

1 Introduction

Soil background is an important factor to consider when conducting human health and ecological risk assessments. Regulators use numerical screening values specific to contaminants commonly found in soil to evaluate potential risks to human receptors and the environment. Screening values are derived using toxicity data, exposure parameters, and chemical-specific parameters. For some chemicals, the screening value may be within the range of concentrations found in soils from natural or anthropogenic ambient background. Because most regulatory agencies do not require action to be taken if the concentrations of a chemical in soil represent background concentrations, soil background plays an important role in remedial decisions.

Although some state and federal agencies and other entities have guidance documents regarding soil background (for example, [USEPA 1992](#), [USEPA 2002](#), [USEPA 2002](#)), there is not one comprehensive and widely accepted guidance document that summarizes the state of the science on this topic. This ITRC guidance document is intended to fill the gap by providing a comprehensive defensible framework for establishing soil background and using soil background in risk assessments.

1.1 Audience

The primary audience for this guidance document is individual risk assessors, risk managers, and site investigators, which may include federal, state, tribal, and various local agency employees; contractors to these agencies; and potentially liable parties and their consultants. Generally, those involved in developing plans for remedial investigations that include the collection of data for the purpose of risk assessment and background evaluation would benefit from this guidance.

Additional audiences that may find this guidance useful include regulatory agency management and other stakeholders, which could include members of the public and other interested parties. This guidance could be a tool for providing stakeholders a better understanding of how soil background may be applied in a risk assessment.

1.2 Purpose

This document is designed to provide comprehensive guidance regarding the establishment and use of soil background values in risk assessment. It focuses on the process of establishing defensible background concentrations of naturally occurring (for example, metals) or anthropogenic substances (for example, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, dioxins/furans, and per- and polyfluoroalkyl substances) to be used for risk assessment at contaminated sites. The following topics are included in this guidance:

- Soil background definition ([Section 2](#)): Provides definitions of natural and anthropogenic ambient soil background, default, and site-specific background, as used throughout this document.
- Establishing default and site-specific soil background ([Section 3](#)): Provides information and best practices for establishing soil background by conducting a soil background study or using existing data.
- Using soil background in risk assessment ([Section 4](#)): Explains how soil background may be applied in risk assessment.
- Geochemical evaluations ([Section 5](#)): Explains the purpose of geochemical evaluations and how they are performed.
- Using geochemical evaluations in risk assessment ([Section 6](#)): Explains how a geochemical evaluation can be used as an additional line of evidence to determine whether site concentrations reflect background.
- Environmental forensics related to soil background ([Section 7](#)): Explains the purpose of an environmental forensics evaluation and how it is performed.
- Conceptual site model and data quality objectives ([Section 8](#)): Discusses how conceptual site model and data quality objectives processes should be considered in developing soil background.
- Sampling ([Section 9](#)): Provides recommendations for best practices when designing a soil background sampling program.
- Analytical methods ([Section 10](#)): Provides recommendations for best practices when analyzing background soil samples to develop a background soil dataset.
- Statistics used for soil background ([Section 11](#)): Identifies statistical methods and best practices for evaluating background soil data.
- Regulatory framework ([Section 12](#)): Establishes baseline understanding of level of development by states of background definitions, default background values, and guidance for using background in risk assessment as

- developed from an ITRC-administered survey to states.
- Existing guidance and studies ([Section 13](#)): Provides references to background values and associated guidance developed by states and the U.S. Environmental Protection Agency (USEPA), and background studies from non-state sources.
 - Case studies ([Section 14](#)): Provides examples of establishing background and using background in risk assessment.
 - Frameworks: Depict the process generally used ([Frameworks](#)).

1.3 Use of Background in the Risk Assessment Process

Background concentrations of chemicals are a factor that should be considered in the risk assessment process, particularly when chemical concentrations at a cleanup site may originate from releases attributable to the site, as well as other sources, including natural sources and anthropogenic ambient sources not attributable to the specific site under investigation. This is especially important when chemical concentrations exceed risk-based values (which are typically numerical chemical concentrations that are protective for specified levels of health risk). Additionally, if soil background levels are elevated or potentially present health risks, this information can be evaluated and presented in the risk assessment process so that the public can be informed ([USEPA 2002](#)). The comparison of site and background concentrations informs risk management decisions and aids in understanding the magnitude and spatial patterns of chemicals of potential concern (COPC) in site media.

A risk assessment is conducted to characterize the current and potential threats to human health and the environment that may be posed by contaminants present at a site. Soil background concentrations are used at two distinct points in the risk assessment process.

- Soil background concentrations can be used in the risk characterization to select COPC and to distinguish between risk contributions from site-related releases and background conditions. To select COPC, site soil concentrations can be compared to default or site-specific background soil concentrations. Many regulatory frameworks allow chemicals that do not exceed soil background concentrations to be excluded as COPC because it is not reasonable to expect cleanups to achieve concentrations less than soil background. A comparison of risk contributions from site and background concentrations may help risk managers make decisions concerning appropriate remedial actions, including evaluating potential risks that can be reduced or controlled by remedial actions and what risks will likely remain due to soil background concentrations.
- Soil background concentrations can be used to establish remedial goals. When background concentrations are greater than risk-based remedial goals, background values are often used to establish remedial goals, because it is not reasonable to expect cleanups to achieve concentrations less than soil background.

A more detailed discussion of the use of soil background in risk assessments is found in [Section 4](#).

1.4 Limitations

This guidance document is intended to describe scientifically sound methods for establishing technically defensible soil background values and appropriate ways to use soil background in risk assessment. It is not intended to provide specific soil background values for chemicals; rather, it is intended to describe appropriate methods and approaches to establish soil background. The focus of this document is on soils, not sediments. This guidance document is intended to inform and support risk-based decision-making and complement existing guidance documents. However, the regulatory framework and the policies of the agency with jurisdiction over the site should be reviewed to ensure compliance with applicable guidance. Additionally, this guidance is not intended to provide in-depth details regarding sampling and laboratory analysis methods, statistics, geochemistry, or forensics. Rather, it is intended to provide useful information covering these topics to help understand the value and methods to evaluate when establishing soil background and using soil background in risk assessment. Similarly, this guidance is not intended to be a comprehensive and detailed textbook on statistics, geochemistry, or forensics; rather, it is intended to describe statistical, geochemical, and forensic approaches that may be helpful for determining soil background and using soil background in risk assessment.

References appropriate to these topics, including ITRC guidance documents, are cited throughout the document.