Conservation Science Institute

Exploration, Environmental Problem Solving, and Education

2624 Bayview Drive
Alameda, CA 94501
Tel: 510-814-9469

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Mr. George Kikugawa
Department of the Navy, Western Division
Naval Facilities Engineering Command
900 Commodore Drive
San Bruno, CA 94066-2402

SUBJECT: REVIEW OF DRAFT ECOLOGICAL ASSESSMENT OF NAVAL AIR STATION ALAMEDA (17 February and 1 July 1994)

Dear Mr. Kikugawa:

This letter represents Conservation Science Institute's review of the 17 February (and 1 July) 1994 Draft Report of the Naval Air Station Alameda Ecological Assessment. Our organization conducts environmental education for the benefit of the general public. We have provided the following comments with the hope that they will be used constructively. We have made attempts to be concise, and we hope that this style is not perceived as terse. In general, we present the following comments:

- The Apparent Effects Threshold (AET) approach is of questionable usefulness, and should be applied with extreme caution. No discussion of the uncertainties of this approach was included in the Ecological Assessment.

- The Ecological Assessment (EA) bears little resemblance to the Framework for Ecological Risk Assessment (USEPA 1992) upon which the authors claim it was based.

- The authors fell short of their stated goal of "... full assessment of the impacts of hazardous material disposal on ecosystems in and around NAS Alameda".

- The EA contains useful bulk-chemical data, although further chemical sampling is needed to adequately characterize the vertical and horizontal distribution of sediment contamination.

- The EA contains some useful toxicity and bioaccumulation data, although they are presented as if the data have good statistical power (ie. as if no *demonstration* of ecological impacts means that no impacts really exist).

- Benthic community studies in the EA are of little value; these studies were not appropriate for assessing ecological effects of contaminants since legitimate, multiple reference stations were not used.

- Sediment at the unreplicated reference stations was contaminated and toxic rendering these comparative stations virtually useless.

- Food-web modeling and other fate-and-transport studies were left out of this EA. These types of studies are critical for identifying ecological receptors (at-risk organisms) and estimating exposure and effects throughout the ecosystem.

- Objectivity, conservativeness, and completeness was lacking throughout the presentation and discussion.

The AET Approach

The Apparent Effects Threshold (AET) Approach has been used to identify concentrations of individual chemicals above which moderate or severe biological effects are likely to occur. These effects-level-low and effects-level-median values are based on observed effects and co-occuring concentrations in a wide variety of studies. Practical application of this approach has widely been abandoned in scientific, and even consulting, realms because of substantial logical and theoretical problems resulting in unacceptable uncertainty. Some of these problems are listed below:

- Most contaminants-of-concern probably do not have threshold effects. Rather, chemical stresses on organisms and biological systems are exerted along a continuum from undetectable to sublethal and lethal effects (Underwood and Peterson 1988, Underwood 1989).

- The concept of threshold effects has meaning only with respect to acute toxicity. It relates little to chronic toxicity and is arguably unrelated to mutagenicity, teratogenicity, and carcinogenicity.

- The AET approach does not adequately address additive or multiplicative effects of complex mixtures of chemicals at specific sites (*see* Hutchenson 1973), nor does it take into account site-specific chemical and physical characteristics of the sediment, or changes in those characteristics.

- The authors of this method recognized the tremendous uncertainty associated with this method, and they advised caution when applying it (Long and Morgan 1990, Long and Markel 1992). The severe limitations of this approach are not addressed in this EA.

- Because the AET approach largely depends on crude toxicity tests to estimate toxicity, and on the statistical power of those tests, stations can erroneously be classified as non-impacted (SWRCB 1990).

EPA Guidance

Despite the authors' claim that the EA was conducted in accordance with the Framework for Ecological Risk Assessment (USEPA 1992), it includes few components outlined therein. That framework divides assessments into three main parts: problem formulation, analysis, and risk characterization. Several important components outlined in each of those parts were neglected in this EA. According to the EPA guidance, the problem formulation phase should include identification and thorough description of the ecosystem potentially at risk, characteristics of the stressors of concern, and the possible ecological effects of those stressors. It also should include endpoint selection and the development of a conceptual model of ecological effects. The thoroughness and objectivity of the NAS Alameda EA suffers because none of these components were adequately addressed. Furthermore, the analysis and risk characterization sections of the EA did not include other important components called for in the EPA guidance, such as discussions of uncertainty.

