SEDIMENT MANAGEMENT ANNUAL REVIEW MEETING
MAY 5, 2004

MEETING MINUTES

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List of Acronyms and Abbreviations

AET	Apparent Effects Threshold
BCOC	Bioaccumulative chemicals of concern
BT	Bioaccumulation trigger
CAD	Confined Aquatic Disposal
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CSMP	Cooperative Sediment Management Program (Washington State)
cy	Cubic yard(s)
DDT	Dichloro-diphenyl-trichloroethane
DMEF	Dredged Material Evaluation Framework
DMMP	Dredged Material Management Program
Ecology	Washington State Department of Ecology
EDC	Endocrine disrupting chemicals
EMAP	Environmental Monitoring and Assessment Program
EPA	U.S. Environmental Protection Agency
ERDC	Environmental Resources Development Center (formerly known as WES)
ESA	Endangered Species Act
GP	Georgia Pacific Corporation
IM	Information management
ISIS	Integrated Site Information System
LAET	Lowest Apparent Effects Threshold
ML	Maximum level
MWAC	Middle Waterway Action Committee
NEPA/EIS	National Environmental Policy Act/Environmental Impact Statement
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Association
NPDES	National Pollutant Discharge Elimination System
ODEQ	Oregon Department of Environmental Quality
PAH	Polycyclic aromatic hydrocarbon
PBDE	Polybrominated diphenyl ether
PCB	Polychlorinated biphenyl
ppb	Parts per billion
PSAMP	Puget Sound Ambient Monitoring Program
PSDDA	Puget Sound Dredged Disposal Analysis
PSNS	Puget Sound Naval Shipyard

PSR	Pacific Sound Resources
PSWQAT	Puget Sound Water Quality Action Team
RI/FS	Remedial investigation/feasibility study
RSET	Regional Sediment Evaluation Team
SAIC	Science Application International Corporation
SEDQUAL	Sediment Quality Information System
SL	Screening level
SMARM	Sediment Management Annual Review Meeting
SMS	Sediment Management Standards
SMU	Sediment Management Unit
SVOC	Semi-volatile organic compound
SVPS	Sediment vertical profile system
TBT	Tributyltin
USACE	United States Army Corps of Engineers
USDOT	United States Department of Transportation
USFWS	United States Fish and Wildlife Service
WDFW	Washington State Department of Fish and Wildlife
WDNR	Washington State Department of Natural Resources
WES	USACE Waterways Experiment Station (now ERDC).

SEDIMENT MANAGEMENT ANNUAL REVIEW MEETING MINUTES

The Cooperative Sediment Management Program (CSMP) held its annual review of dredging/disposal and sediment management issues on May 5, 2004. This Sediment Management Annual Review Meeting (SMARM) was hosted by the Washington State Department of Ecology (Ecology) and was held at the Comfort Inn Conference Center located in Tumwater, Washington. The SMARM encompassed both the Dredged Material Management Program (DMMP) annual review meeting and Ecology's Sediment Management Standards (SMS) annual review process. The DMMP is an interagency cooperative program for dredged material management that began with the Puget Sound Dredged Disposal Analysis Program (PSDDA) and has expanded to other regions of Washington State. The DMMP agencies include the Seattle District U.S. Army Corps of Engineers (USACE); the U.S. Environmental Protection Agency (EPA), Region 10; the Washington Department of Natural Resources (DNR); and Ecology. The meeting agenda is provided as Attachment 1, the list of attendees is provided as Attachment 2, and the presentation materials of the individual speakers are provided as Attachment 3.

Welcome and Opening Remarks

1. Wayne Wagner, USACE, Seattle District. Mr. Wagner started the meeting with talk of preliminaries, such as name tags, signing in, location of the bathrooms, and lunch locations. He finished with an introduction of Colonel Debra Lewis, Commander, USACE, Seattle District.

Colonel Lewis welcomed the meeting participants and spoke of her passion for sediment and light-weight aggregate. She reminded the audience of the dire circumstances that brought forward the need to have such a meeting, and how it makes what we are doing that much more important. While acknowledging the difficulties of today's economy and public environment, she stressed the importance of collaboration and teamwork to continue the effort of cleaning up the contaminated sediments.

Linda Hoffman, Director of Ecology, then gave a brief recap of sediment management in the state of Washington since the birth of SMS in 1991. The first list of contaminated sediment sites was published in 1996 and the most current version in 2003. Out of 133 sites on the 2003 list, 110 are marine sites, and 23 are freshwater sites; two-thirds of all sites are in the cleanup process. A third of the marine sites are not currently in the process of being cleaned up because they have either already undergone cleanup, or no action was necessary at those sites.

Ms. Hoffman emphasized that it is important for the state to continue with sediment cleanup because it is critical to the health of our water bodies, especially Puget Sound. Since last year's meeting, progress has been made on cleaning up the Puget Sound Naval Shipyard Superfund site. Work is ongoing in Bellingham Bay and has begun to focus on Whatcom Waterway.

Ecology is spearheading the effort to create a set of freshwater guidelines for use in Washington State. The Toxics Cleanup Program-Sediment Management Unit (SMU) at Ecology has been improving its information management systems and is working with the agency as a whole to improve intra- and inter-agency sharing of information. In addition to the freshwater guidance, Ecology is also working on guidance for dealing with wood waste issues.

Ms. Hoffman then summarized the purpose for the meeting.

1. Report the status of agencies
2. Update what is happening in science
3. Introduce proposals for changes
4. Provide a forum for those outside the realm of sediment management to bring forth issues for agency consideration

Mr. Wagner acknowledged the individual members of the Panel representing the DMMP agencies and the SMS program. Panel members included:

- Loren Stern – WDNR
- John Malek – EPA
- Kathryn DeJesus – Ecology
- David Kendall – USACE

Mr. Wagner stated that the meeting was being sponsored jointly by the DMMP agencies and the SMS program, with Ecology acting as host and the USACE acting as moderator. The objectives of the meeting were then reiterated by Mr. Wagner before turning the floor over for the agency reports.

Slides

PP 0.1	Sediment Management Annual Review Meeting
PP 0.2	2003 SMARM
PP 0.3-4	Meeting Objectives and Purpose
PP 0.5-6	Agency Summary Reports

PP 0.7-8	DMMP/SMS Presentations
PP 0.9	Regional Sediment Team Update
PP 0.10	Topical Presentations
PP 0.11	Public Issue Papers
PP 0.12	Summary and Closing

AGENCY SUMMARY REPORTS

1. Summary of DMMP Testing Activities (Lauran Warner, USACE). Ms. Warner provided a summary of DMMP testing activities on behalf of the USACE. She began with her own explanation of why the Sediment Management Annual Review Meeting (SMARM) occurs year after year, referring to the state of Elliott Bay approximately 100 years ago and referencing "The Imperiled Sound" article published 20 years ago in *The Seattle Times* on the declining health of Puget Sound. In response to the crisis, the PSDDA and the DMMP began. Twenty years after the *Seattle Times* report, Washington State and the Northwest currently lead the nation in interagency coordination; however, progress is ongoing and at times slow.

Ms. Warner provided an overview of modifications to the PSDDA guidelines that have occurred in the past year. The Bioaccumulative Chemicals of Concern (BCOC) list has been updated and new screening level (SL), bioaccumulation trigger (BT), and maximum level (ML) tables have been created; some contaminants were added, some removed, others had value adjustments. The definition of dredged material has been more clearly defined from the original regulations but still remains flexible. Pre-dredge conferences were held for Grays Harbor and Willapa Bay Projects to coordinate with contractors and applicants (Ms. Warner stated that this is more important than it looks). She also spoke about the importance of determining recency guideline exceedances and how to test when they occur.

Ms. Warner then summarized testing activities associated with the 2004 dredging year (June 16, 2003 to June 15, 2004). Over 1 million cubic yards (cy) were dredged; eight suitability determinations and five recency evaluations were performed. All projects passed except two, which equates to a little over 1 percent that were not suitable for open water disposal. No bioaccumulation testing was required for any of the projects.

The major projects of 2004 were the Upper and Lower Snohomish turning basins, the Blair Bridge Reach, and the Port of Peninsula in Willapa Bay. Recency extensions, which required no further testing, were given to Puget Sound Naval Shipyards, East Waterway-subsurface, Padden Creek, and Glacier NW-Lower Duwamish. The East Waterway had a few surface samples fail and therefore did not qualify for open water disposal. Other areas

that had changes included Blair Waterway, the Pacific Sound Resources (PSR) site in Elliott Bay, and Lower Duwamish Superfund site. Many projects are ongoing and upcoming, see slides for full list.

Ms. Warner then discussed potential issues to be dealt with in the near future. Invasive species are increasingly coming to the forefront and there is no guidance in how to deal with them. Freshwater guidelines are being developed by Ecology and the Oregon Department of Environmental Quality (ODEQ). The Regional Sediment Evaluation Team (RSET), the newest portion of the DMMP, has been founded and is beginning its development. Beneficial uses for clean dredged material are continuously being explored; these range from capping to beach nourishment, and building up deltas and nearshore areas. As beneficial uses increase and divert dredged material from DMMP sites, funding from fees decreases, and this could become a long-term issue.

For more information, Ms. Warner referred the audience to the USACE website (PP 1.21).

There were no questions.

Slides

PP 1.1	Dredging Year 2004 Testing Activities
PP 1.2	Historical Photograph of Seattle
PP 1.3	Photograph of Outfall
PP 1.4	Photograph of "The Imperiled Sound" article from *The Seattle Times*
PP 1.5	20 Years Later
PP 1.6-7	The Big Picture
PP 1.8	Modifications since the last SMARM
PP 1.9	2004 Testing and Evaluation
PP 1.10	Dredging Year 2004 Characterizations
PP 1.11	Dredging Year 2004 Findings
PP 1.12	2004 Big Ones
PP 1.13-14	2004 Recency Extensions
PP 1.15	Project Changes and Trends
PP 1.16-17	Ongoing/Future Projects
PP 1.18	Future Challenges
PP 1.19	Upcoming Issues
PP 1.20	Beneficial Uses
PP 1.21	For more DMMP information

2. Summary of DNR Disposal and Monitoring Activities (Peter Leon, DNR). Mr. Leon presented the results from the 2003 Tiered Full Monitoring at the Commencement Bay DMMP Disposal Site. He began the review by thanking John Nakayama of Science Applications International Corporation (SAIC) for support in the monitoring effort. The monitoring framework is based on three questions:

- Does dredge material remain on site?
- Has dredge material disposal caused biological effects conditions to be exceeded?
- Are unacceptable adverse effects occurring off site due to disposal?

Puget Sound has eight DMMP disposal sites, and the 2003 study focused solely on the Commencement Bay site located off Brown's Point in Tacoma. The site is in 550 feet of water, is oval in shape, and is approximately 4,600 by 3,800 feet with a circular waterline disposal target 1,200 feet in diameter. Tiered monitoring uses a variety of tools to assess the questions at hand: sediment vertical profile system (SVPS) imagery, sediment chemistry, benthic infauna, bioassays, and tissue chemistry.

Mr. Leon gave a brief overview of past monitoring activities at the Commencement Bay site, including the 1988 baseline study, 1996 summary, 1998 SVPS summary, and 2001 full monitoring event.

He discussed in detail the results of the 2003 monitoring. SVPS was used at 64 stations, and sediment, tissue, and benthic monitoring stations were spread amongst approximately a dozen stations. The DMMP agencies had established six hypotheses around the monitoring. Hypothesis #1, that dredge material remains on site was rejected through the use of SVPS imagery, though the footprint is smaller than in 2001. Sediment chemistry was also discussed. The conventional parameters were comparable to previous years. No metals exceeded guidelines and all organics were non-detects, except for hexachlorobenzene, dichloro-diphenyl-trichloroethane (DDT), and a few semi-volatile organic compounds (SVOCs). Benchmark analysis was triggered by the SVOC exceedances, but all stations passed bioassay testing. Field variance was acceptable for most chemicals. Some metals triggered benchmark analysis for tissue samples, but again all bioassays passed. The benthic community increased in both taxa and abundance from previous years.

The hypotheses:

- Hypothesis 1-rejected: dredged material does not remain on site
- Hypothesis 2-rejected: chemistry levels increased off site due to disposal
- Hypothesis 3-accepted: onsite chemical concentrations do not exceed guidelines
- Hypothesis 4-accepted: sediment toxicity does not exceed guidelines

- Hypothesis 5-accepted: no increase in chemical burden of benthic taxa
- Hypothesis 6-accepted: no decrease in abundance of benthic taxa

Mr. Leon concluded his talk by discussing future activities in Commencement Bay. With the current rate of disposal at the site, the limit will likely be reached by 2007. The site will be monitored again this summer.

There were no questions.

Slides

PP 2.1	2003 Tiered Partial Monitoring at the Elliott Bay Disposal Site
PP 2.2	Monitoring Framework
PP 2.3	Agenda
PP 2.4	DMMP Sites in Puget Sound
PP 2.5	Commencement Bay Disposal Site
PP 2.6	Tiered Full Monitoring Framework
PP 2.7	2003 Modifications
PP 2.8	Summary of 1988 Baseline Conditions
PP 2.9	Summary of 1995 “Full”
PP 2.10	Summary of 1996 “Partial”
PP 2.11	Summary of 1998 SVPS
PP 2.12	Summary of 2001 “Full”
PP 2.13	2003 Results
PP 2.14	SVPS, Sediment & Tissue
PP 2.15	Sediment Vertical Profile System (SVPS)
PP 2.16	Dredged Material Footprint
PP 2.17	Sediment Chemistry: Conventionals and Metals
PP 2.18-19	Sediment Chemistry: Organics
PP 2.20	Sediment Chemistry: BCOCs
PP 2.21	Sediment Chemistry: Field Variability
PP 2.22	Tissue Chemistry
PP 2.23	Bioassays
PP 2.24	Benthic Community Analysis
PP 2.25	Benchmark Station Analyses
PP 2.26	Evaluation of 2002 Data
PP 2.27	Question 2
PP 2.28	Question 3
PP 2.29	Future Activities at Commencement Bay
PP 2.30	DNR SUA Disposal Volumes DY 2004

3. Summary of SMS Cleanup/Source Control Activities (Kathryn DeJesus, Ecology). Ms. DeJesus of Ecology gave a summary of the SMS cleanup and source control activities, and the development of state freshwater sediment quality guidelines. Ms. DeJesus mentioned recent hiring activities in the SMU of the Toxics Cleanup Program (TCP) at Ecology, notable additions include Ted Benson, Gina Casteel, and David Sternberg. She also summarized the structure of the TCP, where the SMU is located, with a quick explanation and reminder of how there are four regional offices that manage sediments in addition to the headquarters office in Lacey, Washington.

The development status of Washington's freshwater sediment quality guidelines was summarized as currently being in phase 2. Phase 1 consisted of a review of existing North American guidelines. Ms. DeJesus stated that phase 2 resulted in the development and recommendation of revised Washington state freshwater sediment quality values based on AETs and a floating percentile method developed by Teresa Michelsen (Avocet Consulting) under contract to Ecology. An implementation plan to field test the new chemical values in freshwater environments is currently under development. Ms. DeJesus emphasized that no guidelines will be adopted without first being proven reliable in the field through extensive research.

Ms. DeJesus acknowledged that the SMU is also working on developing guidance on woodwaste, as more and more sites are undergoing woodwaste cleanups. They are working to understand the environmental impact and best tools available, including help with identification and assessment. She expects that Ecology will have guidance ready in the summer of 2005.

Ms. DeJesus briefly mentioned that Sediment Quality Information System (SEDQUAL) revision 5.0 will be available this summer and has many improvements over previous versions. The new version will allow for benthic triad analysis and contains mapping links.

Ecology's Integrated Site Information System (ISIS) list is being updated to include contaminated sediment-only sites and will contain a comprehensive list of all contaminated sites in the state.

Within Ecology, SMU is working with the Water Quality Program to update the 303(d) list on sediment impacted water bodies. There will be a 45-day public comment period in July for the 2004 list. The two programs are working together on source control to make sure National Pollutant Discharge Elimination System (NPDES) permits are not creating new sites through permitted discharges.

Ms. DeJesus went through a quick update of sites around the state that have undergone cleanups in the past year. Jackson Park-Ostrich Bay, a former Navy ammunition depot and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) site, has undergone extensive upland remediation, and marine sediment clean up is in the developmental stages. Bellingham Bay Pilot Project is ongoing. Notable sites in cleanup stages within Bellingham Bay include Gate 2 Boatyard and Whatcom Waterway. The Georgia Pacific (GP) Log Pond capping was very successful and exceeded expectations. The Lower Duwamish Waterway has undergone source control; 489 businesses were interviewed and 64 percent of those have taken action. The Duwamish Diagonal Project was completed and Boeing is working to reduce polychlorinated biphenyl (PCB) contamination.

Ms. DeJesus discussed the freshwater sites the eastern region office has in progress, such as the Spokane River (which is part of the Coeur d'Alene Superfund site) and Lake Roosevelt. Ten beach or shoreline areas in the Spokane River are to undergo sediment management or cleanup, and a health advisory has been issued against consumption of fish from the river. On the west side of the state, the Skykomish River was polluted by 100 years of railroad operations and a formal dispute resolution is currently in progress.

Websites for the various programs within the Toxics Cleanup Program are listed on the last slide of the presentation.

There were no questions.

Slides

PP 3-1	Sediment Management Under the Toxics Cleanup Program
PP 3.2	Chapter 173-204-120 WAC Anti-degradation Policy
PP 3.3-4	Sediment Management within Ecology's Toxic Cleanup Program
PP 3.5	Freshwater Sediment Guidelines
PP 3.6	Woodwaste Site Assessment and Cleanup Guidelines
PP 3.7	SEDQUAL Information System
PP 3.8	Contaminated Site Information…or mud matters, too
PP 3.9	Sediment Source Control
PP 3.10	Some Sediment Site Status
PP 3.11	Jackson Park Housing Complex
PP 3.12	Bellingham Bay Demonstration Pilot Remedial Activities
PP 3.13	Gate 2 Boatyard
PP 3.14	Whatcom Waterway – Bellingham

PP 3.15-16	Lower Duwamish Waterway
PP 3.17	Ecology Eastern Region Freshwater Sediment Projects
PP 3.18	Spokane River Basin
PP 3.19	Upriver Dam Site
PP 3.20	Spokane River Health Advisories
PP 3.21	Lake Roosevelt
PP 3.22	Skykomish River
PP 3.23	Web Sites

4. **Summary of Regional CERCLA Activities** (Lori Cohen, EPA Region 10). Ms. Cohen started her summary of CERCLA cleanup activities by thanking all those involved for their cooperation in the cleanup efforts. Over half a million cy (~166 acres) of contaminated sediments have been removed from Puget Sound under Superfund. The general approach of Superfund sediment work is to seek input from the community on cleanup plans, comply with the Clean Water Act, coordinate with natural resource agencies to create habitat, and fund projects by responsible parties.

Ms. Cohen then proceeded to recap the sediment cleanup work that Puget Sound underwent in 2003. Harbor Island Superfund site is an ongoing site; the West Waterway needs no further action after extensive studies by EPA, but Lockheed, Todd, PSR, and East Waterway all still require action. Approximately 250,000 cy of sediment, contaminated primarily by PCBs and metals, will be dredged from the East Waterway by the Port of Seattle. Former Lockheed Shipyard had 52,000 cy of dredged material, 7,000 piles, 10,000 tons of treated pilings, 13,000 tons of concrete, and 70 tons of scrap metal removed. Post cleanup monitoring data found that some contamination remained in place; therefore, work will continue into a second season. PSR, a 58-acre site with woodwaste-, PCB-, and metals contamination, had 800 piles removed, subtidal and intertidal areas dredged and/or capped, and intertidal habitat created.

Ms. Cohen went on to summarize cleanup activities for the Commencement Bay Superfund site. Thea Foss Waterway had 7,500 cy of dredged material removed, placement of a 3-foot cap, and a sheet pile wall installed. Ms. Cohen mentioned that the mouth of the Thea Foss Waterway will be cleaned up this year. Middle Waterway had 100,000 cy of material dredged and 4.5 acres capped. Ms. Cohen stated, after the cap was determined not to be effective, the mouth of the Hylebos Waterway and Blair Slip 1 are anticipated to be cleaned up next year and source control has continued. The head of the Hylebos Waterway had intertidal work completed last year.

Cleanup work planned for 2004 includes: Todd Shipyards, Thea Foss Waterway, the head of Hylebos Waterway, and the head of Middle Waterway. The Lower Duwamish Waterway and Portland Harbor are currently in the remedial investigation/feasibility study (RI/FS) process. Both are emphasizing source control before beginning remediation work.

There were no questions.

Slides

PP 4.1	Sediment Management Annual Review Meeting
PP 4.2	General Approach of Superfund Sediment Work
PP 4.3	Puget Sound Sediment Cleanup Work Completed 2003
PP 4.4	Map of Lower Duwamish Waterway
PP 4.5	East Waterway
PP 4.6	Photo of Dredging Work in East Waterway
PP 4.7	Lockheed Shipyard
PP 4.8	Before Aerial Photo of Lockheed Shipyard
PP 4.9	After Aerial Photo of Lockheed Shipyard
PP 4.10	Before Photo of Site of Lockheed Shipyard
PP 4.11	Before Photo of Site of Lockheed Shipyard
PP 4.12	Before Photo of Site of Lockheed Shipyard
PP 4.13	After Photo of Site of Lockheed Shipyard
PP 4.14	Pacific Sound Resources
PP 4.15	Map of PSR Site in Elliott Bay
PP 4.16	Photo of PSR Site prior to cleanup
PP 4.17	Photo of Nesting Purple Martens
PP 4.18	Photo of PSR Site after cleanup
PP 4.19	Puget Sound Naval Shipyard
PP 4.20	Enhanced Natural Recovery for Operable Unit B
PP 4.21	Commencement Bay Nearshore/Tideflats Superfund Site
PP 4.22	Photo of Commencement Bay
PP 4.23	Thea Foss Waterway
PP 4.24	Middle Waterway
PP 4.25-27	Photo of Mouth of Middle Waterway Before Remediation
PP 4.25-27	Photo of Mouth of Middle Waterway During Remediation
PP 4.25-27	Photo of Mouth of Middle Waterway After Remediation

PP 4.28	Mouth Hylebos/Blair Slip 1
PP 4.29	Head of Hylebos
PP 4.30	Photo of Hylebos Sites in Progress
PP 4.31	Cleanup Work Planned for 2004
PP 4.32	Todd Shipyard
PP 4.33	Cleanup Work Planned for 2004
PP 4.34	Head of Hylebos
PP 4.35	Head of Middle Waterway
PP 4.36	Status of Site in RI/FS
PP 4.37	Lower Duwamish Waterway Site
PP 4.38	Portland Harbor Site
PP 4.39	Lori Cohen, Office of Environmental Cleanup

DMMP/SMS PRESENTATIONS

5. **Summary/Overview of Clarification and Status Papers** (Stephanie Stirling, USACE) Ms. Stirling presented a summary of clarification papers and status reports that are not presented at the annual review meeting. Ms. Stirling noted that all papers are available on the dredged material website through the USACE. The finalized program changes are also found on the DMMO website under program modifications (topical and chronological).

She began her recap of the papers with the "*Neanthes* Ammonia and Sulfide" paper, which discusses the potential interference of ammonia and sulfides authored by David Kendall and Justine Barton. The threshold of concern for the 20-day test was tested, and ammonia purging is not recommended. Clarifications and guidelines for ammonia reporting include case by case thresholds and purging methods and tests. Ms. Stirling also mentioned that *Neanthes* has a no effect level of <115 mg/Kg bulk ammonia, 10 mg/L total Interstital ammonia, 0.46 mg/L Interstitial unionized ammonia, and 3.4 mg/L total sulfides.

Ms. Stirling mentioned that disposal site coordinates have been updated for the PSDDA sites and Grays Harbor and Willapa Bay sites, and copies are available from the DMMO website under program modifications.

Next, Ms. Stirling discussed Lauran Warner's Tier I Suitability Determinations: Exclusions from Testing. Exclusions will be assessed by the DMMP agencies; either the determinations will be suitable for Tier I, or they will not and Tier II will be necessary.

The DMMP agencies have come up with new guidelines for phthalates to conceptually match with SMS guidelines. Bioassay testing is currently not required for phthalate only exceedances, but this policy may be re-evaluated by DMMP after the SMARM.

Comment. "Dr. Teresa Michelsen of Avocet Consulting expressed her concern regarding guidelines for phthalates, in particular the decision that bioassay testing will not be required for phthalate-only exceedances. In conducting a recent reliability analysis for Ecology regarding the marine standards applied in the Columbia River, she found that the currently high values for phthalates (based on HAETs) resulted in missing some actual toxicity. She believes that phthalates should not be treated differently than other chemical exceedances for this reason, since laboratory contamination has largely been reduced and it is a contaminant in the environment that appears to be responsible, on its own, for toxicity."

Response: Dr. David Kendall of USACE responded that the DMMP agencies will deliberate on Dr. Michelson's concern. **Postcript**. The agencies have discussed Dr. Michelson's comments, revised the clarification paper, posted it on the DMMP website for additional public review and notified those who were invited to the 2004 SMARM. Comments on the revised clarification paper will be accepted through November 15, 2004. The agencies will finalize the clarification paper to address new comments, as deemed appropriate, and then notify the public of the new phthalate guidelines.

Slides

PP 5.1	Summary of Clarification Papers and Status Report
PP 5.3	Papers
PP 5.4	Website Address for Papers
PP 5.5	*Neanthes*, Ammonia and Sulfide
PP 5.6	Table 1. Thresholds of Concern for *Neanthes* 20-day Chronic Test
PP 5.7	Ammonia Purging
PP 5.8	Clarification: Guidelines for standard reporting of ammonia data
PP 5.9	Clarification: Threshold ammonia concentrations and guidelines for conducting ammonia reference toxicant (LC50) tests
PP 5.10	Clarification: Threshold concentrations for consideration of purging
PP 5.11	Clarification: Purging methods and test initiation
PP 5.12	*Neanthes* and Sulfides
PP 5.13	Disposal Site Coordinates
PP 5.14	Photo of STOP sign and "No Stopping Anytime Sign"
PP 5.15	Table of DMMP: Puget Sound Disposal Site Characteristics
PP 5.16	Table of Grays Harbor and Willapa Bay Disposal Site Characteristics

PP 5.17	Tier 1 Suitability Determinations: Exclusions from Testing
PP 5.18	Clarification: DMMP will assess some sediments for suitability at Tier I
PP 5.19	New DMMP Guidelines for Phthalates
PP 5.20	For More Information

6. ***Neanthes* 20-day Chronic Bioassay Protocol Issues** (David Kendall, USACE) Dr. Kendall highlighted *Neanthes* protocol issues that remain to be resolved between the DMMP/SMS 20-day protocol and the WES (now-ERDC) 28-day protocol. The DMMP/SMS protocol was implemented in 1992 and has generally performed well over the past twelve years. Prior to implementation, the protocol underwent an interlaboratory comparison study with six laboratories and a full peer technical review. In 1999, Ecology developed draft *Neanthes* apparent effects thresholds (AETs), which set nine lowest apparent effects thresholds (LAET) for cadmium, chromium, lead, anthracene, dibenz(a,h)anthracene, 1,2-dichlorobenzene, dimethylphthalate, 2,4-dimethylphenol, and benzoic acid. The WES *Neanthes* protocol is currently being evaluated for potential implementation on the East Coast by New York District/Region 2 EPA. As part of that effort, the *Neanthes* protocol differences have been highlighted as needing a more vigorous comparative study to discern how the two protocols compare when evaluating contaminated sediments and dredged material. In 1997, the DMMP participated in a WES directed effort, which was a limited but insufficiently robust comparison of the two *Neanthes* protocols (20-day DMMP/SMS protocol and the 28-day USACE Waterways Experiment Station (WES) protocol). The primary protocol differences are the age/size of worms at test initiation, differences in the feeding regimes, and growth rates. Testing was limited to several labs for each protocol. The limited results, were not conclusive, but did show a more pronounced dose response with the WES protocol. The DMMP have initiated discussions with WES, New York District USACE and EPA Region 2 about their ongoing bioassay comparisons, but due to their regional focus, limited DMMP resources and timelines it does not appear that a robust comparison study will be conducted at this time. The DMMP are interested in evaluating the protocol issues and hope to resolve this issue in the near future. To adequately evaluate the protocol differences properly, the DMMP feel that regional experts should be consulted in the testing design, and the testing conducted should use northwest regional sediments to evaluate test sensitivity, reliability, and variability. Test interpretation guidelines should also be evaluated. Dr. Kendall believes the evaluation should elucidate which protocol is more ecologically relevant and practical as a regulatory test in evaluating sediments. This could result in either no changes, minor changes, or major changes in the DMMP/SMS protocol for the *Neanthes* 20-day bioassay.

Comment: Bill Gardiner of MEC commented that interlaboratory comparisons should be checked for the 28-day to 20-day tests. All labs were proficient in handling the organisms, and the difference in growth rates and responses should be pursued by the agencies. He was also concerned that sediments had been used from Black Rock Harbor, which is a highly contaminated site with fine grain sediments and high levels of organics.

Slides

PP 6.1	*Neanthes* 20-Day Chronic Bioassay Protocol Issues
PP 6.3	DMMP/SMS Protocol
PP 6.4	1999 Draft *Neanthes* AETs
PP 6.5	*Neanthes* Protocol Comparisons
PP 6.6	Feeding Regime Comparison
PP 6.7	Protocol Comparison (*Neanthes*) Battelle NW Laboratory
PP 6.8	DMMP *Neanthes* Protocol
PP 6.9	WES *Neanthes* Protocol
PP 6.10	Test Protocol Comparison Recommendations
PP 6.11	Potential Outcome of Protocol Comparison

7. **Evaluation of Marine/Estuarine Sediment Toxicity Tests in Puget Sound Region: Future Test Clarifications** (Tom Gries, Ecology). Mr. Gries spoke on the subject of "Evaluating Benthic Risk: Future Clarifications." Currently the tools and approaches available are using predictions from the sediment quality guidelines, measuring effects in lab or *in situ* testing, or modeling. One possible problem with the current tools is inconsistent endpoints amongst agencies and programs. Also, there is some concern about the validity of how early benthic community evaluations are performed and whether more tests should be run *in situ* rather than in the lab. The current status of this evaluation of benthic risk has included a comprehensive analysis of the Puget Sound community's database using recent data, investigation of relative sensitivity, and review of the interpretative endpoints.

The relative responsiveness of different amphipod species to a mixture of contaminants is of concern. How do the regional data indicate different responsiveness/sensitivity? The Puget Sound Ambient Monitoring Program (PSAMP) studies in 1997 and 1999 collected 300 random stratified samples of 0-3 cm sediments, only one of which exhibited significant *Ampelisca* mortality. *Ampelisca* may be a less responsive species. EC50 data shows that *Eohaustorius* may be up to eight times more sensitive to some chemicals than *Ampelisca* in the same sediments. Data from the California Environmental Monitoring and Assessment

Program (EMAP) support the hypothesis that *Eohaustorius* may be more responsive than *Ampelisca* when exposed to the same test sediment.

To further clarify this issue, it is important to find more side-by-side data comparisons, both at a regional and national level. Guidelines will then be reviewed and guidance issued.

Acceptance of the performance of larval tests is also being investigated. Criticisms include the possibility that entrainment may cause settling and low counts in lab tests. Evaluation will be performed to revise the protocol if necessary after reviewing the options, such as the sediment water interface screen tube used in California tests.

Mr. Gries and Russ McMillan are looking at the need to make toxicity test interpretive endpoints consistent between the DMMP and SMS programs. They are evaluating the minimum detectable difference for the toxicity tests and comparing interpretive endpoints used by regional sediment management groups. Mr. Gries emphasized the need to reevaluate regional guidelines using current data and update the benthic community data and endpoints.

> ***Question:*** "Dr. Teresa Michelsen of Avocet Consulting commented to support Mr. Gries's concern that *Ampelisca* may not be as sensitive as other amphipod species. She recently worked on a guideline development project in San Francisco Bay where *Ampelisca* ere taken out of the data set because of errors and non-response. Similarly, she noticed a difference in response between *Ampelisca* and other amphipod species in a guideline development project for the Port of Los Angeles. Two other project scientists independently confirmed the finding that the two species responded differently in the same tests, *Ampelisca* being the least sensitive of the species."

Slides

PP 7.1	Evaluating Benthic Risk: Future Clarifications?—Introduction
PP 7.2	Approaches/Tools
PP 7.3	Problem Statements
PP 7.4	Problem Statements, cont.
PP 7.5	Status of Work
PP 7.6	Status of Work, cont.
PP 7.7	Responsiveness of amphipod species
PP 7.8	Responsiveness of amphipod species, cont.
PP 7.9	Responsiveness of amphipod species, cont.
PP 7.10	Graph: California Comparisons

PP 7.11	Stallone vs. Knotts
PP 7.12	Responsiveness of amphipod species, next steps
PP 7.13	Acceptance/performance of larval test
PP 7.14	Acceptance/performance of larval test, next steps
PP 7.15	Acceptance of larval test results
PP 7.16	Optimum and consistent test endpoints
PP 7.17	Graph: Interpretive Guidelines for Amphipod Toxicity
PP 7.18	Optimum and consistent test endpoints, next steps
PP 7.19	Update benthic community data, endpoints
PP 7.20	Update benthic community data, endpoints, next steps
PP 7.21	Update benthic community analyses
PP 7.22	Conclusions

8. **Bioaccumulative Chemicals of Concern Evaluations at Two PSDDA Disposal Sites** (Justine Barton, EPA Region 10). Ms. Barton discussed the results of BCOC evaluations conducted at two PSDDA disposal sites (Elliott Bay and Commencement Bay) using the Bioaccumulation Workgroup lists. List 1, the primary list required for analysis, had some chemicals added or deleted. List 2, the candidate list, includes chemicals of concern that have similar characteristics to the List 1 chemicals, but not enough is known about them.

Monitoring events conducted in Elliott Bay in 2002 and Commencement Bay in 2003 looked for List 1 and 2 chemicals in sediments and *Molpadia* tissue. The Elliott Bay study found most BCOC were not detected except for polycyclic aromatic hydrocarbons (PAHs), which were below the BT level. All laboratory reporting limits met DMMP screening levels. Striplin Environmental and EPA have created a detailed report discussing analytical methods for List 2 BCOCs that is available as of April 12, 2004. The Commencement Bay study in 2003 found detections from the BCOC lists, but all were below BT levels or qualified as estimates. A draft technical appendix is currently in agency review and will available for public review in September 2004.

There were no questions.

Slides

PP 8.1	Bioaccumulative Chemicals of Concern Evaluations at Two DMMP Disposal Sites
PP 8.2	List 1 BCOC
PP 8.3	List 2 BCOC

PP 8.4	DMMP Elliott Bay BCOC Monitoring
PP 8.5	DMMP Elliott Bay Follow-up
PP 8.6	Map of Elliott Bay DMMP Site
PP 8.7	Elliott Bay Conclusions
PP 8.8	Elliott Bay Conclusions, cont.
PP 8.9	Elliott Bay Conclusions, cont.
PP 8.10	DMMP Commencement Bay BCOC Monitoring
PP 8.11	Map of Commencement Bay DMMP Site
PP 8.12	Commencement Bay Conclusions
PP 8.13	Commencement Bay Conclusions, cont.
PP 8.14	BCOC List Follow-Up

9. **PSAMP Sediment Quality Update** (Maggie Dutch, Ecology). Ms. Dutch spoke on the recent findings of the PSAMP sediment sampling and the future direction of work. She started her talk by acknowledging the sediments team and then recapped the sampling methods used by PSAMP. From 1989-2000, only 10 of the original 76 stations were monitored. They were chosen to coincide with other PSAMP monitoring activities that included fish and water monitoring stations.

PSAMP sediment monitoring includes both temporal and spatial monitoring. Temporal monitoring seeks to provide long-term data on sediment characteristics, contaminants, and benthic trends. Recent data have indicated that metals concentrations are decreasing at most stations. Concentrations of PAHs are increasing at many stations, but decreasing at some. Infaunal patterns are changing over time. The Strait of Georgia station is of particular interest as it appears the Fraser River plume is bringing in high levels of fines that have caused the site to decrease in taxa richness but increase in abundance. Temporal monitoring does not provide the “big picture” but does provide valuable data through case studies. Both anthropogenic and natural factors can cause change in community structure. The time series is essential, as it can take decades to see patterns developing.

Spatial monitoring seeks to create a statistically robust sediment quality baseline through stratified, random sampling and to create spatial pattern maps, spatial extent calculations, and a sediment triad index. Conclusions from the spatial sampling found that although a small percentage (1 percent) of sites are degraded, they pose a large threat due to their locations near river mouths and nearshore areas that often function as nurseries for a variety of species. The intermediately degraded (31 percent) areas should be watched, as most are located in harbors and urban bays. The reports for both spatial and temporal monitoring can be found on Ecology’s website.

Ms. Dutch discussed the design refinement the program underwent in 2002 with the assistance of EPA and the National Oceanic and Atmospheric Association (NOAA). Eight monitoring regions in Puget Sound were created, and sampling will be rotated on an annual basis among these regions. Five sediment strata were also created based on proximity to populations and urban centers. In 2002-2003, under-monitored areas were sampled in the San Juan Islands, Admiralty Inlet, and east Strait of Juan de Fuca; chemistry and toxicology results are available, but benthic data are not finished. Studies in 2004 will focus on Hood Canal related to the low dissolved oxygen levels the canal is currently experiencing. A Benthic Triad Index is to be developed in 2005 through partnership with the EMAP project. Western EMAP has found that distinct communities exist in Puget Sound.

PSAMP is seeking input and partnerships to help with revisions to the analyte list, such as recommendations that they include polybrominated diphenyl ethers (PBDEs) and endocrine disrupting chemicals (EDCs). Partnerships could also help regional focus studies and the benthic index development, especially if stakeholders' efforts were coordinated and pooled to monitor Puget Sound estuarine quality.

There were no questions.

Slides

PP 9.1	Puget Sound Ambient Monitoring Program
PP 9.2	Marine Sediment Monitoring Team
PP 9.3	PSAMP Sediment Monitoring Recent Activities and Findings
PP 9.4	Sample Collection Methods
PP 9.5	PSAMP Temporal Monitoring 1989-2000
PP 9.6	PSAMP Temporal Monitoring
PP 9.7	Objectives
PP 9.8	Results
PP 9.9	Infauna Patterns
PP 9.10	Strait of Georgia station
PP 9.11	Temporal Sediment Patterns in the Strait of Georgia Map
PP 9.12	Graph: Changing sediment composition in relation to changes in Fraser River flow
PP 9.13	Graph: Changes in sediment and dominant taxa in relation to changes in Fraser River flow
PP 9.14	What the temporal stations tell us

PP 9.15	PSAMP Spatial Monitoring
PP 9.16	Spatial Extent of Sediment Quality Degradation
PP 9.17	What the spatial stations tell us
PP 9.18	PSAMP Spatial Monitoring
PP 9.19	PSAMP Sediment Monitoring
PP 9.20	PSAMP Sediment Monitoring
PP 9.21	8 Sediment Monitoring Regions
PP 9.22	5 Sediment Strata
PP 9.23	PSAMP Sediment Component Spatial Monitoring
PP 9.24	2004 Hood Canal
PP 9.25	2005 Benthic Index Development
PP 9.26	2006-2013 Regional Rotation
PP 9.27	Input/partnerships sought
PP 9.28	Pictures

10. **PSAMP Fish Tissue Monitoring Program Update** (Sandie O'Neill, Washington Department of Fish and Wildlife [WDFW]). Ms. O'Neill discussed the findings of the PSAMP fish monitoring program and the factors affecting exposure and accumulation in fish. Such factors include proximity to contamination sources, habitat, trophic level, gender, age, and lipid content of tissue. Her talk focused on the bioaccumulation of PCBs in English sole, rockfish, herring and salmon. PCB levels are found highest in the Central and Whidbey basins of Puget Sound. The average concentration in English sole was 62 parts per billion (ppb) as compared to the higher level in rockfish at 121 ppb. A large part (72 percent) of the variation in PCB concentrations within English sole was associated with sediment concentration of PCBs. Only 2 percent was due to age. In rockfish, age and sex had a stronger correlation to PCB levels in fish tissue. Males had higher levels than females because females spawn out the contamination, while males have no mechanism to rid themselves of the PCBs.

Next, Ms. O'Neill discussed PCBs in the pelagic food web using herring and salmon. Herring measure what is in the current environment, as they do not retain bioaccumulated PCBs over a long time period. Two to three year old whole body herring were analyzed and it was found PCB levels were highest in the Central Basin. Ms. O'Neill attributes this to the pelagic food web (with sediments as the source of PCBs) rather than water column exposure to phytoplankton. Fish species that bottom feed pass the PCB contamination to their offspring through reproduction. In the early developmental stages, these juvenile fish may spend a portion of their lives as zooplankton. The zooplankton are eaten by adult fish (e.b., Herring), which then accumulate and biomagnify PCBs. In the end, biota become the sink

for the PCB contamination. Salmon are affected by this cycle as well. Wild coho and Chinook were sampled at the river mouths on their return migration. Total PCBs were higher in Chinook, which are older upon return and eat more vertebrates than coho. A concentration gradient was noted from north to south with highest levels in southern Puget Sound. The contamination is encountered in the marine environment, which is illustrated by the fact that PCB concentrations in smolt are 1.4 µg/kg, and when returning as adults they are 130 µg/kg.

Ms. O'Neill concluded her talk by recapping the factors affecting exposure and accumulation in pelagic fish.

Question: Mr. Loren Stern asked if there were any effects on fecundity in salmon related to PCB levels.

Response: Sandie O'Neill replied "No, but we didn't look." She followed up by saying there was a slide in her presentation she skipped that overlaid National Marine Fisheries Service (NMFS) threshold concentrations associated with reproductive effects with the PCB levels that they have measured in salmon. Fish in urban centers were close to or above the thresholds set by NMFS.

Question: Tom Gries then asked if WDFW has measured PCB levels in salmon tissue as they leave through the Straight of Juan de Fuca.

Response: Ms. O'Neill said the farthest north that they monitored was the North Fork of the Nooksack River. The study looked at coded wire tags to track migration patterns of various stocks. The northern stocks tend to spend less time in Puget Sound and head directly to the open ocean. A graduate student at Evergreen State College (Brian Misseldine) is studying the difference in contamination levels of salmon returning to the coastal fisheries versus those coming back to Puget Sound fisheries.

Question: Mr. Gries asked if we know what is being taken out of the Puget Sound system when fish leave for the north Pacific.

Response: Ms. O'Neill referred to a paper that says salmon in the Copper River system have levels comparable to Puget Sound species and can encounter contamination in the open ocean.

