards for this test do not adequately reflect this variability.

The seawater control performance standard, on the other hand, has been unnecessarily flexible. Very few projects have exhibited mortality in the seawater control greater than the PSEP standard of thirty percent.[2]

Previous work has suggested guideline modifications to the sediment larval bioassay. The Sediment Management Unit of the Washington Department of Ecology proposed standard deviation guidelines of 22% for reference samples and 15% for test samples, reflecting the 95th and 80th percentiles, respectively, of the standard deviation distributions.[3] Review of the DAIS data resulted in similar distributions, with the majority of sediments exhibiting standard deviations of 20% or less (Figure 3). Other studies have suggested stronger consideration of non-treatment factor effects on sediment larval mortality. An EPA-contracted report emphasized un-ionized ammonia and sulfide-related mortality; however, no samples in the PSDDA database exceeded the threshold level for un-ionized ammonia, and the institution of aeration in the sediment larval test has effectively addressed the sulfide concerns.[4] Additional work has shown that no non-treatment factors are significantly correlated with reference sediment larval mortality.[5]

PROPOSED ACTION/MODIFICATION

The seawater control performance standard for effective mortality should be adjusted to thirty percent (from fifty percent). Past control data show that this adjustment would have resulted in only a small number of tests exceeding the revised seawater control performance standard. In conjunction with this reduction in allowable effective mortality in the seawater control, use of the seawater control abnormality standard should be discontinued. Although Figure 1 does not show a problem with labs meeting this performance standard, feedback received prior to[6], and at, the PSDDA annual review meeting, revealed that labs often repeat the larval test due to marginal exceedances of the abnormality standard, even though the effective mortality may be quite acceptable. Bioassay practitioners have provided similar comments to the Puget Sound Water Quality Authority and will likely result in the elimination of the abnormality performance standard in PSEP as well.

The reference performance standard needs to more accurately reflect the variability exhibited historically in this test. Adjusting the seawater-normalized effective mortality performance standard to thirty-five percent will result in fewer reference sediments being rejected. However, in light of the demonstrated variability, additional adjustments must be made to ensure that the test possesses adequate power to minimize Type II errors (accepting the null hypothesis of no difference between test and reference responses when, in fact, they are different).[7] Establishing a performance standard for both reference and test standard deviations of 20% and adjusting the alpha level (the probability of making a Type I error, rejecting the null hypothesis of no difference between test and reference responses when, in fact, they are not different) from 0.05 to 0.1, will assure a power greater than 0.60 with a minimum detectable difference of twenty percent.[8]

These adjustments provide a win-win situation. Environmental protectiveness is increased by the adjustment to alpha and the fact that the maximum possible uncorrected effective mortality for reference sediments is actually reduced (from 60% to 54.5%). Test viability is increased (and the number of retests decreased) by providing greater latitude for the reference sediment performance. A summary of the current and proposed guidelines, and the number of sediments in DAIS which would fail to meet these performance standards, is shown in Table 1.

Table 1. Current and Proposed Larval Guidelines

	CURRENT GUIDELINE	REJECTED SEDIMENTS	PROPOSED GUIDELINE	REJECTED SEDIMENTS
Alpha level:	0.05	N/A	0.10	N/A
Seawater Control	50% EM	0 (n=41)	30% EM	4 (n=41)
Seawater Control	10% A	1 (n=41)	eliminate	0
Reference Sediment	20% NEM	24 (n=61)	35% NEM	7 (n=61)

N = Normalized (to seawater control), E = Effective, M = Mortality, A = Abnormality, N/A = not applicable

With the proposed guideline changes, reference test performance failures would be reduced significantly (from 39% to 11%) and the guideline would more accurately reflect the historical data distribution. To preserve the environmental protectiveness of the test in a statistically valid way, the standard deviation guideline will be implemented, resulting in some test rejections due to exceedances of this guideline. Overall, these changes translate into greater environmental protectiveness and a more reliable sediment larval bioassay, with fewer retests required.

The pressing need to increase the utility of this test resulted in the promulgation of these interim guidelines. Before more permanent guidelines are established, it is proposed that the sediment larval data used to establish these interim guidelines be considered, along with other pertinent data, by the technical work group which will be reviewing this test. It is further proposed that a statistician participate as a member of the work group to review the historical data set and make recommendations concerning performance standards and power analysis.

To summarize, the interim method for evaluating sediment larval bioassay data is as follows:

1) Examine seawater control and reference sediment performance:

   - If the seawater control effective mortality exceeds 30%, reject the test.

   - If the reference sediment (seawater-normalized) effective mortality exceeds 35%, reject the reference sediment.

2) Examine the test sediment data for toxicity using an unpaired one-tailed t-test:

   - If the test sediment effective mortality (seawater-normalized) is less than or equal to 20%, no statistical analysis of the data is needed; the test sediment is considered non-toxic.

   - If the test sediment effective mortality (seawater-normalized) is greater than 20% and is statistically different from reference (alpha = 0.1) but less than or equal to 30% over reference (15% for dispersive sites), the test sediment scores a hit under the two-hit rule.

- If the test sediment effective mortality (seawater-normalized) is greater than 20% and is statistically different from reference (alpha = 0.1) and greater than 30% over reference (15% for dispersive sites), the test sediment scores a hit under the one-hit rule.

3) For non-hits, examine the standard deviations:

   - If the standard deviations for both the test and reference sediments are less than or equal to 20%, accept the test results.

   - If the standard deviation for either test or reference exceeds 20%, perform a power analysis.

4) For non-hits, with reference and/or test sediment standard deviation greater than 20%, evaluate the power using the Borenstein and Cohen power analysis software. The power of the t-test to detect a 20% difference between test and reference sediment means will be evaluated using the actual test and reference standard deviations:

   → If the power is less than 0.6, reject the test results.

   → If the power is greater than or equal to 0.6, accept the test results.

REFERENCES

1. Puget Sound Dredged Disposal Analysis. 1989. Phase II Management Plan Report.

2. Puget Sound Estuary Program. 1991. Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments, Interim Final. U.S. Environmental Protection Agency, Region 10, Seattle, WA.

3. Gries, T. and K. Waldow 1994. Re-evaluation of Some Puget Sound Apparent Effects Thresholds. Washington Department of Ecology.

4. USEPA. 1993. Refinements of Current PSDDA Bioassays-Final Report. Submitted by: Thompson, T., Science Applications International Corporation, Environmental Sciences Division, Bothell, WA.

5. Fox, D.F. 1993. The Effects of Nontreatment Factors in the PSDDA Sediment Larval Test (unpublished).

6. Cappellino, S. (Parametrix, Inc). 1994. Letter to the Dredged Material Management Office (see minutes of the 1994 annual review meeting).

7. Sokal, R.R. and F.J. Rohlf. 1969. Biometry. W.H. Freeman and Company, San Francisco.

8. Borenstein, M. and J. Cohen. 1988. Statistical Power Analysis: A Computer Program. Lawrence Erlbaum Associates, Inc., 365 Broadway, Hillsdale, NJ 07642.

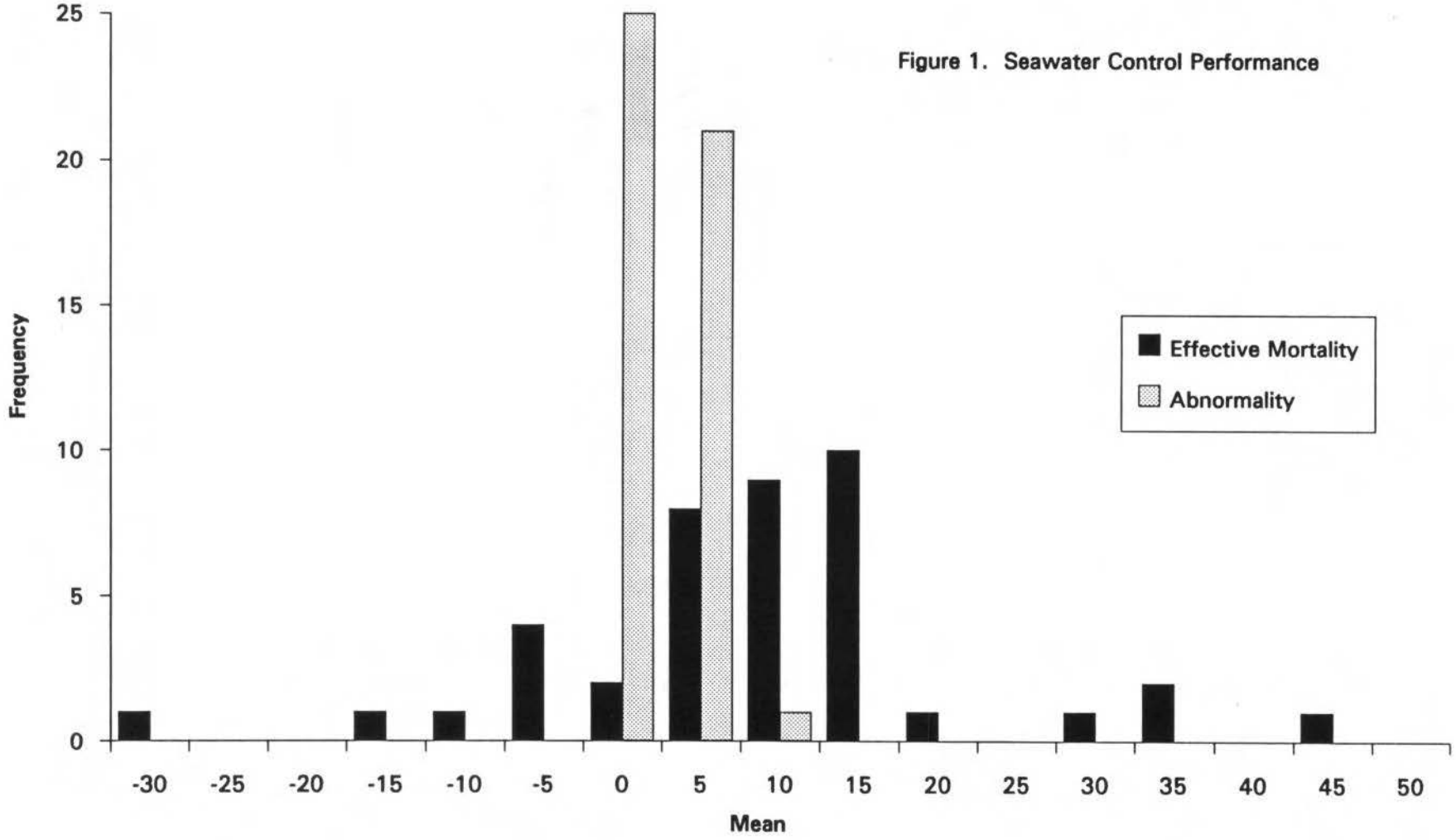


Figure 1. Seawater Control Performance
Effective Mortality
Abnormality
Frequency
25
20
15
10
5
0
-30
-25
-20
-15
-10
-5
0
5
10
15
20
25
30
35
40
45
50
Mean

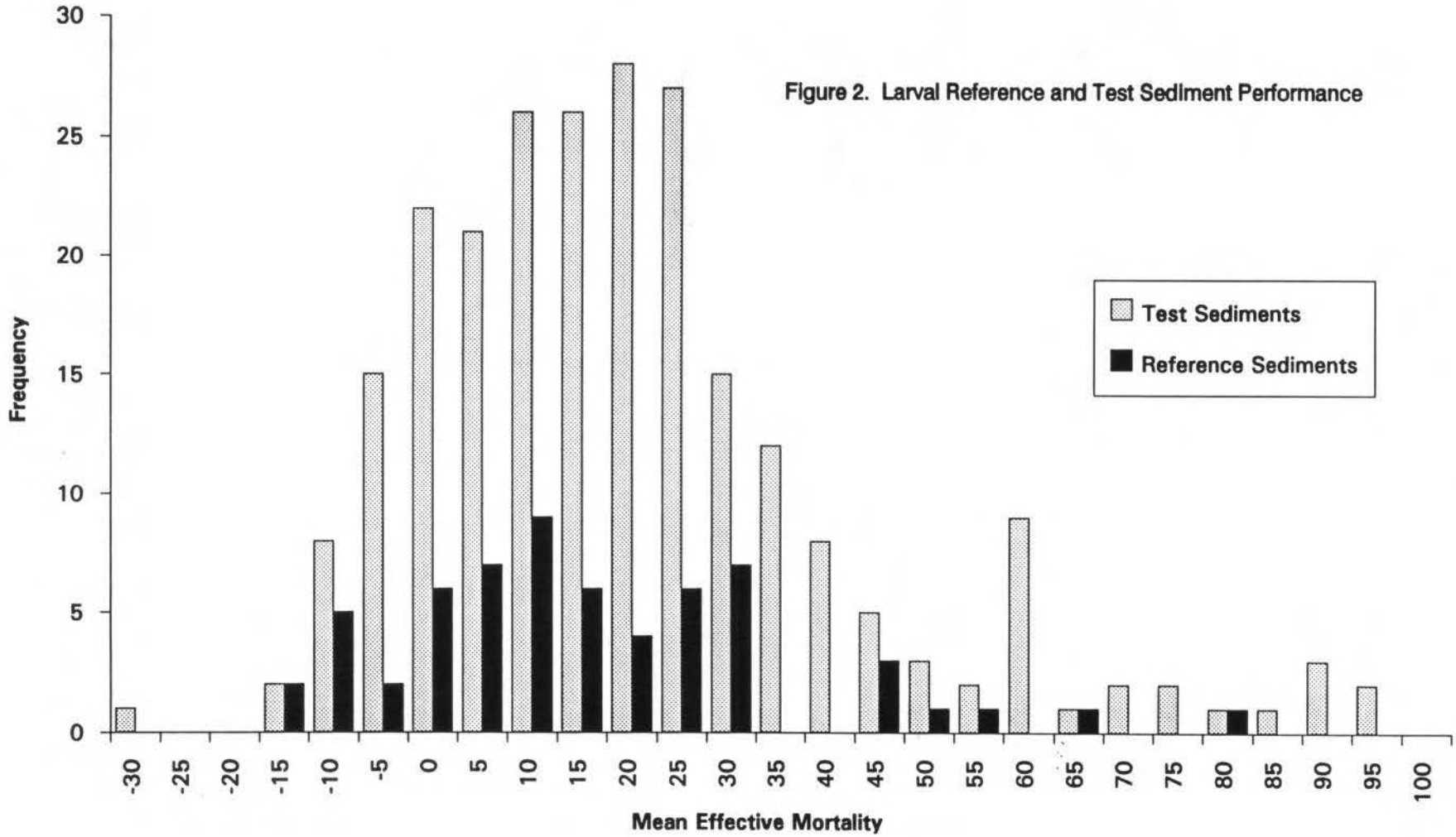


Figure 2. Larval Reference and Test Sediment Performance
Test Sediments
Reference Sediments
Frequency
30
25
20
15
10
5
0
-30
-25
-20
-15
-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Mean Effective Mortality

