

December 15 - 16, 1999

N00204.AR.001858
NAS PENSACOLA
5090.3a

LOCATION: EnSafe Office, Pensacola, Florida
TEAM LEADER: Ron Joyner
RECORDER: Gena Townsend
GATE KEEPER/TIMEKEEPER: Amy Twitty
PROCESS FACILITATOR: Anne Marie Lyddy

ATTENDEES:

TEAM MEMBERS:

Brian Caldwell
Joe Fugitt
Terry Hansen
Allison Harris
Bill Hill
Ron Joyner
Gena Townsend
Amy Twitty

SUPPORT MEMBERS:

Paul Stoddard Tier II

Adjunct Member:

Tom Dillon (NOAA)

GUESTS:

Tom Johnston (Tetra Tech)
Lynn Wellman (EPA)
Barbara Albrecht (Ensafe)

CHECK-IN

Everyone is doing okay. Ground rules were reviewed. The Team reviewed the action items and prioritized the agenda.

ACTION ITEM REVIEW

9908-A72 *Bill suggested using the Navy's database because it is complete and for consistency between the agencies. Robbie agreed that Tier II should discuss this issue.*

Open - Robbie is trying to contact Tim Bahr

9908-A73 *Robbie to discuss the three agency databases at the Tier II conference call. Each agency has their own database, and consistency should probably be applied.*

Open - Joe is currently inputting information, estimated completion date is spring of 2000.

9908-A74 *Allison and Pei are to revise the models for Site 40 by the next meeting.*

Pending 9908-A75

9908-A75 *Joe to get the University of Florida comments out on the Site 40 RI report.*

Complete

9908-A81 Review previous success stories *after Rich May has revised them. Open - Rich is still in the process of converting them. Terry will check with Rich for an update.*

9908-A89 Gena to check with Tom *on Fish Sampling. Complete*

9909-A90 Gena to have EPA Official to sign all three copies and forward to Joe. Joe in turn will have FDEP sign all three copies, retain one and send one to Gena and one to Ron. Ron will send a copy to Allison to be included in the Administrative Record. **Pending- EPA has signed and forwarded to FDEP. Eric Nuzie received it on October 13th. Complete**

9909-A91 Bill will submit *application for a new Site to NAVFAC HQ to get it listed so funding can be acquired. Bill was asked to postpone until after NORM database is completed. Estimated completion date is November 30th. Complete Nov. 12*

9909-A98 Joe to check with his Dept. *if contaminates at depth can be left in place with a NFA with no monitoring is proposed. Complete. Must be presented on a site by site basis.*

9909-A99 Bill to obtain *the services from Dean Neptune assists us in developing DQO processes on the Site 2 related agenda topics. Dean Neptune was not available, Tom Johnston will attend instead. Complete*

Reminders:

These items are understood to be works in progress and are carried forward to remind the team of their presence.

- 9903-A13: Bill will submit a letter to EPA and State requesting that OU10 be handled under RCRA authority.
- 9802-A14: Brian to follow up on the list of wells to be kept for future modeling.
- 9806-A44: Review Tier II deliverable packages (rev.9) for corrections and respond to Bill.
- 9811-M03: Bring MBTI materials to all meetings.
- 9908-AS2: Team will review ~~the~~ new success stories.
- 9908-A83: *Members will email success stories to Team. All team members to review the successes and be ready to discuss at the next meeting. It will be the responsibility of each author to send success stories in the new Tier 11 format to each member.*

Training

Ann conducted an exercise on Mind Mapping, focusing on Site 2. The exercise goal was to use your right brain to evaluate sites conditions.

Tetra Tech Update

Tank (681 & 682). investigation found no petroleum products. There is a mixed plume which contain chlorinated solvents. The solvent plume is under investigation in OU2. The tanks are abandoned and filled with sand in place.

Site 43 – This site was used as debris dump. Preliminary data show inorganics above 62-777 standards. More data to come.

Bronson - Recon. will probably result in a NFA. Data did not identify any contamination problems.

MOA

The LUCAP sites will be added to the MOA within 30 days from receipt of the signed copy from Florida.

Mercury Model

Awaiting FDEP's Comments

Tier II Update

The Navy's facilitation contract will be awarded in early January.

Florida's secondary standards – These are statues and promulgated as law. Consideration for not meeting the requirements can be evaluated on a case by case basis, (i.e. background tu the area, source never existed in the area,..)

Joint Meeting is postponed, maybe a summer date.

The facilitation reports discussing the tier I team will be presented differently at the Tier II meetings.

Pensacola Site 2 Data Quality Objectives Summary (12/15 – 12/16)

Field work is schedule to begin on Feb. 7, 2000.

Dean Neptune commented on the DQO process developed at the October meeting. Comments were discussed during the agenda topic.

Review of Comments
DQO Process (General)

Comment 1 resolution.

9912-D24 The COPCs and HQs will be added to text along with Tom's justification supporting the use of HIs.

9912-D25 Add justification for using HIs of 10 to DQO process document.

9912-D26 DQO process document will be added as appendix to sampling plan or used as a stand alone document.

HI of 10 from past data is acceptable to all parties to use for identifying areas to be investigated+

DQO Step 2.

9912-D27 Add capping to remedial actions, this can include extending the sea wall.

9912-D28 Human health documentation (justification) to be added to text+

DQO Step 3.

The assessment end point – Maintenance of a viable benthic community typical of Lower Pensacola Bay.

9972-A100: Barbara will provide paper by *Cooley* that identifies *the* benthic community of *Pensacola Bay* to use as a reference.

Efforts will be taken to locate an appropriate reference location.

9912-A101: Barbara will identify *some* reference locations within the Lower *Pensacola Bay* by obtaining info *from EPA's Gulf Breeze Lab*.

9912-D29 Add justification (language) to verify not assessing the upper trophic levels.

9912-D30 Change statement to “testing methodologies should be” instead of “testing methodologies must be”.

9912-D31 Benthic assessment will be: Mysid Shrimp – 7day chronic for growth survival and reproduction.

Leptocheirus – 10 day for survival and growth

3 individual grabs should be taken for Benthic assessment (not homogenized) from each data node.

9912-D32 Amend decision statement to add the contaminant levels that are protective.

9912-A102: Barbara will add a justification on using the 5% standard from the lab.

9912-A103: Gena will verify with EPA's sample coordinator which contaminants will be analyzed and compare that against the list that will be sent by Allison.

Action Item: Gena Townsend (with EnSafe) will define the chemical categories to list each specific chemical for which concentrations will be measured. **Complete**

Leptocheirus plumulosus and/or *Mysid* shrimp species are to be used for toxicity testing. Methodology consistent with past toxicity testing methodology will be used to maintain comparability of results with past evaluations

Action Item: Gena Townsend will return to the partnering team with a recommendation for which species to use for toxicity and biodiversity evaluations and whether to use the full toxicity test or the “simple” test. **Complete**

Action Item: Gena Townsend will return to the partnering team with a recommendation concerning growth and fecundity acceptance criteria. The recommendation will include

a recommendation for how to combine survival, growth and fecundity (e.g., equal weight on each) to establish a "+" or "-" on the "Triad Chart". The recommendation will also include a recommendation for the resolution to which the factors will be measured and reported. The resolution to which the benthic assessment parameters are measured will likely dictate the minimum number of organisms required to be included in the testing.

Complete - Tom and Lynn developed a scoring system to be included in the toxicity triad. This information was e-mailed to Barbara.

Action Item: Gena Townsend will investigate whether in-situ toxicity testing is useful. There is a concern over potential interference from outside effects such as vandalism or fishing, and the concomitant lack of control over the test and control populations if in-situ testing is used. She will report back to the partnering team with a recommendation on this issue. **Complete**

9912-D34 Include a table showing sampling methods, low screening levels and lab detection levels.

9912-A104 Allison to verify that A2 is not contributing to the site 2 contamination by reviewing the data to determine if there is a chemical connection.

DQO Step 4.

9912-D35 Add organics to all samples

9912-A105 Barbara to send map and info on reference locations to be used via e-mail.

DQO Step 5.

9912-D36 Use the Long et al 98 method to identify categories of contaminated samples at depth to identify if there is a potential problem

9912-A106 Joe to talk with McDonald to see how numbers translate to State Standards.

DQO Step 6. Establish Quantitative Tolerances for Decision Errors

There are two types of decision error – rejecting the null hypothesis when it is true; and failing to reject the null hypothesis when it is false. Establishment of the null hypothesis rests on establishing the severity of consequences for making each type of error,

Site-specific Errors and Consequences:

Walk away from a dirty site ⇒ more severe consequence.

Clean up a clean site ⇒ less severe consequence.

Establish the null hypothesis

The null hypothesis is the true state of nature that exists when the error having the more severe consequence is made. The error with the more severe consequence is to walk away from a dirty site, so the null hypothesis is that the site is dirty:

H_0 = site is dirty.

Then the alternative hypothesis is:

H_a = site is clean.

