

PENSACOLA PARTNERING TEAM**January 25 - 26, 2000
MEETING MINUTES**

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January 25 - 26, 2000

LOCATION:	EnSafe Office, Pensacola, Florida
TEAM LEADER:	Gena Townsend
RECORDER:	Amy Twitty
GATE KEEPER/TIMEKEEPER:	Brian Caldwell
PROCESS FACILITATOR:	Anne Marie Lyddy (Day 2 only)

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
 Robbie Darby Tier II

Adjunct Member:

Tom Dillon (NOAA; Day 2 only)

GUESTS:

Tom Johnston (Tetra Tech; Day 2 only)
 Lynn Wellman (EPA; Day 2 only)
 Barbara Albrecht (Ensafe; Day 2 only)
 Ken Seeley (U.S. Fish and Wildlife; Day 2 only)

CHECK-IN'

Everyone is doing okay. Ground rules were reviewed. The Team reviewed the action items and prioritized the agenda. Ron announced that Mr. Ucci resigned from the RAB.

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. Waiting on Joe's comments. The letter has been sent.*

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.*

9912-A100 Barbara will provide paper by Cooley that identifies the benthic community of Pensacola Bay to use as a reference. *Complete.*

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

9912-A102 Barbara will add a justification on using the 5% standard from the lab (95% confidence interval). *Complete.*

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. *Complete.*

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. *Complete.*

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

9912-A106 Joe to talk with McDonald to see how Long categories compare to State Standards (TELs). *Pending.*

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 OU10 be handled under RCRA authority. *The letter will include the RCRA permit number and a reference to the decision process from the March 1999 meeting minutes. He will also send a draft to Gena and Joe for review.*
 - **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.
- 9908-A82:** 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 II format to each member. Robbie requests a shorter version of success stories to NAVFAC with pictures.*

Tier II Update

Robbie stated that the Command will be using Suretrack for the database. There was a NAVFAC representative (Scott Market) at the last Tier II meeting.

Gena stated that **EPA** has a new company (Parrallex) under contract to review documents. They are reviewing the OU2 RI and will be conducting an overview only, not the actual full review.

Tetra Tech Update

USTs 68 11682 – The Site Assessment Report recommends transferring the sites to OU2 since chlorinated solvents have been detected.

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Bronson Sites (100 & 102) – Site Characterization Report (draft) will be out in about a month for these sites. Some inorganics were detected in one of the three temporary wells at the Machine Gun Butt Range. Depth to water is about 0.5 feet. Piezometers will be installed to get lower turbidity samples. The Ones taken previously are not representative of groundwater conditions. The wells also exceeded FDEP Secondary Standards for aluminum and iron. At the Fire Fighting Training Area, the groundwater from all four wells and the two background wells were clean.

Site 43 – The draft Site Characterization Report is being prepared. Benzo(a)pyrene (BAP) and some inorganics (arsenic, barium, iron) **were** found in soil above residential standards, No PCBs, VOCs, or TRPHs were detected. Groundwater analytical results exhibited cadmium, iron, potassium, barium, copper, and aluminum above residential standards. Gena is concerned about the soil drums being stored 90 days. Terry says they need to be sampled for site characterization.

Action Item 0001-A01: Ron will check with the facility (Blake) to see whether there is enough money in the budget to cover disposal of the soil from Site 43.

CH2M HILL needs to review the data from Site 43 and make recommendations. Bill says that he needs to obligate funds by February 15. Remediation may include LUCs on groundwater, excavation of contaminated soil to three feet, collection of confirmatory samples, backfilling of the excavation, and resampling of the existing wells.

Phase III (which consists of a cost proposal, technical evaluation, and remediation work plan to be written and implemented) will be sent to CH2M HILL. Gena says CH2M HILL can keep the report as a site characterization instead of going with an **RA**. Neither an **RA** or an **FS** are necessary, even with LUCs on groundwater.

Action Item 0001-A02: Terry will supply Amy with figures and sample depths for Site 43 report by January 31st.

10:15 Tom Dillon (NOAA) arrives.

OU 13

Joe **looked** at the draft Proposed Plan and has sent a comment letter to Tim Bahr (FDEP). The letter got kicked back. When looking at draft PP it was realized that Greg Brown's comments to the Focused FS had not been addressed. What is the status? Joe says he has sent comments in on the RI addendum.

Action Item 0001-A03: Brian will look for FDEP's comments to FFS (Greg Brown) and address them.

Dieldrin leachability was exceeded by 2 ppm in one boring. A comparative analysis between removing to residential or industrial standards needs to be done. Joe will also look at FFS, since it predates his tenure.

Mercury Model

Joe sent comments to the Site 40 RI and addendum. He had some minor changes on figures. UF had more comments. The RI addendum gave Joe the impression that there was a lot of discussion of the model, but no clear conclusion. Joe noted that some uncertainties still remain and perhaps

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fish samples should be collected. Allison noted the model was very conservative. EnSafe will address comments and finalize the RI.

OU-1 Update

Bechtel wanted to increase the pumping rate of the remedial system from 20 gpm to 30 gpm (June 14). Wetland #3 is not dry due to pumping. The groundwater flow through the area is greater than anticipated. The **pump** is equipped with a float-level switch and is constantly running because the water is so high. The **pump** is set at 30 gpm right now. Water levels in the piezometer and the wetland are being checked. A Consumptive Use Permit modification needs to be approved by the NFWMD. The base WWTP doesn't have a problem accepting the water. Brian is concerned that we're treating shallow water, but that the iron-contaminated intermediate zone is recharging and **perhaps** contaminating the wetland.

