03.6

To: Cynda Maxon
Allan Chartrand

4-26-94

From: Mike Reid

Re: Long Beach Naval Base Cleanup

After our discussions last week, I thought it would be a good idea to describe in detail the way I'd like to see work proceed for cleanup of the aquatic portion of this base. An official communication of assessment and cleanup methods will have to await discussions here at the State Water Board as well as between this agency and DTSC since it is the lead for base closure. Nevertheless, I sensed from our discussions that 1) firm regulatory guidance was needed and 2) the current design to assess the need for cleanup was flawed. This memo should get the ball rolling on both counts.

Before addressing this base alone I first want to make a pitch for combining all coastal base closures into one large coordinated effort (you may want to pursue this yourself with DTSC). The reasons for this are to 1) distribute the expense of some methodologic studies from the list presented below and 2) provide for comparison of study sites to a larger than usual group of reference sites. These concerns should become more clear as I proceed. Right now I'm just putting this on the table as an option; given the obvious difficulties in achieving coordination, this deserves further consideration by all parties involved. Now back to Long Beach and the overview of our hot spot monitoring effort which I sent you last week.

Research Design

We (a task force of State and Regional Board, DFG, and OEHHA staff) developed a definition of a hot spot several years ago and decided to follow a conservative course in that effort. Rather than simply showing the presence of chemical contaminants, we felt that bioeffects (namely, toxicity and benthic community impacts) had to be demonstrated. Moreover, these effects had to be shown to be recurrent and associated with anthropogenic contaminants (i.e. some effort had to be made to separate naturally occurring from human-caused bioeffects). [This is all described in the Status Report which you will receive by mail.] The monitoring design that emerged was a compromise between simple correlational studies and full-blown sediment TIE's...that is, reference sites (defined as unimpacted in terms of human-caused bioeffects) have been chosen 1) which "match out" the contribution of important natural variables and 2) in sufficient numbers to allow discrimination between them and hot spots using statistical testing. Supplemental to this fundamental design are several additional measurements which are not, at this time, being routinely applied due to funding constraints (bioaccumulation using either fish or shellfish, fish or shellfish biomarkers, chemical analysis for natural toxins,

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etc.).

Sampling Design

Given these design characteristics, I'd like to see you follow much the same process as we have in identifying sites that qualify as degraded. First, review the available data for the Naval base that demonstrate existing problems (State Mussel Watch, NOAA or other federal programs, sediment chemistry data, toxicity and benthic data, etc.). Either Shirley Birosik or myself are familiar with most of these data and will be glad to help out. It will also prove useful in the long run to identify some random sites within the base's jurisdiction since the Navy will, as a result, be able to make the case that an effort was made to evaluate the entire area (I have some EMAP data that will help you decide how many random sites are sufficient). These sites should be supplemented with other sites that need to be sampled (based on activities that may have resulted in contamination) but never have been. Your total budget should provide some guidance in selecting the total number of sites and the most important ones.

Screening

Once the sites have been selected I'd prefer that some preliminary screening be performed...both to narrow down the number of sites for repeat sampling and to show recurrent problems at these repeat (i.e. confirmation) sites. I'd like to see a single grab sample at each site analyzed for both toxicity and benthic composition. You may think you're risking some false negatives doing this but in reality you're not since the criterion for degradation is recurrent effects. As for the toxicity tests to apply, I would like to see a mixture of tests that address important exposure routes, endpoints, and ecosystem components but which satisfy my comfort zone vis a vis artifacts (see more below on methods studies). Whichever tests are chosen (preferably solid phase Rhepoxynius and Neanthes at this time), ammonia, H_2S, grain size, and TOC need to be measured as well. Considering the expense, I see little utility in performing metal and organic analyses on these samples.

