N00236.000084
ALAMEDA POINT
SSIC NO. 5090.3


# Golden Gate Audubon Society

2236 Mariner Square Drive, Suite 201 • Alameda, CA 94501
Phone: (510) 769-2084 • Fax: (510) 769-2083

Americans Committed to Conservation • A Chapter of the National Audubon Society


7 March 2001

Mr. Richard Weissenborn
BRAC Operations, Code 06CA.RW
1230 Columbia, Suite 1100
San Diego, CA 92101

**Subject: Alameda Point IR Site 2, Draft Remedial Investigation Report**

Dear Mr. Weissenborn,

Attached are detailed comments on the Draft IR Site 2, Remedial Investigation Report, Alameda Point, Alameda, California. These comments were prepared by a Golden Gate Audubon Society team of scientists. The scientists have expertise in a variety of areas including evaluating the potential for human and wildlife risks. The team consisted of Dr. Michael Johnson, Director, Ecotoxicology Program, John Muir Institute of the Environment, University of California, Davis, John Luther, Biology Professor, College of Alameda, Dr. June Oberdorfer, Hydrogeologist, Professor, San Jose State University, and Dr. Rhea Williamson, Civil and Environmental Engineering, Professor, San Jose State University.

The team concluded that the RI was incomplete and flawed. The conclusions reached in the RI report are reached without data to justify those conclusions. The report must be redone with correct and complete data gathered and that data analyzed correctly. Crucial information is missing (data not collected or not shown). Therefore the RI is poorly documented making the findings subjective and arbitrary. Many of the processes at the site are not well understood because the necessary data have not been collected or analyzed appropriately. The Navy report may have overlooked many potential risks to human health and the environment because lower than generally accepted exposure values were used in calculating risk, thus underestimating that risk. The risk findings are completely arbitrary and of no use in understanding the potential ecological risk posed by the West Beach Landfill. The Navy's conclusions are not supported by their own analyses.

This report is simply unacceptable. It must be redone. The data must be collected correctly and in sufficient quantities and over an adequate time period to make the analyses meaningful. The analyses must be done correctly. The data must be used with accepted exposure risk values to arrive at meaningful conclusions. It must be clearly shown that the area is safe for human and wildlife use. If the area is not shown to be safe then actions must be taken to make the area safe.

Arthur Feinstein
Executive Director, Golden Gate Audubon Society

# Evaluation of the Ecological Risk Assessment for the West Beach Landfill and Wetland, IR Site-2,

## Alameda Point, Alameda, CA

## Final Report

**Michael L. Johnson**
**March 6, 2001**

## Introduction

This report presents the results of an evaluation of the Ecological Risk Assessment (hereafter called ERA) for the West Beach Landfill and West Beach Landfill wetland at IR Site-2, Alameda Point, Alameda California. Comments are made only on the aspects of the ERA that are under the purview of the Navy's contractor. Also, this report only covers the ERA and the associated analyses, other aspects of the document (e.g., soil sampling and contaminant detection limits) are reviewed by additional contractors of the Golden Gate Audubon Society. The review follows ERA analysis presented in Chapter 7 of the ERA document. This report supercedes the previous report on the Ecological Risk Assessment provided as an overview.

## General Comments

Although the document is a draft, it is generally poorly documented. Units of measure are not provided in most tables. Supporting data and standards (e.g., sources for Soil Screening Levels for COPECs) are not provided, the rationale for selecting certain parameter values is not provided, and calculations of exposures are difficult to follow and duplicate. Tables are given with little explanation, especially the units of measure for values such as concentration of various constituents in the media and exposure point concentrations.

There are a few internal inconsistencies in the document that detract from the weight of the arguments presented by the Navy. For instance, in Chapter 5 during discussion of the transport of chemicals from buried waste to surface soils and biota, there is a statement that PCBs were not elevated in site tissue samples. However, examination of Table 4-20 reveals that PCBs were found in mouse tissue at what would seem to be significantly elevated levels. Since PCBs are not naturally occurring compounds, any detection of PCBs above detection limits should be considered to be elevated levels (see below).

Most importantly, many of the conclusions drawn in the ERA are not supported by the data and analyses. Certainly, the maxim of conservatism in analysis is not followed. Despite this, the current results do not support the conclusion that the site does not pose a potential ecological risk. If analyses are redone using more conservative assumptions, the conclusion that the site should be investigated further is inescapable.

## Technical Approach

The technical approach outlined in ERA Table 7-1 used by the Navy for the ERA is in agreement with current U.S. EPA and California Department of Toxic Substances Control guidance documents. The ERA produced in the Navy document is considered to be a screening level (or Phase I) ERA. The general overall goal of any screening level ERA is to be as conservative as possible. If there is any potential for a problem resulting from exposure to chemicals, it should be identified at this stage. The key to the analysis of a screening level ERA is that no potential problem, regardless of the probability of occurrence, should be overlooked. Later investigations can either confirm the risk or indicate that the risk does not exist. Throughout the document, less than conservative assumptions are not used in the analysis, and the conclusions drawn from the results are not conservative.

### *Conceptual Site Model*

The conceptual site model is presented in Chapter 5. As presented in Figures 5-1 to 5-4, the conceptual model generally includes the relevant exposure pathways expected from buried waste in a landfill. There is then a discussion of the fate and transport of contaminants on the site and several conclusions are drawn from evidence that is unsupported.

Throughout the chapter, there are arguments that many of the organic constituents placed into the landfill are no longer present due to processes such as degradation or volatilization, and that the levels of the contaminants found in the various locations on the site originated with the fill material used to construct the site, not the chemicals placed into the landfill. These include (specific arguments summarized only for surface soils [section 5.1] and wetlands [section 5.3], the two ecologically relevant locations):

1. The concentration of metals in the wetlands area are higher than in the landfill area indicating that the metals could not have originated in the landfill
2. Concentrations of organic chemicals were elevated in locations with very little metal contamination, and high concentrations of metals were found in areas with low levels of organics. Lack of co-location of contamination argues against a biotic transport mechanism for these contaminants since burrowing animals would be expected to move both metals and organics similarly.
3. Lack of co-location of most chemicals in the landfill surface soil, or the distinct spatial concentrations of any specific chemical suggest that the landfill soil is not coupled to the underlying waste. Only PAHs are co-located in landfill surface soils but is to be expected regardless of whether the PAHs are the result of underlying waste or charred organic matter.
4. A lack of PCB accumulation in mouse tissue relative to the reference site argues against the migration of chemical constituents from the buried waste to the biota.
5. Chemical concentrations are elevated in the northern wetland soil and sediment compared to the southern wetland soils and sediment. However, northern landfill soils show no elevated levels of chemicals indicating that there is no transport via surface water flow. Also, concentrations of chemicals are different in the northern and southern ponds and the elevated soils between them, indicating no hydraulic connection between those areas and the groundwater or the Bay. Consequently, the differences in chemical concentrations may be a result of localized differences in fill history.

Arguments based on the concentration of contaminants in the soils should not be given a great deal of consideration given the relatively poor sampling coverage and relatively high detection limits for many constituents. Also, the argument that there are higher concentrations of inorganics in the wetlands relative to concentrations of organics in the landfill soils doesn't include the possibility for past movement of contaminants. For concentrations of organic chemicals, the Navy report relies on degradation and flushing of chemicals to the bay or volatilization of the chemicals, but precludes the potential for movement by inorganics. Also, the arguments based on lack of co-location of organic and inorganic chemicals in surface soils assume that they are co-located in the landfill and therefore would be moved simultaneously. Because it is not clear that the contaminants are co-located in the landfill, these arguments are not sufficiently powerful to dismiss the potential for contamination originating from the landfill. Also, it is suggested that PAHs could originate from charred organic material rather than the waste in the landfill. While this is true to a minor extent, such would be the case only if the sample contained significant amounts of burned organic material, and it would be unlikely that the range of PAHs found on the site could have originated from charred material. Given that PAHs were disposed of in the landfill, and given that there are PAHs detected in the samples, it is far more parsimonious to conclude that the PAHs in the samples are from landfill material.

Argument 4 is somewhat difficult to understand. Twelve mice were collected for chemical analysis, 6 from the landfill and 6 from the wetland (section 4.4.2, pgs 4-93, 4-94). Table 4-20 lists all the analytes measured in the mouse tissue, different PCB congeners were detected in as many as 10 of the 11 samples used in the analysis (it is not clear why there are only 11 samples). It is stated on page 5-7 that "PCBs were not elevated in site tissue samples", but it is clear from Table 4-20 that several samples did contain PCBs. The comparison to reference site samples indicates not that the levels of PCBs are acceptable, but rather that the reference sites are not appropriate as reference sites. Any levels of PCBs on the site should be considered as a potential ecological risk, and should be presumed to have been the result of activities on the site until further investigation demonstrates otherwise. Comparisons to background are not adequate for dismissing the problem, especially for organic contaminants.

Finally, concluding that the high concentrations of chemicals in the wetland areas are the result of differential fill activities assumes that there is a wide range of variation in the concentrations of chemicals in fill material, and consequently, background soils. If such is the case, additional background soils should be sampled and the variation documented. If this explanation were correct, further statistical testing would not result in significant differences between site soils and background soils. Since these differences do exist, it is not reasonable to make this conclusion.

### COPEC Screening

In the Alameda Point ERA, COPEC screening of inorganic chemicals was performed in a two-step process. Initial comparisons were made between soils from the site and background soils. Additional screening was performed by comparing the site soil concentrations to soils screening levels generated by Los Alamos National Laboratory.

The process of comparing the concentrations of the inorganic chemical constituents against background soils levels is a standard practice. Background soils levels were obtained from a previous investigation at Alameda Point (PRC Environmental Management Inc 1997). The procedures are claimed to "closely follow" those in the

Navy document "Procedural guidance for Statistically Analyzing Environmental Background Data" (Navy 1998) (Section 4.0, pg 4-1). Descriptions of the tests are provided in Appendix B along with the decision rules (Type I error rate) for some tests.

The distributional tests used appear appropriate and if performed correctly, would result in the appropriate elimination of inorganic chemicals constituents. However, there are two major statistical issues that were not addressed that could change the conclusions substantially, the treatment of outliers and the statistical power of the tests.

## Outliers

The statistical treatment for the comparisons should follow the guidelines prepared by the Navy (see Figure 11, Navy 1998) based on U.S. EPA guidelines (EPA 1996). The process requires that the data be evaluated for outliers, and those outliers removed. Outliers are individual samples whose concentration for a particular chemical is considered to be too high or too low to be included in the analysis. Because of the nature of the distributions of concentrations of chemicals in the soil, no samples with low concentrations would be considered outliers. Outliers can only be concentrations that are higher than some determined value. Outliers are evaluated according to EPA standards (EPA 1996) and include the following steps:

- Identify extreme values that may be potential outliers
- Apply a statistical test
- Scientifically review statistical outliers and decide on their disposition
- Conduct data analysis with and without statistical outliers
- Document the entire process

No discussion of outliers was found in the document. Outliers should be considered and reported in the ERA document.

## Power

No discussion of the power analysis or power requirements was found. According to the 1998 Navy statistical guidance, the recommended power is 90% with an alpha value of 0.05. However, the power is not mandated. Instead, the guidelines recommend that the power of the tests be established during the Data Quality Objectives (DQO) process by the project team. There is no evidence in the DQO section of the document (Appendix A) that statistical power is considered at all. (In fact, the DQO section is quite poor and should be rewritten.) Because of the number of statistical tests performed during the evaluation, the alpha value should be adjusted for the number of tests to insure that the experiment-wide error rate remains at 0.05. This would require lowering the alpha level for each individual test with a resultant loss of power. Given the sample sizes for soils data in Tables B-3 to B-6, it is not clear that the power for the adjusted tests can approach 90%. If the power of the test is not 90%, the chemical should be retained for calculation of the hazard quotient. There are numerous other chemicals not included in Tables B-3 to B-6 that could possibly be retained as COPECs. No recalculation of any statistical tests was attempted. The fact that some significant statistical results were found in no way argues that the results of the rest of the tests are valid or achieve a sufficient level of statistical power. The result of one statistical test is independent of another (although the data may not be independent) and the range of variation in measurement of each analyte helps to determine the power of the test.

## COPECs

At this point it would be inappropriate to eliminate any inorganic chemicals from further consideration as COPECs, even if they were at levels below established soil screening levels. The general conclusion from the statistical tests used in the screening of soils (against background) is that any chemical found in the soil in higher concentration than in the native soils is the result of anthropogenic activities and should be retained in the risk calculations. It is unclear from the presentation of the results in Tables 7-2 to 7-5 if any inorganic chemicals were eliminated as a result of screening against benchmarks. However, Tables C-22 to C-26 indicate that most inorganics were carried forward as COPECs in all media examined.

Another method used by the Navy to remove soil constituents from consideration was the evaluation of spatial patterns for constituents that were found in fewer than 5% of the samples collected. The logic for the process is that although there may not be a significant contribution of the constituent to the overall contaminant load, if the release is localized it may pose a significant ecological threat. A discussion of the spatial patterning of the constituents is provided in Chapter 4 (Section 4.1.3) and it appears from the bubble plots that spatial patterning was detected in most of the inorganics present. Discussion of this criterion in Chapter 4 (pg 4-39) indicates that there is some spatial patterning, specifically higher concentrations of inorganics around the northern portion of the wetland. However, it is unclear if this criterion was used to keep or eliminate any chemicals from consideration as COPECs.

