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San Francisco Bay Regional Water Quality Control Board

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DATE: February 18, 2005

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SUBJECT: February 2005 Update to Environmental Screening Levels ("ESLs") Technical Document

Staff of the San Francisco Bay Regional Water Quality Control Board (Water Board) has prepared a February 2005 update to the technical document *Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater* (Interim Final - February 2005). This update reflects recent revisions to toxicity factors presented in the USEPA Preliminary Remediation Goals document ("PRGs", October 2004) as well as references to recent publications regarding the evaluation of vapor intrusion concerns.

The updated ESL document also incorporates California Human Health Screening Levels (CHHSLs) for soil and soil gas published in December 2004 by the Office of Environmental Health Hazard Assessment. These screening levels address direct exposure to soil and potential vapor intrusion into buildings. Screening levels very similar to the CHHSLs were included in the July 2003 edition of the ESL document. The February 2005 edition of the ESL document includes revisions to make correlative screening levels in that document more consistent with approaches used to develop the CHHSLs. As discussed in the accompanying guidance document, the CHHSLs do not address all potential environmental concerns that may be present at sites where contaminated soil and groundwater are identified. Evaluation of additional concerns must be carried out separately. The updated ESL document offers one approach to accomplish this.

A more detailed summary of updates is provided in Chapter 1 and Appendix 8 of the ESL document. The document is intended to help expedite the identification of potential environmental concerns at sites where contaminated soil and groundwater have been identified and ultimately expedite the cleanup and redevelopment of these properties. As an alternative to preparing a detailed, baseline environmental risk assessment, soil, groundwater and other data collected at a site can be directly compared to the ESLs and the need for additional actions determined in an expedited risk assessment. This approach has been shown to be especially effective and efficient at sites with limited or relatively straightforward types of contamination, where the preparation of a more formal risk assessment may not be warranted or feasible due to time and cost constraints.

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Screening For Environmental Concerns At Sites With Contaminated Soil and Groundwater

Volume 1: Summary Tier 1 Lookup Tables

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DISCLAIMER

This document, *Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater* (February 2005), is a technical report prepared by staff of the California Regional Water Quality Board, Bay Area Region (Board staff). This document is not intended to establish policy or regulation. The Environmental Screening Levels presented in this document and the accompanying text are specifically not intended to serve as: 1) a stand-alone decision making tool, 2) guidance for the preparation of baseline ("Tier 3") environmental assessments, 3) a rule to determine if a waste is hazardous under the state or federal regulations, or 4) a rule to determine when the release of hazardous chemicals must be reported to the overseeing regulatory agency.

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This document will be periodically updated as needed. Please send comments, edits, etc. in writing to the above contacts. Board staff overseeing work at a specific site should be contacted prior to use of this document in order to ensure that the document is applicable to the site and that the user has the most up-to-date version available. This document is not copyrighted. Copies may be freely made and distributed. It is cautioned, however, that reference to the screening levels presented in this document without adequate review of the accompanying narrative could result in misinterpretation and misuse of the information.

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Executive Summary

This document presents Environmental Screening Levels (ESLs) for chemicals commonly found in soil and groundwater at sites where releases of hazardous chemicals have occurred. The ESLs replace screening levels presented in the previous edition of this document, entitled *Application of Risk-Based Screening Levels (RBSLs) And Decision Making to Sites With Impacted Soil and Groundwater* (December 2001). The change in terminology from "Risk-Based" screening levels to "Environmental" screening levels is intended to better convey the broad scope of the document and clarify that some screening levels are not "risk-based" in a strict toxicological definition of this term.

The ESLs are considered to be conservative. Under most circumstances, and within the limitations described, the presence of a chemical in soil, soil gas or groundwater at concentrations below the corresponding ESL can be assumed to not pose a significant, long-term (chronic) threat to human health and the environment. Additional evaluation will generally be necessary at sites where a chemical is present at concentrations above the corresponding ESL. Active remediation may or may not be required, however, depending on site-specific conditions and considerations. This document may especially be beneficial for use at sites with limited impacts, where the preparation of a more formal environmental assessment may not be warranted or feasible due to time and cost constraints.

The ESLs were developed to address environmental protection goals presented in the *Water Quality Control Plan for the San Francisco Bay Basin* ("Basin Plan," RWQCBSF 1995) of the San Francisco Bay Area Regional Water Quality Control Board (RWQCB). These goals include:

Surface Water and Groundwater:
- Protection of drinking water resources;
- Protection of aquatic habitats;
- Protection against vapor intrusion into buildings;
- Protection against adverse nuisance conditions.

Soil:
- Protection of human health (direct-exposure);
- Protection against vapor intrusion into buildings;
- Protection against leaching and subsequent impacts to groundwater;
- Protection of terrestrial biota;
- Protection against adverse nuisance conditions.