Shortcomings of the Ecological Assessment

Some of the shortcomings of the Ecological Assessment are outlined in the following sections. These shortcomings prevent the Ecological Assessment from approaching reasonable completeness. The resultant lack of exposure and effects information leads the reader to presume worst-case-scenario.

Limited Bioaccumulation Testing

Bioaccumulation testing was undertaken only at the stations from which sediment was shown to be toxic to test animals. This is unfortunate because this particular tiered configuration makes it impossible to evaluate whether organisms bioaccumulate chemicals from the less contaminated sediment around the base. Studies of bioaccumulation and bioconcentration should be conducted as part of food web analyses and chemical fate and transport studies, especially in a setting where higher trophic-level organisms—like the Brown Pelican—are known to have undergone severe population declines as the result of DDT bio-magnification. There are benefits to tiered designs, but investigative questions should be clearly identified or revisited when adapting Army Corps of Engineers-type conventions such as upper-tier bioaccumulation testing and unreplicated reference sites.

Neglecting Environmental Fate and Potential Impacts

It is probable that many of the contaminants from the sediment at, or surrounding, NAS Alameda accumulate in the tissues of higher food-web organisms such as fishes, birds, and humans. Moreover, many of these contaminants are known to biomagnify (increase in tissue concentration) as they make their way to higher trophic levels. Effects of these contaminants on higher food-web organisms include disruption of reproductive function, carcinogenicity, mutations, and developmental disruption. This should be of great concern because bioconcentration factors were estimated in this EA to be as high as six (6). Food web modeling, tissue-residue studies (of field-collected organisms), and other fate-and-transport studies were not undertaken in this EA.

Limitations of Ecological Effects Studies

Toxicity and bioaccumulation testing represent the only estimates of ecological effects made in the EA. An important complement to these rough estimates of effects are direct studies of effects, such as comparative and correlative studies of benthic communities. Such direct studies are considered important because of the high degree of field-realism they provide. Unfortunately, the investigators fell short of characterizing and evaluating suspected impacts of contaminants on the benthic community because benthic samples were taken only from the most contaminated sites at NAS Alameda and from unreplicated contaminated reference sites. Thus, community structure data may indicate highly stressed communities at every station around NAS Alameda, but correlative data are of little value without data from uncontaminated sites. The effects of pollution on benthic community structure can be properly evaluated only by comparison to multiple unpolluted reference stations and by correlation analyses that include unpolluted sites.

Multiple reference areas are necessary for comparative studies of community structure to be meaningful (Underwood 1992, 1994). This is because the real world is spatially variable, as statistically demonstrated in the EA. Thus, two randomly-chosen, apparently-similar areas would not be expected to have the same community structure. By comparing a potentially impacted site with a single reference station, one would not be able to distinguish whether the difference was due to the measured stress or simply to the natural variability between the two populations. Community impacts can only be evaluated by comparing the community at the potentially impacted site to the *range* of variability among multiple reference sites. Comparative studies of community structure that employ single reference sites result in data with dubious usefulness at best (Underwood 1992, 1994).

Reference stations for many other San Francisco Bay studies have been located in Tomales Bay or Drakes Estero.

It is interesting that benthic samples were rinsed through a 1.0 mm mesh screen. With such a large mesh size, only a limited portion of the benthic community, the largest organisms, remains on the screen. The typical mesh size for benthic community studies is 0.5 mm, but an even smaller size is typically recommended for estuaries and wetlands because the fauna is smaller in these settings.

Although bioassays provide useful estimates of ecological effects, no direct measurements of ecological effects were made on NAS ecosystems during this EA. Many different kinds of ecological effects can be measured in San Francisco Bay. Approaches to investigating direct effects of contamination include histopathological studies, studies of reproductive indicators, enzymatic function, blood disorders, and physiological stress (Long and Markel 1992, *also see* Underwood and Peterson 1988).