### *Baseline ERA*

The baseline ERA concentrated on three lines of evidence, potential exposure (incorrectly termed "dose" in the document), laboratory bioassays, and comparison of tissue concentrations from receptors collected on site with those from a reference site. It is assumed in the document that the only relevant exposure pathway is ingestion. It is also assumed that there is no possible exposure pathway from groundwater to the biological receptors and so groundwater is eliminated from consideration. If the groundwater is closer to the surface than 15 feet, it is possible that some plants could move contaminants from the groundwater to their tissues through contact in the root zone. However, it is more likely that receptors are exposed to contaminants through contact with contaminated soil.

### *Identification of Assessment and Measurement Endpoints*

Twelve assessment endpoints are identified for IR Site 2 covering the terrestrial plant community, and what can generally be described as the terrestrial and aquatic communities. Measurement endpoints are developed that generally reflect the assessment endpoints. Table 7-6 identifies the assessment and measurement endpoints, the risk question, uncertainties in the analysis, and the assumptions of the analysis. Many of the analyses are compromised by chemical analyses of media that had method detection limits that were too high to be used in the risk assessment. These are identified appropriately. Assumptions for the diets of the receptors are reasonable.

### *Food Chain Model, Receptors' Exposure Parameters, and EPCs*

The analysis phase of the ERA consists of two major steps, the exposure analysis and the ecological effects analysis. During the exposure analysis, for each chemical the expected exposure to the receptors via the ingestion pathway is calculated. The effects analysis utilizes available information about the toxicity of those chemicals to derive a "safe" exposure. The "safe" exposure level is called the Toxicity Reference Value (TRV). The effects analysis requires that the risk assessor identify appropriate studies on toxicity and employ appropriate uncertainty factors to provide the exposure at which no adverse effects will be experienced by the receptors.

The equation presented on page 7-18 for ingestion exposure through food chain transfer is incorrect although it is doubtful that the incorrect formulation of the food chain model equation results in incorrect calculation of Hazard Quotients. The quantity calculated is represented as dose when it should be represented as an expected exposure. In the numerator of the equation is a term that is the sum of three parameters. These parameters should be multiplied and a simple examination of the units of measure would indicate that these terms could not be summed. It is noted that the equation does not contain a "food chain multiplier" because there are no trophic discontinuities in the model. It is not clear what this statement means or how a food chain multiplier would be included in the model. Also, within the explanation of terms for Equation 7-1, there is a statement that a default value of 1.0 is assumed for all transfer factors. It is assumed that these transfer factors are valid for both Plant Uptake Factors (PUFs) and animal Bioaccumulation Factors (BAFs). For a majority of constituents that are present, this is a conservative assumption for the PUFs and for the BAFs. However, for some of the constituents, a trophic transfer factor of 1.0 is an underestimate (Table 1). Many of the constituents have BAFs that are several times the value of 1.0 (see the third column of Tables 7-3, 7-4, and 7-5 for bioaccumulating constituents) and using these larger trophic transfer factors would make a significant difference in the calculation of expected exposure (see Table 1 below for BAFs for earthworms).

Table 1. Values of biotransfer factors taken from Sample et al. 1996.

| COPC | Earthworm bioaccumulation factor |
|---|---|
| Cadmium | 40.7 |
| Chromium | 3.2 |
| Chromium (Hexavalent) | 3.2 |
| Lead | 1.5 |
| Mercury | 20.6 |
| Zinc | 12.9 |
| Aroclor-1260 | 15.9 |
| Dioxins and Furans | 26.5 |

In the interest of conservatism, it is recommended that the exposure calculations be redone with these factors used for receptors that consume invertebrates. These calculations were performed for some of the appropriate receptors as part of this review and the results indicate that a substantial number of HQ values exceed 1.0. These results do substantially change the conclusions of the ERA.

Exposure parameters for all the receptors are provided in Tables 7-8 through 7-17. Body weights and ingestion rates are taken directly from the EPA Wildlife Exposure Factor's Handbook (EPA 1993). The body weights were means or medians of reported values. Some exposure factors (ingestion rates) were calculated using equations (e.g., Equation 3-9) in EPA (1993), others are taken directly from values in the tables in EPA (1993). Usually, these tabled values are underestimates of the ingestion rates for the species ***relative to the values calculated from the equations***. To be consistent, all ingestion rates should be calculated from the equations in EPA (1993) using the specific body weights selected for inclusion in the calculations. Also, when calculating the expected exposure (dose), a larger body weight results in a smaller ratio of ingestion rate to body weight resulting in a lower exposure. In other words, a 0.35 kg ground squirrel (with an ingestion rate to body weight ratio of .083) would experience a higher exposure than a 0.75 kg ground squirrel (with an ingestion rate to body weight ratio of .072). To make the analysis as conservative as possible, all body weights used in the analyses should be selected from the lower end of the body weight distribution.

Choices of parameter values for other parameters used in the exposure calculation are questionable. These include:

1. The Site Use Factor (SUF) for the red fox is set at 40% based on the amount of habitat available and the reported home range. However, the habitat available is the only habitat in the vicinity, the rest of the area nearby is industrial or residential. Consequently, opportunities for foraging would be limited and any red foxes present on the site could be expected to obtain all of their food from the site. The SUF should be set at 1.0. In fact, all SUF values should be set at 1.0 to insure the most conservative approach.
2. Body masses for all receptors should be set at the lower limit of the range indicated in the literature used. For example, body mass for the California ground

squirrel is set at 730 grams. This is at the far upper edge of the range for this species. Parameter values used for the Draft OU-2 ERA developed by PRC Environmental Management Inc. indicated a range of body mass of 400g to 750g, with a mean of 600g. There should be some consistency with the exposure scenarios used in all ERA documents for the same general location. Based on the comments above, the body weight should be set to 400g.

### *Comparison of COPEC Soil Concentrations to Plant ESLs*

Screening of the upper 95% UCL of soil COPEC concentrations on the site was performed against plant ecological reference values (ERVs) from both the Oak Ridge National Laboratory and the Los Alamos National Laboratory to offset the extreme conservatism built into the screening values. At this point in the analysis, extreme conservatism should be maintained, not circumvented. Making the analyte pass both screening tests is not appropriate and results in the elimination of seven inorganic constituents, antimony, beryllium, cobalt, manganese, mercury, selenium, and thallium. In each of these cases, the Exposure Point Concentration for at least one of the three sites exceeds the plant ERVs for one set of criteria. In fact, these two different sets of screening criteria often give vastly different values for the same constituent, and may differ from each other by two orders of magnitude (Table 7-19). For this analysis, the most conservative of the two values should be used rather than the least conservative of the two values. Additionally, there is a statement that a visual inspection of the site revealed no evidence of impacts to plants. Such an inspection is insufficient to understand the potential effects of contaminants on plants and should not be used as a criterion in the analysis. However, the Weight of Evidence analysis does indicate that for the West Beach Landfill area, there is potential for significant risk to plants.

### *Bioassay Results*

Results of the *Eohaustorius estuarius* bioassays are reported as indicating that there is the potential for sediment toxicity in areas immediately offshore of Alameda Point, and specifically, immediately offshore of the landfill. Based on the results of the bioassay, this conclusion is justified.

### *Plant and Animal Tissue Comparisons*

During a predictive ERA, tissue samples are typically not collected or used in the analyses. Tissue sampling is more appropriately performed during confirmatory analyses after the predictive ERA indicates the potential for significant ecological risk. Also, collection of tissue is generally performed to confirm predictions from a food chain model concerning the amount of exposure experienced by the receptor. There are four issues involved in evaluating the importance of tissue data to the analysis.

1. Are the species collected representative of the potential species involved in the food chain transfer of contaminants?
2. Are the collections done in a scientifically valid manner?
3. Are the statistical tests performed done properly and is the power sufficient to detect a difference between the sample and the reference sites?
4. Are the results interpreted properly?

These four questions are critical to the calculation of the hazard quotients as the concentrations of several analytes in the tissues are used as exposure point concentrations rather than modeling the food chain transfer of contaminants by an equation similar to Equation 7-1.

1. It is unclear if the species used (*Mus* and *Rattus*) are appropriate to base the calculation of exposure point concentrations. Certainly, capturing *Mus* and *Rattus* on site indicates that they are available as potential food items. However it is not clear, and no explanation is provided, for why *Mus* would be a suitable surrogate for California ground squirrels or all mammalian prey items. Until sufficient justification is provided, it is recommended that the tissue concentrations from *Mus* not be used as the baseline concentration for inclusion in the trophic transfer model. Sufficient justification could include (but would not be limited to) finding of *Mus* remains in fecal material of mammals or pellets of raptors, or observations of receptors such as fox or raptors feeding on *Mus* or *Rattus*.

2. No documentation is provided as to how the animals were collected, processed, and analyzed. Because of the potential for capturing salt marsh harvest mice, it is assumed that the trapping was conducted with live traps. How long were animals kept in the traps after capture, how were they sacrificed, and how were they preserved until analysis? It is unknown if animals were analyzed as whole carcasses or were they skinned prior to analysis? If whole carcasses were used, were animals washed or wiped clean of soil particles? Were specific target organs analyzed rather than whole carcasses? How were the samples processed, and what were the extraction methods for the organics? The answers to these questions could have major impacts on the results of the analyses. Until the protocols are made available, perhaps in a technical memorandum, it is recommended that tissue concentrations not be used.

3. The same statistical tests were used to determine the differences between the concentration of contaminants in mice from the site and reference areas as were used to determine the differences in concentration of contaminants in media and reference sites. Considerable documentation of the statistical methodology is provided, but discussions of outliers and of the power of the tests are lacking. These need to be included in the discussion of these data and results.

4. The interpretation of the results of the entire animal tissue analysis are suspect because of the lack of documentation about all aspects of tissue sampling, the lack of discussion of the power of the statistical tests, and the lack of documentation for using Mus tissue as

a surrogate for all mammalian prey in the trophic transfer analyses. It is recommended that the trophic transfer model be parameterized using standard soils and surface water concentrations and appropriate trophic transfer factors (PUFs and BAFs).

### *Food Chain Dose Calculations and TRV Comparisons*

This section of the ERA combines the estimates of exposure with the Navy Toxicity Reference Values (TRVs) to characterize the potential for significant risk to the receptors. This characterization is accomplished simply by examining the ratio of the expected exposure to the Toxicity Reference Value. This ratio is called the Hazard Quotient (HQ). HQ values greater than one indicate that the expected exposure is greater than the "safe" exposure level and therefore there may be a problem for the ecological receptors. Conversely, HQ values less than one indicate that the exposure to the chemicals at the site is lower than that considered safe, and therefore there is probably no problem for the ecological receptors.

Once again, the primary goal of this exercise is to be as conservative as possible to insure that any potential problem does not slip through the analysis. However, the Navy used several assumptions, model specifications and parameter values that result in the lowest probability of exposure and hence the lowest risk. These include:

1. High body weights for each receptor
2. Ingestion rates that are not calculated for each receptor
3. Incorrect assumptions of home range use by red fox
4. Improper use of tissue concentrations in various taxa as the exposure point concentrations used in the model
5. Defining all bioaccumulation factors to be equal to one

All of these factors combine to make estimates of HQ values very unlikely to exceed 1.0. Consequently, the characterization of risk is not as conservative as it could be.

Two TRVs are used in the calculation of the HQ, the recommended low TRV and the recommended high TRV. The low TRV is selected to be conservative in the estimation of risk, while the high TRV is less conservative. Despite the fact that nonconservative assumptions were used in the analysis, there is at least one $HQ_{low}$ value greater than one for every receptor for which potential ecological risk is evaluated. These results indicate that there is a potential for significant ecological risk present on the site (see below under Interpretation of Lines of Evidence).

We recalculated HQs for six constituents for every receptor (cadmium, lead, mercury, zinc, dieldrin, and Aroclor) to determine if more conservative assumptions and parameterization would result in differences in the number of HQs above 1.0. In general, recalculated HQs were similar to the Navy HQs for the species that are considered herbivores, the California ground squirrel and the herbivore mallard. For the red fox, recalculated HQ values are somewhat larger than those calculated by the Navy, although no $HQ_{high}$ values exceed 1.0. For those species with a substantial portion of the diet consisting of invertebrates, there is at least an order of magnitude difference between the Navy HQ values and those recalculated using more conservative parameter values. In almost every case all low TRVs exceeded 1.0, and a large number of the high HQs exceeded 1.0 (Table 2).

Table 2. Results of recalculation of the $HQ_{high}$ values for receptors for which invertebrates constitute a substantial portion of their diet. A yes value in the table indicates that the recalculation resulted in a HQhigh greater than 1.0. Recalculations were performed only for these six constituents. The differences between parameter values used in the Navy analysis and the analysis presented below are lower body weights, ingestion rates calculated using equations presented in EPA (1993), and the bioaccumulation factors (BAFs) for the invertebrate portion of the diet taken from Table 1 above.

| Receptor | Cadmium | Lead | Mercury | Zinc | Dieldrin | Aroclor |
|---|---|---|---|---|---|---|
| | | | | | | |
| Mallard (invertebrate-carnivore model) | yes | yes | yes | yes | no | yes |
| Mallard (omnivore model) | yes | yes | yes | yes | no | no |
| Song sparrow (omnivore model) | yes | yes | yes | yes | no | yes |
| Raccoon | yes | no | no | no | no | yes |
| Great blue heron | yes | yes | yes | yes | no | yes |

### ***Interpretation of Lines of Evidence***

The conclusions about ecological risk are based on a qualitative Weight of Evidence (WOE) analysis. This analysis involves listing all of the lines of evidence relevant to the decision process, qualitatively evaluating the risk finding for each line of evidence, and generating a rationale for the finding. Two separate sites undergo this WOE exercise, the West Beach Landfill and the West Beach Landfill Wetland. For the West Beach Landfill, eight separate lines of evidence are evaluated (Table 7-34). Two of the eight lines of evidence are found to indicate potential risk, the concentration of soil contaminants compared to plant screening levels, and the comparison of site tissue concentrations relative to reference site tissue concentrations. The remaining six lines of evidence all involve the results of the HQ calculations. In all instances, $HQ_{low}$ values exceeding 1.0 for some metals and no $HQ_{high}$ values exceed 1.0. These results are judged to be an equivocal finding. For the West Beach Landfill Wetland (Table 7-35) six lines of evidence are evaluated. *Eohaustorius* sediment bioassays indicate potential for ecological risk, while the *Neanthes* sediment bioassays result in a negative risk finding. The four food chain models again provide equivocal results based on the same criteria as for the West Beach Landfill. The conclusion drawn from these analyses by the Navy are that the majority of the lines of evidence for both the wetland and the landfill are equivocal, and therefore the sites do not potentially pose a significant ecological risk to the receptors.