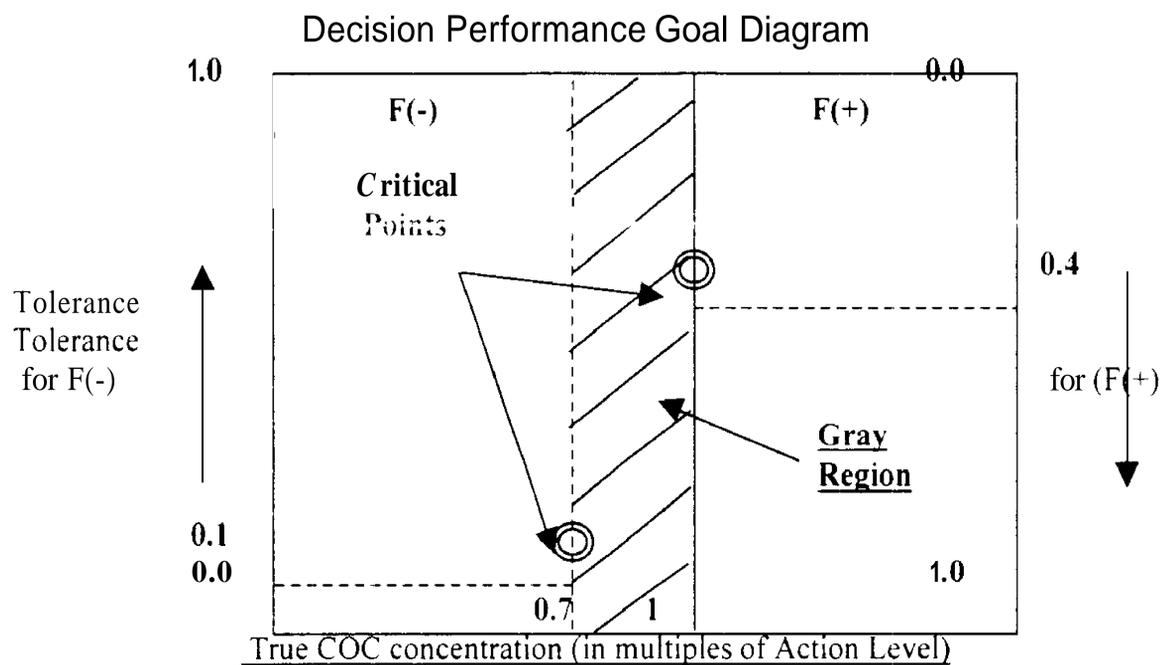
The Type I error is rejecting H_0 when it is true. Therefore, the type I error is: Walk away from a dirty site.

Then the Type II error is: Clean up a clean site.

Quantitative Tolerances for Decision Errors

True Concentration	Error Type	Tolerance
0.7* Action Level	False negative [F(-)]	0.1 (10% tolerance)
Action Level	False Positive [F(+)]	0.4 (40% tolerance)

These specifications are contrary to the proclaimed tolerances for decision errors because they indicate a greater tolerance for making the Type Two Error. Generate the performance goal diagram, anyway, to indicate this decision performance.



Insert from Tom Johnston's notes:

**Pensacola Site 2 Data Quality Objectives Summary
(SECOND DRAFT, 1/4/00)**

"DQO Step 0." Establish an Effective Planning Team

- Allison Harris (EnSafe, geologist)
- Ann Marie Lyddy (Center for Leadership Development, facilitator)
- Bill Hill (EFD South, EIC, environmental engineer)
- Brian Caldwell (EnSafe, Hydrogeologist)
- Gena Townsend (EPA Region 4, RPM, environmental engineer)
- Joe fugitt (FDEP, RPM geologist)
- Jon Williams (proxy for Amy Twitty on 10/25-27/99, CH2MHill, geologist)**
- Paul Stoddard (Tier II, EnSafe, engineer)
- Robbie Darby (Tier II liaison, EFD South, IR Branch manager, 10/25-27 99 only)
- Ron Joyner (PWCPENS, RPM)
- Terry Hansen (TtNUS, geologist)
- Tom Dillon (NOAA, Coastal Resource Coordinator)
- Barbara Albrecht (EnSafe, biologist, ecologist, toxicologist)
- Lynn Wellman (USEPA Region 4, ecological risk assessor)
- Amy Twitty (EnSafe, geologist)

Tom Johnston (TtNUS, DQO facilitator, chemist)

DQO Step 1. State the Problem

Initial Conceptual Site Model:

Untreated plating shop (Bldg. 71) liquid discharges have entered the Pensacola Bay Site 2 area through outfalls. The bay sediments along the shoreline that may have been affected by these discharges have been sampled previously on a rectangular grid oriented along the shore line. Some of the sediments within a few hundred feet of the shore have generated a hazard index (HI) greater than 10 for the benthic communities, presumably a consequence of accumulated chemicals from the discharges. Despite the observed HI values for the benthic communities, the U.S. EPA Region 4, FDEP and the Navy agree a human health risk does not exist in the Site 2 area. The HI values were computed across all chemicals of concern because such an approach simplifies the hazard assessment involving multiple samples and/or locations. The hazard quotients (HQs) are summed across all chemicals to yield an HI for comparative purposes, which could be viewed as a programmatic HI). This approach, which normalizes chemical concentrations to common consensus toxicity benchmarks, is not specifically prohibited by EPA guidance. The HI > 10 cut point was used because the chemical concentrations generally fell into two classes – one with HI < 1 and one with HI > 10, although some exceptions to this condition do exist. A reduction in the HI values > 10 is viewed as an earnest attempt at risk reduction that is protective of the environment. **Can Allison add to this, if necessary? Would the group like to identify the exceptions to the general pattern of HI < 1; HI > 10?**

Two hurricanes were experienced in the bay in the same time frame as past data collection activities, and the hurricanes were observed to have relocated some of the sediment. The relocation amounted to about a 200 ft movement to the west. **Action Item: Ron Joyner to provide substantiation for 200 ft movement?** Since the last data set was collected in 1994, a third hurricane was experienced and there is some uncertainty concerning its effect on sediments. In addition, past data collection efforts focused on the top six inches of sediment where the benthic community lives, and there is now concern about the chemical concentrations at greater depths. The top six inches of sediment is effectively viewed as a cap on deeper sediments, even though knowledge about chemical concentrations at greater depths is of interest for establishing the extent of contamination. Although some sediment transport is possible or even likely, any major transport phenomena (i.e., to depths greater than 6") are expected to be rare and do not warrant protection against at this time. If such an event should occur, the bay area will likely have other, more acute problems with which to deal. **Anybody want to take a shot at explaining this a little better? Please note the discrepancy between my time frame descriptions and the text added by Barbara and also please provide good substantiation or not for the 200 feet (does that include Hurricane Georges which sucked all of the water out of Mobile Bay?).** Others may be able to offer more input, but to clarify dates and events. Hurricanes Erin and Opal hit in 1995, and Hurricane Georges hit in Sept 1998.

Problem Statement:

It has been five years since the last data collection and a hurricane has been experienced at Pensacola during that time period. If conditions adverse to benthic communities in the Pensacola Bay Site 2 area still exist, the conditions will need to be rendered acceptable. In addition, information about chemical nature and extent is desired to support any feasibility study (FS) that might follow this investigation.

DQO Step 2. State the Decision

Primary Study Question:

Are chemicals in Pensacola Bay Site 2 sediments creating a condition adverse to benthic communities? If so, do they warrant remedial action?

Primary Potential remedial actions:

- Monitored natural attenuation (MNA)
- Dredging only
- Dredging with possible recapping of the sediments with clean sediment (this would include extending the sea wall and backfilling the landward area)
- In-situ remediation
- Cap as is (recommendation from Barbara Albrecht)

Note: Dredging to only 6' depth is not practical. However, dredging to greater than 6" with recapping with clean sediment, or simply dredging deep enough to encounter acceptable chemical concentrations would be feasible. The fluidity of the sediments will have to be considered when evaluating remedial options.

Secondary Study Questions:

1. To support any follow-on FS, what is the nature and extent of chemical concentrations in the vertical direction over the yet to be determined decision unit areas?
2. To identify concentration gradients to support the development of site-specific chemical concentrations protective of the environment, what is the relationship between chemical concentration and toxicity for each COPEC?

Alternate Potential remedial actions:

- No further action (no remediation)

Decision Statement:

Based on measured chemical concentrations, toxicity testing and benthic assessments in the Site 2 sediments as compared to established acceptance levels, determine whether remediation is required. If site conditions are acceptable, no remediation is required; if they are unacceptable, move to an FS (i.e., evaluate remedial options and implement the option that is the most cost-effective and protective of human health and the environment).

DQO Step 3. Identify Inputs to the Decision

Assumptions:

- **The assessment end point is maintaining a viable benthic community typical of the lower Pensacola Bay. ("An Inventory of the Estuarine Fauna in the Vicinity of Pensacola, Florida" by Nelson Cooley, 1978; data from 1960-1968. This was the most comprehensive study conducted in this area).**
- Upper trophic levels are not exposed in a significant way to the benthic community sediments. Bioaccumulators were not measured at unacceptable concentrations in the top 6" of sediment, thus posing no threat to upper trophic levels. Therefore, higher trophic levels are not of interest.
- Chemical/physical testing methodologies should be consistent with past testing to maintain comparability. The methodologies will be selected to support the objectives of this investigation. The selected chemical/physical test methods will exhibit detection limits and other analytical figures of merit consistent with project

needs. For example, the detection limits of chemical analysis methods will be low enough to measure chemical at concentrations at least as low as action levels.