Western Landfills

Aside from brief descriptions of the western landfills, the EA does not include a thorough discussion of their role as a *source* of contamination. Sampling was conducted adjacent to these landfills but not within them. This lack of attention to the landfills themselves might lead the reader to believe that the Navy intends to completely remove the hazardous materials and the source-fill at these landfills. Conversely, the impression could be that the Navy does not wish to remind the public of the contents of the landfill because they intend to do nothing in these areas. The reader can only speculate because of the lack of discussion.

Furthermore, the authors did not attempt to determine the source of the Western Bayside sediment contamination, even though simple comparisons of existing data can help determine whether the primary source is the adjacent NAS landfill or nearby Oakland.

At the Western Bayside there is a gradient of chemical concentrations from shore, with higher concentrations near shore and lower concentrations away from shore (compare Figs. 4-3 and 4-4 in draft report amendment). Concentrations of organic compounds at the Western Bayside (Fig. 4-3 and 4-4) were much higher than the same compounds at the Oakland Outer and Inner Harbor sediment (USACE/PO 1994; Table K-8). Furthermore, some organic compounds present in the Western Bayside sediment were not present in Oakland Harbor sediment. These clear patterns indicate that the historical Western Landfills on Alameda are the most likely source of contamination. It would have been extremely useful if the authors of the EA had pointed these patterns out and discussed the implications.

Striving for an Objective Assessment

Instead of pointing out all of the possible exposures, effects, and risks, the authors have created the feeling of a position paper in the EA. This subjective flavor does not serve the Navy because it affects their credibility. Examples of this lack of objective rigor can be found throughout the Ecological Assessment. Some of these are listed below:

- The authors are creative when presenting assumptions and defining terms. For example, on page 1-5 they define "contamination" as synonymous with the ER-M. Here, effects are confused with exposure in a misleading way. Furthermore, they used the ER-M rather than the ER-L so that contamination would be synonymous with Long and Markel's (1992) criteria for severe effects. Also on page 1-5, the authors confuse toxicity with their designation of biologically significant toxicity, and they fail to point out the limited power of the tests.

- The authors apparently rely on speculation only, when they argue that few individuals and low number of species are a natural state in the wetlands. They also argue that the extensive dead vegetation observed at the WBLW is natural. They seem to argue for a self-serving reality when faced with a lack of information resulting from a lack of uncontaminated reference areas in the design of the study.

- The authors point out statistically significant patterns, but they do not point out numerical trends that are potentially detrimental to the Navy's interests. This is misleading because statistical significance is not the same as biological significance, especially when statistical tests have limited power. In other words, many numerical trends are biologically significant, but a limited number of samples or experimental replicates results in sufficient data-noise to render significant differences undetectable. For example, statistically significant differences were not detected between the growth of *Neanthes* and the control group at the West Beach Landfill, but the authors did not point out the real trend: growth was lower in each of the experimental groups relative to the control group. This indication of suppressed growth may be biologically significant.

- It is a mystery how the authors can claim that the wetlands on NAS Alameda have no recreational or cultural value and that their value in terms of social significance, effectiveness and opportunity is absent. This contention is absurd. Apparently, the authors did not consult with the public, government agencies and leaders, legislatures, businesses, schools, and environmental groups when making these statements of opinions.

- Either the WET analysis for wetland characterization is an inaccurate approach, or the authors commonly changed the outcome of the analysis to what suited them, or both. The text in the WET Analysis section of the report is frequently counter-intuitive and steeped in contradiction. This section is confusing and perhaps misleading because the WET analysis is supposed to be an objective and somewhat quantitative approach, yet many of the ratings seem subjective and short sighted; they do not take into account *potential* uses of wetlands. For example:

  Wildlife Diversity/Abundance Breeding is rated low at the West Beach Landfill Wetland and at the Runway Wetland, despite the fact that several bird species are known to nest there, and many others rest and feed there. Surely many more would use this habitat if it were less contaminated.

  Uniqueness and Heritage is rated low at WBLW, ignoring the history of wetlands on Alameda; one third of Alameda was once wetland and now there is almost none (Merlin 1977). *Uniqueness and Heritage* is rated high at RW by WET, but the authors claim that it is actually low because of the currently restricted access. This is silly, and it indicates that analyses are being manipulated to fit a pre-chosen outcome.

