STATE OF CALIFORNIA — ENVIRONMENTAL PROTECTION AGENCY

DEPARTMENT OF TOXIC SUBSTANCES CONTROL

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October 25, 1995

Commander
Engineering Field Activity, West
Naval Facilities Engineering Command
Attn: Camille Garibaldi
900 Commodore Drive
San Bruno, California 94066-2402

Dear Ms. Garibaldi:

STATISTICAL METHODOLOGY FOR BACKGROUND COMPARISONS, NAVAL AIR STATION, ALAMEDA

The California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) and San Francisco Regional Water Quality Control Board (RWQCB) have reviewed Statistical Methodology For Background Comparisons, dated September 17, 1995. Our comments on the document are enclosed. These comments were prepared by Jim Polisini, Ph.D., Staff Toxicologist with the DTSC Office of Scientific Affairs. The RWQCB has concurred with the comments prepared by Dr. Polisini. Their concurrence letter is also enclosed.

If you have any questions regarding this letter, please call me at (510) 540-3809.

Sincerely,

Thomas P. Lanphar

Thomas P. Lanphar
Project Manager
Base Closure Branch

Enclosure

cc: See next page

1247

cc. Mr. James Nusrala
Regional Water Quality Control Board
2101 Webster Street, Suite 500
Oakland, California 94612

Lt. Mike Petouhoff
Base Environmental Coordinator
Alameda Naval Air Station
Building 1, Code 52
Alameda, California 94501

Mr. James Ricks
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105

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MEMORANDUM

TO: Tom Lanphar, Project Manager
Office Military Facilities, Region 2
700 Heinz, Building F, Second Floor
Berkeley, CA 94710

FROM: James M. Polisini, Ph.D.
Staff Toxicologist
Office of Scientific Affairs (OSA)
Human and Ecological Risk Section (HERS)

DATE: October 13, 1995

SUBJECT: STATISTICAL METHODOLOGY FOR BACKGROUND COMPARISONS AT NAS ALAMEDA
[PCA 14740, SITE 200004-45 OC 2:20]

Background

We have reviewed the document titled Naval Air Station Alameda, Alameda, California Statistical Methodology for Background Comparisons, dated September 17, 1995 and prepared by PRC Environmental Management, Inc. of Denver, Colorado. This review is in response to your written work request received in our offices on September 27, 1995. In addition to this written review two members of the OSA attended a meeting to discuss this proposal at NAS Alameda on Tuesday, October 3, 1995.

Naval Air Station (NAS) Alameda occupies the western third of Alameda Island and has been a military installation since 1930. NAS Alameda occupies 2842 acres of land, water and airspace easement, including 1734 acres of land. The majority of the land at NAS Alameda was created by filling existing tidelands with dredged material from San Francisco Bay and the Oakland Inner Harbor.

General Comments

This document presents a proposal for statistical comparisons of a group of 'background' samples against a group of site-specific samples to determine whether the site-specific samples are statistically different from the 'background' samples and therefore can be concluded to be contaminated by site-related activities. The proposed methodology does not address the task of identifying that group of samples which adequately defines 'background'. An OSA memorandum dated September 18, 1995 to the DTSC Project Manager, Tom Lanphar, and forwarded to the U.S. Navy and PRC outlines the process of 'background' identification which OSA expects to be followed at NAS Alameda. A copy of the September 18, 1995 memorandum is attached.

Specific Comments

The 'background' recommendations contained in the DTSC Preliminary Endangerment Assessment (PEA) Manual must be considered in light of the fact that the PEA Manual outlines a screening process (Section 1.1, page 2). Specifically, 'a minimum of four background samples' would be inappropriate for the NAS Alameda environmental restoration program.

Incremental cancer risk associated with 'background' concentrations of carcinogens may be subtracted from incremental cancer risk associated with total concentrations of that carcinogen. Do not subtract the 'background' concentration from the total concentration prior to determining incremental cancer risk (Section 1.1, page 2).

The Preliminary Remediation Goal (PRG) screening process (Section 1.3, page 4) concentrates solely on PRG-screening based on single contaminants. The discussion should be expanded to include screening for multiple contaminants based on the sum of the individual fraction the PRG for each contaminant. Please consult the attached OSA guidance memorandum on the use of PRGs in screening risk assessments.

We agree with all the examples of 'anthropogenic background' except for polycyclic aromatic hydrocarbons (PAHs) from forest fires (Section 2.0, page 5). Certainly wildfires in California contributed some PAHs to the environment prior to human-instigated wildfires.

Incremental cancer risk associated with 'background' concentrations of carcinogens may be subtracted from incremental cancer risk associated with total concentrations of that carcinogen. Do not subtract the 'background' concentration from the total concentration prior to determining incremental cancer risk (Section 2.0, page 5).