Slides

PP 10.1	Factors Affecting Contaminants in Fishes
PP 10.2	Factors Affecting Contaminant Exposure and Accumulation

PP 10.3	Map: Puget Sound Basins
PP 10.4	Map: Average PCB Concentrations in Puget Sound Basins
PP 10.5	English Sole
PP 10.6	Map: PCB in muscle of English sole
PP 10.7	Map: PCB in muscle of English sole-Central Basin highlighted
PP 10.8	Graph: PCB Exposure in English sole muscle (1991-1996) vs. Sediment Concentration
PP 10.9	Graph: PCB accumulation in English sole vs PCB sediment levels and fish age
PP 10.10	Effects of Age and Trophic Level on PCB Accumulation
PP 10.11	Quillback Rockfish
PP 10.12	PCBs by Gender in Quillback Rockfish from Elliott Bay
PP 10.13	PCB Concentration vs. Fish Age Chart
PP 10.14	PCB Accumulation in Benthic and Demersal Fishes
PP 10.15	PCB's in the Pelagic Food Web
PP 10.16	Pacific Herring
PP 10.17	Median PCB Concentration
PP 10.18	Direct Water Source (zooplankton, phytoplankton)
PP 10.19	Sediment source via maternal transfer
PP 10.20	PCB's in Pelagic Food Web
PP 10.21	Do PCB contaminated sediments affect PCB. . .
PP 10.22	Herring in Diet of Other Species
PP 10.23	Coho salmon, Chinook salmon
PP 10.24	PCBs in muscle of adult salmon returning to Puget Sound
PP 10.25	PCB-Lipid Relationship- Wild Coho Salmon
PP 10.26	Lipid Adjusted PCB for Chinook Salmon Returning to Puget Sound Rivers
PP 10.27	Returning adult salmon, outmigrating smolt
PP 10.28	PCB Accumulation in Pelagic Migratory Fish
PP 10.29	Factors Affecting Contaminant Exposure Accumulation
PP 10.30	Blank
PP 10.31	Conceptual Model
PP 10.32	Benthic Pathways
PP 10.33	Benthic Pathways (with macroalgae)
PP 10.34	Pelagic Pathways
PP 10.35	Pelagic Pathways vs. Benthic Pathways
PP 10.36	The Benthic-Pelagic Connection - A One Way Street?
PP 10.37	The Benthic-Pelagic Connection - A One Way Street? Maybe Not

PP 10.38	Salmon in the System
PP 10.39	Species monitored by PSAMP
PP 10.40	Mature male Chinook salmon
PP 10.41	PCBs in Chinook salmon fillets Chart
PP 10.42	Does oceanic distribution affect PCB levels in Pacific salmon. . .
PP 10.43	PCB Accumulation in Pacific Salmon
PP 10.44	Effects of Fish Age and Sediment Hg Concentration on Mercury in English Sole Muscle
PP 10.45	Accumulation of mercury in quillback rockfish individuals, 1995-`98
PP 10.46	Accumulation of mercury in quillback and brown rockfish individuals, 1995-`98
PP 10.47	Accumulation of mercury in quillback and brown rockfish individuals, 1995-`98
PP 10.48	PAH metabolites in Bile
PP 10.49	PAH Metabolites in Bile (Phenanthrene Equiv. ng/ml bile)
PP 10.50	Know your fish (or your local fish biologist)
PP 10.51	Geographic Variation in PCB Levels in Chinook salmon returning to spawn
PP 10.52	Average PCB Concentration in Adult Pacific Salmon from PS Environments (92-95)
PP 10.53	PCBs in Pacific salmon from Alaska

11. **SMS Requirements for TBT Analysis** (Tom Gries, Ecology). Mr. Gries discussed the SMS Requirements for porewater tributyltin (TBT) analysis. He had no slides prepared for this quick talk. He referred participants to the 1996 Issue Paper prepared by Dr. Teresa Michelson on the topic, and stressed that Ecology believes that porewater TBT plays an important role in exposure, and therefore risk, to some organisms. He reiterated that SMS program considers the value derived for the 1996 paper of 0.05 ug/L (as Tin) to be conceptually equivalent to the SQS and is consistently being used as such.

There were no slides.

12. Regional Dredging Team Update (Stephanie Stirling, USACE). Ms. Stirling provided the Northwest Regional Dredging Team (RDT) update. The RDT is composed of the regional leads of the agencies including USACE, NOAA, EPA, United States Fish and Wildlife Service (USFWS), and United States Department of Transportation (USDOT). She began her talk with a few flowcharts of the regional relationship and sediment evaluation in the northwest. Flowcharts are a good measure of progress and help to show where individuals fit in. The Dredged Material Evaluation Framework (DMEF) is undergoing a

chapter-by-chapter revision and has undergone a name change to Sediment Evaluation Framework. The RSET was created to deal with the day-to-day issues in our region. They are leading the revision of the DMEF, dealing with technical, scientific, and policy issues, and helping to set the long-term role of RSET. Ms. Stirling presented a flowchart that explaining the roles and responsibilities of RSET.

RSET is composed of many smaller subcommittees that deal with specific issues. Taku Fuji formerly with Hart Crowser (now with Kennedy Jenks) is the liaison between the subcommittees to keep them communicating. The Policy subcommittee is chaired by Ms. Stirling and focuses on National Environmental Policy Act/Environmental Impact Statement (NEPA/EIS) compliance, public involvement, and the process and organization of RSET. The Contaminant and Analyte List subcommittee is chaired by Todd Thornburg of Anchor Environmental. This committee focuses on how to go about adding or deleting analytes from the list and comparing summation techniques. The Sediment Quality Guidelines subcommittee, chaired by Brett Betts, is focusing on freshwater guidelines consistency, SEDQUAL database usage, and consistency with marine levels in the sediment quality guidelines. The Biological subcommittee, chaired by Bill Gardiner of MEC/Weston, is working to ensure protection of Endangered Species Act (ESA)-listed species, evaluating rapid screening methods, and short-term vs. long-term freshwater bioassays. The Bioaccumulation subcommittee, co-chaired by Teresa Michelsen (Avocet Consulting) and David Kendall (Corps), will focus on developing a bioaccumulation endpoint for screening levels, establishing tissue levels protective of ESA species, and developing a second freshwater bioaccumulation protocol. Each subcommittee will be creating white papers on the above topics. Some are currently on the DMMP website (under RSET, not SMARM).

Recent developments within RSET include the Lewiston meeting, which included working sessions for the subcommittees and sought to regionalize the process by including Idaho. There will be another RSET meeting in Portland, Oregon in late September 2004.

There were no questions.

Slides

PP 12.1	Sediment Management Annual Review Meeting
PP 12.1	Sediment Management Annual Review Meeting
PP 12.3	Regional Dredging Team
PP 12.4	Northwest Regional Dredging Team
PP 12.5	Regional Relationships
PP 12.6	Sediment Evaluation in the NW
PP 12.7	DMEF Becomes SEF

PP 12.8	Regional Sediment Evaluation Team
PP 12.9	RSET Roles & Responsibilities
PP 12.10	Subcommittees Policy
PP 12.11	Subcommittees Containment and Analyte List
PP 12212	Subcommittees Sediment Quality Guidelines
PP 12.13	Subcommittees Biological Testing
PP 12.14	Subcommittees Bioaccumulation
PP 12.15	White Papers
PP 12.16	White Papers, A number of them available on website
PP 12.17	Recent Developments
PP 12.18	Lewiston Meeting
PP 12.20	Interactions of RSET with RDT
PP 12.21	What's next?
PP 12.22	Preliminary PNW Regional Sediment Evaluation Framework Timeline

TOPICAL PRESENTATIONS

13. U.S. Navy PSNS Cleanup Update (Ted Benson, Ecology). Mr. Benson discussed the cleanup plan for Puget Sound Naval Shipyard (PSNS) on Sinclair Inlet. PSNS was added to the Superfund list in 1994. The cleanup consisted of utilizing a confined aquatic disposal (CAD) site at the edge of the property line for containment of contaminated dredge material. Post-disposal monitoring included sediment grab samples that had elevated levels of PCBs and mercury outside the boundaries of the CAD pit. SVPS imagery was conducted on transects radiating from the pit and found that dredge material had spread 100-200 yards beyond the pit boundary and into WDNR lands. Ecology was called in to resolve the issue. More sediment testing was conducted on WDNR land and again found elevated levels of PCBs and mercury. The Navy issued a statement concurring with the findings, but specified that, due to a lack of monitoring during disposal, they do not know which activity led to the contamination. After discussing a variety of remediation possibilities, enhanced natural recovery was chosen because the layer of contamination was thin. A thin-layer cap was placed on the contaminated area with PCB levels greater than 9 mg/kg-organic carbon (OC) using sediments from the turning basin in Sinclair Inlet. Placement was verified using pre- and post-disposal precision bathymetry. It took 40 barge loads to cover the area. Subsequently, the CERCLA line was adjusted to include the overflow of dredged material from the CAD pit into WDNR lands.

Question: An unidentified woman from the middle of the room asked if the cause of the dispersal outside of the CAD was due to placement or migration over time.

Answer: Mr. Benson explained that in 40 feet of water, the water column has great effects as material falls. He used the metaphor that it's like pouring paint into a bucket from the second story roof. He also said you cannot compare the spread at the open water disposal site in Commencement Bay to the CAD site in Sinclair Inlet, due to different geography and water depths.

Question: The same woman then asked if there are any recommendations to preventing the spread in the future.

Answer: Mr. Benson said monitoring during the disposal and using temporary berms could have prevented or minimized the spread beyond the CAD.

Question: Joe Germano asked if any post capping sampling had been performed.

Answer: Mr. Benson replied that it had not yet.

Slides

PP 13.1	CSI: Contaminated Sediment Investigators
PP 13.2	Episode 12
PP 13.3	Sinclair Inlet
PP 13.4	Confined Aquatic Disposal Cell
PP 13.5	Area of Interest
PP 13.6	Barge Disposal (Conceptual)
PP 13.7	A Brief Review of the Physics of Dredged Material Disposal
PP 13.8	Post-Disposal
PP 13.9	Joe Germano Deploying the Sediment Profile Imaging System
PP 13.10	Reduced Dredged Material Sediment Graphic
PP 13.11	PSNS—Ambient Bottom
PP 13.12	PSNS—Inside CAD
PP 13.13	Deployment Almost Resulted in Over-Exposure
PP 13.14	PSNS—Dredged Material
PP 13.15	PSNS—Results
PP 13.16	Revealing the Goods
PP 13.17	Ted Benson Brought in to Assist
PP 13.18	Chemical Analysis of Samples
PP 13.19	Analysis of Data
PP 13.20	Results

PP 13.21	Navy Statement
PP 13.22	Characterization of Surface Contamination
PP 13.23	Surface Characterization Methodology
PP 13.24	The Remedial Alternatives Were Discussed in Planning Sessions
PP 13.25	Remedial Alternatives
PP 13.26	Ecology is Persuaded by Navy and EPA
PP 13.27	Selected Solution
PP 13.28	Agreed Action
PP 13.29	Enhanced Natural Recovery for Operational Unit B Marine
PP 13.30	Potentially Available Material
PP 13.31	Cover Material Dredged from Turning Basin
PP 13.32	Assessment of Effectiveness
PP 13.33	Barge Placement
PP 13.34	Planned Barge Placement
PP 13.35	Location of Barges—Week 1
PP 13.36	Bathymetric Data Analysis Was Expected
PP 13.37	Cover Thickness—At Conclusion of First Week
PP 13.38	Location of Barges—Week 2
PP 13.39	Final Cover Thickness
PP 13.40	Data Interpretation
PP 12.41	Sediment Placement
PP 13.42	Cross Section
PP 13.43	Bremerton Naval Complex
PP 13.44	Blame Cartoon
PP 13.45	Acknowledgements
PP 13.46	Questions?

14. ***Armandia brevis* Bioaccumulation Evaluation** (Dr. Susan McGroddy, Windward Environmental). Dr. McGroddy described a study involving the evaluation of TBT bioaccumulation in *Armandia brevis*. The study was conducted to elucidate the differences between the two polychaetes (*Armandia brevis* and *Nephthys caecoides)* and how they bioaccumulate TBT from sediments and porewater. The question occurred after testing of sediments from Harbor Island West Waterway showed differences in TBT bioaccumulation as compared to that observed at other nearby sites, such as the East Waterway and Todd Shipyard. The study also sought to clarify whether test conditions (static vs. flow-thru) influence bioaccumulation of TBT. The exposure concentrations of test species were between 149-180 ppb TBT dry weight (0.21 – 0.42 ugTBT/L in pore water). *Armandia* and *Nephthys* are grossly

different in size, 3.5 mg/dry wt/individual compared to 81 mg/dry wt/individual, respectively. This meant that a lot more time was spent acquiring *Armandia* for the study. Three tests were run on each of two sediment samples (*Nephtys* flow-through, *Armandia* static, and *Armandia* flow-through). Porewater TBT concentrations were positively correlated with dry weight sediment TBT concentrations. *Armandia* exposed in static conditions had the highest tissue concentrations of TBT (77 – 370 ppb wet weight). TBT concentrations in *Armandia* (flow-through and static) were consistently higher than those found in *Nephthys*.

Question: Ms. Erika Hoffman inquired about the lab issues since *Armandia brevis* is a new species to work with and about the collection issues.

Answer: Mr. Bill Gardiner replied that there were not that many issues other than a small problem with temperature control. Species collection on the other hand is quite difficult. It took 5 days to get enough individuals to test and only for TBT. It took 200 animals per chamber to equal a biomass of 2 grams.

Question: Mr. Jack Anderson asked if the relationship of bioaccumulated TBT to the sediment TBT was a 1:1 ratio.

Answer: Dr. McGroddy replied that some statistics have been calculated, but not much information is there. There are differences between dry sediment and wet tissue weights that make the statistics difficult.

Question: Ms. Justine Barton mentioned that Dr. McGroddy should point out the difference between mono and di-butyltin.

Answer: Dr. McGroddy said they had measured these and saw similar patterns that had even more dramatic differences between species/exposure systems.

Question: Dr. Peter Rude of Landau Associates asked why the difference between the two species.

Answer: Dr. McGroddy pondered whether it was due to differences in feeding mechanisms, but stated that we really don't know.

Response: Ms. Erika Hoffman further touched on the issue of metabolite data. She said *Armandia* have much higher levels of TBT metabolites (MBT and DBT) than *Nepthys* which indicates that they are more actively accumulating TBT, but they don't have a good sense of why.

Question: Dr. Germano followed up by asking what the implications of this study would be.

Answer: Dr. McGroddy responded that she did not know but was glad to at least have data to include in the discussion.

Response: Ms. Hoffman replied that there is a camp of people who thought the wrong bioaccumulation species may have been used in earlier TBT testing, and this is partially what led to the study of species and chamber conditions. Based on these tests, if areas of TBT concern are located within the East Waterway Superfund Site, *Armandia* could potentially be substituted as the bioaccumulation test species.

Slides

PP 14.1	*Armandia Brevis* Bioaccumulation Evaluation
PP 14.2	Work funded by the Port of Seattle with assistance from:
PP 14.3	Goal
PP 14.4	Exposure concentrations
PP 14.5	Three bioaccumulation tests were conducted with each sediment:
PP 14.6	*A. brevis* and *N. caecoides*
PP 14.7	Summary of polychaete survival for the East Waterway
PP 14.8	TBT tissue concentrations
PP 14.9	Conclusions

15. **When will Contaminated Sediment Cleanups be Completed?** (John Dohrmann, Puget Sound Water Quality Action Team [PSWQAT]). Mr. Dohrmann briefly discussed why we are here and asked when the cleanups will be done. He touched on the fact that we contaminated our sediments and now we have to clean them up, but every year it seems we still have the same number of acres left. So why, if we have all the pieces in place, are the numbers not falling? Finally, we are starting to see a decrease in the acreage designated for clean up. He stressed that we need to make sure we are not just getting by, and that source control must be part of the plan. He hopes we can work ourselves out of jobs. He will talk with the agencies over the next year to see how we are progressing with the bay cleanups.

There were no questions.

There were no slides.

PUBLIC ISSUE PAPERS

16. **Upcoming Meetings of Interest to Sediment Management World** (Clay Patmont-Anchor Environmental). Mr. Patmont spoke on coming together to transfer technology within Puget Sound cleanups and with the rest of the country. He reminded us that as the leaders, we are being watched by the rest of the country. A meeting has been set up for late September in Seattle to come together and talk about the lessons we have learned thus far in the efforts to clean up Puget Sound. In the meeting, he would like to see discussions on: what is working and what is not, what we have accomplished, and what are the water quality impacts in the short term and long term. We are known as the capping region nationally when working on remediation projects. What is happening with disposal sites in the long term? The meeting will be jointly sponsored by the Sediment Management Work Group from the east coast, the EPA Contaminated Sediments Technical Advisory Group and possibly the CSMP. He mentioned other workshops that are coming up that will deal with contaminated sediment issues. He thinks that, in addition to discussing case histories from within Puget Sound, that there will be time for question and answer forums, site tours, socializing, and a joint agency presentation of data. You can sign up now and no money is needed.

There were no questions.

Slides

PP 16.1	Puget Sound Sediment Cleanup Technology Transfer
PP 16.2	The idea
PP 16.3	Joint Sponsorship?
PP 16.4	Other Jointly Sponsored Workshops
PP 16.5	When?
PP 16.6	Case Histories?
PP 16.7	Sitcum Waterway, Commencement Bay
PP 16.8	Presentation Format?
PP 16.9	Sign Up Now?

17. **Saving Project Chemistry Costs by Screening with EPA Method 4425** (Jack Anderson, Battelle NW). Mr. Anderson spoke on saving money by using EPA method 4425 to monitor for dioxin-like compounds instead of method 8290. He addressed the basis, purpose, methods, and experience of using EPA 4425, which uses the P450 human reporter gene system. Test results can be obtained in less than 4 days using this method. Sediments from across the region can be compared because the organics are stripped from the sediments, alleviating matrix effects.

The test results were developed from a large NOAA database. Less than 11 ppm yielded no effects, 11-32 and 32-60 ppm yielded intermediate effects, and greater than 60 ppm had severe effects.

There were no questions.

Slides

PP 17.1	Saving Project Chemistry Costs By Screening with EPA Method 4425
PP 17.2	Introduction
PP 17.3	P450 Human Reporter Gene System
PP 17.4	P450 HRGS Procedure
PP 17.5	Daily Testing of Dioxin/Furan Standards
PP 17.6	Interpreting Results
PP 17.7	Threshold Values
PP 17.8	NOAA Studies
PP 17.9	Analysis of Sediments from Northern Puget Sound and Everett Harbor
PP 17.10	Puget Sound Samples
PP 17.11	Data Table
PP 17.12	Relationship Between B[a]P Equivalents and Total PAHs in Sediments
PP 17.13	TEQ Correlations by Nihon Environmental
PP 17.14	Correlation Between TEQs by 4425 and 8290 for Confirmation Samples
PP 17.15	Recommended 4425 Screening
PP 17.16	Conclusion
PP 17.17	Conclusion—Dioxins

GENERAL QUESTIONS AND COMMENTS

Comment: Lincoln Loehr of Heller Ehrman commented on the complications experienced with stormwater discharge permits in relationship to pollution control. Stormwater permits under NPDES are reviewed every 5 years. He believes that there needs to be more coordination within Ecology of the programs, so permits are not automatically denied without looking at the implications.

Response: Dr. David Kendall of USACE replied that Ecology will respond to Mr. Loehr's comment.

SUMMARY AND CLOSING

Mr. Wagner thanked everyone for coming and staying through the whole day. He remarked that the meeting was a success and looked forward to next year's meeting.

Attachment 1

DMMP Responsiveness Summary

DMMP Responsiveness Summary

Comment: Lincoln Loehr of Heller Ehrman commented on the complications experienced with stormwater discharge permits in relationship to pollution control. Stormwater permits under NPDES are reviewed every 5 years. He believes that there needs to be more coordination within Ecology of the programs, so permits are not automatically denied without looking at the implications.

Response: Ecology continues to improve internal procedures between the Water Quality and Toxics Cleanup Programs in order to coordinate on discharge permits and make the most appropriate determinations regarding issuance. Because the SMARM forum is not for site specific issues, Mr. Loehr's concerns of that nature were addressed separately by letter dated July 6, 2004.

Attachment 2

Agenda

Sediment Management Annual Review Meeting (Final Agenda)

May 5, 2004
Comfort Inn Conference Center, Tumwater
Hosted by Washington State Department of Ecology

1 REGISTRATION AND COFFEE ……8:30-9:00

2 WELCOME TO SMARM 2003 (COL. DEBRA LEWIS, SEATTLE DISTRICT COMMANDER; MEETING MODERATOR: WAYNE WAGNER, CORPS/CHIEF OD-TS[1]) ……9:00-9:10

3 OPENING REMARKS (LINDA HOFFMAN, DIRECTOR, WA DEPART. OF ECOLOGY).9:10-9:20

4 AGENCY SUMMARY REPORTS……9:20-10:50

- Corps (Summary of DMMP Testing Activities, Lauran Warner, Corps)
- DNR (Summary of DNR Disposal and Monitoring Activities, Peter Leon, DNR)
- Ecology (Summary of SMS Cleanup/Source Control Activities, Freshwater Guidelines Development, Kathryn DeJesus, Ecology)
- EPA (Summary of Regional CERCLA Activities, Lori Cohen, EPA)

5 BREAK……10:50-11:05

6 DMMP/SMS PRESENTATIONS……11:05-12:00

- Summary Overview of Clarification and Status Papers (Stephanie Stirling, Corps)
- *Neanthes* 20-Day Chronic Bioassay Protocol Issues (David Kendall, Corps)
- Evaluation of Marine/Estuarine Sediment Toxicity Tests in Puget Sound Region: Future test clarifications (Tom Gries, Ecology)
- Questions and Answers (on any of the above presentations)

7 LUNCH (ON YOUR OWN)……12:00-1:00

8 DMMP/SMS PRESENTATIONS (CONTINUED)……1:00-2:15

- Bioaccumulative Chemicals of Concern evaluations at two PSDDA Disposal Sites (Justine Barton, EPA)
- PSAMP[2] Sediment Quality Update (Margaret Dutch, Ecology)
- PSAMP Fish Tissue Monitoring Program Update (Sandie O'Neill, WDFW)
- SMS Requirements for TBT Analysis (Tom Gries, Ecology)
- Questions and Answers

9 REGIONAL DREDGING TEAM UPDATE……2:15-2:45

Stephanie Stirling (Corps)

10 BREAK……2:45-3:00

11 TOPICAL PRESENTATIONS……3:00-4:00

- U.S. Navy PSNS cleanup update (Ted Benson, Ecology)

[1] Operations Division/Technical Support Branch
[2] Puget Sound Ambient Monitoring Program

- *Armandia brevis* bioaccumulation evaluation (Susan McGroddy, Windward)
- When will contaminated sediment cleanups be completed? (John Dohrman, PSWQAT)

12 PUBLIC ISSUE PAPERS……4:00-5:00

- Up coming meetings of interest to Sediment Management World (Clay Patmont, Anchor Environmental)
- Saving Project Chemistry Costs by Screening with EPA Method 4425 (Jack Anderson, Battelle NW)

13 SUMMARY AND CLOSING……5:00:5:15

Deadline for written Comments on SMARM 2004: June 7, 2004

Attachment 3

List of Attendees

List of Attendees at SMARM'04

Last Name	First Name	Affiliation	Mailing Address	Email
Aasen	Sandra	WA Dept of Ecology, EAP	PO Box 46700, Olympia, WA 98504	sgei461@ecy.wa.gov
Anderson	Jack	Battelle Marine Science Labs	1529 W Sequim Bay Rd, Sequim, WA	jw.anderson@pnl.gov
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List of Attendees at SMARM'04

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Attachment 4

PowerPoint Slides for each SMARM Speaker

SEDIMENT MANAGEMENT ANNUAL REVIEW MEETING

May 5, 2004

Wayne Wagner, Seattle District
Meeting Moderator

0.1

2004 SMARM

- Jointly Sponsored by the Dredged Material Management Program (DMMP) and the Sediment Management Standards (SMS) Program
- Moderated by the Corps of Engineers (Lead DMMP agency)
- Hosted by Washington Department of Ecology

0.2

MEETING OBJECTIVES AND PURPOSE

- Obtain public input on proposed changes to the DMMP Management Plans through Clarification Papers posted on the Corps Dredged Material Management Office's Homepage:
  (http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=dmmo&pagename=home)
- Discuss disposal site management actions and changes.
- Summary of Ecology Cleanup Activities
- Summary of EPA Regional Cleanup Activities

0.3

MEETING OBJECTIVES AND PURPOSE (continued)

- Obtain public input on proposed changes to the DMMP.
- Presentation and discussion of Public Issue Papers.
- Comments and discussion on Status Reports of ongoing actions of DMMP and SMS Program.

0.4

Agency Summary Reports:

- DMMP Program Testing Activities Summary (Lauran Warner, Seattle District)
- DMMP Disposal and Monitoring Activities Summary (Peter Leon, DNR)

0.5

Agency Summary Reports: (continued)

- Summary of Ecology SMS Cleanup Activities (Kathryn DeJesus, Ecology)
- Summary of EPA Regional Activities (Lori Cohen, EPA)
- QUESTIONS AND ANSWERS (on above topics)

0.6

DMMP/SMS Presentations (morning):

- Summary Overview of DMMP Clarification Papers and Status Reports not presented (Stephanie Stirling, Seattle District)
- *Neanthes* 20-day Chronic Bioassay Protocol Issues (Status) (David Kendall, Seattle District)
- Evaluation of Marine/Estuarine Sediment Toxicity Tests in Puget Sound Region: Future test clarifications (Status) (Tom Gries, Ecology)
- QUESTIONS AND ANSWERS (on above topics)

0.7

DMMP/SMS Presentations (afternoon):

- Bioaccumulative Chemicals of Concern evlauations at two PSDDA disposal sites (Justine Barton, EPA)
- PSAMP Sediment Quality Update (Margaret Dutch, Ecology)
- PSAMP Fish Tissue Monitoring Program Update (Sandie O'Neill, WDFW)
- SMS Requirements for TBT Analysis (Tom Gries, Ecology)
- Questions and Answers

0.8

Regional Sediment Team Update:

- Stephanie Stirling, Seattle District

0.9

Topical Presentations

- U.S. Navy Puget Sound Naval Shipyard Cleanup Update (Ted Benson, Ecology)
- *Armandia brevis* bioaccumulation evaluation (Susan McGroddy, Windward)
- When will contaminated sediment cleanups be completed? (John Dohrman, PSWQAT)
- Questions and Answers

0.10

Public Issue Papers

- Up coming meetings of interest to Sediment Management World (Clay Patmont, Anchor Environmental)
- Saving Project Chemistry Costs by Screening with EPA Method 4425 (Jack Anderson, Battelle NW)

0.11

Summary and Closing

- **Public Issues Summary**: Written comments may be submitted on the SMARM proceedings, but must be submitted to the DMMP agencies by **June 7, 2004** for consideration.
- **SMS Issues Summary**: Written comments on SMS issues presented at SMARM may be submitted to SMS for consideration until **June 7, 2004**.

0.12

SEDIMENT MANAGEMENT ANNUAL REVIEW MEETING

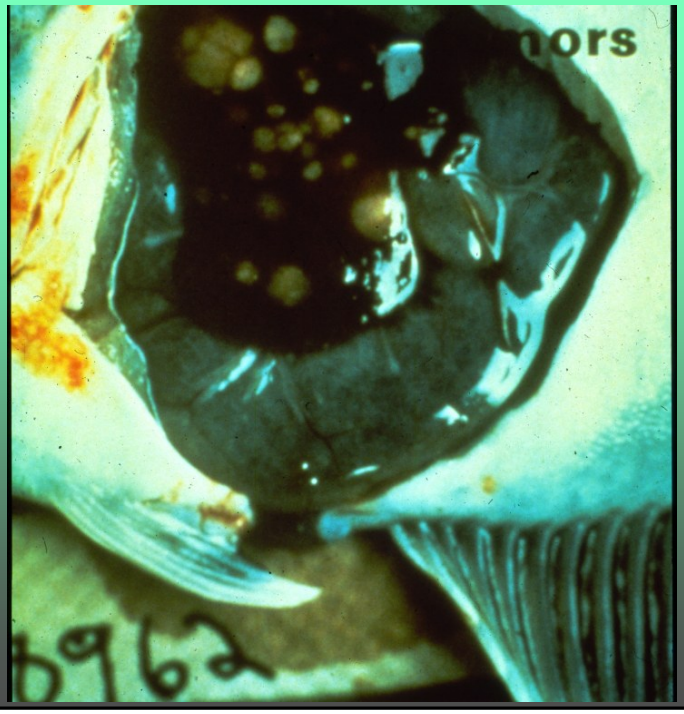
May 5, 2004

Dredging Year 2004

DMMP Testing Activities Summary

1.1

1.2



1.3

TIMES SPECIAL REPORT

JUNE 10, 1984

The

MPERILED SOUND

First of three parts

eautiful Puget Sound clearly contaminated, ut just how sick is it?

Eric Prime
mes staff reporter

Geoff Ryan stood on the fishing pier at Waterfront Park, casting for his dinner, unaware of a potential danger that may lurk beneath the surface of Elliott Bay.

Nothing looked dangerous. A tour boat nosed to the pier, its aft deck packed with passengers. Gulls dived from pilings to intercept French fries tossed by tourists. Across the sound the Olympics played hide-and-seek in the clouds.

Ryan, an Australian sailor in town to pick up a ship, had never fished in Elliott Bay before. He didn't know the Seattle-King County Health Department has warned that some of the sole, cod and other bottomfish in Elliott Bay are contaminated.

Scientists have discovered a high percentage of the bay's bottomfish are sick, their livers spotted with tumors, their fins rotting away. They suspect there's a link between those illnesses and high concentrations of toxic chemicals in the bay's sediments.

Ryan hadn't heard about that.

"I've been told the cod here are very good eating," he said.

Locals and out-of-towners alike need to take Puget Sound for granted. It's always been pretty clean, we think, and presumably it always will be.

But now a barrage of reports of sick fish, toxic sediments and contaminated shellfish beds has challenged that presumption, raising doubts about the one leisure that may be most responsible for making this region "more livable."

"What we're seeing is red flags going up all over the place," says Dale Peeke, manager of a new state-federal program investigating the sound's health. "We're finding Puget Sound clearly is not a healthy environment."

Clearly, parts of Puget Sound are in trouble.

Its problems extend beyond Elliott Bay and its other industrialized arms.

Several miles to the north, far from the bustle of Elliott Bay, Cindy Layne dug clams on the quiet beach at Carkeek Park.

She planned to steam some of the shellfish and

Jeanne Macauley and son Matthew, 3, beachcomb at Discovery Park, not far from Metro's West Point sewage-treatment plant, which discharges treated sewage into Puget Sound.

other Seattle beaches "should be considered a potential health hazard."

The clams Layne was digging couldn't be sold in a supermarket or restaurant. Last summer the average fecal coliform bacteria concentrations in the water at Carkeek exceeded federal Food and Drug Administration standards four times over.

Layne didn't know that.

"A friend told us the clams here were fine," she said.

Just how sick is the sound? Today The Times begins a three-part examination of its condition.

1.4

20 years later…

- We still lead the nation in interagency coordination on sediment issues
- Progress is ongoing
- We're still talking, testing and evolving

1.5

The Big Picture

1. DMMP modifications since last SMARM
2. 2004 Testing & Evaluation
3. Future challenges

1.6

The Big Picture

1. DMMP modifications since last SMARM
2. 2004 Testing & Evaluation
3. Future challenges

1.7

Modifications since the last SMARM…

- Revised BCOC lists and new SL, BT, ML tables
- Definition of Dredged Material
- Pre-dredge Conferences for Projects in Grays Harbor and Willapa Bay
- Recency Guideline Exceedances

1.8

The Big Picture

1. DMMP modifications since last SMARM
2. 2004 Testing & Evaluation
3. Future challenges

1.9

Dredging Year 2004

Characterizations

- June 16, 2003 – June 15, 2004
- 8 Suitability Determinations
- 5 Recency Evaluations
- 1,214,430 cy will have completed the evaluation process

1.10

Dredging Year 2004
Findings

- 15,030 cy (1.2 %) unsuitable material in 2 projects
- Other projects passed ALL material
- One project was recency retesting (100% unsuitable)
- NO bioaccumulation testing this year

1.11

2004 Big Ones

Projects over 100,000 cy:

- Lower Snohomish Turning Basin (272,000 cy)
- Upper Snohomish Turning Basin (425,000 cy)
- Blair Bridge Reach (265,000 cy)
- Port of Peninsula, Willapa Bay (145,000 cy)

1.12

2004 Recency Extensions

No additional testing required

- PSNS
- East Waterway (subsurface)
- Padden Creek
- Glacier Northwest Cement Terminal

1.13

2004 Recency Extension

Further testing required

- East Waterway – Stage II
  - Three DMMU all failed re-testing

1.14

Project Changes & Trends

- Cutbacks in the Blair Waterway, Port of Tacoma
- Pacific Sound Resources (PSR) Project using about 300,000 cy of clean material for capping in Elliott Bay
- Projects in Lower Duwamish Superfund area getting extra coordination and oversight

1.15

Ongoing/Future Projects

- Port of Tacoma / Blair Turning Basin Cutback Project (2.6 million cy)
- Dakota Creek (Anacortes) – additional testing
- Grays Harbor O&M (1.86 million cy)

1.16

MORE
Ongoing/Future Projects

- South Park Marina, Duwamish River (9,000 cy)
- Tidewater Cove Marina, Columbia River (12,000 cy)
- Brightwater Outfall (5,300 cy)
- Port of Seattle, Terminal 46 (27,000 cy)

1.17

The Big Picture

1. DMMP modifications since last SMARM
2. 2004 Testing & Evaluation
3. Future challenges

1.18

Upcoming Issues

- Commencement Bay Shoreline Permit (on track!)
- Invasive Species (scope not clear)
- Freshwater Guidelines
- Regional Sediment Evaluation (RSET)

1.19

Beneficial Uses

- What exactly is a beneficial use?
- Where will DMMP funding come from?
- Are DMMP open-water disposal guidelines sufficient for evaluating BU material?

1.20

For more DMMP information

http://www.nws.usace.army.mil/index.cfm

Click on "Dredge Material Management"

1.12

2003 Tiered Full Monitoring: Commencement Bay Disposal Site

Peter Leon
DNR DMMP Manager

Seattle District

2.1

Monitoring Framework

1. Does dredged material remain on site?
   - Sediment Vertical Profile System (SVPS)
   - Sediment Chemistry
2. Were biological effects conditions exceeded?
   - Sediment Chemistry
   - Sediment Bioassays
3. Were adverse effects to off-site biological resources observed?
   - Tissue Chemistry
   - Infaunal Community Structure

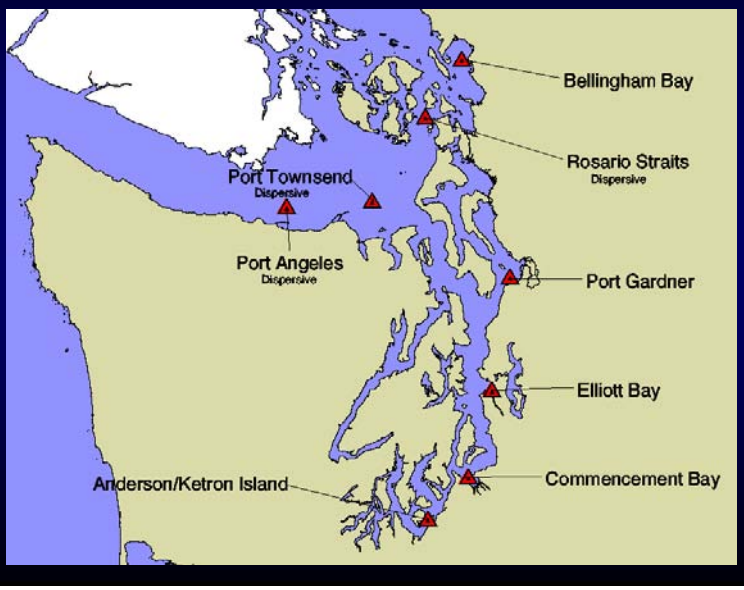
2.2

Agenda

- Monitoring Tools
- Modifications
- Summary of Previous Conditions
- 2003 Findings
- 2003 Evaluations
- Future Activities

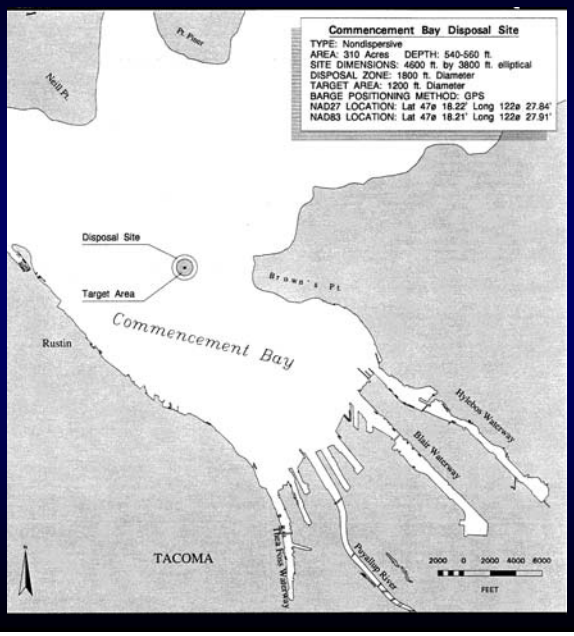
2.3

DMMP Sites in Puget Sound



2.4

Commencement Bay Disposal Site



2.5

Tiered Full Monitoring Tools

	SVPS	Sed. Chem.	Benthic Infauna	Bioassays	Tissue Chem.
Zone Station (Z)	✓	✓		✓	
Site Station (S)	✓	✓		✓	
Perimeter Station (P)	✓	✓			
Transect Station (T)	✓		✓		✓
Benchmark Station (B)		✓	✓	✓	✓
Cross Station (C)	✓				
Floating Station (F)	✓				
Reference Station (R)				✓	

2.6

2003 Modifications

- Revised SVPS Sampling Approach
  - Day 1: lower density, greater spatial coverage
  - Day 2: finer delineation of DM footprint
- 2003 Transect Stations: T13, T14, T16
  - 1988, 1995 Stations: T01, T03, T05
  - 2001 Stations: T13, T14, T15, T16
- BCOC Analysis: onsite, perimeter, transect stns.
  - Revised BCOC list implemented (List 1 and List 2)
  - Dioxins and furans excluded
- Butyltins Analysis removed

2.7

Summary of 1988 Baseline Conditions

- Historic DM present in Southeast
- Several cmpds/metals exceeded SLs:
  HPAH, LPAH, phenol, 4-methylphenol, dibenzofuran, hexachlorobutadiene, Sb, & Hg
- 1 on-site & 1 benchmark failed bioassay
- Benthic infauna were abundant

2.8

Summary of 1995 “Full”

- SVPS – All material remained on site
- On-site stations passed chem. & bioassay
- High PAHs and Metals
- Increase in percent fines at southern end
- Molluscan taxa showed a significant decrease at the farthest transect station, unrelated to DM

2.9

Summary of 1996 “Partial”

- Dredged material remained on site
- No effects beyond minor adverse biological effects
- On-site chemistry and bioassays passed
- Benchmark results used to represent baseline: All metals and several PAHs detected; Pb >SLs in all reps; indeno(1,2,3-c,d)pyrene, 4,methylphenol, benzyl alcohol, and benzoic acid > SL @ CBB02

2.10

Summary of 1998 SVPS

- Thin band of fine sands and sandy silts were present beyond the site boundary to the NW

2.11

Summary of 2001 “Full”

- SVPS – Large excursions (areal, not volumetric) to the NNW and SW
- On-site stations passed chem. & bioassay
- No chemical concentration increase offsite
- Bay-wide decrease in infauna

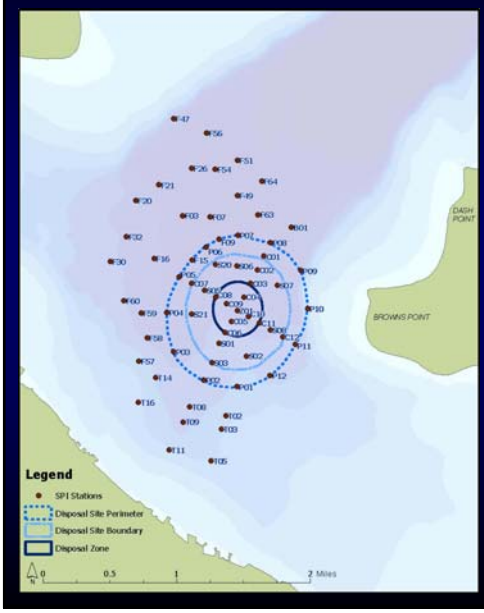
2.12

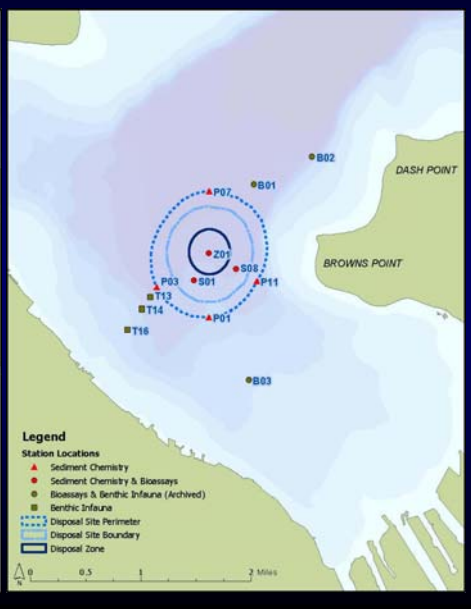
2003 Results

- SVPS
- Site Chemistry
- Site Bioassays
- Benthic Infauna
- Tissue Analyses
- Benchmark Stations

2.13

SVPS, Sediment & Tissue





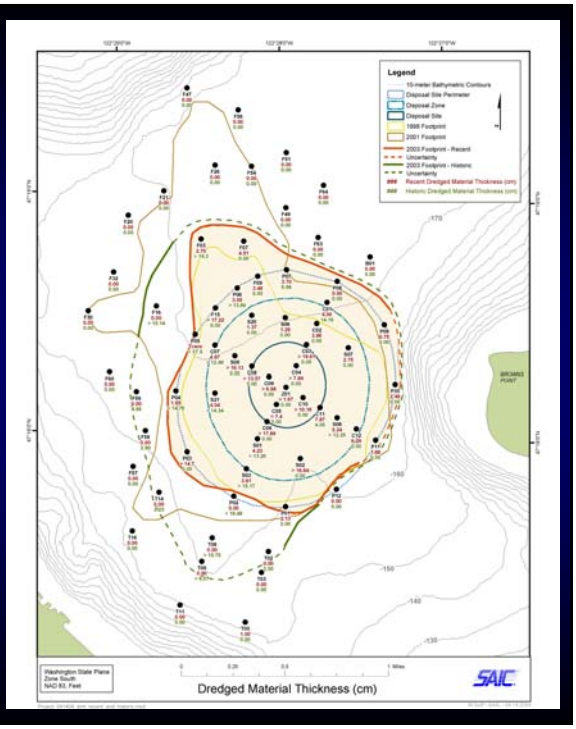
2.14

Sediment Vertical Profile System (SVPS)

- Images obtained at 64 stations
- Recent dredged material generally onsite
  - Small lobe of recent material to the NW
- Historic dredged material extends roughly SW and NW
- PSDDA Hypothesis 1 is rejected

2.15

Dredged Material Footprint: Some uncertainty exists between recent and historic dredged material deposits.



2.16

Sediment Chemistry: Conventionals and Metals

- Conventional parameters generally comparable to 1995, 1996, and 2001 data except:
  - Total sulfide higher than 2001 at all locations
  - Grain size -- More gravel Z01, more fines S01 and S08
- Metals detected in all samples (consistent w/ 1995, 1996, and 2001)
  - No samples exceeded DMMP SL guidelines or SQS criteria
  - Metals slightly higher at perimeter than onsite

2.17

Sediment Chemistry: Organics

- Volatile organic compounds, chlorinated aromatic hydrocarbons, pesticides, and PCBs **NOT DETECTED** except:
  - Low concentration hexachlorobenzene @ P01, P07, P11.
  - Low concentration DDT @ Z01.
- Some SQS exceedances due to detection limits and low TOC
  - All onsite stations pass bioassay
  - Perimeter normalized concentrations comparable to onsite measurements

2.18

Sediment Chemistry: Organics

- PAHs, phthalates, phenolics, and dibenzofuran detected in most sediment samples analyzed for semivolatile organics.
  - Phenol exceeds DMMP SL and SMS SQS – BENCHMARK ANALYSIS TRIGGERED
  - Phthalates exceed SMS SQS at 1 P station – BENCHMARK ANALYSIS TRIGGERED

2.19

Sediment Chemistry: BCOCs

- List 1 BCOCs: No BT exceedances
  - Metals, HPAHs, and pesticides detected
  - Chlorinated aromatics and phenols undetected
- List 2 BCOCs (candidate list – BT's not developed)
  - HPAHs detected
  - Pesticides detected

2.20

Sediment Chemistry: Field Variability

- In general, field variability acceptable for all samples (RSD < 50%), except:
  - Total sulfides at all perimeter locations
  - P01: % gravel, butylbenzylphthalate, bis(2-ethylhexyl)phthalate
  - P03: flourene, anthracene, total benzofluoranthenes
  - P07: acenaphthene, phenanthrene, anthracene, HPAHs, 4-methylphenol
  - P11: total benzofluoranthenes, phenol

2.21

Tissue Chemistry

Molpadia samples from T stations analyzed for metals, semivolatile organics, pesticides/PCBs, and miscellaneous BCOC List 1 & 2 compounds

- No BCOC organics detected
- Metals (except Ni and Ag) detected at low concentrations at all T stations
- Arsenic exceeded TTL, but lower than baseline
- Cadmium exceeded baseline – BENCHMARK ANALYSIS TRIGGERED
- Ag (undetected) detection limit exceeded baseline

2.22

Bioassays

All stations passed all bioassay guidelines

- Amphipod Mortality
  - All test samples pass
- Larval Mortality/Abnormality
  - All test samples pass
- Juvenile *Neanthes* Growth
  - All test samples pass

2.23

Benthic Community Analysis

- Total abundance and taxa increase over both 1995 and 2001.
- Dominant species composition is similar to previous surveys, however proportional abundances are shifting among transect stations
- Benthic community structure dominated by mollusca in 2003 and 1995 (dominated by crustacea in 2001).
- Polychaetes decrease w/ distance from site.