The ESLs are presented in a series of four lookup tables. Each table reflects a specific combination of soil, groundwater and land-use characteristics that strongly influence the magnitude of environmental concerns at a given site. This allows the user to select ESLs

that are most applicable to a given site.

The ESL document presents a "tiered" approach to environmental risk assessments. Under "Tier 1", sample data are directly compared to ESLs selected for the site and decisions are made regarding the need for additional site investigation, remedial action or a more detailed risk assessment. In a "Tier 2" risk assessment, a selected component(s) of the Tier 1 ESL is modified with respect to site-specific considerations. An example may be the adjustment of a screening level for direct exposure with respect to an approved, alternative target risk level. Site data are then compared to the revised screening level as well as the remaining, unmodified components of the Tier 1 ESL. This provides an intermediate but still relatively rapid and cost-effective option for preparing more site-specific risk assessments. Risk assessment models and assumptions that depart significantly depart from those used to develop the Tier 1 ESLs are described in a more traditional, "Tier 3" risk assessment. The Tier 1 methodology can, however, still provide a common platform to initiate a Tier 3 risk assessment and help ensure that all potentially significant environmental concerns are considered.

The Tier 1 ESLs presented in the lookup tables are NOT regulatory "cleanup standards". Use of the ESLs and this document in general is intended to be entirely optional on the part of the regulated facility and subject to the approval of the case manager in the overseeing regulatory agency. The presence of a chemical at concentrations in excess of an ESL does not necessarily indicate that adverse impacts to human health or the environment are occurring; this simply indicates that a potential for adverse risk may exist and that additional evaluation is warranted. ESLs presented for chemicals that are known to be highly biodegradable in the environment may in particular be overly conservative for use as final cleanup levels (e.g., many petroleum-related compounds). Use of the ESLs as cleanup levels should be evaluated in view of the overall site investigation results and the cost/benefit of performing a more site-specific risk assessment.

Reliance on only the Tier 1 ESLs to identify potential environmental concerns may not be appropriate for some sites. Examples include sites that require a detailed discussion of potential risks to human health, sites where physical conditions differ drastically from those assumed in development of the ESLs (e.g., mine sites, landfills, etc., with excessively high or low pH) and sites where impacts pose heightened threats to sensitive ecological habitats. The latter could include sites that are adjacent to wetlands, streams, rivers, lakes, ponds or marine shoreline or sites that otherwise contain or border areas where protected or endangered species may be present. Potential impacts to sediment are also not addressed. (e.g., presence of endangered or protected species). The need for a detailed ecological risk assessment should be evaluated on a site-by-site basis for areas where significant concerns may exist. Notification to the Natural Resource Trustee Agencies (including the state Department of Toxics Substances Control and Department of Fish and Game and the federal Fish and Wildlife Service, Department of the Interior and National Oceanic and Atmospheric Administration) may also be required, particularly if the release of a hazardous substance may impact surface waters.

The ESLs should NOT be used to determine when impacts at a site should be reported to a regulatory agency. All releases of hazardous substances to the environment should be reported to the appropriate regulatory agency in accordance with governing regulations. The lookup tables will be updated on a regular basis, as needed, in order to reflect changes in the referenced sources as well as lessons gained from site investigations and field observations.

1

Introduction

1.1 Purpose

Preparation of detailed environmental risk assessments for sites impacted by releases of hazardous chemicals can be a time consuming and costly effort that requires expertise in a multiple of disciplines, including toxicology, geology, ecology, chemistry, physics and engineering, among others. For small-business owners and property owners with limited financial resources, preparation of such risk assessments can be time and cost-prohibitive.

As a means to partially address this problem, this document presents a series of conservative Environmental Screening Levels (ESLs) for soil, groundwater and soil gas that can be directly compared to environmental data collected at a site. Correlative screening levels for surface water are also provided. Screening levels for over 100 commonly detected contaminants are given in a series of "lookup" tables. The tables are arranged in a format that allows the user to take into account site-specific factors that help define environmental concerns at a given property.

Within noted limits, risks to human health and the environment can be considered to be insignificant at sites where concentrations of chemicals of concern do not exceed the respective ESLs. The presence of chemicals at concentrations above the ESLs does not necessarily indicate that a significant risk exists at the site. It does, however, generally indicate that additional investigation and evaluation of potential environmental concerns is warranted.

The introductory text of this document is kept intentionally brief with a focus on the use of the ERLs rather than technical details about their derivation. The latter is provided in the appendices of Volume 2.