A WOE approach is a valid approach when disparate lines of evidence are available for evaluation of risk. The validity of the conclusions based on the WOE approach are determined by the appropriateness of the lines of evidence used, the interpretation of those lines of evidence to arrive at a risk finding, and how those individual findings are combined into an overall finding of risk or safety.

Essentially all of the information generated in the ERA is used in the WOE analysis. Disregarding for the moment that some of the analyses should be redone to develop a more conservative overall approach, almost all sampling data are used in the WOE analysis. In fact, data not traditionally used in predictive stage terrestrial ecological risk assessments are used for this analysis (i.e., sediment bioassays). Consequently, the lines of evidence are appropriate.

The rationale used in the interpretation of the lines of evidence is completely lacking, particularly for the equivocal risk finding for the food chain models. Exceeding 1.0 for $HQ_{low}$ for some metals and not exceeding 1.0 for $HQ_{high}$ is interpreted as an equivocal finding. No justification for this conclusion is provided. No indication is provided of what would be required for a positive or negative risk finding. As it stands, the risk findings are completely arbitrary and of no use in understanding the potential ecological risk that the sites may pose.

There is no indication of how the individual lines of evidence were combined into a conclusion as to the potential risk posed by the site. Two positive and six equivocal risk findings lead to the conclusion that no potential risk is present at the west beach landfill. It appears that the equivocal findings are interpreted as no risk rather than as an item that has no information content. The definition of an equivocal finding is that it could be interpreted in either way. At the very least, the equivocal findings should not be a factor in the generation of conclusions, leaving the two positive findings as the only valid lines of evidence. To be conservative, the equivocal risk findings should be interpreted as indicating the potential for significant risk. The same is true for the West Beach Landfill Wetland. As explained above, there should be a rationale provided for the method used in summing up the different lines of evidence as well as a justification for the rationale. Given the current state of the decision process, there is no reason to assume that the conclusions are valid. In fact, it appears that the present findings are completely subjective and arbitrary. **Therefore, given the current state of the analysis, the conclusions of the Navy that the sites do not potentially pose an ecological risk are not justified.**

If a reanalysis of the food chain transfer modeling is conducted, the $HQ_{high}$ values for several receptors and several additional constituents would exceed 1.0 leading one to believe that the risk findings in Tables 7-34 and 7-35 (middle column) would become positive rather than equivocal. Under these conditions, the conclusions that these sites do not potentially pose an ecological risk are not justified.

### *Uncertainty of the ERA*

This section explains where within the ERA analysis there are uncertainties in the process. Large numbers of uncertainties are introduced and discussed. Often, the discussion of the uncertainties leads to the conclusion that the analysis is more conservative than necessary. This then leads to the conclusion that the sites pose no potential risk. The major uncertainties include:

1. Toxicity information used in the analyses is based on laboratory-raised individuals who are more likely to show the effects of a contaminant than are wild-reared populations.
2. The assumptions of the trophic transfer models are overly conservative leading to an overestimation of risk.
3. Ecological Toxicity Reference Values are overly conservative leading to an overestimation of the risk.

IR-2 specific uncertainties are discussed and are an expansion of the uncertainties listed above. These also lead the Navy to the conclusion that there is no real potential for ecological risk to the receptors. Those few instances where the food chain model provided HQs larger than 1.0 are explained away and the conclusion of no risk is implicitly supported.

The Navy seems to miss the point of the uncertainty analysis. It should not be an exercise that focuses on the overly conservative aspects of the ERA. Instead, it should discuss the aspects of the project that lead one to question the outcome of the analysis, with perhaps a qualitative assessment of whether the conclusions would change.

## Identification of Risk Drivers

The identification of the risk drivers is somewhat difficult to follow, but the key drivers are provided in Table 7-37. These risk drivers are based on the current analysis and would be expected to expand if the analysis was redone to make the parameter values used more conservative.

## Conclusions of the ERA

The conclusion provided by the Navy is that the baseline ERA supports a recommendation of No Further Action. Four supporting reasons are provided:

1. **Results of most lines of evidence are equivocal and not suggestive of high risk.** As discussed above, this conclusion is completely arbitrary and it is equally arguable that the lines of evidence more than support the conclusion that the sites pose a significant ecological risk.

2. **Food chain exposures exceeded only low TRV values; no high TRVs were exceeded.** As discussed above, these results are the result of careful selection by the Navy of the parameter values used in the exposure analysis, and the use of the animal tissue concentrations instead of using a full modeling approach. If one selects or generates different parameter values for use in the food chain exposure model, high TRVs are exceeded leading one to believe that the risk finding would be positive rather than equivocal.
3. **The risk drivers responsible for the ambiguity of the results are distributed site-wide and do not appear to originate from a discrete source.** It is not clear why this line of evidence is important or even relevant to the discussion. The implicit message is that cleaning the contamination would involve removing significant amounts of soil from the entire site as opposed to being able to remediate one or a few hot spots. However, the decision of how to deal with the contamination is a risk management issue, not an assessment issue. The fact that cleaning the site would be difficult or expensive does not alter the fact that the site poses a potentially significant ecological risk to the receptors. Also, there are some statements in the document that there are a few locations with higher concentrations of some constituents indicating that perhaps remediation of a few sites might be possible.
4. **A valued ecosystem is currently in place at IR Site-2 with no evidence that constituents impact the site.** The conclusion of no impact is not supported by the analyses performed by the Navy. In fact, it is perfectly reasonable to take the same lines of evidence that provided equivocal risk findings and generate positive risk findings. If the changes recommended in the analysis are implemented, the risk findings certainly become positive. Also, the current community is not an issue in this analysis other than being exposed to significant contamination. Once again, the implicit message is that the current community should lead to the conclusion that the site is not impacted. And once again, this is a risk management issue and should not be part of the criteria considered during the risk assessment. The area potentially poses a significant ecological risk, and the fact that endangered species may occupy the area does not change that fact.

The conclusions of the Navy's baseline ERA are not justified. It is recommended that the document be rewritten using the changes and additions suggested in this review. It is also recommended that the risk management aspects currently interjected into the analysis be removed. Once a clear understanding of the risk is developed these factors can and should be introduced to the discussion.

## Specific Recommendations

It is recommended that:

- The ERA document be revised to reflect the suggestions presented in the reviews provided by the Golden Gate Audubon Society. These include:
    - Soil sampling is insufficient to adequately characterize the ecological risk
    - Data quality objectives for the analyses should be more explicit

- Food chain modeling of exposure should be redone using conservative parameter estimates
  - Lines of evidence in the risk analysis should be interpreted conservatively
- The site should be moved to the next phase of the Ecological Risk Assessment process. This next step would be a validation study (or set of studies) to confirm the potential ecological risk presented by contaminants located at the site.
- A formal analysis of the Data Gaps should be provided. These gaps most noticeably include:
  - soil sampling on a finer geographic scale across the site
  - soil sampling from 6 inches to 2 feet in depth
  - sampling of the media across different seasons
  - tissue concentrations from appropriate organisms
  - explanation of the fate and transport of the chemicals in the landfill

## Literature Cited

U. S. Navy. 1998. Development of Toxicity Reference Values for Conducting Ecological Risk Assessments at Naval Facilities in California. Interim Final Technical Memorandum

U.S. EPA. 1996. Soil Screening Guidance: Technical Background Document. Office of Solid Waste and Emergency Response, EPA/540/r-95/128

U.S. EPA. 1993. Wildlife Exposure Factors Handbook. U.S. Environmental Protection Agency Report EPA/600/R-93/187a, Washington D.C.

February 27, 2001

Arthur Feinstein
Executive Director
Golden Gate Audubon Society
2530 San Pablo Avenue, Suite G
Berkeley, CA 94702

Following are general and specific comments on IR Site 2 at Alameda Point. Comments are based on an extensive review of the below document, and on review of additional documents located in the library at Alameda Point. The document reviewed is as follows:

- IR Site 2. Remedial Investigation Report: Alameda Point. Alameda Point, Alameda, California. Prepared for Southwest Division Naval Facilities Engineering Command. San Diego, CA. 4 December 2000.

**General Comments:**

The Remedial Investigation (RI) report of the IR Site 2 is a large document that summarizes considerable amounts of information collected over the last several years (1991-1998). Unfortunately, the document is very difficult to review in that data are tabulated such that it is difficult to track changes; maps, tables, and other information are referred to in appendices, but are not provided; pages and figures are missing from the core of the document; colored symbols are used that are not reproduced in the document requiring computer review of the CD version; assumptions are made without reference to the justification and discrepancies in the presentation of the data. For example, Figure B-146 on page B223 is a plot of motor oil range organics in surface soil and sediments. The units should be mg/kg, not ug/kg. The figure shows 16 data points, yet the tables show that there were 31 detects. Due to the data organization, it is difficult to find out what data are not plotted.

Several concerns have been raised during the document review. These are summarized below.

**Locations of contaminants of potential concern (COPCs) on site.** The RI provides a written description of the site; this includes assumptions of where various chemicals and wastes were disposed of. No attempt is made to use this information, along with the analytical data reviewed, to develop a site map showing the locations of COPCs. This information is critical for assessing potential human health and ecological risk impacts.

Of great concern is the lack of soil/sediment data with depth. Surface and subsurface sampling of soil were completed in 1990-1991 and in 1994-1995. All **subsurface** samples were collected from depths greater than two (2) feet deep. The document describes the **surface** samples as those collected in the upper two (2) feet of the site. Figure 3-1 and Table 3-2, however, show that all surface samples were collected between zero (0) feet and 0.5 feet of depth (*i.e.,* the top 6 inches of soil). No surface samples were collected from anywhere in the wetland, interior margin or landfill areas of IR Site 2 between 0.5 to 2.0 feet. This is the range of depth where, according to Drs. Hunt, Udell and Sitar of UC Berkeley, the maximum concentrations of COPCs are likely to be found (Alameda Library # 1627). Several samples between 0.5 and 2 feet deep were collected from soil borings during the geotechnical investigations from the coastal margin area (Figure 3-2). Those borings collected below 0.5 feet were measured ONLY for total organic carbon or radionuclides. The importance of this information is that the maximum numbers (or the amount based on a 95% confidence level) are used in the human health and ecological risk assessment analyses. An underestimate of the soil concentrations could result in an underestimate of the impact to human health and the environment.

**Ambient or background data.** It is unclear where the background or ambient samples for soil and sediments were collected. A written description indicates the location was to the north and east of the site. An analysis of the background data indicates that the location of sampling was likely contaminated. Numerous COPCs were above the ecological and human health reference levels (Appendix B). For many compounds, no ambient data were available in that they were not tested for (particularly true for the organics). In many cases, the median ambient concentrations of inorganic and organic COPCs exceeded the ambient concentrations in the landfill. This is a critical point in that the way a COPC was either retained for further evaluation or discarded was a function of whether or not there was a statistically significant difference between the concentration at the IR Site 2 and the background or ambient concentration.

In the assessment of chemical levels in tissues of biota, plants and animals were collected from a "reference area" and the data were compared to that for plants and animals collected from the IR Site 2. The reference area, however, was located North of the IR Site 2 from several locations along runways in IR Site 1; this site was also used as a disposal site for wastes. Runoff from this area is attributed later in the document as potentially responsible for the elevated levels of COPCs in the NorthWest corner of IR Site 2 (MO-24).

Although there is some reference to the ambient data set, as stated above, the report does not include any of the raw data provided by PRC Environmental Management in their 1997 report to the Department of the Navy. Also missing from the PRC report is the site map depicting the various ambient data sample locations. Specifics relative to the ambient data set follow where text shown in italics are quotes from the IR Site 2 RI Report Alameda Point text.

Page 4-3 – Paragraph 2: "*The ambient data set used for comparison purposes was comprised of 52 sample locations identified by PRC Environmental Management, Inc. in 1997 to be representative of ambient conditions in the western portion of Alameda Point*".

Appendix B – Attachment A – Page 5 of 8 – Paragraph 4: "*Some samples collected as part of the IRP investigation could be used as background samples for the three areas.* ***Use of this data would avoid costly delays associated with additional sampling*** *and so was considered the most efficient method for developing a background data set. The RI database was reviewed on a sample-by-sample basis to select samples that could represent background. First, for each area, all samples collected from IRP sites that could contain metal contamination based on site history (Sites 4 and 5) were excluded as background samples. Also excluded from consideration were areas of suspected PAH contamination, specifically, the landfill and burn pit areas of Site 1.*"

Appendix B – Attachment A – Page 5 of 8 – Paragraph 5: "*Samples from borings that contained non-PAH organic chemicals…were excluded from consideration.*"

Appendix B – Attachment A – Page 5 of 8 – Paragraph 6: "*Samples located within IRP sites were excluded as well.*"

Page 4-37 – Paragraph 3: "*PAHs are the only organics for which ambient data were collected. However, the detection rates for the PAHs in the ambient data set were not sufficient to perform distribution shift tests. Because the detection limits in the ambient data set were elevated relative to detected concentrations and detection limits in the site data,* ***no conclusions were drawn with regard to the relationship between ambient and site data for organic constituents***."