2.24

Benchmark Station Analyses

- Tissue: Cadmium
  - Benchmark analysis suggests no area-wide change
  - Low tissue concentrations do not warrant concern
- Sediment Chemistry: Phthalates and phenol
  - Results pending
  - Blank contamination contributes to SQS exceedance

2.25

Evaluation of 2002 Data

- Question 1: Does dredged material remain on-site?
  - Hypothesis 1: Dredged material remains within the site boundary
    - Rejected, based on SVPS Survey
  - Hypothesis 2: Chemical concentrations offsite do not increase due to disposal
    - Tentatively Rejected, while global and chemical group results show decreases in COCs, increases in phthalates and phenol warrant further evaluation.

2.26

- Question 2: Has DM disposal caused bio. effects conditions to be exceeded?
  - Hypothesis 3: On-site chemical concentrations do not exceed Site Cond. II guidelines
    - Not Rejected, no ML exceedances
  - Hypothesis 4: Sediment toxicity does not exceed Site Condition II guidelines
    - Not Rejected, all 3 onsite stations passed bioassay interpretive guidelines

2.27

- Question 3: Are unacceptable adverse effects occurring off-site due to disposal?
  - Hypothesis 5: No significant increase in chemical body burden of benthic infaunal taxa
    - Not Rejected, BPJ for low cadmium concentrations – little concern. No other contaminants warrant concern.
  - Hypothesis 6: No significant decrease in abundance of dominant benthic infaunal taxa
    - Not Rejected, increase in dominant infaunal species abundance relative to 1995 and 2001.

2.28

Future Activities at Commencement Bay

Future monitoring is likely to occur next summer due to anticipated volumes at Commencement Bay next season.

DMMP agencies are initiating long-term studies in anticipation of reaching the initial planning volume (1988 EIS) of 9 M cys as early as 2007.

2.29

DNR SUA Disposal Volumes DY 2004

- Anderson/Ketron: 5,772 cys
- Commencement Bay: 1,194,668 cys
- Elliott Bay: 8,545 cys
- Rosario Straits: 4,962 cys
- Bellingham Bay, Port Angeles, Port Gardner, Port Townsend: 0 cys

2.30

Sediment Management
under the Toxics Cleanup Program

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Kathryn [?]
Sediment Management Unit, TCP-HQ

3.1

Chapter 173-204-120 WAC Antidegradation Policy

- The antidegradation policy of the state of Washington is applicable to any person's new or increased activity – the goal not to worsen existing conditions in the attempt to improve them…
- Despite this, Ted Benson continues to work for the Sediment Management Unit.
- Mitigated by the hiring of Gina Casteel, SMU
- …and David Sternberg, ERO

3.2

Sediment Management within Ecology's Toxic Cleanup Program, Jim Pendowski

HQ Section, Tim Nord

- Sediment Management Unit – Kathryn DeJesus
- Federal Site Cleanup & UST Unit
- Policy & Technical Support Unit
- Information Communications Unit

NWRO Section, Steve Alexander

- Uplands Unit
- Aquatics Unit – Gail Colburn
- Expedited Cleanups and Tank Unit
- Operational Support Unit

3.3

Sediment Management within Ecology's Toxic Cleanup Program, Jim Pendowski (cont.)

SWRO Section, Rebecca Lawson

- Urban Bay Action Team
- Technical Support Unit
- Site Management and Tank Unit

ERO Section, Flora Goldstein

- Preremedial Unit
- Site Management Unit – John Roland

CRO Section, Don Abbott

- Units? They don't need no stinking units…

3.4

Freshwater Sediment Guidelines

Phase I - Review North American freshwater guidelines

- Assembled synoptic Washington/Oregon data set
- Reliability analyses identified no preferred guidelines

Phase II – Freshwater guidelines

- Developed new
  - Apparent Effects Threshold (AET) values
  - "Optimal" AET values
  - "Floating Percentile" values
- Ecology Implementation Plan in management review

3.5

Woodwaste Site Assessment and Cleanup Guidelines

Ecology is developing SMS rule guidance to address identification and assessment of woodwaste cleanup sites

Woodwaste creates impacts to benthos via smothering, direct toxicity, and secondary toxicity e.g., DO sag

Guidance will identify:

- Environmental impacts of woodwaste
- Use of "best available science" assessment tools
- Recommended methods for site and cleanup boundary identification

3.6

SEDQUAL Information System

R5.0 will be available Summer 2004

R5.0 completes triad analysis system

- User may modify "compare to" criteria
- SMS marine chemistry, bioassay and benthic criteria included

External and internal mapping capable (Arc View)

Software upgrades to current releases

- Install Shield
- SQL Server

Revised internal HELP feature

3.7

Contaminated Site Information … or mud matters, too

- "Sediment-only" sites being added to Facility Site list for entry into TCP's Integrated Site Information System (ISIS)
- Comprehensive list of all TCP sites, now including "sediment-only" sites
- Automating information for reporting purposes

3.8

Sediment Source Control

- 2002/2004 Preliminary Draft 303(d) List
  - Public Comments and New Data
  - Responsiveness Summary
- 2004 Proposed 303(d) List
  - 45 day Public Comment Period in July
- Increased NPDES Permit Coordination

3.9

some... Sediment Site Status

- Jackson Park Housing Complex (Ostrich Bay)
- Bellingham Bay Demonstration Pilot Project
- Lower Duwamish Waterway source control
- Skykomish River
- Spokane River
- Lake Roosevelt

3.10

JACKSON PARK HOUSING COMPLEX

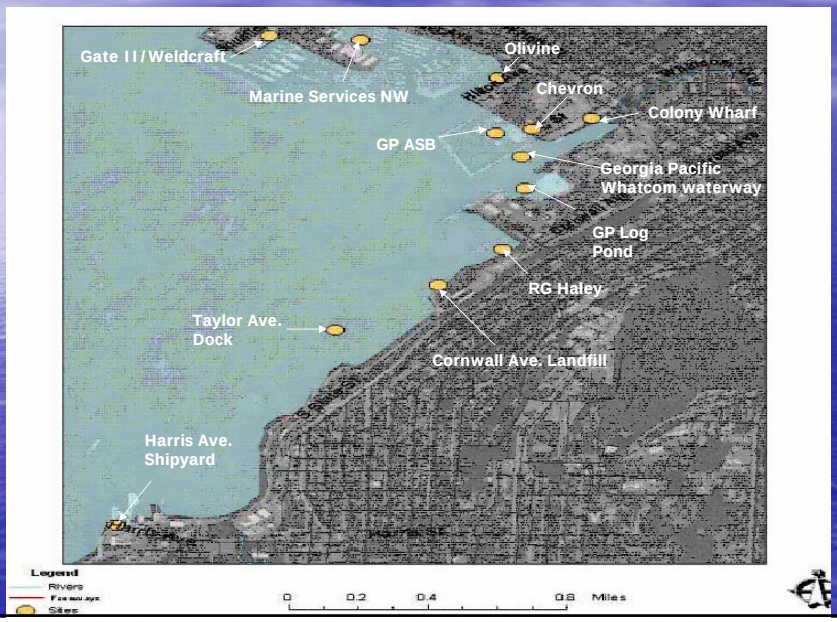
NAVAL HOSPITAL BREMERTON

Ostrich Bay

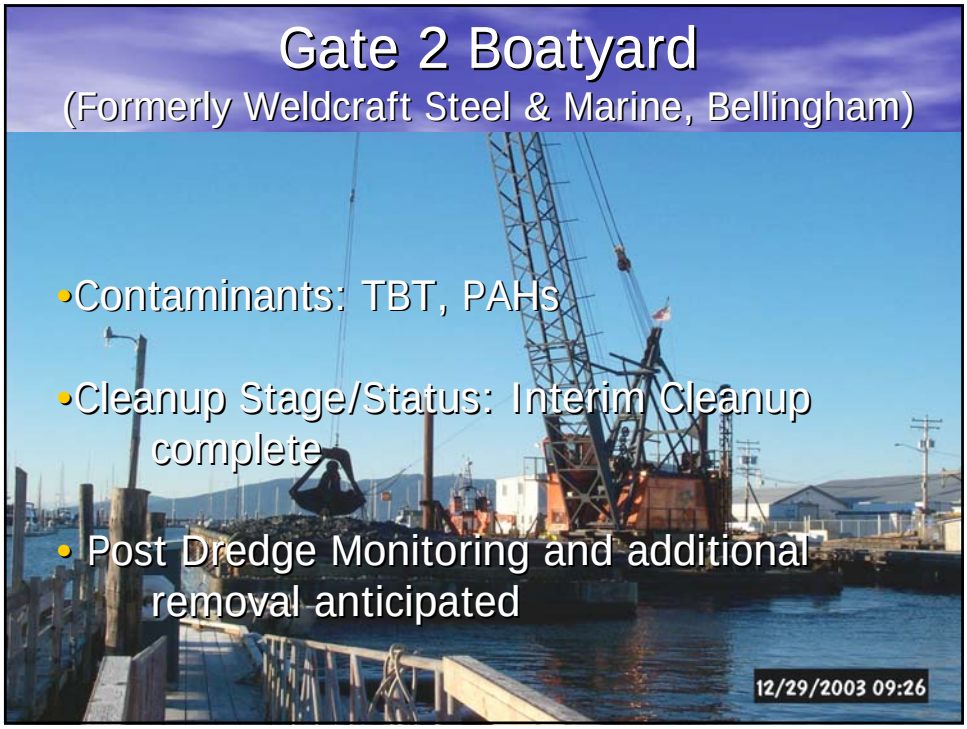
3.11

Bellingham Bay Demonstration Pilot

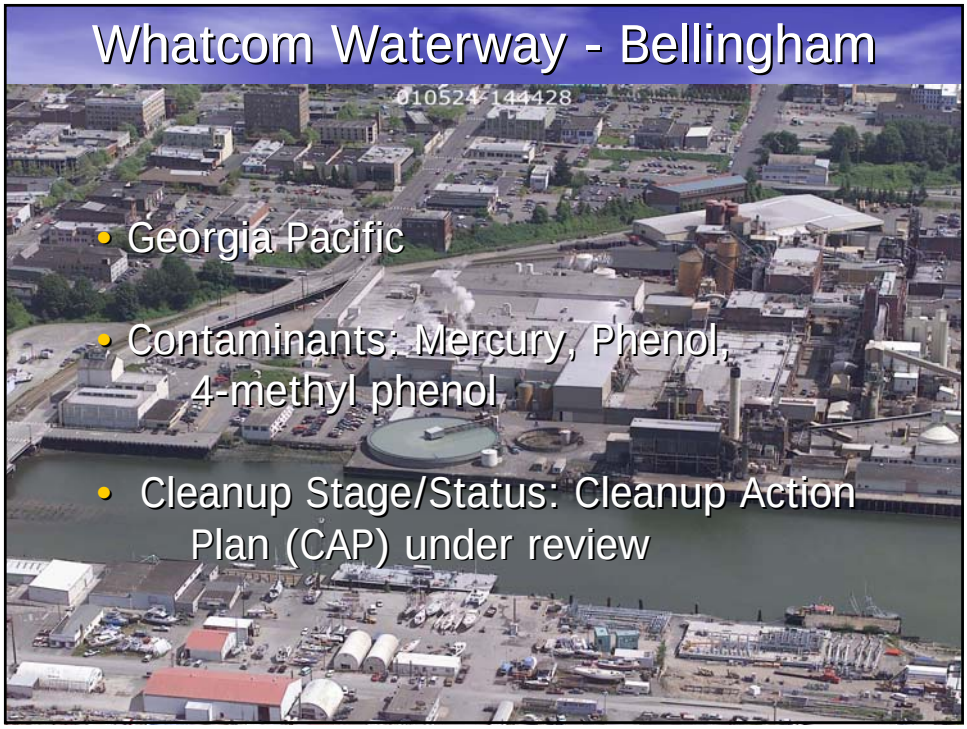
Remedial Activities



3.12


Gate 2 Boatyard
(Formerly Weldcraft Steel & Marine, Bellingham)
•Contaminants: TBT, PAHs
•Cleanup Stage/Status: Interim Cleanup complete
• Post Dredge Monitoring and additional removal anticipated
12/29/2003 09:26

3.13


Whatcom Waterway - Bellingham
010524-144428
• Georgia Pacific
• Contaminants: Mercury, Phenol, 4-methyl phenol
• Cleanup Stage/Status: Cleanup Action Plan (CAP) under review

3.14

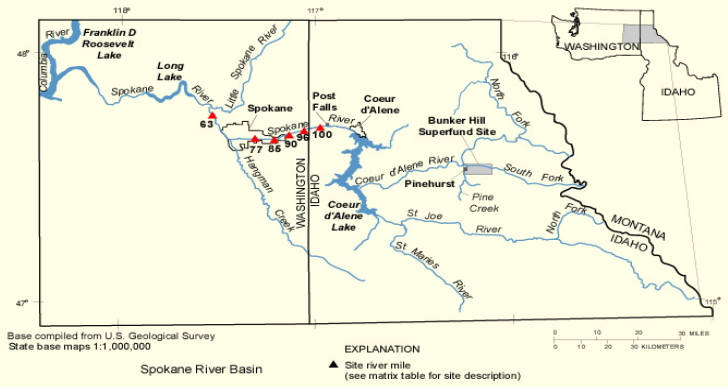
3.15

Lower Duwamish Waterway

- Source Control Strategy Complete (http://www.ecy.wa.gov/biblio/0409043.html)
- Duwamish/Diagonal Source Control Action Plan in final draft
- 489 source control business inspections performed
- Work on Terminal 117, Slip 4 Action Plans next
- Norfolk CSO: Approx. 65 cy of PCB contaminated sediment removed by Boeing in 8/03 to address cap contamination; monitoring begins Fall 2004

3.16

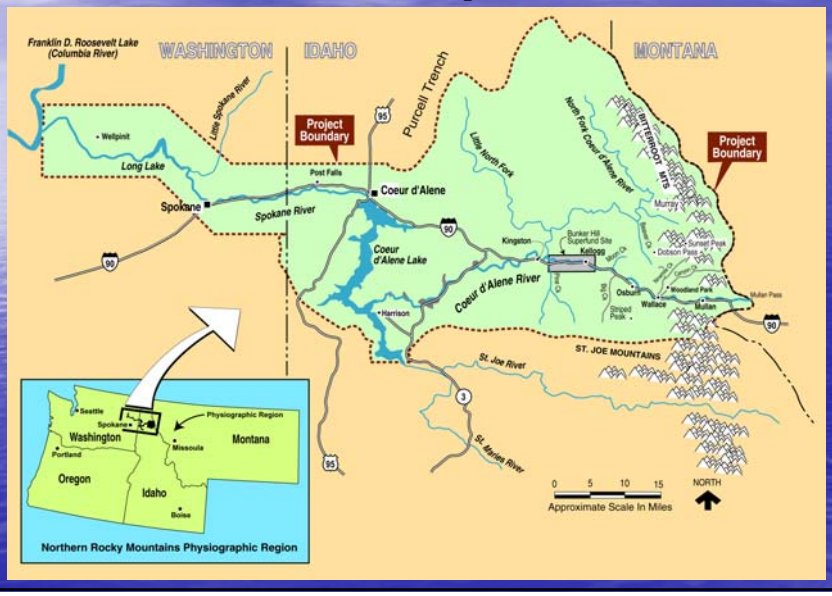
Ecology Eastern Region Freshwater Sediment Projects



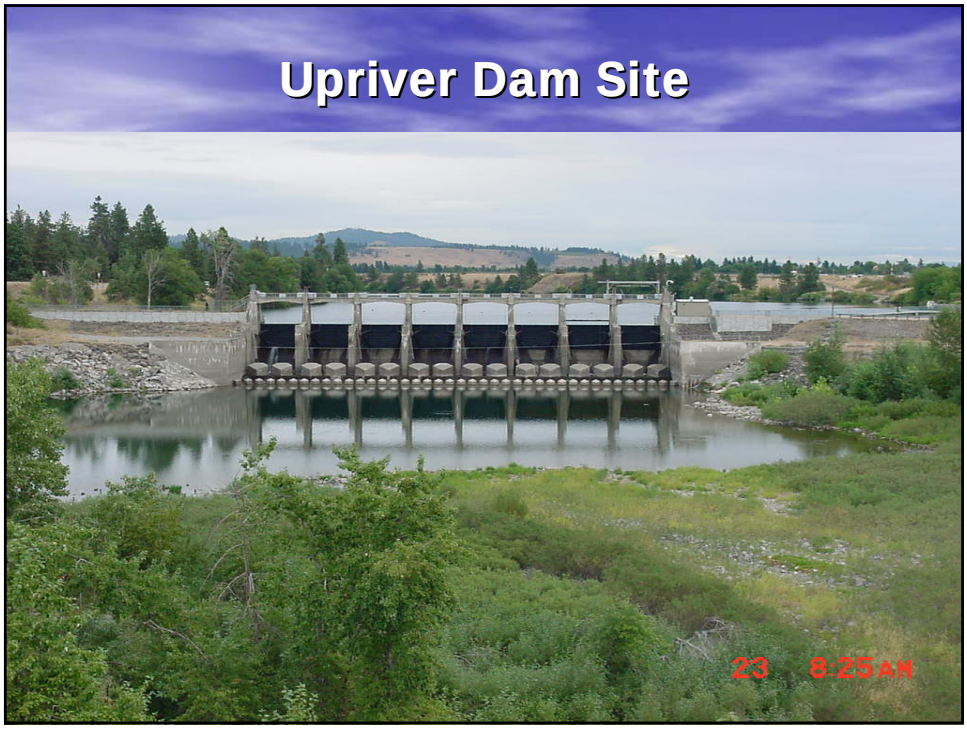
LAKE ROOSEVELT & SPOKANE RIVER

3.17

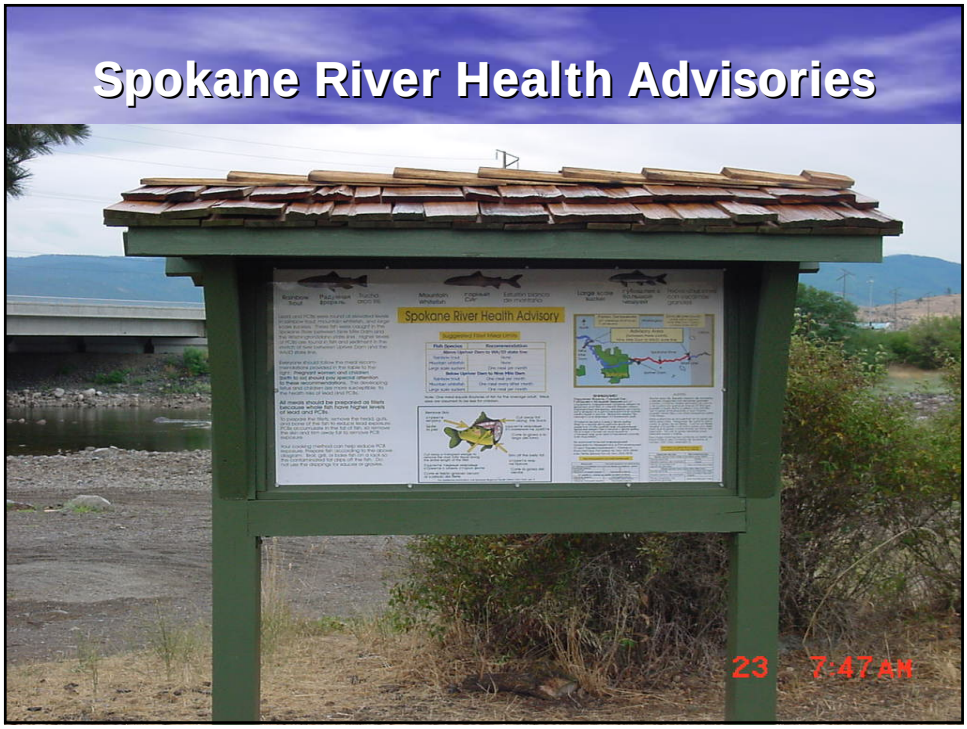
Spokane River Basin
(Coeur d'Alene Basin Superfund Cleanup)



3.18


Upriver Dam Site
23 8:25AM

3.19


Spokane River Health Advisories
Spokane River Health Advisory
23 7:47AM

3.20

Lake Roosevelt
(Upper Columbia River)

3.21

Skykomish

- Burlington Northern/Santa Fe RR
- Contaminants: PAHs, TPH (Diesel/Oil) LNAPL - 15 feet below ground surface
- Groundwater to sediment pathway
- Site specific TPH groundwater cleanup level calculated for protection of sediments - 208 micrograms per liter
- Cleanup Stage/Status: Currently under formal dispute resolution

3.22

Web Sites. . .

- Toxic Cleanup Program, Sediment Management homepage: http://www.ecy.wa.gov/programs/tcp/smu/sediment.html
- SEDQUAL data entry templates: http://www.ecy.wa.gov/programs/tcp/smu/sedqual/sedqualtemplates.htm
- 2003 SAPA: http://www.ecy.wa.gov/programs/tcp/smu/sapa/sapa.htm
- Cleanup Site Information: http://www.ecy.wa.gov/programs/tcp/sites/sites.html
- Water Quality Program 303(d) homepage: http://www.ecy.wa.gov/programs/wq/303d/index.html

3.23

THAT'S ALL FOLKS...

answer... Kathryn DeJesus

WASHINGTON STATE DEPARTMENT OF ECOLOGY

3.24

Sediment Management Annual Review Meeting (SMARM)

Lori Cohen

May 5, 2004

4.1

General Approach of Superfund Sediment Work

- Early and Continued Public Involvement
- Focus on Source Control
- Coordinate w/Sediment Program
- Work with ESA Agencies
- Identify Early Action Work
- Combine Development Projects with Cleanup
- Emphasize PRP Lead/Enforcement Projects

4.2

Puget Sound Sediment Cleanup Work Completed 2003

- East Waterway, Harbor Island
- Lockheed Shipyard
- Pacific Sound Resources
- Puget Sound Naval Shipyard
- Commencement Bay
  - Thea Foss Waterway
  - Middle Waterway
  - Mouth Hylebos/Blair Slip 1
  - Head Hylebos

4.3

4.4

East Waterway

- **Approximate size**: 20 acres
- **Contaminants**: PCBs and metals
- **Volume to be dredged**: 250,000 cubic yards
- **Dredging over two seasons**
- **Further investigation planned**

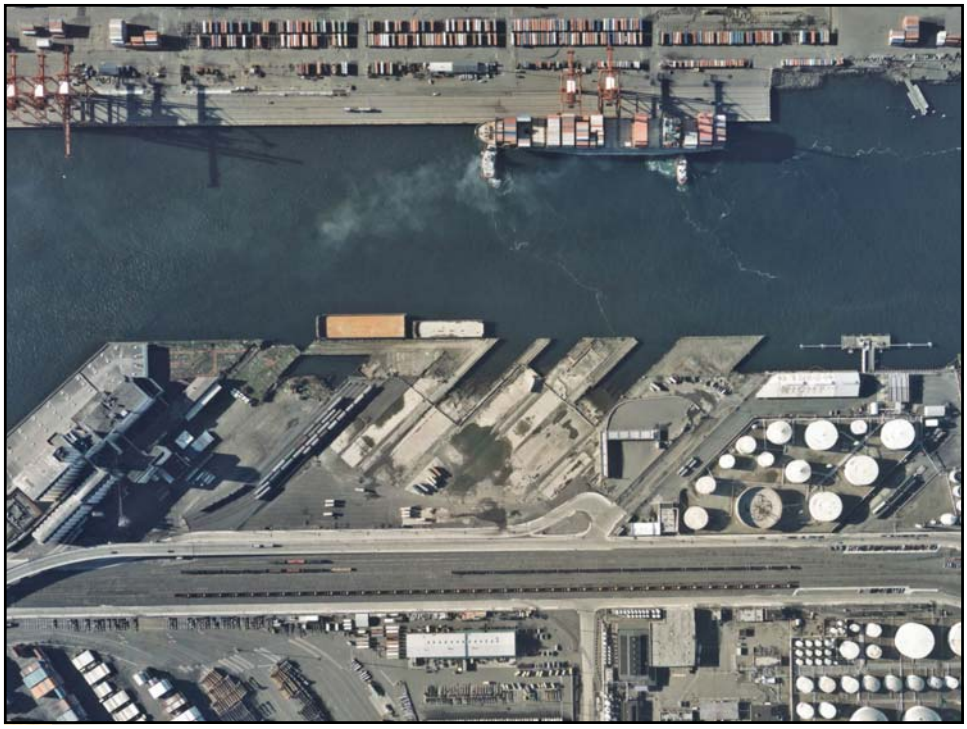
4.5

4.6

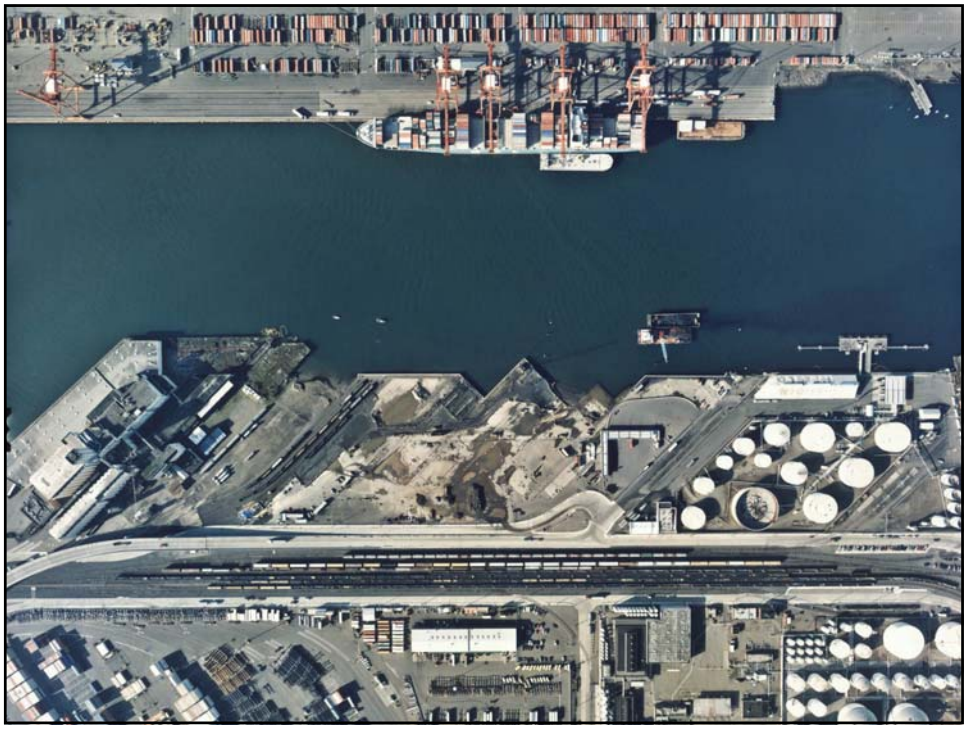
Lockheed Shipyard

- **Approximate size:** 8.5 acres
- **Contaminants**: As, Cu, Pb, Hg, Zn, PCBs, and PAHs
- **Remedial Action:**
  - 7,000 treated piles were pulled
  - 52,000 cy of contaminated sediments were dredged
  - 10,600 tons treated wood; 13,000 tons of concrete for recycling; 70 tons scrape steel were removed
  - Re-examining dredging approach for next season
  - Work performed by: Lockheed Martin

4.7



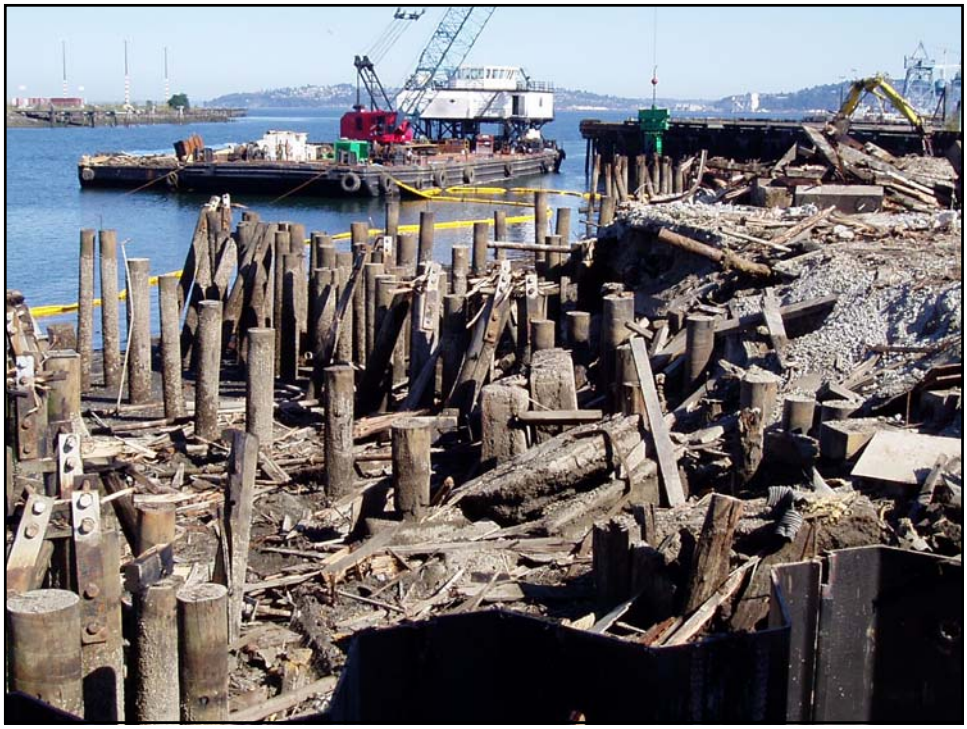
4.8



4.9

4.10

4.11



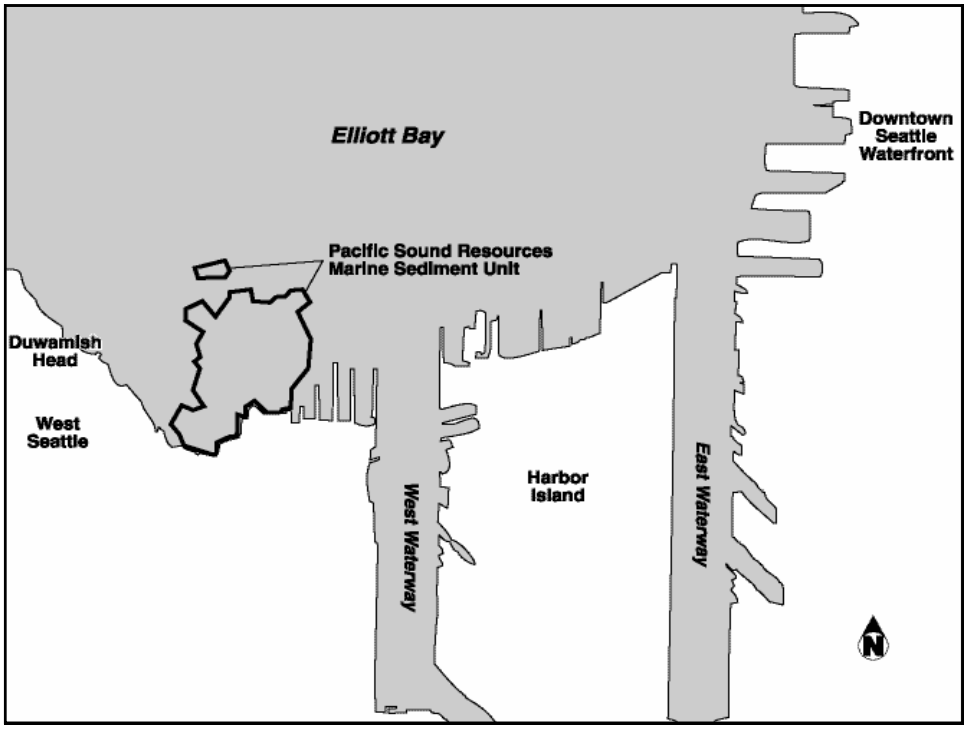
4.12

4.13

Pacific Sound Resources

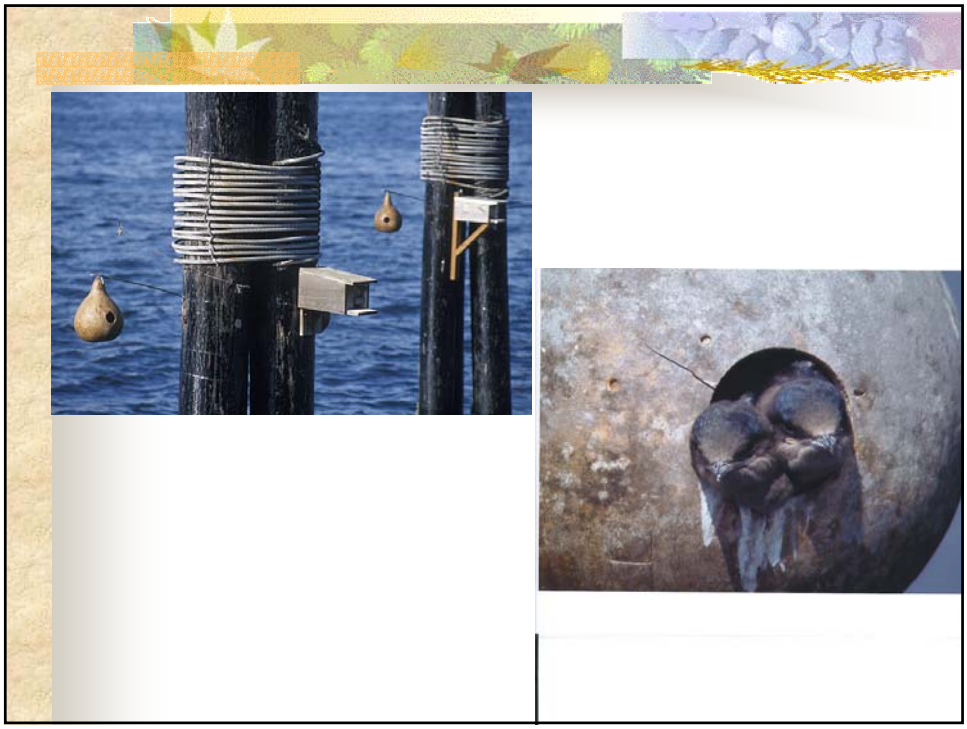
- **Approximate area**: 58 acres
- **Contaminants**: wood-treatment related contaminants, PCB and metals contamination from unrelated but nearby sources
- **Remedial action**: removal of 800 pilings, capping, dredging, creation of intertidal habitat
- **Funding**: PSR Environmental Trust

4.14


Elliott Bay
Downtown
Seattle
Waterfront
Pacific Sound Resources
Marine Sediment Unit
Duwamish
Head
West
Seattle
West Waterway
Harbor
Island
East Waterway
N

4.15

4.16



4.17

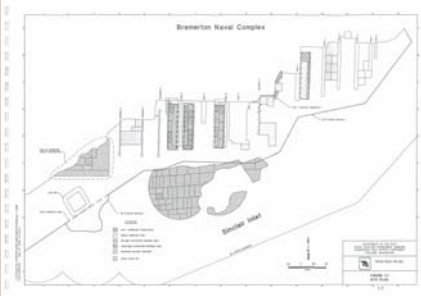
4.18

Puget Sound Naval Shipyard

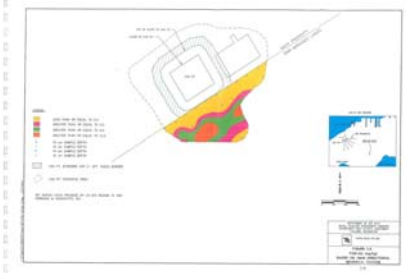
- **Approximate Size:** 8 acres
- **Contaminants:** PCBs, mercury
- **Type of Cleanup:** Enhanced Natural Recovery
  - In area associated with disposal of contaminated sediments in the CAD Pit
  - Sediment Profile Imaging (SPI) to determine the extent of deposition from CAD Pit disposal operation
- **Work Completed in March 2004**
- **Parties Performing Cleanup:** U.S. Navy

4.19

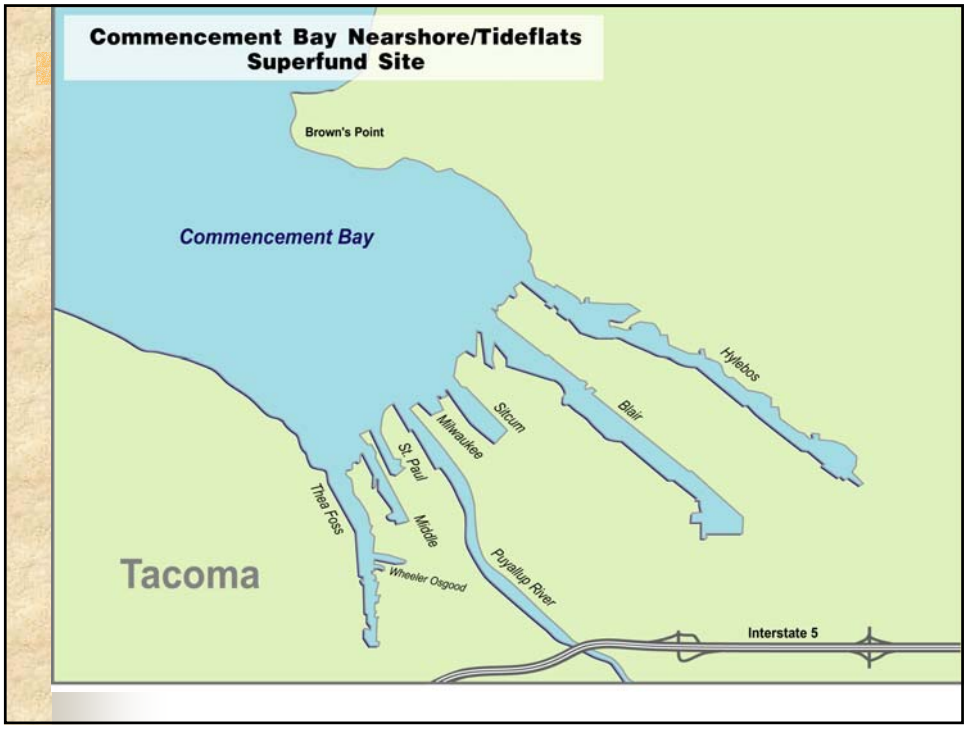
Enhanced Natural Recovery for Operable Unit B Marine



Confined Aquatic Disposal (CAD) Pit



4.20


Commencement Bay Nearshore/Tideflats
Superfund Site
Brown's Point
Commencement Bay
Hylebos
Blair
Sitcum
Milwaukee
St. Paul
Middle
Thea Foss
Wheeler Osgood
Puyallup River
Tacoma
Interstate 5

4.21

4.22

Thea Foss Waterway

- **Head of Waterway was remediated**
  - Acres: 9 acres
  - Contaminants: PAHs, BEP, Zn, Pb, Hg, PCBs
  - Remedy: 7,500 cy dredged, cap, sheet pile wall
  - Work performed by Utilities Group

- **Mouth of Waterway Activities**
  - Dredged confined aquatic disposal facility
  - Dredged area in front of Glass Museum
  - Completed habitat mitigation on west side of St. Paul peninsula by City of Tacoma

4.23

Mouth of Middle Waterway

- **Approximate size of site (Areas A & B):** 10.7 acres
- **Contaminants:** PAHs, metals, mercury
- **Number of creosote-treated pilings removed:** 865
- **Volume of sediment dredged:** 107,658 cy
- **Capping**: 4.5 acres
- **Enhanced Natural Recovery**: < 0.5 acre
- **Parties performing cleanup**: Middle Waterway Action Committee

4.24

4.25

4.26

4.27

Mouth Hylebos/Blair Slip 1

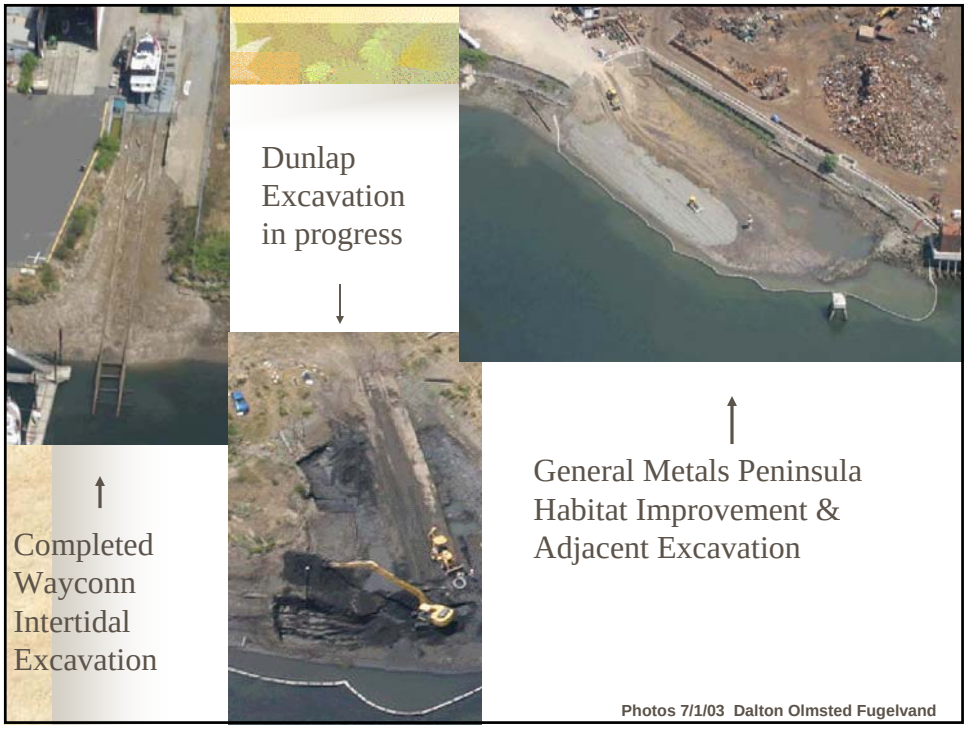
- **Approximate size**: 50 Acres
- **Volume**: 300,000 cy disposed in Slip 1
- **Contaminants**: PCBs, Pb, Hg, Ni, Cu
- **Parties performed work**: Port of Tacoma and Occidental
- **Confirmation sampling demonstrates success**
- **Further worked planned**

4.28

Head of Hylebos

- **Volume/area**: excavation/capping of 5.5 acres of bank/intertidal (40,000 cy) and habitat improvements
- **Contaminants**: Primarily PCBs, PAHs
- **Work performed by**: General Metals and Atofina
- Relocation of Hylebos Marina
- Complexity of "source control"
  - e.g., Atofina groundwater seeps

4.29



4.30

Cleanup Work Planned for 2004

- Lockheed Shipyard
- Todd Shipyard
- Commencement Bay
  - Mouth of Thea Foss Waterway
  - Head of Hylebos Waterway
  - Mouth of Hylebos Waterway/Blair Slip 1
  - Head of Middle Waterway

4.31

Todd Shipyard

- Area: 40 acres
- Volume – est. 200,000 cy dredged
- Contaminants: As, Cu, Pb, Zn, Hg, TBT, Zn, PCBs, PAH
- Major source control upgrades with cleanup
- Pier replacement
- Create additional habitat

4.32

Cleanup Work Planned for 2004

- **Thea Foss**
  - hydraulically dredge 525,000 cy of sediments
  - cap 21 acres
  - remove and replace 5 marinas
  - construct a new marina in front of Glass Museum
  - mitigation projects in the Middle Waterway, St. Paul Waterway, Puyallup River Side Channel
  - bank stabilization and creation of pocket beaches throughout the waterway

4.33

Head of Hylebos

- General Metals & Atofina Chemicals
- "Precision" dredging 45 acres – 370,000 cy
- Contaminants: PCBs, PAHs, metals
- July 15, 2004 - February 15, 2005
- By rail to Roosevelt Regional Landfill

4.34

Head of Middle Waterway

- Cleanup of subsurface sediments to be conducted by DNR in summer 2004

4.35

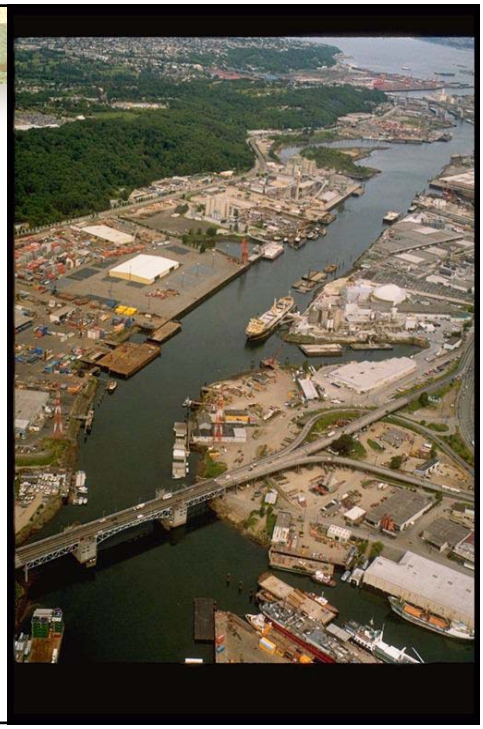
Status of Sites in RI/FS

- Lower Duwamish Waterway
- Portland Harbor

4.36

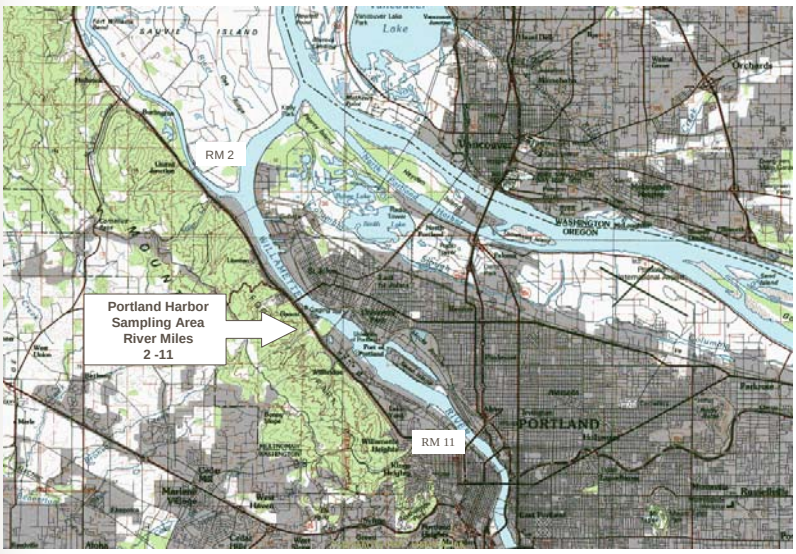
Lower Duwamish Waterway Site

- Source Control
- Remedial Investigation
- Feasibility Study
- Early Cleanup Actions



4.37

Portland Harbor Site



4.38

Lori Cohen

Office of Environmental Cleanup

EPA/Region 10

206-553-6523

cohen.l@epa.gov

4.39

SEDIMENT MANAGEMENT ANNUAL REVIEW MEETING

May 5, 2004

Summary of Clarification Papers and Status Reports

5.1

"Before I begin, I'd just like to make it known that I didn't volunteer to do this presentation."

