

APPENDIX M

SITE-SPECIFIC BACKGROUND CONCENTRATIONS

M.1. INTRODUCTION

“Site-specific background concentration” can be defined as the ambient concentration of a chemical in soil or ground water in the immediate area of a site. Background concentrations can be naturally occurring (i.e., the concentration is not due to a release of chemicals from human activities), or anthropogenic (i.e., the concentration of a chemical in the environment is due to human activities, but is not the result of site-specific use or release of waste or products, or industrial activity).

Naturally occurring metals and other compounds are found in natural soils and ground water at varying concentrations. The presence of naturally occurring metals and other compounds in soil and groundwater is a direct function of its original natural composition. Over time, the concentration of naturally occurring metals in soil and groundwater will be influenced by geomorphologic processes such as erosion, weathering, and dissolution of mineral deposits.

Anthropogenic “background” concentrations of chemicals in the environment result from many human activities. For example, lead from automobile emissions, arsenic from use of defoliants, petroleum compounds from automobile and equipment leaks, pesticides/herbicides from agricultural practices, and poly-nuclear aromatic hydrocarbons from combustion of hydrocarbons. Widespread, ambient anthropogenic impacts typically result from the use of a product in its intended manner and may be present at generally low levels over large areas.

Natural and anthropogenic chemicals may be present in soil and groundwater in addition to those chemicals that are the result of on-site activities at contaminated sites. The chemical screening and remediation strategy (including implementation of institutional controls) for such sites often necessitates that background concentrations of chemicals be determined in order to ascertain the extent to which the contamination can be attributed to on-site activities.

The determination of ‘background’ concentrations of chemicals poses fundamental technical challenges. Background concentrations will be inherently variable resulting in a distribution or a range of concentrations that vary with the spatial distribution of the samples. This variability is rooted largely in the heterogeneous nature of soil and groundwater. Defining a single, representative site-specific background concentration for a chemical compound. Further, at sites where the site-specific COCs are identical to naturally occurring and/or anthropogenic chemicals that are present, differentiating the contribution of each source may be a difficult, yet necessary, task in formulating site investigation and risk management plans.

Determination of background concentrations for certain chemicals detected at a site is a very important aspect of establishing the scope of site-specific chemicals of concern (COC) and determining risk-based remediation levels for soil and groundwater. Chemicals not related to past or current site activities may be present at a site, hence, it is important to determine the background concentrations for those specific chemicals. Further, for site related chemicals, background concentrations may be present that are greater than the target risk-based levels. In such cases, determinations will be needed as to whether site remediation will be predicated on background or risk-based levels to protect human health, public welfare and the environment. Where background concentrations are above risk-based concentrations, it may not be feasible or practical to remediate sites to the target risk-based levels due to technical impracticability, lack of cost-effectiveness and the potential for recontamination of remediated areas by surrounding areas with elevated background concentrations.

M.2. METHODOLOGY

Prior to determining the site-specific background concentration for any chemical, the following approach should be followed to determine if a background determination is necessary.

First, it should be determined if the chemicals present on-site are due to site-related activities, activities at adjacent/nearby sites and/or may be naturally occurring or due to local/regional anthropogenic activities. Historical research, literature searches and interviews should be performed to determine the past and current activities at the site and adjacent properties and identify any local or regional background information that can be used to establish a definitive list of the site-specific chemicals of concern.

This guidance establishes three levels of risk-based criteria:

1. Default Target Levels/WQC
2. Tier 1 Risk-Based Target Levels
3. Site-Specific Risk-Based Target Levels

Determination of background concentrations in soil and groundwater may be necessary for chemicals that exceed Default Target Levels or Tier 1 Target Levels, if those chemicals are expected to be present in the ambient environment because they are naturally occurring and/or are present as a result of anthropogenic activities.

In determining site-specific background levels, the area targeted for sampling should be on or in close proximity to the site. The selected area should not have been impacted by historical or current site or nearby activities. Sampling of off-site anthropogenic fill materials should also be avoided, though this may not always be possible or practical.