The text specifies that 'chemicals identified as background will not be eliminated as COCs' (Section 2.2, page 7) while the flowchart (Figure 2) indicates that chemicals may be classified as 'not a COC' based on comparison with 'background'. Standard treatment of 'background', given an adequate 'background' study, would be to eliminate inorganic chemicals as COCs before beginning the risk assessment. Please clarify the proposed outcome of the 'background' comparison for carcinogenic and non-carcinogenic inorganic chemicals and organic compounds. This point was discussed at the October 3, 1995 meeting.

The description of 'outliers' (Section 3.3, page 11) describes many statistical tests which have been applied in evaluation of 'outliers'. These techniques are not required to identify the set of 'background' measurements. The process for evaluating 'outliers' in the set of 'background' measurements is contained in the September 18, 1995 OSA memorandum. Exclusion of outliers from the site-specific data set is appropriate only for specific and restricted reasons. If the site-specific outlier is not the result of analytical or entry error it should remain in the site-specific data set. If the 'outliers' can be identified as representative of a spatially-restricted 'hot spot', and this 'hot spot' is remediated, the 'outliers' from the hot spot may be removed prior to statistical comparison with the 'background' data set.

The number of non-detects is strictly a quantitation limit problem for those contaminants likely to be encountered at NAS Alameda, since it is unlikely these contaminants are completely absent (Section 3.4, page 14). Use of the UNCENSOR programs was discussed at the October 3, 1995 meeting, without designating which of the five techniques contained in UNCENSOR would be utilized. Use of the UNCENSOR techniques may be appropriate for some contaminants depending on the proportion of non-detected values and the degree to which the probable shape of the distribution may be ascertained from the detected values. Use of one-half the quantitation limit may be required in the risk assessment for some contaminants depending on the applicability of the UNCENSOR techniques.

The recommendations contained in the September 18, 1995 OSA memorandum outline our preference for descriptive statistics and cumulative probability vs. concentration plots for evaluation of the 'background' data set. The same preference applies to the site-specific data set. In our experience, histograms and box plots have been less useful and should not be employed at NAS Alameda (Section 3.6, pages 16 through 18).

Technically, we agree that samples collected by random or stratified random sampling provide the most robust statistical comparison (Section 3.7, page 18). Resource limitations, however, do not allow random sampling of sites such as NAS Alameda, particularly where activities likely to result in contamination are localized. This is, however, a good argument to utilize the Environmental Baseline Study (EBS) data as the primary database for determining 'background'. The EBS data set, which consists of approximately 1000 soil samples based on discussion at the October 3, 1995 meeting, is much more wide-spread and therefore more appropriate for site-wide 'background'.

We agree that patterns of co-occurrence in inorganic chemicals can help identify local lithographic patterns (Section 3.9, page 20).

What type of 'objective criteria' are required for identifying 'hot spots' (Section 4.0, page 21)? Basically, the elevated concentrations must be demonstrated to correlate with some site-specific characteristic which offers a potential source and release mechanism for the elevated concentrations:

1. If the elevated concentrations are strongly associated with the presence of a particular lithography which differs from a distinct lithography at the rest of the site, the 'hot spot' can be assigned to differences in soil type.
2. If the elevated concentrations are in surface irregularities which might serve as transport pathways across the site, or if the elevated concentrations reveal a spatial trend in concentration moving from one boundary to another , the 'hot spot' may be due transport from an adjacent installation restoration (IR) site.
3. In the event the elevated concentration cannot be associated with some causative agent or spatial pattern it must be assumed to have been caused by site-related anthropogenic activities.

We do not agree that use of the 80 percent lower confidence limit (80 LCL) on the 95th percentile presents an '... unacceptably high probability that chemicals will incorrectly be selected as COCs' (Section 4.2, page 22). With more than 1000 samples in the EBS data set the 80 LCL will collapse nearly to the 95th percentile. In fact OSA recommends that If the 'background' population size exceeds 50, the Navy may use the 95th quantile itself, rather than a lower confidence limit. In addition, we do not agree that upper tolerance limits (UTLs) are appropriate for 'background' determination.

Please clarify whether the comparison with PRGs or ARARs for 'hot spot' identification (Section 4.2.2, page 23) is proposed as an alternative or in addition to statistical comparison of 'background' to site-specific samples.