5.

Papers

- Ammonia and Sulfide Guidance Relative to *Neanthes* Growth Bioassay
- Disposal Site Coordinate Update and Clarification
- DMMP Tier I Suitability Determinations
- DMMP Screening Level Revision for Phthalates

5.3

Copies can be found on the Web at:

http://nws.usace.army.mil

Click on "Dredge Material Management"

Click on "Annual Review Meeting"

5.4

Neanthes, Ammonia and Sulfide

- Issue: Potential interference with test results
- Thresholds of concern identified
- Recommended guidance

5.5

Table 1. Thresholds of Concern for *Neanthes* 20-day Chronic Test.

Parameter	No effects (0% mortality; no effect on growth)	Minor effects (~20% mortality; growth reduced 31-35% relative to control)	Major effects (~100% mortality, no growth)
Bulk Ammonia	≤ 115 mg/Kg	> 230 mg/Kg	> 400 mg/Kg
Total Interstitial Ammonia	≤ 10 mg/L	> 20 mg/L	> 40 mg/L
Unionized Interstitial Ammonia	≤ 0.46 mg/L	> 0.68 mg/L	> 1.25 mg/L
Total Sulfide	≤ 3.4 mg/L	≥ 5.5 mg/L	≥15 mg/L

5.6

Ammonia Purging

- Not recommended
- Concern regarding loss of contaminants
- May still be necessary in some cases

5.7

Clarifications

- Guidelines for standard reporting of ammonia data
  - Total ammonia from original bulk sediment sample
  - Total and unionized ammonia at the start of each toxicity test, and at day 3 (prior to first water exchange)
  - All water-only ammonia reference toxicant test data

5.8

Clarifications

- Threshold ammonia concentrations and guidelines for conducting ammonia reference toxicant (LC^{50}) tests
  - Use no effects level from table as threshold
  - Outline proposed reference toxicant tests in SAP

5.9

Clarifications

- Threshold concentrations for consideration of purging
  - Use minor effects level from table
  - Coordinate with DMMO to develop ammonia monitoring plan
  - Additional data collection if purging is allowed

5.10

Clarifications

- Purging methods and test initiation
  - Variety of protocols available –general approach
    - Replace overlying water 2 times a day
    - Testing in sacrificial containers every 1-3 days
  - Will be designed on a project specific basis
  - Overall goal is to minimize purging

5.11

Neanthes and Sulfides

- No effects level of 3.4 mg/L
- Levels above 5.5 mg/L should be reported to DMMO to discuss possible remedies

5.12

Disposal Site Coordinates

- Sites are managed adaptively
- Some confusion on recent projects concerning site coordinates
- Updated tables of site characteristics for Puget Sound, Gray's Harbor, and Willapa Bay

5.13

5.1

Table 1. DMMP: PUGET SOUND DISPOSAL SITE CHARACTERISTICS

Site	Area (acres)	Depth (ft)	Disposal Zone diameter (ft)	Target Area diameter (ft)	Disposal Site Dimensions (ft)	Site Coordinates (NAD83: Lat/Long)	Positioning VTS/DGPS
Anderson Island (nondispersive site)	318	442	1,800 (circle)	1,200 (circle)	4,400 x 3,600 (ellipsoid)	Lat: 47° 09.42' Long: 122° 39.47'	DGPS
Bellingham Bay (nondispersive site)	260	96	1,800 (circle)	1,200 (circle)	3,800 x 3,800 (circular)	Lat: 48° 42.82' Long: 122° 33.11'	DGPS
Commencement Bay (nondispersive site)	310	540-560	1,800 (circle)	1,200 (circle)	4,600 x 3,800 (ellipsoid)	Lat: 47° 18.21' Long: 122° 27.91'	VTS
Elliott Bay [1] (nondispersive site)	415	300-360	1,800 (circle)	1,200 (circle)	6,200 x 4,000 (Tear drop shape)	Lat: 47° 35.96' Long: 122° 21.45'	VTS
Port Gardner (nondispersive site)	318	420	1,800 (circle)	1,200 (circle)	4,200 x 4,200 (circular)	Lat: 47° 58.85' Long: 122° 16.74'	DGPS
Port Angeles (dispersive site)	884	435	3,000 (circle)	none	7,000 x 7,000 (circular)	Lat: 48° 11.67' Long: 123° 24.94'	VTS
Port Townsend (dispersive site)	884	361	3,000 (circle)	none	7,000 x 7,000 (circular)	Lat: 48° 13.61' Long: 122° 59.03'	VTS
Rosario Strait (dispersive site)	650	97-142	3,000 (circle)	none	6,000 x 6,000 (circular)	Lat: 48° 30.87' Long: 122° 43.56'	VTS

Legend: VTS = USCG Vessel Traffic Service; **DGPS** = Differential Global Positioning System

[1] Note that the original disposal site coordinates were shifted 300 ft to the south by the PSDDA agencies in 1991 following disposal site monitoring. The disposal zone was not changed, so the coordinates plotted within the disposal zone will show the target zone center coordinates are off center to the south relative to the disposal zone.

5.15

Table 2. GRAYS HARBOR AND WILLAPA BAY DISPOSAL SITE CHARACTERISTICS

Site (Dispersive)	Area (acres)	Depth (ft)	Disposal Zone	Disposal Site Dimensions (ft)	Site Coordinates (NAD83: Latitude/Longitude)	Positioning
Grays Harbor						
Point Chehalis (Estuarine)	229.6	>50 ft	Within rectangle, partitioned into 3 cells (2,000 x 5,000 ft)	2,000 x 5,000 ft. (rectangle)	Lat: 46°55'00.51 46°55'04.49 46°55'10.46 46°55'17.09 Long: 124°08'06.94 124°07'50.66 124° 07'26.23 124°06'59.10 Lat: 46°54'41.91 46°54'45.90 46°54'51.87 46°54'58.50 Long: 124°07'57.26 124°07'40.98 124° 07'16.55 124°06'49.42 (Corners of 3 cells within rectangle)	DGPS
South Jetty (Estuarine)	55.1	>50 ft	Within rectangle (800 X 3,000 ft)	800 X 3,000 ft. (rectangle)	Lat: 46°54'34.82 46°54'32.06 46°54'26.96 46°54'24.20 Long: 124°09'30.67 124°08'47.65 124° 09'31.74 124°08'48.72 (4 corners of rectangle)	DGPS
Half Moon Bay (beneficial use)	2.9 (1A) 52.6 (1) 37.3 (2)	15.5 ft (1A) 10-15 ft (1) 11-26 ft (2)	Variable within each subarea, see Figure	Variable within each subarea (Area 1A, Area 1, Area 2)	Variable within each subarea	DGPS
South Beach (beneficial use)	1,223.4	17-46 ft	Within Quadrilateral (6,400 x 7,700 ft x 6,200 x 9,500 ft)	6,400 x 7,700 ft x 6,200 x 9,500 ft (Quadrilateral)	Lat: 46°54'23.23 46°54'29.23 46°52'51.62 46°53'05.60 Long: 124°10'14.39 124°08'42.22 124° 09'41.30 124°08'14.60 (4 corners of Quadrilateral)	DGPS
3.9-Mile SW Ocean Site	58.4 (circle) 1,056.6 (parallel.)	>120 ft	1,800 ft diameter circle within parallelogram	6,000 x 8,000 ft. (parallelogram)	Lat: 46°51'55.68 Long: 124°14'40.53 (center of circle) Lat: 46°51'56.19 46°52'57.51 46°52'08.67 46°51'07.35 Long: 124°15'03.91 124°13'51.34 124° 13'02.50 124°14'15.06 (4 corners of parallelogram)	DGPS
8.0 Mile Ocean Site	58.4	140-160 ft	1,800 ft diameter circle	1,800 ft diameter circle	Site presently inactive. Used only once for the Federal Grays harbor deepening project material	DGPS
Willapa Bay						
Cape Shoalwater (Estuarine)	178.9	5-19 ft	USCG buoy G "13"	3,000 x 5,196 x 6,000 ft. triangle	Lat: 46°42'05.34 Long: 124°01'21.50 (coordinates for USCG buoy G "13")	USCG Buoy G13
Goose Point (Estuarine)	58.4	30–48 ft	1,800 ft diameter circle	1,800 ft diameter circle	Lat: 46°39'27.60 Long: 123°59'46.04 (center of circle)	DGPS

5.16

Tier I Suitability Determinations: Exclusions from Testing

- Clean Water Act and Inland Testing Manual provide for exclusions from testing
  - Sediment not a "carrier of contaminants"
  - Predominantly sand/gravel
  - Away from sources of contamination
- No existing PSDDA policy on exclusion
- Exclusion exists for Gray's Harbor, Willapa and Lower Columbia River

5.17

Clarification

- DMMP will assess some sediments for suitability at Tier I
- Two possible outcomes:
  - Existing information not sufficient for factual determination. Tier II necessary
  - Existing information sufficient. Tier I suitability determination possible
- Not applicable in moderate or high ranked areas

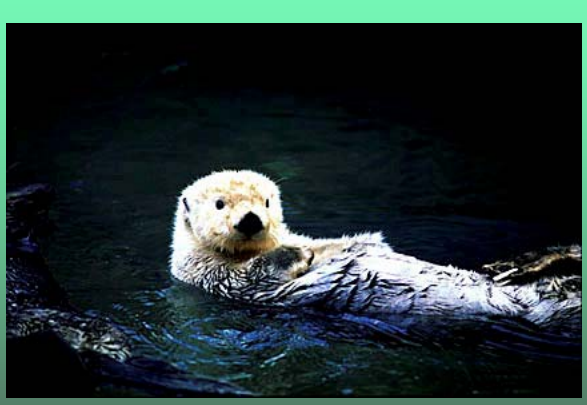
5.18

New DMMP Guideline for Phthalates

- Current number not consistent conceptually with SMS
- Proposed changes listed in table
- Change would result in limited number of SL exceedances
- Bioassay testing not required on phthalate-only SL exceedance

5.19

For more information



http://www.nws.usace.army.mil

Click on "Dredge Material Management"

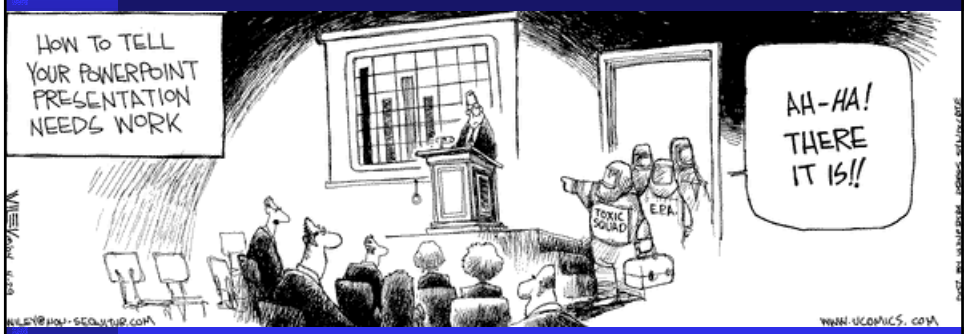
5.20

NEANTHES 20-DAY CHRONIC BIOASSAY PROTOCOL ISSUES

by

David Kendall and Tom Gries

6.1



6.2

DMMP / SMS Protocol

- Interlaboratory comparison study and full peer review development process
- Implemented in 1992
- It has generally performs well during regulatory testing (e.g., few QA/QC failures, and generally good concordance with other bioassays in testing suite when *Neanthes* exhibits a response)

6.3

1999 Draft *Neanthes* AETs potentially set 9 LAET's

- **Cadmium**
- **Chromium**
- **Lead**
- **Anthracene**
- **Dibenzo(a,h)anthracene**
- **1,2-dichlorobenzene**
- **Dimethylphthalate**
- **2,4-dimethyl phenol**
- **Benzoic Acid**

6.4

Neanthes Protocol Comparisons.

Parameter	20-day DMMP/SMS Protocol	28-day WES Protocol
Test Chamber	1 Liter Beakers	300 mL Beaker
Organisms / Replicate	5 per replicate	1 per replicate
Replicates / Treatment	5	10
Organism Age	2-3 weeks	< 7 days
Feeding Regime	40 mg Tetramarin per chamber every other day (8 mg/individual)	2 mg Tetramarin and alfalfa per chamber twice weekly

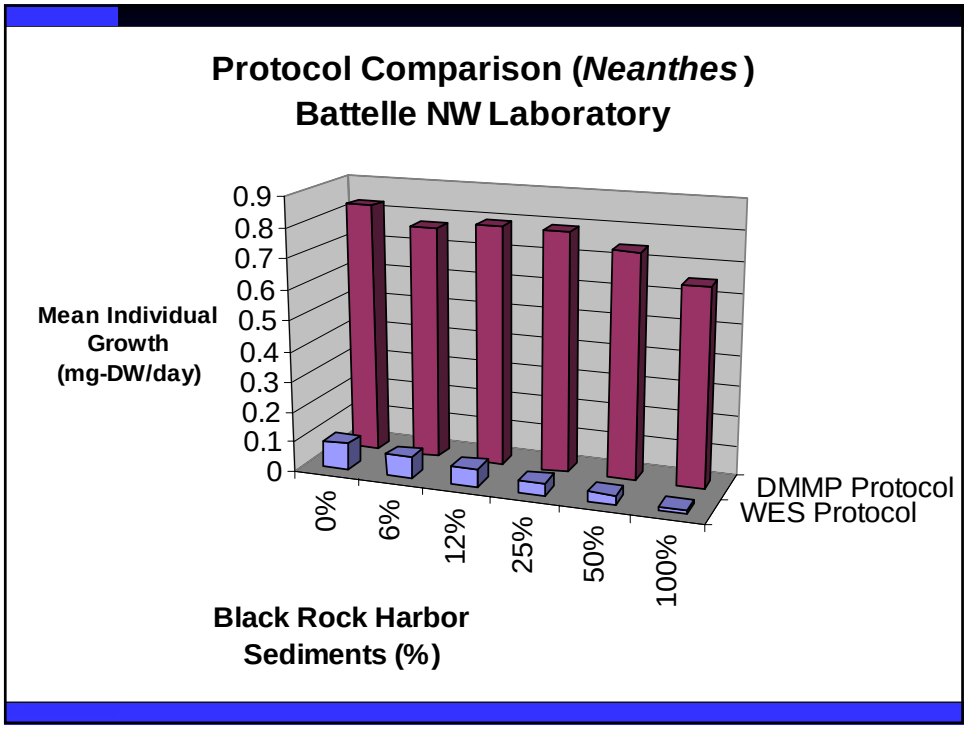
6.5

Feeding Regime Comparison

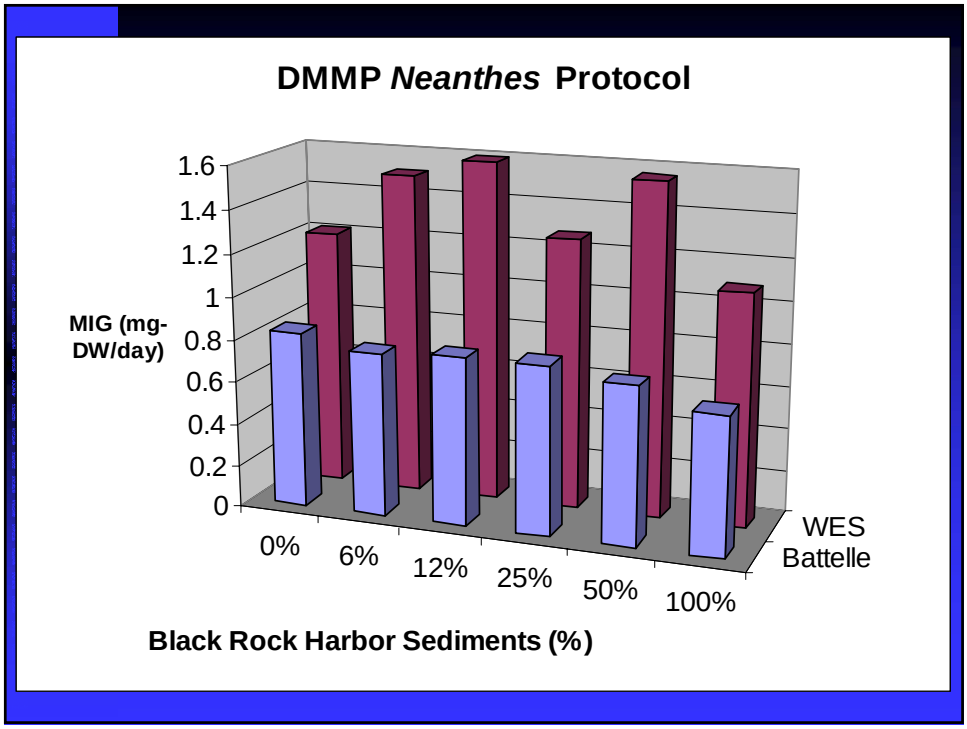
- **DMMP/SMS Protocol**
- 80 mg/individual total Tetramarine over 20 day exposure period

- **ERDC/WES Protocol**
- 16 mg/individual total Tetramarine and alfalfa over 28 day exposure period

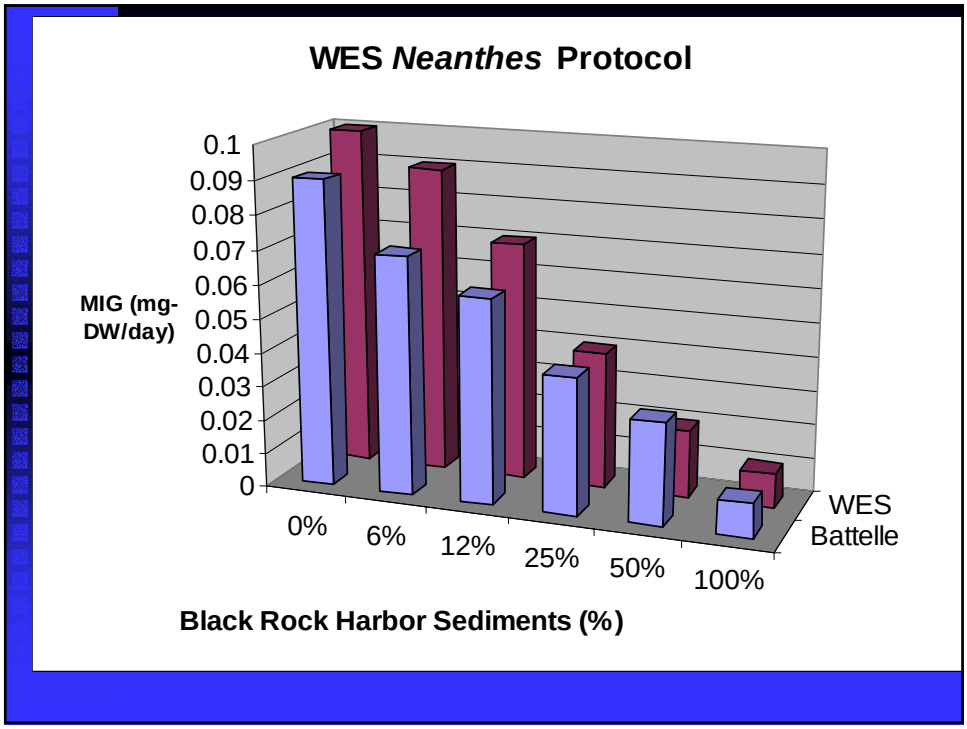
6.6


Protocol Comparison (*Neanthes*)
Battelle NW Laboratory
Mean Individual Growth (mg-DW/day)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0%
6%
12%
25%
50%
100%
DMMP Protocol
WES Protocol
Black Rock Harbor Sediments (%)

6.7


DMMP *Neanthes* Protocol
MIG (mg-DW/day)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0%
6%
12%
25%
50%
100%
WES
Battelle
Black Rock Harbor Sediments (%)

6.



6.7

Test Protocol Comparison Recommendations

- A more rigorous comparison study will be discussed with New York Corps/EPA (Region 2)
- Regional Input from bioassay practitioners/experts should be solicited in designing and conducting the test comparison
- Use Regional Sediments when conducting test, preferably from areas where previous *Neanthes* testing has been conducted with DMMP/SMS protocol
- Evaluate Test Sensitivity
- Evaluate Test reliability and variability
- Determine which protocol is more ecologically relevant
- Evaluate Test Interpretation Guidelines

6.8

Potential Outcome of Protocol Comparison

- No changes to DMMP protocol
- Minor changes to protocol (e.g., modify feeding regime, age/size at test initiation)
- Major changes to protocol (duration of test, # of replicates, # of worms/replicate, age/size at test initiation, feeding regime, interpretation)

6.9

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Introduction

Problem Statements

Status of Work

Next Steps

Conclusion

7.1

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Introduction - approaches/tools

- Predict benthic community health using chemical Sediment Quality Guidelines (SQGs) based in part on benthic community effects data
- Measure toxicity and bioaccumulation in lab (common) and/or *in situ* (rare)
- Benthic community analysis/risk modeling rare

7.2

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Problem statements

- SQGs - How well do regional guidelines and standards predict benthic community health?
- Toxicity and bioaccumulation tests - Are these good surrogates for benthic community health?
- **Toxicity and bioaccumulation tests - Do we need to revise guidance on organisms used, test protocols and interpretative endpoints?**

7.3

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Problem statements

- **Interpretive endpoints - Shouldn't these be updated and consistent among/between regulatory programs?**
- Benthic community evaluations - How valid are criticisms of the early benthic effects data and interpretive endpoints? Update both?
- *In situ* tests and models - Should these be used more frequently to evaluate benthic risk? If so, then when and how?

7.4

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Status of work

- ➔ Investigating relative sensitivity of amphipod species used in acute toxicity test
- ➔ Reviewing performance of the marine sediment larval development test protocol
- ➔ Evaluating interpretive endpoints for various biological tests and need for consistency between regulatory programs

7.5

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Status of work

- ➔ Analyzing comprehensive Puget Sound benthic community database, with results useful for evaluating optimum endpoints, performance of toxicity tests as surrogates, overall predictive ability of SQGs

7.6

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Responsiveness of amphipod species

- *Ampelisca*, *Eohaustorius*, *Rhepoxynius* and other species are all considered acceptable test species, selected based on salinity and grain size
- Reference toxicant Sensitivity$_{Ampelisca}$>S_R>S_L>S_E
- Regional data bring this into question
- Evidence, opinions differ

7.7

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Responsiveness of amphipod species

- Puget Sound Ambient Monitoring Program
  - 300 stratified/random 0-3 cm sediment samples collected throughout basin
  - Single *Ampelisca* "hit" observed
  - Least responsive of four toxicity tests

7.8

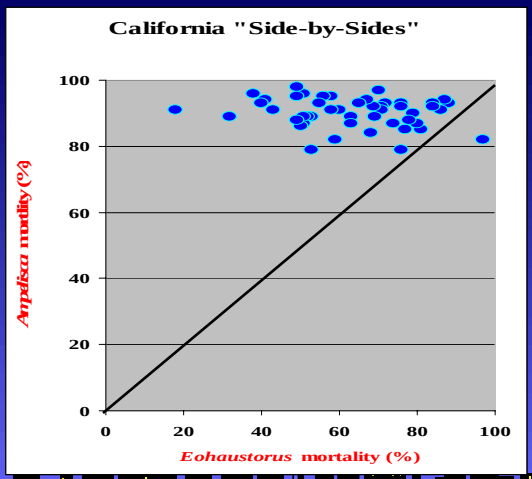
EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Responsiveness of amphipod species

- U.S. Navy Bremerton/PS Naval Shipyard
  - Round 1: 78/83 *Eo* “hits”, 62/83 sediment larval “hits”
  - Round 2: 0/72 *Ampelisca* “hits”
  - Round 2: 8/10 *Eo* “hits” and 0/10 *Ampelisca* “hits” in side-by-side tests
  - Influence of clay alone unclear

7.9

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?



7.10

7.1

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Responsiveness of amphipod species

Next steps

- Examine more “side-by-side” results, chemical-specific response data, regional incidence of effects
- Review existing guidance and elsewhere
- Revise guidance on selection of test species?

7.12

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Acceptance/performance of larval test

- Criticisms
  - Availability or spawning adults
  - Ecological relevance/unrealistic exposure
  - Combined endpoint
  - Entrainment/loss of larvae in test sediment
  - Identification of abnormal larvae
  - Greater variance among replicates than other tests
  - Influence of confounding factors

7.13

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Acceptance/performance of larval test

Next steps

- Evaluate need to revise current protocol
- Review options
  - Longer settling time?
  - Additional water quality monitoring?
- Review "sediment water interface" (SWI) or "screen tube" protocol and its performance outside Puget Sound

7.1

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Acceptance of larval test results

Next steps

- Evaluate performance of larval development test with SWI exposures, using more sediment samples from Puget Sound?
- Prepare detailed responses to criticisms
- Propose revised or entirely new protocol?

7.15

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

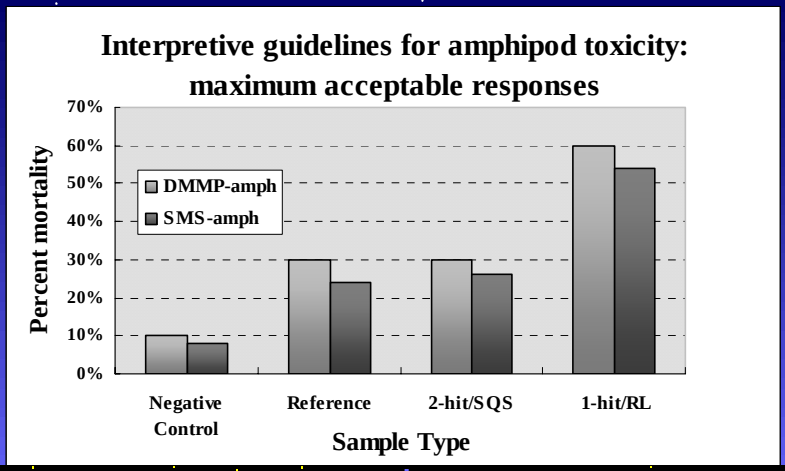
Optimum and consistent test endpoints

Next steps

- Continue assembling minimum detectable difference (MDD) data for toxicity tests
- Finish comparing interpretive endpoints used by regional sediment management programs

7.1

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?



7.17

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Optimum and consistent test endpoints

Next steps

- Evaluate implications of revising endpoints
- Propose revisions to interpretive endpoints that represent significant measurable effects and IF they are more predictive of benthic community health

7.18

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Update benthic community data, endpoints

- Criticisms
  - Historic data not adequately screened for influence of confounding factors
  - Interpretive endpoint not conservative

7.19

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Update benthic community data, endpoints

Next steps

- Review/screen original benthic data sets for potential influence of organic carbon, grain size, ammonia, sulfides, etc.
- Use screened and newer benthic data to develop revised “hit” / “no hit” list based on recommended metrics

7.20

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Updated benthic community analyses

Next steps

- Use compilation of benthic effects data to evaluate
  - alternative interpretive endpoints
  - ability of toxicity tests to act as surrogates of benthic community health
  - predictive ability of current and alternative SQGs

7.21

EVALUATING BENTHIC RISK: FUTURE CLARIFICATIONS?

Conclusions

Current regional approaches and tools for evaluating risk to benthic communities should be examined and revised, as appropriate, using "latest scientific knowledge" and updated regional benthic community effects data as the "bottom line"

7.22

Bioaccumulative Chemicals of Concern Evaluations at Two DMMP Disposal Sites

Justine Barton & Erika Hoffman,
EPA Region 10

May 5, 2004

8.1

List 1: Primary list of bioaccumulative contaminants of concern (required for analysis)

- Alpha-Benzene Hexachloride
- Arsenic
- Cadmium
- Chlordane
- Chromium
- Copper
- Dioxins/Furans
- Fluoranthene
- Hexachlorobenzene
- Lead
- Mercury
- Nickel
- Pentachlorophenol
- Total Aroclor PCB
- Pyrene
- Selenium
- Silver
- Tributyltin
- Total DDT
- Zinc

8.2

List 2: Candidate list of bioaccumulative contaminants (strong concern and priority for study)

- 1,2,4,5-Tetrachlorobenzene
- 4-Nonylphenol
- Benzo(e)pyrene
- Biphenyl
- Chlorpyrifos
- Chromium VI
- Dacthal
- Diazinon
- Endosulfan
- Ethion
- Kelthane
- Mirex
- Oxadiazon
- Parathion
- PBDEs
- PCNs (Halowaxes)
- Perylene
- Tetraethyltin
- Trifluralin

8.3

DMMP Elliott Bay BCOC Monitoring (Sediments and *Molpadia* Tissue)

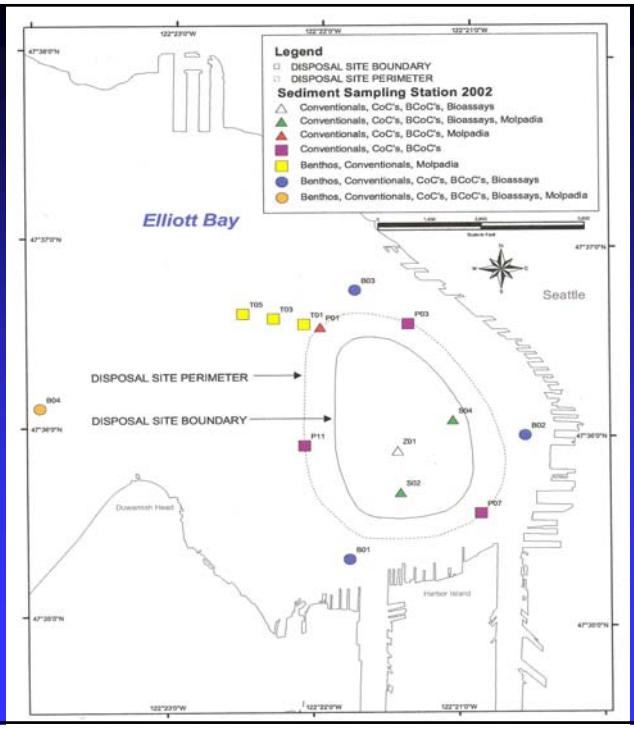
- Elliott Bay – 2002 Tiered Partial
  - 7 sediment stations
  - 4 tissue stations (1 benchmark, 2 onsite, and 1 perimeter)

8.4

DMMP Elliott Bay Followup

- Determine magnitude and frequency of List 1 and 2 contaminants at disposal site
- Determine whether standard hazardous waste methods (e.g. EPA methods 8260, 8270, 8081) are capable of detecting List 1 and 2 BCOCs at the limits set by DMMP

8.5



8.6

Elliott Bay Conclusions:

- Most new BCOCs were not detected in sediments and tissues analysed, PAHs detected in Elliott Bay sediments were at concentrations well below BTs
- Target trace metals and organics measured can be adequately quantified using routine solid waste methods

8.7

Elliott Bay Conclusions (con't)

- Semi-volatile data for sediments and tissues verified using two methods (isotope dilution and routine solid waste methods)
- Extra sample preparation (e.g., clean-ups, increased sample volume) was generally helpful in achieving DMMP target detection limits

8.8

Elliott Bay Conclusions (con't)

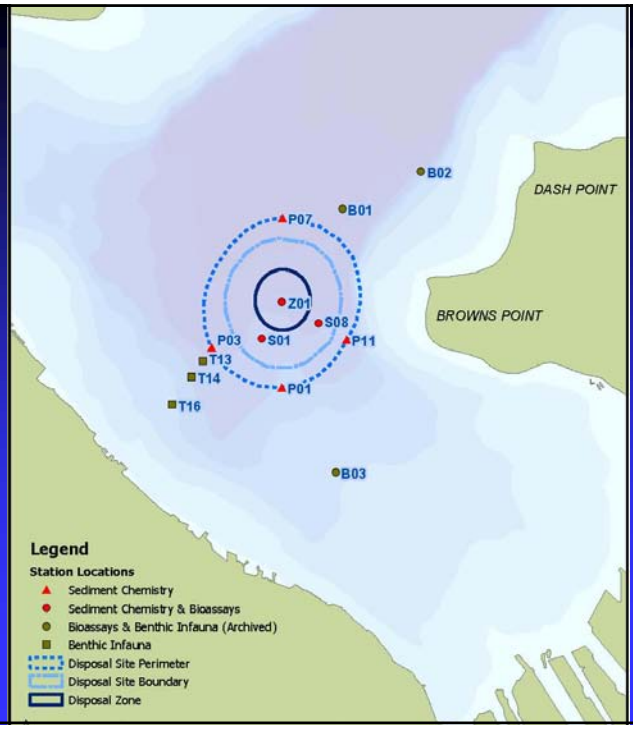
- In 2002 Elliott Bay BCOC Monitoring Report (April 12, 2004) -- suggestions provided for analytical improvements for selected analytes

8.9

DMMP Commencement Bay BCOC Monitoring (Sediments and Molpadia Tissue)

- Determine magnitude and frequency of List 1 and 2 contaminants at existing disposal site
- Commencement Bay – 2003 Tiered Full
  - 7 sediment stations
  - 3 transect tissue stations

8.1



8.1

Commencement Bay Conclusions:

- List 1 BCOCs in sediment samples: metals, HPAH's and pesticides – no BTs exceeded
- List 2 BCOCs in sediment samples: benzo(e)pyrene, biphenyl, perylene, 4-nonylphenol, parathion
- All detected List 2 BCOCs qualified as estimates (except perylene)

8.12

Commencement Bay Conclusions (con't)

- No List 1 or 2 organics/pesticides detected in tissue samples
- List 1 metals (except Ni and Ag) detected in tissue samples at low concentrations

8.13

BCOC List Follow-up

- Draft Technical Appendix - currently out for agency review
- Draft final available for BWG/external review in June, 2004

8.14

The Puget Sound Ambient Monitoring Program (PSAMP) Sediment Component

Recent Activities and Findings, Future Direction

Maggie Dutch
Ecology's Coastal and Estuarine Assessment Unit
WASHINGTON STATE DEPARTMENT OF ECOLOGY

prepared for the
2004 Sediment Management Annual Review Meeting

9.1

Marine Sediment Monitoring Team

Maggie Dutch – field logistics, data analysis & reporting

Kathy Welch - taxonomy coordinator

Sandra Aasen - field logistics, data base management, data analysis & reporting

Edward Long - data analysis & reporting, Mr. Sediments, ex-NOAA guy

Valerie Partridge - field logistics, statistics, data analysis & reporting

Eugene Ruff – "Worm-Works" CEO, annelid taxonomist extraordinaire

9.2

PSAMP Sediment Monitoring Recent Activities and Findings/ Future Direction

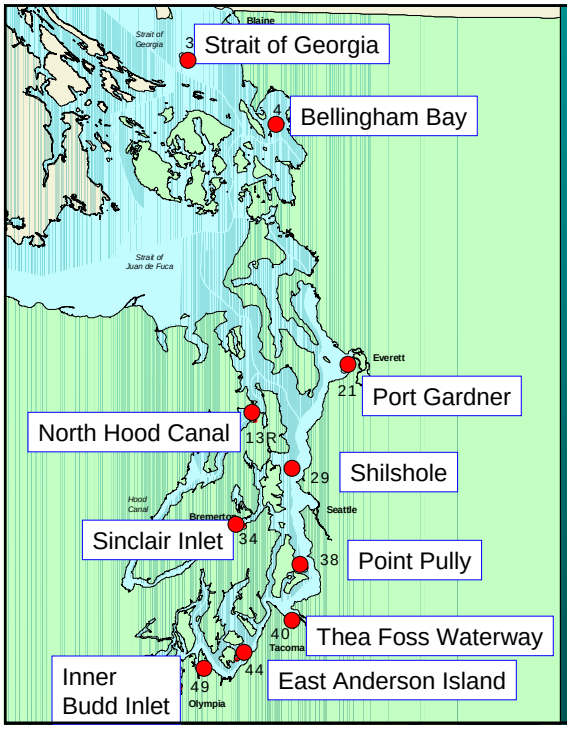
- Temporal monitoring element
  - 10 long-term station results
- Spatial monitoring element
  - 1997-1999 Sediment Quality, Triad Index, PCA
  - 2002-2003 results poster
- Upcoming monitoring
  - 2004 Hood Canal sampling plans
  - 2005 – Benthic Infaunal Index development, EDC
  - 2006-2013 – regional rotation with focus overlay

9.3

Sample Collection Methods

- **Station sediments were collected with a 0.1 m^2 stainless steel double vanVeen grab sampler**
  - **The top 2 to 3 cm of sediment from 3-6 grabs were collected, composited, analyzed for up to 170+ chemicals & 4 toxicity tests**
- **Benthic infauna collected on 1mm mesh and analyzed for community structure**

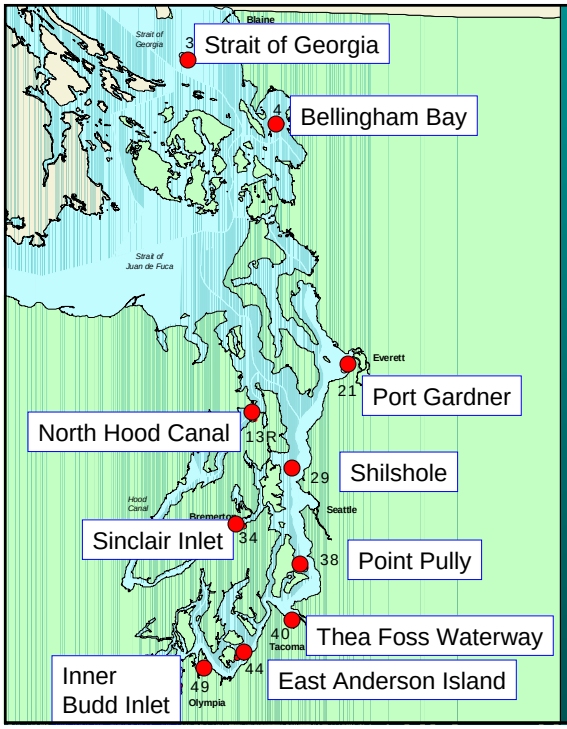
9.4



PSAMP Temporal Monitoring 1989-2000

Trends in sediment chemistry and benthic infaunal at long-term stations

9.5



PSAMP Temporal Sediment Monitoring

- 10 of 76 original PSAMP sediment stations
- Co-located with other PSAMP sampling
- Varied geographic, geophysical, infaunal
- Mostly distant from known point sources
- Chemistry, TOC 1989-1996*, 2000
- Benthos, grain size annually 1989-2000

9.6

PSAMP Temporal Sediment Monitoring 1989-2000

Objectives

- **Collect and provide long-term data on:**
  - **sediment characteristics**
  - **contaminants in sediment**
  - **benthic macrofauna**
- **Evaluate benthic communities over time in relation to sediment quality:**
  - **changes in chemistry - 1989-1996 vs. 2000**
    (box plot, 2-tailed sign test)
  - **trends in benthos – 1989-2000**
    (two-sided Mann-Kendall test of monotone trend)

9.7

PSAMP Temporal Sediment Monitoring 1989-2000

Results

Metals

- **Cr, Cu, Ni, Zn high at Sinclair Inlet but decreasing**
- **9 metals decreased at Inner Budd Inlet**
- **Copper decreased at 7 stations**
- **Mercury decreased at 6 stations**

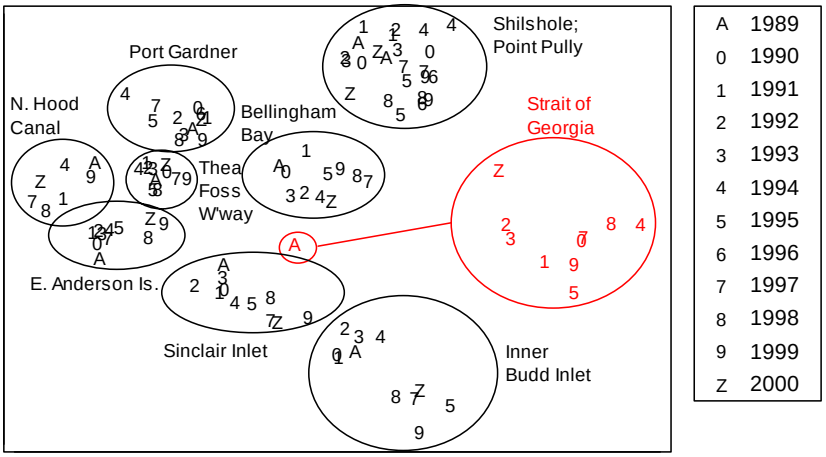
PAHs

- **High at Thea Foss Waterway**
- **Total PAHs increased at 4 stations**
- **Individual PAHs increased at 2 stations**
  - **esp. E. Anderson Is.**
- **6 PAHs decreased at Point Pully**