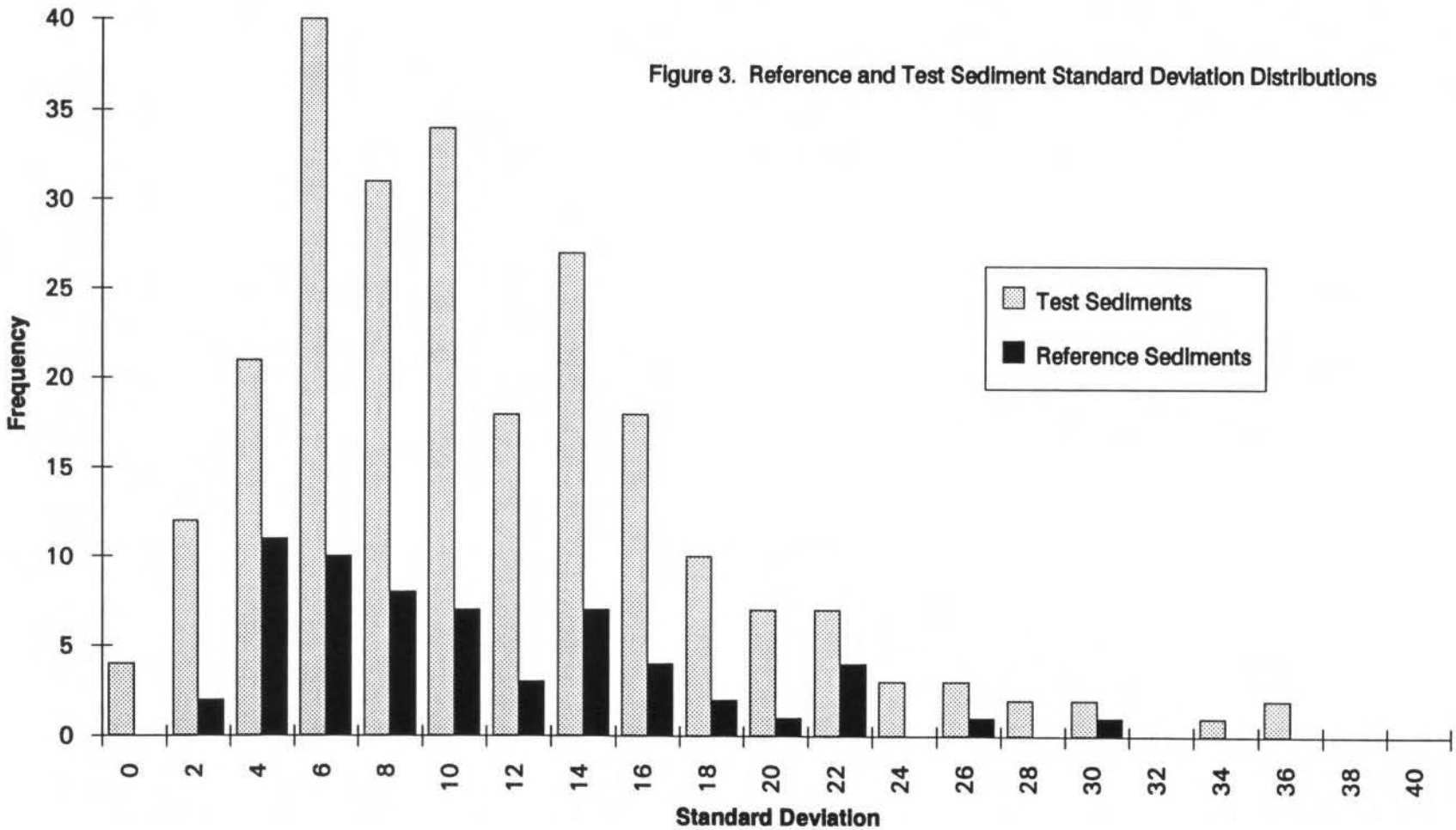


Figure 3. Reference and Test Sediment Standard Deviation Distributions

SIXTH ANNUAL PSDDA REVIEW MEETING

- THE MEETING IS HOSTED BY THE REGION 10 ENVIRONMENTAL PROTECTION AGENCY AND ADDRESSES PSDDA ACTIVITIES DURING DREDGED MATERIAL MANAGEMENT YEAR 1993 (JUNE 16, 1992 - JUNE 15, 1993).

dk1

SIXTH ANNUAL PSDDA REVIEW MEETING

MEETING OBJECTIVES AND PURPOSE

- Obtain public input on proposed changes to the PSDDA Management Plan per Clarification Papers and Issue Papers mailed out with the Meeting Announcement (contained in the Biennial Report).
- Discuss Disposal Site Management Actions and Changes.
- Discuss Status Reports on Important Ongoing Actions.

dk2

SUMMARY OF FIFTH 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 fifth ARM mailed out to participants and interested parties.
- The PSDDA agencies shared information with appropriate state and federal agencies on the apparent bay-wide increases in metals (particularly copper) concentrations in Elliott Bay.
- The Site History Clarification Paper was revised to provide clearer guidance based on the size of the project and its proximity to sources of contamination.
- Clearer guidance on the collection and matching of test and reference sediment grain sizes was disseminated.
- A status report on the shoreline permit renewal process will be presented at this year's ARM as requested.

dk3

SUMMARY OF FIFTH ANNUAL REVIEW MEETING COMMITMENTS AND ACCOMPLISHMENTS

- A status report on the shoreline permit renewal process will be presented at this year's ARM as requested.
- Interim reference performance standards for the sediment larval test are proposed for implementation following the ARM, and will be presented by David Fox.
- The Regulatory Work Group did not meet this past year to deliberate new ASTM guidance on the interpretation of the echinoderm test (i.e., abnormality) due to heavy work loads. The current abnormality performance standard and recommendations for PSDDA changes will be discussed during the public forum session of the ARM.

dk4

SUMMARY OF FIFTH ANNUAL REVIEW MEETING COMMITMENTS AND ACCOMPLISHMENTS

- PSDDA agency / Regulatory Workgroup examination of false positive responses in bioassays and recommendations for resolving this concern were not addressed due to heavy workloads.

- The Benthic Experts Workshop endpoint determination recommendations have not been acted on by the Regulatory Workgroup. Ecology is conducting ongoing work to identify benthic reference communities, which would help to frame future interpretive endpoint recommendations for the SMS and PSDDA programs. Therefore, resolution of this issue will be forthcoming. A status report prepared by Sandra Manning on this work was provided in the Biennial Report, mailed to the public in March.

dk5

SUMMARY OF FIFTH ANNUAL REVIEW MEETING ACCOMPLISHMENTS

- The Dredged Analysis Information System (DAIS) is now completed and fully operational. GIS development is well underway. David Fox, David Gustafson and Glen Salts are to be commended for their hard work and dedication in getting this database system operational. We are now using DAIS daily to facilitate data review and quality assessments and in conducting dredged material suitability determinations.

- The PSDDA agencies sent out a Biennial Report in March (copies available in back), which combines four former PSDDA reports into one (Corp's Dredged Material Evaluation Application Report, Ecology's Management Plan Assessment Report, and DNR's Dredging and Disposal Report and Disposal Site Monitoring Report).

dk6

SUMMARY OF FIFTH ANNUAL REVIEW MEETING ACCOMPLISHMENTS

- The PSDDA agencies have consolidated all clarifications and adjustments to the Management Plan and Evaluation Procedures over the past five years of implementation. This document was prepared by Ms. Linda Cox, Corps, and will be mailed out with the minutes of the Annual Review Meeting.

- The PSDDA agencies have been working cooperatively to address a number of emerging issues relative to contaminated sediments issues, which will be the focus of a status report to be presented by Keith Phillips, Ecology, later today.

dk7

PSDDA PROJECT AND TESTING ACTIVITIES

Dredging Year 1993

June 16, 1992
to
June 15, 1993

ss1

DY93 PSDDA EVALUATION ACTIVITIES

Ranking Determinations	16
Sampling Plan Review	11
Data Review/ Suitability Determination	14

23 Total Projects 2,280,043 cubic yards

ss2

PROJECT DEFINITION

DY 93 projects are defined as those projects for which the PSDDA agencies made suitability determinations or partial characterization rankings between 16 June 1992 and 15 June 1993, or for which sampling and testing was completed and the application for open-water disposal was withdrawn.

14 projects

1,902,443 cubic yards

ss3

DY93 PROJECTS

- Boyer Alaska Barge Lines - Seattle
- Port of Everett, South Terminal PC - Everett
- King County, Sammamish River - Lake Washington
- LaConner Marina
- Lone Star Northwest, West Terminal - Seattle
- Pratt/Todd Private Moorage - Friday Harbor
- Port of Seattle, Southwest Harbor PC - Seattle
- Port of Seattle, Terminal 91 - Seattle
- Port of Seattle, Terminal 115 - Seattle
- Shell Oil - March Point
- USACE Duwamish DY93 - Seattle
- USACE Everett Downstream PC - Everett
- USACE Everett Downstream FC - Everett
- US Navy Homeport Element II - Everett

ss4

DY93 PROJECT INITIAL RANKING

Rank	Project
Low	0
Low-Moderate	1
Moderate	6
High	7

ss5

DY93 SAMPLING PLANS

- 12 projects
- 1,087,179 cubic yards (full characterization)
- 1,072,243 cubic yards (partial characterization)
- 2,159,422 cubic yards total
- 166 field samples
- 43 dredged material management units

ss6

DY93 CHEMICAL TESTING

- 8 of 14 projects had screening level exceedances
- 340 screening levels were exceeded
- 15 bioaccumulation triggers were exceeded
- 108 maximum levels were exceeded
- South Terminal PC accounted for 209 SL exceedances, 10 BT and 70 ML exceedances

ss7

DY93 BIOLOGICAL TESTING

- 6 projects required biological testing
- Tiered testing was conducted for 4 projects
- 14 dredged material management units were tested

ss8

DY93 SUITABILITY DETERMINATIONS

- 11 projects
- 43 chemical analyses
- 14 biological analyses
- 5 DMMU failed (21,296 cubic yards)

ss9

DY93 DISPOSAL

♦ Anderson/Ketron	10,197
♦ Elliott Bay	17,282
♦ Port Gardner	109,500
♦ Bellingham Bay	32,883
♦ Rosario Strait	176,486
♦ Port Townsend	22,642

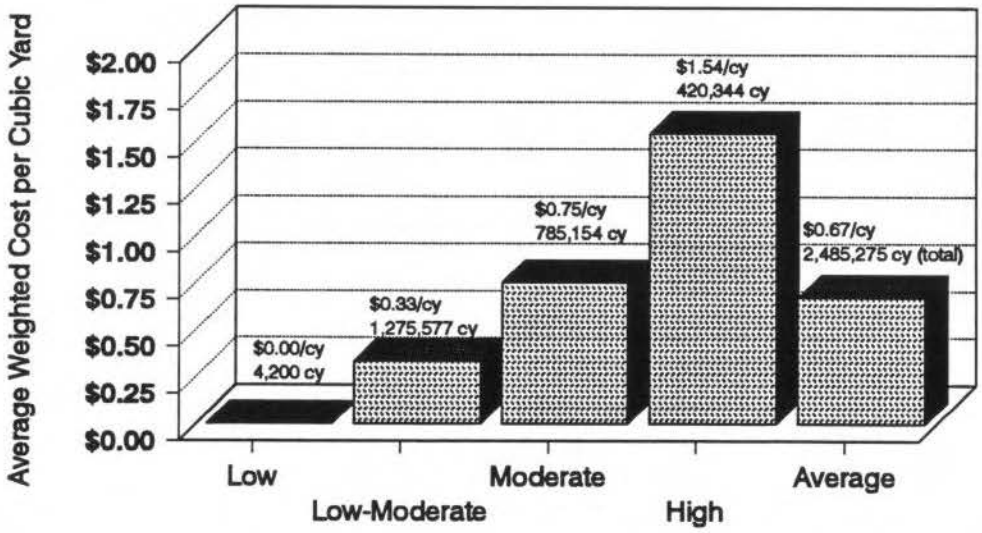
ss10

DY94 PROJECTS

- 16 projects
- 7 suitability determinations
- 676,600 cubic yards

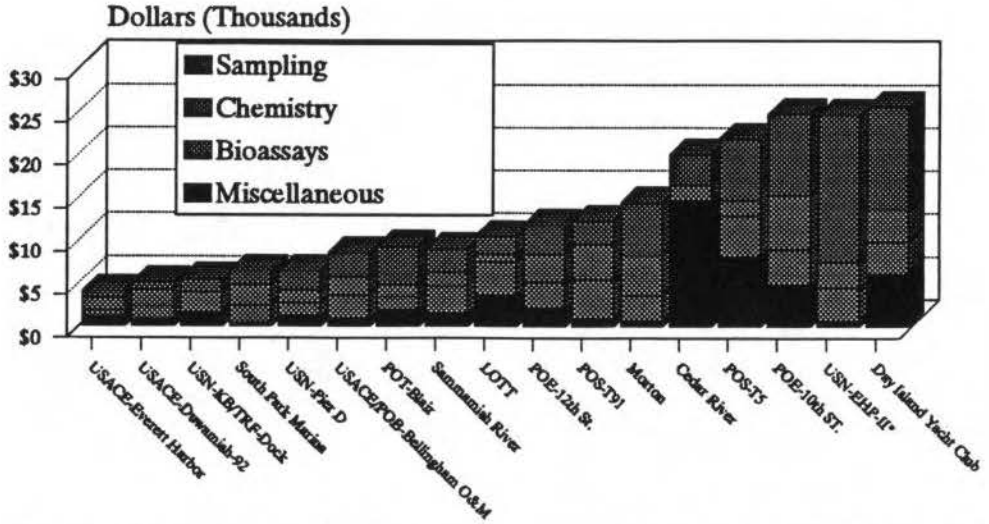
ss11

Rank versus Unit Testing Cost
Dredging Years 1992 and 1993



ss12

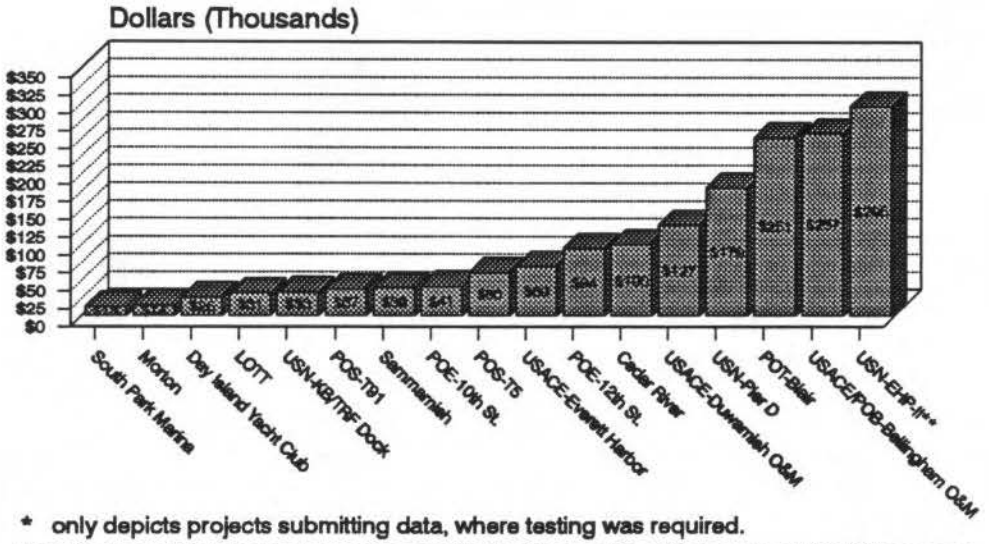
Average Cost per Dredged Material Management Unit



* reflects additional supplemental sampling/testing costs outside normal PSDDA process, including dioxin analyses.

ss13

Total Project Sampling/Testing Costs*

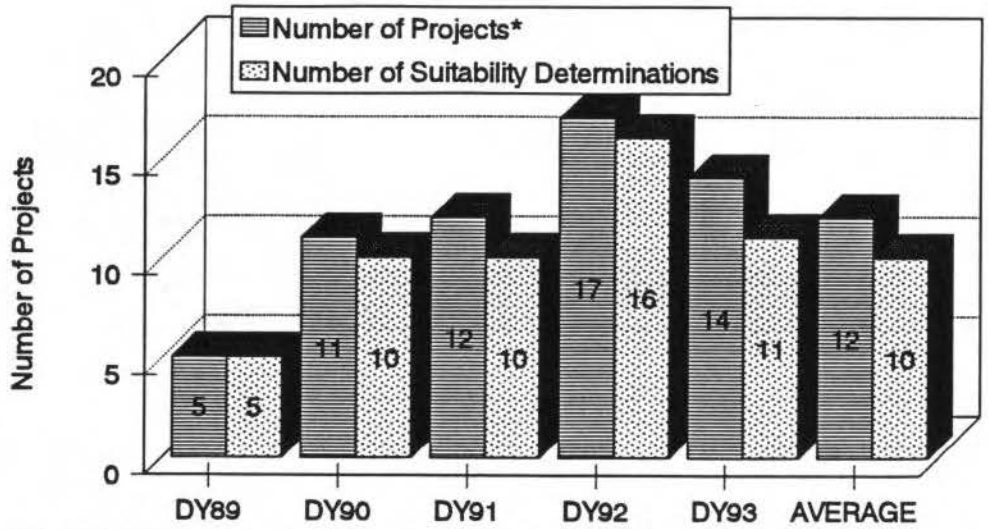


* only depicts projects submitting data, where testing was required.