TtNUS has been awarded O&M for 1 year for the site. Sampling is to be done semi-annually. The Regulators are reviewing the plan.

Pre-RAB

- Mr. Ucci has resigned from the RAB.
- Pursuing; transferring land west of Site 1. Who will pay for environmental assessment! VA?
- Bill will give report status update.
- Allison will go over sample nomenclature.

MISCELLANEOUS

- **RAC** funding down to \$125M (Robbie)
- Joe says FDEP is proposing to legislature to use 62-777 numbers for all types of sites (not just petroleum, dry-cleaning, etc.).

LUNCH

Schedules

- Bill presented schedules for each of the sites (see handouts).
- Site 15 (OU4) ROD concurrence letters are to be signed by EPA and FDEP by early March.
- Terry suggested adding the projected quarter for funding on the project schedules to **facilitate** the process,
- Brian suggested to Joe that he send comments to Proposed Plan for OU-13.

Action Item 0001-A04: Joe will e-mail the comments to the Proposed Plan for OU-13 to the team for review by 2nd week of February.

- OU-2 – Bill would **like** EPA and FDEP to give him target dates to review draft FS by next meeting.
- Site 38 – Joe says he prepared a concurrence letter to the RI on 01/20/00. Gena has no problem with the RI and will prepare a letter.
- Allison stated the final FS for **Site 38** was submitted 1/19/99 instead of 12/24/99.

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- Gena noted that there needs to be a "Remedial Design" Work Plan as well as a "Remedial Action" Report. They need to be two separate documents under CERCLA guidance.

ROD Update

OU-6, Site 15, Site 1, and Site-42 – Need to be reviewed by FDEP.

OU-4 – Signed by CO. Needs to be reviewed by FDEP.

Sites 7, 10, and 18 – Remove LUCs based on soil removals.

Site 34 – Needs NFA letter.

DAY 2

Check In

Anne Marie is present. Other guests are present for the Site 2 discussion.

Post RAB

RAB meetings will be held twice annually. The next meeting will be held around July 25th.

Training

Anne Marie on Negotiating. See Handout.

Site 2 Update

Torn J. recapped the site situation:

- There are 5 areas with HI > 10
- Dynamic situation offshore – eddy 400 x 400' area
- The five areas are within the eddy
- Siltation maps are consistent with eddy
- High spots could have moved or disappeared and new high spots could have been generated (i.e., number of high spots and locations could be different)
- Last time the sediment was sampled was 5 or 6 years ago
- Concern with costs for sampling

The Site 2 subcommittee handed out a proposed sampling map that contains:

- 21 sample grid squares 100 x 100'
- 8 composite sample locations per square for toxicity and general chemistry
- 3 discrete samples diagonally per grid square for benthic study (some may overlap with next square and therefore can be eliminated).
- 3 validation stations
- 51 species diversity (0 – 6") collected first
- 21 cores (0 – 36") collected last (plus two reference samples = 23)
- 21 toxicity & chemical samples (0 – 6") collected second (plus two reference samples = 23)

There was a general discussion on whether Site A2 should be a separate site from Site 2 or the two sites should be combined. Site A2 is east of Site 2. The general flow is westerly. Why is it a

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separate site? The contaminants are different and there appears to be separate sources. Grain size of sediments is different. **A2** source is the Port Operations. They also have different flow patterns. **A2** is very protected. The Site **A2** contaminants were analyzed at Site 2. Sources of contamination at **A2** could be from bilge water that greater than 10 years ago could have been dumped directly in the bay. There was also a fuel spill near Building 45 about 40 years ago; reportedly there were six inches of JP5 spilled in the area.

Joe's concerns are that Site **A2** may be a compliance issue (ongoing source of contamination), not a historical release problem under CERCLA. Tom Dillon wants to know if the contamination at **A2** is from PAHs or metals. If PAHs are a problem, the site should be separate. If metals are the main problem, Tom thinks that the sites should be connected.

Tom D. reviewed the Site **A2** data which revealed that the high HI from Site **A2** is generated from PAHs (75%), copper (16%) and lead (8%). Therefore, Site **A2** will remain a separate site.

Decision Item 0001-D01: Team agrees that due to the difference in contamination at Site 2 and **A2**, the sites will remain separate.

It was noted that there are fewer cores than previously proposed. Tom stated that the problem would be determined from the shallow samples. If there is a problem, the core sample will be used to determine the vertical extent. It also helps from a cost perspective.

Decision Item 0001-D02: Team agreed that the upper 6" of the core will be analyzed independently of the other surface samples and not composited. The result will be used only to determine the depth profile. not to determine whether the grid is hot or not.

Decision Item 0001-D03: There will only be one core per 100' grid.

Decision Item 0001-D04: Dredging is the driver for the depth intervals, therefore, split the bottom 30" into two intervals. The remaining 30" of the core (after the upper 6" is removed) will be split into 21" and 21" – 36" or to total depth (approximately 15" each).

Decision Item 0001-D05: The lower core samples will be analyzed for the full chemical suite.

Tom D. spoke with the EPA lab at Sabine Island regarding reference sites. The lab director (Kevin Summers) is currently researching reference sites that have similar grain size to our site samples (20% sand and 80% sand) that have chemical and toxicity information. This info will be used to identify two additional reference sites {number of reference sites will be driven by sand content). Reference site C17 is not suitable since it's from Perdido Bay which is siltier.

If EPA cannot identify areas, there are other reference areas in the Pensacola Bay system with 23% sand and 72% sand that could be used as a backup.

Decision Item 0001-D06: Team agreed that the reference samples should be cores and not just surface samples. The samples will be analyzed the same way as the other cores at Site 2.