Reference Site Survey

Regarding reference sites, the BPTCP has been performing a survey for toxicity reference sites for a year and a half throughout the SoCal Bight. Repeat testing has led to the sites listed in some of the items I faxed you last week. Unfortunately, a similar effort for benthic reference sites is not as far along (although a large data set from San Diego Bay is about to be completed). If we're lucky, some of the toxicity reference sites will also function as benthic reference sites. Nevertheless, since you're going to include benthic composition as an indicator in your effort, you should be sure to locate enough benthic reference sites to allow comparisons. These may be within or outside the Naval base but should represent nondegraded, healthy benthos from areas free of human influence;

as we discussed by phone, the presence or absence of chemical contaminants should not effect their choice as reference sites. [The requirement that benthic reference sites represent areas free of human influence may not be as stringent as it first sounds...BPTCP data will have to tell the story but it may be that clearly degraded benthos is relatively rare, even in highly human-impacted areas.]

Confirmation

Once the screening data is reviewed, those sites showing impacts are matched for grain size and TOC (and, perhaps, other variables in the case of benthic data) with an appropriate number (determined statistically) of unimpacted (reference) sites. Both impacted and reference sites are then resampled but this time field replicates are collected to resolve whether bioeffect variability is greater within or between sites. Metals and organics scans are also performed on the three replicates at all sites, both reference and suspect. Reference site bioeffect data are summarized as a population estimate and tests are performed on each suspect site to evaluate its membership in the sample of reference sites. For those which are clearly distinct, tests are also performed to see if chemical contamination is significantly distinct from that typical of reference sites. [I'm mailing you part of the work of Bob Smith and Neil Willits (at UCD) to develop appropriate statistical methods...I can't send any data yet.] Unfortunately, some questions are yet to be resolved in all this. For example, what do we do about reference sites that test negative during confirmation...drop them out of the analysis, leave them in, drop them out only for specific reasons such as ammonia toxicity, etc.? How should the considerable amount of chemical data be summarized or should each species be evaluated separately? What cost savings are possible from the continued reuse of reference sites? What role do natural toxins play and what research design can be applied to handle this nuisance variable?

Other Indicators

As for the role of other indicators, such as biomarkers and bioaccumulation, it makes most sense to me to include those during the confirmation phase to illustrate a link between ecological risk factors and impacts. For example, an even stronger case for degradation would be made for a site if the toxicity and benthic data were supplemented with biomarker and bioaccumulation data (that is, a pathway from contaminated sediment to uptake and response in organisms (both in the field and in the lab) to population or community effects could be traced). Unfortunately (or not, I guess, depending on your viewpoint), much additional work needs to be performed on biomarkers to firmly establish their utility; bioaccumulation therefore is probably sufficient. As for the organism to use, mussels are my current preference. These have been used much more frequently than other shellfish in California and are usually preferable to fish due to lack of movement from the site. However, fish may be preferable for a large, relatively enclosed

area like the Naval base. One indicator that needs more attention in the BPTCP is something that will raise a flag for human health risk (again, data have been collected to this end but are yet to be reviewed).

Methods Research

A rather significant number of methodologic issues have been identified over the course of our program. I'll simply list some of them and leave detailed discussion until later. We've already discussed the need to evaluate the toxicity tests for artifacts resulting from the manner in which sediment is collected (box core, modified Van Veen, or diver cores), transferred (depth of sediment removed, oxic/anoxic layer, exposure to air or not), manipulated (exposure to air, squeezing (high or low pressure), centrifugation (high or low speed), and filter pore size), and stored (refrigeration, freezing, preservative, duration of storage, type of container). Fortunately, many of these concerns are resolved if pore water testing is not pursued (this is not however a blanket condemnation). Additional concerns include the development of more cost-effective bioeffects tests, evaluation of optimal replicate numbers for both toxicity testing and benthic analysis (both field and lab), understanding of the effects of various sampling conditions (high flow, wind, season, salinity, recency of sediment resuspension, etc.), and methods of linking bioeffects to chemistry (normalization methods, measurement of metals and organics bioavailability, reference site selection). This no doubt looks imposing but a more realistic condensed version can be compiled given some key decisions and judgement so that funding for methods work via base closure efforts may not be overly expensive.

In closing, some who read this may conclude that I'm asking for a much more expensive effort than was ever envisioned. Since I've not indicated the funding which should be contributed to the various components above (and have in fact indicated some areas where cost savings might be realized), this would be a mistake. Moreover, the monitoring design described above is much more likely to resolve the magnitude and extent of damages. Nevertheless, people probably won't be comfortable until some specifics are put on paper. As I offered last week, I'll be happy to help in such an effort.