

## Soil Sampling Guide for Local Background Reference Sites

This document provides a consistent soil sampling approach for use in the assessment of substance concentrations in the soil of background reference sites. Alternative sampling approaches may also be used. The purpose of this document is to provide general guidance only.

### Definitions

**“Interquartile range”** means the difference between the upper quartile (i.e., 75th percentile) value and the lower quartile (i.e., 25th percentile) value of a distribution or series of analytical results.

**“Site-specific local background soil contaminant concentration”** means the concentration of a substance in soil determined within a local geographical area and which can be attributed to natural and anthropogenic non-point sources but does not include any contribution from anthropogenic point sources.

**“Surficial (genetic) materials”** means the non-lithified, unconsolidated materials occurring on the earth’s surface. These materials may be produced by weathering,

biological accumulation, and anthropogenic and volcanic activities. They include:

- residual materials weathered from rock *in situ*;
- transported materials composed of mineral, rock, and organic fragments deposited by water, wind, ice, gravity, or any combination of these agents;
- accumulated material of biological origin, including man-made deposits; and
- unconsolidated pyroclastic sediments.

**“Nominal contaminated site”** means a site at which exceedances of the soil, water or sediment numerical standards of the [Contaminated Sites Regulation](#) have been detected, but the status of the site under section 11 (3) of the Regulation has yet to be determined.

### Regulatory considerations

A person responsible for a nominal contaminated site seeking to have it released from that status (under section 11 (3) of the Contaminated Sites Regulation) must do so in accordance with the requirements of Contaminated Sites [Protocol 4: “Determining Background Soil Quality.”](#)

Individuals wishing to determine site-specific local background soil contaminant concentrations for their site may use the soil sampling approach described below.

## **Suggested soil sampling approach**

### **Selection of a reference site**

Local background reference sites must be identified, selected, and documented in accordance with the requirements of Protocol 4.

### **Materials classification**

In addition to the local background reference site selection requirements of Protocol 4, the following procedures are recommended:

- Check available soil, terrain, or surficial geology maps to determine the type of surficial (genetic) material at the background reference site.
- Wherever possible, locate the local background reference site such that it has the same surficial (genetic) material as the suspect contaminated site.
- If information on soils and terrain are not available for the site, have a terrain survey for the site conducted.
- Document the classification of reference site materials for inclusion as a component of Protocol 4 data submission requirements.

### **Soil sampling locations**

Wherever possible, the local background reference site should be approximately 1 ha in size. At any reference site, a minimum of four sampling points (randomly selected soil sampling locations) should be identified as follows (see Figure 1):

1. Locate the approximate the centre of the site.
2. Divide the site through the centre point into two halves. This is the division line.

3. Draw a line perpendicular to the division line through the centre to further divide the site into four quadrants. This is the perpendicular line.
4. Randomly select one soil sampling location for each of the four recommended 40 x 40 m quadrants. For example, using a 1–40 random number table, randomly select two numbers: the first is the number of metres perpendicular to the division line; and the second is the number of metres the sampling site is located to the right or left of the perpendicular, depending on the quadrant you are working in.

### **Soil sampling**

Once the sampling locations have been selected, a minimum of three soil samples should be collected at each soil sampling point:

- a surface sample, obtained from 0 m to 0.1 m from the surface of the site;
- a shallow sub-surface sample obtained from 0.5 m to 0.6 m from the surface of the site; and
- a deep sub-surface sample obtained from 0.9 m to 1.0 m from the surface of the site.

Under this approach, a minimum of 12 discrete soil samples would be collected from the reference site.

In collecting soil samples, the following should be consulted:

- Technical Guidance document 1: “Site Characterization and Confirmation Testing”;
- Technical Guidance document 5: “Sampling and Determining Soil pH at Soil Relocation Receiving Sites”; and
- any other appropriate general soil sampling procedures described in the ministry’s laboratory manual.

In addition, it is recommended that:

- only a clean trowel or coring tools be used to collect samples;
- sampling equipment be cleaned following the collection of each sample; and
- one duplicate sample for metal analyses be created by splitting one of the samples collected.

### **Chemical analyses**

Soil samples must be chemically analyzed for all potential contaminants of concern relevant to the nominal contaminated site. Samples should be analyzed only by laboratories registered under the Environmental Data Quality Assurance Regulation or accredited by the Canadian Association of Environmental Analytical Laboratories, or by laboratories holding equivalent qualifications.

Chemical analyses must be performed in accordance with the methods acceptable to a Director of Waste Management and the results documented in accordance with Protocol 4.

### **Statistical data evaluation (identification of anomalous results)**

As an aid to evaluating the background chemical analytical data obtained, the following equations<sup>1</sup> are recommended for use in identifying anomalous results:

Upper cut-off value = Upper Quartile value (75<sup>th</sup> percentile) + 1.5 (interquartile range)

Lower cut-off value = Lower Quartile value (25<sup>th</sup> percentile) - 1.5 (interquartile range)

Results that do not fall between the upper and lower cut-off values can be considered anomalous. Soil sampling points giving rise to anomalous data should be re-sampled and re-analyzed.

Document 12-8 in the ministry's Technical Guidance on Contaminated Sites series on statistics, which deals with outliers, may also be a useful reference.

### **Data submission**

All soil sampling data collected (regarding the selection of a reference site, the location of soil sampling points, sampling logs and other documentation of soil sampling procedures followed, the soil sample chemical analytical results obtained, and the statistical data evaluation performed) form a component of the "Direct Determination of Local Background Soil Quality" report required under Protocol 4 and must be included in that report.

*For more information, contact the Environmental Management Branch at [site@gov.bc.ca](mailto:site@gov.bc.ca)*

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<sup>1</sup> Hoaglin, D.C., F. Mosteller and J.W. Tukey. (1983). *Understanding Robust and Exploratory Data Analysis*. Wiley: New York.

Figure 1. Identification of reference site soil sampling points.