Allison noted that the cost of the toxicity samples alone under the present proposed plan is approximately \$30K. Is there any way to lower the number of actual samples? The subcommittee presented a second plan that has a 150 x 150' grid, which covers more surface area with fewer samples. The trade off is that the statistical confidence is lower,

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Anne Marie is feeling poorly and will leave early. It was agreed to cancel the February meeting. The March meeting will still be held on the 28th and 29th and will be in Memphis.

Site 2 Discussion (continued)

It was determined that the cost to analyze the samples on a 100 x 100 foot grid is approximately \$223,100 and the cost to analyze samples on a 150 x 150' grid is \$126,000. The cost savings of using the 150' grid is \$97,000.

Decision Item 0001-D07: Team decided to use a 150' grid for the Site 2 sampling; plan.

Discussed decision criteria for COPCs. Lynn suggested using TELs. If there is no TEL established, look into **exceedence** of background concentrations and then use professional judgement.

Decision Item 0001-D08: The lower of the TEL vs. the SSV will be used for determining if there is an exceedence of sediment criteria at Site 2.

With concentrations at depth, if the COPC concentrations are greater than Long Category 1, evaluate need for FS with other grid squares.

If COPC concentrations in top 6" are > the COPCs from reference stations, do we say the site is clean? Gena says no; our reference area may be from an area of contamination that we were unaware of. If the reference data is higher than the site data, we won't necessarily throw the reference data out, just reevaluate the data.

Lynn and Tom D. say that we shouldn't be looking at just the chemical data first. we should look at all members of the triad (chemistry, toxicity and diversity) in parallel, Tom J. and Gena say that if there is no chemical contamination?there isn't a problem at least from the Navy's standpoint). There is nothing to remediate.

Decision Item 0001-D08: Team agrees to evaluate the chemical data first. If there is a chemical concern, look into the toxicity and diversity results.

If conditions 7 and 8 don't **exist** (see triad), but conditions 4 or 7 do, we will reevaluate conditions. If conditions 4, 5 and 7 **exist**, explain and go to **NFA**.

Barbara stated that diluted tests will be performed for the toxicity testing for the *mysids* at 100%, 50% and 25%. This means that a sample aliquot will consist of 100% site sediment, another one will have 50% site sediment mixed with 50% control sediment. and another where there is 25% site sediment and 75% control sediment. This will help in predicting the dose-response curves. LC₅₀ will be calculated from the data.

Action Item 0001-A05: Barbara will send Gena the new sampling plan (locations and numbers) so that she can send it to Bobby,

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Next Meeting:

March 28th & 29th, 2000
EnSafe Office
5724 Summer Trees
Memphis, TN

Agenda

Meeting Leader: Amy Twitty
Scribe: Brian Caldwell
Timekeeper/Gatekeeper: Joe Fugitt
Facilitator: Anne Marie Lyddy

Topic	Goal	Leader	Duration
Check-In	Say Hey	Amy Twitty	1 hour
Site 2	Update	Allison	1 hour
Training	Learn	Anne Marie Lyddy	1 hour
OU 13	FS/PP/ROD	Allison Harris	1 hour
Mercury Model	Finalize	Allison Harris	0.5 hour
Schedules	Update	Bill Hill	1 hour
TtNUS	Update	Terry Hanson	1 hour
Site 38	Finalize FS	Allison Harris	1 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	Amy Twitty	1 hour
	Next Agenda		
Field Trip	Field Trip	Team	2 hour

Future Meeting Dates

March 28 & 29,2000 (Memphis)
April 25 & 26, 2000 (Navarre)
May 23 & 24,2000 (Charleston)
June 27 & 28, 2000 (Key West)

July 25 & 26,2000
August 22 & 23, 2000
September 26 & 27,2000
October 24 & 25,2000
December 5 & 6,2000

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ATTACHMENT A

Pensacola Site 2 Data Quality Objectives Summary

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List of Attachments

- Attachment 1. **TAL** Metals Plus Cyanide Analyte List
- Attachment 2. **SVOC** Analyte List (**EPA CLP OLM 3.2**)
- Attachment 3. Organochlorine Pesticide Analyte List
- Attachment 4. Toxicity Testing Background and Specifications
- Attachment 5. Statistical Specifications for Toxicity Testing

Pensacola Site 2 Data Quality Objectives Summary
(2-14-00)

DQO Step 0. Establish an Effective Planning Team

Allison Harris (EnSafe, geologist)

Amy Twitty (CH2MHill, geologist)

Ann Marie Lyddy (Center for Leadership Development, facilitator)

Barbara Albrecht (EnSafe, biologist, ecologist, toxicologist)

Bill Hill (EFD South, EIC, environmental engineer)

Brian Caldwell (EnSafe, Hydrogeologist)

Gena Townsend (EPA Region IV, RPM, environmental engineer)

Joe Fugitt (FDEP, RPM geologist)

Jon Williams (CH2MHill, geologist)

Ken Seely (Fish and Wildlife Service)

Lynn Wellman (USEPA Region IV, ecological risk assessor)

Paul Stoddard (Tier II, EnSafe, geologist)

Robbie Darby (Tier II liaison, EFD South, IR Branch manager)

Ron Joyner (PW/CPENS, RPM)

Terry Hansen (TtNUS, geologist)

Tom Dillon (NOAA, Coastal Resource Coordinator)

Tom Johnston (TtNUS, DQO facilitator, chemist)

DQO Step 1. State the Problem

Assumptions:

- Cost is a significant factor in this investigation.

Background and 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 shoreline. 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 IV, 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.

