Executive Summary

Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs)

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EXECUTIVE SUMMARY

This document describes the process used to derive a set of risk-based ecological soil screening levels (Eco-SSLs) for many of the soil contaminants that are frequently of ecological concern for plants and animals at hazardous waste sites and provides guidance for their use. The Eco-SSL derivation process represents the group effort of a multi-stakeholder workgroup consisting of federal, state, consulting, industry, and academic participants led by the U.S. Environmental Protection Agency Office of Superfund Remediation and Technology Innovation (OSRTI). The Eco-SSLs are concentrations of contaminants in soil that are protective of ecological receptors that commonly come into contact with soil or ingest biota that live in or on soil. These values can be used to identify those contaminants of potential concern in soils requiring further evaluation in a baseline ecological risk assessment. The Eco-SSLs should be used during Step 2 of the Superfund Ecological Risk Assessment process, the screening-level risk calculation. The Eco-SSLs are not designed to be used as cleanup levels and EPA emphasizes that it is inappropriate to adopt or modify these Eco-SSLs as cleanup standards.

EPA derived the Eco-SSLs in order to conserve resources by limiting the need for EPA and other risk assessors to perform repetitious toxicity data literature searches and data evaluations for the same contaminants at every site. This effort should also allow risk assessors to focus their resources on key site-specific studies needed for critical decision-making. EPA also expects that the Eco-SSLs will increase consistency among screening risk analyses and decrease the possibility that potential risks from soil contamination to ecological receptors will be overlooked.

EPA prepared a list of twenty-four (24) contaminants to be addressed initially by the Eco-SSL guidance. This list was based on a review of the contaminants of concern reported in recent Record of Decisions at Superfund National Priority List sites. The Eco-SSL contaminant list also included contaminants nominated by the EPA regional Biological Technical Assistance Group Coordinators. The list of 24 Eco-SSL contaminants contained 17 metals including aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, vanadium, and zinc. The organic contaminants on the list were dieldrin, Hexahydro -1,3,5-trinitro-1,3,5-triazine (RDX), trinitrotoluene (TNT), 1,1,1-Trichloro-2,2-bis (p-chlorophenyl)ethane (DDT) and metabolites (DDE and DDD), pentachlorophenol, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs).

The omission of other contaminants, such as phthalates, cyanides, dioxins and mercury, does not imply that these contaminants can be excluded from the ERA screening process for soil contamination. The processes and procedures established here for developing the Eco-SSLs were intended to be sufficiently transparent to allow others to derive values for additional contaminants, as needed. PCBs were included by the workgroup in the original Eco-SSL contaminant list. However, it became apparent early in the process, that development of a PCB soil screening value was not warranted. Because of the known high persistence and toxicity of PCBs, and the conservative nature of the Eco-SSLs, it was acknowledged that soil screening

levels derived for PCBs would normally be lower than the soil analyses detection limits. EPA believes that if PCBs are detected in soil above background levels, the PCBs are probably site-related and therefore should be included as a contaminant of potential concern in the baseline risk assessment.

The approach developed for deriving the Eco-SSLs for plants and soil invertebrates was similar to the approach taken for deriving the wildlife Eco-SSLs (specifically the toxicity reference values). The general approach included four steps: (1) conduct literature searches, (2) screen identified literature with exclusion and acceptability criteria, (3) extract, evaluate, and score test results for applicability in deriving an Eco-SSL, and (4) derive the value. These procedures were finalized as standard operating procedures prior to initiating any work to derive the actual values.

Chapter 3 provides a description of the procedures used for deriving plant and soil invertebrate Eco-SSL values. The values were derived directly after an evaluation of all available plant and soil invertebrate chronic toxicity test data (measured toxicity related to soil contaminant concentrations). Chapter 4 provides a description of the procedures for deriving the wildlife Eco-SSLs. The wildlife Eco-SSLs were the result of back-calculations from a hazard quotient of 1.0. The hazard quotient is equal to the estimated exposure dose divided by the toxicity reference value (TRV). An HQ of 1.0 is the condition where the exposure and the dose associated with no adverse chronic effects are equal, indicating adverse effects at or below this soil concentration are unlikely. A generic food-chain model was used to estimate the relationship between the concentration of the contaminant in soil and the dose for the receptor (mg per kg body weight per day). The TRV represents a receptor-class specific estimate of a no-observed adverse effect level (dose) for the respective contaminant for chronic exposure.

The Eco-SSLs apply to sites where terrestrial receptors may be exposed directly or indirectly to contaminated soil. Seven groups of ecological receptors were initially considered in the development of the Eco-SSLs. These included mammals, birds, reptiles, amphibians, soil invertebrates, plants, and soil microbes and their processes. After investigation, the toxicity data for amphibians and reptiles were deemed insufficient to derive Eco-SSLs. EPA recognizes that the Eco-SSL may not be protective of these receptor groups. Eco-SSLs protective of microbes and soil microbial processes were also not derived. Like amphibians and reptiles, EPA recognizes their importance within terrestrial systems, but concurs with the workgroup that data are insufficient and the interpretation of test results too uncertain for establishing risk-based thresholds.

Eco-SSLs are appropriate to all sites where key soil parameters fall within a certain range of chemical and physical parameters. The Eco-SSLs for plants and soil invertebrates were derived to apply to soils where the pH is greater than or equal to 4.0 and less than or equal to 8.5, and the organic matter content is less than or equal to 10%. Based on these stated parameters, it is expected that there are certain soils and situations to which Eco-SSLs do not apply. These situations include (but may not be limited to) wetland soils that are regularly flooded (i.e., sediments), sewage sludge amended soils where the organic matter content is > 10%, and waste types where the pH is < 4.0.

Because of the diversity of the workgroup scientists, the process developed to derive the Eco-SSLs underwent constant peer review. There were also two external peer reviews performed during the development process. The first was a consultation requested by EPA's Office of Solid Waste and Emergency Response of EPA's Science Advisory Board (SAB). This consultation was held on April 6, 1999. At this meeting, the SAB provided verbal comments to the presenters which were subsequently addressed, as appropriate, by the workgroup as they prepared the guidance. A peer review of the draft guidance document was also performed. The peer review workshop was held on July 26 and 27, 2000 and was open to the public. Each of the comments received was carefully considered by the workgroup Steering Committee and appropriate changes were made to both the procedures for establishing Eco-SSLs and to the guidance document.

After developing the procedures and completing the peer review process, the workgroup focused primarily on deriving Eco-SSL values for the list of contaminants. The results of the application of the derivation procedures reported in this document are provided as separate contaminant-specific documents. In cases where data were limited or not available and Eco-SSL values could not be derived for specific contaminants and receptor groups, EPA may at some point in the future revise the contaminant-specific documents or add contaminants as appropriate.