



Protocol for the *Contaminated Sites Regulation* under the *Environment Act*

**Protocol no. 3:
Soil sampling procedures at contaminated sites**

**Prepared pursuant to Part 6 – Administration, Section 21,
Contaminated Sites Regulation, OIC 2002/171**





Soil sampling procedures at contaminated sites

1. Introduction

Section 21(1) of the *Contaminated Sites Regulation*, OIC 2002/171 authorizes the Minister to approve or adopt protocols for sampling soil, sediment, water, snow and other environmental media. In accordance with Section 21(1), this protocol has been designed to ensure that standardized and consistent approaches to sampling procedures are used when sampling soil at contaminated sites.

The protocol addresses two types of on-site soil sampling: site assessment sampling (Section 2) and confirmatory sampling (Section 3). Site assessment sampling is done prior to remediation; it is used to determine the type, level and extent of contamination at a site in order to direct excavation of the contaminated material or to gather information to select other appropriate remediation activities. It also allows spatial relationships between contaminant sources and contaminated materials to be established, which can help minimize the volume of contaminated material that needs to be managed. Confirmatory sampling is used to confirm that excavation or other remediation has successfully removed all contaminated material. Both types of on-site soil sampling must conform to Section 4 of this protocol (Field Testing versus Laboratory Analysis).

It is the responsibility of the site owner or operator to ensure that contaminated material is properly characterized, and that proper confirmatory sampling is carried out, in accordance with all applicable Yukon laws, regulations and standards. Specifically, site assessments, as required by section 9 of the *Yukon Contaminated Sites Regulation*, must be sufficiently thorough to identify the “specific areas, depths and degree of contaminants on the site, including areas and extent of migration, if applicable”.

Following excavation, material contaminated with petroleum hydrocarbons is normally treated at a land treatment facility, where it must be sampled before being removed at



the end of the treatment process. Procedures for sampling material in land treatment facilities are not covered in this protocol; please see Protocol 11 “Sampling procedures at Land Treatment Facilities”.

In this protocol:

“generally accepted industry practices” means practices that align with generally acceptable methodologies, standards and approaches for this type of work, including acceptable practices in Alberta and British Columbia as long as they are not inconsistent with acceptable practices in Yukon;

“qualified professional” means an applied scientist or technologist specializing in a particular applied science or technology including, but not limited to agrology, biology, chemistry, engineering, geology, or hydrogeology and who, through suitable education, experience, accreditation and knowledge, may be reasonably relied on to provide advice within his or her area of expertise;

“highly contaminated soil” includes:


- a) soil with a total petroleum hydrocarbon concentration of 30,000 ppm or greater;
and
- b) soil contaminated with a non-aqueous phase liquid.

“non-aqueous phase liquid” means an immiscible liquid composed of organic compounds (which may be lighter or denser than water) at any apparent thickness.

2. Site Assessment

2.1. Industry standards

A site investigation (also known as a Phase I Environmental Site Assessment) must be performed in accordance with section 8 of the *Contaminated Sites Regulation*, as well as in keeping with industry standards such as those of the Canadian Standards Association and ASTM International and generally accepted industry practices. This site investigation will assist in focusing future sampling to locations suspected to be contaminated.



A site assessment (also known as a Phase II Environmental Site Assessment) must be performed in accordance with section 9 of the *Contaminated Sites Regulation*, as well as in keeping with industry standards from the Canadian Standards Association and ASTM International and generally accepted industry practices.

Samples must be taken in accordance with standard industry practices, and must be taken by a qualified professional to ensure that reliable results are obtained.

2.2. Initial Characterization


In situ Characterization

In situ (in the ground) sampling must be conducted for initial characterization purposes in situations where emergency response is not required¹. *In situ* sampling allows suspected areas of contamination to be targeted based on site knowledge. This is not possible if sampling is performed after soil has been excavated.

During the initial characterization of a site, biased sampling must be carried out with a focus on hot spots or probable hot spots identified during the site investigation. In some cases, such as where the site investigation may not have revealed all probable locations of contamination, sampling may be done using a coarse grid with 25 to 50 metre spacing between sample locations. Where grid sampling is used, greater attention must still be focused on any probable hot spots identified during the site investigation.

Samples must be relatively homogenous, representing the dominant type of soil or fill at each location and depth. Surface samples must be collected from a maximum depth of 0.5 m below the site surface and at consistent depth

¹ Most commonly, emergency response situations are recent spills where immediate contaminant removal and isolation is required.



intervals (usually 0.5, 0.75, or 1.0 m intervals), unless site-specific conditions warrant a different approach.

Sufficient samples must be taken such that each sample represents 10 m³ of soil suspected to be highly contaminated, or 50 m³ of other contaminated soil.