9.8

Infauna Patterns

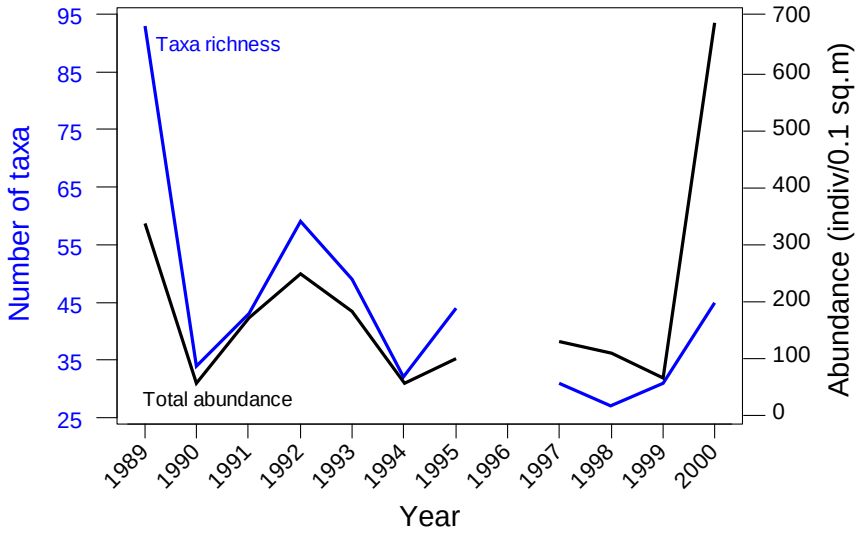
MDS ordination of infaunal assemblages



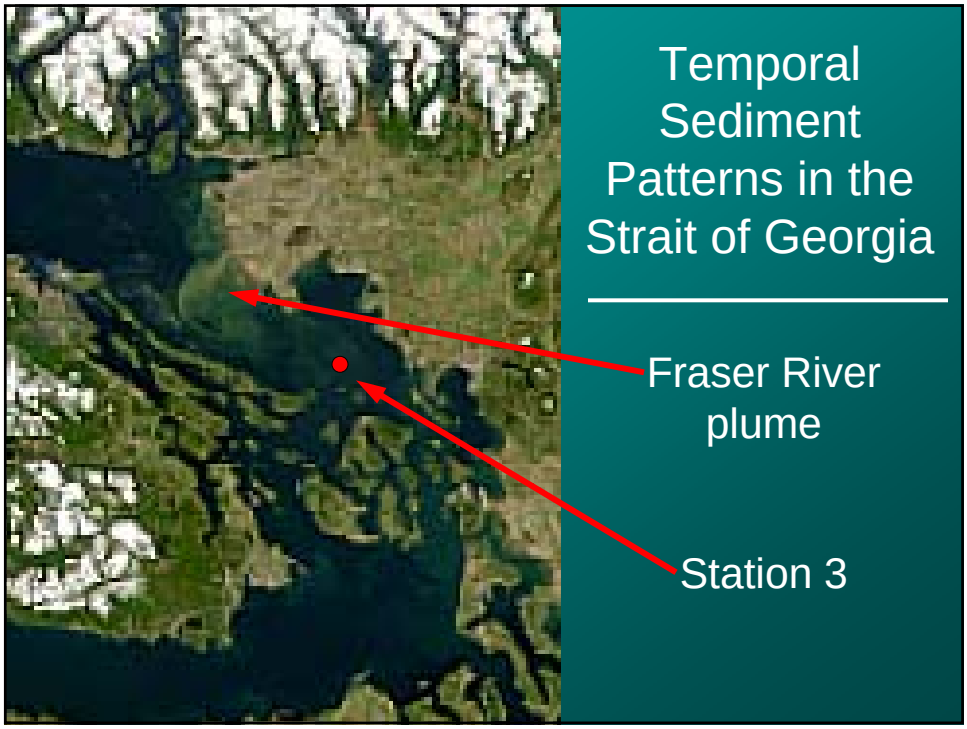
9.9

Strait of Georgia station

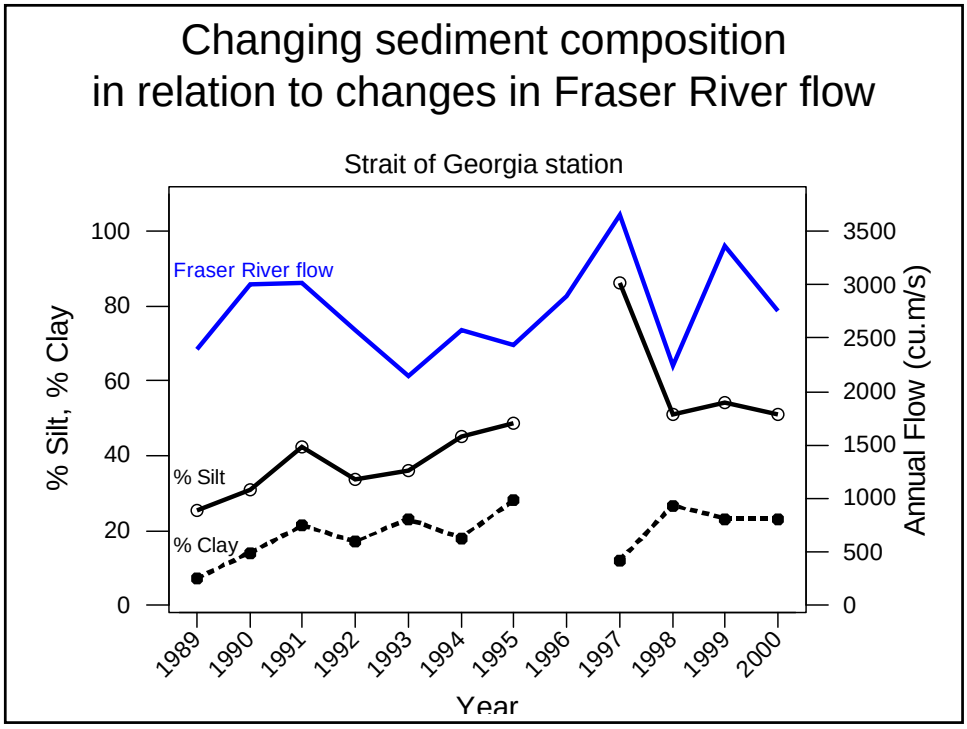
- Taxa richness, total abundance quite variable



9.10

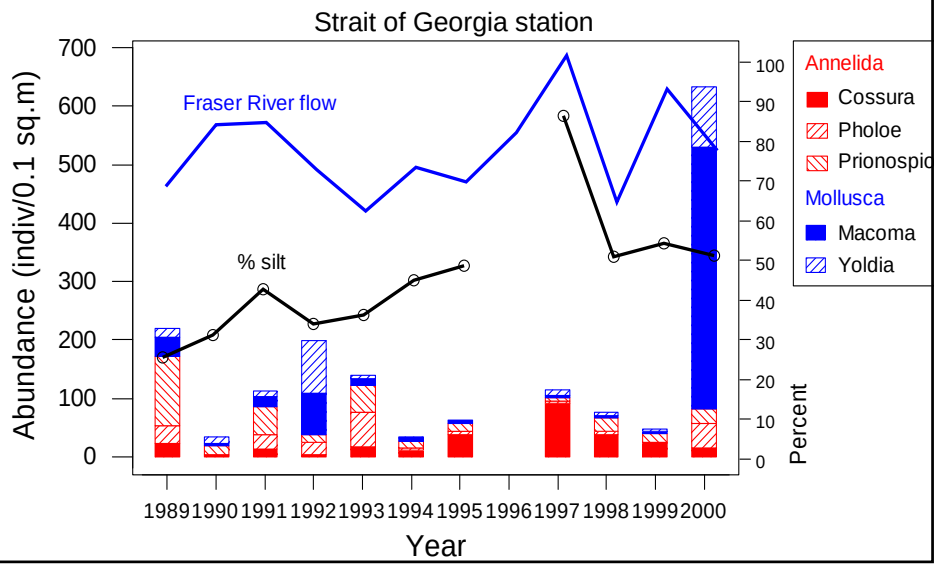

Temporal Sediment Patterns in the Strait of Georgia
Fraser River plume
Station 3

9.11


Changing sediment composition in relation to changes in Fraser River flow
Strait of Georgia station
Fraser River flow
% Silt
% Clay
% Silt, % Clay
Annual Flow (cu.m/s)
Year
0
20
40
60
80
100
0
500
1000
1500
2000
2500
3000
3500
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000

9.12

Changes in sediment and dominant taxa in relation to changes in Fraser River flow



9.13

What the temporal stations tell us

- **Not big picture characterization, but a series of "case studies" displaying what can occur with the diversity of habitat types and community assemblages throughout Puget Sound**
- **In heterogeneous PS, different stations subjected to and sensitive to differing suites of both human-caused and natural stressors (no one size fits all explanations)**
- **Emphasizes that temporal trends/change take years/decades to characterize; length, completeness of time-series essential**
- **Annual baseline of data useful in event of catastrophic change (oil spill, invasive species, global warming)**
- **Integration/linkage with physical, chemical, biological data from other programs is essential**
- **Report in review; data available at http://www.ecy.wa.gov/programs/eap/mar_sed/msm_intr.html**

9.14

PSAMP Spatial Monitoring
PSAMP/NOAA 1997-1999
Puget Sound Sediment Quality Survey

Objectives

- Use of stratified, random sampling to develop statistically robust "sediment quality baseline" for triad parameters:
  - Regional/sound-wide spatial patterns maps – chem, tox, benthos
  - Regional/sound-wide spatial extent calculations – i.e., % area of degradation calculated (chem, tox)
  - Station/region/sound-wide Sediment Quality Triad Index – see glossy and poster
  - Examine relationships between the triad parameters - Principal Components Analysis

9.15

Spatial Extent of Sediment Quality Degradation:
Puget Sound Study Area (2363km^2)
Sediment Quality Triad Index

	# stations	% area
• **High** (0 hits) – most of large basins, passages, rural bays	138	68%
• **Intermediate/High** (1 hit)	85	27%
• **Intermediate/Degraded** (2 hits) – harbors, outer reaches of large urban bays, small urban bays	40	4%
• **Degraded** (Triad (3) hits) – all in industrialized harbors, urban bays – sediment quality rapidly improves along gradient from head to mouth of embayments	37	1%

(*See poster for more details)

9.16

What the spatial stations tell us

- **Small percentage (1%) of PS sediments degraded, but…**
  POSSIBLE large impact to PS health
  - **highly degraded urban harbor sediments near river mouths and shallow, nearshore areas**
  - **critical habitat (nursery, feeding areas) for many species of fish, birds, mammals, invertebrates**
  - **other PSAMP studies show contaminants measured in shellfish, fish, birds, and marine mammals associated with more highly contaminated Central/South Puget Sound regions**
- **31% intermediate levels of degradation**
  - **areas that should be watched to make sure they don't degrade further**
  - **unmeasured parameters, toxic mixtures, "non-triad" issues – need to be identified and studied**
- **Continued monitoring required**
  - **PSAMP to conduct annual rotational monitoring to resample/recharacterize regional sediment quality in future to determine improvement, decline, or no change over time**
  - **focus studies needed in critical habitat areas to determine species impact (partnerships ???)**

9.17

PSAMP Spatial Monitoring
PSAMP/NOAA 1997-1999
Puget Sound Sediment Quality Survey

- Data and reports available:
  http://www.ecy.wa.gov/programs/eap/mar_sed/msm_intr.html
  - in Long et al., 1999, 2000, 2002, 2003

- **Glossy Summaries** - see poster

9.18

PSAMP Sediment Monitoring

2000-2001 Revision of Spatial Sampling Design

Funding, Design Assistance and Training Provided by:

Jawed Hameedi
Ed Long

United States Environmental Protection Agency

Tony Olsen
Kevin Summers
Walt Nelson, Henry Lee

9.19

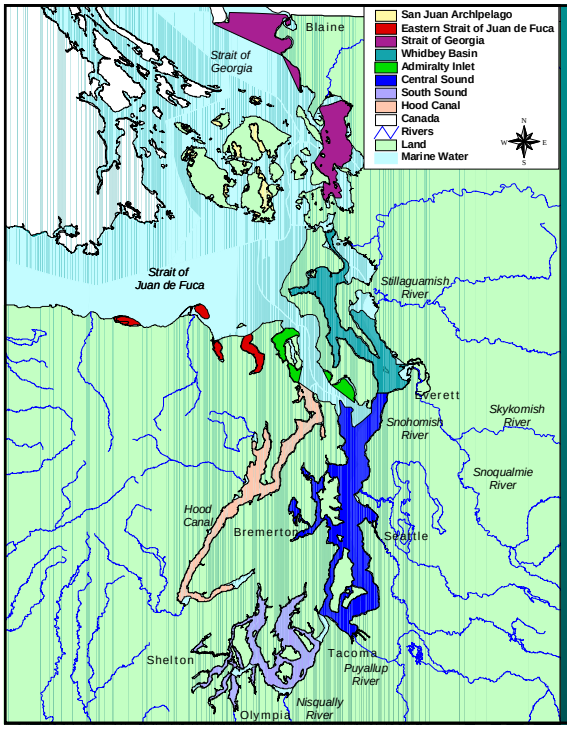
PSAMP Sediment Monitoring

Spatial/Temporal Sampling Design Refinement (2002+)

Design

- "spatially balanced" probabilistic, random, stratified sampling design
- Nested sampling population/subpopulations
- Minimum 30 sediment triad samples/sampling area
- Both Spatial & Temporal element

9.20

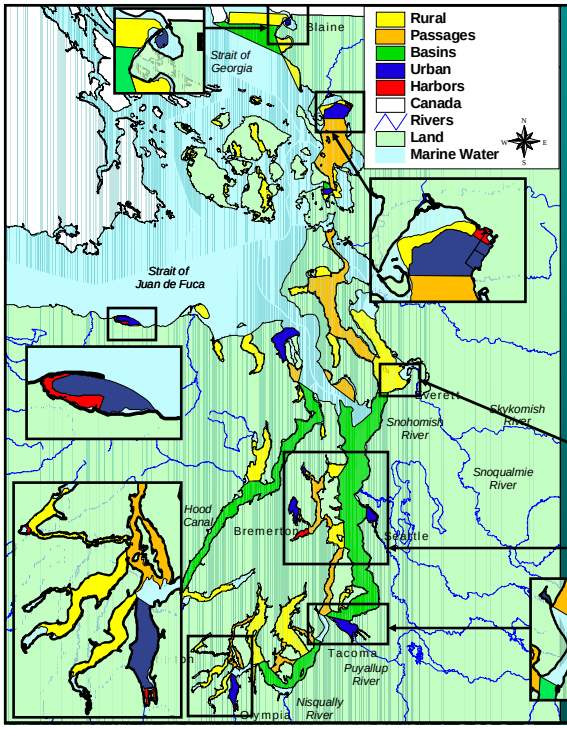


8 Sediment Monitoring Regions*

- San Juan Archipelago
- Eastern Strait of Juan de Fuca
- Strait of Georgia
- Whidbey Basin
- Admiralty Inlet
- Central Sound
- South Sound
- Hood Canal

(*hydrologic/bathymetric subpopulations coinciding with PSAMP-designated PS basins)

9.21

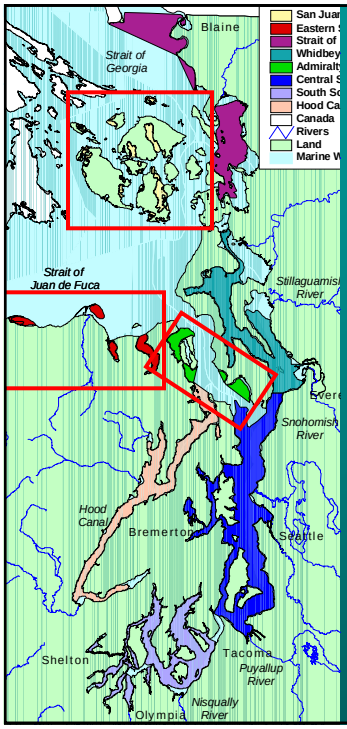


5 Sediment Strata

- Rural
- Passages
- Basins
- Urban
- Harbors

(geographic/anthropogenic subpopulations)

9.22

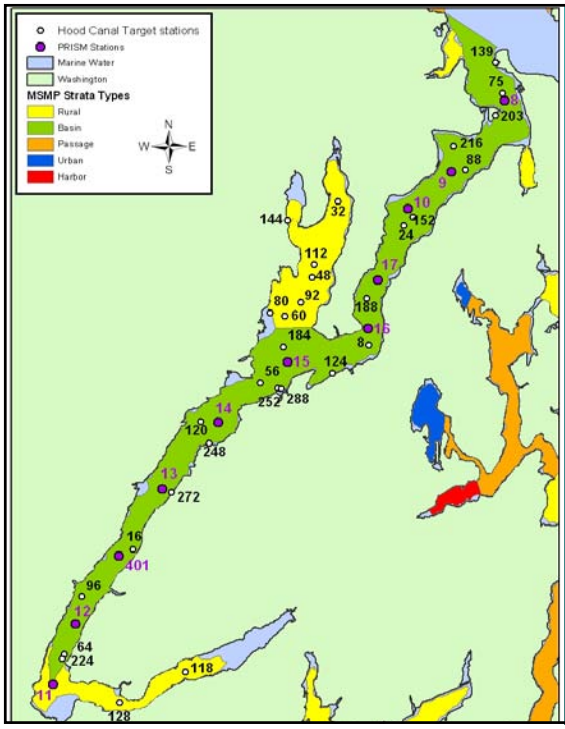


PSAMP Sediment Component Spatial Monitoring

2002-2003
San Juan Islands, Admiralty Inlet, E. Strait of Juan de Fuca

Chemistry/Toxicity results available
(see posters)

9.23



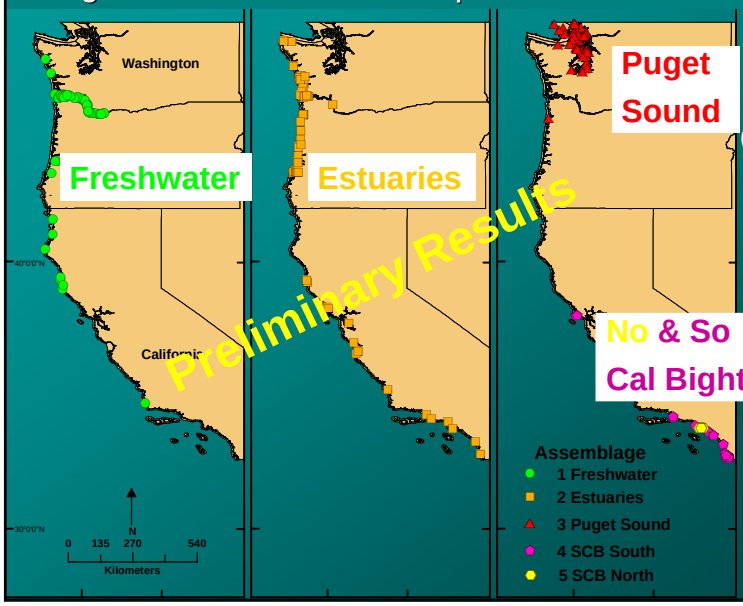
PSAMP Sediment Component Spatial Monitoring

2004
Hood Canal

- Sediment Triad
- Dissolved Oxygen (examine relationship between infaunal structure and bottom DO)

9.24

- West-coast wide with western coastal EMAP partnership with EPA, OR DEQ, SFEI, SCCWRP
- Puget Sound-wide with local partners



PSAMP Sediment Component Spatial Monitoring

2005 Benthic Index Develop-ment

9.25

PSAMP Sediment Monitoring

2006-2013 Regional Rotation (with focus overlay)

2004-2015 sampling schedule (10 year rotation through 8 regions and focus studies)

Region	Year Sampled (minimum no. samples required)											
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
San Juan Archipelago, Eastern Strait of Juan de Fuca, Admiralty Inlet									90			
Strait of Georgia			30									
Whidbey Basin				30								
Central Sound (north)					30							
Central Sound (south)						30						
South Sound							30					
Hood Canal								30				
focus studies	30	30	10+	10+	10+	10+	10+	10+	10+	10+	30	30
Reporting Schedule												
regional			x	x	x	x	x	x	x			
whole sound/strata										x		
focus study	x	x									x	x

9.26

PSAMP Sediment Monitoring
Input/partnerships sought

- **Revisions** to chemical analyte list – PBDEs, EDCs, other changes?
- Regional **focus studies** – partnership studies/funding with regional stakeholders
- **Benthic Index Development** – work with EPA, build on SMU (Musgrove and Striplin) effort
- **Coordinated stakeholder efforts/pooled resources** to monitor PS estuarine quality (incl. sediments) sound-wide (e.g., SCCWRP (so. Cal. Bight), SFEI (San Fran. Bay)

9.27

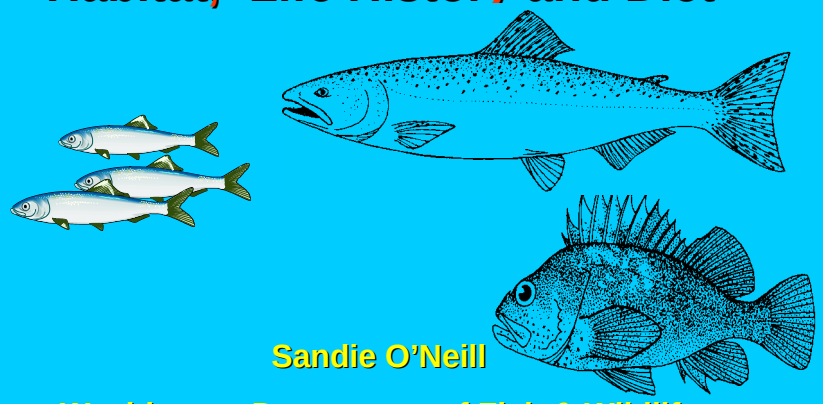
Data and reports available:

www.ecy.wa.gov/programs/eap mar_sed/msm_intr.html

9.28

Factors Affecting Contaminants in Fishes

Habitat, Life History and Diet

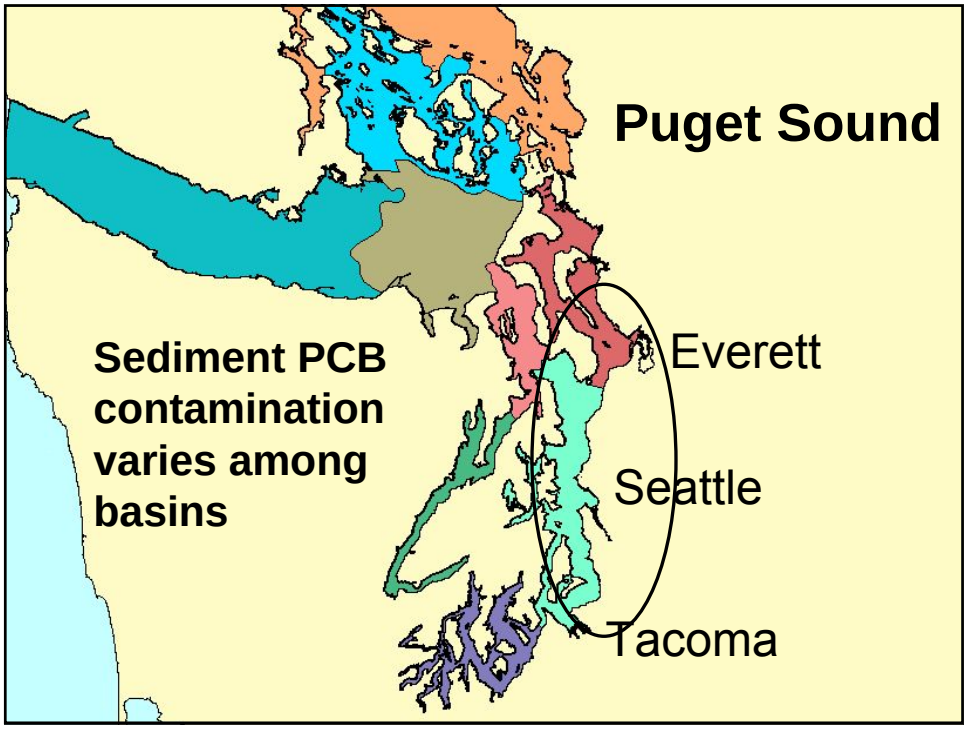


Sandie O'Neill

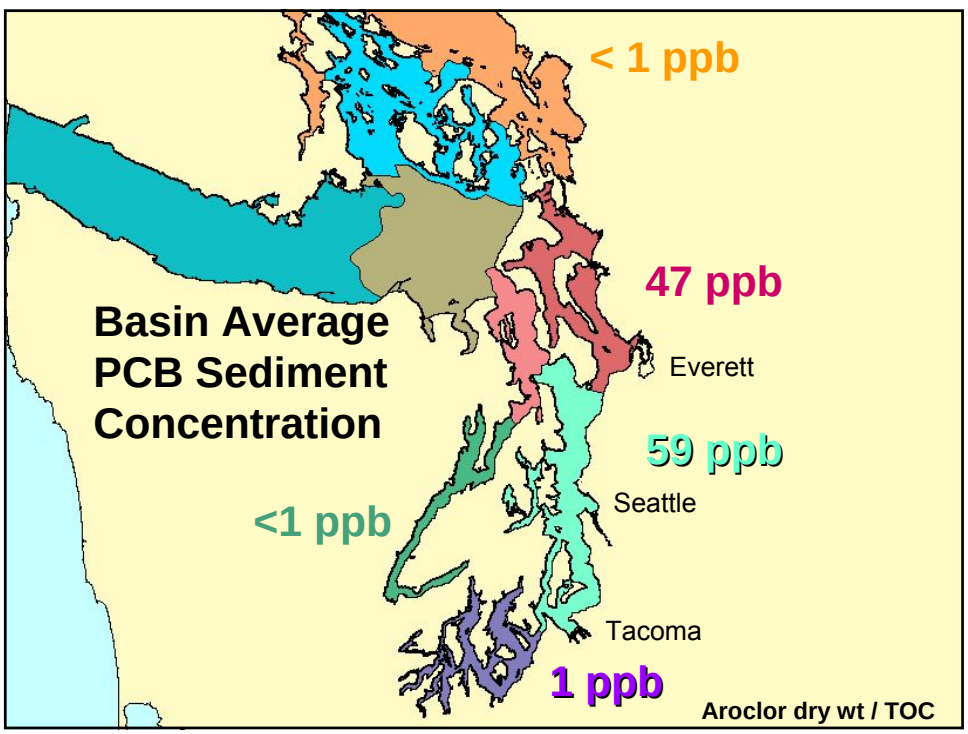
Washington Department of Fish & Wildlife
Puget Sound Ambient Monitoring Program

Factors Affecting Contaminant Exposure and Accumulation

- proximity to contaminant sources
- habitat
- trophic level
- gender and age of fish
- lipid content of tissues


Puget Sound
Sediment PCB contamination varies among basins
Everett
Seattle
Tacoma

10.3

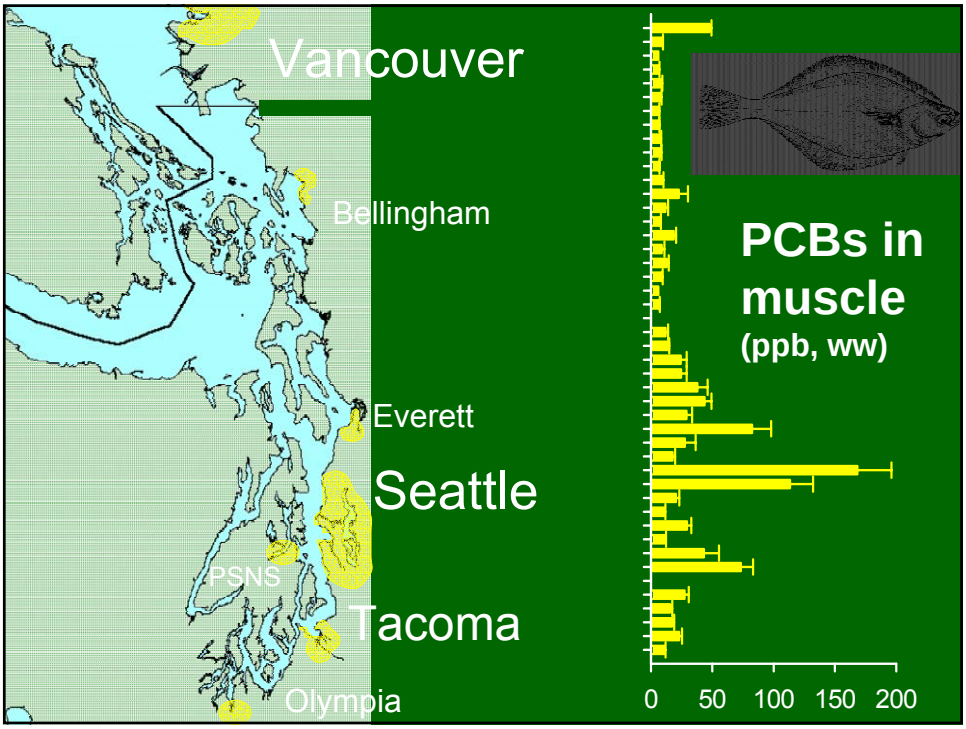

< 1 ppb
47 ppb
Basin Average PCB Sediment Concentration
Everett
59 ppb
Seattle
<1 ppb
Tacoma
1 ppb
Aroclor dry wt / TOC

10.4

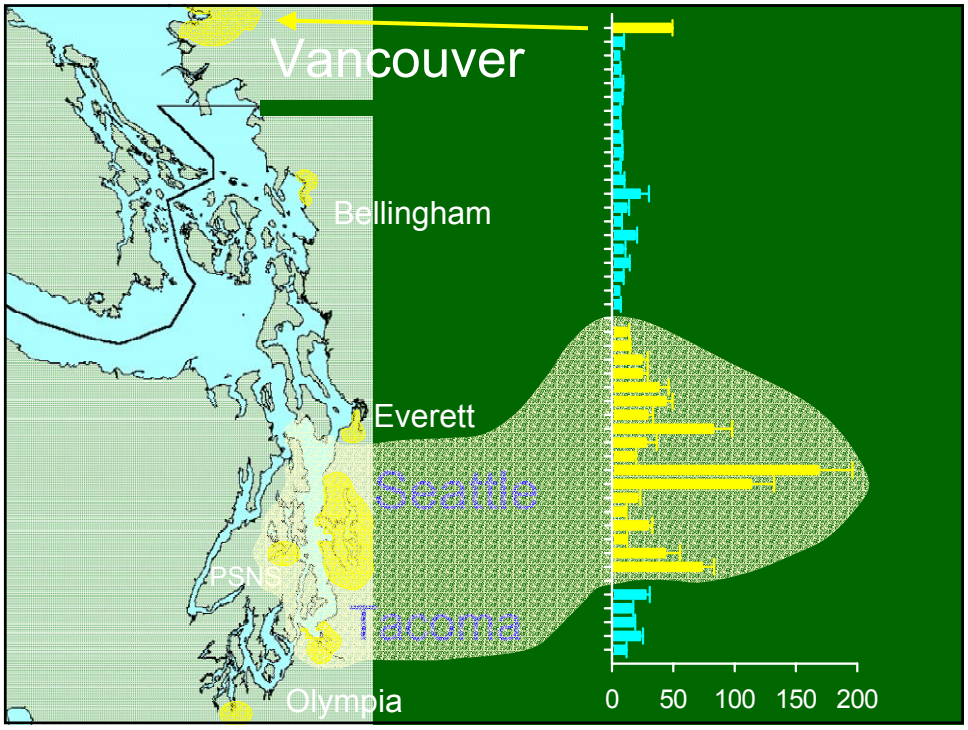
- bottom dwelling
- consumes benthic infauna
- moderate home range
- ubiquitous in Puget Sound (and west coast)

English sole
(*Pleuronectes vetulus*)

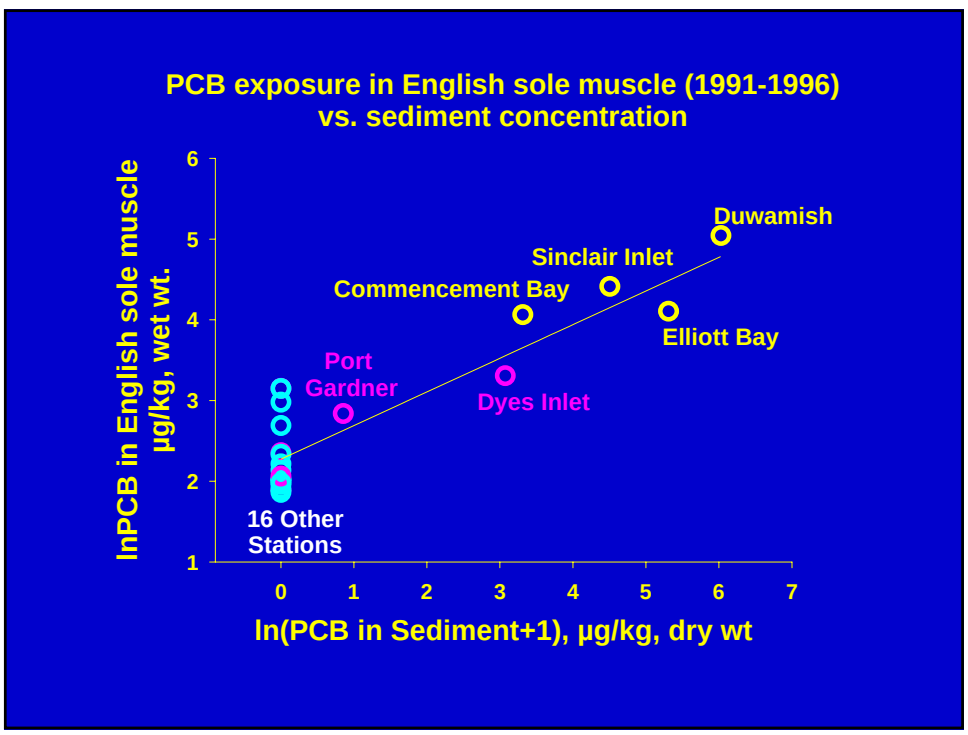
10.5



10.6

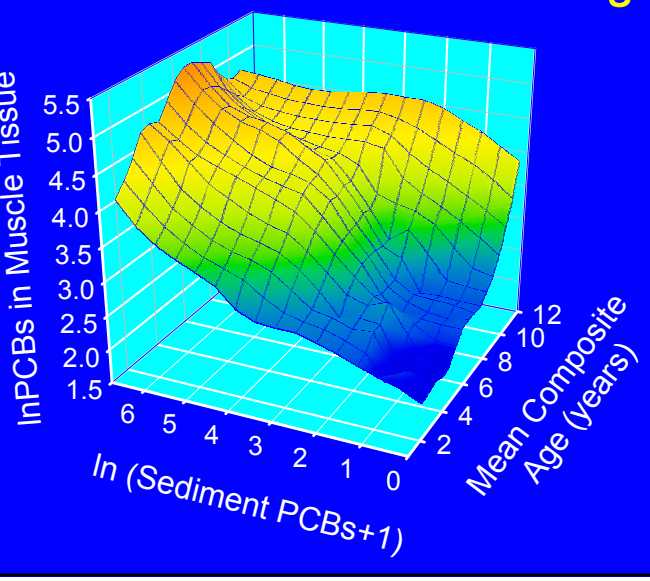

Vancouver
Bellingham
Everett
Seattle
PSNS
Tacoma
Olympia
0
50
100
150
200

10.7


PCB exposure in English sole muscle (1991-1996)
vs. sediment concentration
lnPCB in English sole muscle
µg/kg, wet wt.
ln(PCB in Sediment+1), µg/kg, dry wt
Duwamish
Sinclair Inlet
Commencement Bay
Elliott Bay
Port
Gardner
Dyes Inlet
16 Other
Stations
1
2
3
4
5
6
0
1
2
3
4
5
6
7

10.8

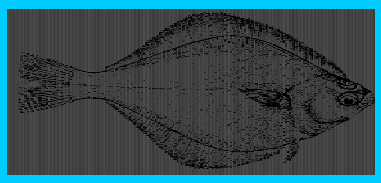
PCB accumulation in English sole vs PCB sediment levels and fish age

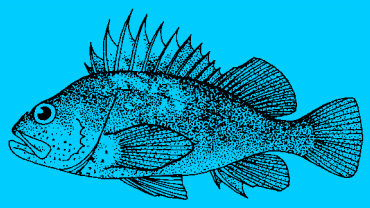


Effects of Age and Trophic Level on PCB Accumulation ?

121 µg/kg

62 µg/kg



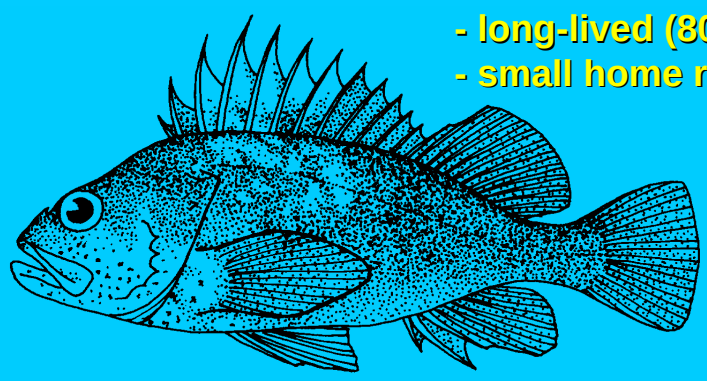


Quillback rockfish (*Sebastes maliger*)

English sole (*Pleuronectes vetulus*)

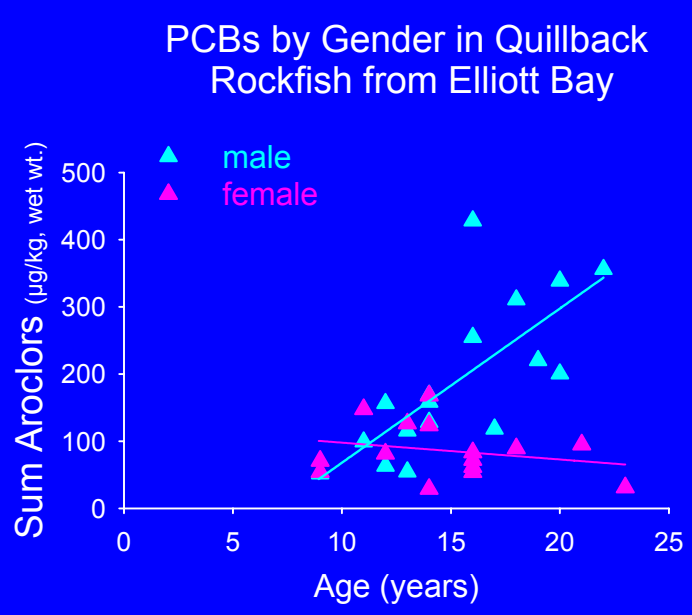
measured as Aroclor (ww) at Seattle Waterfront

- demersal
- carnivorous
- long-lived (80+ yrs)
- small home range



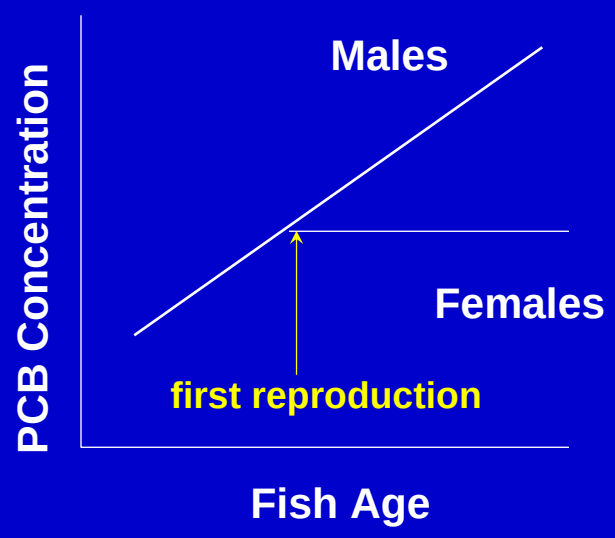
Quillback rockfish
(*Sebastes maliger*)

10.11



10.12

Adapted from Larson et al. 1996



10.13

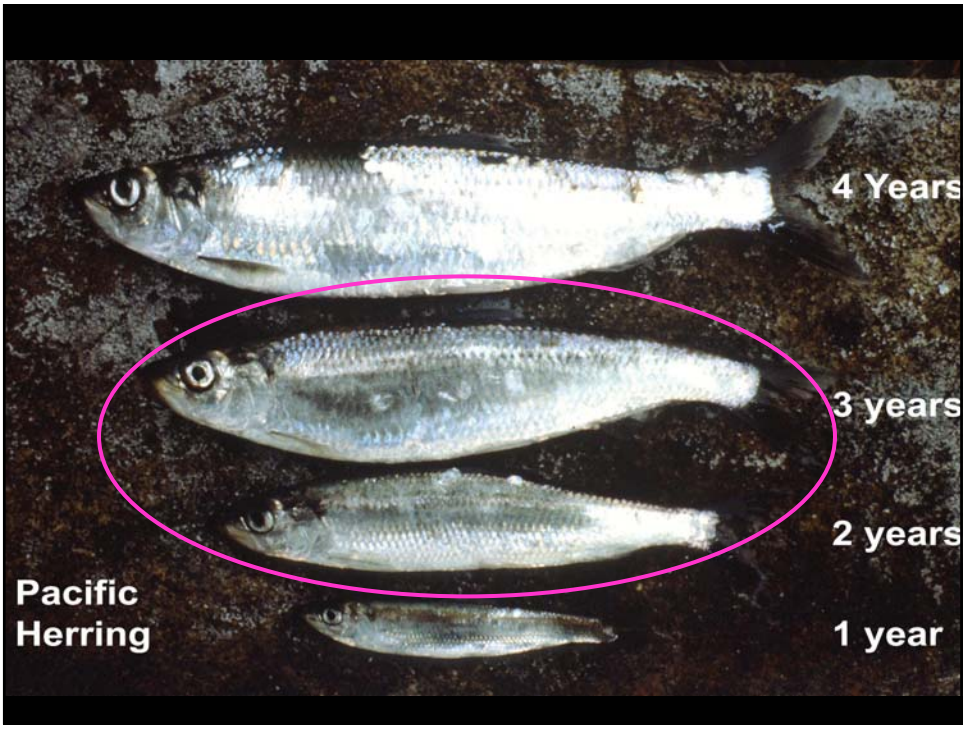
PCB Accumulation in Benthic and Demersal Fishes

- Correlated with sediment concentrations
  - highest correlation in fish with small home range
- Increase with trophic level (biomagnification)
- Bioaccumulation in long lived fish
  – possible male/female differences