** reflects additional supplemental sampling/testing costs outside normal PSDDA process.

ss14

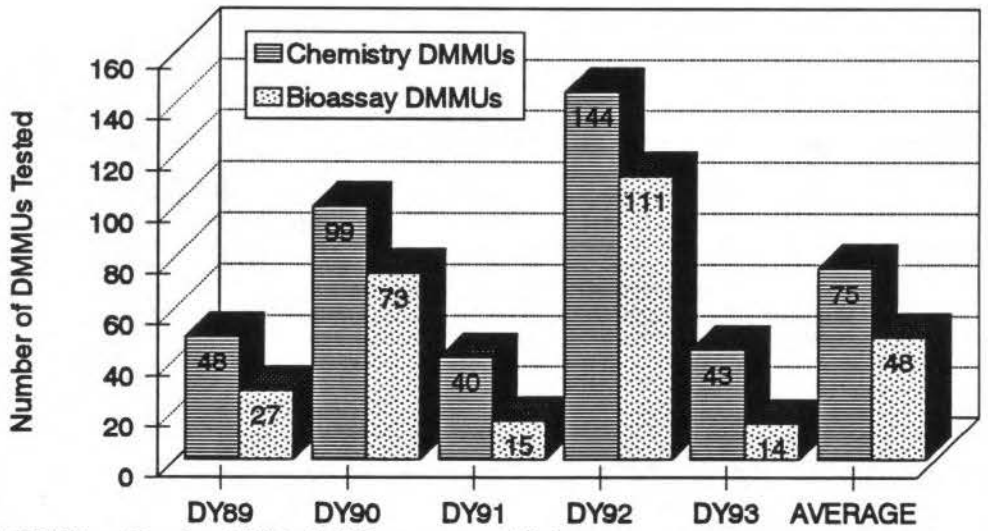
PSDDA Program Retrospective: Number of Projects Evaluated under PSDDA



* includes projects undergoing Partial Characterizations

ss15

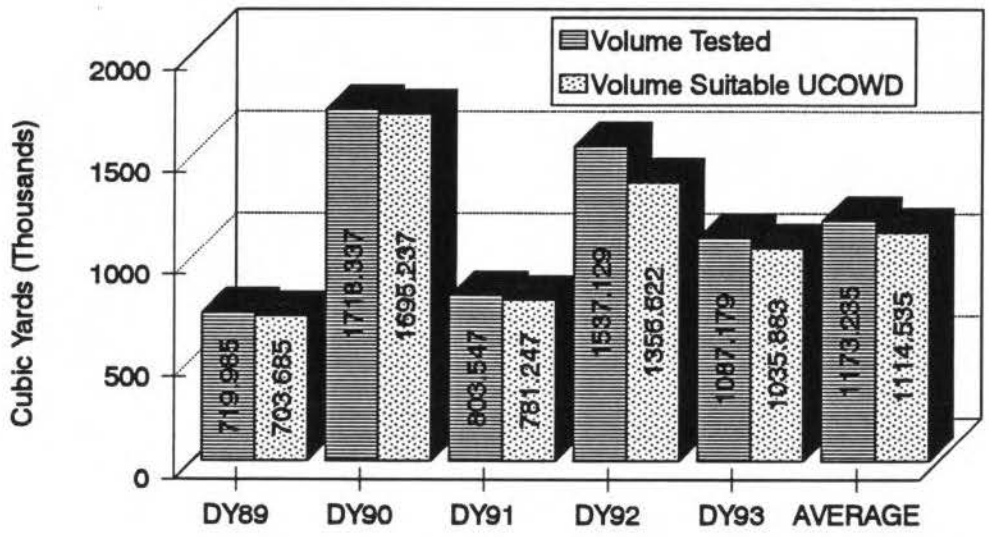
PSDDA Program Retrospective: Number of Chemistry and Bioassay DMMUs Tested



DMMU = Dredged Material Management Unit

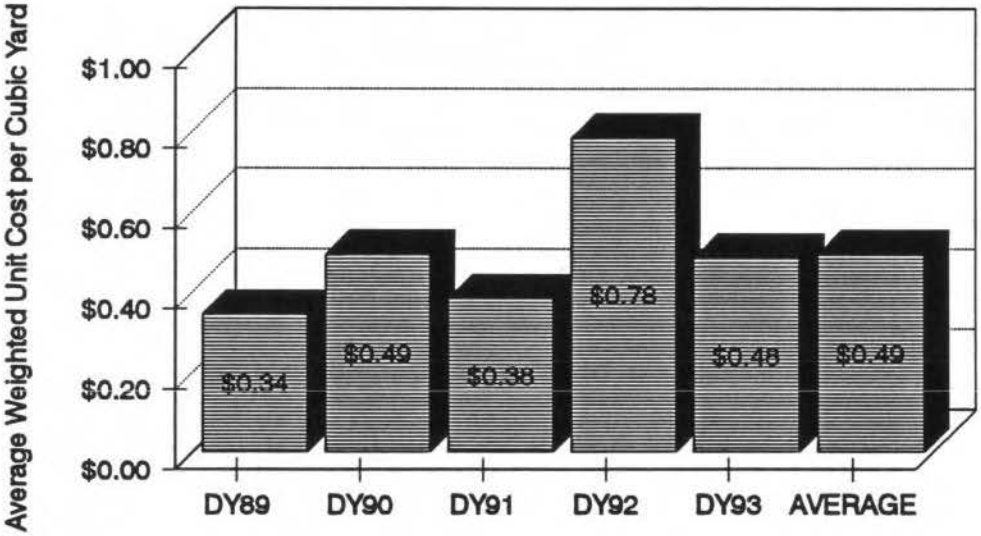
ss16

PSDDA Program Retrospective:
Total Tested versus Suitable Volume



ss17

PSDDA Program Retrospective:
Average Sampling and Testing Costs



SS 18

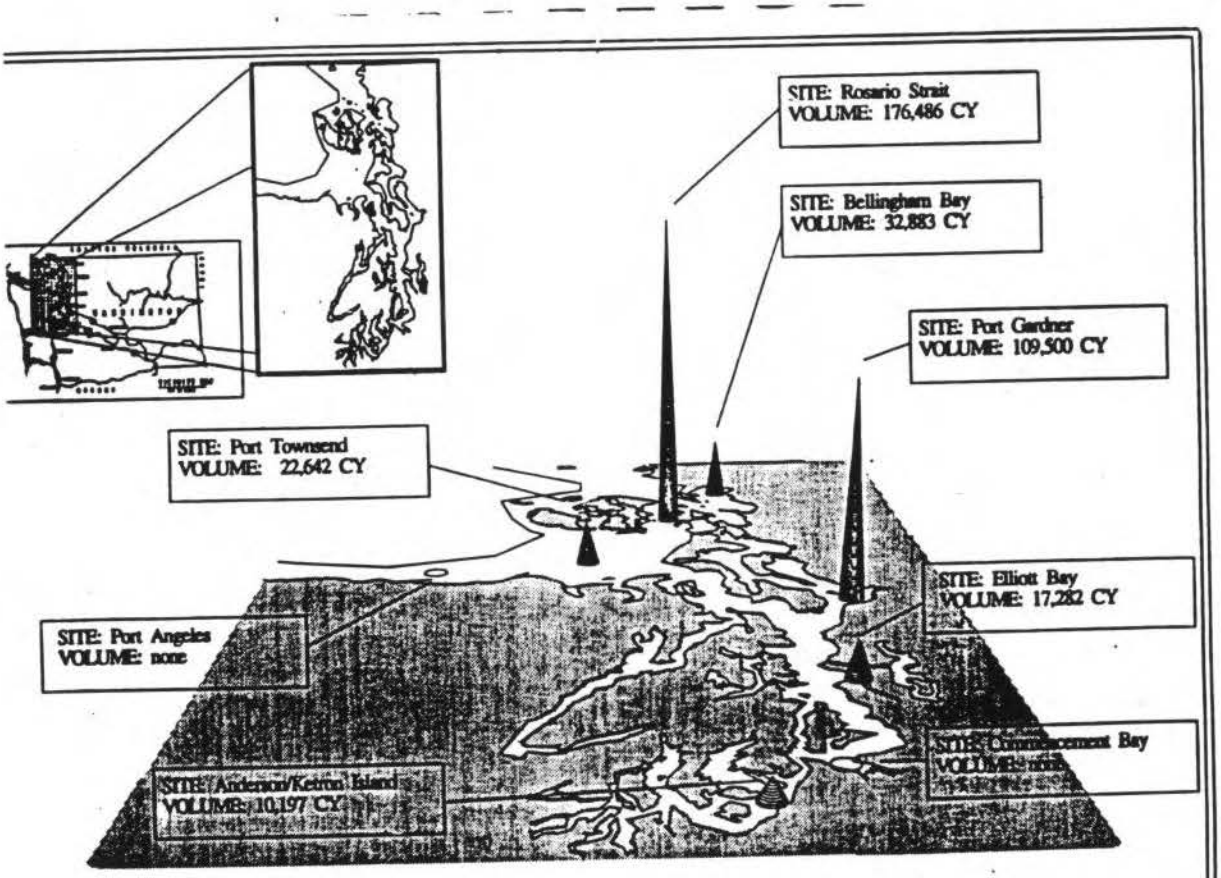


Figure 2-2. Dredging Year 1993 Disposal Volumes

ph1

ENVIRONMENTAL MONITORING QUESTIONS

1. DOES DEPOSITED DREDGED MATERIAL STAY ONSITE?

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

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

ph2

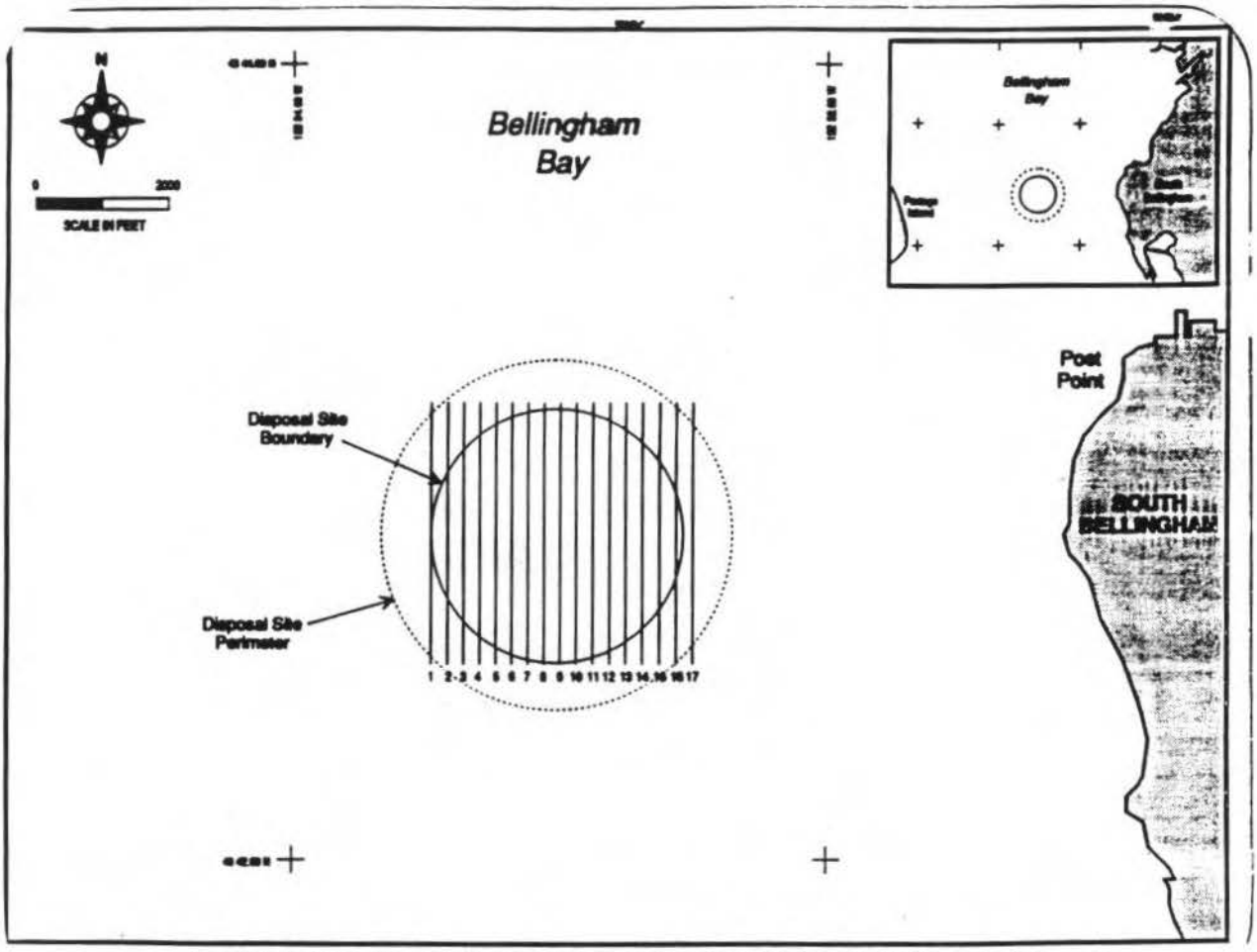


Figure 3-1. Seventeen-lane side scan sonar survey conducted at the Bellingham Bay dredged disposal site.

ph3

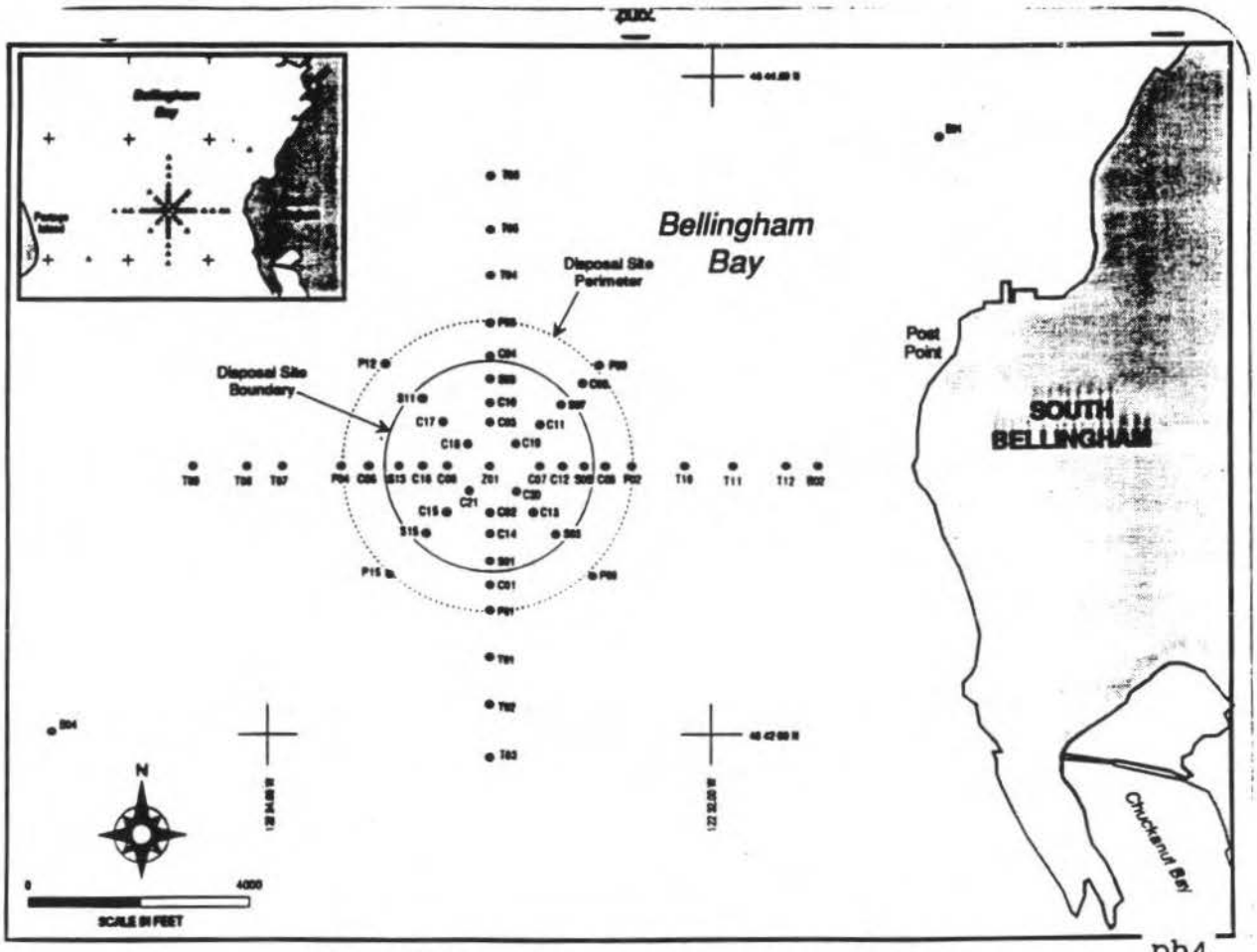


Figure 3-2. SVPS stations occupied at the Bellingham Bay disposal site in April, 1993.