The five areas with HI > 10 appear to be relatively localized as a result of rotational flow in the bay. This is evident from siltation patterns, flow patterns and chemistry data themselves that are documented in the latest RI report. This oval region is approximately bounded by grid nodes FO, F4, L4 and LO. There also appears to be a general westward flow. However, Site A2 to the east of Site 2 does not appear to be a source term for Site 2 because of flow patterns and the fact that the contaminant distributions at the two sites are significantly different. At Site 2, metals and the SVOC bis(2-ethylhexyl)phthalate drive the elevated HI values; at site A2 PAHs drive the elevated HI values. Copper detected at elevated levels at Site A2 may be associated with boat traffic and is not expected to be associated with Site 2 operations.

Two hurricanes; (Erin and Opal) were experienced in the bay in 1995 (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-foot movement to the west (note: R. Joyner can provide documentation to support this 200-foot estimate). In September 1998, a third hurricane (Georges) 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. This concern derives in part from recognition that dredging has the potential to uncover contaminated sediments. 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.

Note:

The short video (filmed within the past year but after Hurricane Georges) 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, a

small eddie (current) appears to have 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 and had some of the highest TOC levels in this area,

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.

Problem Statement:

It has been five years since the last data collection and a hurricane has been experienced at Pensacola during that time period. Past data indicate localized areas of adverse or potential adverse effects on benthic communities ($HI > 10$). If conditions adverse to benthic communities in the Pensacola Bay Site 2 area exist today, 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. The criteria for establishing extent of contamination are to be determined.

DQO Step 2. State the Decision

Primary Study Question:

Are chemicals in Pensacola Bay Site 2 sediments creating a condition adverse to benthic communities and, 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 back-filling 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. The depth resolution of dredging is likely to only be approximately one foot.

Alternate Potential Remedial Actions:

- No further action (no remediation)

Secondary Study Questions:

1. To support any follow-on FS, what is the nature and extent of chemical concentrations in the vertical and horizontal directions 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?

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, proceed 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).
- 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 assessment. The actual numbers of samples/organisms for benthic community assessment will be addressed by the test methodology.
- In-situ toxicity testing is not practical.

Acceptance Criteria:

Refer to Attachments 4 and 5.

Biological Test Species:

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. The two bioassays will be evaluated independently and results treated with equal weight.

Chemistry *Inputs*:

- Acid volatile sulfides (AVS)
- 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

Attachments 1 through 3 list the target analytes.

Physical Inputs:

While sediment core lithology will not be used for determining risk, it will provide additional valuable information for understanding deposition at the site.

Note: *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:

- 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.
- 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 (maximum estimate = 12 mm/yr), up to 24" of sediment have accumulated in the past 50 years. A 36" depth should provide at least 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 also coincides with the length of a core sampling 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 for the following reasons. The bottom of Site A2 is rocky with limited sediment accumulation and significant sediment migration from site A2 to Site 2 is not likely, based on water flow patterns. 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. Finally, chemistry at Site **A2** is significantly different from that at Site 2.

- 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.

The five locations exhibiting $HI > 10$ five years ago may not exist today because sediment has likely been redistributed within this general region. Therefore, the five hot spots simply represent a general area of contamination bounded by grid nodes FO, F4, LA and LO. For various reasons, it is useful to subdivide this area into smaller subunits called decision units. One reason is to facilitate the generation of concentration gradients to establish effects levels. Another reason is that it could facilitate the initial evaluation of remedial alternatives.

Combining depth boundaries with chemistry inputs from Step 3 yields the following associations:

- Top 6" of sediment:
 - TAL metals
 - Cyanide
 - Inorganic tin
 - Organic tin
 - Grain size
 - TOC
 - A_{vs}
 - SEM
 - Herbicides
 - Organochlorine Pesticides
 - SVOCs
 - Toxicity

- Biodiversity
 - Fecundity
 - Growth
- Sediment depths > 6”
- TAL metals
 - e Cyanide
 - Inorganic tin
 - Organic tin
 - Grain size
 - Herbicides
 - Organochlorine Pesticides
 - SVOCs

Sediment concentrations of interest below 6” will be the remainder of the core length (i.e., 30”) divided equally to yield two 15-inch core intervals below 6” depth. However, some sediment may be lost from the bottom of the coring tube during sampling so the bottom interval will be from 21” to the bottom of the sediment in the coring tube.

Reference stations should emulate the decision units of the site with regard to grain size, chemistry and toxicity. Therefore, it is desirable to select two reference stations, one with approximately 20% sand content and one with approximately 80% sand content, as sand content is a common denominator. Lower Pensacola Bay areas might be suitable back-up reference stations if no others can be identified.

U.S. EPA Pensacola Bay Stations 18 and 22 were selected as the reference stations for Site 2 based on similar sand (%) components, high amphipod survival rates when exposed to sediments for 10 days, and healthy benthic indices in past studies (1992 & 1996). The average depth of Station 18 is twice that expected at Site 2, but phone conversations with several benthic ecologists (Gary Gaston (University of Mississippi), Richard Heard (Gulf Coast Research Laboratory), Tony Martin (Barry Vittor and Associates), and Virginia Engle

(U.S. EPA Environmental Monitoring and Assessment Program Coordinator) indicated that the fauna in this shallow bay system would be similar, and that sand, silt, and clay are the factors that drive habitat recruitment and not depth.