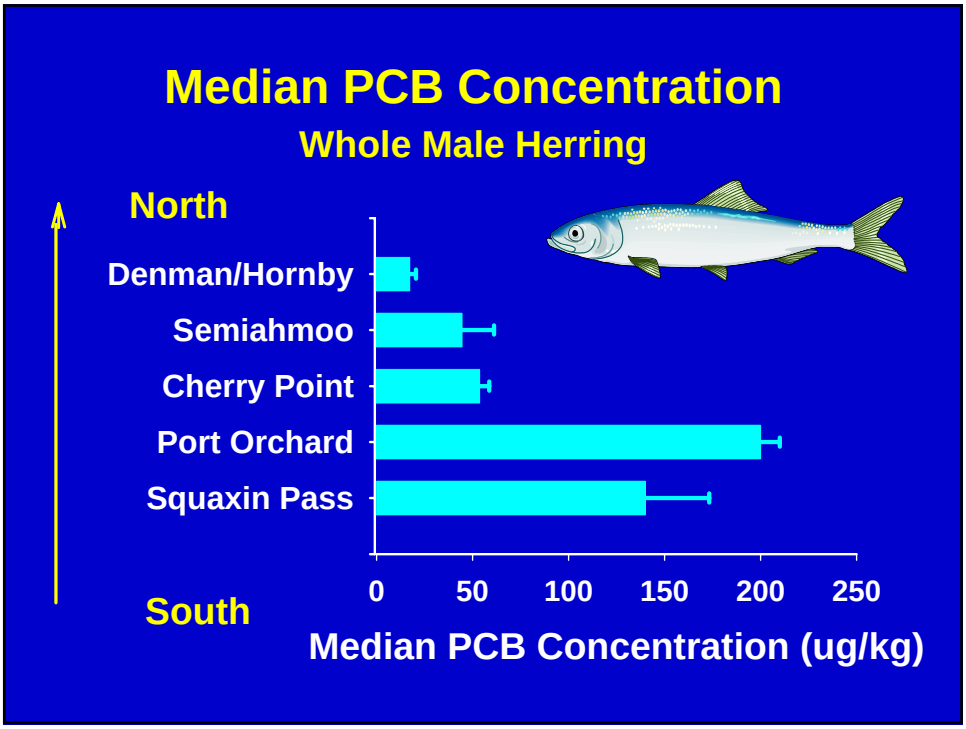
10.14

PCBs in the Pelagic Food Web

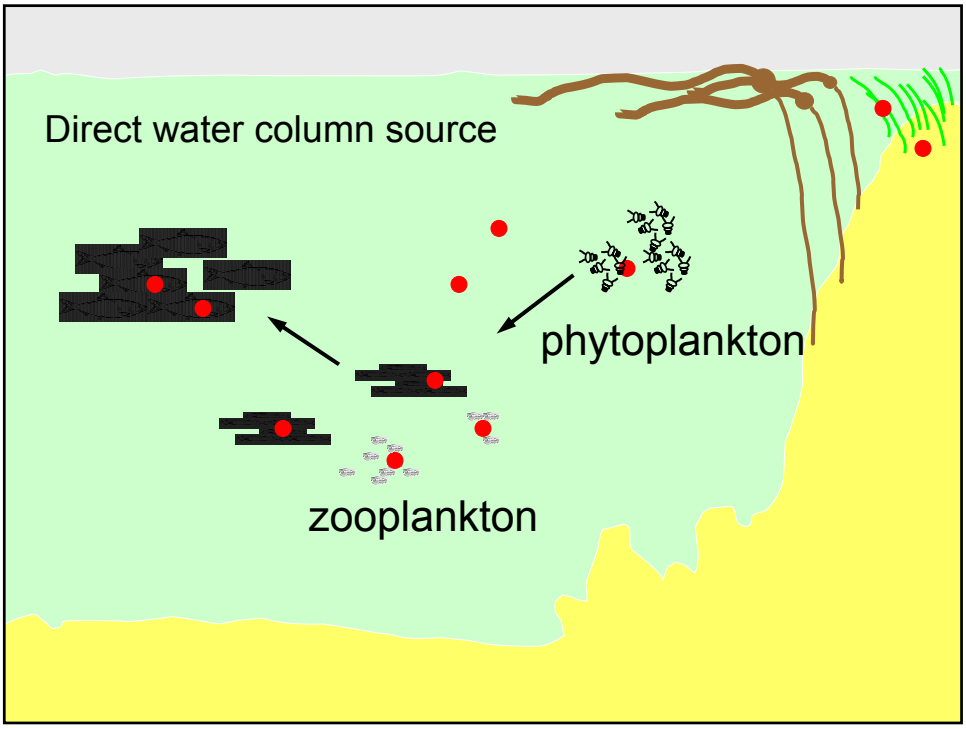
10.15



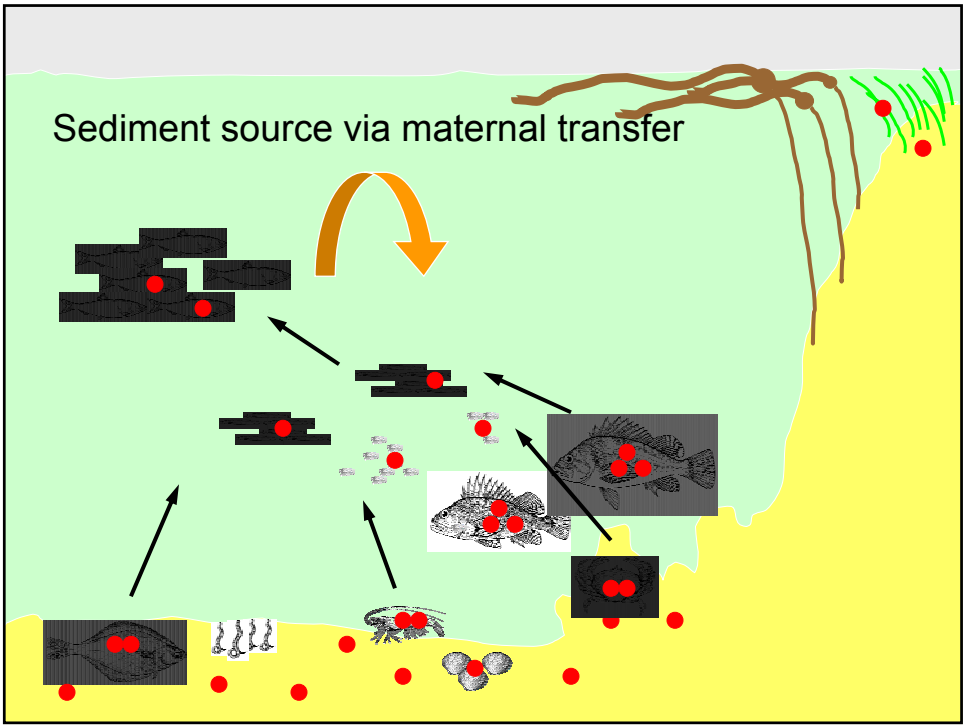
10.16


Median PCB Concentration
Whole Male Herring
North
Denman/Hornby
Semiahmoo
Cherry Point
Port Orchard
Squaxin Pass
South
0
50
100
150
200
250
Median PCB Concentration (ug/kg)

10.17


Direct water column source
phytoplankton
zooplankton

10.18



10.19

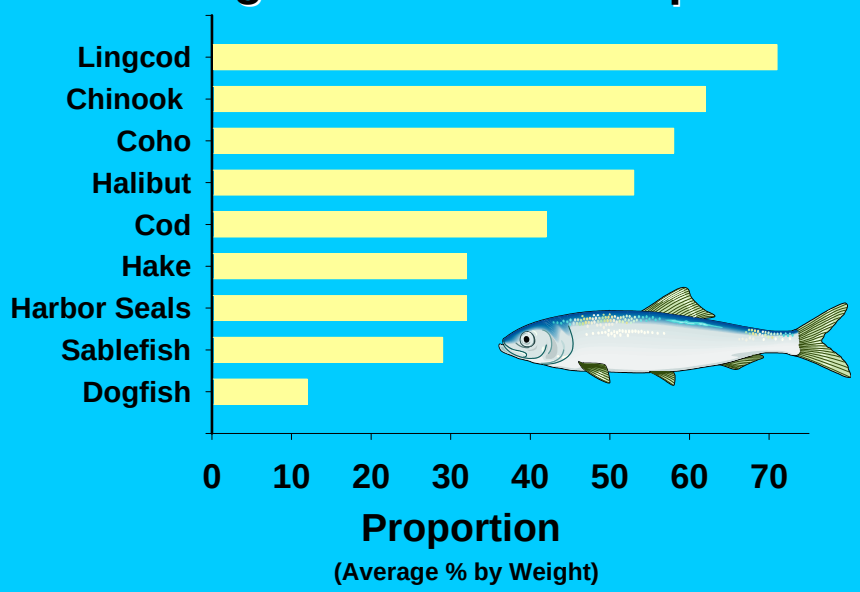
PCBs in Pelagic Food Web

- Water column:
  - Direct uptake from water by phytoplankton that are accumulated by zooplankton
- Sediment Source
  - PCBs are maternally transferred from benthic and demersal species to their planktonic eggs or larvae
- Pelagic predators consume zooplankton
- Biomagnification within pelagic zone

Do PCB contaminated sediments affect PCB concentrations in adult salmon returning to Puget Sound?

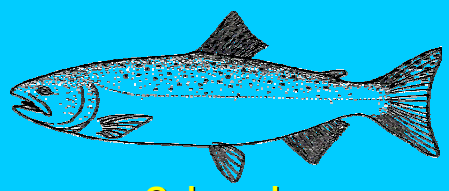
10.21

Herring in Diet of Other Species

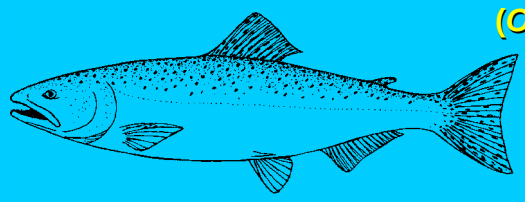


10.22

- anadromous, wide-ranging, pelagic
- carnivorous
- high fat content
- complex life history



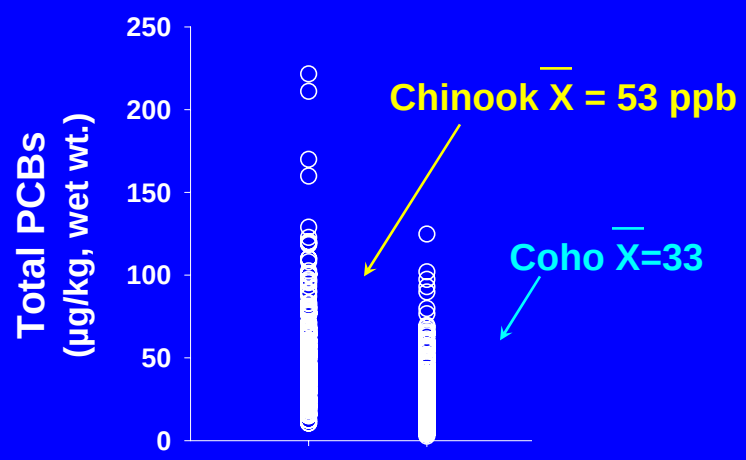
Coho salmon
(*Oncorhynchus kisutch*)



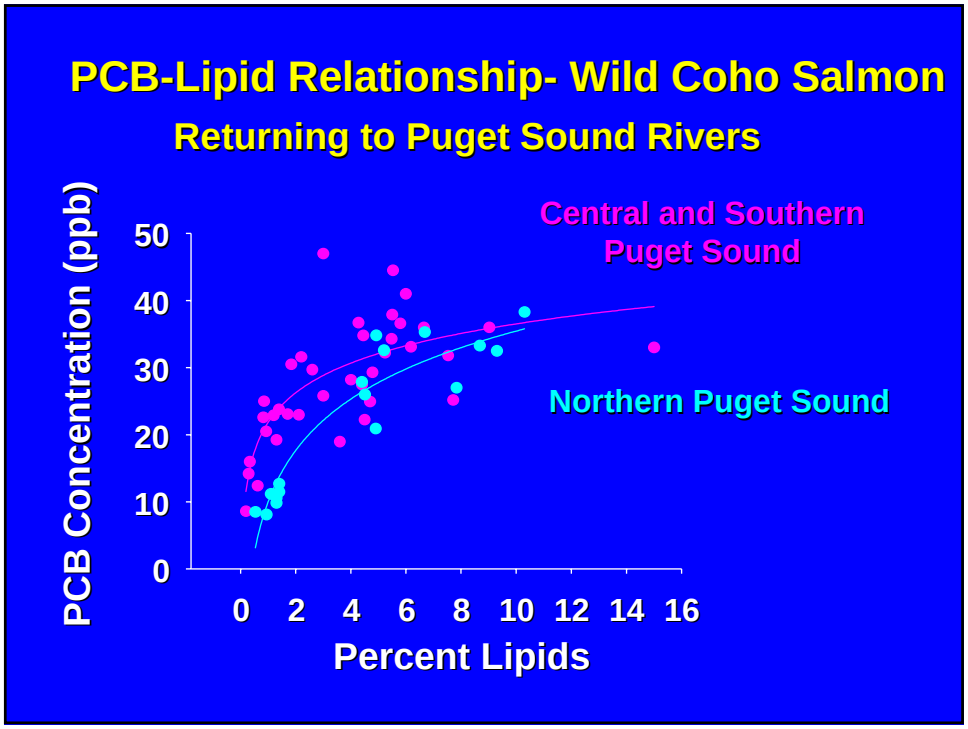
Chinook salmon
(*Oncorhynchus tshawytscha*)

10.23

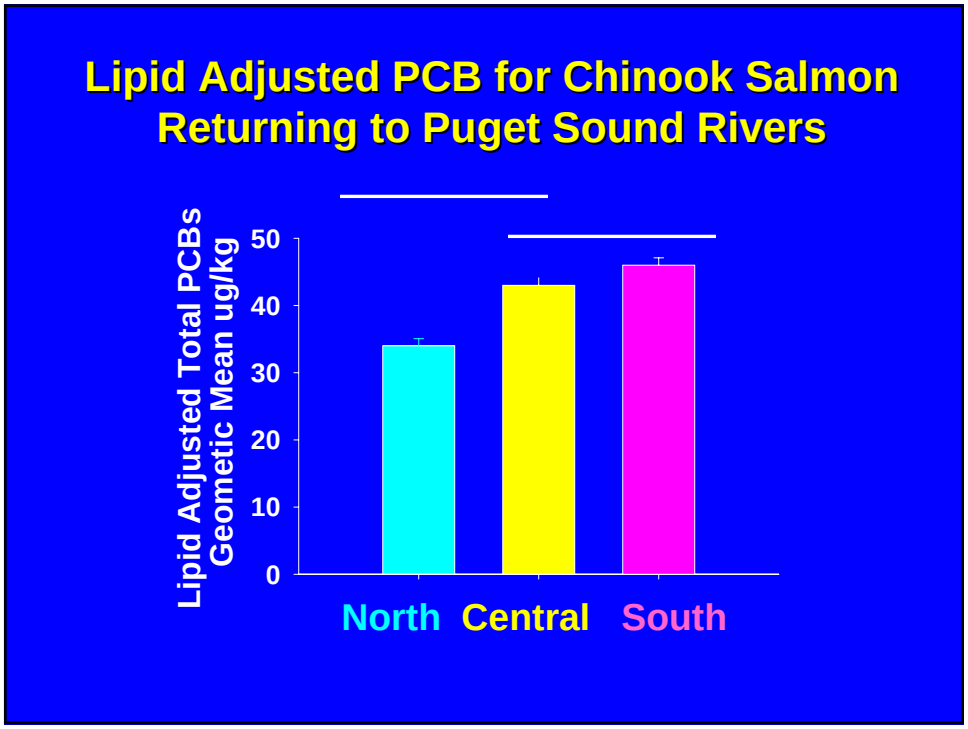
PCBs in muscle of adult salmon returning to Puget Sound



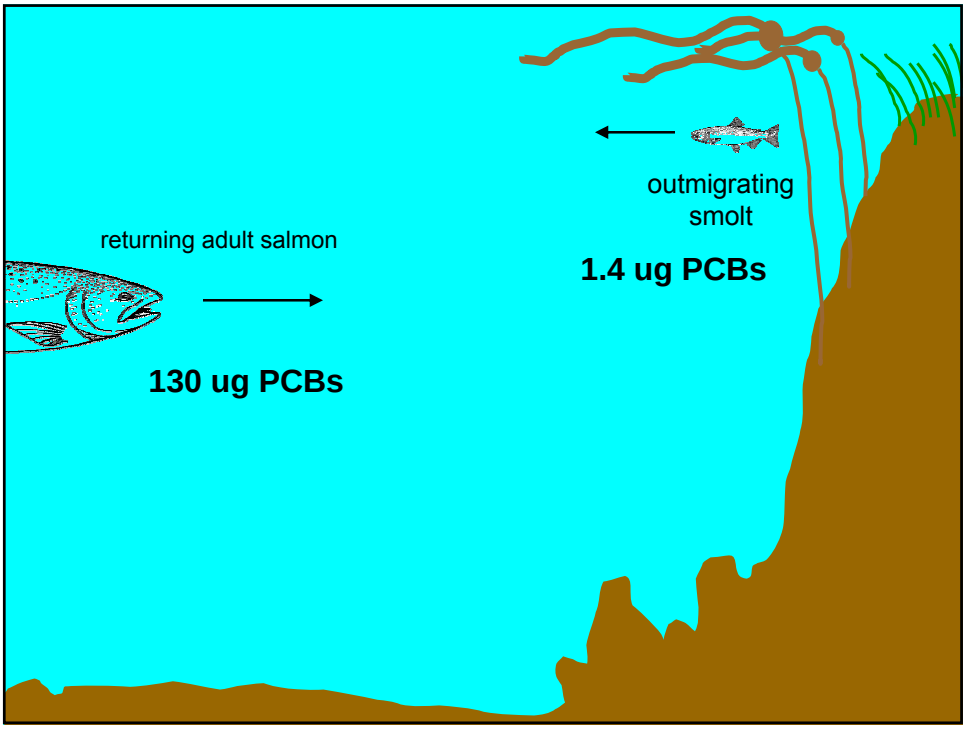
10.24


PCB-Lipid Relationship- Wild Coho Salmon
Returning to Puget Sound Rivers
Central and Southern Puget Sound
Northern Puget Sound
PCB Concentration (ppb)
50
40
30
20
10
0
0 2 4 6 8 10 12 14 16
Percent Lipids

10.25


Lipid Adjusted PCB for Chinook Salmon
Returning to Puget Sound Rivers
Lipid Adjusted Total PCBs
Geometic Mean ug/kg
50
40
30
20
10
0
North
Central
South

10.26



PCB Accumulation in Pelagic Migratory Fish

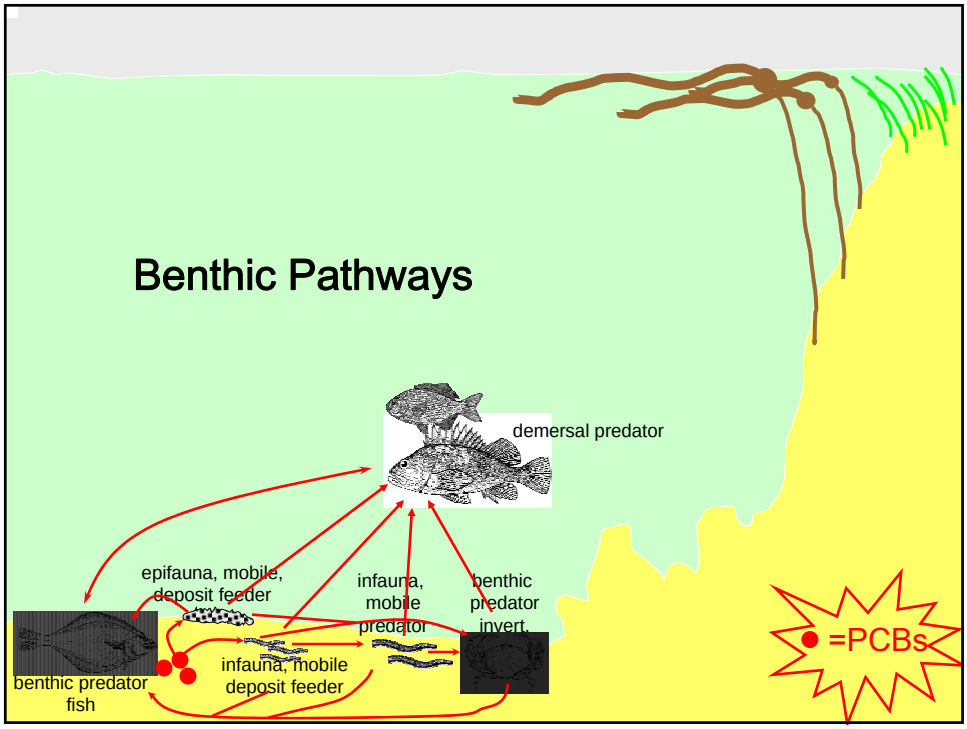
- Pelagic fish integrate PCBs over broad areas.
  - Need to know where fish (and their prey) feed
- Trophic level affects PCB accumulation
- Age/size may (or may not!) affect PCB accumulation
  - Depends if age/size classes feed in different areas
  - Depends if age/size classes eat at different trophic levels

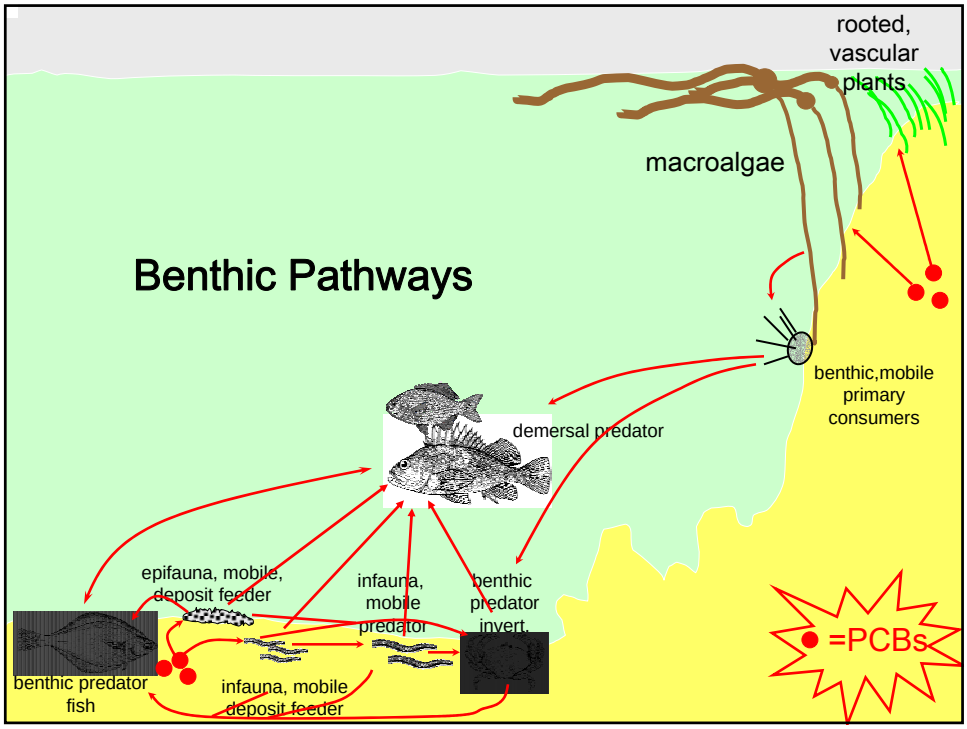
Factors Affecting Contaminant Exposure and Accumulation

- proximity to contaminant sources
- habitat
- trophic level
- gender and age of fish
- lipid content of tissues

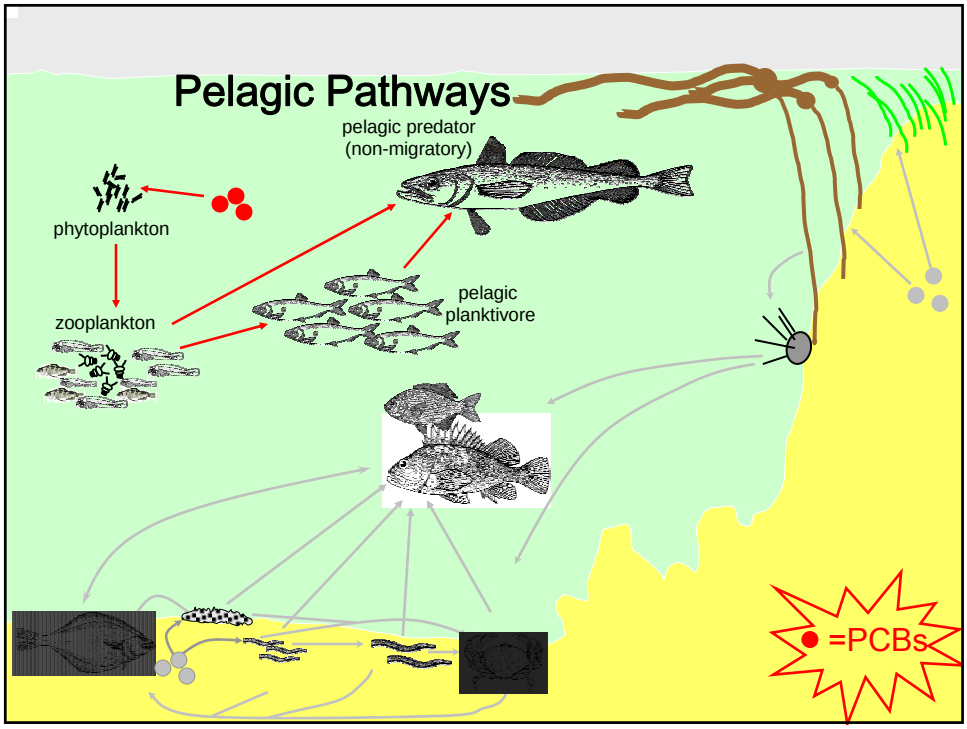
Conceptual Model

- pictorial illustration of potential PCB pathways
- food-web based
- provides a framework to input bioconcentration, accumulation, and magnification

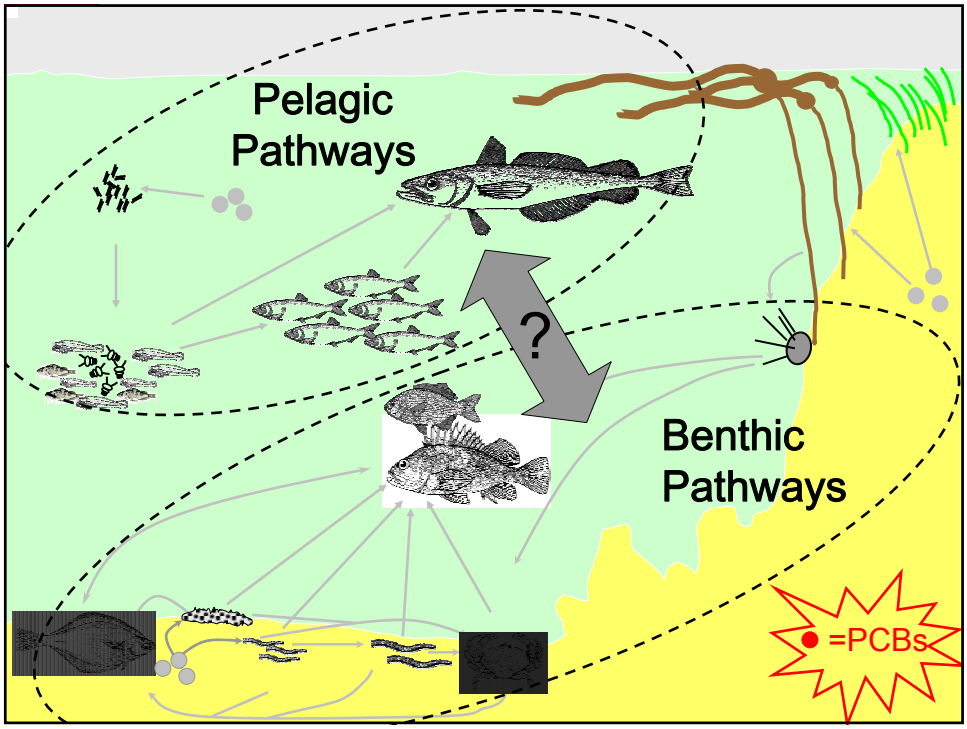



rooted,
vascular
plants
macroalgae
Benthic Pathways
benthic,mobile
primary
consumers
demersal predator
epifauna, mobile,
deposit feeder
infauna,
mobile
predator
benthic
predator
invert.
benthic predator
fish
infauna, mobile
deposit feeder
=PCBs

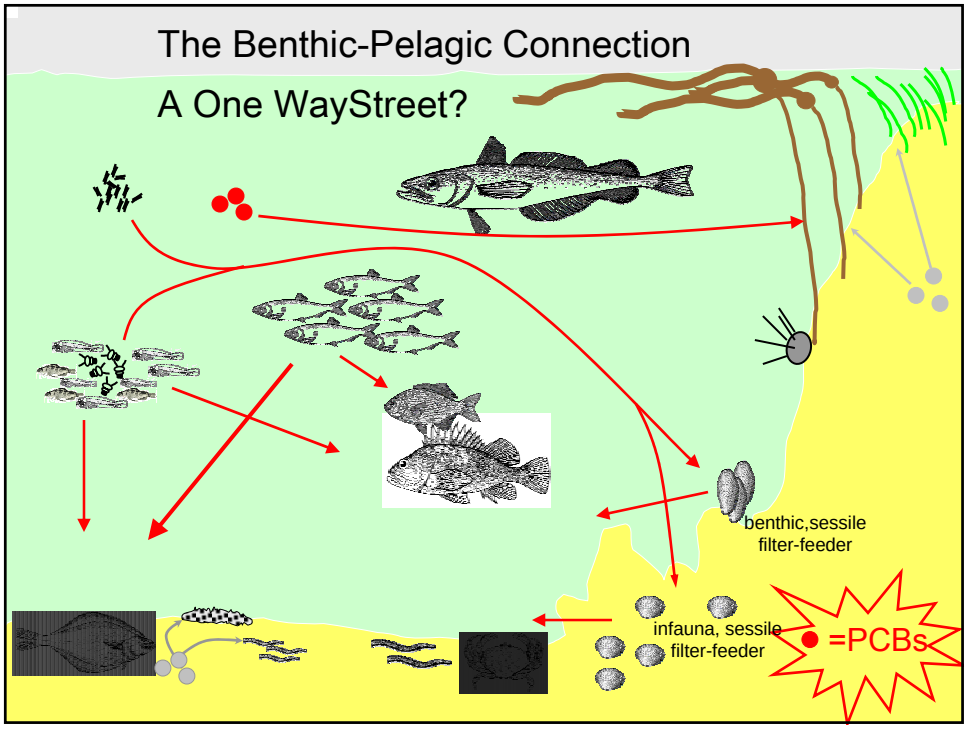
10.33


Pelagic Pathways
pelagic predator
(non-migratory)
phytoplankton
zooplankton
pelagic
planktivore
=PCBs

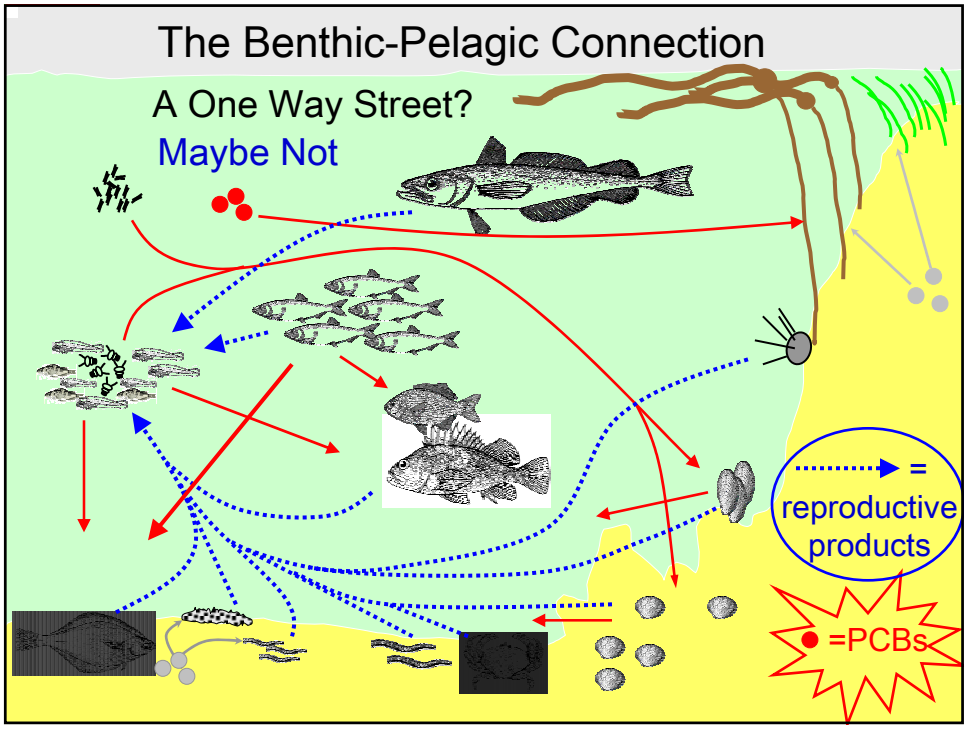
10.33


Pelagic
Pathways
?
Benthic
Pathways
=PCBs

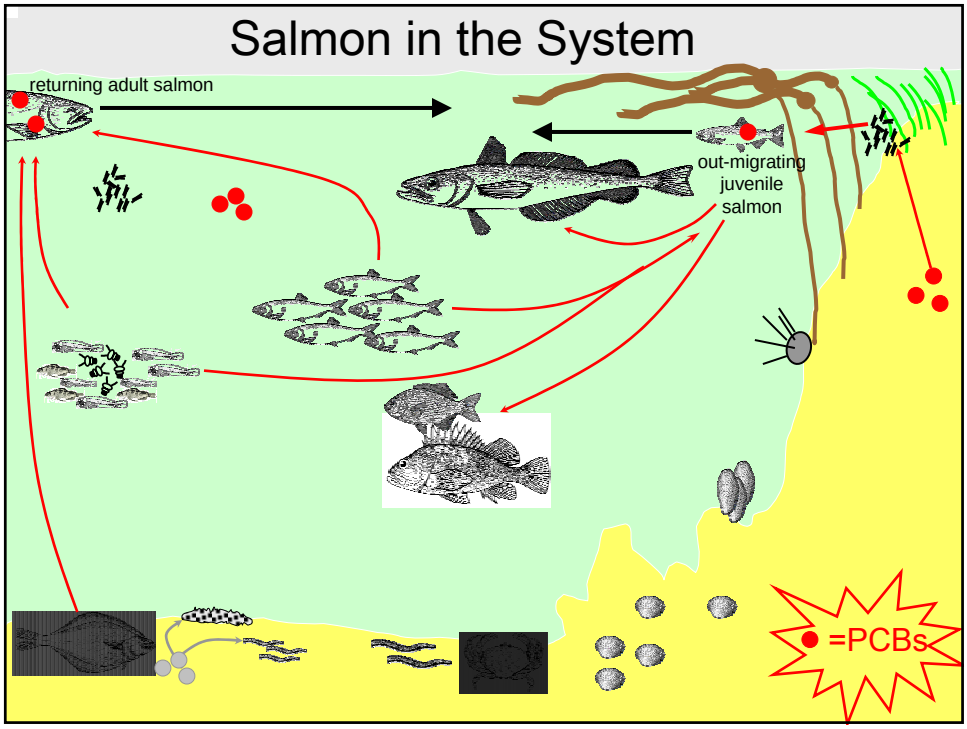
1035


The Benthic-Pelagic Connection
A One WayStreet?
benthic,sessile
filter-feeder
infauna, sessile
filter-feeder
=PCBs

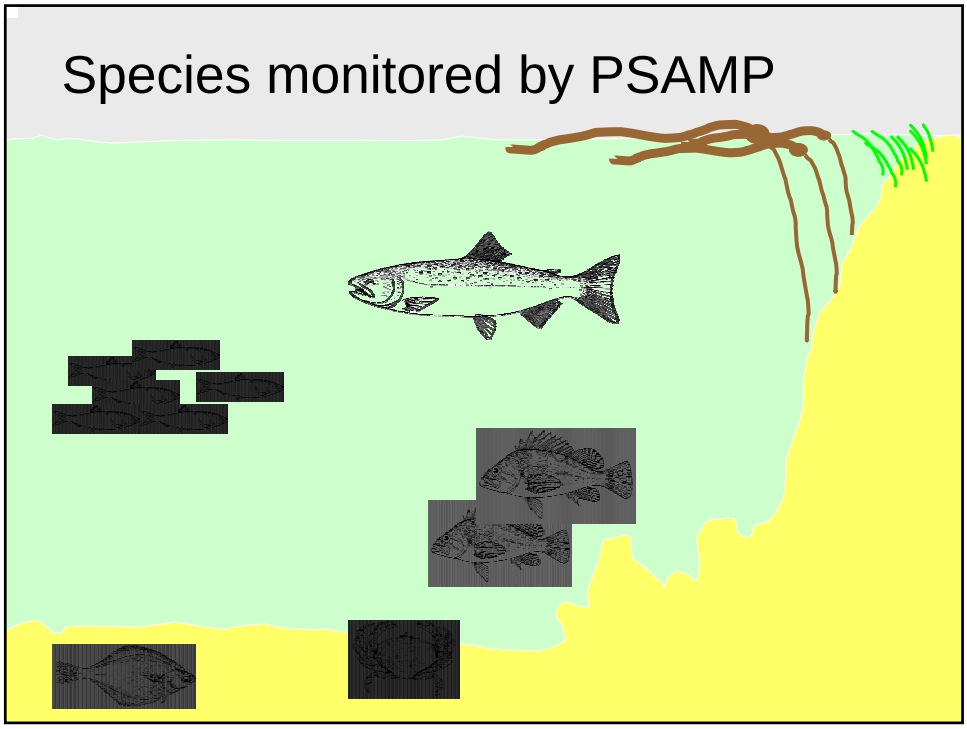
10.36


The Benthic-Pelagic Connection
A One Way Street?
Maybe Not
= reproductive products
=PCBs

10.36


Salmon in the System
returning adult salmon
out-migrating juvenile salmon
=PCBs

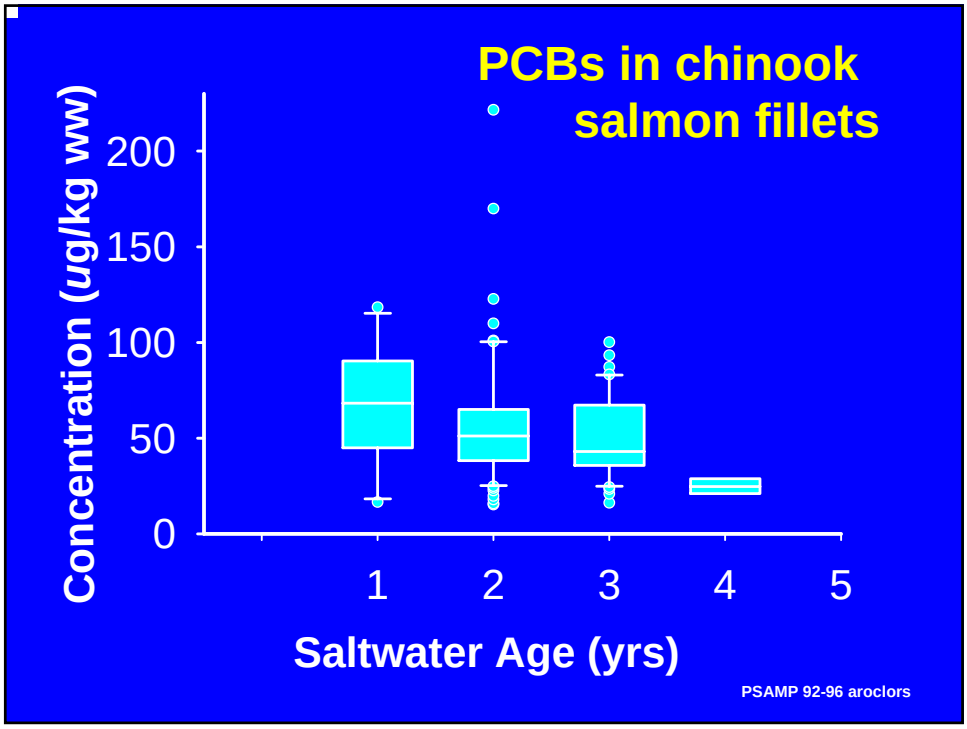
10.37


Species monitored by PSAMP

10.37

Mature male chinook salmon
Age 1
Age 2
Age 3
Age 4

10.38



10.39

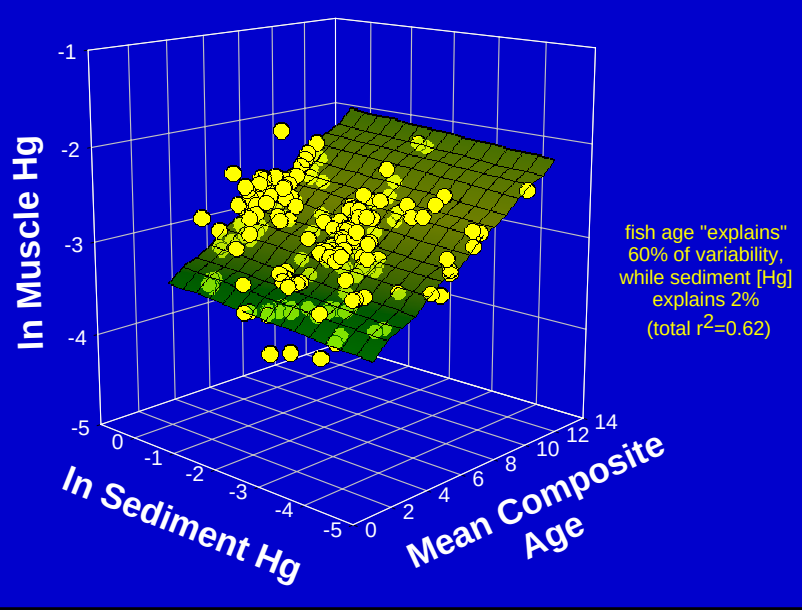
Does oceanic distribution affect PCB levels in Pacific salmon stocks in the Pacific Northwest?

10.40

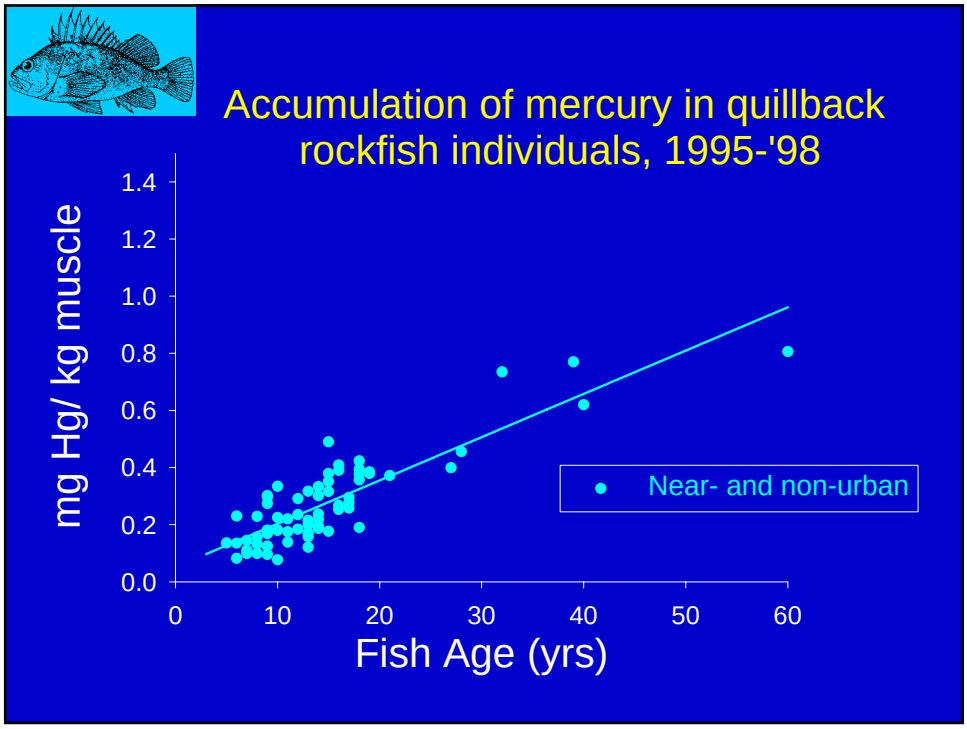
PCB Accumulation in Pacific Salmon

- Majority of PCBs are accumulated in marine waters including coastal areas & open ocean.
- Adult chinook /sockeye accumulate higher PCB concentrations than pink and chum.
- Species and stock-specific differences in life history traits such as saltwater age and marine distribution may influence PCB levels.