ph4

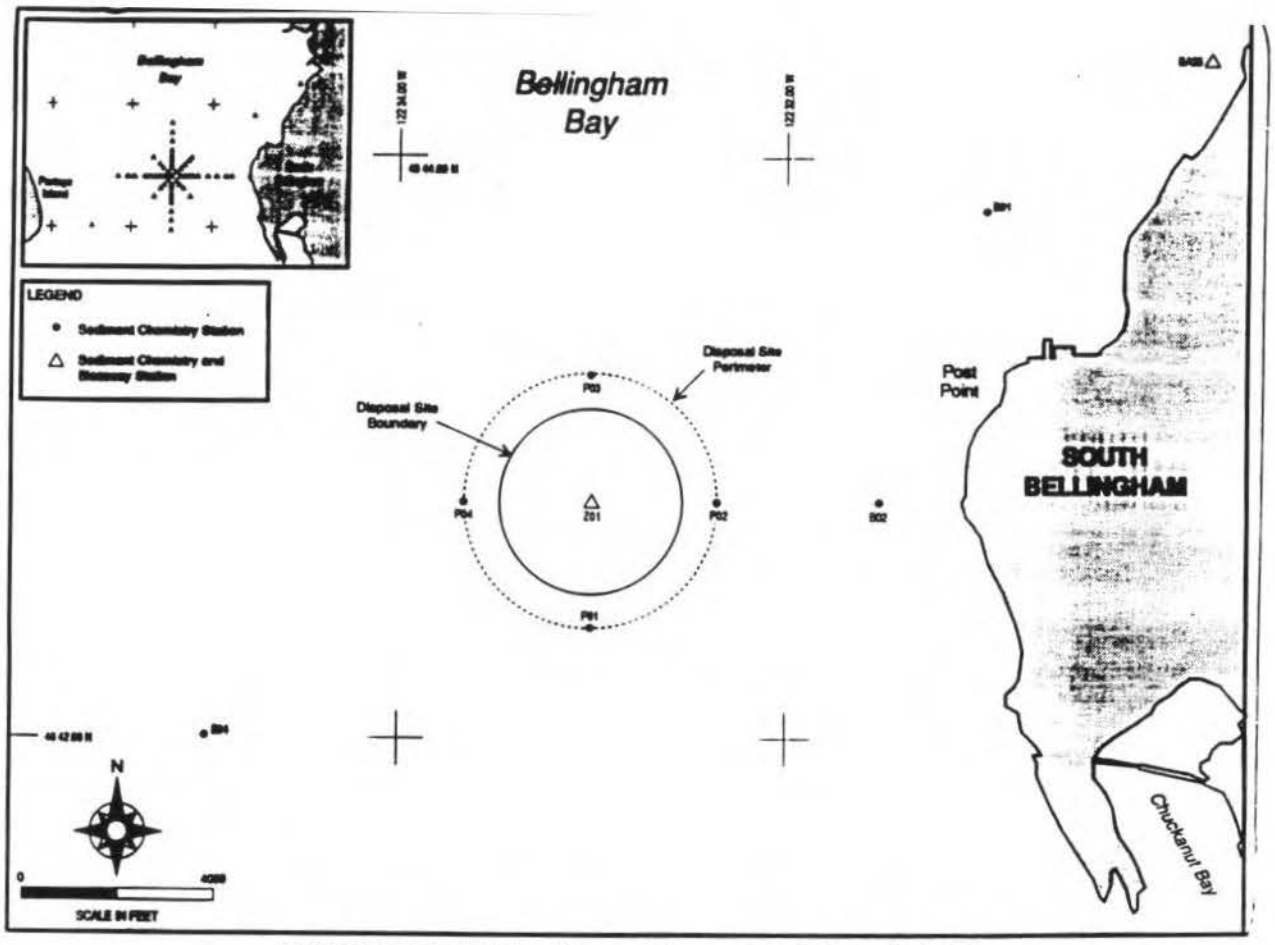


Figure 3-3. Sediment chemistry and bioassay stations occupied in Bellingham Bay in 1993.

ph5

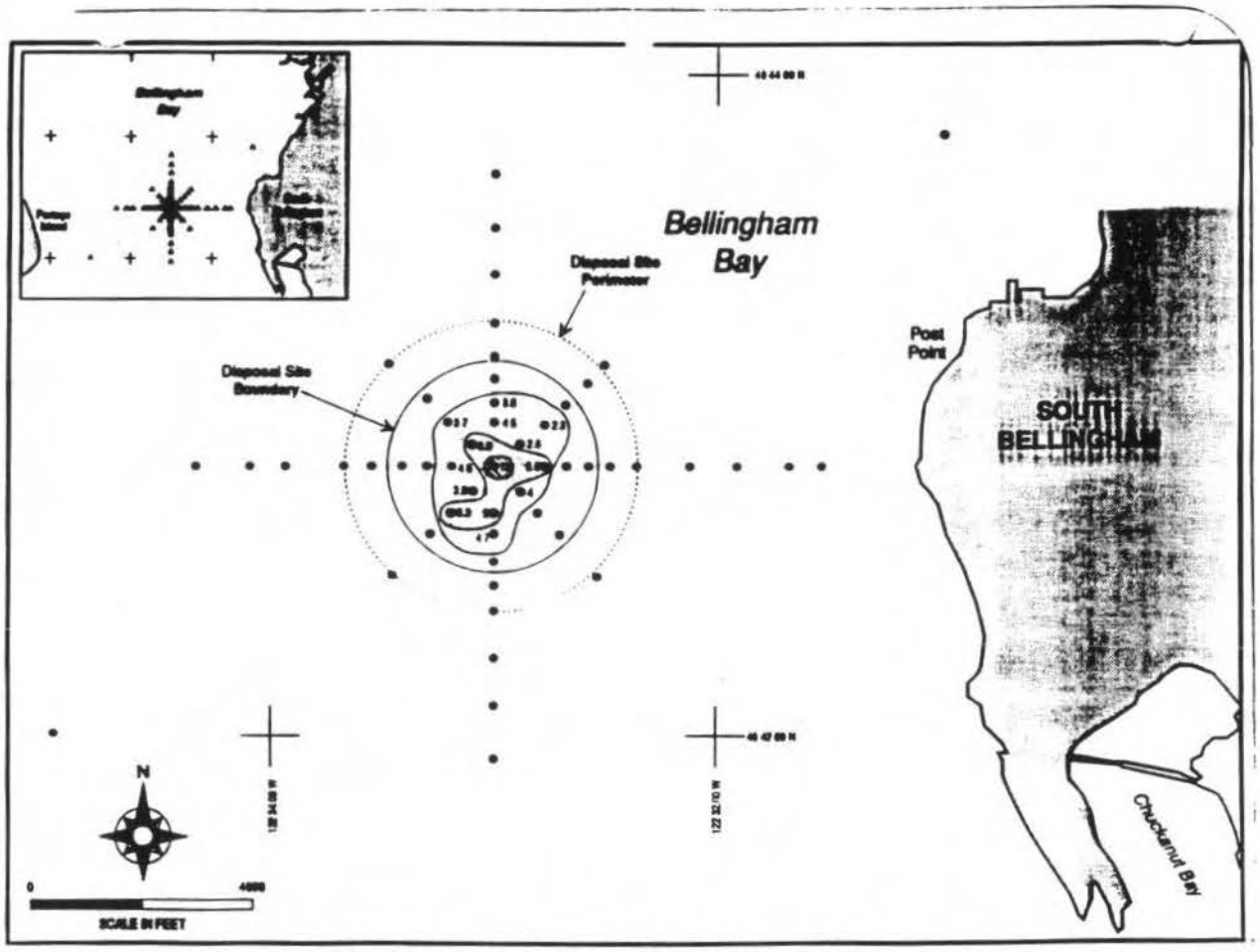


Figure 4-9. Distribution of dredged material at the Bellingham Bay PSDDA disposal site. Measurements are in centimeters. Contours are in 5 cm intervals.

ph6

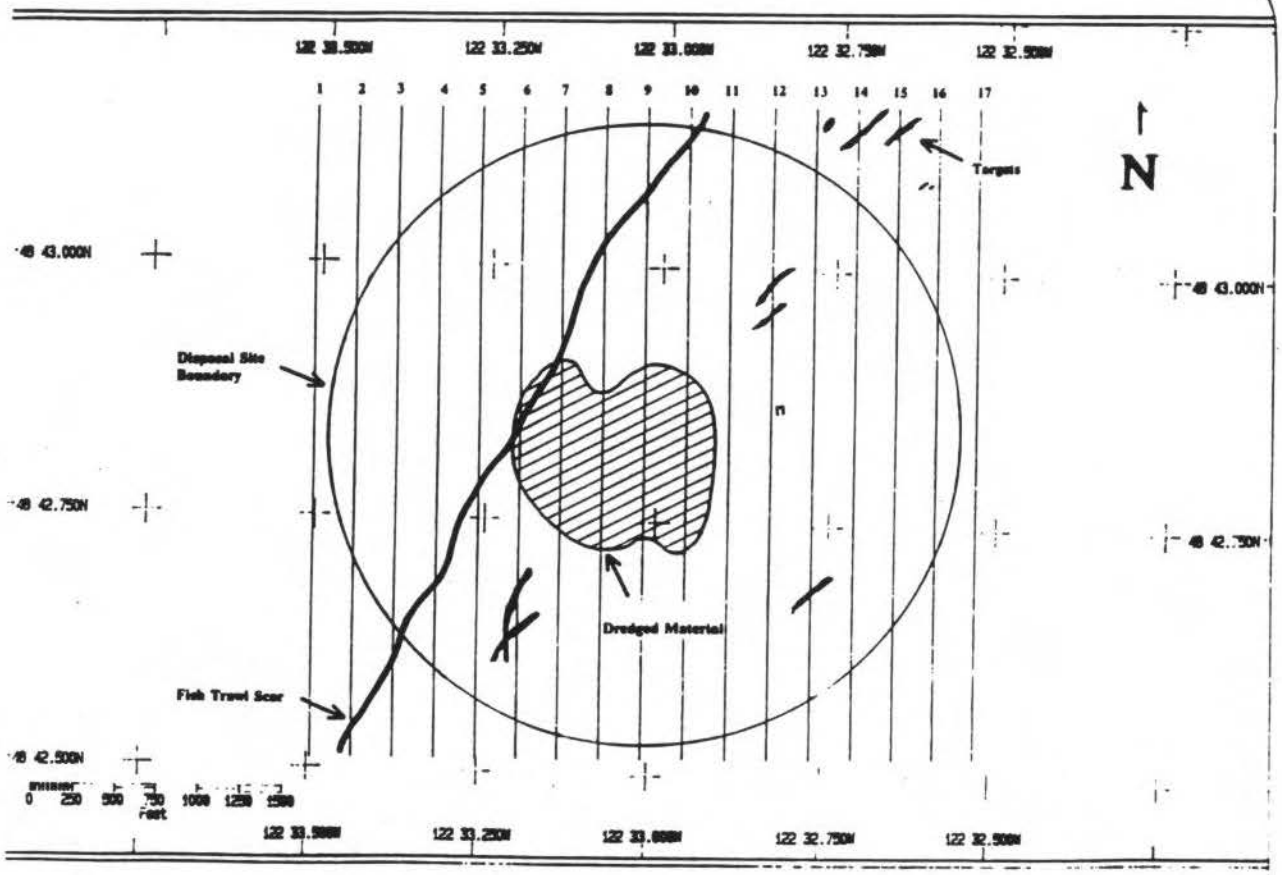


Figure 4-1. Display of dredged material location and features interpreted from the side scan sonar echograms of the Bellingham Bay dredged disposal site.

ph7

Perimeter
Chemistry
Guideline

Organics

Guideline =
Baseline chem. conc.
x 1.47

ph8

Table 5-1. Organics of concern that exceed guideline values at perimeter stations (highlighted).

Organics (µg/kg, dry weight)	Guideline	Rep. 1	Rep. 2	Rep. 3	Mean	S.D.
		Station BBP01				
PHENOLS						
4-Methylphenol	23.5 U	25	NA	NA	–	–
		Station BBP02				
PHENOLS						
4-Methylphenol	23.5 U	44	NA	NA	–	–
		Station BBP03				
PHENOLS						
4-Methylphenol	22.1 U	30	NA	NA	–	–
		Station BBP04				
LPAH						
Naphthalene	23.5	32	19 U	20	24	7.2
Phenanthrene	23.5	42	28	27	32	8.4
PHTHALATES						
Bis(2-ethylhexyl)phthalate	17.6 U	49	35	28	37	11
PHENOLS						
4-Methylphenol	17.6 U	42	25	26	31	9.8

NA = Not Analyzed
U = Undetected

ph9

Perimeter
Chemistry
Guideline

Metals

Guideline =
Baseline chem. conc.
X 1.25

ph10

Metal (mg/kg, dry weight)	Guideline	Rep. 1	Rep. 2	Rep. 3	Mean	S.D.
		Station 88P01				
Arsenic	9.63	10	NA	NA	--	--
		Station 88P02				
Arsenic	9.88	12	NA	NA	--	--
		Station 88P03				
Arsenic	9.75	12	NA	NA	--	--
Cadmium	0.55	0.8	NA	NA	--	--
		Station 88P04				
Arsenic	8.63	15	12	12	13	1.7
Cadmium	0.56	0.58	0.5	0.5	0.53	0.06
Copper	56	58.2	47.1	47.3	50.9	6.4
Nickel	98	111	87	90	96	13

NA Not Analyzed

ph11

Table 5-2. Concentrations of PSDDA chemicals of concern measured onsite. Concentrations exceeding the PSDDA SL are highlighted.

	SL[1]	ML[2]	STATION BBZ01
METALS (mg/kg, dry weight)			
Antimony	20	200	0.3*
Arsenic	57	700	15
Cadmium	0.96	9.6	0.28
Copper	81	810	68.9
Lead	66	660	43
Mercury	0.21	2.1	0.19
Nickel	140	--	182
Silver	1.2	6.1	0.21
Zinc	160	1600	112
ORGANICS (µg/kg, dry weight)			
LPAH			
Naphthalene	210	2100	15 J
Acenaphthylene	64	640	21 U
Acenaphthene	63	630	21 U
Fluorene	64	640	21 U
Phenanthrene	320	3200	29
Anthracene	130	1300	21 U
2-Methylnaphthalene	67	670	11 J
Total LPAH	610	6100	128

ph12

TABLE 2-5. 1993 PSDDA SITE MONITORING BIOASSAY RESULTS, BELLINGHAM BAY.