**Problems with detection limits.** Detection limits changed widely, and often were set above ecological and human health screening levels. Often, non-detect results are a result of changing detection limits, and not decreases in COPC concentration. A major concern about this is that high detection limits result in a non-detect result for COPCs that are relatively low in concentration, yet still above a screening level. Again, detection limits are often set higher than the ecological and/or human health screening levels. For example, samples up to 4 times higher than the ecological screening level for mercury would be tabulated as a non detect due to the use of high detection limits.

**Exposure point concentrations (EPCs).** The maximum contaminant value is the recommended value to use as an EPC according to CalEPA (1994). **When site characterization is adequate, and on approval of the CalEPA**, the 95 percent upper confidence limit of the arithmetic mean can be used as the EPC. Review of this RI for IR Site 2 indicates that the site has not been adequately characterized, and that the health risk assessment and ecological assessments should be repeated using maximum values measured for a conservative measure of risk.

**Unsubstantiated statements and/or assumptions.** Throughout the document statements are made that are not based on data or fact but rather are an interpretation or assumption. Other interpretations exist but are not provided. The use of less definitive terminology in these circumstances is requested. Such statements and assumptions are pointed out in the specific comments section. Examples include:

Data used to determine the direction of flow within the site are based on a hydrologic study completed during El Nino, an extremely wet period. Sampling dates were described as wet and dry periods, yet the dry date was in March 1999 when the cumulative rainfall plot shows an exponential increase. Later the report designates this time period as non-storm related *i.e.,* it was not raining at the time of sampling.

In the human health risk calculations, numerous assumptions are made (*e.g.*, exposure frequency, duration and body weight) that are not considered conservative. For example, the occupational RME for noncarcinogens is set at 12 days per year and for 2 hours per day. It is also assumed that children will be on site for only 12 days per year and for 2 hours per day. This is not a very conservative estimate. In addition, several parameters used in the human health risk assessment differ from those recommended by the USEPA including skin surface areas available for contact, exposure frequency and duration, soil to skin adherence factors, and inhalation rate. In general, use of USEPA values results in a more conservative number.

**Lack of data or confusing presentation.** Numerous site characterization data were not collected or evaluated for numerous reasons. Data not tested for, evaluated, considered or assessed include the following:

1. The deep aquifer is not considered in this report. No testing was completed.
2. Subsurface sediment samples were not collected from the wetland areas.
3. Only the PAHs organics were collected in soils for the ambient data locations (page 4-37). This means that PCB and pesticide data along with the radionuclide data are not available for the ambient site, which is potentially contaminated with organic COPCs. Detection rates for the PAHs were low due to high detection limits. As a result, the relationship between ambient and IR Site 2 organics was not discussed or evaluated! The report concludes that there is not enough evidence to establish a pattern of contamination. Later the statement is made that the "frequency of detection for organic chemicals in the ambient soil data set obtained for this assessment was inadequate to permit quantitative comparisons with site soil data." (page 6-3). This statement implies that the data were collected; when in fact, only PAH samples were collected. This lack of information is later used to state that there is no evidence of contamination.
4. Bioaccumulation tests for the wetland areas used sediments collected from locations outside of the wetlands.
5. The lack of sufficient tissue data and the mixing of species in analysis resulted in there not being enough data to complete a **quantitative** analysis of COPC uptake or bioaccumulation.

6. The text indicates that bioaccumulation tests using the sea urchin *Stronglocentrotus purpuratus* would be completed (page 3-72). No data are provided.

7. Various transport pathways and release mechanisms that may explain the fate and transport of COPCs are not considered in the site conceptual model due to the lack of "relevant data" or the fact that "existing data are generally inadequate to determine which release mechanisms and pathways are the most significant…". of suspension of soil particles and gaseous dispersion were not collected.

8. Analytes with less than 50 percent detection in either the ambient or IR Site 2 data set were not compared statistically and were dropped from the statistical analysis program. In fact, these COPCs were dropped from any further consideration. Often, the reason that analytes were detected fewer than 50 percent of the time was an artifact of very high detection limits. Detection limits changed widely, and often were set above ecological and human health screening levels. Rather than eliminating the COPCs, the analytical protocol should have been clearly defined and adhered to from the beginning of the site characterization.

9. Data are often tabulated using one set of units, then discussed using a different set. Use of detection rates and percent detection is an example. Percent survival data are provide in Table 4-27, but the text discusses mortality. While it is not difficult to convert from on to the other, it does require careful and critical review and reading. Other confusing inconsistencies exist throughout the document.

10. The following table shows inorganic analytes with very low sample frequency:

| location | analyte | # detects | # samples | Range µg/kg |
|---|---|---|---|---|
| Inorganic data - coastal margin surface soil | Mo | 0 | 2 | 0 |
| Inorganic data - coastal margin surface soil | Ti | 1 | 1 | 470 |
| Inorganic data - coastal margin subsurface soil | Ti | 2 | 2 | 410-610 |
| Inorganic data - coastal margin subsurface soil | U/Mo | | 0 | |
| Inorganic data - landfill surface soil | Mo | 1 | 6 | 7.4 |
| Inorganic data - landfill surface soil | Ti | 3 | 3 | 410-513 |
| Inorganic data - landfill surface soil | Tot Uranium | 1 | 3 | 0.3 |
| Inorganic data - landfill subsurface soil | Ti | 9 | 9 | 440-878 |
| Inorganic data - Wetland surface soil | Ti/U/Mo | | 0 | |
| Inorganic data - Wetland sediment | Mo | 6 | 6 | 0.65-4.4 |
| Inorganic data - Wetland sediment | Ti/U | | 0 | |

11. Page 4-10 – Paragraph 1: "*Only constituents with sufficient detection rates in both ambient and site data sets are shown.*"

12. Page 4-63 – Paragraph 4: Groundwater analysis. "*In summary, no depth trend is evident for most analytes. Because the data sets are too small to allow a formal statistical trend analysis, conclusions were based on qualitative assessments.*"

13. The units on Figure B-146 – Page B-223 are incorrect. The units should be mg/kg not μg/kg. Also, only 17 of the 31 motor oil range organics are shown.

14. Page 4-38 – Arsenic: "*No depth samples were taken in the wetland area, so it is unknown if this pattern is consistent across IR Site 2.*"

15. Page 6-7 – Paragraph 4: Exposure Point Concentration calculations. "*If the data did not fit one of these continuous statistical distributions, a 95UCL was calculated using a bootstrap approximation of the UCL.*"

**Filtered vs. unfiltered water data analysis**. Most of the historical data are for filtered samples; concentration probability distributions are almost always based on filtered water quality data. Exposures at the site, however, are likely to be to unfiltered water (ground, surface and pore). The text of the report (Page 4-40 - Paragraph 5) states that all the 1991 surface and pore water data were filtered. "*Although all of the 1991 data result from filtered samples, in general, the concentration ranges cover those from other years, when either unfiltered or a combination of filtered and unfiltered analyses were performed.* "

The 1991 data comprise the majority of data samples collected. While **generally**, the values fall within the range of unfiltered analyses, a review of the tabulated data show much higher levels for unfiltered samples for parameters that tend to sorb to colloidal and particulate matter (*e.g.*, organics, metals). The use of filtered data will result in the underestimation of the average of the values for a given parameter. What is important about this is that the average (and 95% confidence based on the average) of all data were used in the human and ecological risk assessments. The following tables in Section 4 list whether the samples are filtered or unfiltered in the left-hand column:

Table 4-14. Summary Statistics for Surface Water Data, North Pond
Table 4-15. Summary Statistics for Surface Water Data, South Pond
Table 4-16. Summary Statistics for Groundwater Data, Coastal Margin
Table 4-17. Summary Statistics for Groundwater Data, Landfill

**Specific Comments:**

Specific comments provided are arranged in by page and paragraph. When section numbers are provided, the paragraph listed is that under the section title.

**Page No.** **Comment**

ES-2 Paragraph 2. The statistical analyses were not among the various site components as stated, but rather were between the ambient and each separate component.

ES-2 Paragraph 3. The summary of cancer risks and chemical hazards are calculated using assumptions determined by the contractors that are not necessarily conservative.

ES-2 How do the soil screening levels and the sediment and water benchmarks developed for the ecological and health risk assessments by Los Alamos and Oak Ridge National Laboratories compare to those established by the USEPA?

ES-3 Last Paragraph. The conclusions are premature, and based on an inadequate site characterization and non-conservative risk assessment.

1-1 Paragraph 3. While the limitations of CERCLA/SARA with respect to naturally occurring petroleum, crude oil, natural gas and synthetic gas do exist, the emphasis is on naturally occurring products. Addressing the site contamination by these COPCs is necessary for site remediation, and prior to early transfer.

2-1 Paragraph 3. Plate 2A is referred to but is missing from the document.

2-6 Paragraph 2. Plates 3 and 4 are referred to but are missing from the document.

2-7 Paragraph 2. Plates 5 through 8 are referred to but are missing from the document.

2-10 Last Paragraph. The unlined pits for waste oils described in this paragraph are not further addressed in the document. The pits were not located, and the areas where the pits were thought to be located were not analyzed for petroleum based contaminants (TOC, VOC, TPH, and TRPH) or 1 sample was collected.

2-22 The deep aquifer underlying the site is assumed to be isolated and was not sampled or discussed in this report.

2-23 The changes in magnitude and direction of flow of water (and associated chemicals) on a seasonal basis that occurs between the upper and lower intervals within the first and second water bearing zones (FWBZ and SCWZ, respectively) is of concern. These changes in magnitude and direction could result in fluctuating levels of contaminants, contingent on precipitation, run-on, and evapotranspiration at the site. Discussion of chemical data in Chapters 4-6 with respect to this issue is very limited.

2-24 The conceptual hydrologic model in section 2.3.1.4.2 is based on limited data collected during 1997-1998 during El Nino weather events. The application of the data is limited to similar conditions per Appendix D, yet the data are used to generalize flow patterns at the site. Reversals of the patterns described may occur as previously stated.

2-41 Paragraph 3. Penetration into the zone of soil contamination could also be a result of human activities *e.g.,* bike-riding tracks, children digging.

2-41 Paragraph 4. Last sentence. Add ….how much plant-borne material enters into the soil, the air, or into the food chain.

2-43 Section 2.3.4.3 Paragraph 2. Discussion of the importance of the organic carbon content of the sediments relative to cover soils, and the adsorption of hydrophobic organics and other COPCs to these sediments is provided. No sediment samples, however, were collected from the wetland or pond areas to substantiate the discussion.

3-2 Paragraph 1. The first sentence is misleading. Surface soil samples were all collected in the upper 6 inches of the soil. Extrapolation of the data to "determine if chemicals were present, and, if so, to delineate the lateral extent of chemicals in the upper 2 ft (60 cm) of soil" is NOT ACCEPTABLE. Note that limited total organic carbon data (TOC) were collected (none in 1991).

3-3 Figure 3-1. The plotting of all the surface water, sediment, and surface soil locations measured from 1991-1998 make it very difficult to locate sites, evaluate placement and get a sense of the monitoring strategy.

3-16 Paragraph 3. Large data gaps exist. In 1994, only one surface soil sample (SS2-5) was collected from the wetland area (between the two ponds, not in the wetland area to the southwest of the ponds); the sample was analyzed for percent moisture and total petroleum hydrocarbons only (Table 3-2).

3-54 Section 3.1.3. Sediment samples of the ponds and wetlands were restricted to the upper 6 inches of soil (Table 3-2 and 3-5). Parameters monitored in the wetlands changed from year to year (Table 3-5) resulting in data gaps. Data for the ponds were collected to assess the transfer of chemicals from the adjacent fill areas to the ponds via runoff, leaching, groundwater transport and airborne deposition. Two of the four locations sampled in the North pond were near the culvert and thus were impacted by tidal action (LW001 and LW002); the only sample in the South pond (LW013) was not located near any of the sites analyzed in 1991, making the goals of this sampling strategy unattainable as there is nothing to compare to.

3-63 Paragraph 1. The text does not reflect the information in Table 3-6, which shows both filtered and unfiltered samples collected on the March 3, 1998 "nonstorm" sampling event. Note that this sampling event followed El Nino storm conditions only one week earlier.

3-69 Paragraph 3. The biotic sample reference area location is questionable. This area is on IR Site 1, an area known to be contaminated with a large number of COPCs. The site was described as a dumping ground for various chemicals. Groundwater transport of chemicals from IR Site 1 has been used to explain the relatively high concentrations of COPCs in the NorthWest corner of IR Site 2.

3-69 Paragraph 3. The use of a single composite invertebrate reference value is of question.

3-72 Last Paragraph. It is stated that bioaccumulation studies using the clam (*Macoma nasuta*) and the sea-urchin (*Strongylocentrotus purpuratus*) were conducted. No mention of the results of the bioaccumulation studies with the sea-urchin are provided anywhere in the document. In addition, the referenced Figure is wrong. It should be Figure 3-4.

3-74 Table 3-12 and Figure 3-4. Table 3-12 shows that bioaccumulation analyses were on samples collected from areas W4, W5, W6, and W7. W7 is not located on Figure 3-4. Where is it? Note also that W4, W5, and W6 areas are NOT within the WBL wetland area designated in Figure 2-3.