  Sediment/ Toxicity Retention is rated low at the Runway Wetland, but the authors state that all the characteristics suggest that it should be high.

  Recreation is rated low at both wetlands despite the obvious potential.

  Education Potential has not been included as a category.

The stated conclusion, "... neither (wetland) appears to be conducive to supporting diverse and abundant biological populations", is highly contestable.

Recommendations

- Further chemical sampling should be undertaken at all areas of concern to determine the vertical and horizontal distribution of contamination, as well as sources of contamination where unknown, so that remedial action and habitat enhancement can be planned and undertaken with minimal delay.
- Immediate remedial action should be undertaken in the Seaplane Lagoon. Engineering feasibility studies should be initiated immediately.
- All potentially impacted ecological components around NAS Alameda should be identified including fishes, birds, humans, and other mammals.
- Food web studies, or at least food-web modeling, should be conducted to estimate exposure and effects on higher food-web organisms.
- Investigations should include the full range of sub-lethal effects (Underwood and Peterson 1988, Long and Markel 1992).
- Cleanup priorities should be determined and communicated. Managers should anticipate the needs for more funding, and secure it as soon as possible.
- All parties should strive to conduct objective studies and present objective interpretations of data.

A Note on Efficiency and Flexibility

Several parties have expressed the need for flexibility and efficiency during the cleanup process. It has been suggested that investigators and regulators proceed using a "presumptive" rather than a strict approach. Thus, exhaustive assessments need not necessarily be undertaken for those areas that clearly must, and will, be cleaned up. However, the converse is not true; we assume that, faced with a lack of information, protective conservatism would dictate that investigators and regulators must presume the worst-case-scenario.

A Call for a Proactive Approach

We approach the Alameda base closure process with a certain idealism: that the interests of the United States Navy are the same as those of the public. We hope that the subjective and incomplete flavor of this Draft Ecological Assessment does not lead the public to believe that the armed forces, in some settings, can lose track of their mission to protect the citizens of the United States of America. We remain optimistic. We *know* that the Navy has the resolve to proceed on a thorough and honorable path. When *all* costs and risks are included in the calculation, the cleanest path will ultimately be the straightest, easiest, and least expensive.

If you have any questions regarding the issues outlined above please feel free to contact me at (510) 814-9469.

Sincerely,

Thomas A. Okey

Thomas A. Okey, M.S.
Director / Research Coordinator
Conservation Science Institute

cc: James Ricks, U.S. Environmental Protection Agency
Thomas P. Lanphar, California Environmental Protection Agency
Lt. Mike Petouhoff, NAS Alameda/BEC/RAB/BCT

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References

Hutchinson, T.C. 1973. Comparative studies of toxicity of heavy metals to phytoplankton and their synergistic interactions. *Water Pollution Research of Canada* **8**:68-90.

Long, E.R. and L.G. Morgan. 1990. The Potential Biological Effects of Sediment Sorbed Contaminants tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52.

Merlin, I. 1977. Alameda: A Geographical History. Friends of the Alameda Free Library, Alameda, CA, 105 pp.

SWRCB, 1990. Evaluation of the AET Approach for Assessing Contamination of Marine Sediments in California. State Water Resources Control Board 90-3 WQ, Sacramento, CA.

Underwood, A. J. and C. H. Peterson.1988. Towards an ecological framework for investigating pollution. *Marine Ecology Progress Series* **46**:227-234.

Underwood, A. J. 1989. The analysis of stress in natural populations. *Biological Journal of the Linnean Society* **37**:51-78.

Underwood, A. J. 1992. Beyond BACI: the detection of environmental impacts in the real, but variable, world. *Journal of Experimental Marine Biology and Ecology* **161**:145-178.

Underwood, A. J. 1994. On beyond BACI: sampling designs that might reliably detect environmental disturbances. *Ecological Applications* **4**(1):3-15.

USACE / PO. 1994. Environmental Impact Report/Environmental Impact Statement Oakland Harbor Deep-Draft Navigation Improvements (Final Supplemental). U.S. Army Corps of Engineers, San Francisco District and Port of Oakland.

USEPA. 1992. Framework for Ecological Risk Assessment. Risk Assessment Forum, U.S. Environmental Protection Agency, Washington, DC. EPA/630/R-92/001.