Station	*Ampelisca* (%mortality)	*Neanthes* individual biomass (mg)	*Dendraster* (% combined mortality)	Microtox % light reduction
	Mean (SD)	Mean (SD)	Mean (SD)*	N/A
Control	9.5 (9.3)	18.1 (1.9)	18.3 (10.7)	-20.60
Reference	5.0 (3.5)	14.4 (3.8)	12.3 (10.4)	-25.78
BB site center	24.0 (9.6)	15.2 (1.7)	11.3 (6.7)	-12.5

SD = Standard Deviation
*SD calculated on raw data

ph13

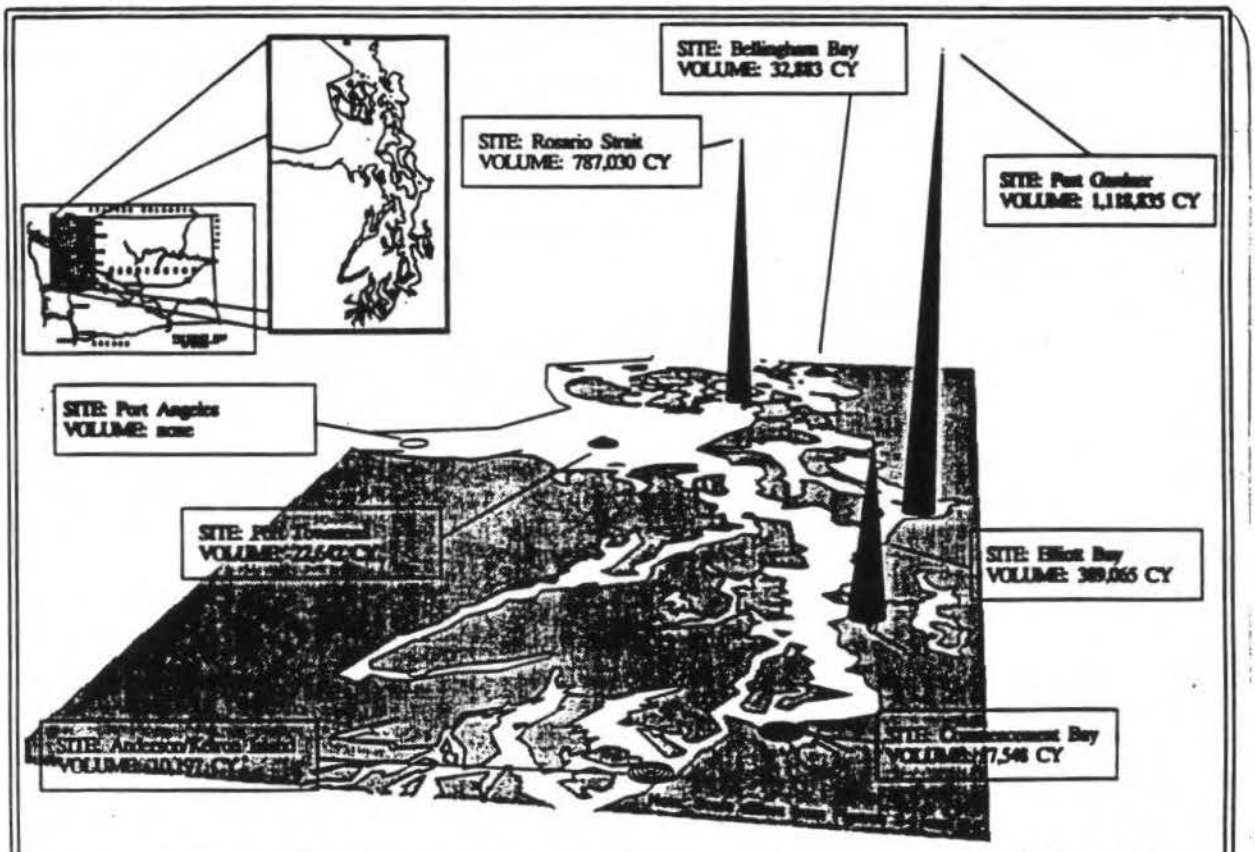
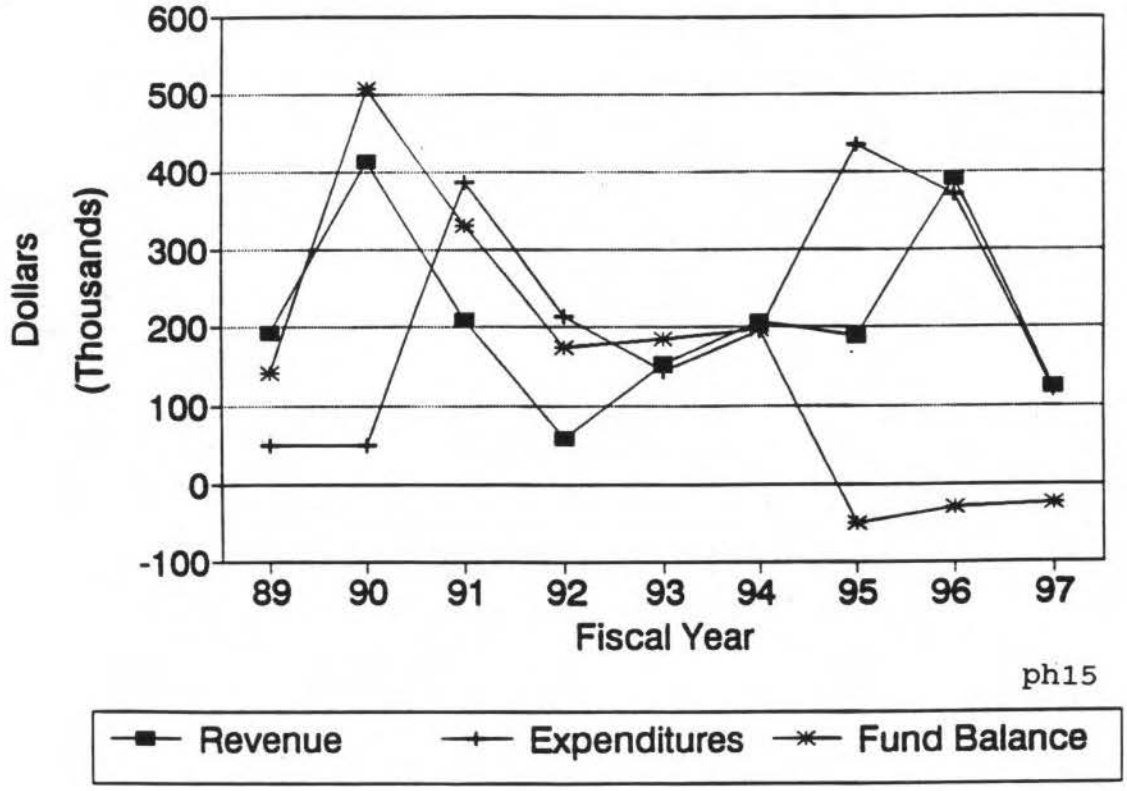


Figure 2-7. Cumulative Disposal Volumes (Dredging Years 1989-1993)

ph14

PSDDA FUND

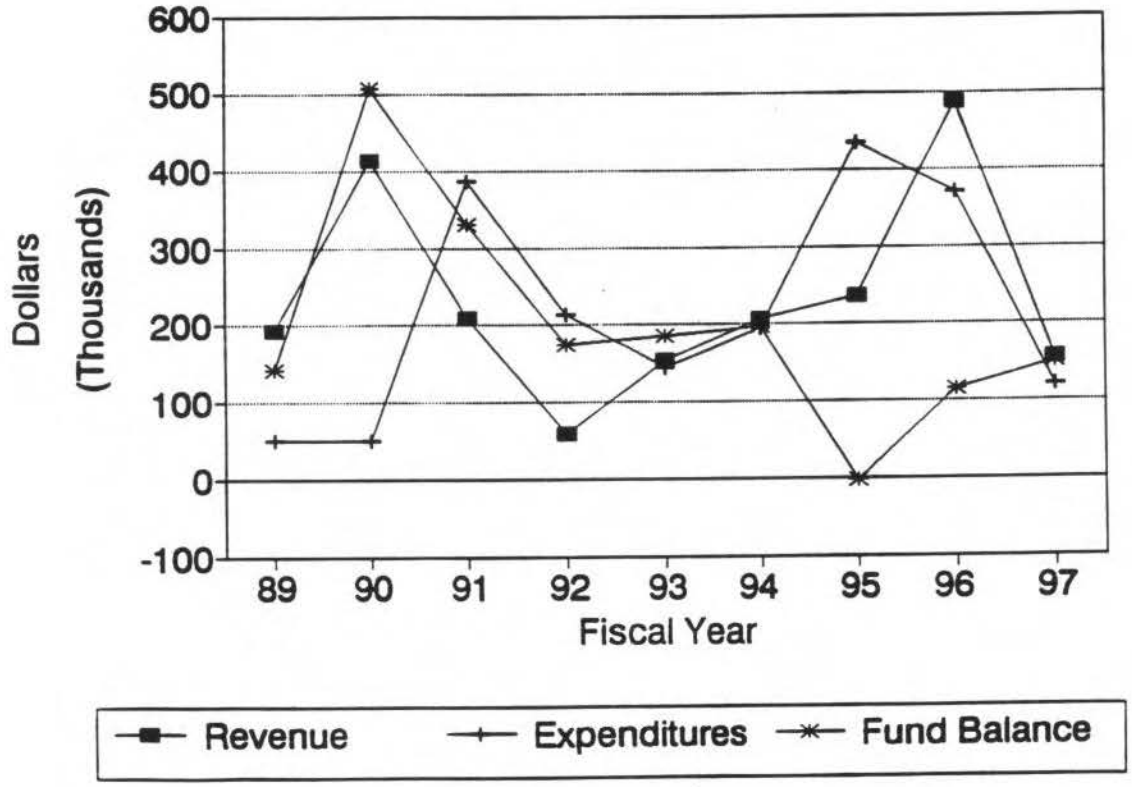
Disposal Fee = $0.40/cy



ph15

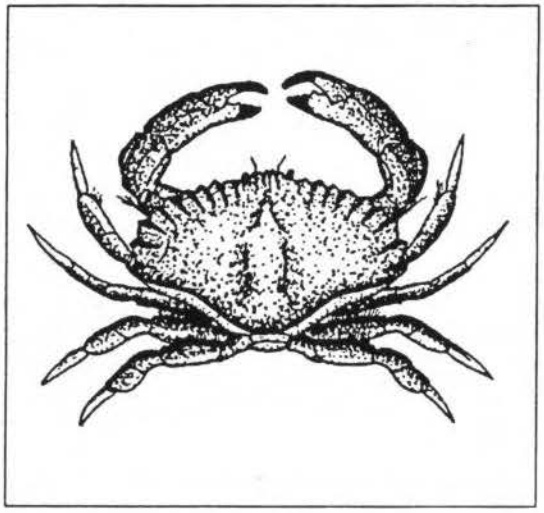
PSDDA FUND

Disposal Fee = $0.50/cy



ph16

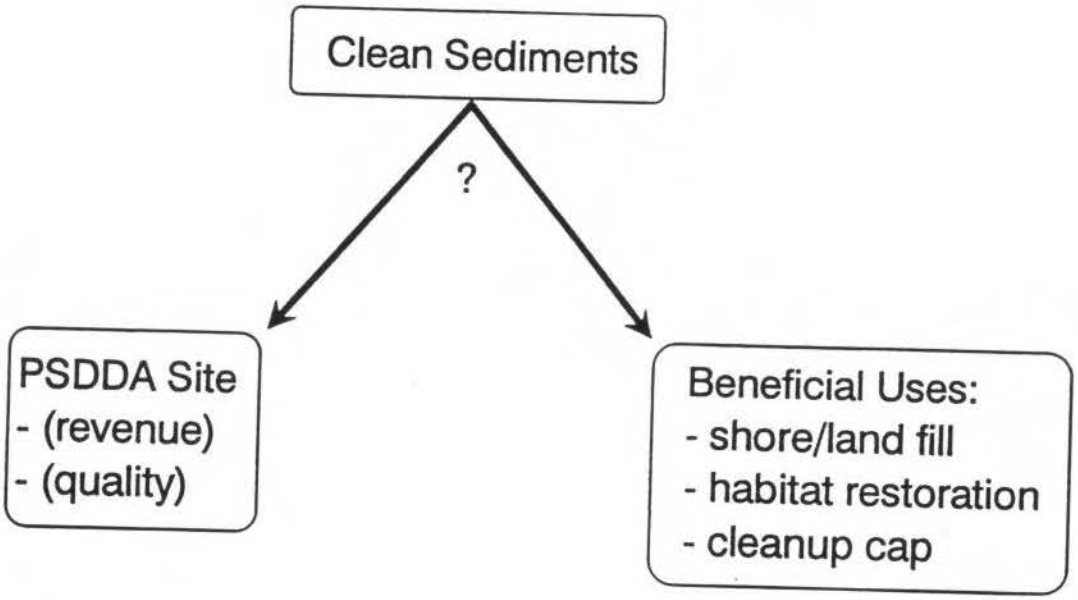
Interagency Option Papers on Sediment Management Issues



kp1

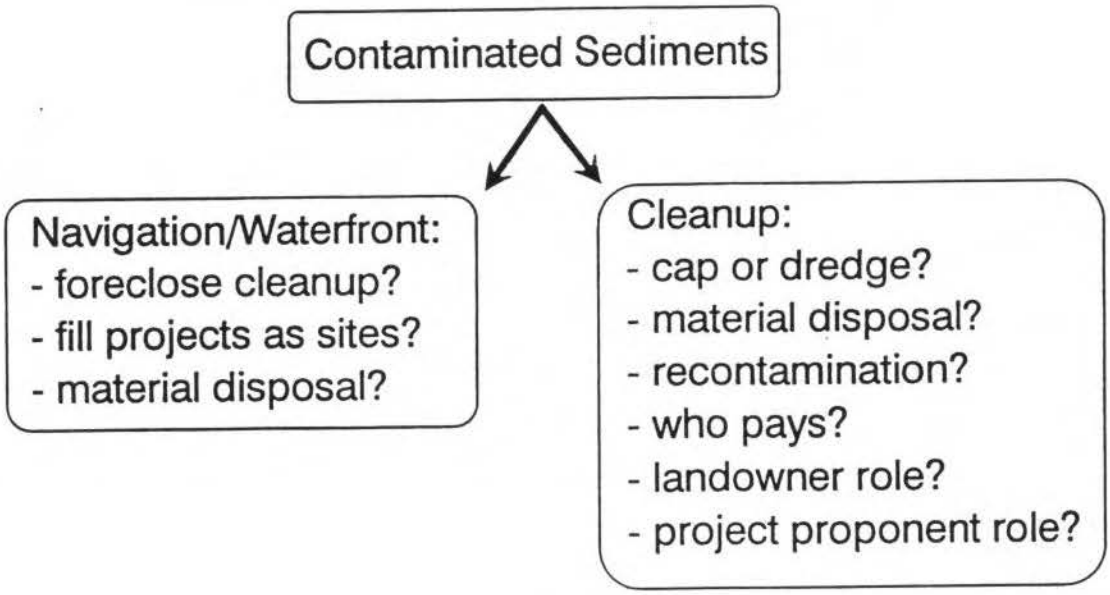
May 6, 1994

Sediment Management Issues



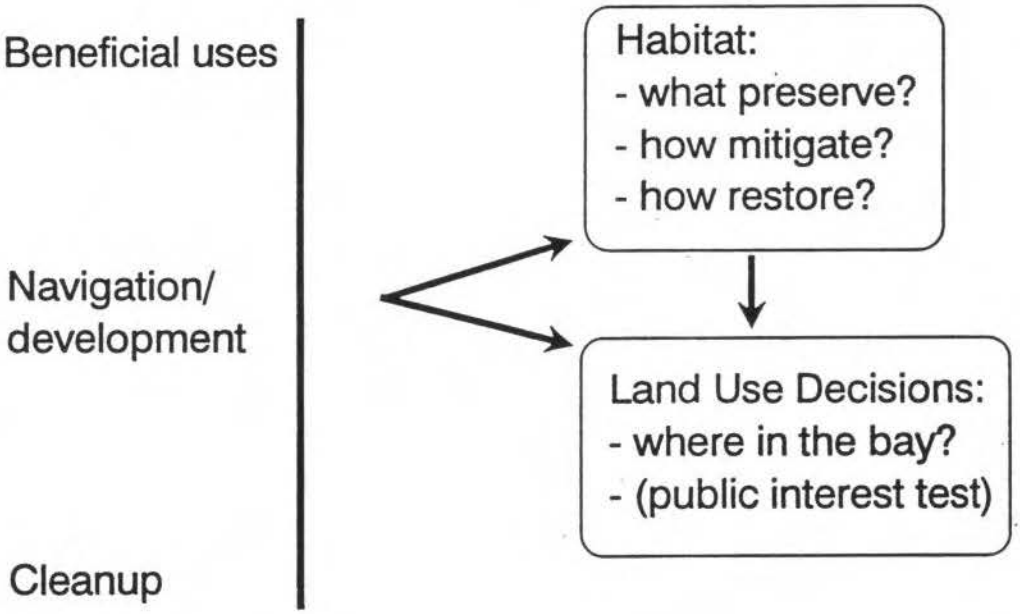
kp2

Sediment Management Issues



kp3

Sediment Management Issues



kp4

AGENCY HEAD CHARGE

Origin	June 1993 meeting of PSDDA agency heads
Premise	Agency heads interest in use of PSDDA model of cooperative decisionmaking for sediment challenges
Scope	Broad review of issues to develop "option papers"
Schedule	Recommendations to agency heads by Spring 1994

kp5

THE PSDDA MODEL

Principles	shared responsibilities and resources
	consensus decisionmaking in an open, cooperative forum
	active involvement/participation by others
Practices	programmatic decisions/project flexibility
	scoping of costs, roles and assumptions
	attention to "implementation"
	annual reassessment and public review

kp6

GENERAL CONCLUSIONS

General Options	General Recommendations
Continue case-by-case/ separate decisions	Current condition is inefficient/ineffective
Resolve by baywide aquatic lands plans	An ideal solution/requires resource commitment
Separate program response for given issues	Workable first steps towards solution

kp7

MULTIUSER CONFINED DISPOSAL SITES

Issue

Lack of confined disposal sites hinders cleanup, navigation dredging and waterfront development

Conclusion

Agencies should continue their efforts to site, construct and operate one/more multiuser confined disposal sites

Also, access to large projects could provide some relief during limited time periods, assuming liability was addressed

kp8

BENEFICIAL USES OF DREDGED MATERIAL

Issue

Projects involving beneficial use are competing for clean dredged material. Unclear policies and different agency mandates prevent routine and effective implementation of beneficial use projects.