Numerous statistical tests are discussed for testing the statistical significance between a 'background' data set and site-related data sets (Section 5.0). This section is a listing of some statistical tests which may be useful, but the restrictions on some of these tests, particularly the parametric tests, make it doubtful they could be used. For example, Cochran's t-test requires normality, independence of data, complete frequency of detection and adequate sample size (Section 5.4.2, page 28). These conditions are probably only met for a highly-contaminated site so that there is complete frequency of detection. We prefer appropriate non-parametric hypothesis testing to remove the tedious process of testing for normality and attempting several transformations to identify a transformation which allows only an approximation of normality. Non-parametric tests with sufficiently high power, other than those discussed, are available and should be employed.

Conclusions

A separate section which addresses identification of the 'background' data set as outlined in the September 18, 1995 OSA memorandum should be included in this outline and the NAS Alameda 'background' work plan.

The proposed methodology is a very broad description of many techniques and tests which might be applied to an evaluation of the statistical significance of any difference between site-related samples and a 'background' data set. The methodology should be amended to address the comments listed above and to outline only those methods and techniques applicable and appropriate for NAS Alameda.

We support the Navy efforts to develop a robust determination of 'background' at NAS Alameda which will be useful both to the IR Program and the Base Reuse Program. We look forward to a collaborative effort.

Reviewed by : John P. Christopher, Ph.D., DABT
Staff Toxicologist
Human and Ecological Risk Section

cc: Michael J. Wade, Ph.D., DABT, Senior Toxicologist, OMF Liaison, HERS
Deborah J. Oudiz, Ph.D., Senior Toxicologist, Northern California Liaison, HERS

Attachments.

Ms. Sophia Serda, Ph.D.
U.S. EPA, Superfund Technical Assistance Section (H-8-4)
75 Hawthorne Street
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MEMORANDUM

TO: Tom Lanphar, Project Manager
Office Military Facilities, Region 2
700 Heinz, Building F, Second Floor
Berkeley, CA 94710

FROM: James M. Polisini, Ph.D.
Staff Toxicologist
Office of Scientific Affairs (OSA)
Human and Ecological Risk Section (HERS)

DATE: September 18, 1995

SUBJECT: METHODOLOGY FOR DETERMINING 'BACKGROUND' OF INORGANIC CONSTITUENTS AT NAS ALAMEDA
[PCA 14740, SITE 200004-45 OC 2:4]

Background

You have requested participation by OSA at a meeting scheduled for September 18, 1995 to discuss the methodology for determining 'background' for inorganic constituents at NAS Alameda. The enclosed methodology for determining 'background' has been employed at other U.S. Navy sites in California and is appropriate for NAS Alameda. Please forward a copy of this memorandum to the Navy to focus the discussion at the meeting scheduled for September 18,1995.

Naval Air Station (NAS) Alameda occupies the western third of Alameda Island and has been a military installation since 1930. NAS Alameda occupies 2842 acres of land, water and airspace easement, including 1734 acres of land. The majority of the land at NAS Alameda was created by filling existing tidelands with dredged material from San Francisco Bay and the Oakland Inner Harbor.

Determination of Inorganic 'Background'

We recommend that metals be eliminated as COPC as early as possible in the risk assessment. This is most easily accomplished by comparing the highest concentration detected to a value which represents the upper range of the ambient concentrations for that metal. For this purpose we recommend here a procedure which we have previously recommended for other sites in California. The crux of the method is the use of plots of the log of concentration vs. cumulative probability.

a. **Expand the data set.** The largest data set possible is desirable for describing ambient conditions. If the number of 'background' samples planned is not sufficiently large, the population size for 'background' analysis can be expanded by a technique used successfully at several other sites. Samples of soil collected because of suspected contamination with petroleum products often are found negative for these mixtures upon assay. If these same samples were assayed for metals, the basewide data set can be augmented. This method worked well for Marine Corps Air Ground Combat Center Twentynine Palms. At Naval Station Long Beach, data sets from several investigations were combined to good effect.

b. **Display summary statistics for the expanded data set.** Construct a table showing the following for each metal: frequency of detection, range of detected values, range of sample quantitation limits, arithmetic means and standard deviations, and coefficients of variation (CV). If ranges of values for a metal exceed two orders of magnitude or if the coefficient of variation exceeds 1.00, then data from contaminated samples may be present..

c. **Plot logarithm of concentration vs. cumulative probability.** Sort concentration data for a metal from the lowest to the highest value, using one-half the sample quantitation limit for non-detects. Assume that ambient concentrations of metals are lognormally distributed. Our experience at other sites in California has shown lognormality to be a robust and useful assumption for the distributions of ambient concentrations of metals, even at frequencies of detection much less than 100%. Construct a plot of cumulative probability vs. log of concentration. Equal distances on the probability axis represent equal numbers of standard deviations. If the sample population numbers 100, then the cumulative probability is 0.05 when the lowest five values have been plotted.