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 each 150 sq. ft. decision unit, validation area and the reference area, as appropriate. Eight decision units will **be** sampled and the decisions will be made about these **eight** areas. Three additional validation *areas* will be used to validate the notion that the area of Contamination is localized within the area of eddy flow. These validation regions may provide additional information on extent of contamination if perimeter decision units are contaminated at unacceptable levels. Two reference areas will be sampled as a benchmark against which to evaluate decision unit conditions. Decision units and reference areas that will be compared for decision-making will **exhibit** similar physical characteristics that validate their comparability. Chemistry data will be needed at depths greater than 6" for evaluating remedial options during the FS.

Decision-making will be staged and will **apply** to each decision unit. 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 comparing the detected concentrations at **depth** to the site-specific remedial goals. 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. In all cases, even if a decision unit is {declared not to pose a problem based on chemistry alone, evaluation of toxicity and benthic diversity will occur. This evaluation may be used to explain any cases in which **adverse** biological effects are observed when chemistry appears to be acceptable.

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.

“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 accommodates 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.		++	=	+
+++++	Survival hits in 1-2 species and/or adverse sublethal effects.	++	=	+	
++++++	Survival hits in both test species and adverse sublethal endpoints.		+++	=	+
+++++++	Survival hits in both test species and adverse sublethal endpoints.		+++	=	+

Project Decision Making Triad Matrix				
Condition	Sediment Chemistry	Toxicity Tests	Benthic Assessment	Interpretation
1	+	+	+	Strong evidence for pollution-induced degradation .
2	-	-	-	Strong evidence for absence, of pollution-induced degradation.
3	+	-	-	Contaminants are not bioavailable.

Project Decision Making Triad Matrix				
Condition	Sediment Chemistry	Toxicity Tests	Benthic Assessment	Interpretation
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.

Notes:

- + = 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

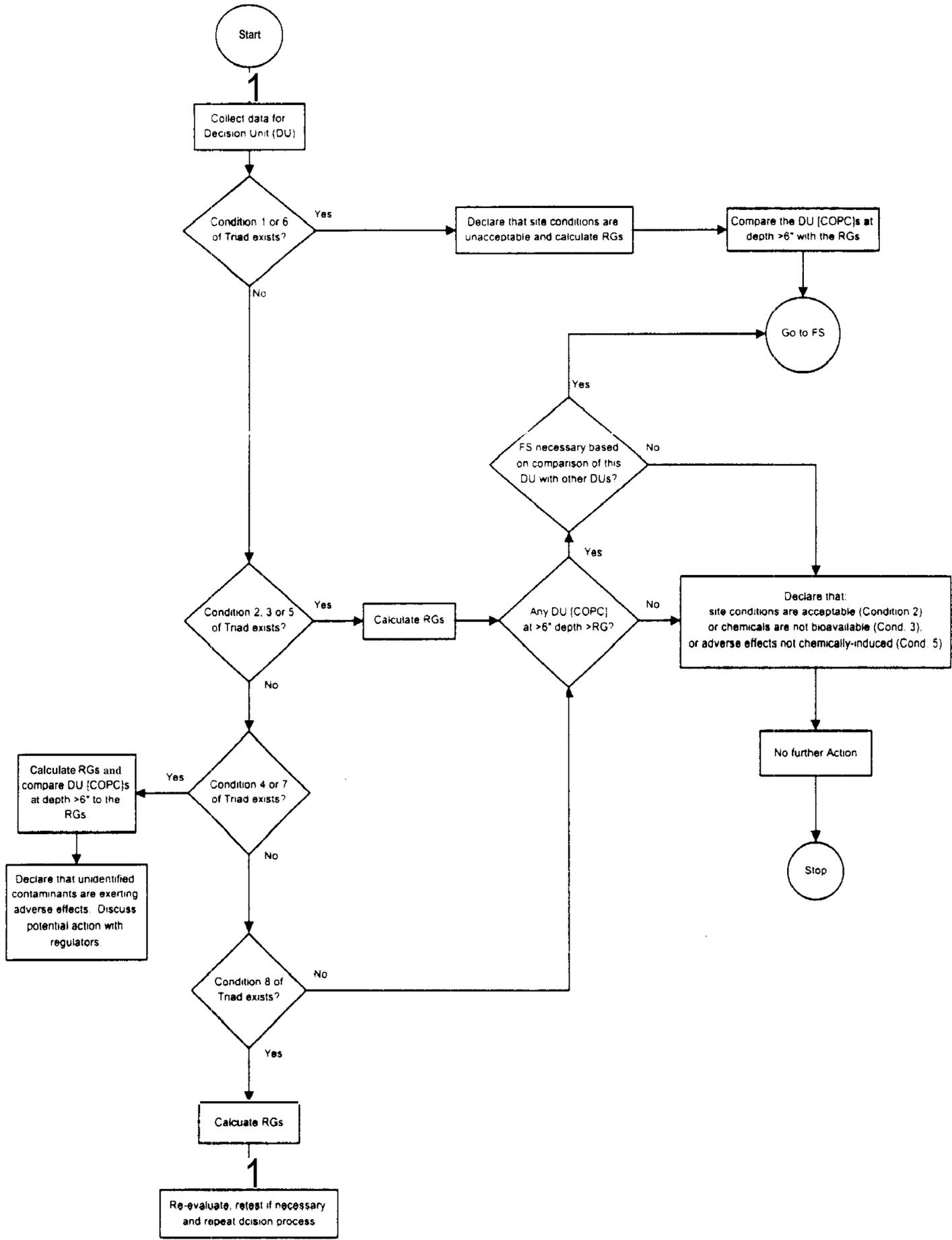
Given the advanced status of the project prior to initiating these DQOs, this step of the DQO process was used primarily as a means of introducing **and** reinforcing the concept of quantified error tolerances to the planning team. The outputs from this DQO step were used only as a rough guide to establish numbers of samples to be collected.