- A minimum of three samples from each sampling area in an AOC are needed for benthic community analysis. The actual numbers of samples/organisms for benthic community assessment will be driven by the test methodology.
- In-situ toxicity testing is not practical.

Note:

The short video which was shown 16 Dec 99 during the Partnering meeting was apparently taped at Site 2, in the immediate area within which this group is concerned. The video showed a silty bottom devoid of any flora or habitat. Pock marks and fecal matter dotted the area, indicating burrowing organisms. The area is affected by tidal influence as was evident when the diver disturbed the bottom and the current carried away the disturbed water column rather quickly. The diver handled the bottom in several areas in which clay and silt were evident components but sand dominated, as was clear when it was observed falling through the water column (despite the current) to the seafloor.

At one location, the diver handled a darker sediment which may have contained less sand, and more organic matter (difficult to ascertain from video). Although the viewer has no way of orienting the divers' position to the specific sites in question, by looking at the data, I suspect a small eddy (current) has developed in the area of F3 and H3 which has concentrated organic matter. Site F3 and H3 resulted in 49% mortality in the exposed Mysid sediment toxicity test.

The lack of flora (seagrasses) and habitat (whole or fragmented shells) are indications that this area may not support a "grand" diversity composed of crustaceans (i.e., shrimp, crabs, amphipods, etc.) or bivalves (oysters) and snails. This being the case, a reference station similar in composition may be a bit more difficult to locate. **Action Item: Ron Joyner to determine when video was filmed relative to hurricane George?**

Acceptance Criteria:

Refer to Attachments 4 and 5.

Leptocheirus plumulosus will be used for toxicity evaluations; *Mysid* shrimp will be used for toxicity, fecundity and growth evaluations/endpoints. Methodology consistent with past toxicity testing methodology will be used to maintain comparisons of results with past evaluations. The 10-day toxicity test will be used on *Leptocheirus plumulosus* and the 7-day toxicity test will be used on the shrimp, *Mysidopsis bahia*.

Toxicity Testing Inputs: Refer to Attachments 4 and 5; see toxicity acceptance criteria.

Action Item: Tom Dillon will return to the partnering team with a recommendation concerning growth and fecundity acceptance criteria. The recommendation will include a recommendation for how to combine survival, growth and fecundity (e.g., equal weight on each) to establish a "+" or "-" on the "Triad Chart". Alternatively, the triad chart will be expanded to accommodate the additional information. The recommendation will also include a recommendation for the resolution to which the factors will be measured and reported. The resolution to which the benthic assessment parameters are measured will likely dictate the minimum number of organisms required to be included in the testing. *Tom, I've got the triad chart, and will send that to you as an attachment so you can place it within the document.*

Chemistry *Inputs* (**Action Item: Allison to provide method lists**, where needed):

- Acid Volatile sulfides
Simultaneously extracted metals
Total metals (hot HNO₃/HCl leach)
Herbicides
- Organochlorine Pesticides
- SVOCS
- Sediment chemistry Quality criteria: defined in the SQAGs and EPA's action levels (SSVs)
- TOC
- inorganic and organic tin
- Grain size

Biology *Inputs*:

- Toxicity (pH, NH₃, salinity, etc. to be controlled as per the test methodology)
- Fecundity
- Growth
- Biodiversity

Important *information* concerning the purpose of toxicity testing and toxicity testing parameter *specifications* is provided in Attachment 4.

DQO Step 4. Establish Decision Unit Boundaries

Assumptions:

- Habitats span only the top 6" in sediment (that's where the benthic communities are). Thus, contaminants in this region exhibit a pathway to benthic communities.
- Acceptable sediment chemistry in the top 6" would effectively constitute a cap on the deeper sediments.
- Based on calculations of sedimentation rates, 36" provides a 50% margin of error in sediment depth estimates and appears to be a reasonable maximum depth to which chemical concentrations should be measured. This depth coincides with the length of a core sample tube. Any chemicals deeper than 36" in sediment are not likely to generate unacceptable environmental risks because they are much deeper than the typical benthic communities. Even dredging to remove any chemicals is not likely to expose sediments at depths of ≥ 36 " to the benthic communities.
- Site A2 (east of Site 2) is not part of this problem. The bottom of Site A2 is rocky and significant sediment migration from site A2 to Site 2 is not likely. Furthermore, mortality rates at Site A2 (*to mysids*) were approximately 20% and any sediment causing this level of mortality would be reduced significantly in lethality via dilution associated with migration. **Action Item: Allison will investigate this assertion by reviewing chemical markers that would suggest a transport link between the two sites,** Other monitoring is expected to be useful for evaluating this effect.
- Depths greater than 6" will be used to evaluate sedimentation rates and potential remedial actions, and will be useful for the FS, but they are not directly related to establishing a problem condition at Site 2.

Areas of primary interest within the *Site 2* region (based on past toxicity data):

- those where HI in top 6" of sediment is > 10
- those where HI top 6" of sediment is ≤ 10

Each area with HI >10 is a circle with diameter = 50'. The diameter criterion was established based on the 100' grid used in past data collection (50' is half of a grid spacing).

There are five areas with HI >10 at grid nodes F3, G2, H1, H3, I0. Based on these boundaries, the chemistry inputs are divided as follow:

Outside the five areas with HI > 10

Top 6" of sediment:

- TAL metals
- Cyanide
- Inorganic tin
- Organic tin
- Grain size
- TOC
- AVS
- SEM
- Herbicides
- Organochlorine Pesticides
- SVOCs
- Toxicity
- Biodiversity
- Fecundity
- Growth
- Sediment depths >6"
 - TAL metals
 - Cyanide
 - Inorganic tin
 - Organic tin
 - Grain size
 - Toxicity
 - Herbicides
 - Organochlorine Pesticides
 - SVOCs

• Inside the five areas with HI > 10

• Top 6" of Sediment:

- TAL metals
- Cyanide
- Inorganic Sn
- Organic Sn
- Herbicides
- Organochlorine Pesticides
- SVOCs
- TOC
- AVS
- SEM
- Grain Size

• Sediment depths >6"

- TAL metals
- Cyanide

- Inorganic Sn
- Organic Sn
- Herbicides
- Organochlorine Pesticides
- SVOCS
- Grain Size

Toxicity testing and benthic assessment will be performed for the five areas with HI > 10. These are the areas of concern. The reference area will be located based on sand, silt and clay composition. There is also currently some question about the shape and size of areas of concern.

Action Item: Barbara will lead a reference area selection discussion with the appropriate team members and will report back to the team by Jan. 7, 2000. The goal will be to identify at least one area with sediment similar to the test area sediments that have not been impacted by Navy operations. The organisms need not be the same in the reference and test areas, but if they are different, different tolerances of the different organisms to chemical impacts would have to be weighed. Barbara has had contact with EPA (and copied T. Dillon, L. Wellman, and A. Harris) who have indicated that the data request must come from EPA or a sister agency otherwise they will charge us and require a FOIA. My contact at EPA has already gathered the info but has to go thru the proper channels to avoid problems down the road.

DQO Step 5. State the Decision Rule

See flow chart. Mean COC concentrations ([COC]), toxicity and benthic assessments identified as "Condition x" in the flow chart refer to conditions within the top 6" of sediment in an AOC (and in the reference area, as appropriate). Five AOCs (50' circles centered on previously established grid nodes F3, G2, H1, H3, I0), will be sampled and the decisions will be made about these five areas. At least one reference area (also a circle with a 50' radius?) will be sampled as a benchmark against which to evaluate AOC conditions. AOCs and reference areas that will be compared for decision making will exhibit similar physical characteristics that validate their comparability. All other grid nodes were determined not to pose unacceptable risks to benthic communities or higher trophic levels. Chemistry data will be needed at depths greater than 6" for evaluating remedial options during the FS. Note: Barbara recommends three reference stations based on sand characterizations but would like to get agreement on this from Tom and Lynn. Tom, I'd like to talk to T. Dillon and L. Wellman about how they would like to see these sediment types grouped...I suspect 2-3 different reference sites will suffice...and by laying the scenario out in the DQO fashion, all bases should be covered.

Decision making will be staged. The first test to perform is an evaluation of chemistry in the top 6" of sediment. If surface chemistry is acceptable, an evaluation of deeper sediments will be conducted, with a possibility of NFA if chemistry to depth is acceptable. If chemistry is unacceptable in either the surface or at greater depths, additional evaluations will ensue. If surface chemistry is acceptable but the subsurface chemistry is unacceptable, the need for an FS will be evaluated by summarizing the data according to Long et al. and comparing to the four Long et al. Categories (Action Item: need reference). If the surface chemistry is unacceptable, the benthic assessment and toxicity will be evaluated according to the decision matrices below with incorporation of sub-evaluations of fecundity, etc.