d. **Define ambient conditions as the population with the lowest concentrations.** If data are drawn from just one population, then the log-probability plot will be a straight line. Inflection points suggest multiple populations, possibly as a result of differing soil types or anthropogenic influences (contamination). For the purpose of identifying COPC for risk assessment, we recommend defining ambient conditions as the range of concentrations associated with the population nearest the origin in the plot . This definition may be performed by inspection or via commercially available computer software. The population with the lowest range is selected to minimize the chance of erroneously eliminating a metal whose concentrations are actually due to contamination. The population with the highest range of concentrations might represent contamination, especially if the summary statistics show that the range of detected values exceeds two orders of magnitude and/or if the CV exceeds 1.00. Professional judgment is sometimes required to conclude that some portion of the data intended to represent ambient conditions actually represents contamination.

e. **Calculate a value to represent the upper range of ambient conditions.** Using only the data from the population with the lowest concentrations (with one-half sample quantitation limits substituting for non-detects), calculate the 80% lower confidence limit on the 95th quantile. A lower confidence limit on a quantile is used in preference to an upper confidence limit, because it is self-correcting with respect to sample size. By this is meant that small sample sizes will yield restrictive comparators (lower values) and metals will tend to retained as COPC, while larger sample populations will yield less restrictive comparators and COPC may be eliminated more easily. Statistical tables for calculating lower confidence limits on quantiles may be obtained from OSA. If the 'background' population size exceeds 50 use the 95th quantile itself, rather than a lower confidence limit on the 95th quantile.

f. **Include or exclude metals as COPC.** If the highest concentration of a metal detected at a site is less than the comparator selected to represent the upper range of ambient conditions, then eliminate the metal as a COPC. If concentrations higher than the comparator are found, then include the metal in the risk assessment as a COPC. For those metals retained, it is often useful to examine the spatial distribution of the elevated concentrations to determine if a "hot spot" is present.

The U.S. EPA Region IX Regional Toxicologist has reviewed and agreed with the enclosed methodology.

Reviewed by : John P. Christopher, Ph.D., DABT
Staff Toxicologist
Human and Ecological Risk Section

cc: Deborah J. Oudiz, Ph.D., Senior Toxicologist, Northern California Liaison, HERS

Ms. Sophia Serda, Ph.D.
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M E M O R A N D U M

TO: Ken Smith, Chief
Office of Military Facilities

VIA: Richard A. Becker, Ph.D., DABT, Chief
Human and Ecological Risk Section (HERS)
Office of Scientific Affairs (OSA)

FROM: Michael J. Wade, Ph.D., DABT
Senior Toxicologist, HERS

Laura Valoppi, M.S.,
Associate Toxicologist, HERS

John P. Christopher, Ph.D., DABT,
Staff Toxicologist, HERS

DATE: October 28, 1994

SUBJECT: RECOMMENDED OUTLINE FOR USING U. S. ENVIRONMENTAL PROTECTION AGENCY REGION IX PRELIMINARY REMEDIATION GOALS IN SCREENING RISK ASSESSMENTS AT MILITARY FACILITIES

Outcome: 02 PCA: 14765 Site: 914600-45

BACKGROUND

Anthony Landis of Office of Military Facilities (OMF) requested that Office of Scientific Affairs (OSA) provide guidance on the use of Preliminary Remediation Goals (PRGs) published by U. S. Environmental Protection Agency (EPA), Region IX for the purpose of screening sites or prioritizing sites for remedial action at military facilities. This request is a follow-up to our memorandum to you of August 26, 1994, in which Human and Ecological Risk Assessment Section (HERS) outlined three acceptable approaches to performing risk assessment at open military facilities.

HERS continues to recommend that the *Preliminary Endangerment Assessment (PEA) Guidance Manual* (Department of Toxic Substances Control (DTSC), 1994) be used to screen sites for "no further action", based upon the potential for adverse effects on human health and the environment. We understand that military facilities in California have expressed interest in using U. S. EPA Region IX PRGs. In the past, HERS has expressed concern that the U. S. EPA Region IX PRGs omit important exposure pathways and other components specified in the PEA. Thus, we have often stated that PRGs were not appropriate for screening sites.

U. S. EPA Region IX published new PRGs on August 1, 1994 which differ from earlier versions. The August 1, 1994 PRGs from U. S. EPA Region IX were modified to consider more pathways and factors. The derivation of the "Soil PRGs" shown in the August 1, 1994 list from U. S. EPA Region IX now more closely conforms to the PEA process. As explained below in **Section C**, "Cal Modified" PRGs" are provided for six chemicals in the August 1 PRG list which differ by more than four fold from values calculated using the PEA process. Nevertheless, using this most recent August 1 list of PRGs requires a complete guidance context, such as that provided in the PEA.