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.

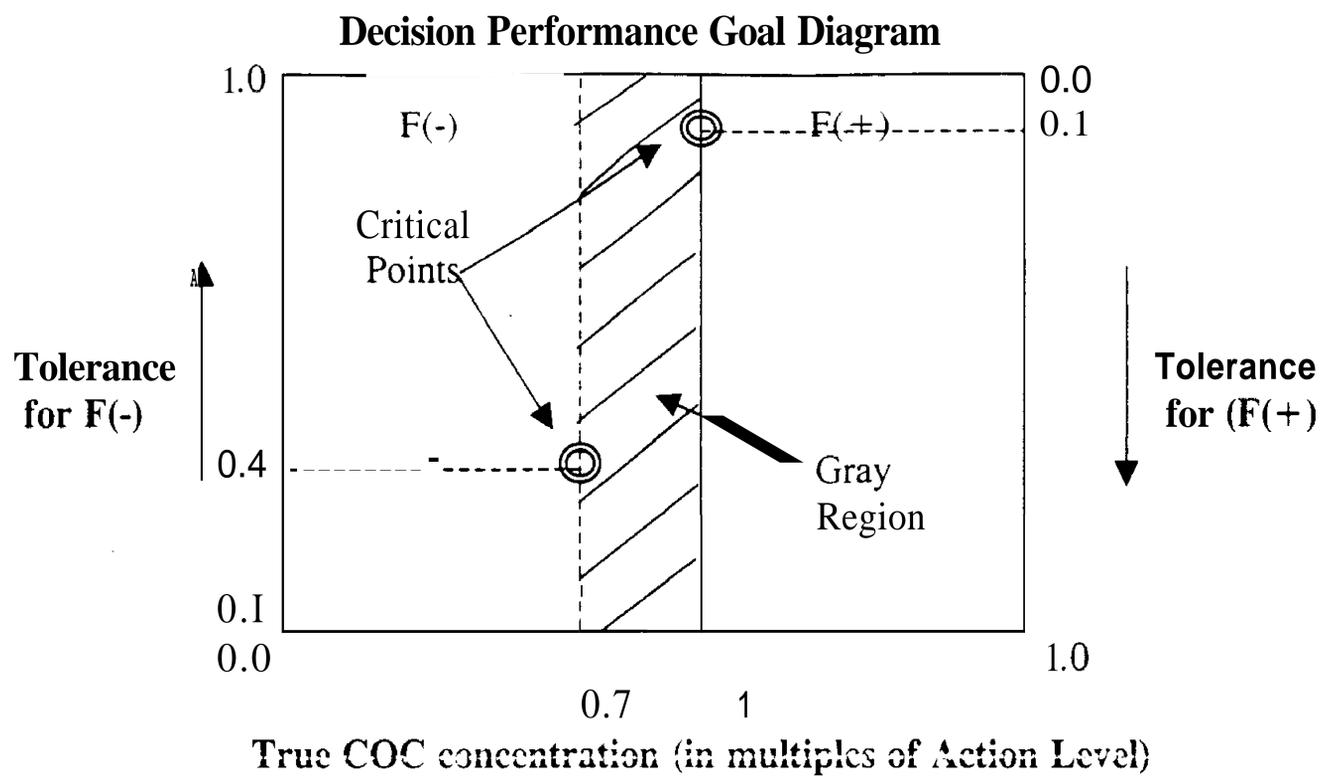
The Type I error (false positive) is rejecting H_0 when it is true. Therefore, the type I error is: Walk away from a dirty site.

Then the Type II error (false negative) is: Clean up a clean site.

<i>Quantitative Tolerances for Decision Errors</i>		
True Concentration	Error Type	Tolerance
0.7* Action Level	II: False Negative [F(-)]	0+4(40% probability)
Action Level	I: False Positive [F(+)]	0.1 (10% probability)

Note;

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:	
H_0	Site is Dirty
H_a	Site is Clean
Action Level	SSV
Gray Region Boundary	0.7SSV
Probability of F(+)	0.1 (walk away from dirty site)
Probability of F(-)	0.4 (clean up clean site)

Numbers of Samples				
Metal	Standard Dev.	Screening Value	Null Condition: Site is Dirty	
			Gray Region	No, Samples
Arsenic	8.35	7.24	5.1	36
Cadmium	7.67	0.68	0.48	>1000
Chromium	68.1	52.3	36.6	46
Zinc	59.3	124	86.8	6

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.

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%). Also consider both possibilities for the null hypothesis:

DQO Specifications		
	Case 1	Case 2
H ₀	Site is Dirty	Site is Clean
H _a	Site is Clean	Site is Dirty
Action Level	SSV	SSV
Gray Region Boundary	0.7SSV	(1/0.7)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						
		Screening	Case 1 (Assume site is dirty)		Case 2 (Assume site is clean)	
Metal	Standard Dev.	Value	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	68.2	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 $n = 9$.							
Metal (mean)	Std Dev.	Screening Value	Mean Concentration	Δx	n	Prob. of $F(+)$	Prob. of $F(-)$
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%

Note:
UD = undefined

Probability of F(-) with $n = 15$.							
Metal (mean)	Std Dev.	Screening Value	Mean Concentration	Δx	n	Prob. of F(+)	Prob. of F(-)
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%

Note:

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 **and because** sediments are relatively mobile. Mobile sediments imply 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.