Decision Making Triads

Decision making will proceed based on the triads or assessment results presented in the matrices below. First, biological decision making triads will be used to assess biological test results. These will be fed into the Project Decision Making Triad to establish decisions at the project level.

Assumptions:

- Conduct 10-day *Leptocheirus* bioassay (survival and growth endpoints) as well as the 7-day *Mysidopsis* bioassay (survival, growth, and reproduction endpoints).
- The two bioassays will be evaluated independently and results treated with equal weight.

“Hits” and “Adverse effects” (terms used below) mean statistically different using methods accompanying each test protocol. “OK” = results were not statistically significant.

For weighting purposes, “Hits” on survival are considered twice as important as “Hits” on reproduction or growth because survival (i.e., mortality) is irreversible whereas reproduction and growth endpoints are potentially reversible; 2 sublethal hits = 1 lethal hit.

After the bioassays are considered individually, their results will be combined for input to the triad matrix assuming additivity of cumulative adverse effects.

The triad matrix will be revised to accommodate multiple +’s and -’s within each box to reflect the continuum of chemistry, toxicity, and benthic community response one normally encounters. The “interpretation” description currently in the triad matrix will remain unchanged. The multiple +’s will better reflect the strength one should associate with that interpretation.

Possible Outcomes from the *Leptocheirus* Test:

Survival	Growth	Scoring
OK	OK	
OK	Hit	+
Hit	OK	++
Hit	Hit	+++

Possible Outcomes from the *Mysidopsis* Test:

Survival	Growth	Reproduction	Scoring
OK	OK	OK	-
OK	OK	Hit	+
OK	Hit	Hit	++
Hit	OK	OK	++
Hit	OK	Hit	+++
Hit	Hit	OK	+++
Hit	Hit	Hit	++++

Biological Decision Making Triad

Integrate results from each test by combining scores in an additive fashion,

Combined Score	Biological Interpretation Considering both Bioassays	Input to Triad Matrix		
+	No adverse effects	-	=	-
	No survival hits in either species. 1 sublethal hit in one species.	-	=	-
++	1 survival hit in one species or 2 sublethal hits.	+	=	+
+++	1 survival hit in one species and/or adverse sublethal effects.	+	=	+
++++	Survival hits in 1-2 species and/or adverse sublethal endpoints,	++	=	+
+t++++	Survival hits in 1-2 species and/or adverse sublethal effects.	++	=	+
+t+++++	Survival hits in both test species and adverse sublethal endpoints.	+++	=	+
++++++	Survival hits in both test species and adverse sublethal endpoints.	+++	=	+

The 4 above possible inputs to the Toxicity column in the triad matrix would correspond very nicely to 4 columns in the Chemistry column if we adopt Long's 4 categories for classifying sediments per chemistry; i.e.,

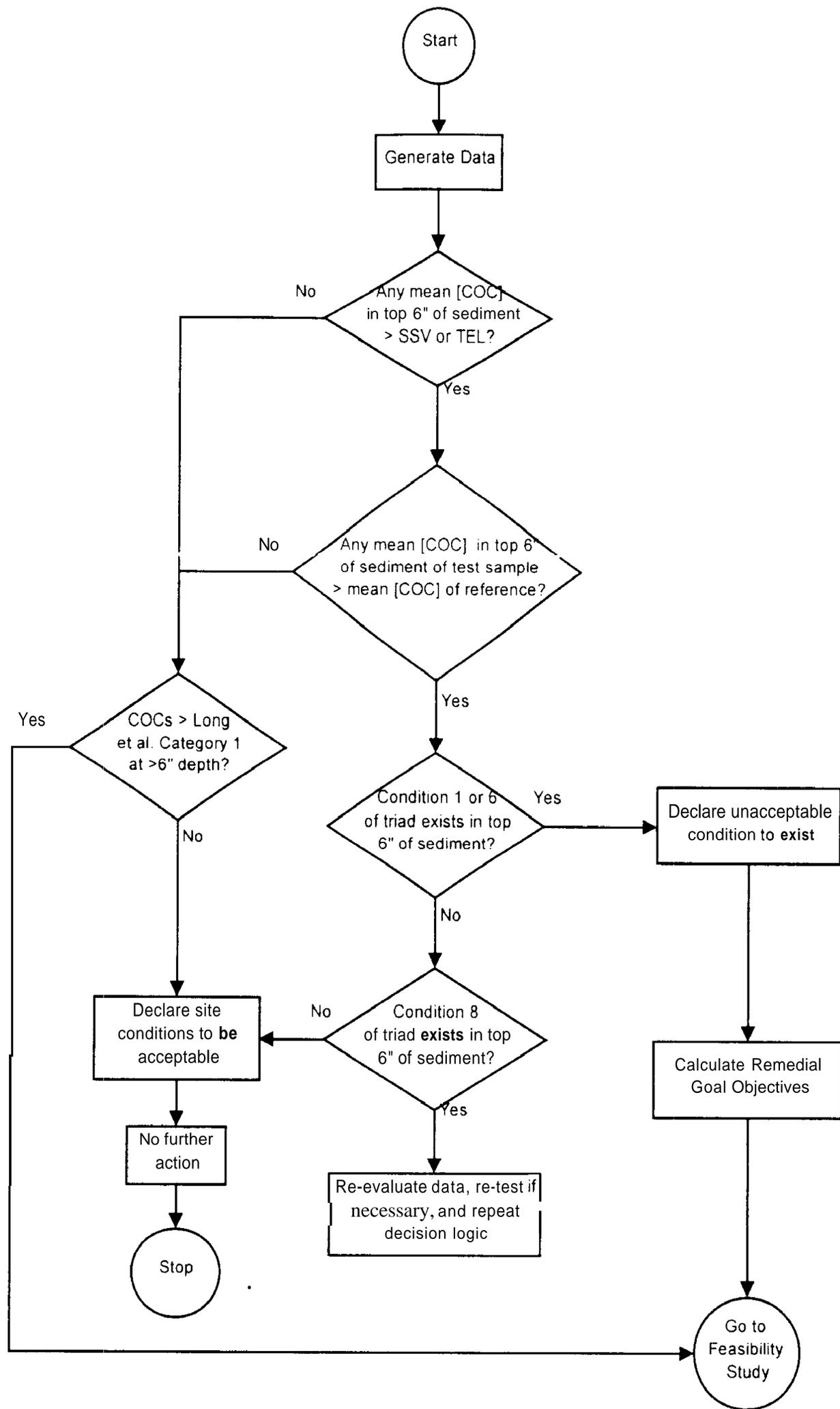
- Category 1 No toxicity
- Category 2 Toxicity possible
- Category 3 Toxicity likely
- Category 4 Toxicity highly certain

Project Decision Making Triad Matrix

Condition	Sediment Chemistry	Toxicity Tests	Benthic Assessment	Interpretation
1	t	+	+	Strong evidence for pollution-induced degradation.
2	-	-	-	Strong evidence for absence of pollution-induced degradation.
3	+	-	-	Contaminants are not bioavailable.
4	-	+	-	Unmeasured contaminants or conditions exist that have the potential to cause degradation.
5	-	-	+	Alteration of benthic community is probably not due to toxic chemical contamination.
6	+	+	-	Toxic chemicals are probably stressing the system.
7	-	+	+	Unmeasured toxic chemicals are causing degradation.
8	+	-	+	Benthic community degraded by toxic chemicals but toxicity tests not sensitive to toxic chemicals present or chemicals are not bioavailable or alteration is not due to toxic chemicals.

+ = Measured difference between test and control or reference conditions.

- = No measurable difference between test and control or reference conditions.



DQO Step 6. Establish Quantitative Tolerances for Decision Errors

There are two types of decision error – rejecting the null hypothesis when it is true: and failing to reject the null hypothesis when it is false. Establishment of the null hypothesis rests on establishing the severity of consequences for making each type of error.

Site-specific Errors and Consequences:

Walk away from a dirty site ⇒ more severe consequence.

Clean up a clean site ⇒ less severe consequence.