In our previous memorandum to you of August 26, 1994, HERS outlined three acceptable approaches to performing risk assessment at open and closing military facilities:

1. Use the 1994 PEA process;

2. Use the August 1, 1994 PRGs from U. S. EPA Region IX (or subsequent lists), provided a protocol is submitted and accepted specifying how these PRGs are to be used; or

3. Perform a complete multipathway risk assessment using DTSC and U. S. EPA guidance for risk assessment.

The purpose of this memorandum is to provide OMF with a framework of important elements to be included in the protocol for Number 2 above. What we provide below is largely the logic of the PEA process to supplement the August 1, 1994 PRGs from U. S. EPA Region IX.

REQUIRED ELEMENTS FOR USING U. S. EPA REGION IX PRGs

The following are elements which must be addressed in any work plan or protocol which makes use of the August 1, 1994 U. S. EPA Region IX PRGs, or subsequent lists. All of these elements must be addressed.

A. Land Use

In general, HERS strongly recommends that an unrestricted land use scenario, similar to a residential scenario, be used for site screening, unless a recorded deed restriction prevents such land use. This recommendation is based on our experience that screening evaluations are conducted to determine whether a finding of "no further action" is warranted. We make this recommendation for screening risk assessments at all military facilities, both active and closing.

In nearly all cases, the unrestricted (residential like) setting provides the greatest potential exposures to contaminants. Therefore, sites found to have acceptable risk for unrestricted land use will also have acceptable risks for other uses, such as industrial. However, sites found acceptable for industrial use might not be acceptable for other uses. For military facilities which are closing or have closed, HERS recommends that the unrestricted setting be used for site screening. We assume that reuse of these facilities will result in a change of ownership and land use. The unrestricted scenario is the most appropriate for screening sites at open facilities as well, because this health-conservative analysis provides the risk manager with enough information to approve "no further action" or to require additional investigation. Use of an unrestricted exposure scenario in no way obligates the risk manager to clean up to this level. If ultimately industrial use is seen to be the probable land use, then the site can be remediated to this level. The unrestricted scenario can then provide documentation to restrict land use to industrial.

PRGs for an industrial setting are provided in the August 1, 1994 publication from U. S. EPA Region IX. The protocol should clearly document the basis for assuming unrestricted land use (such as residential) will not occur in the future; the results of screening against residential PRGs should be included to document the need for any restrictions on future land use.

The Project Manager should be aware that several exposure pathways are <u>not</u> included in U. S. EPA Region IX's calculation of Industrial PRGs. The excluded pathways are:

1. All uses of surface and groundwater;

2. Exposure to soil gas which infiltrates indoor air;

3. Exposure to surface and goundwater contaminated by soil leachate; and

4. Inhalation of particulates from trucks and heavy equipment.

The protocol must address the rationale for eliminating each of these pathways for use of the Industrial PRGs to be acceptable.

B. Background, Detection Limits, Exposure Point Concentrations, and Key Chemical Groups

Inorganic constituents present at levels above the PRGs but at or below site background may be eliminated from the screening procedure. However, the fact that they are present above the PRGs should be noted in the assessment, along with the levels at which they were found. Preparers of protocols should consult with the DTSC Project Manager on the adequacy and representativeness of background sampling.

The protocol must include evaluation of the adequacy of the method detection limits (e.g., can the media-specific PRGs be detected?).

For site related chemicals remaining after comparison against background, the choice of the exposure point concentration should be specified in the protocol as either the maximum concentration observed or the 95 percent upper confidence limit on the arithmetic mean concentration (95 percent UCL). The 95 percent UCL may be used only with the approval of the DTSC Project Manager.

Several chemical groups occur repeatedly as "risk drivers" for military sites. The protocol should include how the following chemical groups will be assessed:

1. Polycyclic aromatic hydrocarbons (PAHs),

2. Polychlorinated biphenyls (PCBs),

3. Polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs),

4. DDT and its congeners DDE and DDD; and

5. Hexavalent chromium.

Analytical results for total petroleum hydrocarbons (TPH) may not be used at any level of risk assessment. Instead, the principal toxic constituents must be quantified and their concentrations compared against the August 1, 1994 PRGs from U. S. EPA Region IX. The principal toxic constituents of hydrocarbon fuels are certain metals benzene, toluene, ethylbenzene, xylene(s), and PAHs.