DQO Step 7. Optimize the Design

The site will be subdivided into eight decision units (DUs), 150' x 150' square. Each DU will be sampled in an identical manner, as follows:

- One core sample at the center of the DU. The top 6" will be removed and the remaining 30" will be divided equally into two samples, yielding a total of three samples. The top 6" will be used as a point of reference for sediment depth profiling only. Its concentration relative to the composite samples described below will not affect decision making. That is, a surface core sample that is of greater or lesser concentration than the composite samples will have no bearing on decisions. This approach should limit "knee-jerk" reactions to hot spots which may arise as a consequence of statistical fluctuations or heterogeneity of the surface sediment.
- Eight grab samples from the top 6" of sediment will be composited into a single sample that will be split for toxicity testing and chemical analysis. One grab sample will be collected from each corner of the DU and four grab samples arranged in a diamond pattern will be collected closer to the center of the DU. The samples will be arranged to provide relatively even coverage of the DU area.
- Three sediment diversity samples will be collected along the water flow direction: one sample in the NE corner of the DU, one near the center of the DU, and one from the SW corner of the DU.

It will be important to collect sediment samples such that any sediment lost from coring tubes does not contaminate nearby sediment that is yet to be sampled. Therefore, the following sampling sequence will be used for each DU:

1. Mark the coring location with a buoy
2. Collect sediment diversity samples
3. Collect grabs for compositing
4. Collect the core sample

A map identifying the Site 2 area and the 150' x 150' areas of concern is included in the appendix. Reference stations and validation units will be sampled and analyzed in a manner identical to that of the DUs. A Map of these stations is also included in the appendix of this document.

Q:/T.059/Pcola/Site.2/Final/DQO Summary.doc

Attachment 1. TAL Metals Plus Cyanide Analyte List

ANALYTE	CAS No.	CRQL, WATER ($\mu\text{g/L}$)
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, ($\mu\text{g/L}$)	Soil, ($\mu\text{g/kg}$)	Med. Soil, $\mu\text{g/kg}$	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)
2-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)

COMPOUND	CAS No.	Water, ($\mu\text{g/L}$)	Soil, ($\mu\text{g/kg}$)	Med. Soil, $\mu\text{g/kg}$	On Column (ng)
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	621-64-7	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, ($\mu\text{g/L}$)	Soil, ($\mu\text{g/kg}$)	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 I 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).

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

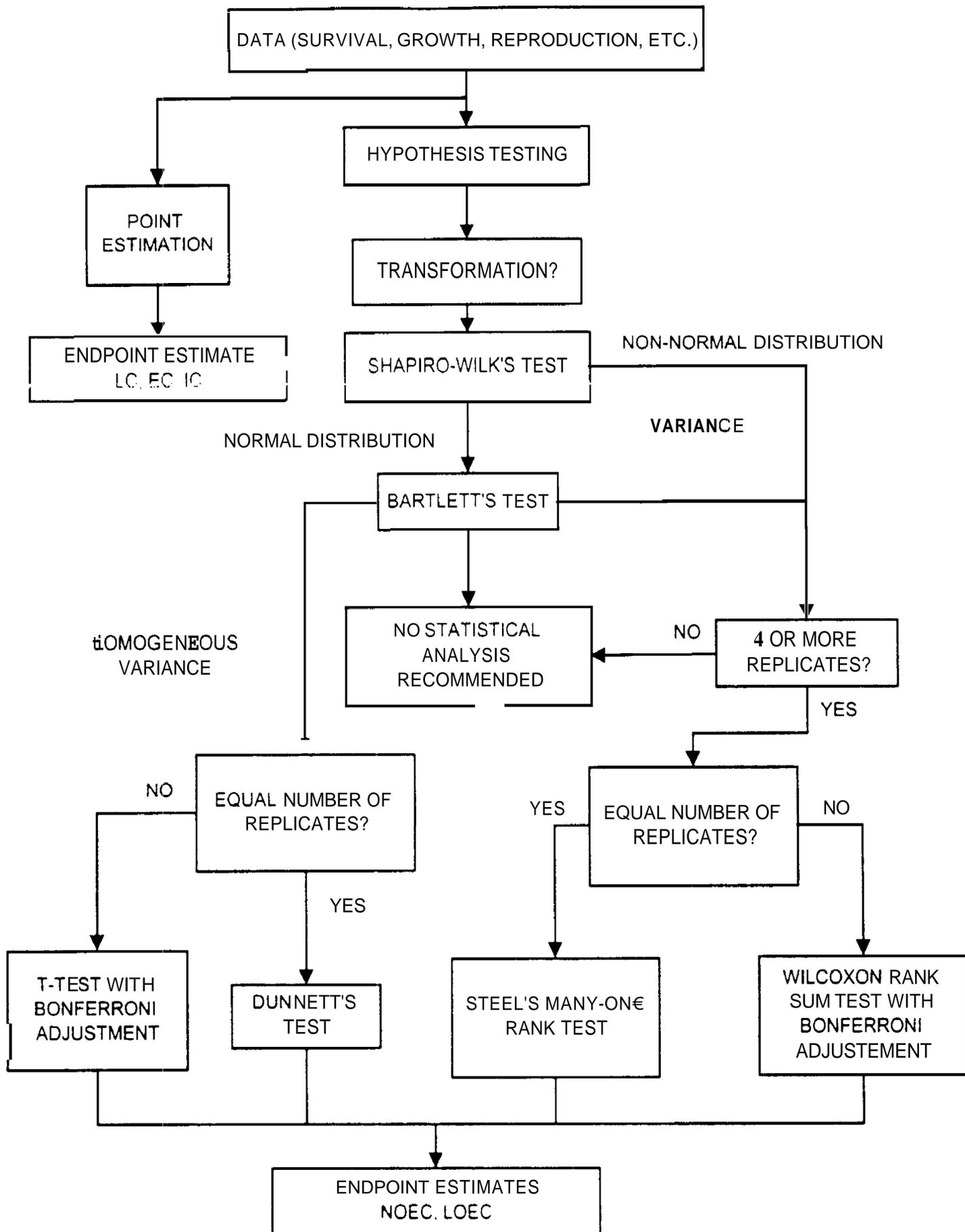


Figure 2. Determination of pass or fail from a single sediment exposure with *Leptocheirus plumulosus*.