Establish the null hypothesis

The null hypothesis is the true state of nature that exists when the error having the more severe consequence is made. The error with the more severe consequence is to walk away from a dirty site, so the null hypothesis is that the site is dirty:

$H_0 = \text{site is dirty.}$

Then the alternative hypothesis is:

$H_a = \text{site is clean.}$

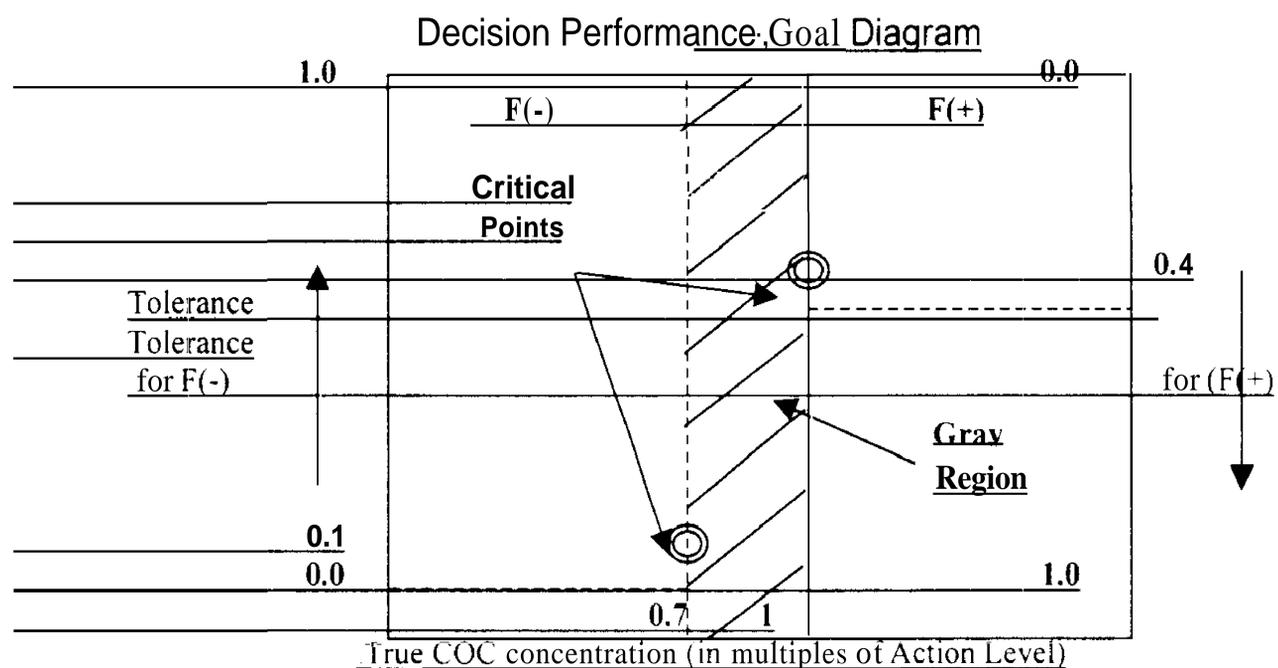
The Type I error is rejecting H_0 when it is true. Therefore, the type I error is: Walk away from a dirty site.

Then the Type II error is: Clean up a clean site.

Quantitative Tolerances for Decision Errors

<u>True Concentration</u>	<u>Error Type</u>	<u>Tolerance</u>
<u>0.7* Action Level</u>	<u>False negative [F(-)]</u>	<u>0.1 (10% tolerance)</u>
<u>Action Level</u>	<u>False Positive [F(+)]</u>	<u>0.4 140% tolerance)</u>

These specifications are contrary to the proclaimed tolerances for decision errors because they indicate a greater tolerance for making the Type II Error. Generate the performance goal diagram, anyway, to indicate this decision performance.



Based on the above specifications, the following numbers of samples were computed:

DQO Specifications:

	<u>Case 1</u>	<u>Case 2</u>
<u>H₀</u>	<u>Site is Dirty</u>	<u>Site is Clean</u>
<u>H_a</u>	<u>Site is Clean</u>	<u>Site is Dirty</u>
<u>Action Level</u>	<u>SSV</u>	<u>SSV</u>
<u>Gray Region Boundary</u>	<u>0.7SSV</u>	<u>(1/0.7)SSV</u>
<u>Probability of F(+)</u>	<u>0.4 (walk away from dirty site)</u>	<u>0.1 (clean up clean site)</u>
<u>Probability of F(-)</u>	<u>0.1 (clean up clean site)</u>	<u>0.4 (walk away from dirty site)</u>

Numbers of Samples

<u>Metal</u>	<u>Standard Dev.</u>	<u>Screening Value</u>	<u>Case 1</u>		<u>Case 2</u>	
			<u>(Assume site is dirty)</u>	<u>(Assume site is clean)</u>	<u>Gray Region</u>	<u>No. Samples</u>
<u>Arsenic</u>	<u>8.35</u>	<u>7.24</u>	<u>5.1</u>	<u>36</u>	<u>10.5</u>	<u>17</u>
<u>Cadmium</u>	<u>---</u>	<u>0.68</u>	<u>0.48</u>	<u>>1000</u>	<u>1</u>	<u>>1000</u>
<u>Chromium</u>	<u>68.1</u>	<u>52.3</u>	<u>36.6</u>	<u>45</u>	<u>75</u>	<u>22</u>
<u>Zinc</u>	<u>50.3</u>	<u>124</u>	<u>86.8</u>	<u>6</u>	<u>180</u>	<u>4</u>

These calculations assume normally distributed data, independent samples, and random sample collection. We do not expect the data to be normally distributed, and the standard deviations used in the calculations are only estimates based on approximately nine samples. The actual variances are likely to be greater than those used in these computations, which would cause the number of samples to increase for each metal.

Now, exchange the error tolerances to be consistent with the desire to have a greater probability of cleaning up a clean site than of walking away from a dirty site.

DQO Specifications:

	<u>Case 1</u>	<u>Case 2</u>
<u>H₀</u>	<u>Site is Dirty</u>	<u>Site is Clean</u>
<u>H_a</u>	<u>Site is Clean</u>	<u>Site is Dirty</u>
<u>Action Level</u>	<u>SSV</u>	<u>SSV</u>
<u>Gray Region Boundary</u>	<u>0.7SSV</u>	<u>(1/0.7)SSV</u>

Probability of F(+)	0.1 (walk away from dirty site)	0.4 (clean up clean site)
Probability of F(-)	0.4 (clean up clean site)	0.1 (walk away from dirty site)

Numbers of Samples

Metal	Standard Dev.	Screening Value	Case 1 (Assume site is dirty)		Case 2 (Assume site is clean)	
			Gray Region	No. Samples	Gray Region	No. Samples
Arsenic	8.35	7.24	5.1	36	10.5	16
Cadmium	7.67	0.68	0.48	>1000	1	>1000
Chromium	68.1	52.3	36.6	46	75	22
Zinc	59.3	124	86.8	6	180	3

Still, the numbers of samples required is greater than can be afforded. So, compute the numbers of samples required when the tolerance for both decision error types is equal and more liberal (i.e., 45%):

DQO Specifications:

	Case 1	Case 2
H₀	Site is Dirty	Site is Clean
H_a	Site is Clean	Site is Dirty
Action Level	SSV	SSV
Gray Region Boundary	0.7SSV	(/0.7)SSV
Probability of F(+)	0.45 (walk away from dirty site)	0.45 (clean up clean site)
Probability of F(-)	0.45 (clean up clean site)	0.45 (walk away from dirty site)

Numbers of Samples

Metal	Standard Dev.	Screening Value	Case 1 (Assume site is dirty)		Case 2 (Assume site is clean)	
			Gray Region	No. Samples	Gray Region	No. Samples
Arsenic	8.35	7.24	5.1	2	10.5	2
Cadmium	7.67	0.68	0.48	93	1	37

Chromium	68.1	52.3	36.6	2	75	2
Zinc	59.3	124	86.8	2	180	2

Still, in the case of cadmium, the number of samples is prohibitively large. That's because the smallest detectable difference is small relative to the standard deviation of the data.

If only the areas with HI>10 are used in the calculations, the standard deviations generally increase and the means and action levels become a little more different. These factors offset each other and the required numbers of samples using these new means and standard deviations with the 45% tolerance for F(+) and F(-) above are: As= 2, Cd = 201, Cr = 3, and Zn = 2. Using the same factors with an error tolerance of F(+) - F(-) =35% yields: As= 10, Cd = 872, Cr = 21, and Zn = 2.

In the above calculations the number of samples required is computed using the difference between the gray region boundary and the action level as the minimum detectable concentration difference. This causes the number of samples required to achieve the specified decision performance to be limited by cadmium.

If the actual mean concentration, computed from the 1997 Site 2 data is used for each analyte, the situation changes because the mean cadmium concentration is significantly greater than the computed gray region boundary. Using these mean concentrations, we can ask the question, "What statistical power is achieved if we wish to detect a difference between the observed mean analyte concentration and the action level?" To determine this, the problem is reversed to yield the probability of making a F(-) error when we specify a given number of samples (n) and fixed values of mean concentration (mean), standard deviation (std. dev.), Screening Value, and the Probability of false positive error, F(+). The results of these calculations are shown in the tables below.

Probability of F(-) with $n = 3$.

<u>Metal (mean)</u>	<u>Std Dev.</u>	<u>Screening Value</u>	<u>Mean Concentration</u>	<u>Δx</u>	<u>n</u>	<u>Prob. of F(+)†</u>	<u>Prob. of F(-)‡</u>
Arsenic	8.37	7.24	9.98	2.74	3	50%	29%
						35%	51%
						20%	UD
Cadmium	8.10	0.68	4.1 ■	3.43	3	50%	23%
						35%	42%
						20%	69%
Chromium	70.7	52.3	58.9	6.6	3	50%	44%
						35%	UD
						20%	UD
Zinc	59.6	124	68.1	55.9	3	50%	5.2%
						35%	■ 19%
						20%	25.9%

* UD= undefined

Probability of F(-) with $n = 9$.