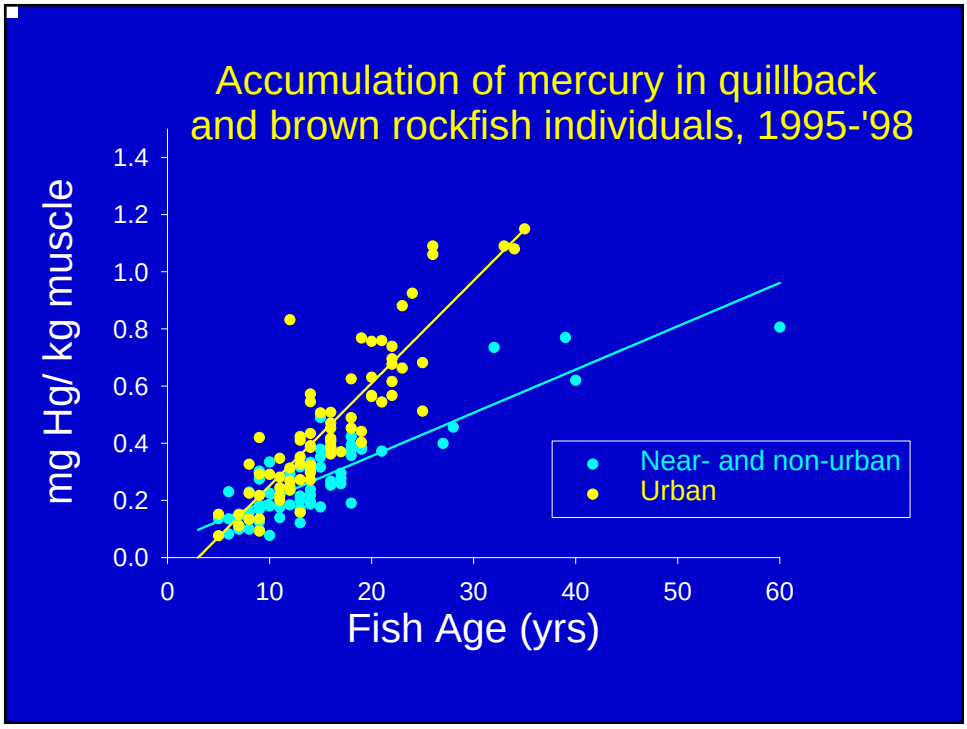
Effects of Fish Age and Sediment Hg Concentration on Mercury in English Sole Muscle Tissue



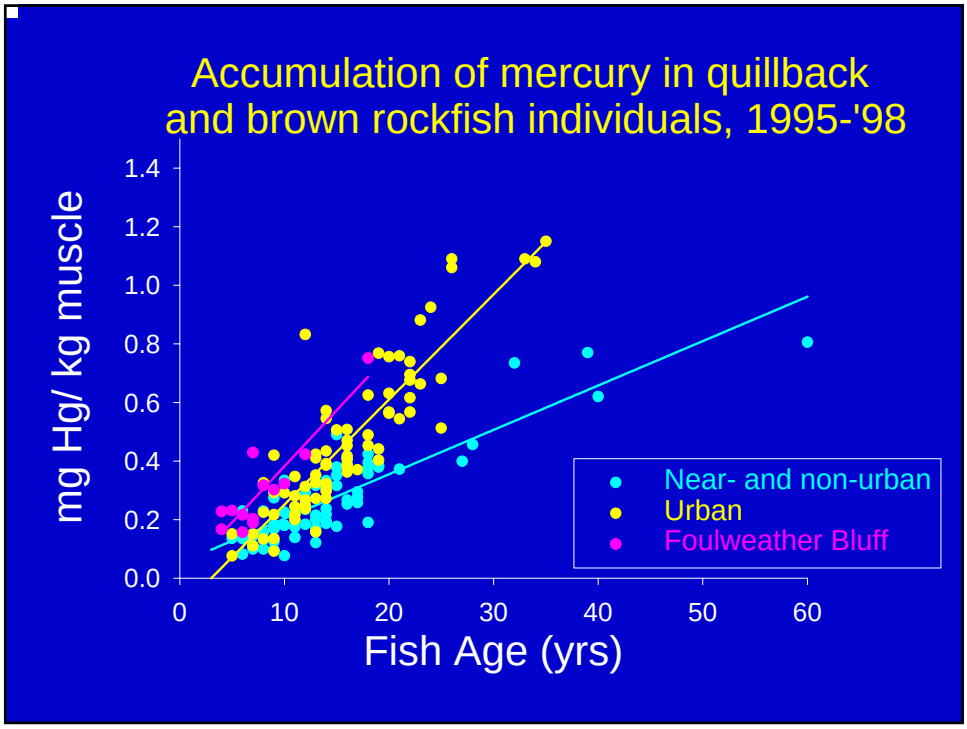
fish age "explains" 60% of variability, while sediment [Hg] explains 2% (total r^2=0.62)


Accumulation of mercury in quillback rockfish individuals, 1995-'98
mg Hg/ kg muscle
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
50
60
Fish Age (yrs)
Near- and non-urban

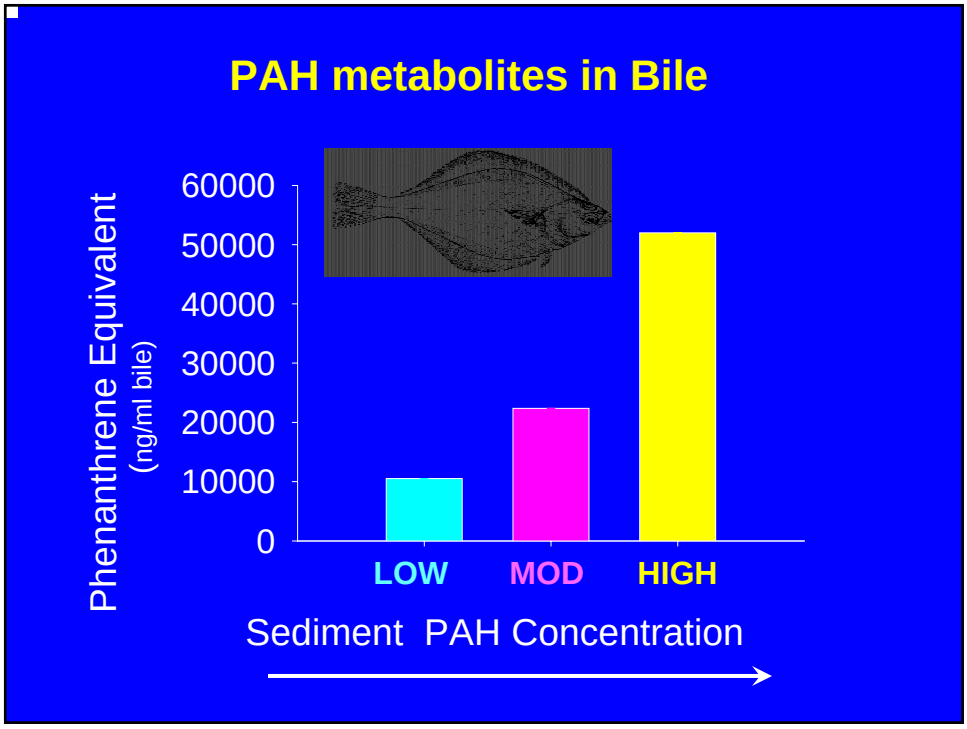
10.43


Accumulation of mercury in quillback and brown rockfish individuals, 1995-'98
mg Hg/ kg muscle
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
50
60
Fish Age (yrs)
Near- and non-urban
Urban

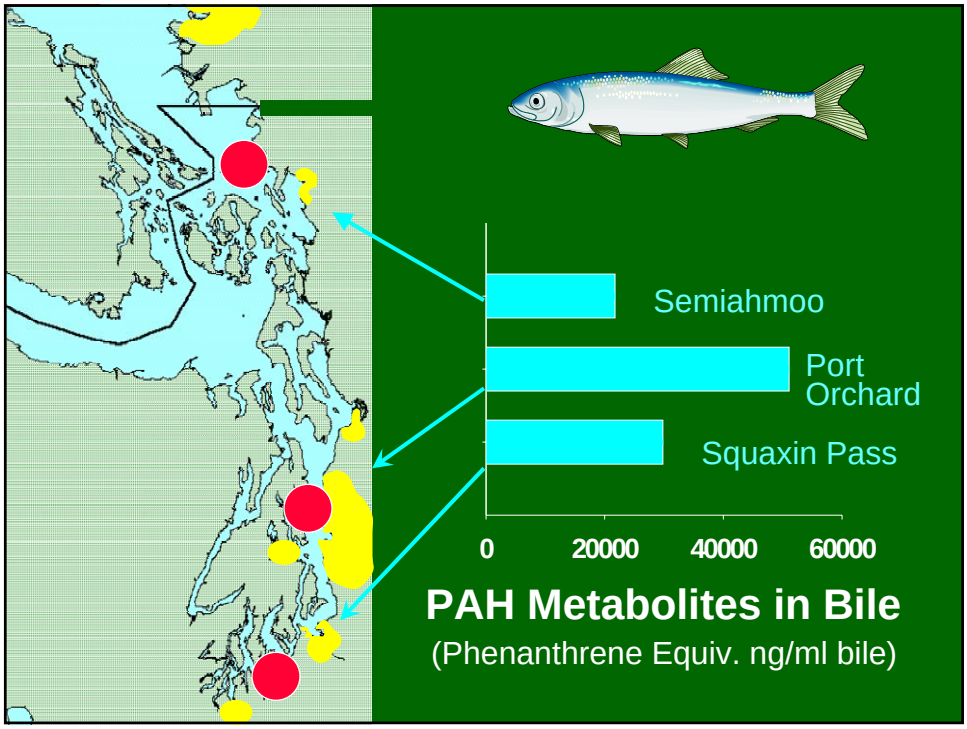
10.44


Accumulation of mercury in quillback and brown rockfish individuals, 1995-'98
mg Hg/ kg muscle
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
50
60
Fish Age (yrs)
Near- and non-urban
Urban
Foulweather Bluff

10.45

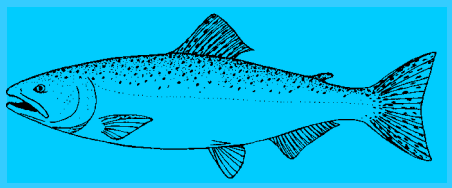

PAH metabolites in Bile
Phenanthrene Equivalent
(ng/ml bile)
60000
50000
40000
30000
20000
10000
0
LOW
MOD
HIGH
Sediment PAH Concentration

10.46



10.47

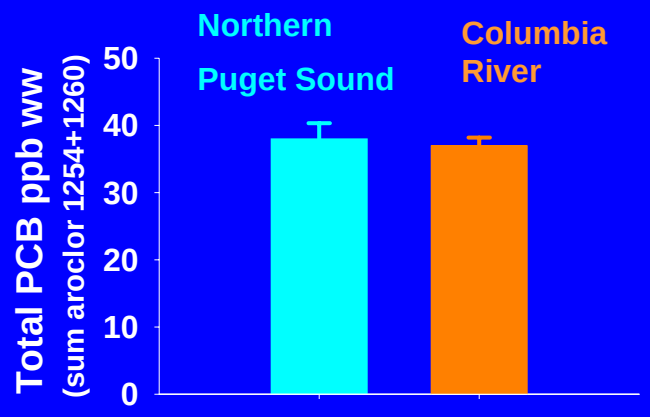
If you want to
- design cost effective monitoring programs
- communicate risk information



Know your fish!
(or your local fish biologist)

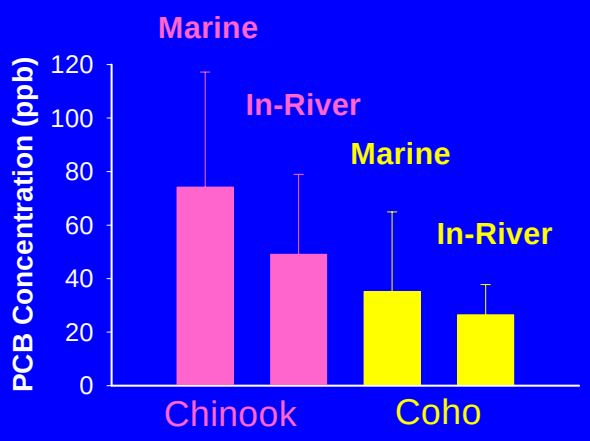
10.48

Geographic Variation in PCB Levels in chinook salmon returning to spawn

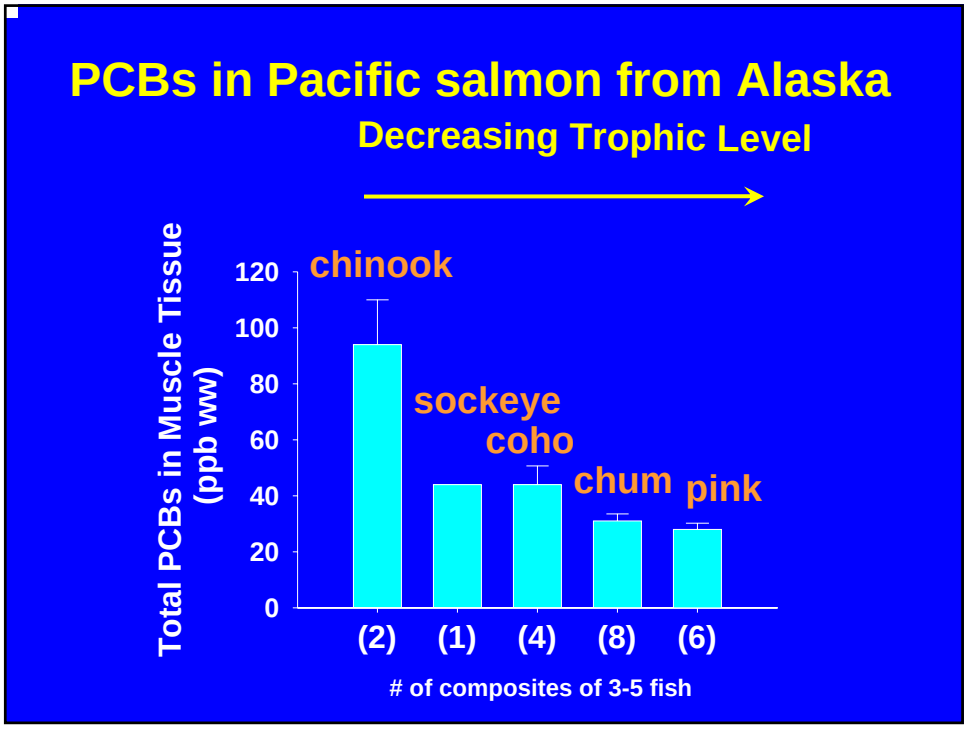


10.49

Average PCB Concentration in Adult Pacific Salmon from Puget Sound Environments (1992 -1995)



10.50


PCBs in Pacific salmon from Alaska
Decreasing Trophic Level
Total PCBs in Muscle Tissue (ppb ww)
120
100
80
60
40
20
0
chinook
sockeye
coho
chum
pink
(2)
(1)
(4)
(8)
(6)
# of composites of 3-5 fish

There were no slides in presentation number 11.

SEDIMENT MANAGEMENT ANNUAL REVIEW MEETING

May 5, 2004

Regional Dredging Team and Regional Sediment Evaluation Team

12.1

12.2

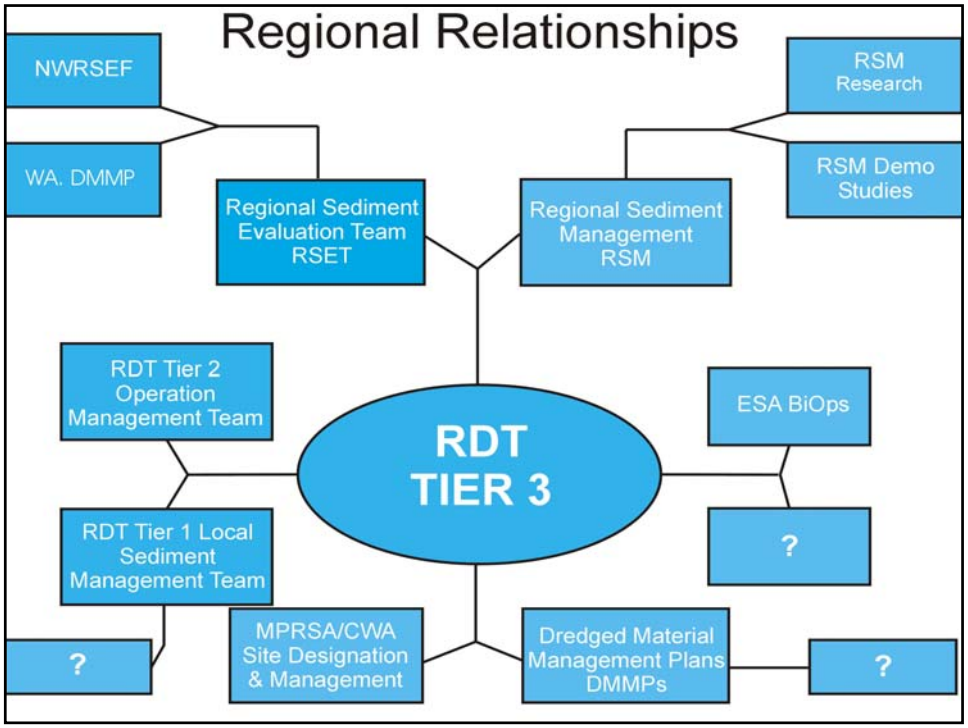
Regional Dredging Team

- Agency leaders
- Policy considerations
- Part of the national program

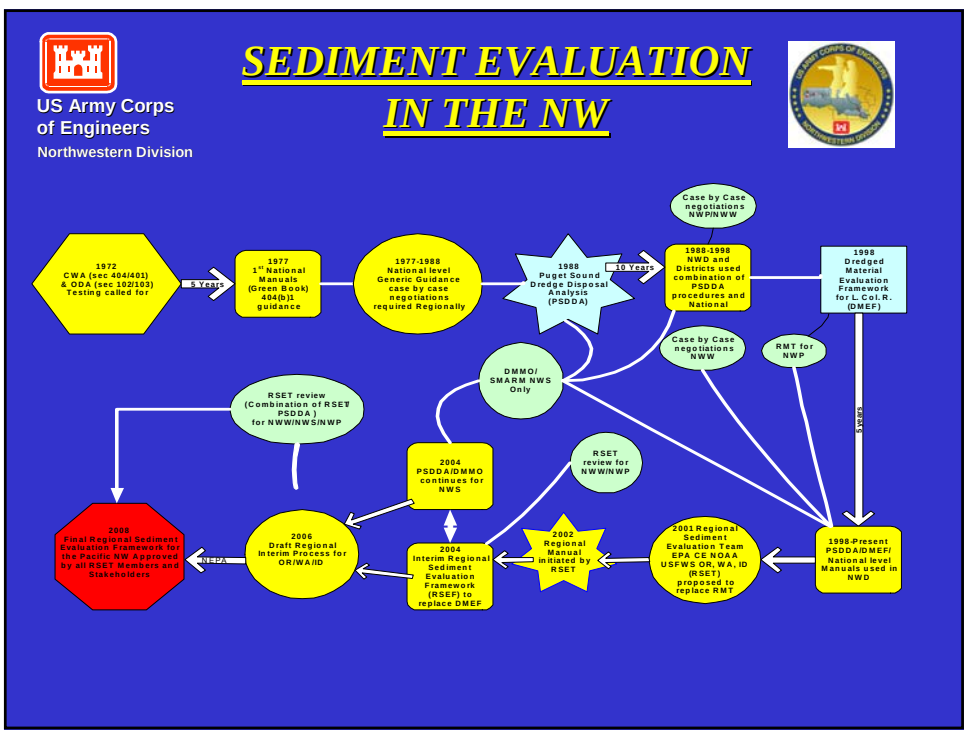
US Army Corps of Engineers

12.3

12.4


Regional Relationships
NWRSEF
WA. DMMP
Regional Sediment Evaluation Team RSET
Regional Sediment Management RSM
RSM Research
RSM Demo Studies
RDT Tier 2 Operation Management Team
RDT TIER 3
ESA BiOps
RDT Tier 1 Local Sediment Management Team
?
?
MPRSA/CWA Site Designation & Management
Dredged Material Management Plans DMMPs
?

12.5


SEDIMENT EVALUATION IN THE NW
US Army Corps of Engineers
Northwestern Division
1972 CWA (sec 404/401) & ODA (sec 102/103) Testing called for
5 Years
1977 1st National Manuals (Green Book) 404(b)1 guidance
1977-1988 National level Generic Guidance case by case negotiations required Regionally
1988 Puget Sound Dredge Disposal Analysis (PSDDA)
10 Years
1988-1998 NWD and Districts used combination of PSDDA procedures and National
Case by Case negotiations NWP/NWW
1998 Dredged Material Evaluation Framework for L. Col.R. (DMEF)
Case by Case negotiations NWW
RMT for NWP
DMMO/ SMARM NWS Only
RSET review (Combination of RSET PSDDA) for NWW/NWS/NWP
2004 PSDDA/DMMO continues for NWS
RSET review for NWW/NWP
2008 Final Regional Sediment Evaluation Framework for the Pacific NW Approved by all RSET Members and Stakeholders
NEPA
2006 Draft Regional Interim Process for OR/WA/ID
2004 Interim Regional Sediment Evaluation Framework (RSEF) to replace DMEF
2002 Regional Manual initiated by RSET
2001 Regional Sediment Evaluation Team EPA CE NOAA USFWS OR, WA, ID (RSET) proposed to replace RMT
1998-Present PSDDA/DMEF/ National level Manuals used in NWD
5 years

12.6

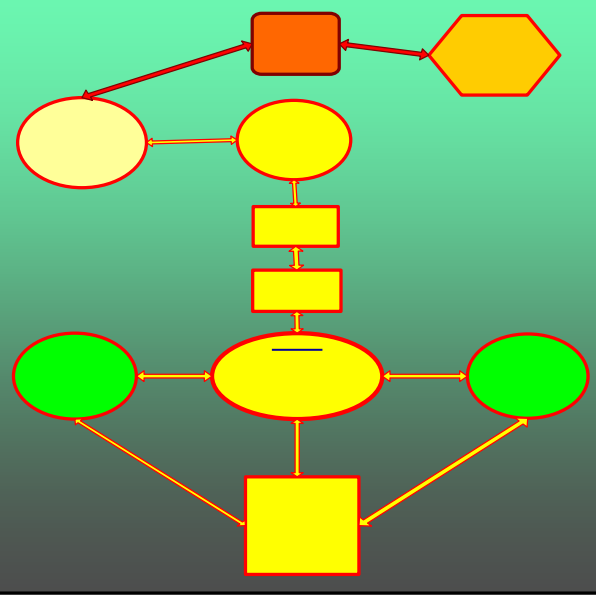
DMEF Becomes SEF

- We have new acronym
- Not just a DMEF rewrite
- Chapter by chapter revision
  - Chapters 1, 2, 3 revised
  - Parts of Chapter 4 and 5 revised

Regional Sediment Evaluation Team (RSET)

- Revision of DMEF
- Technical/Scientific issues
- Policy issues
- Long-term role

RSET ROLES & RESPONSIBILITIES



12.9

Subcommittees

- Policy
  - NEPA/EIS
  - Public Involvement
  - Process and organization

12.10

Subcommittees

- Contaminant and Analyte List
  - PCBs
  - How to add and subtract analytes
  - Summation techniques

Subcommittees

- Sediment Quality Guidelines
  - Freshwater guideline consistency
  - SEDQUAL database
  - Consistency with marine levels

Subcommittees

- Biological Testing
  - Protectiveness for ESA species
  - Short-term vs long-term freshwater bioassays
  - Evaluating rapid screening assessment methods

Subcommittees

- Bioaccumulation
  - Develop bioaccumulation endpoint (Human Health and Ecological) screening levels.
  - Establish tissue levels protective of ESA species.
  - Develop second freshwater bioaccumulation species protocol.
  - Evaluate current bioaccumulation protocols

White Papers

- Complex issues
- Broad discussion needed
- Part of Subcommittee work
- Sharing issues, gathering feedback

White Papers

- A number of them available on website
  - Disposal Options
  - Frequency
  - Grain size exclusion
  - NEPA/EIS
  - Programmtic consultation

Recent Developments

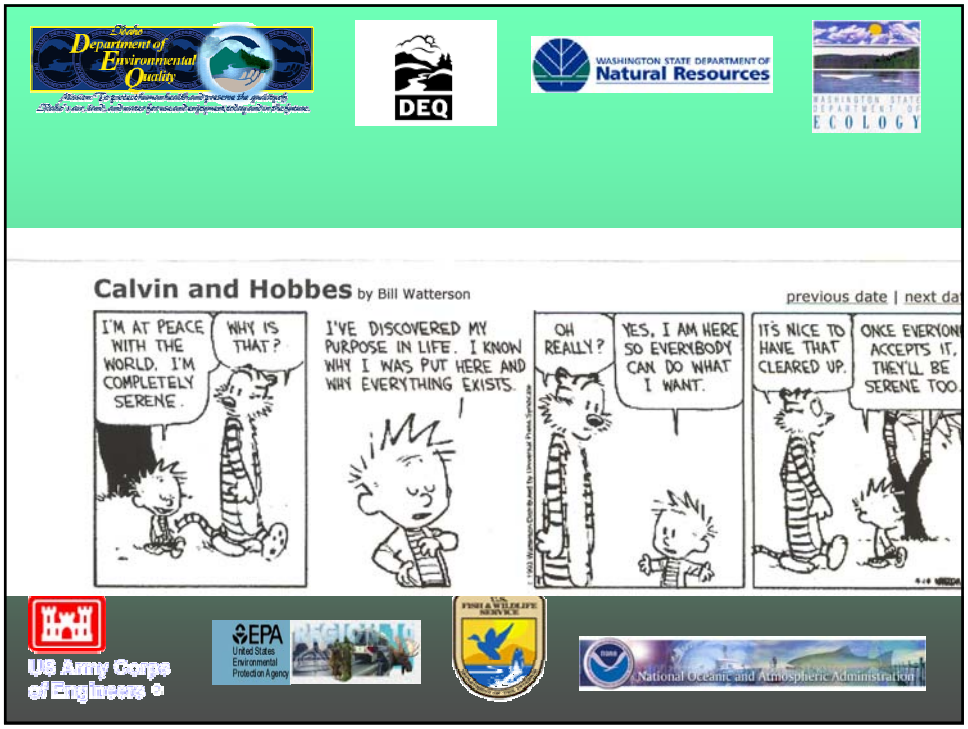
- Lewiston meeting
- Charting the next 6 months

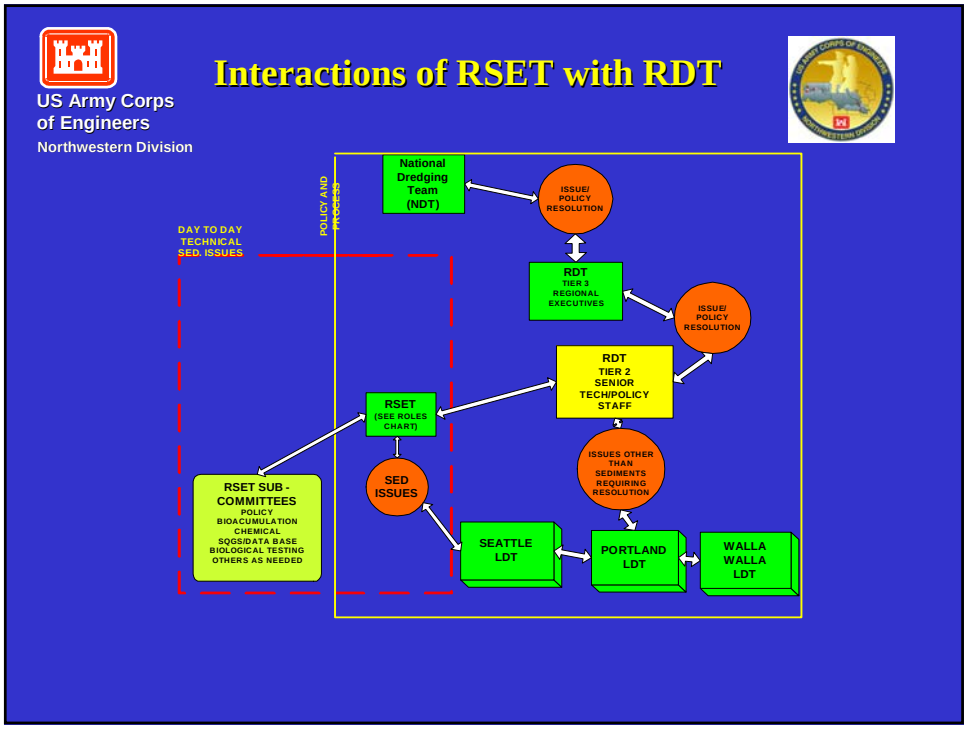
12.17

Lewiston Meeting

- Regionalizing the process
- Subcommittee work
- Decisions, decisions

12.18


Idaho Department of Environmental Quality
DEQ
WASHINGTON STATE DEPARTMENT OF Natural Resources
WASHINGTON STATE DEPARTMENT OF ECOLOGY
Calvin and Hobbes by Bill Watterson
previous date | next da
I'M AT PEACE WITH THE WORLD. I'M COMPLETELY SERENE.
WHY IS THAT?
I'VE DISCOVERED MY PURPOSE IN LIFE. I KNOW WHY I WAS PUT HERE AND WHY EVERYTHING EXISTS.
OH REALLY?
YES, I AM HERE SO EVERYBODY CAN DO WHAT I WANT.
IT'S NICE TO HAVE THAT CLEARED UP.
ONCE EVERYONE ACCEPTS IT, THEY'LL BE SERENE TOO.
US Army Corps of Engineers
EPA United States Environmental Protection Agency
U.S. FISH & WILDLIFE SERVICE
National Oceanic and Atmospheric Administration


US Army Corps of Engineers
Northwestern Division
Interactions of RSET with RDT
DAY TO DAY TECHNICAL SED. ISSUES
POLICY AND PROCESS
National Dredging Team (NDT)
ISSUE/ POLICY RESOLUTION
RDT TIER 3 REGIONAL EXECUTIVES
ISSUE/ POLICY RESOLUTION
RDT TIER 2 SENIOR TECH/POLICY STAFF
RSET (SEE ROLES CHART)
ISSUES OTHER THAN SEDIMENTS REQUIRING RESOLUTION
SED ISSUES
RSET SUB - COMMITTEES POLICY BIOACUMULATION CHEMICAL SQGS/DATA BASE BIOLOGICAL TESTING OTHERS AS NEEDED
SEATTLE LDT
PORTLAND LDT
WALLA WALLA LDT

What's next?

- Subcommittee work through the summer
- Draft manual available for review late summer
- Next full RSET meeting September 23 and 24 2004, in the Portland area

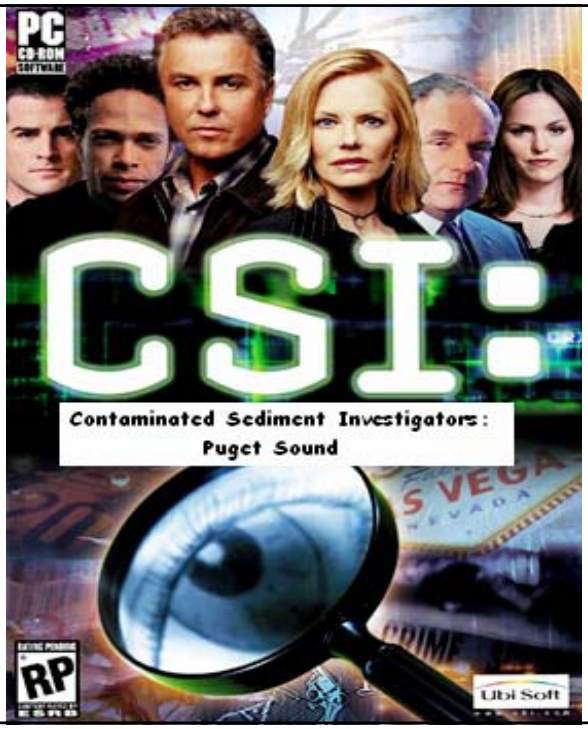
12.21

Preliminary PNW Regional Sediment Evaluation Framework Timeline

	Who's Responsible	# Days	Deadline
Phase 1 - Internal Document Preparation			
Technical Subcommittees			
Complete Issue/White Papers to Submit to Policy Committee			
- Prepare White/Issue Paper	Subcommittee	65 days	
- Submit to Policy Committee for Review			July 8, 2004
- Policy Committee Review	Policy Committee	15 days	
- Policy Committee Presents Comments to Consultant/Subcommittee			July 29, 2004
- Incorporation of Policy Committee Comments	Subcomittee/Hart Crowser	10 Days	
- Present to Entire RSET for Review			August 12, 2004
- RSET Review and Comment	RSET Membership	15 Days	
- RSET Presents Comments to Subcommittee			September 2, 2004
- Incorporate RSET Comments	Subcomittee/Hart Crowser	15 days	
- White/Issue Paper Done			September 23, 2004
Rewrite of Specific Chapters			
Revision of Chapters Not Requiring Agency/Subcomittee Input (see note #1)			
- Prepare Chapter	Hart Crowser	30 Days	
- Submit to Policy Committee for Review			May 20, 2004
- Policy Committee Review	Policy Committee	15 days	
- Policy Committee Presents Comments to Consultant/Subcommittee			June 10, 2004
- Incorporation of Policy Committee Comments	Hart Crowser	10 Days	
- Present to Entire RSET for Review			June 24, 2004
- RSET Review and Comment	RSET Membership	15 Days	
- RSET Presents Comments to Subcommittee			July 15, 2004
- Incorporate RSET Comments	Hart Crowser	10 days	
- White/Issue Paper Done			July 29, 2004
Revision of Chapters Requiring Agency Input (see note #2)			
- Prepare Chapter	Hart Crowser/Agency	45 Days	
- Submit to Policy Committee for Review			June 10, 2004
- Policy Committee Review	Policy Committee	15 days	
- Policy Committee Presents Comments to Consultant/Subcommittee			July 1, 2004
- Incorporation of Policy Committee Comments	Hart Crowser/Agency	10 Days	
- Present to Entire RSET for Review			July 15, 2004
- RSET Review and Comment	RSET Membership	15 Days	
- RSET Presents Comments to Subcommittee			August 5, 2004
- Incorporate RSET Comments	Hart Crowser/Agency	10 days	
- White/Issue Paper Done			August 19, 2004
Revision of Chapters Requiring Subcomittee Input (see note #3)			
- Tracks as Above for Completion of White/Issue Papers	Subcomittee/Hart Crowser		September 23, 2004
Policy Committee			
- Organize/Prepare Materials for Regional Executive Meeting	John/Jim		May 11, 2004
- Organize and Prepare Materials for PNWA	John/Jim		Late May
- Develop/Implement Public Involvement Plan	Jennifer Richman		Ongoing
- Implement Tribal Involvement	Jennifer Richman		Ongoing
- Tribal Invite Letter	John/Jim		May
- Thank You Letters (Col. and IDEQ)	Carrie (Draft)		April
- Three Page Summary - RSET So Far (Briefing Memo)	Taku		May
Interim Teleconference (Purpose to answer questions/comments/concerns)			
- Identify Participants (one or two conference calls)	Policy Committee		May
- Information Letter (Agencies, Stakeholders)	Carie		May
- Teleconference	John/Jim/Taku/Carie?		June 17, 2004
Miscellaneous Tasks			
- Outreach/Education to Idaho	John/Jim/WA Dept. Ecology		May?
NOTES:			
1) Chapters Include: Goals, Descriptions, and Organization Chapter, Tiered Risk Evaluation Chapter, Sampling and Analysis Plan Chapter, and Sampling Chapter.			
2) Chapters Include: Sediment Management Regulations Chapter, Regulatory Process Chapter, and Data Submitals and Database Chapter.			
3) Chapters Include: Physical and Chemical Testing Chapter, Toxicity Testing Chapter, Risk Assessment Chapter, and Various Technical Appendicies.			

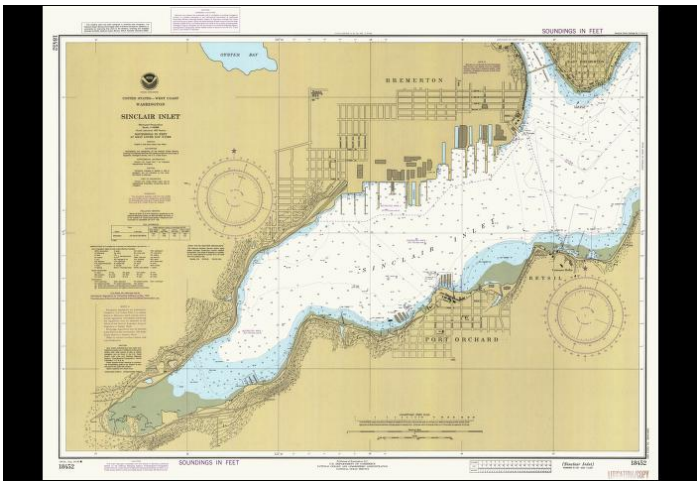
12.22

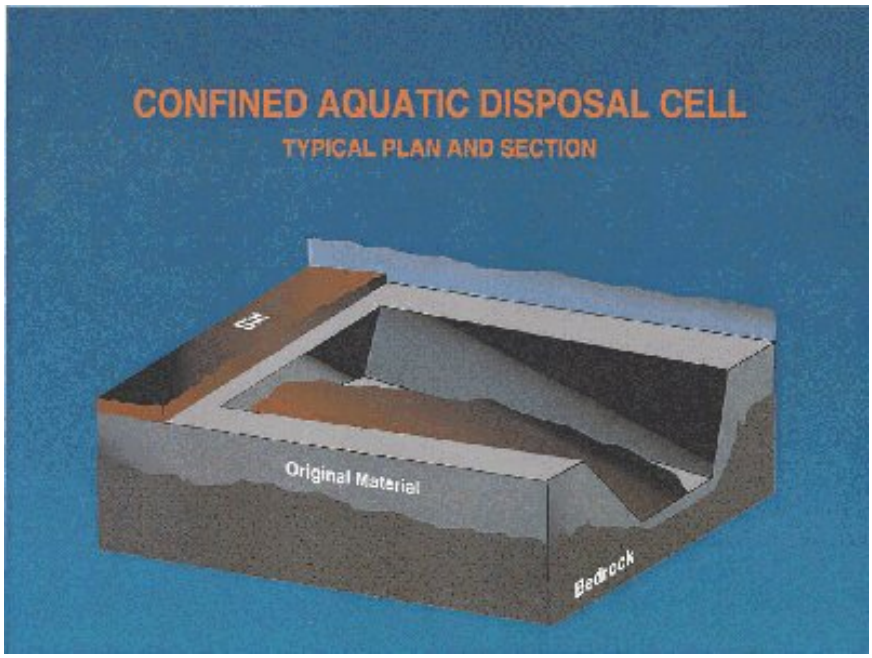
Idaho Department of Environmental Quality
DEQ
WASHINGTON STATE DEPARTMENT OF
Natural Resources
WASHINGTON STATE DEPARTMENT OF ECOLOGY
US Army Corps of Engineers
EPA
United States Environmental Protection Agency
U.S. FISH & WILDLIFE SERVICE
National Oceanic and Atmospheric Administration



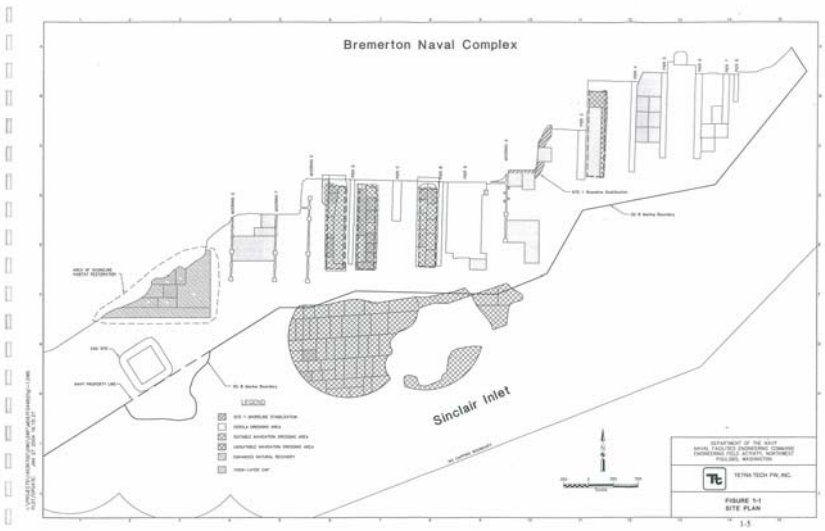
Episode 12:
"Escape from the CAD Pit at PSNS"

Sinclair Inlet
Site of the Navy's CAD Facility



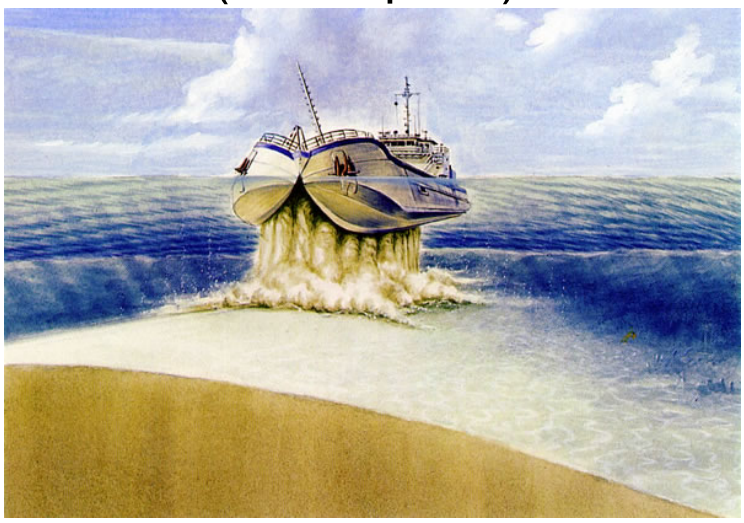


The Area of Interest



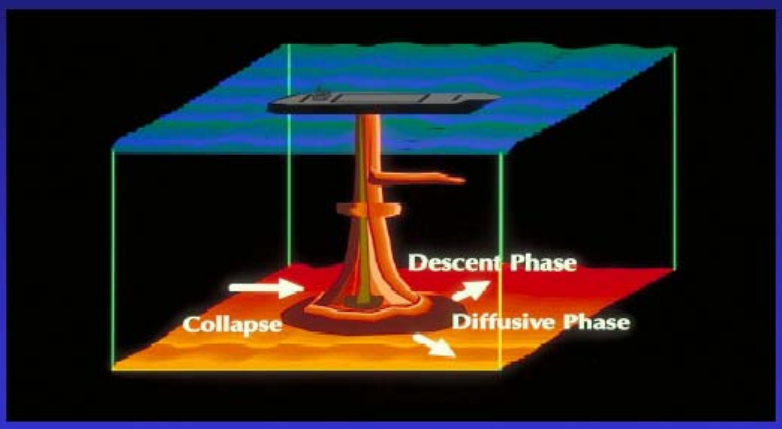
13.5

Barge Disposal (Conceptual)



13.6

A Brief Review of the Physics of Dredged Material Disposal

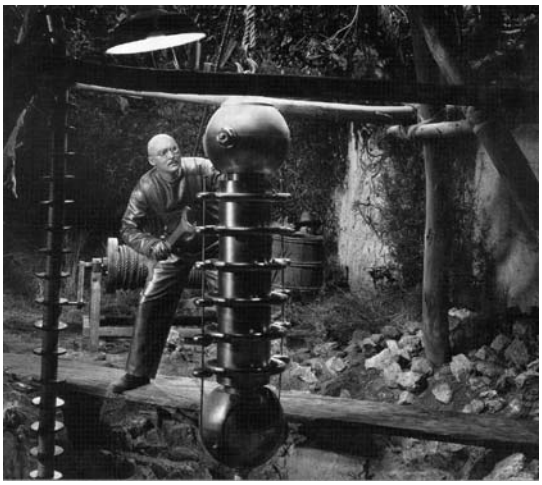


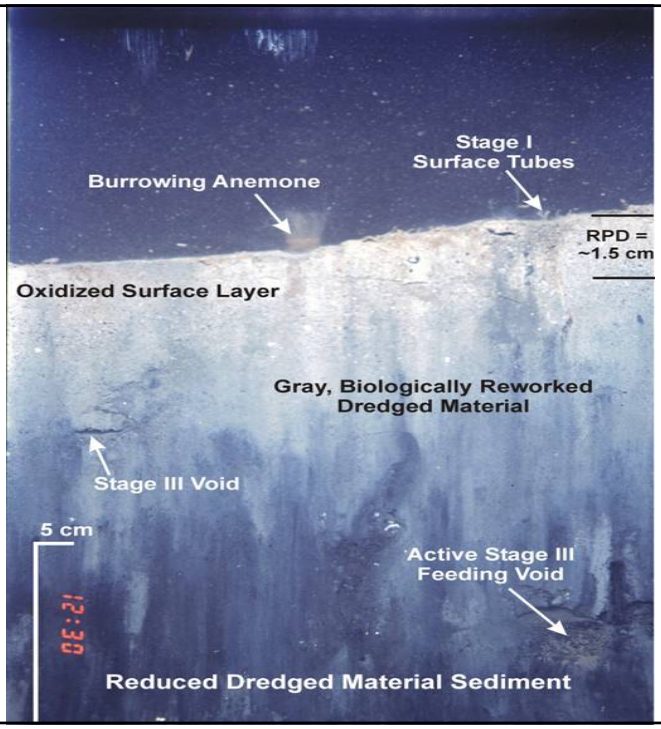
Slide courtesy of Joe Germano

Post Disposal

- Following the placement of the initial sand cap, sediment grab samples were collected approximately 20 feet from the perimeter of the CAD pit as required by the EPA's Water Quality Certification. The sediment sampling was repeated at the same GPS coordinates again in August 2001. Results showed elevated levels of PCBs and mercury.