C. California Modified PRGs

With the exception of nine substances (the six compounds listed immediately below, two PAHs listed in a following paragraph and lead, described on the next page), the August 1, 1994 PRGs from U. S. EPA Region IX now differ by no more than four-fold from values calculated using the PEA process and Cal/EPA cancer potency factors. U. S. EPA Region IX has published "CAL-Modified PRGs" for the following six chemicals in its August 1, 1994 PRGs:

1. Cadmium,
2. Hexavalent chromium,
3. 1,2-dibromo-3-chloropropane (DBCP),
4. Nickel and compounds,
5. Benzo(a)pyrene (in water only), and
6. Tetrachloroethene (PCE).

These "CAL-Modified PRGs" should be used when screening sites at Federal facilities in California.

In the August 1, 1994 Region IX list, PRGs for two additional substances, chrysene and benzo(k)fluoranthene differ by more than a factor of four as calculated by the PEA process and by Region IX. CAL-Modified PRGs for chrysene and benzo(k)fluoranthene (both are PAHs) are given in Appendix A-1, to be included with the Region IX PRG list. *These should be used when screening sites at Federal facilities in California.* It is expected that the CAL-modified PRGs for these two chemicals will be added to the body of the Region IX PRG list at its next iteration. Also contained in Appendix A-1 are PRGs for all Carcinogenic PAHs for which Region IX has calculated a PRG.

Appendix A-2 contains Provisional PRGs for all PAHs that have Cal/EPA Potency Slopes or Potency Equivalency Factors available, but for which Region IX has not calculated a PRG. These Provisional PRGs were derived by OSA using Cal/EPA Potency Equivalency or Cancer Slope Factors and U.S. EPA Region IX PRG methodology. These Provisional PRGs are available for screening sites at Federal Facilities in California upon consultation with OSA and Region IX toxicologists.

The PRG for naphthalene is currently under discussion with Region IX. Please consult with Michael Wade at OSA regarding a PRG for this substance. A finalized PRG for naphthalene should be available by the next iteration of the Region IX PRG list.

The U. S. EPA Region IX soil PRG of 400 parts per million (ppm) for inorganic lead under residential scenario, does not conform to DTSC policy. The PEA (1994) screening level of 130 ppm inorganic lead in soil should be used at Federal facilities in California.

D. Impacts to Water

The August 1, 1994 publication from U. S. EPA Region IX also contains "Tap Water PRGs". These "Tap Water PRGs" can only be used if an exposure point concentration for the contaminant in groundwater or surface water is available or can be estimated. It is important to understand that the "Soil PRGs" are not calculated to include the potential for the contaminant to move to groundwater or surface water. Neither do they assess the likelihood that groundwater or surface water has been impacted by past releases. Such a determination requires the preparer of the protocol and the DTSC Project Manager to consider the complexities of geology and soil characteristics, disposal history, and chemical fate and transport to make an informed determination based on professional judgment.

The protocol should describe how impacts to groundwater and surface waters will be assessed, considering not only past releases, which could have resulted in existing impacts to groundwater, but also the potential for additional releases which may result in future impacts.

Preparers of protocols must gain the concurrence of the DTSC Project Manager that impacts to groundwater and surface waters are adequately addressed. This approval should be given prior to any calculation of risks/hazards to human health. If site-specific information is insufficient to judge the potential impact of contaminants on surface water and groundwater, then the calculation of risks/hazards cannot proceed. Estimates of risks/hazards are not useful if they do not reflect the true risk from site contaminants. If it has been determined that no threat exists now or in the future to surface water or groundwater, and if DTSC staff concur with this determination, then the protocol must contain the rationale for eliminating this pathway.

In some instances, information may be limited on threats to surface water and groundwater, but available data do not fully represent the nature and extent of the contamination in water. In such an instance, the "Tap Water PRGs" from U. S. EPA Region IX's August 1, 1994 document can be used to compare against concentrations in waters at the site; however, such comparisons must be accompanied by a qualifying statement indicating that the risk estimates from the water pathway may be underestimated.

The "Tap Water PRGs" are for screening levels for human health only; protection of aquatic organisms was not considered in their derivations. It cannot be assumed that levels protective of humans are protective of aquatic organisms and wildlife.

E. Excluded Pathways

Certain pathways were excluded in the derivation of the August 1, 1994 PRGs from U. S. EPA Region IX. The protocol must provide a rationale for why these pathways can be excluded at the site in question.

1. **Water**: The August 1, 1994 "Tap Water PRGs" from U. S. EPA do not consider dermal absorption from bathing/showering for groundwater and surface water exposures. The "Tap Water PRGs" include neither ingestion of water while swimming nor transfer of contaminants in the water column to aquatic organisms or terrestrial plants, with subsequent ingestion by humans. This is not consistent with the PEA (1994), which does add this route of exposure. If this pathway is expected to result in a significant exposure, HERS should be contacted.