1.2 Tiered Approach to Environmental Risk Assessments

This document presents a three-tiered approach to environmental risk assessment. Under "Tier 1", sample data are directly compared to ESLs selected for the site and decisions are made regarding the need for additional site investigation, remedial action or a more

detailed risk assessment. A detailed understanding of the derivation of the screening levels is not required for use at this level.

Under "Tier 2", selected components of the models used to develop the Tier 1 ESLs are modified with respect to site-specific data or considerations. Examples include adjustment of the assumed depth to impacted groundwater in the Tier 1 indoor-air impact model or use of an approved, alternative target risk level for direct-exposure concerns. Site data are then compared to the revised screening level as well as the remaining, unmodified components of the Tier 1 ESLs. This provides an intermediate but still relatively rapid and cost-effective option for preparing more site-specific risk assessments.

Under Tier 3, the user employs alternative models and modeling assumptions to develop site-specific screening or final cleanup levels or quantitatively evaluate the actual risk posed to human and/or ecological receptors by the impacted media. Consideration of the methodologies and potential environmental concerns discussed in this document is still encouraged, however. This will help increase the comprehensiveness and consistency of Tier 3 risk assessments as well as expedite their preparation and review.

1.3 Comparison To Existing Screening Levels

The CalEPA Office of Environmental Health Hazard Assessment recently published California Human Health Screening Levels or "CHHSLs" for a number of common contaminants in soil and soil gas (CalEPA 2004a). The CHHSLs are essentially identical to Preliminary Remediation Goals or "PRGs" developed by Region IX of the U.S. Environmental Protection Agency and in use since the early 1990s (USEPA 2004). The City of Oakland (Oakland 2000) has also prepared lookup tables of Environmental Screening Levels for soil and water.

The Environmental Screening Levels or "ESLs" presented in this document represent an expansion of the USEPA PRGs (and by default, the CalEPA CHHSLs) and the City of Oakland screening levels to reflect the broader scope of environmental concerns put forth in the Regional Water Quality Control Board (RWQCB) Basin Plan (RWQCBSF 1995). Differences and similarities between the ESL document and lookup tables prepared by the other programs are summarized below.

1.3.1 OEHHA CHHSLs

1.3.1.1 Background

The CalEPA Office of Environmental Health Hazard Assessment (OEHHA) published "California Human Health Screening Levels (CHHSLs)" in a reported entitled *Proposed Methodology for Calculating Advisory Human-Exposure-Based Screening Numbers*

Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (November 2004, CalEPA 2004a). Preparation of the CHHSLs was required under the California Land Environmental Restoration and Reuse Act (CLRRA 2002). An accompanying guidance document entitled *Use of California Human Health Screening Levels in Evaluation of Contaminated Properties* was also prepared (CalEPA 2005). The documents present human health-based screening levels for 50+ common contaminants in soil and/or soil gas. The CHHSLs are essentially identical to correlative soil and soil gas screening levels incorporated into the ELS lookup tables. A brief discussion of the CHHSLs is provided below. A comparison of CHHSLs and ESLs (as well as the USEPA Region IX PRGS) is provided in Appendix 9. CHHSLs were not developed for groundwater or surface water.

Soil CHHSLs for direct-exposure concerns were developed by OEHHA in coordination with the Department of Toxic Substances Control. Screening levels are presented for semi-volatile and nonvolatile chemicals. Models and exposure assumptions used are essentially identical to those used to develop the USEPA Region IX Preliminary Remediation Goals (see Section I.3.2) as well as comparable ESLs (see Appendices 1 and 2). CalEPA toxicity factors and skin absorption factors were used in preference over USEPA factors when available. The same factors were incorporated into this edition of the ESLs, with only minor adjustments to affected screening levels. One exception is the (continued) use of a more conservative Hazard Quotient of 0.2 to calculate ESLs for noncarcinogens (versus 1.0 for both the CHHSLs and the PRGs). This is done in order to address potential cumulative health effects at sites with multiple contaminants. Cumulative effects must be evaluated on a site-by-site basis under both the CHHSLs and the USEPA PRGs.

The DTSC and OEHHA opted not to publish direct-exposure CHHSLs for volatile organic chemicals or "VOCs" (refer to Section 2.5 of CHHSLs guidance document). Screening levels for VOCs are, however, included in the ESL document (see Appendix 1). The ESL screening levels are based on the same model and exposure assumptions used to develop the USEPA Region IX Preliminary Remediation Goals, with the addition of CalEPA toxicity factors and an adjustment of the target Hazard Quotient for noncarcinogens (refer to Section 1.3.2 and Appendix 2).