Joe Germano Deployed the Sediment Profile Imaging System





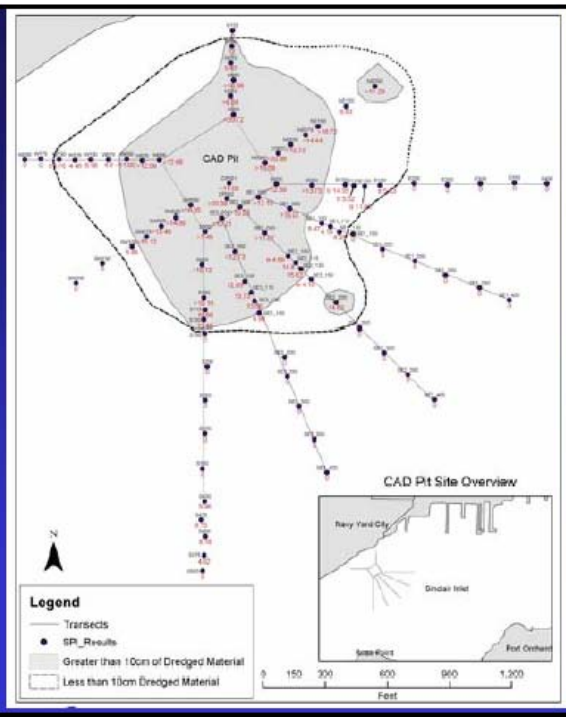
PSNS – Ambient Bottom

PSNS – Inside CAD

Deployment Almost Resulted in Over-Exposure

Slide courtesy of Joe Germano

PSNS – Dredged Material



PSNS – Results

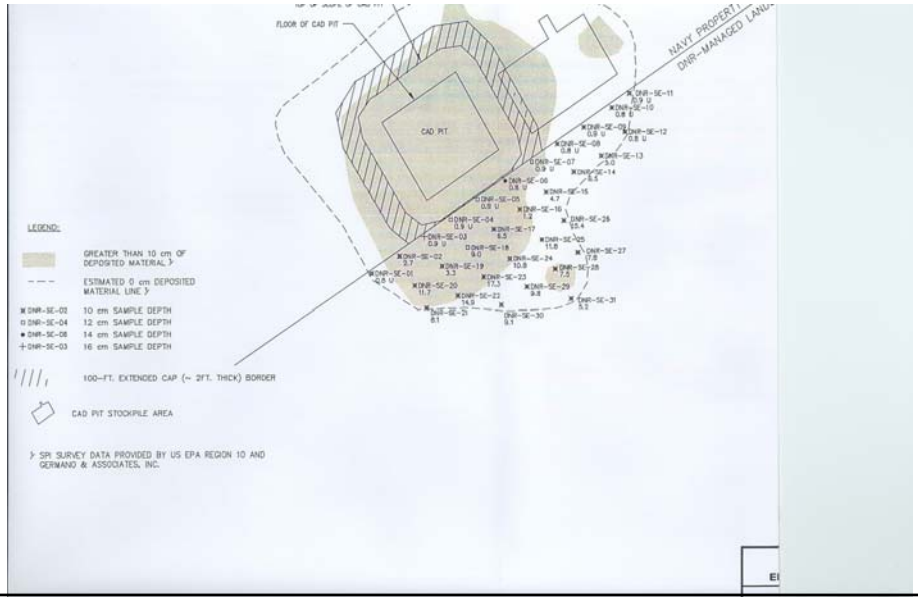
REVEALING THE GOODS....

- *Dredged material has spread out 100-200 meters in all directions from the CAD boundary*
- *These results are similar to those found at other disposal site and CAD cell investigations in Puget Sound, Long Island Sound, New York, Massachusetts Bay, Los Angeles, Hong Kong, and off CA coast*

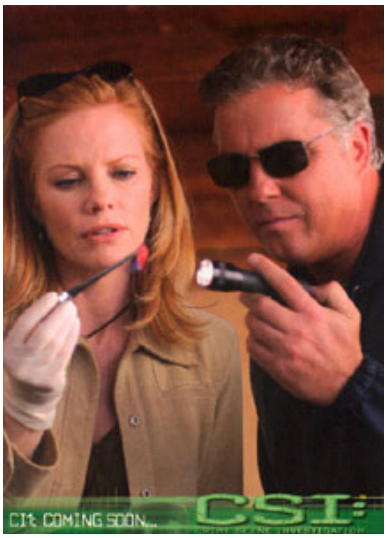
Slide Courtesy of Joe Germano

Ted Benson Brought In To Assist

Chemical Analysis of Samples



Analysis of Data



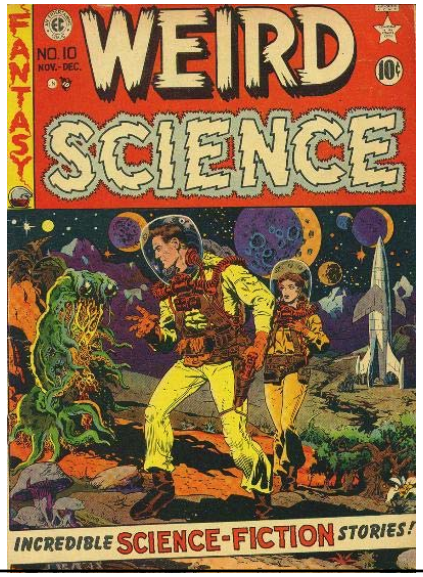
Results

- The data indicated elevated concentrations of PCBs and mercury in the sediment outside the CAD pit boundary.
- The southeastern edge of the CAD pit coincides with the line of Navy property ownership (i.e., the material that escaped from the CAD pit wound up on State-Owned Aquatic Land).

Navy Statement

- The Navy stated that:
  - Sediment deposition extends beyond the established CAD pit footprint, including the 100-foot buffer zone surrounding the CAD pit footprint.
  - It appears that some of the material may contain CERCLA and/or MCON (Military CONstruction) unsuitable sediments.
  - It is impossible to discern which activities have resulted in sediment deposition outside the CAD pit and how much of this material may be contaminated." ("Draft Sampling and Analysis Plan; Extend Confined Aquatic Disposal Cap")

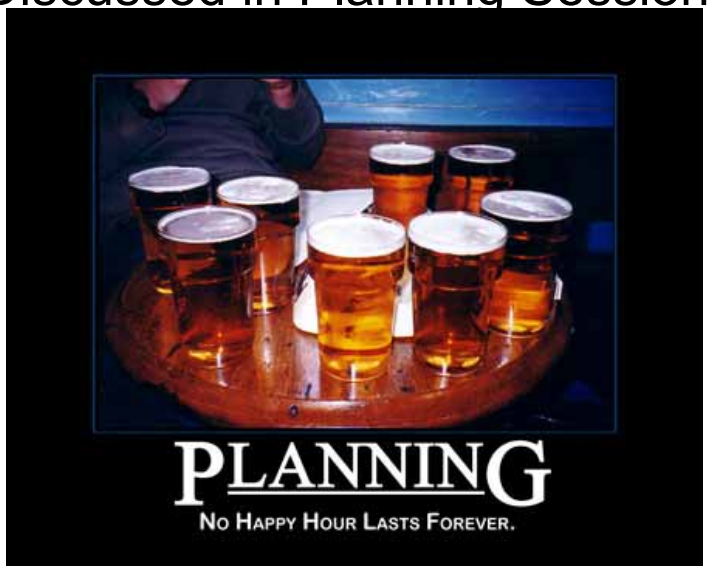
Characterization of Surface Contamination



Surface Characterization Methodology

- Several different interpolators were used to perform spatial estimation of organic-carbon normalized PCB values
  - Inverse Distance Weighting
  - Natural Neighbor
  - Spline
  - Kriging (proved to be the preferred interpolation method)

The Remedial Alternatives Were Discussed in Planning Sessions



Remedial Alternatives

- Dredging and removal
  - Contaminants in a thin layer
- Capping
  - Small volume, large area, limited budget
- Enhanced Natural Recovery
  - Selective application to impacted areas
- “No action”
  - Not found acceptable at this site

Ecology Is Persuaded by Navy and EPA

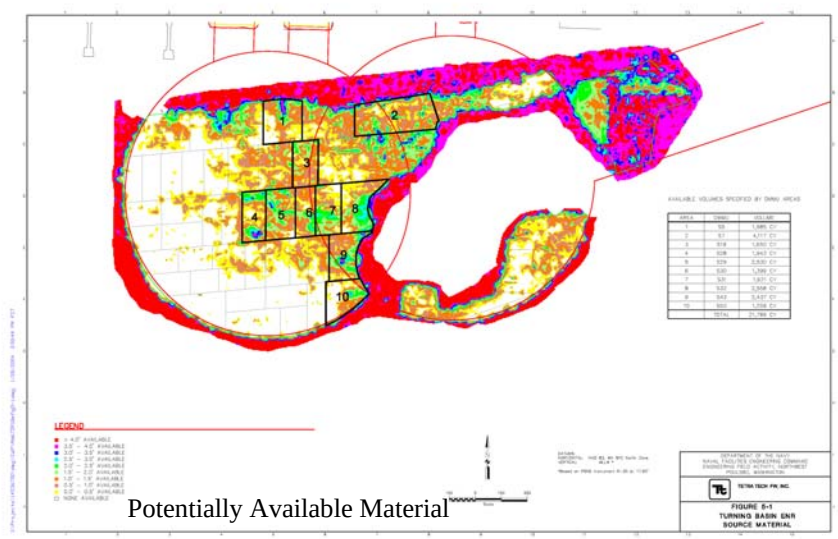
Selected Solution

- Enhanced Natural Recovery
  - Remediation tailored to level of contamination
  - Cover material available:
    - Upland source (sand mine)
    - Other dredging projects
    - Turning basin material (previously characterized)
  - Source selected
    - Turning basin

Agreed Action

- Enhanced Natural Recovery for areas with PCBs > 9 mg/kg, OC normalized
- Coincidental remediation (natural spreading of clean material during placement) for areas > 6 mg/kg, OC normalized
- Verification of performance through pre- and post-placement bathymetric surveys

Enhanced Natural Recovery for Operable Unit B Marine



Potentially Available Material

Cover Material Dredged from Turning Basin

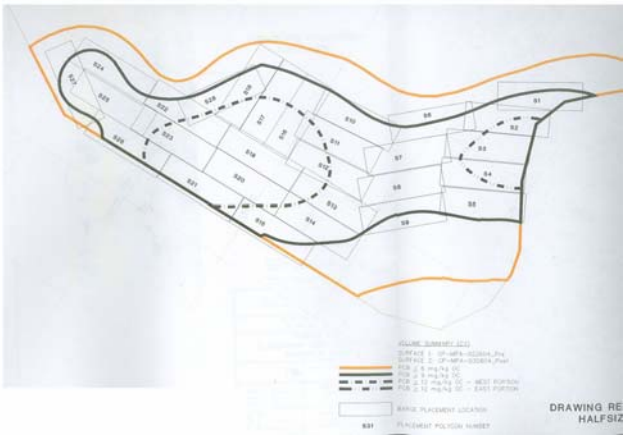
Assessment of Effectiveness

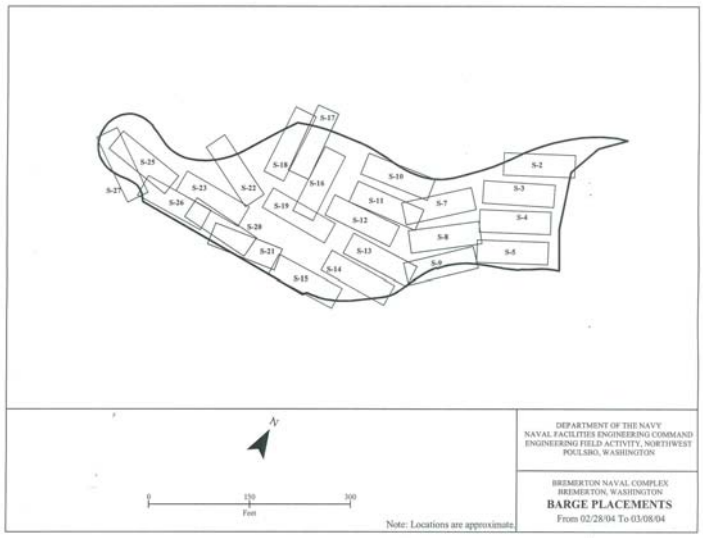
- Conducted both pre- and post-disposal precision bathymetry
- Allowed calculation of depth of cover material
- Barge positioning for disposal integral to effective placement

Barge Placement

- Placed 40 barge loads of sediment over area with PCB concentrations $\geq$ 9mg/kg OC.

Planned Barge Placement

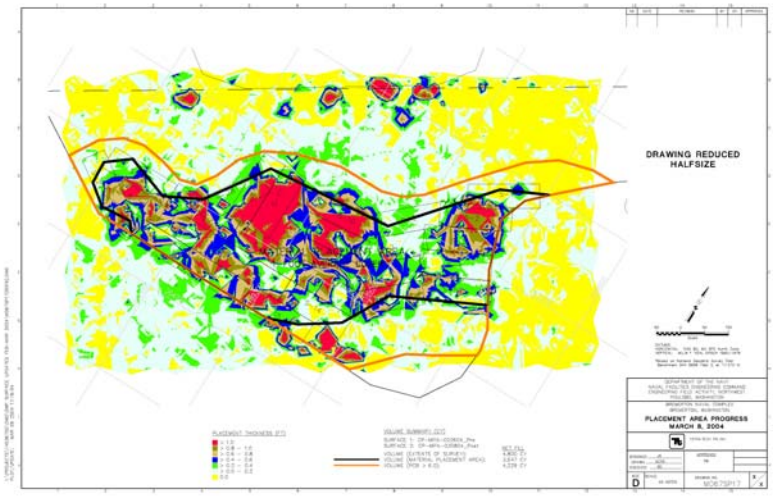


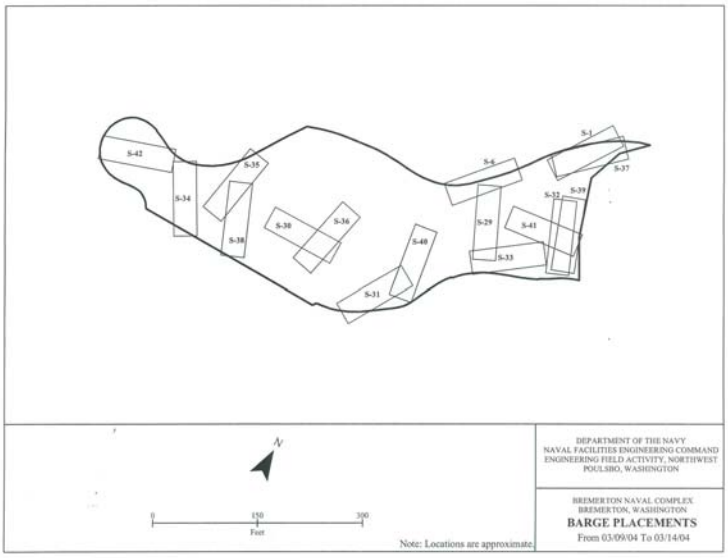


Location of Barges – Week 1

Bathymetric Data Analysis Was Expedited

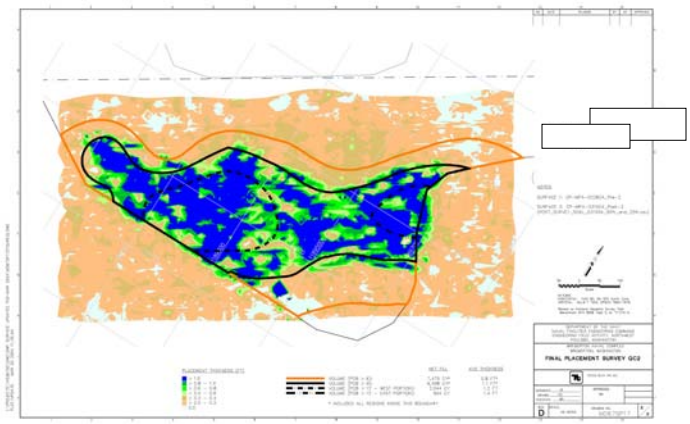
Cover Thickness – At Conclusion of First Week



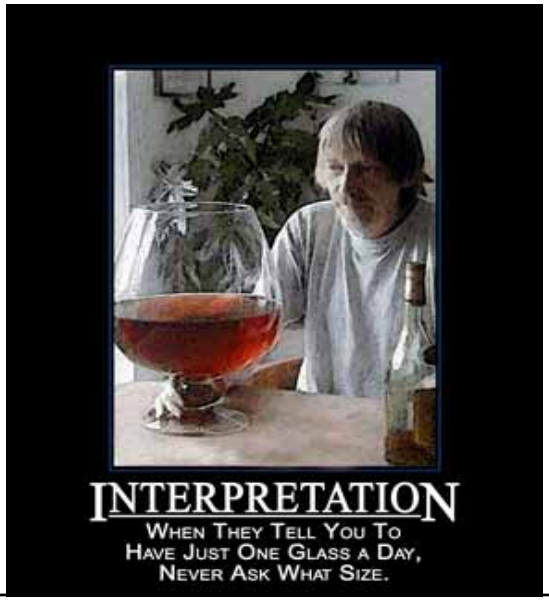


Location of Barges – Week 2

Final Cover Thickness



Data Interpretation



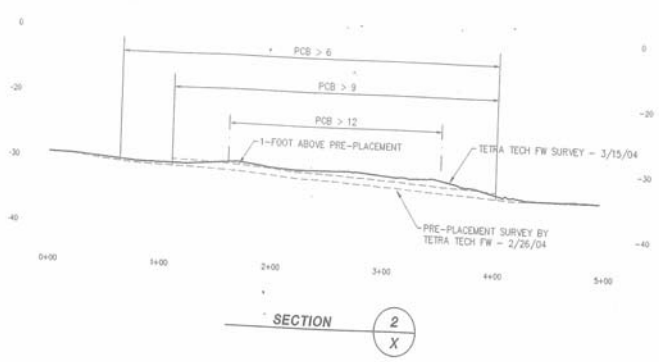
Sediment Placement

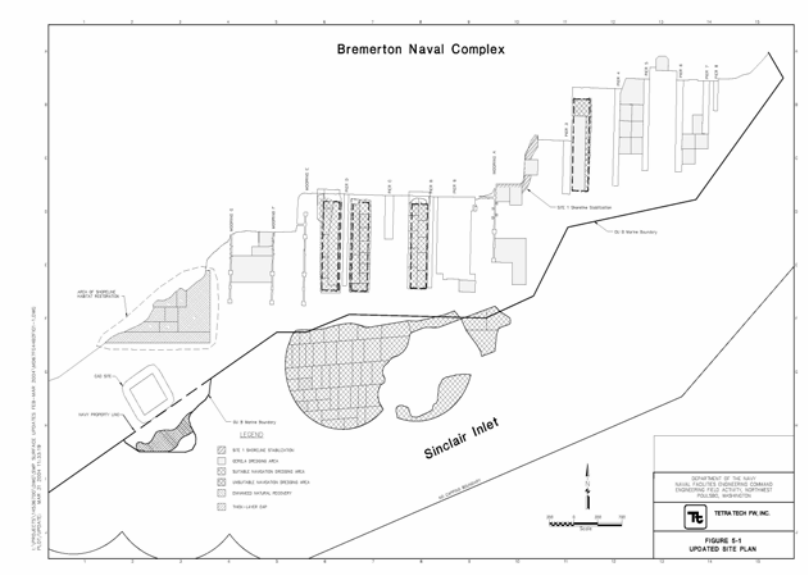
	Net Fill	Avg Thickness
Volume (PCB $\geq$ 6)	7,475 CY*	0.8 FT*
Volume (PCB $\geq$ 9)	6,498 CY*	1.1 FT*
Volume (PCB $\geq$ 12 – West Portion)	2,044 CY	1.2 FT
Volume (PCB $\geq$ 12 – East Portion)	594 CY	1.4 FT

* Includes all Regions inside this boundary

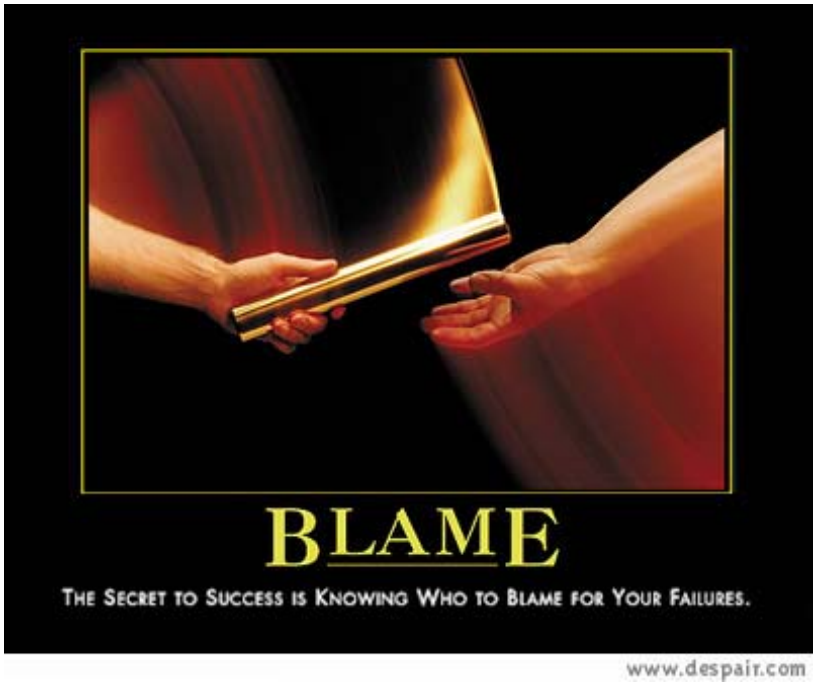
Challenges
- High water content in dredge sediments
- Shallow dredge cuts required tight control
- Weather conditions impacted barge positioning

Note: Minimum volume to meet nominal one foot thick requirement is 6,167 CY




Bremerton Naval Complex
Sinclair Inlet
LEGEND
TETRA TECH FW, INC.
FIGURE 5-1
UPDATED SITE PLAN

13.43

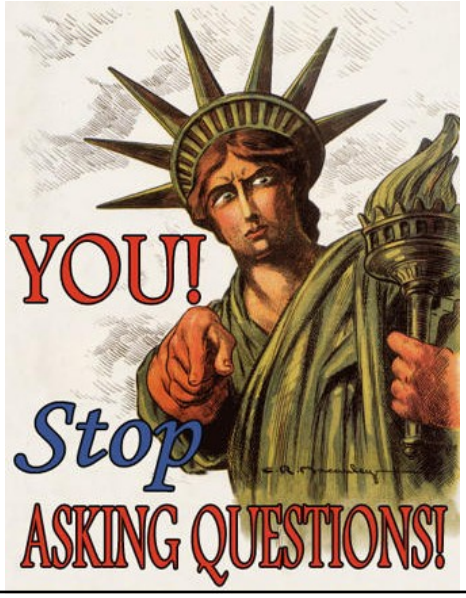

BLAME
THE SECRET TO SUCCESS IS KNOWING WHO TO BLAME FOR YOUR FAILURES.
www.despair.com

13.44

Acknowledgements

- I would like to thank Joe Germano and Gina Dinn in particular for their input and assistance.
- I would also like to thank everyone else who participated and crafted, despite my participation, a remedial effort that appears to be successful. This includes, but is not limited to, Courtney Wasson & Chris Hanlon-Meyer (DNR), Denice Taylor (Suquamish Tribe), Nancy Harney & Erika Hoffman (EPA), Rod Gross (EFA-NW), and my colleagues at Ecology.

What questions do you have?



Armandia Brevis Bioaccumulation Evaluation

Susan McGroddy, PhD
Windward Environmental LLC

Work funded by the Port of Seattle, with assistance from:

- Doug Hotchkiss – Port of Seattle
- Mike Johns, Bob Complita, Joanna Florer – Windward Environmental LLC
- Jack Word and Bill Gardiner – MEC Analytical Systems Inc
- Allison Geiselbreicht – Floyd, Snider, McCarthy Inc.
- Armandia Workgroup

Goal: To attempt to resolve several issues that were raised as a result of the bioaccumulation testing for TBT conducted in West Waterway

- Is there differential accumulation of sediment TBT concentrations by *Armandia brevis* compared to *Nephthys caecoides*?
- Do test conditions influence the bioaccumulation of TBT, specifically static vs. flow-through systems?

Windward environmental LLC

Exposure concentrations

- Sediment data were reviewed to identify sediments with TBT concentrations between 100 and 1,000 ppb and no CSL exceedances for other contaminants. Two samples were collected with 140 µg/kg TBT dw (B2) and 180 µg/kg TBT dw (B6).
- Prior to initiating bioaccumulation tests, several aquaria were used to measure "porewater" TBT concentrations under test conditions. The resulting concentrations were 0.21 µg/L TBT (B2) and 0.38 µg/L TBT (B6).

Windward environmental LLC

Three bioaccumulation tests were conducted with each sediment:

- *Nephthys caecoides*: 45-day exposure under flow-through conditions
- *Armandia brevis*: 28-day exposure under flow-through conditions
- *Armandia brevis*: 28-day exposure under static conditions

Windward environmental LLC

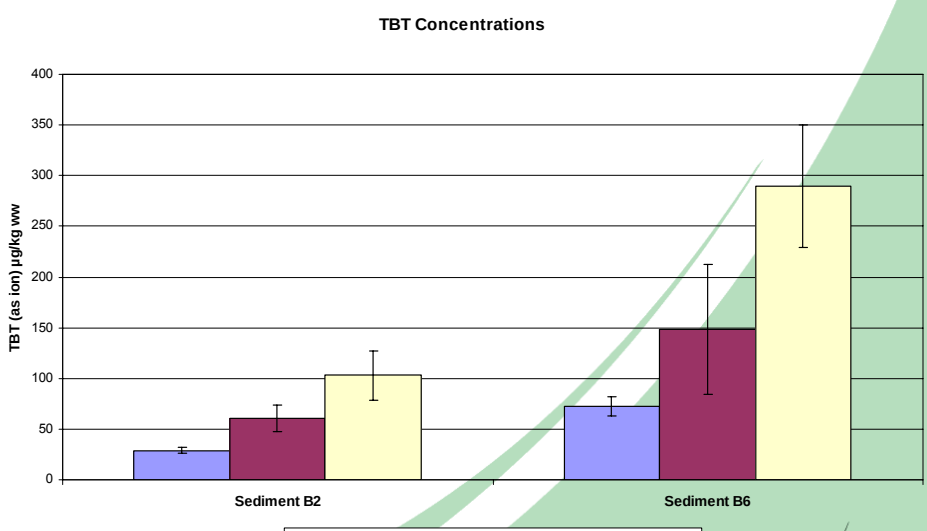
A. brevis and *N. caecoides*

Summary of polychaete survival for the East Waterway bioaccumulation exposures, April 2003

Treatment	Mean Percent Survival	Standard Deviation
***Armandia brevis* 28-d static exposure**		
Control	94.3	5.9
EWW-B2	86.9	8.2
EWW-B6	89.5	7.0
***Armandia brevis* 28-d flow-through exposure**		
EWW-B2	74.9	22.2
EWW-B6	76.8	29.8
***Nephtys caecoides* flow-through exposure**		
Control	90.8	4.1
EWW-B2	86.4	18.5
EWW-B6	88.8	4.6

Windward environmental LLC

TBT tissue concentrations



Windward environmental LLC

Conclusions

- *Armandia* tissue from the static test had the highest TBT concentrations, followed by *Armandia* tissue from the flow-through test.
- *Nephthys* tissue from the flow-through test had the lowest TBT concentrations.
- All differences are statistically significant.

Windward environmental LLC

There were no slides included in presentation number 15.

Puget Sound Sediment Cleanup Technology Transfer

Presented to:

SMARM

May 2004

Presented by:

Clay Patmont

ANCHOR ENVIRONMENTAL, L.L.C.

16.1

The Idea

- Summarize lessons learned from representative Puget Sound sediment cleanup projects
  - Dredging (water quality & residuals)
  - Sediment Disposal
  - Capping / Habitat Restoration
- Regional and national audience

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16.2

Joint Sponsorship?

- Sediment Management Work Group (SMWG)
  - Industry and Corps/Navy
- Cooperative Sediment Management Program (CSMP)
- EPA Contaminated Sediments Technical Advisory Group (CSTAG)

ANCHOR ENVIRONMENTAL, L.L.C.

16.3

Other Jointly Sponsored Workshops

- January 2005 (New Orleans) – 3rd International Conference on Contaminated Sediments
  - Battelle, EPA & SMWG
- October 2004 (St Louis) – Addressing Uncertainty and Managing Risk at Contaminated Sediment Sites
  - Corps / EPA / S-SW HSRC / Navy / NOAA & SMWG
- April 2003 (San Diego) - Workshop on the Stability of Chemicals in Sediments
  - Corps, Navy, EPA, USGS, NOAA HSRC & SMWG

ANCHOR ENVIRONMENTAL, L.L.C.

16.4

When?

- September 21- 22, 2004 in Seattle
- Half-Day Workshop
- Already on SMWG Calendar

ANCHOR ENVIRONMENTAL, L.L.C.

16.5

Case Histories?

- St. Paul Waterway
- Sitcum Waterway
- Eagle Harbor
- Bellingham Bay / G-P Log Pond
- Hylebos Waterway
- East Waterway
- Others?

ANCHOR ENVIRONMENTAL, L.L.C.

16.6

Sitcum Waterway, Commencement Bay

ANCHOR ENVIRONMENTAL, L.L.C.

16.7

Presentation Format?

- Joint Agency & Performing Party Presentation
- Written Abstract?
- Question and Answers
- Follow-up Site Tours (optional)
- Socializing Afterward

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16.8

Sign Up Now?

- Co-Sponsorship
- No hard dollars required
- Coordinating group?

ANCHOR ENVIRONMENTAL, L.L.C.

SAVING PROJECT CHEMISTRY COSTS BY SCREENING WITH EPA METHOD 4425

Jack W. Anderson
Battelle Marine Sciences Laboratory
Sequim, Washington

Battelle

Introduction

- Basis of the response to dioxin-like compounds (CYP1A-induction by PAHs, Coplanar PCBs, dioxins/furans)
  - Ah-receptor affinity in living human cells
  - Reporter gene (luciferase) for ease of measurement
- Purpose of this Biological Screening Assay
  - Conduct a comprehensive site investigation
  - Rapid production of findings
  - Selection of samples for confirmation
- Methodology
  - Extraction by EPA methods
  - For TEQ, cleaning of PAHs from extracts with silica gel
  - Application of 10 uL for 16 hours & measure light
  - Responses adjusted by standard curve with D/F mix
- Experience
  - Over 1300 sediment samples for NOAA on all coasts (B[a]PEq)
  - Several dioxin cleanup sites (TEQ)

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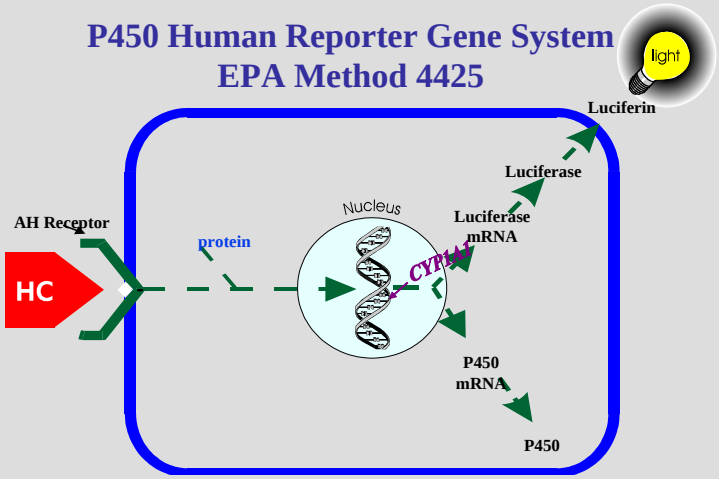
P450 Human Reporter Gene System
EPA Method 4425



Battelle

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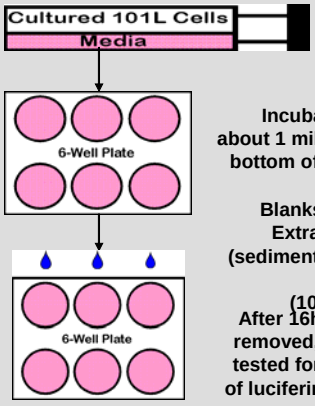
17.3

P450 HRGS (EPA 4425) Procedure



Incubate for 3 days - about 1 million cells adhere to bottom of wells, 1 cell thick

Blanks, standards and Extracts of samples (sediment, soil, tissue, water) applied (10 uL) to cells

After 16h, cells rinsed, medium removed, cells lysed, cytoplasm tested for luciferase by injection of luciferin in 96-well luminometer

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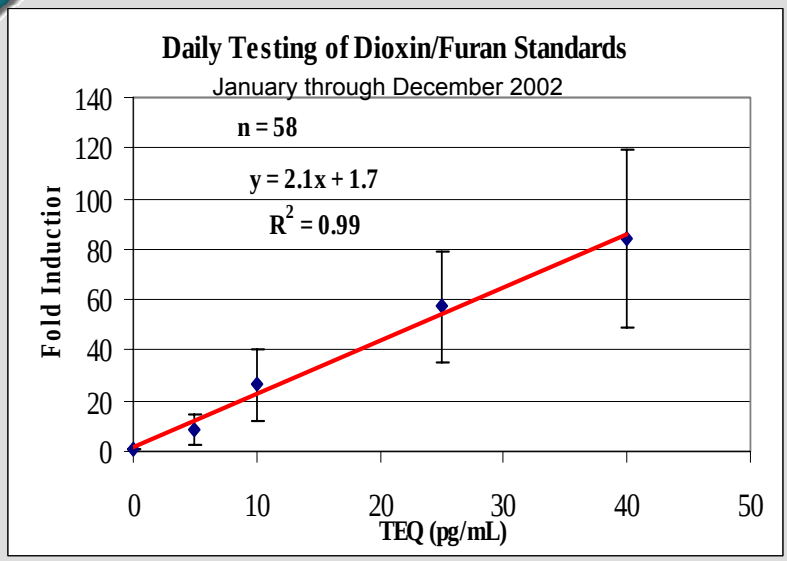
4

17.4



Battelle 5

17.5

Interpreting Results

- **Data output from the luminometer is in Relative Light Units (RLU) and the mean RLU of the samples and standards are divided by that of the solvent blank to produce fold induction values.**
- **To calculate of Benzo[a]pyrene Equivalents, a factor of 60 fold (equivalent to 1 ppm of B[a]P), the weight of the sample, the volume of extract (1 mL), and volume applied to the cells (10 µL) are used.**
- **Dioxin TEQ values (extracts cleaned with silica gel) are adjusted in each assay by the equation produced the same day from the responses to five concentrations (TEQ of 0, 5, 10, 25, 40 pg/mL) of a standard dioxin/furan mixture.**
- **The final TEQ of the sample is then calculated from factors considering the volumes used and the sample dry weight.**

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17.6

Threshold Values

- B[a]PEq threshold values (µg/g) have been developed from a very large NOAA data base.
- < 11 no effects are likely
- 11 -32 no conclusive evidence of effects
- 32 – 60 effects on the benthic species are likely
- > 60 demonstrated benthic degradation

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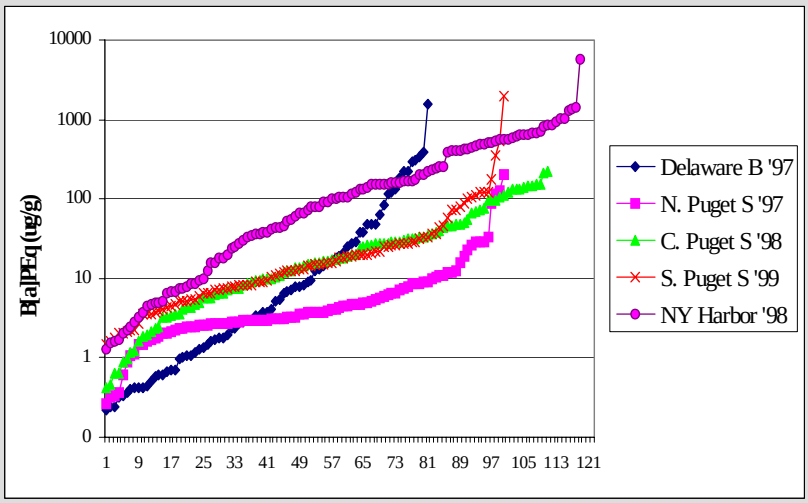
7

17.7

NOAA Studies



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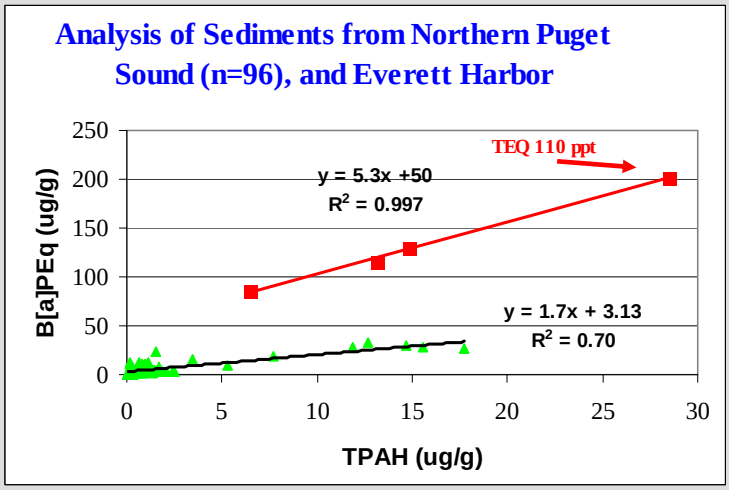
17.8



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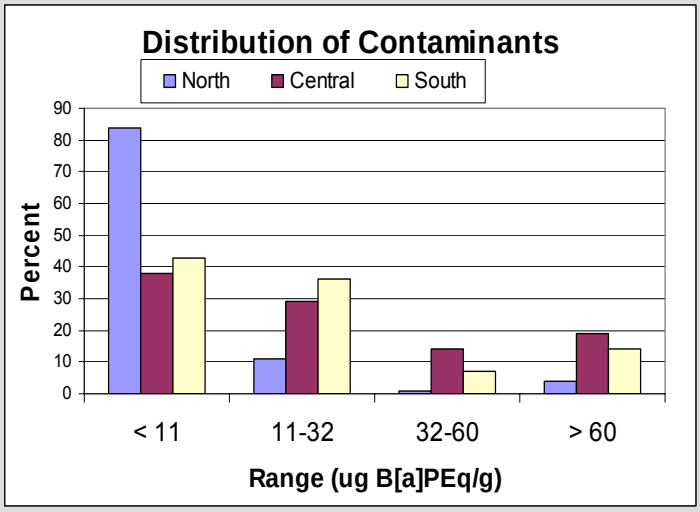
17.9



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10

17.10

Location	Year	Mean	St.Dev.	99% CI	No. of Stations > 32	No. of Stations > 60	Total Area (km2)	Survey Area % >32	Survey Area km2 >32
Delaware River & Bay	1997	57.0	190.8	23.8	18	13	2,346.8	3.43	80.5
N. Puget Sound	1997	11.1	27.3	7.0	5	4	806.2	0.04	0.3
C. Puget Sound	1998	37.5	48.3	12.5	33	19	731.7	3.20	23.7
S. Puget Sound	1999	52.8	207.7	53.5	21	14	857.7	5.00	43.1
Chesapeake '98	1998	25.9	31.0	10.1	20	7	2,265.0	27.98	633.8
Chesapeake '99	1999	8.3	11.9	3.7	4	1	3,859.4	1.36	52.7
Chesapeake '01	2001	5.1	10.9	3.2	3	1	2,201.3	0.16	3.5

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11

17.11

Relationships Between B[a]P Equivalents and Total PAHs in Sediments

Location	Stations	Factor Higher	TPAHs R_2
Winyah Bay '93	9	16	0.86
Charleston Harbor '93	20	18	0.87
San Diego Bay '94	30	16	0.71
Sabine Lake '95	65	10	0.84
Delaware River & Bay '97	81	17	0.81
N. Puget Sound '97	100	2	0.70
C. Puget Sound '98	100	8	0.73
S. Puget Sound '99	100	11	0.87
New York Harbor '98	119	24	0.87
Chesapeake '98 MD	63	17	0.62
Chesapeake '99 DC	69	8	0.68
Chesapeake '01VA	78	2	0.64

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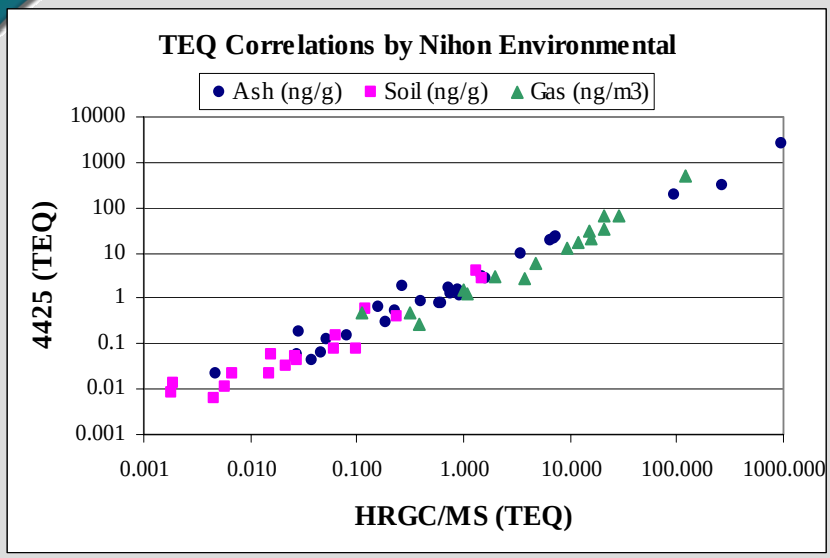
12

17.12



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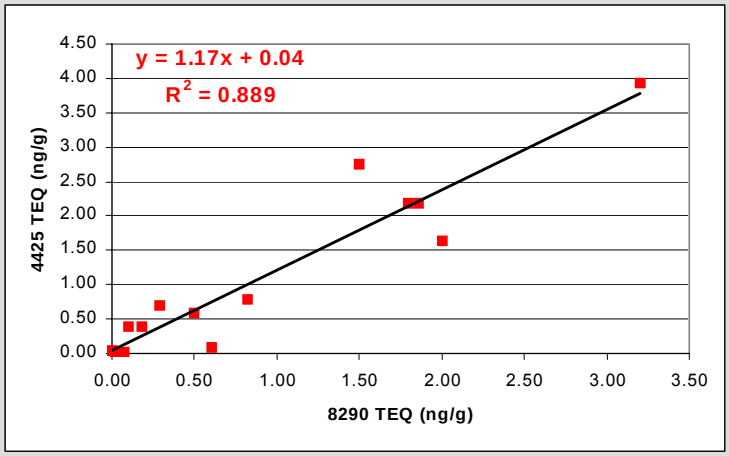
13

17.13

Correlation Between TEQs by 4425 and 8290 for Confirmation Samples

13 Comparison samples of 158 tested



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14

17.14

Recommended 4425 Screening: A Tiered Approach

- Tier I- Initial 4425 screening of all samples from a site before and after PAH removal
- Produce 4425 TEQ and B[a]PEq values on all samples
- Select samples from low, moderate, and high levels of the range for confirmation
- Tier II- Chemical analyses of PAHs and Dioxins based on the results of Tier I
- Tier III- Produce Correlation Curves
- Note samples above PAH correlation curve
- Use TEQ regression equation to produce Predicted 8290 TEQs for those analyzed, show the differences, and predict 8290 TEQs for all remaining samples from the site.

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17.15

Conclusion – B[a]PEq

- Method 4425 successfully identified sediments containing low, medium and high levels of organic contaminants, which are carcinogenic and linked to chronic toxicity
- In most cases high molecular weight PAHs are the primary contaminants identified
- The chlorinated compounds identified are potentially bioaccumulated
- Threshold levels (11, 32, 60 ug B[a]PEq/g) developed earlier appear to be verified in the recent investigations
- Benthic community parameters (indices) are the most appropriate biological measures for comparison to this biomarker

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17.16

Conclusions - Dioxins

- A screening assay can save time and a significant amount of expense
- A more comprehensive view of a site can be obtained by first screening a wide range of samples
- For TEQ confirmation by HRGC/HRMS of 10-20% of samples should be conducted
- There is little chance of false negatives, and most comparisons show 4425 TEQs 1.2-3.3 times higher

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17