2. **Soil**: The "Soil PRGs" include neither inhalation of soil gases which infiltrate indoor air nor ingestion of contaminants by humans via uptake by plants (home-grown

fruits and vegetables) or animals (milk, meat, eggs). If these pathways are expected to result in a significant exposure, HERS should be contacted.

F. Air Models

Several issues regarding air are covered in the PEA but not in the August 1, 1994 PRGs from U. S. EPA Region IX. The following limitations should be noted when using these PRGs:

1. **Volatile Compounds**: The models used to calculate the "Ambient Air PRGs" and "Soil PRGs" do not represent the enhanced volatilization of compounds which can occur in the presence of landfill gases such as methane. For example, when solid waste is disposed along with hazardous wastes, the generation of methane formed from the decomposition of the solid waste can increase the emission rate of other volatile compounds. The air model for volatile compounds is based on the soil as the only source; shallow groundwater which contains volatile compounds may be an additional source to the ambient air. The August 1, 1994 PRGs from U. S. EPA Region IX were derived with a volatile emissions model using an industrial area of 2025 m^2, while the PEA manual used an area of 484 m^2 for a residential setting. This may result in different air concentrations from the two methods.

   Sometimes calculation of the "Soil PRG" resulted in a concentration which would exceed the theoretical saturation concentration in soil; in these cases U. S. EPA Region IX notes the "Soil PRG" as a "max" or "sat". This means that the "Soil PRG" is based not on risk or hazard but on the maximum soil concentration that is predicted to be absorbed onto the soil (without free product present). Above this predicted saturation concentration, the air model employed by U. S. EPA Region IX is no longer applicable, and the potential presence of free product implies a predicted threat to surface or groundwater. The protocol should indicate how exceedances of the saturation concentration will be dealt with.

2. **Fugitive Dusts**: The dust model used in the "Soil PRGs" and "Ambient Air PRGs" is a rapid assessment method which assumes a continuous and constant source for emissions. If the source at the site is actually small

and will deplete over the time frame of the exposure, then risks/hazards will be overestimated.

G. Additivity of Risk and Hazards

For each site-related chemical, concentrations in soil, air and water (if all these pathways are relevant) should be divided by the corresponding "Soil PRG", "Tap Water PRG", or "Ambient Air PRG"; these ratios must then be added across media. This summed ratio provides an estimate of the total risk or hazard for that compound in multiple media. In addition, the risk or hazard for multiple compounds at the site must also be accounted for according to the following:

1. **Compounds with Non-threshold Effects (Carcinogens)**: Chemicals whose PRGs are based on carcinogenic effects are designated with "ca" in the August 1, 1994 PRGs from U. S. EPA Region IX. All concentrations of carcinogens are thought to be associated with at least some risk, i.e., no threshold. Section 2.4 of the August 1, 1994 PRGs from U. S. EPA Region IX suggests adding the risk ratios together for multiple carcinogens to provide an estimate of risk for the total site. The magnitude of the risk will be the sum of the ratios times 10^{-6}. This provision must be included in the protocol.

2. **Threshold Compounds (Non-carcinogens)**: Chemicals whose PRGs are designated with "nc" in the August 1, 1994 PRGs from U. S. EPA Region IX are thought to exert toxic effects which display a threshold, i.e., a level below which no toxicity is expected. Section 2.4 of the August 1, 1994 PRGs from U. S. EPA Region IX suggests that hazard ratios (non-cancer endpoints) be summed to provide a hazard index. U. S. EPA Region IX does not provide PRGs for the threshold effects of carcinogens.

   If the summed hazard index is greater than one, then the hazard index may be recalculated for chemicals which have the same toxic manifestation or which affect the same target organ. The protocol must provide a discussion of which chemicals will be grouped, if any, and provide a rationale for the grouping.

E. Ecological Assessment

The August 1, 1994 PRGs from U. S. EPA Region IX only apply to human receptors. It cannot be assumed that levels protective of humans will also protect ecological receptors. The protocol must describe how the ecological assessment will be conducted. The protocol must address the potential for impacts to ecological receptors within the site boundary, as well as the potential for impacts off-site due to movement of contaminants (e.g., conveyance off-site via a storm drainage system) or intermedin transfers (e.g., food-chain transfers to animals residing off-site but using the site as a forage area). HERS recommends a screening level ecological evaluation, either one which follows the guidance outlined in Section 2.6 of the PEA, or one which follows the recently published *Draft Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities, Parts A and B: Scoping Assessment* (DTSC, September 1994).

SUMMARY

HERS provides in this memorandum a framework similar to the PEA within which the August 1, 1994 PRGs from U. S. EPA Region IX may be used for screening sites at military bases in California. If it is determined that a full-scale baseline risk assessment is needed, chemicals cannot be eliminated because they are below PRG or PEA levels due to the need to add risk and hazard for all chemicals.