Soil gas screening levels for potential vapor intrusion concerns are presented in the CHHSLs document (VOCs only). Staff with the San Francisco Bay Area Regional Water Quality Control Board as well as DTSC assisted in preparation of these screening levels. The screening levels were also developed using the same USEPA model as used to develop the soil gas screening levels presented in the ESL document (refer to Appendix 1) and referenced in the recent DTSC vapor intrusion guidance document (CalEPA 2004b). One difference is the use of a higher, assumed indoor-air exchange rates in the ESL model, due to the more moderate climate of the San Francisco Bay area (1.0 and 2.0 exchanges per hour for residences and commercial/industrial settings, respectively, versus 0.5 and 1.0 exchanges per hour referenced in the CHHSLs document; refer to

Appendix 1). As a result, soil gas screening levels presented in the CHHSLs document are roughly half of those presented in the ESL document at similar target risk goals for comparative site scenarios (see Appendix 9). For noncarcinogens, soil gas ESLs remain lower than comparable CHHSLs due to the more conservative target Hazard Quotient used.

1.3.1.2 Use of ESLs Versus CHHSLs

At sites overseen by the San Francisco Bay Regional Water Quality Control Board, the ESLs should continue to be used without modification. Soil, soil gas and indoor air screening levels essentially identical to the CHHSLs are already incorporated into the ESL document. While important, the CHHSLs do not address potential groundwater protection concerns and address only two of five environmental concerns potentially related to contaminated soil (refer also to Section 2.1 and Figure 1):

Environmental Concerns Addressed

	ESLs	CHHSLs
Groundwater Quality		
Drinking Water	YES	NO
Vapor Emission To Buildings	YES	NO
[1]Aquatic Receptors	YES	NO
[2]Gross Contamination	YES	NO
Soil Quality		
Direct Exposure	YES	YES
Vapor Emissions To Buildings	YES	NO
Leaching to Groundwater	YES	NO
Terrestrial Receptors	YES	NO
[2]Gross Contamination	YES	NO
Shallow Soil Gas		
Vapor Emission	YES	YES

1. Groundwater discharge to surface water.
2. Nuisances (odors, etc.), general resource degradation.

The CHHSLs should be thought of as one component of the ESLs, not as an alternative to the ESLs. Separate reference to the CHHSLs is not needed for use of the ESL document. Because the CHHSLs do not address the full scope of potential environmental concerns, they cannot be used as a stand-alone tool to evaluate contaminated sites (refer to Section 1.4 of CHHSLs guidance document). It is important to understand that, for many chemicals, the need to clean up contaminated soil may be environmental concerns other than direct exposure or vapor intrusion.

1.3.2 USEPA Region IX PRGs

The U.S. Environmental Protection Agency (USEPA) Region IX "Preliminary Remediation Goals" or "PRGs" are intended to address human health concerns regarding direct exposure with impacted soils (USEPA 2004). The equations used to develop the USEPA PRGs are generally consistent with human health risk assessment guidance prepared by the Department of Toxic Substances Control, including the CalTOX model (CalEPA 1994a) and the documents *Preliminary Endangerment Assessment Guidance Manual* (CalEPA 1994b) and *Supplemental Guidance For Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities* (CalEPA 1996a). As noted in Chapter 3, use of the CalTOX model and other CalEPA guidance documents and models may be necessary where more detailed risk assessments are required.

As discussed in the USEPA Region IX document, the PRGs are intended to address human direct-exposure with impacted soil and "...do not consider impact to groundwater or address ecological concerns." (USEPA 2004). Expansion of the USEPA PRGs in the lookup tables presented in this document includes:

- Modification of soil PRGs to reflect CalEPA-specific toxicity factors;
- Adjustment of PRGs for noncarcinogens to reflect a target hazard quotient of 0.2 to address potential cumulative health concerns;
- Addition of direct-exposure screening levels for construction and trench workers' exposure to subsurface soils;
- Addition of soil and groundwater screening levels for indoor-air impact concerns;
- Addition of groundwater screening levels for the protection of aquatic habitats/surface water quality;
- Use of a more rigorous leaching model to develop soil screening levels for protection of groundwater quality;
- Addition of soil screening levels for urban area, ecological concerns;
- Addition of soil and groundwater "ceiling levels" to address gross contamination and general resource degradation concerns; and
- Addition of soil and groundwater screening levels for Total Petroleum Hydrocarbons (TPH).

Use of the USEPA Region IX PRG models in the RWQCB lookup tables is discussed further in Section 3.2 of Appendix 1. A summary of the direct-exposure models is provided in Appendix 2.

1.3.3 City of Oakland Screening Levels

A brief comparison of the RWQCB and the City of Oakland approaches to the development of environmental screening levels is provided in Table 1-1. Since 1999, the City of Oakland has presented environmental screening levels for soil and groundwater through its Urban Land Redevelopment (ULR) Program. The ULR Program is a collaborative effort by the City of Oakland and the principal agencies charged with