Conclusions

Develop interagency policies and guidance for beneficial use projects. Policies could provide the basis for a more structured administrative coordination and streamlined regulatory process.

kp9

ACHIEVING SEDIMENT CLEANUP

Issue

Complexity of sediment contamination heightens concerns regarding cleanup liability and funding

Conclusions

Agencies could facilitate cleanup under existing system through enforcement discretion, cost allocation, etc.

Agencies should evaluate whether sediment cleanup is best secured by managing liability under the current system or whether to recommend changes to the liability scheme for sediment contamination

kp10

AQUATIC HABITAT PLANNING

Issue

"Habitat" is common to all agency missions -- navigation development projects and cleanup actions involve mitigation and restoration of habitat. Lack of agreement on habitat needs is a significant challenge to proponents and decisionmakers

Conclusions

Agencies should continue to sponsor and participate in informal habitat planning efforts within individual bays that rely, at least initially, on existing information. This will be an effective step towards more comprehensive baywide plans.

kp11

BAYWIDE PLANNING

Issue

Competing uses in the aquatic environment (e.g., capping, disposal, habitat) can at times be in conflict. There is no detailed "land use" planning for the aquatic environment.

Conclusions

Agencies should consolidate technical information/ agency policies into a set of federal/state guidelines and models for aquatic land use planning.

Guidelines implemented for bays by local governments pursuant to SMA and GMA

kp12

Option Papers Recommendations

❶ Action plan for multiuser site(s) for disposal of contaminated sediments

❷ Agency policies and procedures to facilitate beneficial use of clean dredged material

❸ Strategy to address sediment liability and facilitate sediment cleanup along the urban waterfront

❹ A memorandum of agreement to implement recommendations and reaffirm the PSDDA cooperative model

kp13

Interagency/Intergovernmental Agreement: "A Cooperative Sediment Management Program"

OBJECTIVES

- establish a coordinated and cooperative program to address the management of clean and contaminated sediments and the protection and restoration of aquatic habitat

- reaffirm continued support for cooperative ventures that are already underway to manage dredged material (e.g., PSDDA), and to improve contaminated sediments management and aquatic habitats

kp14

AGREEMENT PRINCIPLES

- Open communication
- Share resources and expertise
- Coordinated use of respective authorities
- Periodic reviews of agreement
- Resolution of disputes along parallel administrative levels, at the lowest staff level
- Agency authorities reaffirmed and unaltered

kp15

Sediment Cleanup Strategy

A high priority effort to develop a strategy for cleanup of contaminated sediments in the aquatic environment. Convene an external work group to:

(1) how agencies can facilitate sediment cleanup under the existing system

(2) strategy for cleanup along urban waterfront, including landowner/project roles

(3) agency roles, responsibilities, and funding sources

kp16

(4) existing vs changed regulatory framework

Action Plan for Multiuser Confined Disposal Site(s)

An action plan outlining studies for development of one or more multiuser confined disposal sites for contaminated sediments

(1) detail disposal siting process, including public participation

(2) recommend a site liability management scheme

(3) evaluate institutional management (agency roles)

(4) identify possible funding sources and mechanisms for future siting and construction steps

kp17

Policies for Beneficial Use of Dredged Material

Policies to facilitate projects involving beneficial uses of clean dredged material; recommendations for implementation via existing agency authorities and programs

(1) compile agency policies/procedures

(2) prepare a common set of policies

(3) integrated procedure for agency review and approval of beneficial use projects; and

kp18

(4) implementation methods and unresolved issues

Schedule

	Start	End
Sediment Cleanup	May 94	Nov 94
Multiuser Plan	Oct 94	Mar 95
Beneficial Uses	Dec 94	Apr 95

kp19

Sediment Quality Value Re-evaluation: Process and Interim Results

Technical Tasks

- Data Acquisition, Review, Entry, Screening
- Biological Interpretation
- AET and Reliability Calculation
- Implication Analysis
- Technical Report, Draft and Final

Non-Technical Tasks

- Expert and Public Review of Draft Report
- Regulatory Work Group Review, Consensus and Recommendations
- PSDDA Annual and SMS Triennial Review Processes
- Adoption of New Regulatory Sediment Quality Values

tg1

/

Apparent Effects Thresholds:
1994 Puget Sound Update

Background

Commitments from 1992-1993:

- Amphipod mortality AETs and reliability
- Sediment larval (combined species) *abnormality* AETs and reliability
- Sediment larval (combined species) *abnormality+ mortality* AETs and reliability
- Benthic and Microtox AETs and reliability, if possible
- "Pooled" reliability of current AET suite and "pooled" reliability of new suite of AETs
- Reliability of new PSDDA MLs/SLs
- Possible implications of new PSDDA MLs/SLs

tg2

Bioassay data excluded from 1993 AET calculations.

Specific sample data were excluded from the 1993 AET calculations because they were not synoptic, failed to meet minimum chemical quality assurance (QA) requirements, failed to meet various bioassay QA requirements, or were statistically inconclusive. Exclusions are ordered by Survey Code and Sample Code.

Survey/Station/Sample/Batch Bioassay Data Excluded:

Criteria for Exclusion:

Survey Code	Sample ID	Bioassay Type	Batch	Not Synoptic	Failed Chem. QA	< 5 Bioassay Repl.	Poor Control Sampl	Other Biological QA	Statistically Inconcl.
DUWO&M91	All		2	E					
EHRITM10	All	All			S				
SEATLSC2	All	All			S				
SED18804	All		3			A			
NAVYMANÇ	MANCHEXXC006		1			E			
CBMSQS	All	B				S			
COLUMBIA	All	All					S		
PSDDA2	All	B					B		
OLYHARFC	OLYHFCXXC012							A	
BLAIR 91	BLAIR91XC005								A
OLYHARFC	OLYHFCXXC019								E

tg3 3

Ecology's SEDQUAL database: Status of synoptic chemistry/bioassay data.

Numbers in parentheses are for the contents of SEDQUAL after all data exclusions. The table does not include benthic abundance, Microtox or juvenile polychaete bioassay survey/sample counts.

Year/ Biological Data Type	Survey Number	Station Number
1988 Amphipod	9(9)	287(286)
1993 Amphipod	76(30)	693(235)
1988 Oyster	2(2)	56(56)
1993 Bivalve	9(3)	162(31)
1993 Echinoderm	35(29)	306(193)
1993 Larval	44(31)	405(204)
Total Inventory	85(39)	980(521)

tg4

4

How AETs are Computed

Chemical: Benzo(a)anthracene

CLASS.[1]	STATION	CONCENTRATION (PPB)
◘	EW-14	3200
■	EW-04	810
■	EW-10	620
■	EW-07	440
□	NG-10	310 ← AET
■	EW-01	160
◘	SR-07	120
□	EW-12	89
□	SR-04	68
□	SR-08	66
□	NG-14	42
■	OG-03	42
■	NG-06	35
□	SS-01	24
□	ES-03	23
□	SS-03	19
□	ES-01	16
◘	SD-02	14
□	ES-02	13
□	NG-01	11
■	NG-04	11
□	NG-12	7.0
□	NG-13	7.0
□	NG-02	5.0
□	SR-01	4.0
□	SR-02	4.0
■	NG-15	4.0
□	NG-03	4.0
□	SD-01	1.0

[1] station classification
- ■ Impacted
- □ Nonimpacted
- ◘ Inadequate power

Amphipod and Sediment Larval AETs: Summary of Observed Changes

Amphipod mortality AETs:

10 Increases
- Average 2.17
- Range 1.17 - 3.96

3 Decreases (within detection limits)
- Average 0.73
- Range 0.67 - 0.78

Larval abnormality (combined species):

6 Increases
- Average 1.75
- Range 1.04 - 2.82

25 Decreases (within detection limits)
- Average 0.41
- Range 0.10 - 0.89

New Highest AETs: Comparison to PSDDA Maximum Levels.

Chemical of Concern	1988 HAET	1993 HAET	Test Type	PSDDA ML
Cadmium	9.6	14	A	9.6
Lead	660	1,200	A	660
Mercury	2.1	7.3	A	2.1
Nickel	>140	140	A	
Silver	6.1	8.4	L	6.1
Zinc	1600	3,800	A	1,600
LPAH	24000	>29000	A	6,100
Phenanthrene	6,900	>21000	A	3,200
Chrysene	9,200	>21000	A	6,700
Dibenzo(a,h)anthracene	970	1,100	A	1,200
Dimethyl phthalate	>1400	1,400	A	
Bis(2-ethylhexyl) phthalate	>3100	3,100	A	
Hexachorobutadiene	270	140	A	290
N-Nitrosodiphenylamine	130	48	A	220
Ethylbenzene	>50	33	B	50
Total xylenes	>160	100	B	160

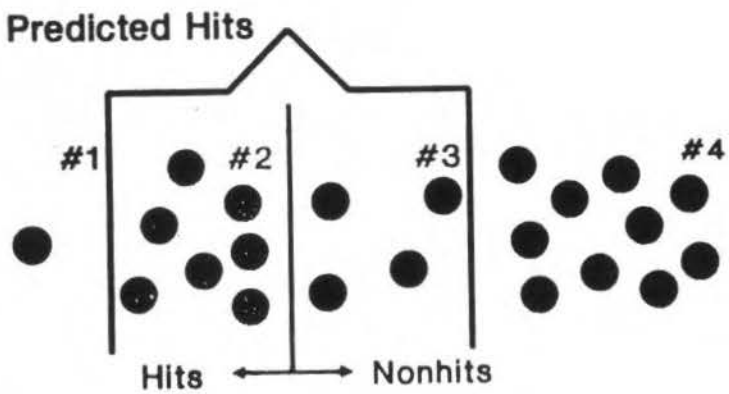
tg7

Comparison of PSDDA Screening Levels to Some New HAETs/10 and New LAETs.

Chemical of Concern	1988 LAET	1993 LAET	Test Type	PSDDA SL	1993 HAET/10 or LAET
Antimony	150	36	A	20	36
Mercury	0.41	0.41	M	0.21	0.41
Silver	>.56	>.56	L	1.2	>.56
LPAH	5200	1200	L	610	1200
Naphthalene	2100	230	L	210	230
Acenaphthylene	>560	71	L	64	71
Acenaphthene	500	110	L	63	110
Fluorene	540	110	L	64	110
2-Methylnaphthalene	670	64	L	67	64
Chrysene	1400	950	L	670	950
Benzo(a)pyrene	1600	1100	L	680	1100
2-Methylphenol	63	55	L	20	55
4-Methylphenol	670	190	L	120	190
Pentachorophenol	>140	>140	M	100	>140
Dibenzofuran	540	77	L	54	77
Total xylenes	40	>21	B	12	10
Cadmium	5.1	3.7	A	0.96	1.4
Lead	450	430	A	66	120
Dibenzo(a,h)anthracene	230	230	A	120	110

tg8

Criteria Reliability



Sensitivity = ● / (● + ●) = 88%

Efficiency = ● / (● + ●) = 64%

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

The predictive reliability of amphipod mortality AETs: comparison between 1993 and 1988 results.

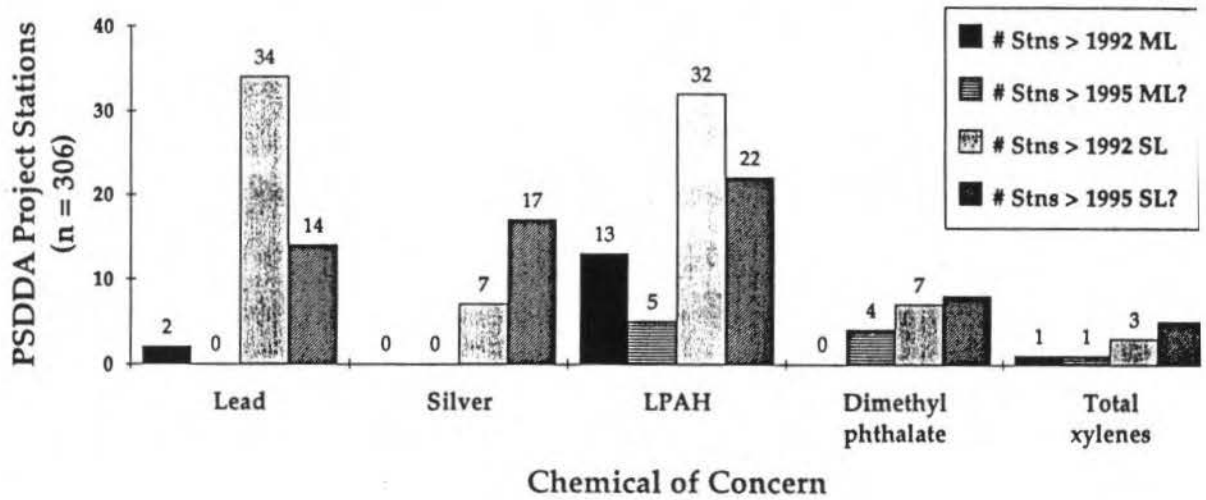
AET Data Set	Station Count	Sensitivity	Efficiency	Overall Reliability
Dry Weight-Normalized				
1988 Puget Sound AETs	287	58%	100%	85%
1988 "Independent" AETs	287	57%	67%	74%
1993 Puget Sound AETs	510	51%	100%	84%
1993 "Independent" AETs	NA	NA	NA	NA
TOC Normalized				
1988 Puget Sound AETs	287	45%	100%	80%
1993 Puget Sound AETs	478	35%	100%	77%
Mixed Normalization				
1988 Puget Sound AETs	287	55%	100%	83%
1993 Puget Sound AETs	NA	NA	NA	NA

The predictive reliability of Larval abnormality AETs: comparison between 1993 and 1988 results.

AET Data Set	Station Count	Sensitivity	Efficiency	Overall Reliability
Dry Weight Normalized				
1986 Oyster AET	56	88%	100%	96%
1986 "Independent" AET	56	88%	37%	50%
1993 Larval AET	170	40%	100%	65%
1993 "Independent" AET	170	42%	52%	43%
TOC Normalized				
1986 Oyster AET	56	71%	100%	91%
1993 Larval AET	160	49%	82%	61%
Mixed Normalization				
1986 Oyster AET	56	88%	100%	96%
1993 Larval AET	NA	NA	NA	NA

tg11

Stations Exceeding 1992 PSDDA MLs/SLs vs Some POSSIBLE New PSDDA MLs/SLs



tg12

Technical Tasks Remaining:

- Complete sediment Larval *abnormality+ mortality* AET and reliability calculations
- Calculate "pooled" reliability of new suite of AETs
- Compare to pooled reliability of 1988 AETs
- Complete draft technical report
- Complete analysis of implications
- Complete final technical report

tg13

Non-Technical/Policy Decisions, Activities Remaining:

- Re-incorporate certain data into final calculations?
- Use Larval *abnormality* and/or *abnormality+mortality* AETs for "pooled" reliability analysis?
- How to complete assessment of implications to regulatory programs?
- Convene Regulatory Work Group, reach consensus recommendations
- Begin PSDDA and SMS program review processes, including ample public review
- Adopt new regulatory sediment quality guidelines

tg14

PSDDA Suite of Bioassays

- Amphipod 10-day mortality
- Saline-extract Microtox luminescence
- Neanthes 20-day growth
- Sediment larval combined mortality and abnormality

df1

Amphipod Bioassay

- Reference sediment performance problems with *Rhepoxynius abronius*
- Analysis of non-treatment factors provided evidence of grain-size effects
- Substitution of *Ampelisca abdita* when fines content exceeds 60 percent (clarification paper at last year's ARM)
- DY94 experience with *Ampelisca*

df2

Ampelisca Data

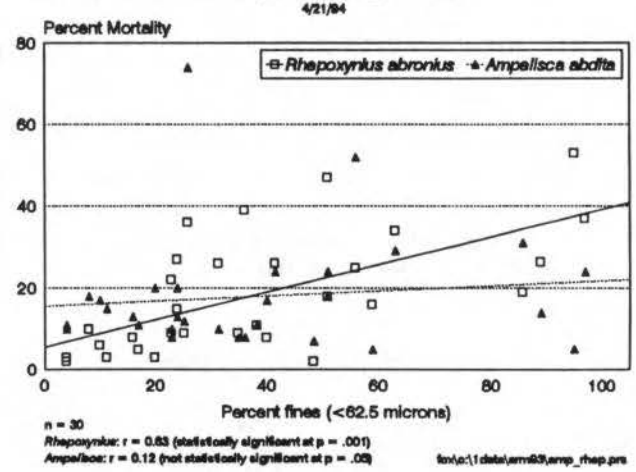
- *Ampelisca* used in 8 sediment surveys in Puget Sound and Grays Harbor
- Hits in 2 surveys
- Performance problems in 2 surveys
- Side-by-side testing with *Rhepoxynius abronius* in 5 surveys
- Reference toxicant results were similar to *Rhepoxynius abronius*

df3

Rhepoxynius vs *Ampelisca*

Side-by-side testing results

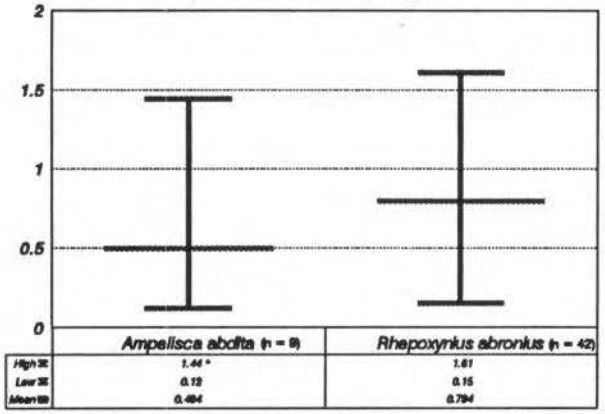
4/21/94



df4

Reference Toxicant Data

Ampelisca vs Rhepoxynius



	Ampelisca abdita (n = 9)	*Rhepoxynius abronius* (n = 42)
High %	1.44 *	1.61
Low %	0.12	0.15
Mean EC	0.484	0.794