We emphasize to OMF that sites which fail this screening process require further investigation, and <u>do not necessarily require removal actions</u>. Such further investigation might be very limited in scope. For example, further characterization of certain compounds may be needed, such as speciation for hexavalent chromium, or further refinement of the risk estimates could be conducted, such as use of a different air model based on site characteristics.

If you have any questions on this memorandum, please contact HERS liaison for Federal facilities, Dr. Michael Wade, at (916) 327-2496 (CALNET 467-2496).

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REFERENCES

1. Department of Toxic Substances Control. January 1994. Preliminary Endangerment Assessment Guidance Manual. State of California, Environmental Protection Agency. Sacramento, California.

2. Department of Toxic Substances Control. September 1994. Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities, Part B: Scoping Assessment. Draft guidance for review and comment. State of California, Environmental Protection Agency, Office of Scientific Affairs, Human and Ecological Risk Section. Sacramento, California.

3. United States Environmental Protection Agency, Region IX. August 1, 1994. Memorandum from Stanford J. Smucker, Ph.D., Regional Toxicologist, Technical Support Section, Subject: Region IX Preliminary Remediation Goals (PRGs) Second Half 1994.

APPENDIX A-1
SOIL PRGs FOR CARCINOGENIC PAHs

COMPOUND	CAL/EPA POTENCY EQUIVALANCY FACTOR	U.S. EPA REGION IX RESIDENTIAL SOIL PRG (ppm)
benzo(a)pyrene	1.0 (index compound)	6.1 E-02
dibenz(a,h)anthracene	0.4[a]	6.1 E-02
benzo(a)anthracene	0.1	6.1 E-01
benzo(b)fluoranthene	0.1	6.1 E-01
benzo(k)fluoranthene	0.1	6.1 E-01[b]
indeno(1,2,3-c,d)pyrene	0.1	6.1 E-01
chrysene	0.01	6.1 E+00[b]

[a]Toxicity Equivalency Factor calculated from CAL/EPA Cancer Slope Factor of 11.5 $(mg/kg\text{-}day)^{-1}$ for benzo(a)pyrene and 4.1 $(mg/kg\text{-}day)^{-1}$ for dibenz(a,h)anthracene.

[b]Cal-Modified PRGs based on Cal/EPA Potency Equivalency Factors and U.S. EPA Region IX PRG methodology.

Appendix A-2
CARCINOGENIC PAHs WITHOUT U.S. EPA REGION IX PRGs

COMPOUND	CAL/EPA POTENCY EQUIVALENCY FACTOR OR CANCER SLOPE FACTOR	PROVISIONAL SOIL PRG[a,b]
benzo(j)fluoranthene	0.1	6.1 E-01
dibenz(a,j)acridine	0.1	6.1 E-01
dibenz(a,h)acridine	0.1	6.1 E-01
7H-dibenzo(c,g)carbazole	1.0	6.1 E-02
dibenzo(a,e)pyrene	1.0	6.1 E-02
dibenzo(a,h)pyrene	10.0	6.1 E-03
dibenzo(a,i)pyrene	10.0	6.1 E-03
dibenzo(a,l)pyrene	10.0	6.1 E-03
5-methylchrysene	1.0	6.1 E-02
1-nitropyrene	0.1	6.1 E-01
4-nitropyrene	0.1	6.1 E-01
1,6-dinitropyrene	10.0	6.1 E-03
1,8-dinitropyrene	1.0	6.1 E-02
6-nitrochrysene	10.0	6.1 E-03
2-nitrofluorene	0.01	6.1 E+00
7,12-dimethylbenzanthracene	(250)[c]	2.8 E-03
3-methylcholanthrene	(22)	3.2 E-02
5-nitroacenaphthene	(0.13)	5.4 E+00

[a]Derived by OSA using CAL/EPA Potency Equivalancy Factors or Cancer Slope Factors and U.S. EPA Region IX PRG Methodology.

[b]Please contact OSA should you have a question regarding PRGs for these compounds.

[c]Parentheses signify Cancer Potency Slopes given in units of $(mg/kg\text{-}day)^{-1}$.

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Subject: Statistical Methodology for Background Comparisons, Naval Air Station Alameda, California, September 17, 1995

The subject document has been reviewed by Regional Board staff along with the draft comments to this document from James Polisini of the Department of Toxic Substances Control. Regional Board staff generally concurs with the Dr. Polisini's comments and offers no additional comments at this time.

If you have any questions regarding this document, please feel free to contact me at (510) 286-4222, or Ron Gervason at (510) 286-0688.

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