3-74 Table 3-12 does not show any information on the sea-urchin tests.

4-1 Paragraph 2. The lack of sufficient and appropriate tissue data resulted in an inability to make **quantitative, not qualitative as stated,** comparisons.

4-2 Paragraph 2. Surface soil samples are misrepresented. Samples were measured in the uppermost 6 inches of soil below ground surface (bgs), yet are being used to characterize the upper 2 feet of soil bgs.

4-2 Paragraph 2. Due to the selection of inappropriate detection limits, the ability to determine differences in organic constituents between areas (coastal, landfill, margin and wetland) was lost.

4-2 Paragraph 4. The statement that the interior margin and landfill are not different from a risk assessment is out of place and is not validated by the data.

4-3 Paragraph 2. The document makes reference to the ambient data set collected by PRC but neglects to indicate where these sample locations are, to state when the ambient data were collected from them, and to provide a map showing the location of these samples. This is critical to the analysis of the site. Other reference locations outside of IR Site 2 were shown (*i.e.,* for tissue sampling).

4-3 Section 4.1.1. Paragraph 1. Tables 4-1 through 4-6 do not include the summary statistics for the interior margin.

4-3 Last Paragraph. The statement that the higher concentrations are generally associated with the northern pond when compared to the southern pond as evidenced by the box plots is confusing. The box plots do no differentiate between ponds, but rather show all the data as from the wetland. The statement also does not always hold true. In fact, the exact opposite statement could be made for some of the constituents.

Tables in Chapter 4. Numerous problems in data interpretation exist due to the large number of non-detect samples that are a direct result of changing and inappropriate detection limits. Throughout the tables, detection limits are set that exceed the ecological and/or human health screening levels used by the Department of Navy. The use of elevated detection limits results in an increase of non-detects that then affect the percentage of detectable samples. As stated throughout the document, when the number of detects is greater than 50%, the data for that constituent are eliminated from statistical analysis.

An example of the problem is with mercury. The ecological screening level is 0.05 mg/kg. The human health screening level is 6.1 mg/kg. The detection limits used for the landfill ranged from 0.054 to 0.21 mg/kg. This means that samples with concentrations less than 0.21 mg/kg will be listed as non-detect, even though the level exceeds the ecological screening level. This means that samples up to 4 times higher than the ecological screening level would be non-detect. This is of great concern in that mercury is known to bioaccumulate; there is a total maximum daily load (TMDL) being set by the RWQCB to protect San Francisco Bay. With selenium, out of 26 samples collected from the coastal margin subsurface soil, only one (0.55 mg/kg) was detected above the detection limit (range of 0.214 to 12 mg/kg). If a sample had a concentration less than 12, it would be considered non-detect; this means that a sample with 24 times more selenium than the ecological screening level of 0.5 mg/kg would be a non-detect sample.

Another problem with the detection limits is that they change for the various areas on the site. This can really exacerbate data analysis. Some of the detection limits are quite different. For example, selenium ranged between 0.214 and 12 mg/kg (Table 4-2) in the coastal margin subsurface soil; the range was 0.198 to 42 mg/kg for selenium in the landfill subsurface soils. This makes comparisons of data from the different areas also difficult, as the lack of difference may be a result of higher detection limits in one area relative to another. No information on the reference site data detection limits is provided in the document.

Detection limits are also often listed in tables, but analytical values lower than the detection limits are provided.

4-9 Last Paragraph. The ambient data do not indicate that the reference site was not contaminated by site COPCs per the guidance manuals provided by the State of California and the USEPA. "Background samples should be collected at or near the site but not in areas likely to be influenced by the contamination and/or facility operations (past or present)" according to CalEPA (1994). The statistical analysis of the ambient to site data described in pages 4-10 and 4-11 is flawed by the problems with non-detect samples indicated above. The lack of available data for organics, pesticides, radiological and other COPCs for comparisons of ambient to site data is additionally problematic.

4-11 Last Paragraph. The statement that the lack of non-detects for organics made further statistical analysis unnecessary is problematic. Once again, maximum detection limits for many of the organics are quite high, and often exceed the ecological and/or human health screening levels; Aroclor analytes have an ecological screening level of 50 ug/kg, yet the detection limit was set at 390 ug/kg (Table 4-9).

4-36 Paragraph 2. The human health and ecological risk drivers for organics were set at COPCs detected in greater than 5% of the samples. Once again, the problem of detection limits exists. For many of the organics, the detection limits ranged from 6.2 to 47 ug/kg (VOAs in Table 4-13). If only one of the 13 samples resulted in a detectable concentration, the percentage of detected samples would be almost 8%.

Acetone, which was found in 31% of the samples, is dismissed as a likely laboratory artifact. Acetone is also a common oxidation byproduct of larger organics.

4-37 Paragraph 2. The absence of subsurface soil samples in the wetland area for analysis of organics means the area, which is downgradient of the landfill, could be highly contaminated.

4-37 Paragraph 2. The statement is made that "LMW PAHs were not detected at all in the wetland surface soils". This is incorrect. Table 4-13 shows that 170 ug/kg of anthracene and between 140 and 230 ug/kg of phenanthrene were measured, representing 4 and 13 percent of the samples collected, respectively. Note that for these contaminants, the upper detection limit was set at 660 ug/kg, meaning that other samples may have been detected at lower detection limits.

4-37 Paragraph 3. The information in this paragraph only supports the statement that the ambient data set is not a true set of background samples, and that the analytical protocols employed at this site are severely flawed. To use detection limits at a reference site that are above the detection limits used at the contaminated site prevents data comparison. This error means that the cost of all the organic analyses for the sites and for the reference area are limited in application.

4-39 Section 4.1.3.2. Paragraph 1. The low detection of the Aroclors may again be an artifact of the high detection limit (up to 790 ug/kg).

4-39 Section 4.1.3.2. Last Paragraph. This statement has no basis. Just as there is no evidence that pesticides in the soil surface are the result of pesticides buried in the landfill, there is no evidence that the pesticides in the soil surface are not related to buried pesticides. Availability of pesticide soil data from a valid reference site would have helped address this issue.

4-40 Section 4.2. Paragraph 1. Figures B-220 through B-264 do not plot any of the unfiltered data collected.

4-40 Section 4.2. Paragraph 2. Discussion of filtered and unfiltered results for dissolved organics in surface and pore water are of little value if TOC levels are not also considered.

4-40 Section 4.2. Paragraph 3. Discussion on whether or not there is a time trend in the data is not possible due to the lack of data available over the seasons and over time that are comparable. The greatest data set is for 1991 using filtered samples. While the document does not provide any discussion of changes in analytical techniques, they are likely to have occurred, which makes data comparisons even more difficult.

4-40 Section 4.2. Paragraph 3. The conclusion of this paragraph-that maximum values tend to be in data from the north pond is incorrect. Elevated concentrations occur in the southern pond for arsenic, cadmium and acetone. In the northern pond, elevated concentrations of nickel, selenium, thallium, lindane, heptachlor epoxide, and 4,4'DDD, among others, occur. The statement that ranges and patterns are not sufficient to support the overall conclusion that the northern pond surface water concentrations are elevated compared to those in the southern pond is true, but for what reason is this expected. Different COPCs were deposited in different areas of the site. Numerous COPCs are higher in the southern pond than in the northern pond that the document never addresses, and should. In tables 4-14 and 4-15, the maximum nitrate nitrogen concentration in the northern pond was 0.331 mg/L. The maximum nitrate nitrogen concentration in the southern pond was 433 mg/L. This is a significant difference, and is likely a result of the differential distribution of contaminants at the site. Nitrate is highly soluble. Elevated concentrations of sulfate and motor range organics in the southern pond also exist. The elevated concentrations in the southern pond are of great concern and need to be addressed.

4-63 Paragraph 4. The lack of depth trend data due to a poorly developed monitoring plan resulted in the inability to provide a statistics based trend data analysis. Nonetheless, the conclusion that there is "no other evidence of a depth trend" is made based on "qualitative assessments" of the data. The qualitative assessment based conclusion is misguided and should be omitted in that the data can be interpreted either way. The statement that a depth trend may exist is just as likely one that states it does not.

4-63 Paragraph 4. The area that may be responsible for the elevated organic concentrations at M-024 is the location reference area used to tissue analyses, and potentially where the ambient data were collected.

4-97 Section 4.8 and Table 4-27. This section is poorly organized and the data are inadequately and incorrectly summarized. Percent survival is tabulated, yet the text discussed mortality. That the *Eohaustorius estuarius* mortality exceeded the Bay reference envelope UTL means it is greater than that value, but the UTL is in percent survival not mortality. The data for the two test organisms are presented in Table 4-27 using very different methods: *Eohaustorius* data are presented as % survival whereas *Neanthes arenaceodentata* data are presented as number of survival. The lack of data on the initial number of organisms in the test prevents calculations of the mean percent survival. The conclusion that *Neanthes* are not adversely impacted by wetland sediments is invalid, when the mean number that survived has a standard deviation equal to the mean. This means that 5 organisms, +/- 5 organisms, survived. In addition, the text refers to a growth difference in terms of percent of the UTL, but data are presented as mean organism weight.

Table 4-27 lists stations W1, W2, W3, W4, W5, W6, and W7 as located in the West Beach Landfill Wetland. On page 3-69, however, it is stated that only locations W2 and W6 are representative of wetland habitat. In addition, Table 4-27 provides data on the Runway Wetland. This area was not discussed in the discussion of tests performed (Section 3.2.5, page 3.72) nor is there any discussion of the results in this section, even though at station R3, the percent survival is less than the Bay reference envelope UTL.

There is no information available on when or where the control organisms were collected. No analysis of the growth data for the *Neanthes* was made; the intent of the experiment was to assess growth (page 3-72). A rough analysis of the data indicates that there was a 22% decrease in mean organism weight at W6 relative to the Control. At W5, the difference was 21% and at W4 it was 13%. What the Navy consultants consider significant is unknown as it is not provided or discussed. Note that areas of *Neanthes* weight loss are the locations where the mean % survival of the *Eohaustorius* was lower than the threshold limit. The statement that "*Neanthes* was not adversely impacted by wetland sediments" is unfounded.

4-98 Section 4.9. There is no reference to the bioaccumulation results for the sea-urchin (*Strongylocentrotus purpuratus*) which was tested according to page 3-72.

5-1 Paragraph 4. The decision to not address a fate and transport process due to a lack of data or to the complexity of the processes is a serious flaw and calls to question the conceptual site model as described in this report. The conceptual model may not address significant or active processes that may result in the contamination of the primary media due to inadequate data collection. That the "existing data are inadequate to determine which release mechanisms and pathways are the most significant in contributing chemicals to an environmental medium" indicates the need for better and more complete site characterization activities.

5-6 Paragraph 3. The presence of metals on the high ground between the ponds and along the lower ground adjacent to the ponds does not mean that the landfill is not the origin of high metal concentrations in the wetlands. Data to support this do not exist.

5-8 Paragraph 1. Recall that the direction and flow of water from the landfill area outwards was based on data collected during the El Nino storms of 1998. The data are applicable to the same conditions only. Statements in the text emphasize the potential for changes in direction and magnitude seasonally.

5-8 Paragraph 3. The presence of a hotspot in area M024 should not be used to negate all the other evidence of organic and inorganic chemical migration from the landfill based on numerous sites and data points. It is well stated in the report that M024 is likely affected by contaminants coming from IR Site 1 located to the North of IR Site 2.

5-9 Paragraph 3. The hypothesis that groundwater chemical concentrations should be higher in the downgradient first water bearing zone (FWBZ) than in the upgradient FWBZ if the landfill is the source of groundwater is validated by the data. Many of the contaminants in the water-bearing zones used to determine direction of flow adsorb to soil particles (Al, Sb, Cr, Cu, Pb, Mo, Vi, V) and are therefore not applicable to transport mechanisms in water. Of those that are soluble, (As, Ba, Fe, Mg, K, Na) most were higher in the downgradient FWBZ wells, supporting the hypothesis. Leaching of Cd, Cr, Pb, and Zn occur under specific conditions not addressed in this report.

5-10 Paragraph 2. Loss of organics and metals via volatilization should be addressed. The presence of gas vents around the landfill indicates gas loss. Data on the concentrations of the various COPCs and their degradation products should be incorporated into this report.

5-10 Paragraph 3. There are absolutely no data to support the statements that the West Beach landfill could be classified as a bioreactor and that conditions for waste biodegradation would have been optimal. For a bioreactor type of landfill, in addition to water, there needs to be an active microbial population. No data were collected to assess the presence and viability of bacteria at this site. Many of the chemicals disposed of are toxic to bacteria. In many cases involving hazardous materials, the abiotic and biotic transformations of contaminants can result in the formation of "new toxic compounds, some of which may be more toxic than the original" (Tchobanoglous, Theisen and Vigil, 1993). This is true for combustion reactions, for halogenated compounds, metals, and for the persistent organic compounds.

Last sentence. Chlorinated hydrocarbons and organics can have a half life of months to thousands of years. It is unlikely they would be biodegraded.

6-3 Top Paragraph. The statement that the frequency of detection of organics prevented quantitative analysis is misleading. The ambient data set was only tested for PAHs. No other organics were analyzed for.

6-3 Paragraph 3. The collection of samples from the site with 1 sample per 2/3 acres did occur, but the characterization of the site is flawed. The facts are that many contaminants were not assessed, a majority of the soil samples were limited to the top 6 inches collected in 1991, detection limits were questionable, and that the records of disposal indicates that localization of certain chemicals is highly likely.