<u>Metal (mean)</u>	<u>Std Dev.</u>	<u>Screening Value</u>	<u>Mean Concentration</u>	<u>Δx</u>	<u>n</u>	<u>Prob. of F(+)</u>	<u>Prob. of F(-)</u>
Arsenic	8.37	7.24	9.98	2.74	9	50%	16%
						35%	31%
						20%	54
Cadmium	8.10	0.68	4.11	3.43	9	50%	10%
						35%	21%
						20%	40%
Chromium	70.7	52.3	58.9	6.6	9	50%	39%
						35%	UD
						20%	UD
Zinc	59.6	124	68.1	55.9	9	50%	0.2%
						35%	0.8%
						20%	2.9%

* UD= undefined

Probability of F(-) with $n = 15$.

<u>Metal (mean)</u>	<u>Std Dev.</u>	<u>Screening Value</u>	<u>Mean Concentration</u>	<u>Δx</u>	<u>n</u>	<u>Prob. of F(+)</u>	<u>Prob. of F(-)</u>
Arsenic	8.37	7.24	9.98	2.74	15	50%	10%
						35%	21%
						20%	40%
Cadmium	8.10	0.68	4.11	3.43	15	50%	5.0%
						35%	12%
						20%	25%
Chromium	70.7	52.3	58.9	6.6	15	50%	36%
						35%	UD
						20%	UD
Zinc	59.6	124	68.1	55.9	15	50%	0.0%
						35%	0.1%
						20%	0.3%

UD= undefined

Conclusion:

Using the above information, it appears that about 15 samples should provide acceptable statistical power for decision making (false positive and negative rates near 35% or better). Chromium stands out as an exception, however, a review of chromium data reveals that a single concentration of 220 ppm is contributing to this exception. Removing that single value from the data set renders the decision performance between that for cadmium and zinc, a significant improvement. This conclusion is caveated because analyte distributions are likely not Gaussian and the statistical calculations assume Gaussian distributions. It also assumes that sediments are relatively that concentration hot spots may move and be redistributed over time. Therefore, standard deviations observed for past data could be considerably different than current standard deviations, so it does not pay to invest much more time into power calculations.

Attachment 1. TAL Metals Plus Cyanide Analyte List

ANALYTE	CAS No.	CRQL, WATER (ug/L)
Aluminum	7429-90-5	200
Antimony	7440-36-0	60
Arsenic	7440-38-2	10
Barium	7440-39-3	200
Beryllium	7440-41-7	5
Cadmium	7440-43-9	5
Calcium	7440-70-2	5000
Chromium	7440-47-3	10
Cobalt	7440-48-4	50
Copper	7440-50-8	25
Iron	7439-89-6	100
Lead	7439-92-1	3
Magnesium	7439-95-4	5000
Manganese	7439-96-5	15
Mercury	7439-97-6	0.2
Nickel	7440-02-0	40
Potassium	7440-09-7	5000
Selenium	7782-49-2	5
Silver	7440-22-4	10
Sodium	7440-23-5	5000
Thallium	7440-28-0	10
Vanadium	7440-62-2	50
Zinc	7440-66-6	20
Cyanide	57-12-5	10

Attachment 2. SVOC Analyte List (EPA CLP OLM 3.2)

COMPOUND	CAS No.	Water, (ug/L)	Soil, (ug/kg)	Med. Soil, ug/kg	On Column (ng)
1,2,4-Trichlorobenzene	120-82-1	10	330	10000	(20)
1,2-Dichlorobenzene	95-50-1	10	330	10000	(20)
1,3-Dichlorobenzene	541-73-1	10	330	10000	(20)
1,4-Dichlorobenzene	106-46-7	10	330	10000	(20)
2,2'-oxybis(1-Chloropropane)	108-60-1	10	330	10000	(20)
2,4,5-Trichlorophenol	95-95-4	25	830	25000	(50)
2,4,6-Trichlorophenol	88-06-2	10	330	10000	(20)
2,4-Dichlorophenol	120-83-2	10	330	10000	(20)
2,4-Dimethylphenol	105-67-9	10	330	10000	(20)
2,4-Dinitrophenol	51-28-5	25	830	25000	(50)
2,4-Dinitrotoluene	121-14-2	10	330	10000	(20)
2,6-Dinitrotoluene	606-20-2	10	330	10000	(20)
2-Chloronaphthalene	91-58-7	10	330	10000	(20)
3-Chlorophenol	95-57-8	10	330	10000	(20)
2-Methylnaphthalene	91-57-6	10	330	10000	(20)
2-Methylphenol	95-48-7	10	330	10000	(20)
2-Nitroaniline	88-74-4	25	830	25000	(50)
2-Nitrophenol	88-75-5	10	330	10000	(20)
3,3'-Dichlorobenzidine	91-94-1	10	330	10000	(20)
3-Nitroaniline	99-09-2	25	830	25000	(50)
4,6-Dinitro-2-methylphenol	534-52-1	25	830	25000	(50)
4-Bromophenyl-phenyl ether	101-55-3	10	330	10000	(20)
4-Chloro-3-methylphenol	59-50-7	10	330	10000	(20)
4-Chloroaniline	106-47-8	10	330	10000	(20)
4-Chlorophenyl-phenyl ether	7005-72-3	10	330	10000	(20)
4-Methylphenol	106-44-5	10	330	10000	(20)
4-Nitroaniline	100-01-6	25	830	25000	(50)
4-Nitrophenol	100-02-7	25	830	25000	(50)
Acenaphthene	83-32-9	10	330	10000	(20)
Acenaphthylene	208-96-8	10	330	10000	(20)
Anthracene	120-12-7	10	330	10000	(20)
Benzo(a)anthracene	56-55-3	10	330	10000	(20)
Benzo(a)pyrene	50-32-8	10	330	10000	(20)
Benzo(b)fluoranthene	205-99-2	10	330	10000	(20)
Benzo(g,h,i)perylene	191-24-2	10	330	10000	(20)
Benzo(k)fluoranthene	207-08-9	10	330	10000	(20)
bis(2-Chloroethoxy) methane	111-91-1	10	330	10000	(20)
bis(2-Chloroethyl) ether	111-44-4	10	330	10000	(20)
bis-(2-Ethylhexyl)phthalate	117-81-7	10	330	10000	(20)
Butylbenzylphthalate	85-68-7	10	330	10000	(20)
Carbazole	86-74-8	10	330	10000	(20)
Chrysene	218-01-9	10	330	10000	(20)
Dibenz(a,h)anthracene	53-70-3	10	330	10000	(20)
Dibenzofuran	132-64-9	10	330	10000	(20)
Diethylphthalate	84-66-2	10	330	10000	(20)
Dimethylphthalate	131-11-3	10	330	10000	(20)
Di-n-butylphthalate	84-74-2	10	330	10000	(20)

Di-n-octylphthalate	117-84-0	10	330	10000	(20)
Fluoranthene	206-44-0	10	330	10000	(20)
Fluorene	86-73-7	10	330	10000	(20)
Hexachlorobenzene	118-74-1	10	330	10000	(20)
Hexachlorobutadiene	87-68-3	10	330	10000	(20)
Hexachlorocyclopentadiene	77-47-4	10	330	10000	(20)
Hexachloroethane	67-72-1	10	330	10000	(20)
Indeno(1,2,3-cd)pyrene	193-39-5	10	330	10000	(20)
Isophorone	78-59-1	10	330	10000	(20)
Naphthalene	91-20-3	10	330	10000	(20)
Nitrobenzene	98-95-3	10	330	10000	(20)
N-Nitroso-di-n-propylamine	62I-64-7	10	330	10000	(20)
N-Nitrosodiphenylamine	86-30-6	10	330	10000	(20)
Pentachlorophenol	87-86-5	25	830	25000	(50)
Phenanthrene	85-01-8	10	330	10000	(20)
Phenol	108-95-2	10	330	10000	(20)
Pyrene	129-00-0	10	330	10000	(20)

Attachment 3. Organochlorine Pesticide Analyte List

COMPOUND	CAS No.	Water, (ug/L)	Soil, (ug/kg)	On Column, (pg)
4,4'-DDD	72-54-8	0.1	3.3	10
4,4'-DDE	72-55-9	0.1	3.3	10
4,4'-DDT	50-29-3	0.1	3.3	10
Aldrin	309-00-2	0.05	1.7	5
alpha-BHC	319-84-6	0.05	1.7	5
alpha-Chlordane	5103-71-9	0.05	1.7	5
beta-BHC	319-85-7	0.05	1.7	5
delta-BHC	319-86-8	0.05	1.7	5
Dieldrin	60-57-1	0.1	3.3	10
Endosulfan I	959-98-8	0.05	1.7	5
Endosulfan II	33213-65-9	0.1	3.3	10
Endosulfan sulfate	1031-07-8	0.1	3.3	10
Endrin	72-20-8	0.1	3.3	10
Endrin aldehyde	7421-93-4	0.1	3.3	10
Endrin ketone	53494-70-5	0.1	3.3	10
gamma-BHC (Lindane)	58-89-9	0.05	1.7	5
gamma-Chlordane	5103-74-2	0.05	1.7	5
Heptachlor	76-44-8	0.05	1.7	5
Heptachlor epoxide	1024-57-3	0.05	1.7	5
Methoxychlor	72-43-5	0.5	17	50
Toxaphene	8001-35-2	5	170	500

Attachment 4. Toxicity Testing Background and Specifications

Toxicity tests are designed to determine whether toxic chemicals are present in toxic amounts. Toxicity tests are not designed to be quantitative predictors of ecosystem responses - though many studies have demonstrated significant associations between toxicity test results and ecosystem impacts.