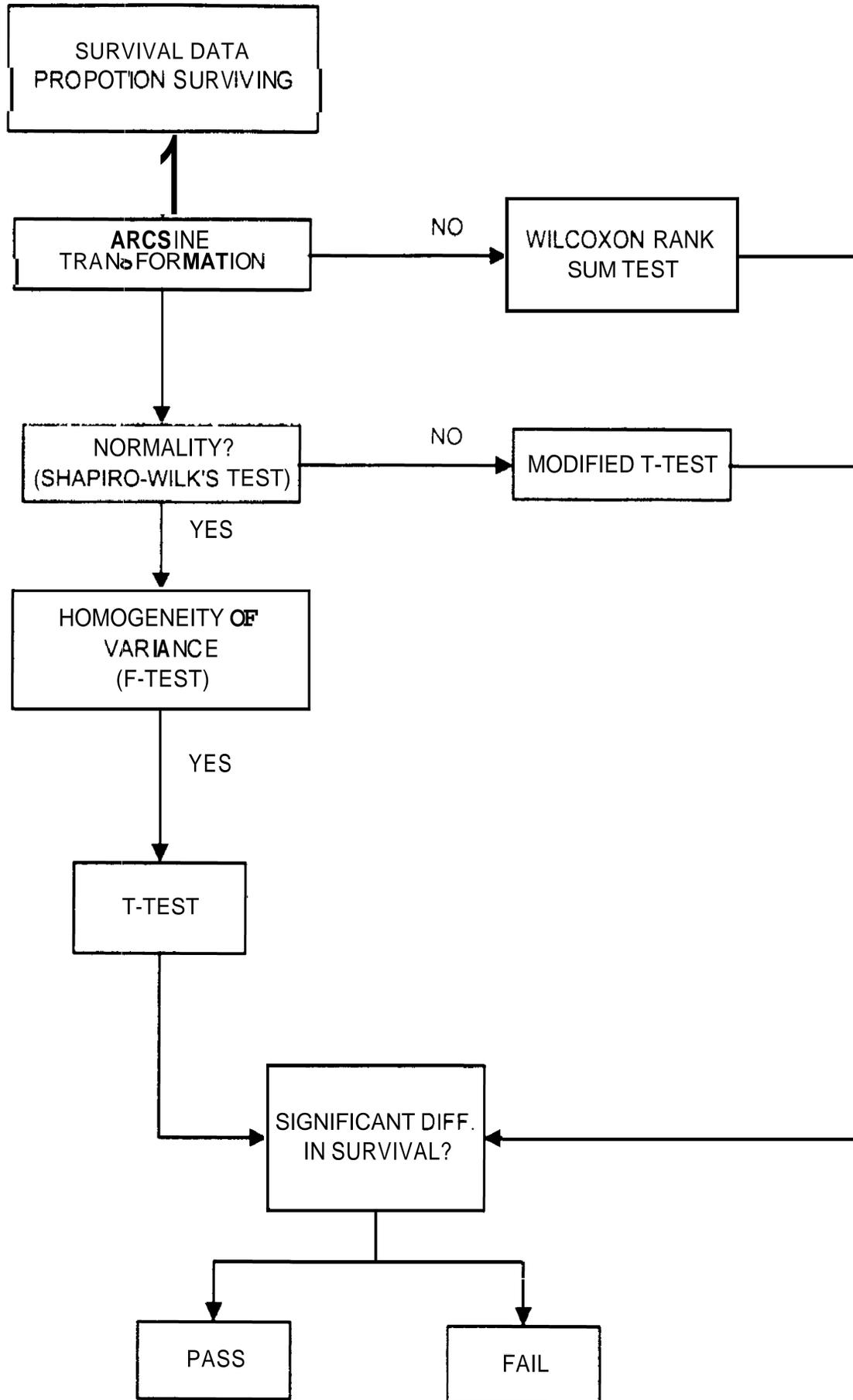


TABLE 1 SUMMARY OF TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA FOR THE MYSID, MYSIDOPSIS BAHIA, SEVEN DAY SURVIVAL, GROWTH, AND FECUNDITY TEST WITH SEDIMENTS	
1. Test type:	Static renewal
2. Salinity:	20% to 30% ($\pm 2\%$ of the selected test salinity).
3. Temperature:	26 \pm 1 C
4. Light quality:	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 fowl:	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.

Note:

Modified from: U.S. 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.

TABLE 2 TEST CONDITIONS FOR CONDUCTING A 10-D SEDIMENT TOXICITY TEST WITH THE AMPHIPOD, <i>LEPTOCHEIRUS PLUMULOSUS</i>	
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.
a. 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- U.S. 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.

Note:

Modified from: U.S. 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. The *Mysid* test will use 40 organisms per replicate; the *Leptocheirus* test will use 100 organism **per** replicate.
- Biodiversity: Species diversity will be assessed utilizing the triad matrix (overall) and comparisons between reference stations and site locations (individually). Site 2 diversity data will be compared to the US **EPA** Stations 18 and 22 (reference location) data.

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

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