6-4 Section 6.3.1. Paragraph 1. The possibility of chronic exposure being extremely slight is true if the exposure pathways addressed are agreeable. No assessment of gaseous dispersion of landfill gases from the vents surrounding the site was made.

6-4 Section 6.3.1. Paragraph 4. Exposure activities may differ between occupational and recreational uses. Bike riding, digging, planting and other activities may occur.

6-5 Paragraph 3. Risks associated with exposure to the wetland for researchers and workers needs to be addressed. Monitoring activities and maintenance in the wetland areas will be needed.

6-5 Paragraph 4. Hunting and fishing of the organisms that spend time on the refuge and then move off-site could occur.

6-5 Last Paragraph. Risk due to inhalation of VOCs and radon isotopes must be assessed. Vents, monitoring devices that are standard for landfills and analytical methods exist.

6-6 Table 6-1. Occupational receptors for the wetland sediment and water need to be revised to a primary exposure pathway.

6-6 Last Paragraph. Exposure point concentrations for the landfill and interior margin need to be calculated separately. According to Page 4-2, "if concentrations between the two areas appeared to belong to different populations (distributions), exposure point concentrations for the human health and ecological risk assessment would be calculated differently than if concentrations from the two areas appeared to originate from the same population". Page 4-2 then states that landfill concentrations were higher than interior margin concentrations. As a result, these areas were considered separately. Page 4-6 provides more data to support that the two areas are different. Exposure point concentrations (EPC) need to be determined. The human risk assessment should be redone without the pooling of data from the landfill with that from the interior margin. This will affect the data in Table 6-2.

6-7 Paragraph 1. Subsurface samples in the interior margin, the landfill and the wetland areas were not collected.

6-7 Paragraph 3. According to CalEPA (1994), the maximum contaminant value found should be used as the EPC. The 95% UCL of the arithmetic mean is used for data at sites with adequate characterization. This means that all analytes in Table 6-2 with a superscript of "b" (where b = a detect frequency exceeds 5% but there are insufficient samples to quantify risk) should be considered using the maximum value measured. These include chlorobenzene, ethylbenzene, molybdenum, titanium, and uranium.

6-8 Table 6-2 and Table 6-3. The last column should show >5% detect frequency not <5%. There are some errors in the table. Pyrene and Indeno(1,2,3-cd)pyrene in the landfill exposure area have a detection limit that is not less than 5% so the last column should read yes. Fluoranthene has a detection frequency of 19% and Indeno(1,2,3-cd)pyrene has a detection frequency of 8% and pyrene has a detection frequency of 42% for the coastal margin. The last column should be updated.

6-11 Table 6-4. EPC for the interior margin and the landfill need to be determined separately.

6-12 Table 6-4. There is some concern about the correctness of these data. For example, it is stated that dieldrin was not detected in any sample in the landfill exposure area and so an EPC was not determined. Review of Table 4-10 shows that dieldrin was detected in landfill surface soil samples. Note that interior margin data are not provided in Chapter 4.

6-12 Bottom and top of page 6-13. This is unclear. The text implies that the detection limit was divided by the square root of two, but then goes on to say the data do not justify this. What was done. In addition, lognormal distribution is assumed for very low detection limits. A review of the tables in Chapter 4 reveals that the detection limits changed considerably and covered a wide range of values.

6-13 Paragraph 2. According to CalEPA (1994), the maximum contaminant value found should be used as the EPC when data are available. Poor monitoring and data characterization does not negate the responsibility of completing a thorough and conservative risk assessment.

Sum The values determined for the exposure point concentrations are questioned.

6-14 Last Paragraph. NOTE: In making risk management decisions, it is the reasonable maximum exposure (RME) value that is used; the central tendency exposure (CTE) value helps assess the protectiveness of the RME.

6-16 Paragraph 2. When the reference concentration is converted to inhalation reference dose (RfD), the value can only be applied to adults in that the conversion was based on adult inhalation and adult body weight values.

6-19 Paragraph 3. When the inhalation unit risk values are converted to inhalation slope factors, the inhalation slope factor can only be applied to adults in that the conversion was based on adult inhalation and adult body weight values.

6-19 The goal of a risk assessment is to determine risk using a conservative approach. The risks associated with PAHs should have been determined using the CalEPA values. The information on overestimation could have then taken place in the Uncertainty Analysis section.

6-24 Section 6.5. Risk Characterization. Multiple issues exist about the assumptions used to calculate the intake values that are then used to determine the HI and ICLR summations in Table 6-9 and 6-10 for RME and CTE Occupational and Recreational exposures. The values provided in these tables are considered to be underestimates. These concerns are enumerated in comments on Appendix C.

6-25 Paragraph 1. The summation of the hazard quotient (HQ) calculated for each exposure route to determine a hazard index (HI) for a COPC at the site was done for each specific area in Table 6-9. The sums should also have been made by column to reflect the effect of the entire area on the receptors. To assess the exposure route of soil ingestion, for the RME Recreational, Child exposed to the landfill and coastal margin areas, the HI is equal to 0.06 + 0.06 = 0.12. Deleterious health effects are still not associated with these exposure routes. Changes in some of the "best engineering judgement" assumptions used in the calculations (*e.g.*, exposure frequency greater than 12 days per year and 2 hours per event) will result in an increase in the HI. All other HI sums are increased for all exposure pathways as well; no others are at or above 1.0 when using the calculation methods used to generate Table 6-9.

6-25 Paragraph 2. The requirement that a HI be greater than 1.0 for a given PAH and a given exposure pathway at the site before additive effects are considered is flawed. Chemicals that are similar in toxicity should be summed, even when the HI for one or more of the similar chemicals is less than one. The point is to determine if someone at the site is exposed to all of a given class of chemicals know to be present is at risk.

6-25 Paragraph 3. Note that the EPCs used in the calculations provided in Table 6-9 are not necessarily conservative. The interior margin and the landfill area were combined. The wetland area is omitted. Note also that soil ingestion and dust inhalation are considered incidental intakes, meaning that soil and dust from the wetland areas may still affect individuals at the site, but are not accounted for in this assessment. This table should include data for the wetland area.

6-25 Paragraph 4. The RME Recreational, Child calculated HI is 8 times lower than the threshold value of 1.0.

6-28 Table 6-10. Cancer risks should be combined for the various areas and exposure pathways. This results in a cancer risk greater than $10^{-6}$ for RME Occupational and RME Recreational. Note that the ICLR values listed are considered underestimates due to the assumptions made in Appendix C, Tables C-3 and C-4. Again, the wetland area should be included in this risk assessment.

6-30 Table 6-11. Cancer risks should be combined for the various areas and exposure pathways. This results in a cancer risk greater than $10^{-6}$ for the RME Occupational and RME Recreational and CTE Occupational. Note that the ICLR values listed are considered underestimates due to the assumptions made in Appendix C, Tables C-3 and C-4. Again, the wetland area should be included in this risk assessment.

6-31 Paragraph 2. The results do not suggest that chemical cancer risks are likely to fall outside to the EPA's target risk range of $10^{-4}$ to $10^{-6}$. The RME Recreational risk total ICLR for the landfill area alone was at the $10^{-6}$ level, when using assumptions that are in question as to exposure duration and frequency, for example. Combining the risks associated with the coastal margin and the landfill area results in the RME Occupational risk total ICLR also exceeding $10^{-6}$.

6-31 Paragraph 3. Placing a greater concern on radiological risk at the expense of addressing the chemical risks is not an acceptable approach, nor is it a part of the role of a remedial investigation report. Chemical risk values as calculated and summed by Navy consultants are at or below the threshold level of $10^{-6}$ used by CalEPA (1994) as the level to attain.

8-1 The conclusion of this report are not supported by the analysis of the report provided.

**Appendices**

B-1 Paragraph 2. Attachment A does not include the tables and figures referenced in the text and in the attachment. It is unclear where the ambient samples were collected. It is clear from Attachment A that the background samples did come from fill areas on the Navy base that contained elevated concentrations of many of the Site IR2 COPCs.

B-1 Use of ambient comparison tests can result in the loss of valuable information pertaining to specific compounds. This is of particular concern given the variety of contaminants and the non-uniform distribution of the contaminants around the site. Hotspots where individual classes of compounds may occur are "lost" by using overall site data.

B-3 Paragraph 5. The statement that for human health and ecological risk the interior margin and the landfill areas are not different is not acceptable. The assessment did not address wetland areas, and the interior margin and landfill area were combined. This approach is not acceptable. Reasons are provided in comments on the text for Chapter 6.

B-3 Analytes with greater than 50% detection in either the ambient or site data sets were not compared statistically and were dropped from the statistically program. In fact, they were not addressed any further at all.

B-3 Inconsistent use of terminology is a problem. Detection rates used are described as a %, and as a decimal value. In Tables B3-B6, detection rates are listed as a %, but are shown as a proportion; i.e., 1 = 100%.

B-4 The decision flow is flawed. Even when the data show a difference with the ambient data set, if the detection rates are non-detect for greater than 50% of the samples, the analytes are dropped from further statistical analysis. This is of particular concern given the multiple issues raised about detection limits for the data set (See previous comments).

B-11 Section B.3.2. Paragraph 1. Assessment of soil and sediment data in Figures B-77 through B-151 is difficult due to the lack of color or distinguishing features in the text.

B-12 Note that the size of the bubbles in the bubble plots are relative to ecological and human health screening levels **when they are available**. When not available, the smallest bubble is set at the minimum detected concentration. When a human health screening level is available, the bubbles are set based on that, with the smallest bubble size correlated to the screening level. Since in most cases, the ecological screening level is much less (orders of magnitude) than the human health level, the magnitude of the contamination problem can be underestimated; use of these plots must be carefully considered.

B-14 There is a strong likelihood that the EPCs have been underestimated in that soil samples in areas of potentially elevated COPC concentration were not assessed, the data for the interior margin and the landfill areas were combined, many parameters were not analyzed for across the site, and other reasons discussed above.

B-15 Bullet 2. The EPC was determined based on data for the upper 6 inches, not the upper 2 feet. This issue has been adequately discussed.

B-16 A normal distribution requires normality, independence of samples, linearity and equal variance. These conditions cannot be met. Equal variance is confounded by the data set; detection limits vary considerably for the contaminants.

B-18 The ANOVA is flawed in that non-detects were included as the detection limit. Again, this value fluctuated considerably over time.

B-19 The wetland area shows greater values than all other areas for many of the inorganics, yet this area was not included in the human health risk assessment.

B-23 NOTE that the Tables B-9 through B-20 include the maximum value measured at the site. This is the value that is supposed to be used as the EPC per CalEPA (1994) for a conservative assessment of impact.

B-79 Box plots. The box plots are very informative, but they are also problematic for several reasons. When ambient soil and sediment values are provided, the median values are often greater than the ecorisk and human risk screening levels provided. This is of concern in that it indicates that the selection of background or ambient sampling locations was flawed. Ambient median levels are greater than the ecorisk screening levels for aluminum, antimony, arsenic, barium, chromium, cobalt, lead, manganese, mercury (only one sample: the non-detect level was greater than the ecorisk level), nickel, selenium, silver, titanium (eco-72; titanium median = 450), thallium, vanadium, zinc, benz-anthracene (exceeds human health risk level), benzo(a)pyrene (exceeds human health risk level), dibenzo(a,h)anthracene (exceeds human health risk level), indeno(1,2,B,-cd)pyrene, and naphthalene. In many cases, the median ambient concentration of organics is greater than that measured at the landfill!

For many compounds, no ambient data are provided for comparison because only the PAHs (organics) were measured at the reference locations. This is shown in Figures B-47 to B-76 for the pesticides, aroclors, motor oils, tributyl tin, phenol, endrin, dieldrin, DDT, DDE, and others.

C-8 Table C-3. This table provides the values and assumptions used for Central Tendency Exposure (CTE) calculations for recreational and occupational scenarios. Assumptions are used in calculations of risk. A spread sheet developed for changing the assumptions to more reasonable or different ones indicated that Hazard Quotient (HQ) values are altered to show an adverse effect. Problems with the assumptions follow.

- IRs-child = 100 mg/d soil ingestion rate; USEPA recommends 200mg/d; up to 10,000 mg/d possible.
- IRs-adult = 50 mg/d occupational and recreational; USEPA recommends 100 mg/d
- EFs-child = 4 days per year recreational exposure frequency to soil, dermal exposure, inhalation; expectation is far greater
- EFs -adult = 4 days per year recreational, 12 days per year occupational to soil, dermal exposure, inhalation; expectation is higher
- ED-adult non carcinogens = 9 years recreational exposure duration, 6.6 years occupational; expect longer time period
- ED-adult carcinogens = 3 years recreational, 6.6 years occupational; expect longer time period
- InhR-child = 1.0 meters cubed per hour inhalation rate; is based on light activity; not expected.
- ET-child = 2 hours per day exposure time. It is expected that children will spend far more than 2 hours per day playing onsite, once there.
- ET-adult = 2 hours per day exposure time recreational. It is expected that adults will spend far more than 2 hours per day onsite, once there.
- SA-child = 1700 $cm^2$ recreational assumes wearing long pants and shoes; unlikely expectation
- SA-adult = 3300 $cm^2$ recreational and occupational assumes wearing long pants and shoes; unlikely expectation as bikers generally wear shorts.

- AF-child = 0.2 mg.$cm^2$-d based on exposure to head, hands, and forearms. USEPA recommends use of 1.0 as a default value.
- AF-adult = 0.05 mg.$cm^2$-d based on exposure to head, hands, and forearms. USEPA recommends use of 1.0 as a default value. Workers are expected to work in soil
- AT-noncarcinogen = to exposure duration, which is considered an underestimate

C-10 Table C-4. This table provides the values and assumptions used for Reasonable Maximum Exposure (RME) calculations for recreational and occupational scenarios. Assumptions are used in calculations of risk. A spread sheet developed for changing the assumptions to more reasonable or different ones indicated that Hazard Quotient (HQ) values are altered to show an adverse effect. Problems with the assumptions follow.