*one outlier removed

Reference toxicant: cadmium chloride (mg/l)
(from DAIS database 4/20/94)

df5

PSDDA ARM - May 6, 1994

Neanthes Data

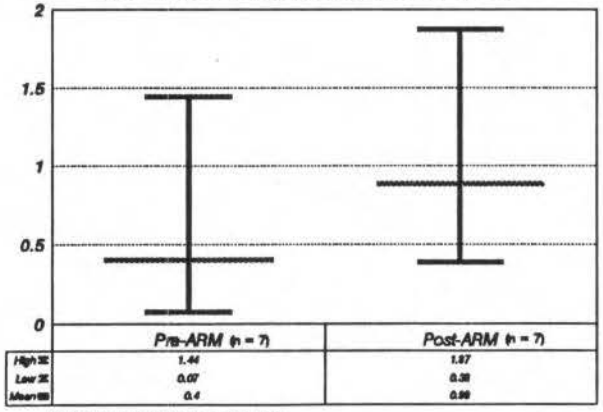
- PSDDA agencies instituted use of the *Neanthes* 20-day biomass test two years ago
- The biomass test has been used in 13 sediment surveys in Puget Sound and Grays Harbor
- Hits in 3 surveys
- Reference sediment performance problems in 3 surveys
- Excessive mortality has not occurred

Neanthes Bioassay Review

df6

Neanthes 20-day Mean Initial Weight

*Pre- vs Post-1993 ARM Clarification**



	Pre-ARM (n = 7)	*Post-ARM* (n = 7)
High %	1.44	1.87
Low %	0.07	0.38
Mean EC	0.4	0.99

*The 1993 ARM clarification established 0.5 mg as the minimum mean worm size recommended for use

(from DAIS database 4/22/94)

df7

PSDDA ARM - May 6, 1994

Neanthes Clarification Paper

- Adoption of the growth endpoint:

$$G = \frac{DWt - DWi}{T}$$

Where:

- G = individual growth rate (mg dry wt/day)
- DWt = individual dry wt at termination (mg)
- DWi = mean individual dry wt at initiation (mg)
- T = exposure time (days)

Neanthes Bioassay Review

df8

Microtox

- Problems with light-enhancement and perceived lack of sensitivity
- PSDDA agencies committed to evaluating the Microtox solid-phase protocol at last year's ARM
- Technical Work Group meeting was held in July 1993
- Solid-phase demonstration was conducted by Microbics Corporation

df9

Technical Work Group Meeting - July 1993

- Representatives from PSDDA agencies, PSWQA, bioassay laboratories, Microbics Corporation
- PSDDA data review and protocol evaluation
- Microbics pointed out potential protocol problems: saltwater carryover, sample preparation variability and pipetting errors. Proposed use of the 100% protocol if the saline extract test is continued.
- Microbics agreed to perform solid-phase protocol demonstration. Recommended round-robin testing before implementation.

df10

Microbics Solid-Phase Demonstration

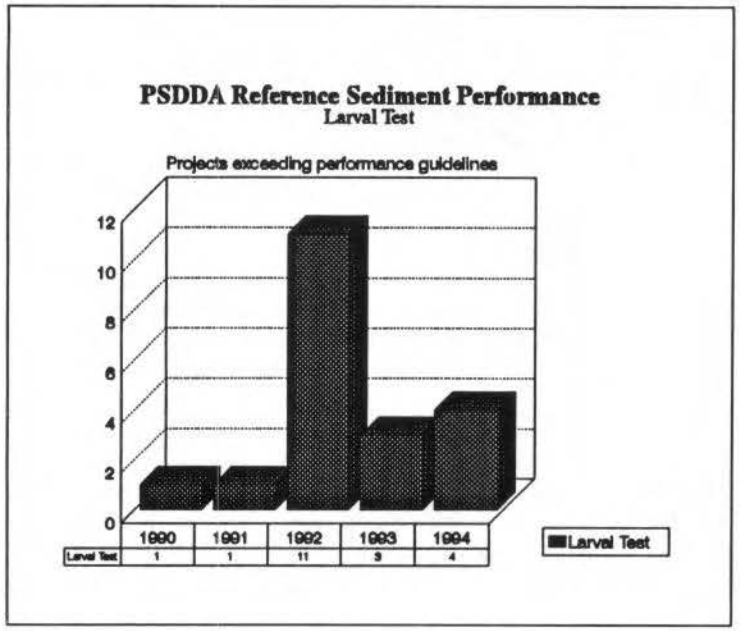
- Solid-phase protocol run side-by-side with 100% protocol for 3 sediments from a PSDDA project, 2 Carr Inlet reference sediments and West Beach sediment.
- Light enhancement with 100% protocol
- Equivocal results with the solid-phase test: no dose response for West Beach but similar dose response for test and reference sediments (complication: test sediments were not as contaminated as predicted)
- Additional work will be required to evaluate the utility of the solid phase test

df11

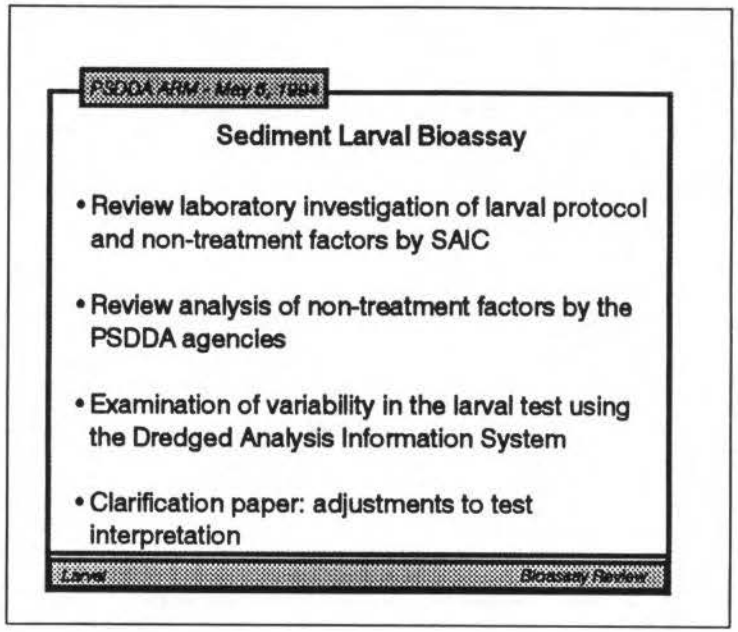
Sediment Larval Bioassay

- Problems with reference sediments meeting the performance standard of 20% control-normalized combined mortality and abnormality
- Consequences:
  - → use of BPJ in data interpretation
  - → retest required
  - → resampling prior to retest

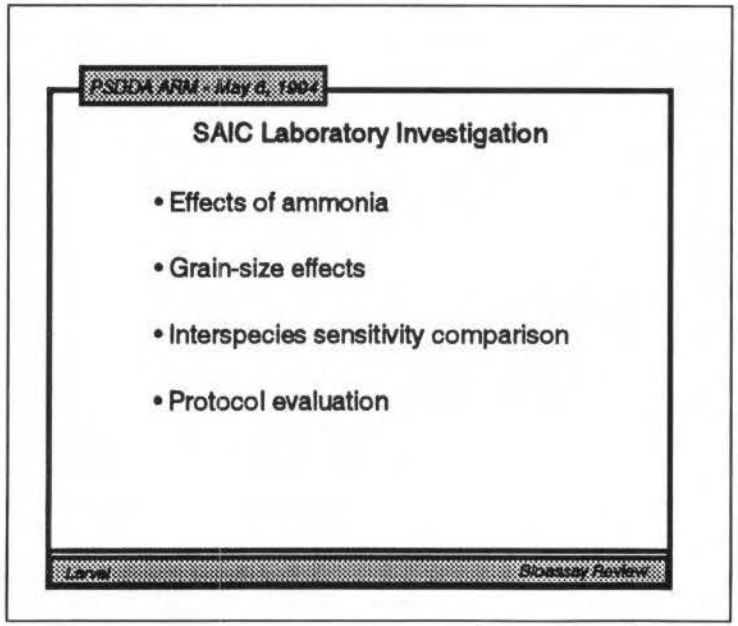
df12



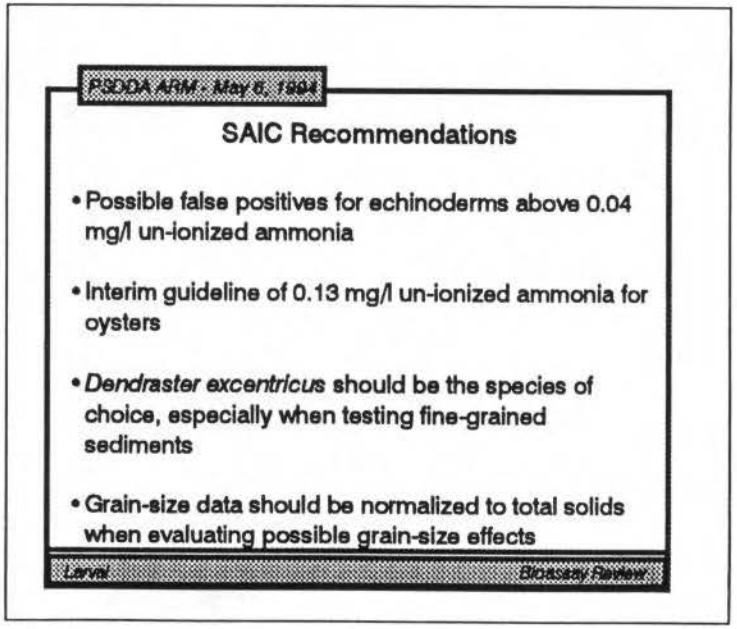
df13



df14



df15



df16

SAIC Recommendations (continued)

- Maintain current protocol with 4-hour settling time
- Aerate routinely
- Continue use of the combined mortality/abnormality endpoint

df17

Analysis of Non-treatment Factors

- Un-ionized ammonia levels were calculated from data in the Dredged Analysis Information System (DAIS)
  - → No exceedances of the 0.04 mg/l guideline for echinoderms or the 0.13 mg/l interim guideline for oysters were found
- Correlation analysis was conducted for many non-treatment factors
  - → No non-treatment factor, including solids-normalized grain-size fractions, was significantly correlated with the combined larval endpoint for reference sediments

df18

Examination of Variability

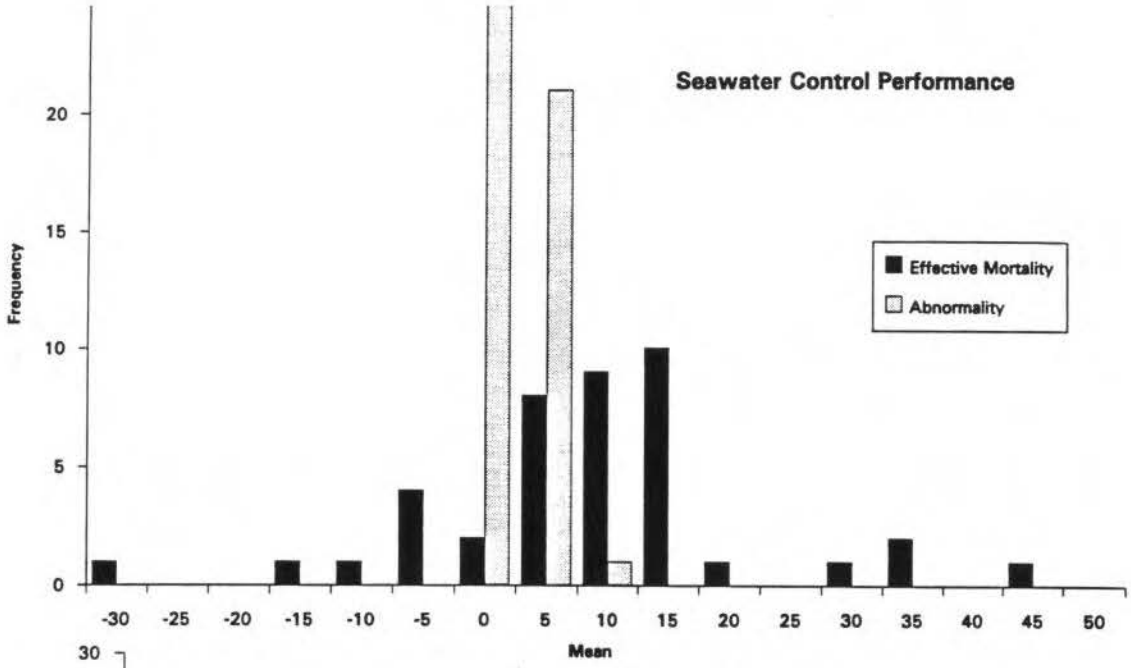
- Negative seawater control abnormality and combined mortality and abnormality
- Reference and test sediment combined mortality and abnormality