V. deVlaming and T. Norberg-King (draft) identified 10 studies from the literature in which marine sediment toxicity tests were compared to ecological effects on marine benthos. In all ten of these studies, laboratory sediment tests were reliable qualitative predictors of benthic community effects, although the laboratory tests tended to underestimate the extent of the benthic community impacts.

Each toxicity test is designed with test acceptability criteria (TAC), which determine the validity and acceptability of the test based on control survival and other test endpoints. In addition to control criteria, a toxicity test may set limits on minimum growth requirements in weight or length, reproduction, fertilization, etc.

Another acceptance criterion is based on the performance of a specific batch of animals. Stressed organisms will not be suitable predictors of what is actually occurring within a toxicity test, so to insure that the population of organisms is sensitive (but not stressed) to toxicants reference toxicant tests are performed.

Reference toxicant tests are multi-dilution tests with a known chemical that gauges the sensitivity of a pool of organisms. Reference toxicant tests are set up prior to the test or concurrent with the compliance test and utilize organisms from the same brood (when cultured in-house) or same batch when organisms are purchased. The reference toxicant is tested using the same concentrations from test to test under the same conditions (i.e., the same test duration, type of dilution water, age of test organisms, and feeding regime) and the same statistical analysis as the effluent test.

Reference toxicant tests indicate the relative sensitivity of the test organisms being used and demonstrate a laboratory's ability to obtain consistent test results with the test method. It is the laboratory's responsibility to demonstrate its ability to obtain consistent, precise results with reference toxicants before the laboratory performs toxicity tests with effluents for permit compliance purposes. Reference toxicants should be verified analytically and stock solutions should be replaced when concentrations show signs of degradation.

The frequency of reference toxicant testing depends on whether the organisms are cultured in-house or obtained from an outside source. If the laboratory obtains the test organisms from an outside source, the reference toxicant test must be conducted concurrently with the effluent test. If the laboratory facility maintains in-house cultures, a reference toxicant test must be conducted at least once a month. It is preferred that this reference toxicant test be performed concurrently with an effluent toxicity test.

Toxicity test conditions are outlined in Tables 1 and 2 for the mysid shrimp and the amphipod *Leptochoinos plumulosus*. Both test methods have been tailored to address the concerns unique to sediments at Site 2.

Traditionally, scientists have set the nominal error rate for biological studies at 0.01 to 0.1 (1% to 10%). The 0.01 level, at one extreme, provides a conservative error rate for false positives and the 0.10, at the other extreme, provides a more liberal rate for false positives. The WET test method manuals recommend a nominal error rate of 0.05 for hypothesis testing, striking a balance between the two extremes. A nominal error rate of 0.05 means a 5% probability of making a Type I error and is associated with a 95% level of significance,

Toxicity tests will be statistically analyzed at test termination. Figure 1 provides a glimpse of the statistical programs utilized when analyzing data with multiple endpoints. Figure 2 illustrates the steps which one takes to analyze data from a screening type test. (Single exposure).

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TABLE 1 SUMMARY OF TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA FOR THE MYSID, *MYSIDOPSIS BAHIA*, SEVEN DAY SURVIVAL, GROWTH, AND FECUNDITY TEST WITH SEDIMENTS

1. Test type:	Static renewal
2. Salinity:	20% to 30% (\pm 2% of the selected test salinity).
3. Temperature:	26 \pm 1 C
4. Light quality:	Ambient laboratory illumination.
5. Light intensity:	10-20 E/m ² /s (50-100 ft-c.)(ambient laboratory levels).
6. Photoperiod:	16 h light, 8 h darkness, with phase in/out period.
7. Test chamber:	8 oz plastic disposable cups, or 400 mL glass beakers.
8. Sediment volume:	2 cm
9. Overlying water volume:	150 mL per replicate.
10. Renewal of overlying water:	Daily
11. Age of test organisms:	7 days
12. No. organisms per test chamber:	5 (minimum)
13. No. replicate chambers per concentration:	8 (minimum)
14+ No. larvae per concentration:	40 (minimum)
15. Source of food:	Newly hatched <i>Artemia</i> nauplii (less than 24 h old).
16. Feeding regime:	Feed 150 24 h old nauplii per mysid daily, half after test solution renewal and half after 8-12 h.
17. Cleaning:	Pipette excess food from cups daily immediately before test solution renewal and feeding.
18. Aeration:	None unless DO falls below 4.0 mg/L, then gently aerate in all cups.
19. Overlying water:	Clean sea water, natural or reconstituted water.
20. Test concentrations:	Sediments: Minimum of 3 and a control sediment.
21. Sediment concentrations:	Sediments to be serially diluted with clean sediment. Sediment concentrations will be 100, 50, and 25%.
22. Test duration:	7 days
23. Endpoints:	Survival, growth, and egg development.
24. Test acceptability criteria:	80% or greater survival! average dry weight 0.20 mg or greater in controls; fecundity may be used if 50% or more of females in controls produce eggs.

Modified from: US EPA. 1991. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to marine and estuarine organisms. Environmental Monitoring and Support Laboratory, Cincinnati, OH. EPA/600/4-91/028.

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TABLE 2 TEST CONDITIONS FOR CONDUCTING A 10-D SEDIMENT TOXICITY TEST WITH THE AMPHIPOD, *LEPTOCHEIRUS PLUMULOSUS*

1. Test type:	Whole sediment toxicity test, static.
2. Temperature:	25°C
3. Salinity:	20‰
4. Light quality:	Wide-spectrum fluorescent lights
5. Illuminance:	500 - 1000 lux
6. Photoperiod:	24L:0D
7. Test chamber:	1-L glass beaker or jar with - 10 cm I.D.
8. Sediment: volume:	175 mL (2 cm)
9. Overlying water volume:	800 mL
10. Renewal of overlying water:	None
11. Size and life stage of amphipods.	2 - 4 mm (no mature males or females).
12. No. of organisms/chamber:	20 per test chamber.
13. No. of replicate chambers/treatment:	Depends on objective of test. At a minimum, four replicates must be used.
14. Source of food:	GORP - US EPA recipe.
15. Feeding:	Twice during test duration; day 2 and day 6.
16. Aeration:	Water in each test chamber should be aerated overnight before start of test, and throughout the test; aeration at rate that maintains 90% saturation of dissolved oxygen concentration.
17. Overlying water:	Clean sea water, natural or reconstituted water.
18. Overlying water quality:	Temperature daily. pH, ammonia, salinity, and DO of overlying water at least at test start and end. Salinity, ammonia, and pH of pore water.
19. Test duration:	10 days
20. Endpoints:	Survival and growth.
21. Test acceptability criteria:	Minimum mean control survival of 90% in the control exposure. Growth endpoint will be determined by subsampling the population at test initiation to establish a baseline weight. Organism weight at test termination will be compared to the control exposures and calculated using a T-test.

Modified from: US EPA. Methods for assessing the toxicity of sediment-associated contaminants with estuarine and marine amphipods. EPA/600/R-94/025.

Attachment 5. Statistical Specifications for Toxicity Testing

Data Acceptance Criteria:

- Toxicity, fecundity, growth: Survival rates will be dictated by the test methodology; an $\alpha = 5\%$ significance level (95% confidence level) will be used. *Action Item:* Barbara will explore the need to also specify the test beta, the

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number of organisms per replicate, the number of replicates, the minimum detectable difference, and whether we'll use static or renewal testing, or any other pertinent specifications, as appropriate. She will obtain concurrence with Tom Dillon and Lynn. The *Mysid* test will use 40 organisms per replicate; the *Leptocheirus* test will use 100 organism per replicate.

- Biodiversity: Barbara will add the required info here?

Note: Much of the acceptance criteria for toxicity and biodiversity may be incorporated into the decision matrix.

- Sediment Chemistry: Threshold Effects Levels (TEs) and Sediment Screening Values (SSVs)

Action Item: Allison will define the chemical categories and will list each specific chemical for which concentrations will be measured.

Note: Allison has provided most of this (see attachments 1 through 3). The group might want to review the lists (herbicides not included) to ensure that the lists are not overly comprehensive or incomplete.

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Figure 1. Flowchart for statistical analysis of test data for *Mysidopsis bahia*.