- IRs-adult = 50 mg/d occupational and recreational; USEPA recommends 100 mg/d
- EFs-child = 12 days per year recreational exposure frequency to soil, dermal exposure, inhalation; expectation is far greater
- EFs -adult = 12 days per year recreational, 50 days per year occupational to soil, dermal exposure, inhalation exposure frequencies; expectation is higher
- ET-child = 2 hours per day exposure time. It is expected that children will spend far more than 2 hours per day playing onsite, once there.
- ET-adult = 2 hours per day exposure time recreational; 8 hours occupational. It is expected that adults will spend far more than 2 recreational hours per day onsite, once there.
- SA-child = 1700 $cm^2$ recreational assumes wearing long pants and shoes; unlikely expectation. Use of total body surface area should be used for volatile compounds.
- SA-adult = 3300 $cm^2$ recreational and occupational assumes wearing long pants and shoes; unlikely expectation as bikers generally wear shorts. USEPA default is 19,400 $cm^2$. Use of total body surface area should be used for volatile compounds.
- AF-child = 0.2 mg.$cm^2$-d based on exposure to head, hands, and forearms. USEPA recommends use of 1.0 as a default value.
- AF-adult = 0.05 mg.$cm^2$-d based on exposure to head, hands, and forearms. USEPA recommends use of 1.0 as a default value. Workers are expected to work in soil
- AT-noncarcinogen = to exposure duration, which is considered an underestimate

Sum In a spreadsheet developed using the risk equations in Appendix C, recalculated HQ values are compared to those used in the document for estimating the risk. Recalculated HQ values are always greater than those calculated by Navy consultants. In many cases, HQ values greater than 1.0 result. These observations result in a low confidence in the conclusions made about health risks at the site.

D-3 Paragraph 2. Plans to close the landfill as a Class II landfill were flawed. Landfills for hazardous wastes are classified as Class I landfills. Closure criteria are more stringent.

D-4 Paragraph 2. "The only material known to be deposited into the wetland area was scrap metal", however the area was primarily used for stockpiling of dredged materials from the harbor entrance channel. Dredged materials are often classified as hazardous due to the high concentrations of tribulytin, hydrocarbons, metals and other contaminants. Information on the chemical characteristics of the dredged material would be of use in assessing the wetland areas.

D-5 Surface water properties were stated as being representative of storm and dry conditions at various stages of the tide, yet the sampling dates were February 12, February 23, and March 3 of 1998. The latter, a non-storm sample date was collected during a period of increased cumulative rainfall values (Appendix Figure 3-3) resulting in the samples all being affected by dilution. No dry weather conditions were monitored during the surface water sampling period.

D-14 Top Paragraph. The conclusion that the culvert from the northern pond functions in draining water from that pond into the SF Bay only applies to periods when the pond elevation exceeds that of the culvert invert. Note that the conditions during the study were El Nino storm conditions, when significantly more rainfall was measured in the area.

D-19 Paragraph 3. The increased conductivity in the northern pond during dry months could be a result of 1) recharge of saline water greater than that of groundwater, as postulated, and 2) evaporation of the surface pond water leaving the dissolved compounds in the pond. Figure 3-8 shows the northern pond surface water elevation higher than the mean tide during the dry months. Evaporation effects on pond conductivity have not been addressed.

D-20 Section D.3.3.2.1. Paragraph 2. Reference should be to the southern pond.

D-23 Bottom. Bullet. The statement is contradictory. Conductivity and salinity measurements are said to be higher at NP-C than the other sites during storm and non-storm events; then the conductivity and salinity are said to be higher in the southern pond during storm events.

D Table C-1. The data in this table do not reflect the conclusive statements in the text. Dry conditions were not sampled. For some sample times, salinity in the south pond exceeds that in the north pond. Turbidity data do not indicate a greater increase in loading from the land in the northern pond than in the southern pond Difference in pond morphology and vegetation could explain these differences.

D-26 Section D3.5. A simple site reconnaissance would have revealed that the culvert pipe is corroded at the top, which has rusted away leaving an open pipe. The pipe no longer has a viable radius, and the Manning's coefficient will be increased. In addition, the depth of water in the culvert will vary with length of pipe due to there not being a pipe. Questions on what slope was used (inverted pipe) exist.

**Questions that need to be answered:**

1. Were the landfill off-gas vents ever sampled for VOCs or other CPOCs? If so, where are the data and what were the results.
2. Was the landfill closure completed per the specific standards required by the regulatory authority? If not, what are the plans to do so prior to transfer to the USFWS?

Comments on *IR Site 2 Remedial Investigation Report, Alameda Point*, 4 December 2000, Prepared for Southwest Division, Naval Facilities Engineering Command, San Diego, CA

Dr. June A. Oberdorfer

General Comments:

1. Completeness of Document: A Remedial Investigation Report (RI) at a CERCLA (Superfund) site should be reasonably complete and self-standing. This document is missing a number of crucial pieces of information (ex., geologic and well completion logs, description of analytical methodologies) that make it difficult for the reader to conduct an adequate review without tracking down previous documents. These essential pieces of information could have been included in appendices to the report on the CD.
2. Adjacent Areas: The RI artificially sets the boundaries to the study area at the land-Bay interface to the west and south of the Coastal Margin sub-area. The report does not indicate that investigative work has been carried out on sediment or biota just offshore of the landfill to the west. The highest concentrations of contaminants in ground water have been found in monitoring well MO24A in the northwest corner of the landfill immediately adjacent to the Bay. The RI acknowledges that ground water in this area discharges into San Francisco Bay. This region will also be part of the proposed wildlife refuge and should be evaluated as well for ecological risk. Eight sampling sites (WB011 through WB014 and WB016 through WB019) are shown on Figure 3-1(sample locations), however, they are not included in Table 3-2 (number of analyses). The results of those sampling events should be reviewed as part of the RI ecological risk assessment.
3. Soil Sampling:
   a. Spatial Adequacy: The spatial distribution of soil sampling is adequate to characterize the site. An exception to this statement would be if the risk assessment indicates that hot spots in the soil are associated with significant risk. Examples of such potential hot spots are the high PAH concentrations in the southeast corner of the site and the volatile organic compounds (VOCs) in the northwest corner. If there are significant risk hot spots, additional sampling should be performed at those locations to determine their extent.
   b. Background Values: Since the plate and tables to Attachment A (background soil sampling) are not given in the report, it is not possible to determine if the samples and values are representative of background. All metals except for calcium and lead were greater in IR Site 2 than in background; lead was retained as a Contaminant of Potential Concern (COPC), and calcium was eliminated since it's an essential nutrient. Since no COPCs were screened out because of similar concentrations to background, the issue of the validity of background sampling is not particularly important. In other words, the Navy has taken a conservative approach.
   c. High Detection Limits: The high detection limits on some metals (molybdenum and selenium) in soils, however, played a role in their being eliminated as COPCs based on a low detection frequency. If lower detection limits had been obtained in the chemical analyses, it is possible that additional metals would have been retained.
   d. Infrequent Analysis: some constituents, such as molybdenum, uranium, titanium, and thallium were analyzed for so infrequently that there were not enough data to determine if they were COPCs, so they were screened out. It needs to be determined if there were

likely sources for these metals and if they pose significant health or ecological risks to determine whether they need to be included in the risk assessment.

   e. Analytical Methodology: The text does not specify the extraction or chemical analytical methodology used on the soil or sediment samples. This lack of information makes it difficult to evaluate the nature of the contaminants found for a number of reasons. Different contaminant concentrations will be found depending on the extraction technique because different fractions (soluble, adsorbed, present in organic fraction, present in mineral crystals) are extracted by different techniques. Different chemical analytical methods have different detection limits, often varying as a function of the Total Dissolved Solids (TDS) in the extracted solution. Different fractions will have different degrees of bio-availability. An extraction that includes soluble, adsorbed, and organic fractions (but excludes the mineral fraction) would be sufficiently conservative.
   f. Ecological Risk Calculated on Mean: Whereas it is probably reasonable to use the UCL95 of the mean soil concentrations for the Human Health Risk Assessment since the humans will be traveling pretty much all over the site, it is likely that many of the organisms will have a much more localized area (ex., ground squirrels). It would be more conservative to use a reasonable area around the highest soil concentrations for an averaging area, rather than using the entire site.

4. Sediment Sampling:
   a. Spatial Adequacy: the samples appear to give adequate spatial coverage of the pond sediment.
   b. Lack of Background: there were no background samples collected for the pond sediment. Having samples from a similar tidal wetland, only one without a landfill or other significant terrestrial source of contaminants, would have helped put the contaminants found in the Northern and Southern Ponds into perspective. However, since no COPCs were screened out with reference to background levels, the Navy has proceeded in a conservative manner by including all frequently-detected COPCs for consideration.
   c. Influence of marine water: some of the contaminants detected in pond sediment may have their origin in the marine water of San Francisco Bay, which enters the north pond at high tide (approximately 29% of total time, according to App. D). Sediment may also be brought in through the culvert, particularly during storms. A review of literature values for metals in S.F. Bay waters might indicate if this is an area for further investigation. In any case, the Navy has proceeded in a conservative fashion by assuming that all the contaminants present need to be evaluated in the risk assessment.
5. Surface Water Sampling:
   a. Adequacy: the spatial distribution of surface water samples appears to be adequate, but the temporal distribution appears to be skewed toward wet weather sampling when surface runoff would tend to dilute the contaminant concentrations. There was no systematic seasonal sampling performed that would allow evaluation of concentrations and risk at different times of the annual climate cycle.
   b. Background sampling: No background tidal pond water was sampled that would allow for comparison. Knowledge of concentrations in S.F. Bay water in the area would have been helpful, since there is a regular inflow of water from the bay to the northern pond.
   c. Hypersalinity: The surface water in the South Pond (Table 4-15) was always hypersaline (more saline than seawater) at the time of sampling, as can be seen from the range of chloride values (24,970 to 32,020 mg/L; seawater chloride is approximately 19,000

mg/L). During the dry summer period, there appears to be a gradient reversal from the Bay towards the wetland area in the vicinity of the southern pond. A combination of marine water input and evaporation could cause the pond to become hypersaline. The North Pond also becomes hypersaline (chloride range: 5,342 to 56,950 mg/L in Table 4-14). It would be good to examine the ratios between individual metals and chloride to determine if dilution and evaporation of Bay water are the main reason behind concentration differences or if there is significant input from the landfill and runoff from the fill material. In any case, the Navy has taken a conservative approach by not discarding COPCs because they might originate in marine water.

d. High Detection Limits: Many of the metals (ex., antimony, selenium, thallium) had high detection limits which may have been why they had such low frequencies of detection. This likely resulted in their being dropped from the COPEC list (p. 7-2). Lower detection limits might have resulted in their being retained.

6. Ground Water Sampling:
   a. Well information missing: the geologic logs, well completion information, and well water levels are not given in this report. This makes it difficult to relate the ground water quality data to specific water-bearing zones within the site area or to evaluate ground water contaminant transport pathways.
   b. Sparseness of Data: The data appear to be adequate in their geographic distribution except to the north of the landfill where there don't appear to be any monitoring wells. There were very few samples taken over time. This makes it difficult to evaluate any time trends in concentrations that might indicate a growing problem. There have been relatively few samplings and those were performed at irregular time periods. It is difficult to tell how sampling was performed with respect to recharge events during the wet winter months; such recharge events could influence contaminant concentrations.
   c. Background Data: No background data for contaminants are provided so it is difficult to know if the contaminants are specific to the landfill area or if they are more regional in extent and origin.
   d. Spatial Distribution of Contaminants: It is difficult without the data posted on a map to see how the contaminants in the groundwater fit into a future release or exposure scenario. Many of the detected contaminants are found in the shallow wells (M036A through M039A) completed in the downgradient edge of the landfill, where ground water is most likely to discharge into the North Pond. The M024 nest of wells at the northwestern corner of the site has a number of relatively high detects, indicating a continued source. This source may be either the Site 2 landfill or the Site 1 landfill to the north. This contamination would most likely have more impact on the shoreline area to the west than on the pond area.
   e. Importance of Ground Water Data: Since there is no direct exposure pathway for ground water, the lack of complete information about ground water concentrations may not be all that important. The main cause for concern is that ground water is one of the primary pathway for hazardous chemicals within the landfill to migrate to the ponds or Bay.
   f. Low Concentrations of Many Contaminants: What is particularly surprising is the very low level of contamination in relation to the description of the types of materials disposed of in the landfill. Many, but not all, of the inorganic and organic compounds are present below their respective drinking water standards or not detected (although again there is the problem of high detection limits for some analyses). It is common to have higher

concentrations of chlorinated organic compounds at municipal landfills that didn't receive hazardous waste per se than are present in the ground water at this site that did receive hazardous waste. The explanations that the wastes have all been flushed out of the landfill or were never disposed of into it are plausible, but their likelihood is not evaluated. The first water-bearing zone at the site (which includes the partially-saturated landfill material) is relatively permeable, consisting primarily of sandy material. Such material is more likely to be flushed than the Bay mud material upon which many of the landfills around San Francisco Bay are constructed. There is much more severe ground water contamination at Site 1 to the north of Site 2; this was a landfill that predated the Site 2 landfill. It seems strange that the Site 1 landfill should have significant contamination and this one does not. On the other hand, the Navy has at least some data indicating that ground water is only a minor source of contamination in this area.

g. Ground Water as Source of Contaminants to North Pond: Leachate from the landfill has impacted ground water and appears to be a source of contaminants to North Pond. The ground water flow direction, as defined by the hydraulic gradient, is from the landfill to the pond. Contaminants that are present at high concentrations in wells adjacent to North Pond, are also detected at somewhat lower concentrations within the Pond. The periodic flushing of the pond by tidal action probably accounts for the fact that many of the compounds detected in ground water have not been detected in North Pond.