There are a number of issues related to selection of a background area for sampling. The following points must be taken into consideration:

- a) **Background soil samples should be taken from an area with soil characteristics similar to the site.** For example, background soil samples for sites in alluvial settings should not be taken from nearby uplands as those soils may have a significantly different chemical composition. Because of the heterogeneity of soils, multiple background soil samples may be necessary to establish a range and/or average background concentration for a COC. As soil characteristics may vary both laterally and vertically, it may be necessary to determine background concentrations for different stratigraphic intervals or for areas of impact that are widely separated by unimpacted areas.

Because of these considerations, it is important to ensure that factors that affect the concentrations of chemicals in the soil are considered when collecting samples from the site and off-site. To the extent possible, off-site background soil samples taken for comparison with on-site impacted soils should be taken from identical/similar soil associations at the same time of the year. However, timing of the sampling may not be critical if the COCs are metals or other chemical compounds for which concentrations are expected to remain relatively constant over time.

Grid sampling can be an effective way of obtaining representative background soil samples; however, care must be taken to avoid including samples from impacted areas, or samples from areas or intervals that are significantly dissimilar considering the physical, chemical, and biological characteristics of the soil.

- b) **Background groundwater samples should be taken from identical/ similar groundwater bearing zones.** To determine background concentrations of chemicals in ground water, sampling should generally be conducted for a minimum of one year over four consecutive quarters unless a different schedule is approved by the department. This is necessary to account for seasonal and temporal variations in groundwater quality. Wells used in the background determination must be:
- Located in areas not affected by releases related to the site,
 - Screened in the same hydrostratigraphic unit that is contaminated on site,
 - Located up gradient from the release area(s),
 - Sufficient in number to account for all possible off-site releases; and
 - Sufficient in number to adequately characterize the hydrogeologic setting.
- c) **Determination of background area:** The background area must be comparable to the soil and groundwater characteristics at the site. The background area must be in close proximity to the site and not be impacted by the site or nearby activities. Establishment of acceptable background areas can vary significantly from metropolitan to non-metropolitan areas.
- d) **Evaluation of land use and prior history is important:** It is important to collect information regarding current and historical land use at and near the site, in order to determine whether prior human activities could have contributed to background

concentrations, and to the presence of certain chemicals unrelated to activities at the site or from nearby sites. Similarly, if anthropogenic fill materials are present, it is important to recognize the potential for contaminants because of the presence of fill materials.

- e) **Appropriate number of samples:** It is important to collect an appropriate number of samples for the statistical method being used to determine representative background concentrations, and in consideration of site-specific conditions. The sampling strategy should be designed to determine background concentrations that are truly representative of the site vicinity. Care should be taken if composite sampling will be used to reduce the total number of samples, such that the composites are representative of background conditions and do not create biased results. The number of samples to be obtained must be supported by a valid sampling strategy that has been approved by the department.

Any statistically valid approach approved by the department can be used to develop representative site-specific background concentrations. The approach must be appropriate for the characteristics of the data set being evaluated.

M.3. APPROVAL

The basis for approval of a site-specific background concentration for a specific chemical shall be determined by review of the following criteria:

- a) Evaluation of all samples used in the background data set to determine if appropriately representative of site conditions based on locations, depths, number of samples, sampling methods, and laboratory analysis methods.
- b) Evaluation from toxicological /risk-assessment standpoints to determine if the background concentrations are inherently too high from potential exposure and current/future land use perspectives.
- c) Verification of the statistical methodology and assumptions used and results obtained.

M.4. APPLICATION

An approved site-specific background concentration of a chemical may be used in development of site-specific screening and remediation strategies at any level (i.e., Default Target Levels, Tier 1 Target Levels, Site-Specific Risk Assessment Target Levels). In some cases, the site-specific background concentrations will be higher than the risk-based remediation level. For example, the risk-based concentration of a chemical in soil related to site-specific activities may be lower than the naturally occurring concentration of that chemical in the same soil. In that situation, the soil background concentration, rather than a risk-based concentration, may drive the remediation.

If the site-specific background concentration for a specific chemical is higher than the concentrations detected in all other samples, then that chemical may be dropped from further consideration in the development of site-specific remediation goals.