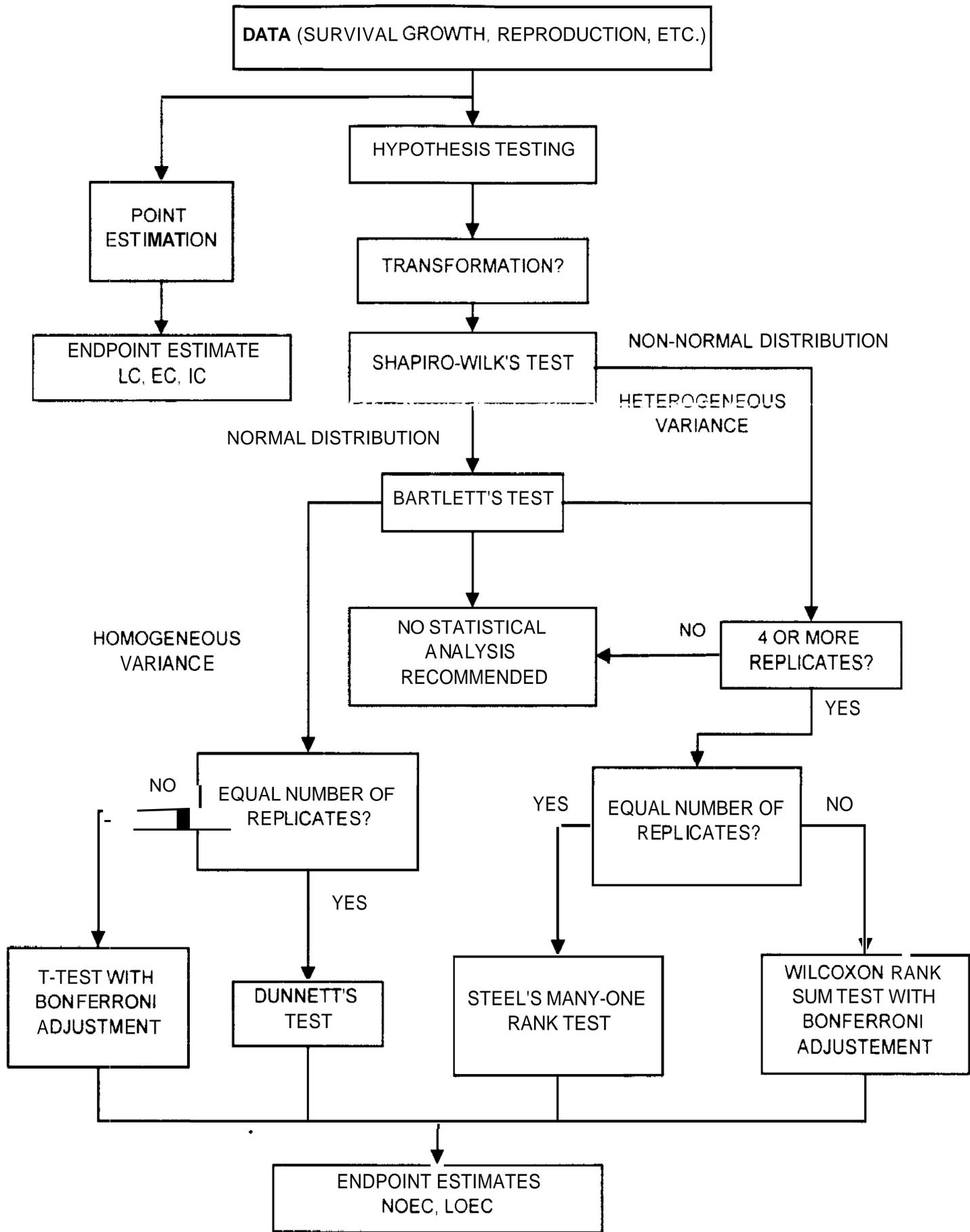
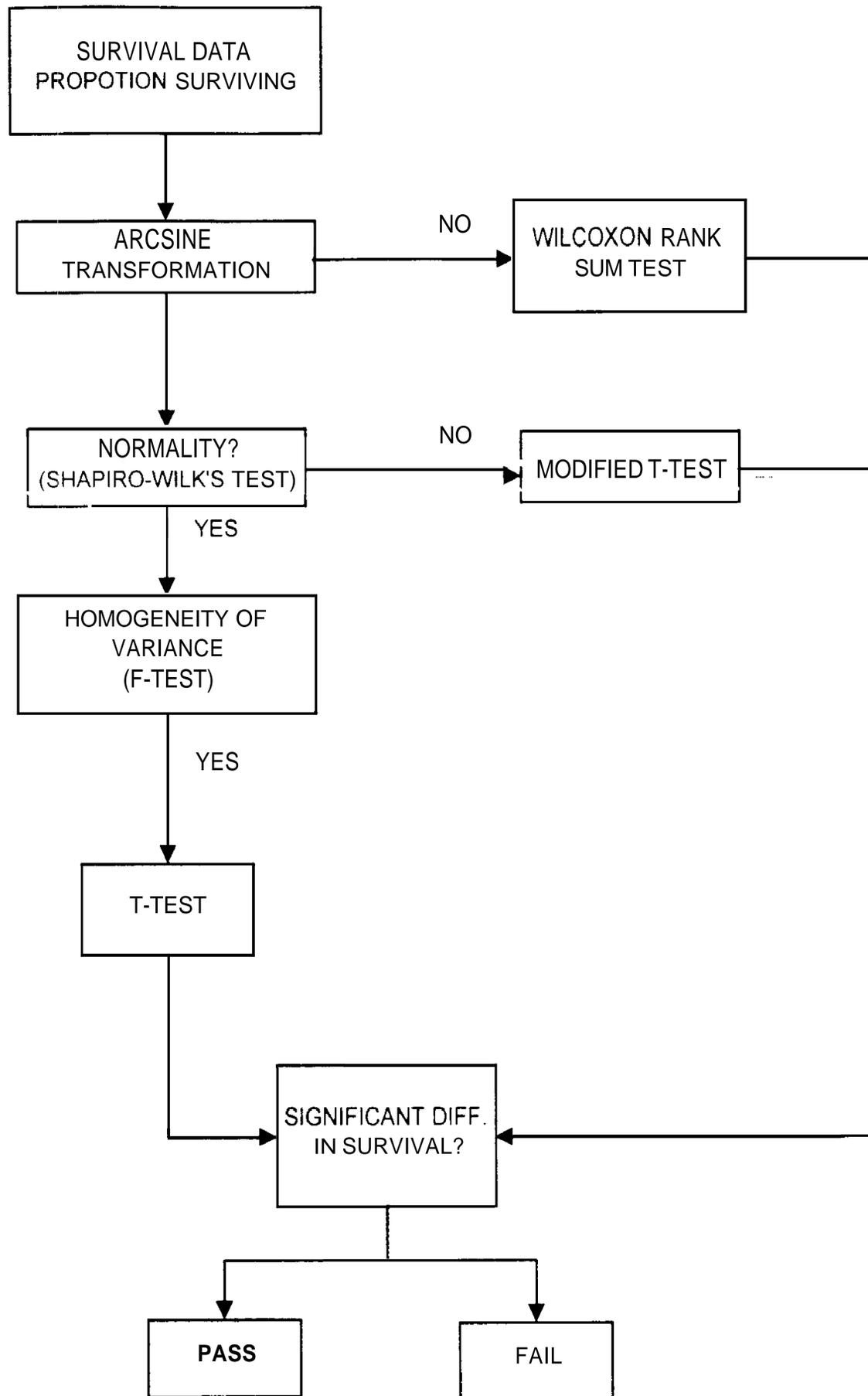


Figure 2. Determination of pass or fail from a single sediment exposure with *Leptocheirus plumulosus*.



December 15 - 16, 1999

MEETING MINUTES

Next Meeting

**EnSafe Office
201 North Palafox St
Pensacola, FL**

**Agenda
January 25 & 26, 2000**

Meeting Leader	Gena Townsend
Scribe	Amy Twitty
Timekeeper/Gatekeeper	Brian Caldwell
Facilitator	Anne Marie Lyddy

Topic	Goal	Leader	Duration
Check-In	Say Hey	Gena Townsend	1 hour
Site 2	Finalize	Gena/Allison	4 hour
Training	Learn	Anne Marie Lyddy	1 hour
OU 13	PP/ROD	Allison Harris	1 hour
Mercury Model	Finalize	Allison Harris	0.5 hour
OU1 Update	Status	Bill Hill	0.5 hour
Schedules	Update	Bill Will	1.5 hour
TtNUS	Update	Terry Hanson	0.5 hour
Site 38	Finalize FS	Allison Harris	1 hour
RAB	Prepare	Ron Joyner	0.5 hour
RAB	Recover	Ron Joyner	0.5 hour
Tier 2 Update	Update	Paul Stoddard	0.5 hour
		Robbie Darby	
Update Past: RODs	Review	Joe Fugitt	0.5 hour
Check-Out	Say Bye	Ron Joyner	1 hour
	Next Agenda		
Lab Visit	Field Trip	Team	2 hour

Future Meeting Dates

February 22 & 23, 2000	July 25 & 26, 2000
March 28 & 29, 2000	August 22 & 23, 2000
April 25 & 26, 2000	September 26 & 27, 2000
May 23 & 24, 2000	October 24 & 25, 2000
June 27 & 28, 2000	December 5 & 6, 2000