7. Site Conceptual Model: The text states (p. 5-1) that a number of potential contaminant pathways (ex., suspension of soil particles, contamination of ground water by buried waste) are not discussed because the necessary data have not been obtained. Many of the processes at this site are not well understood because the necessary data have not been collected or analyzed appropriately. This means that the Conceptual Site Model is incompletely developed. Contaminant concentrations from monitoring data, that provide a relatively static view of conditions at the site, are the only bases for evaluating risks at the site. If the risk calculations based upon those concentrations indicate minimal risk for the site, a more complete understanding may not be necessary. However, there is always the possibility of future releases from the landfill and, to understand the risks and the processes involved in such potential releases, it is necessary to have an accurate and complete site conceptual model. In the absence of such a model, there cannot be a great deal of confidence in a "no risk" conclusion.

Specific Comments

1. Measures to Reduce Uncertainties in FS (p. ES-3): the following tasks are suggested to be included in the FS in order to reduce uncertainties apparent in the RI. If it turns out that risk calculations in the report have significantly underestimated risk, these activities along with others should be carried out as part of the investigative work for the revised RI.
   a) Perform a quantitative analysis of recharge and tidal flushing to see if those are reasonable mechanisms for the removal of contaminants from the landfill.
   b) Obtain background sample analyses for pond sediment and surface water and compare to site concentration levels.
   c) Obtain surface water and ground water samples at distinct time points in the wet and dry season so that seasonal variability can be taken into account. During the site visit in December 2000, no monitoring wells could be observed in the area. It is possible that the

ground water monitoring wells have been destroyed (i.e., removed), and that such sampling is no longer feasible, without the reinstallation of wells.

d) Perform a soil vapor survey of the landfill to determine if there are hot spots of VOCs still present within the landfill.

e) Those COPCs which were eliminated because of a small number of samples or because of low frequency of detection when the detection limits were high should be resampled for in sufficient number and with much lower detection limits so that their concentrations can be evaluated.

2. Landfill not inundated by seawater (p. 2-24): It is unclear how far marine water has entered the landfill. Shallow monitoring wells (M037A and M038A) on the downgradient edge of the landfill next to the north pond are relatively saline (23% and 64% seawater based on chloride concentrations in App. E). Shallow wells on the northern side of the landfill (M011A and M024A) both contain about 10% seawater, even though one lies adjacent to the Bay (M024A) and the other is located about 1,800 ft inland. Examination of chloride concentrations across the site and with depth beneath the site would help to elucidate the ground water flow pathways and how likely it was that flushing of hazardous materials from the landfill occurred. In addition, well tidal response in both shallow and deep wells should help to indicate hydraulic connection with the Bay and between water-bearing zones, as well as give some indication of formation permeability. There is undoubtedly a lot more that could be determined about the site's hydrogeology than what has been presented in this RI report.
3. Connectivity with the Bay (p. 2-36): The text states that the estuarine community in the wetlands is compromised because of the poor connectivity with the Bay. If improved connectivity would enhance the community and decrease eco-risk, then as part of the feasibility study the Navy should examine the replacement of the existing culvert with a somewhat larger and more efficient culvert.
4. Future contamination from burrowing animals (p. 2-42): If increased populations of burrowing animals in the future may augment the deposition of contaminants on the landfill surface, the Navy should examine this possibility as part of the FS or RI revision process. This may require some additional sampling of the shallow waste and possibly the creation of some sort of biotic barrier within the landfill cover.
5. Buildup of fine particulates in local depressions (p. 2-43): Have the fine particles in the depressions been sampled and analyzed? It is unclear from the report. If these regions have accumulated the highest concentration of contaminants, as hypothesized in the text, then they may need to be taken into account as high risk areas in the ecological risk assessment. It may be necessary as part of the FS to investigate the elimination of these depression areas and removal of the fine-grained sediment.
6. Unidentified soil borings (Fig. 3-2): There are four soil borings (353, 354, S441, and S442) along the northern perimeter of the site that are identified on this figure but are not included in the data tables in App. E. What are these borings and what data exist for them?
7. Long ground water sampling periods (p. 3-23): The duration of a single sampling event varied from two to four months. This is very unusual. Typically the sampling of 29 wells could be accomplished in a few days. A short sampling period is by far preferable to provide a synoptic view of chemical concentrations at the site. There were also only 12 sampling events in a seven year period. That's an average of less than two per year, an insufficient number to look at seasonal variability. Radiation anomalies (p. 3-73): What were the sources

of the radiation anomalies? What radionuclides were present? Was radium the only radionuclide found or were there others? Was a survey performed after the removal actions to corroborate that the site had been cleaned up? More information needs to be provided about the radioactive materials detected at the site.

8. Detection Limits (Table 4-8): The minimum detection limit for many of the "non-detect" samples was frequently higher than the minimum amount detected in other "detect" samples. Many of the "non-detects" would likely have become "detects" if the detection limits were lower. This is even more the case if one examines the maximum detection limits for the "non-detects", which in some cases are comparable to the maximum "detect" concentrations. The low percentage of detects for some analytes may well be the result of high detection limits, not of the fact that the chemical was not present. Eliminating certain chemicals from the list of COPCs based on their low frequency of detection is not a defensible approach if the limits of detection are unreasonably high. Of particular concern are the high detection limits for selenium (ex., Table 4-19 for plant tissue), because of the sensitivity of many wildfowl to selenium.
9. Error in Sodium Value (Table 4-15): There is an error in the Max Detect for Sodium in this table. A value of 3,430,000 μg/L is listed, but other values in App. E (ex., for surface water sample 309SW with a sodium value of 12,500, 000 μg/L) are greater. All entries in the summary table need to undergo a quality control check for accuracy.
10. High Nitrate in Surface Water (Table 4-15): There are at least some high nitrate concentrations in South Pond (max. 433 mg/L as nitrogen), but this is not addressed in the ecorisk in App. C. Is nitrate not of environmental concern at those concentrations?
11. Lack of radium data (Ch. 4 and App. E): Radium isotopes were analyzed for in soil and ground water samples, but not in sediment or surface water samples. Radium tends to sorb onto soil particles under fresh water conditions, but desorb under marine water conditions. Since both ponds can be quite saline, there could well be mobile radium. Since radium-226 (the dominant form at this site) is a carcinogen, it should have been analyzed for in all media. Even if there is only considered to be sporadic exposure to sediment or water, the risk associated with that exposure needs to be analyzed to determine its significance. Its ecological risk for those media also needs to be evaluated.
12. Neglected Transport Pathway (Fig. 5-2): The figure, and therefore the conceptual model, neglects the pathway from ground water to wetland water and sediment. The limited data that exist point strongly to ground water (much of it with detectable concentrations of contaminants) discharging into the north pond at the southwest edge of the landfill. This is a significant likely pathway and needs to be acknowledged and analyzed as such.
13. Landfill soil not coupled to underlying waste (p. 5-7): The lack of any consistent patterns in contaminant distribution in the landfill soil does not necessarily mean that the contaminants found in it have not migrated from the waste. The underlying waste itself may be so varied in the contaminants it contains that it would not produce any particular pattern. The later statement that the data do not confirm a biotic pathway for chemical migration of buried waste to the surface soil is ambiguous and misleading; it is misleading because the data just as much do not negate that biotic pathway.
14. Ground water contamination at M024 nested wells (p. 5-8): The relatively high concentration of contaminants in these wells is troubling as it may be indicative of greater release of contaminants from the landfill to the environment in the future. There were a number of organic compounds detected in the nearest soil sample (A-201), but it is still unclear if the

high concentrations in ground water result from a surface spill, landfill leachate, or a different unknown source. Since no risk calculations were made for ground water or modeling performed to estimate concentrations at discharge points, it is not possible to say whether the chemicals in these wells pose a threat or not.

15. Comparison of metals in landfill and wetland soils (p. 5-11): The text states that no comparative evaluation can be made between landfill and wetland soils, because the wetland data encompasses data from the far end of the wetland that did not receive surface runoff from the landfill. It should be relatively easy to create a subset of the wetland soils data for those regions that would have received such runoff; at that point a valid comparative evaluation could be made.
16. Ground water not contributing contaminants to northern pond (p. 5-11): The logic in this paragraph supporting the non-contribution of ground water to wetlands contamination is impossible to follow. The existence of higher contaminant concentrations in the vicinity of the northern pond, immediately adjacent to the landfill, does not deny but rather supports ground water transport as a potential mechanism for contaminants in the landfill waste to reach the wetlands.
17. Surface runoff not migration pathway (p. 5-11): This paragraph and conclusion are very misleading. Phrasing the final statement as a negative, that the data do not confirm surface water runoff as a pathway, implies that it is not a pathway. The existing data however do not deny its being a pathway, and surface runoff is likely to contribute at least somewhat to the contaminant concentrations found in the northern wetlands.
18. Risk from future releases (Ch. 6 and 7): One of the limitations of the human health and ecological risk assessments is that they are based on levels of contaminants currently detected. The potential for future releases from the landfill is not taken into account. While the likelihood of such releases is small (based on the relatively low quantities of contaminants observed), it is not impossible. It is difficult to evaluate the likelihood of future releases because the Navy has not obtained data or performed analyses that would permit such an evaluation. An additional problem is that there are no provisions for future sampling so a future release would likely go undetected until serious environmental or human health harm had been observed. A solution would be for the Navy to set up a trust fund with the Dept. of Fish and Wildlife that would cover the costs of future periodic monitoring. It should also be made clear that the navy does not lose liability for environmental clean-up if future releases occur.
19. Inadequate analyses for some compounds (Tables 6-2, 6-3, and others): Certain COPCs (ex., chlorobenzene, ethylbenzene, molybdenum, uranium, xylenes) were analyzed for in so few samples that they were discarded as COPCs because there were insufficient samples to quantify risk. This is a very non-conservative approach and is not protective of human health and the environment.
20. Recreational risk greater than occupational (p. 6-27): It seems illogical that the recreational cancer risk should be greater than the occupational, since the occupational exposure time would be so much greater. What assumptions produce this illogical conclusion and are they reasonable?
21. Risks from radium-226 exposure (p. 6-30): The radionuclide cancer risk for workers at the site seems too high to ensure worker safety. While measures might be taken to minimize inhalation or ingestion, the risk results from external irradiation which would be very

difficult to minimize, other than by limiting a worker's time spent in the area. How will this risk be addressed? At a minimum, workers should wear dosimeters.

22. Calculation of benzene flux (p. 6-33): Shouldn't the concentration of benzene in air (calculated to be 4.8 μg/L) have been used rather than the concentration of benzene in water (21 μg/L) to calculate the benzene flux? The value used in the risk calculation is conservative (i.e., will produce a greater risk value), however.
23. Radon gas production (Ch. 6): While risks associated with exposure to radium have been calculated, no effort was made to evaluate the risks associated with radon gas that is produced from the decay of radium. Since radon gas is much more mobile than radium, the exposure may be greater and the exposure and associated risk should be calculated.
24. Metals distribution (p.8-3): The Navy justifies no action to the ecological risk by saving that the metals of concern are evenly distributed over the site and do not appear to be associated with the landfill. This is not true of all the nine metals (see section 4.1.3.1), particularly not of nickel and copper which are found preferentially in the northern portion of the wetlands area, adjacent to the landfill.
25. Monitoring of Surface Runoff (p. D-1): One of the stated goals of the Hydrologic Study was to monitor surface runoff from the landfill into the ponds both in terms of quantity and amount of entrained surface soils. There does not seem to have been any attempt to collect the data required to meet this stated goal. Such information would have been very helpful in assessing the transport of contaminants from the landfill surface to the wetland.
26. Errors in Table 3-1C (p. D-16): There is a contradiction between the hours GW was above PSW elevation and the % of Time for the second, third and fifth entrees. These need to be corrected.
27. Lack of inundation of landfill (p. D-17): A better way to assess whether or not the landfill is inundated by seawater is by examining the chloride content of the wells surrounding the landfill. Maps should be provided showing chloride concentrations in all monitoring wells at a specific depth interval. Some monitoring wells along the eastern margin of the landfill (ex., M011A and M012B) have high chloride contents (10 and 77% of seawater's, respectively) which may indicate some landfill-marine interactions.
28. Vertical gradient calculation (p. D-18): In calculating the vertical gradient, the distance over which the head change takes place should be the difference in elevation of the bottom of the pond and of the mid-point of the screen on the well, not the average pond depth. This distance would be about 1.5 m, not the 3 m used in the calculation. It is also highly unlikely that the pond depth is ever 3 m. The same incorrect calculation is made for the South Pond on p.D-20.
29. Missing Bay Water Level (App. D, Attachment A): It is not possible to interpret the water level data properly without knowing the contemporaneous level of the Bay adjacent to the landfill. Those data should be include in this attachment. Analysis of the tidal response at all wells and the chloride data would likely provide a great deal of insight into potential flushing mechanisms for the landfill and underlying ground water.
30. The RI does not specify ARARs (Applicable or Relevant and Appropriate Regulations) for the site, so it is not possible to evaluate their remedial approach (i.e., No Action) to see if it complies with site ARARs. Such a discussion is clearly needed.