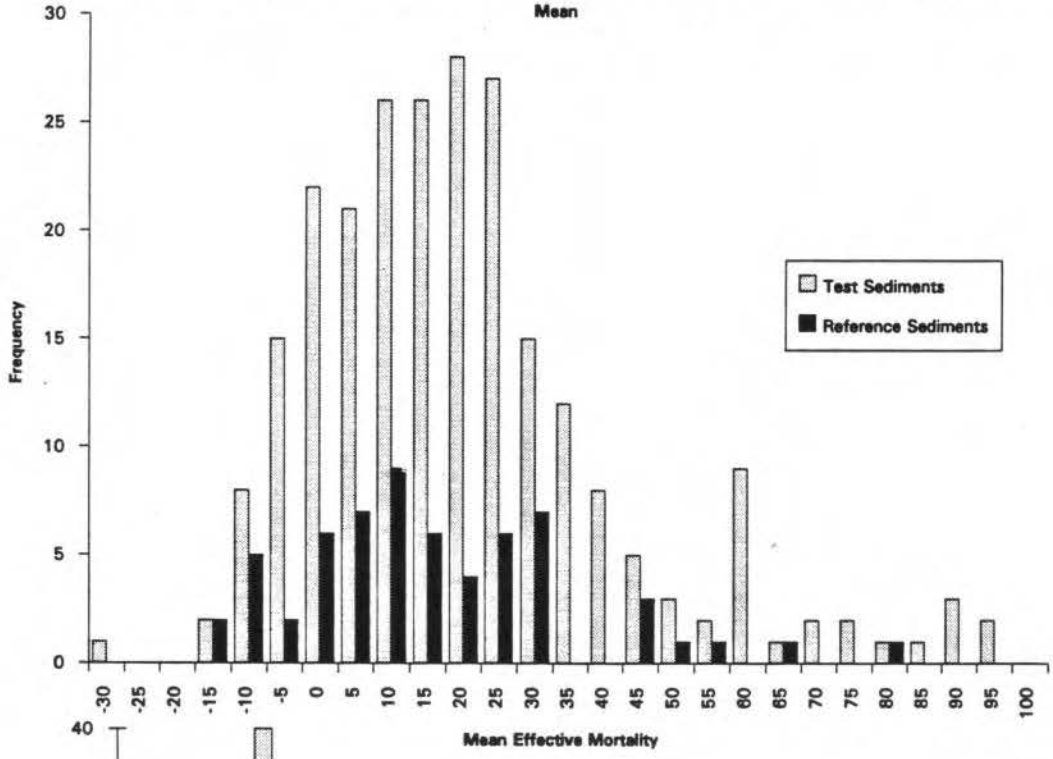
df19

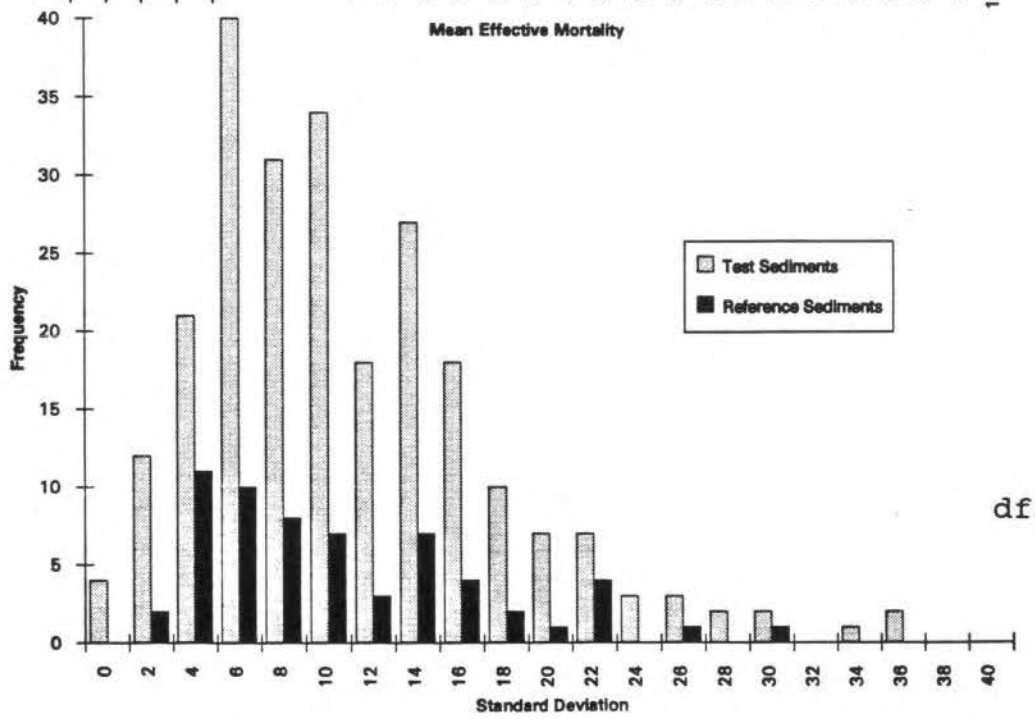
Current Performance Standards

- Negative seawater control:
  - abnormality $\leq$ 10%
  - combined mortality and abnormality $\leq$ 50%
- Reference sediment:
  - control-normalized combined mortality and abnormality $\leq$ 20%

df20


Seawater Control Performance
Effective Mortality
Abnormality
Frequency
Mean


Test Sediments
Reference Sediments
Frequency
Mean Effective Mortality


Test Sediments
Reference Sediments
Frequency
Standard Deviation

df21

Clarification Paper

- Performance standard adjustments
- Adjustments to ensure adequate statistical power

df22

Performance Standard Adjustments

- Adjust negative seawater control performance standard to match PSEP
- Increase allowable seawater-normalized combined mortality and abnormality from 20% to 35% for reference sediments

df23

Adjustments to Ensure Statistical Power

- Adjust the alpha level from 0.05 to 0.10 for the sediment larval test only
- For non-hits, calculate the power of the test if the test or reference sediment SD > 20%
- Reject data if the power is less than 0.60 with the minimum detectable difference set at 20%

df24

Reality Check

Guideline	Current Guideline	Rejected Sediments	Proposed Guideline	Rejected Sediments
Seawater Control	50% EM	0 (n=41)	30% M	4 (n=41)
Reference Sediment	20% NEM	24 (n=61)	35% NEM	7 (n=61)

NEM = normalized effective mortality

df25

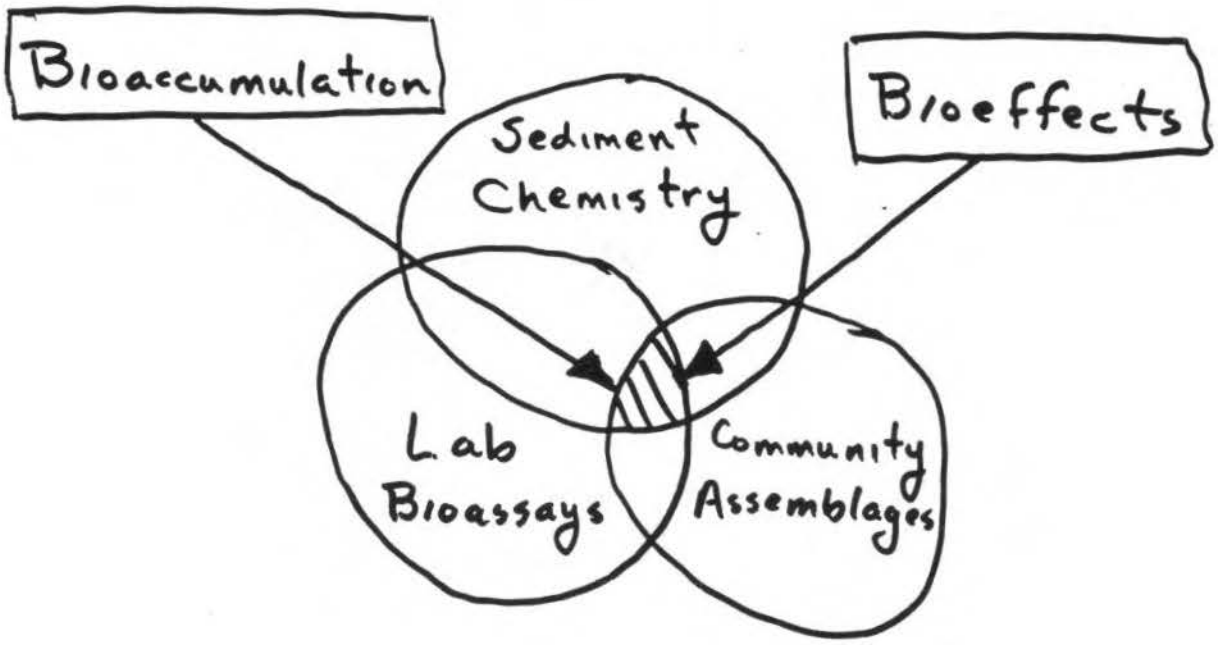
Approach

1. Source identification
2. Short- & long-term trends
3. Temporal & spatial variability
4. Site-specific differences
5. Dose-response estimates

ms1

Michael Salazar

Beyond the Triad



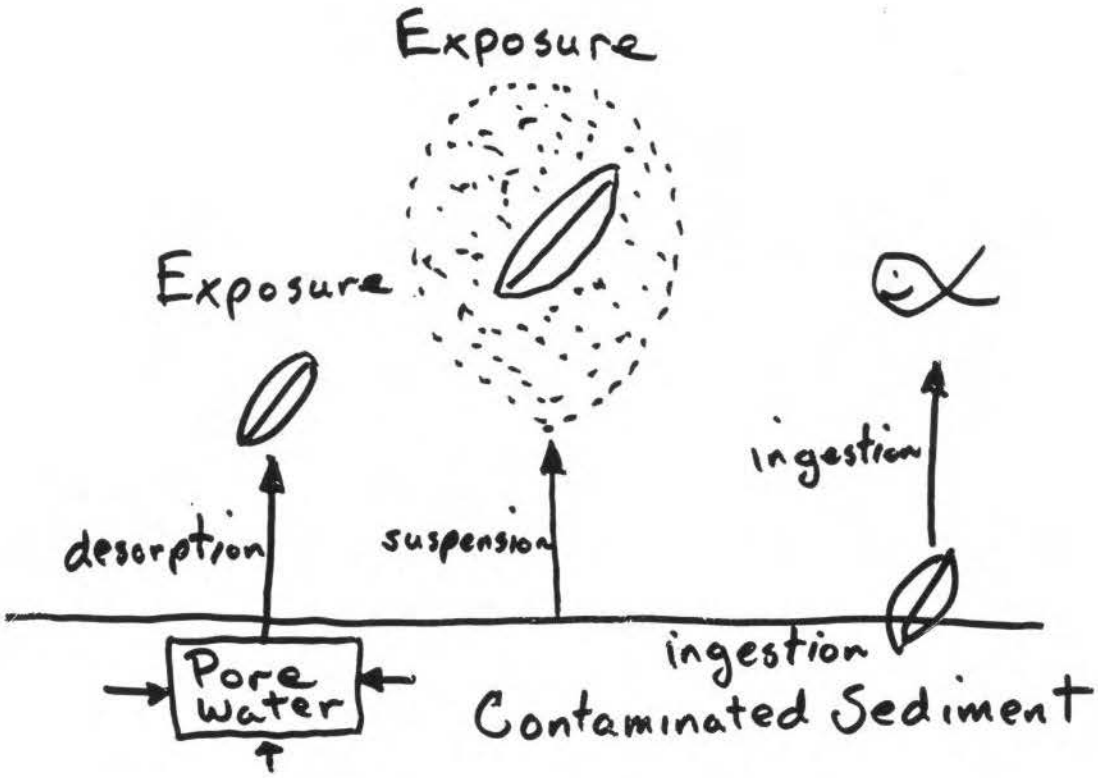
ms2

Previous Work

1. DDT in So Calif. sediment
2. Calif. Mussel Watch
3. NOAA NS&T
4. TBT & PAH in Bermuda
5. Exxon Valdez
6. Harbor Island Superfund Site
7. Black Rock Harbor

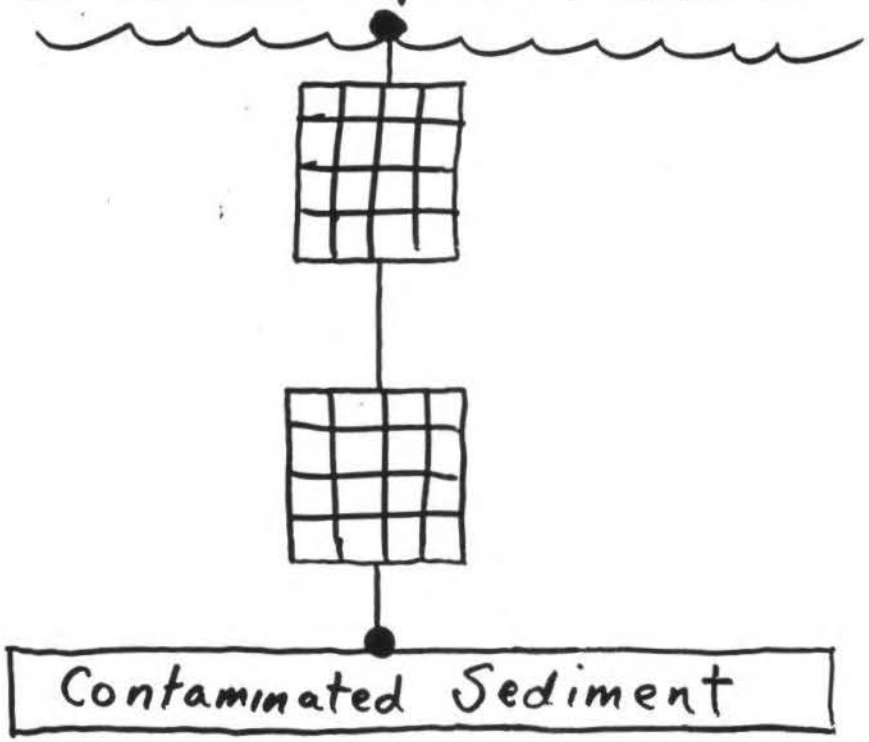
ms3

Bivalve Exposure



ms4

In-Situ Bioassays: Transplanted Mussels to Estimate Exposure & Bioeffects



Advantages

1. Biomonitoring space & time
2. Laboratory control
3. Field realism

ms5

Suggestions to PSDDA

1. Incorporate in-situ bioassays
2. Measure bioaccumulation & bioeffects
3. Evaluate overlying water
4. Conduct a pilot study

Mike Salazar
NOAA Bioeffects Branch
(206) 526-4343

ms6

ISSUE PAPER:

REFINEMENTS TO BIOACCUMULATION TESTING REQUIREMENTS: ADOPTION OF SECOND TEST SPECIES FOR CONSISTENCY WITH NATIONAL GUIDANCE.

dk8

The current PSDDA Program bioaccumulation guidance specifies conducting a single 28-day bioaccumulation test with the facultative deposit-feeding bivalve Macoma nasuta.

dk9

Interpretive Guidance

Human Health Assessment:
EPTA (1988) and Phase II MPR (1989).

Ecological Effects Assessment:
Statistical comparison with reference sediment.

dk10

Current Guidance specified in 1991 "Greenbook" (Ocean Dumping Manual) and 1994 draft Inland (404) Testing Manual recommends conducting bioaccumulation tests using appropriately sensitive species from two trophic niches:

- suspension-feeding / filter-feeding organism
- burrowing deposit-feeding organism

dk11

1994 draft Inland Testing Manual guidance states as follows:

"Two species should be used in bioaccumulation testing where possible, unless adequate regional data are available to justify single species testing."

dk12

Rationale for testing two species:

"...to cover the range of differing species contaminant accumulation and to be environmentally protective."

dk13

The 1991 "Greenbook" (Ocean Dumping Manual) specifies:

" The present recommendation is that a burrowing polychaete and a deposit-feeding bivalve mollusc be tested. These two organisms satisfy the requirements specified in paragraph 227.27(d) and are relevant to evaluating contaminant bioavailability at disposal sites."

dk14

Species characteristics to be considered when selecting bioaccumulation species:

- availability (seasonally or year-round)
- adequate biomass for analysis
- organism ingests sediments (deposit feeder / suspension feeder)
- important ecologically, economically, and/or recreationally
- tolerates handling and laboratory conditions
- related phylogenetically and/or by ecological requirements to species characteristic of the disposal site area in the season of the proposed discharge
- inefficient metabolizers of contaminants, particularly PAH

dk15

Table 13. Candidate Test Species for Determining Potential Bioaccumulation from Whole Sediment Tests. Details of testing procedures are provided in Appendix E.

Polychaetes	**Bivalves**
*Neanthes arenaceodentata** (N)	Macoma clam, *Macoma nasuta**(N)*
*Nereis virens** (N)*	Yoldia clam, *Yoldia limatula* (N)
Arenicola marina (N)	
	Crustaceans
Oligochaetes	*Diporeia* sp. (F)
Lumbriculus variegatus (F)*	
Insect Larvae	
Mayfly, *Hexagenia limbata* or sp. (F)	

Note: Examples are not presented in order of importance; however, the asterisks indicate recommended benchmark species. Other species may be designated in future as benchmark species by EPA and USACE when the data on their response to contaminants are adequate. Only benthic species should be tested. Although sediment ingesters are preferable, intimate contact with sediment is acceptable.

Only tests which do not require feeding of the organisms are included. Feeding is a research issue; for the present, food is not to be added because it provides additional organic carbon and can alter contaminant partitioning during testing.

For the purpose of this manual, related to the tolerances of the test animals, (F) = Freshwater, salinity ≤ 1‰ (N) = Near Coastal, salinity ≥ 25‰ (E) = Estuarine, salinity 1-25‰. It is recognized that the commonly accepted salinity range for estuaries is 1-35‰ and near coastal water is usually greater than 30‰ salinity.

* *Macoma nasuta* and *Nereis virens* bioaccumulation tests are in the process of standardization by EPA; it is expected that these will, in future, be the primary benchmark species for near coastal waters. Further, these two species can be used in estuarine waters down to low levels of salinity.

dk16

Problem Identification:

PSDDA Program lack of consistency with current guidance recommended by "Greenbook" and proposed guidance in draft Inland Testing Manual to test two appropriately sensitive species from two trophic niches represented by "filter feeding/suspension feeding oranism" and a "burrowing deposit feeding organism" (1977 Ocean Dumping Regulations: 40 CFR paragraph 227.27(d); 1980 404(b)(1) Guidelines: 40 CFR part 230, paragraph 230.61).

dk17

Proposed Action / Modification

Add an additional bioaccumulation test to the current test suite. The addition would include a 28-day bioaccumulation test using a deposit-feeding adult polychaete (Nereis virens or Arenicola marina). This would augment the existing 28-day bioaccumulation test with the facultative deposit-feeding / suspension feeding bivalve Macoma nasuta.

dk18