Samples must be analyzed for all potential contaminants of concern. See Protocol 5 for information on which constituents must be analyzed at sites contaminated with petroleum hydrocarbons.


Ex situ (Stockpile) Characterization

Ex situ sampling of stockpiles may be conducted for initial characterization purposes in situations where emergency response has been carried out (i.e. recent spills). Stockpile sampling results may not be used to override *in situ* characterization sampling results. This is because *ex situ* sample results are subject to inadvertent dilution during excavation and soil handling, and therefore may not be representative of on-site conditions.

When conducting characterization sampling on stockpiles created in emergency response situations, stockpiles must be divided into portions or “cells” representing 50 m³ for non-highly contaminated soils or 10 m³ for soils suspected to be highly contaminated. One sample made up of several aliquots must be collected throughout the cell with a focus on suspected “hot spots”.

2.3. Step-Out and Step-Down Sampling

Once areas of contamination have been identified or confirmed, step-out samples must be taken at the same depth as the original sample. Locations of step-out samples may be adjusted based on information gathered during a site investigation, or on previous analytical data. When a sample indicates contamination, the zone of contamination will be presumed to extend to the nearest sample location and depth found not to be contaminated. If only one step-out sample is taken and it is found not to be contaminated, the contamination will be presumed to exist in a circle centred on the original



contaminated sample with a radius equal to the distance between the original sample and the uncontaminated step-out sample. If no step-out samples are taken, the contaminated area may be presumed to be unlimited in size. The more samples that are taken, the more tightly the contaminated area can be defined, resulting in lower costs for remediation. Proponents are encouraged to take step-out samples in all directions where possible.

Concurrent with the determination of the horizontal extent of contamination, the vertical extent must also be delineated using step-down samples. The zone of contamination will be presumed to extend to the depth of the shallowest uncontaminated step-down sample at each sampling location where contamination has been detected.

The *Yukon Environmental and Socioeconomic Assessment Act* requires that an assessment be done if a permit is required for any activity involving 3000 m³ or more of contaminated material (see that Act and associated regulations for more details). This assessment must be completed prior to the permits being issued. Such an assessment may cause a significant delay or increase the costs associated with the activity; it is therefore in the proponent's best interests to define the area of contamination as tightly as possible to avoid unnecessarily surpassing this threshold.

If excavation is the selected method of remediation, all material over the applicable standard must be excavated and appropriately managed and confirmatory sampling must then be conducted on the floor and walls of the excavation.

3. Confirmatory sampling

Following excavation of contaminated material, the floor and walls of the excavation must be sampled and analyzed to confirm that no contaminated material remains at that location or to identify any contaminated material remaining at the removal location. A minimum of 5 samples must be taken from the faces of the excavation: one from each wall and one from the excavation floor. From each excavation wall, at least one



sample must be taken for each 10 metres running length and for each 3 metres running depth. If any of the characterization samples demonstrate that the excavated material is highly contaminated, one sample must be taken for each 5 metres running length and for each 3 metres running depth. In the case of the excavation floor, one sample must be collected for each 10 metres running length and for each 10 metres running width.

For shallow excavations not exceeding 0.20 metres in depth, step out samples are to be collected adjacent to each excavation boundary in lieu of wall samples at a frequency of one sample for each 10 metres running length or for each 5 metres running length if any of the characterization samples demonstrate that the excavated material is highly contaminated. Floor samples are to be collected as outlined above.

4. Field testing versus laboratory analysis

Since laboratory analysis of samples may often not be completed in a timeframe that would allow the results to be used to guide a site assessment or excavation, various types of field instruments are used to estimate contaminant levels during on-site work. Indeed, the use of field tests to define the initial focus of the investigation is encouraged. However, results from such field tests may not be used to demonstrate compliance with the *Contaminated Sites Regulation* or other legal requirements. In particular, confirmatory samples and samples used to characterize materials for relocation must be submitted for laboratory analysis.

If an excavation must be closed before confirmatory analytical results are received and contamination levels are subsequently found to be above the applicable land use standard, proponents should be aware that the site may continue to be designated as a contaminated site in accordance with the *Contaminated Sites Regulation* and listed as Contaminated in the Registry of Contaminated Sites.

5. Analytical parameters

Several of the soil standards in the *Contaminated Sites Regulation* are dependent on the pH of the sample medium. Where samples are analyzed for contaminants with pH-dependent standards, pH must be measured in order to interpret the results correctly.



Where the pH is not reported by the laboratory, the most stringent standard will be applied.

6. Effective date

The effective date of this protocol shall be February 7, 2018 and it shall remain in effect until replaced or rescinded by the Standards & Approvals section of the Environmental Programs Branch.

7. Failure to comply

When sampling fails to meet the requirements of this protocol after its effective date, the proponent will be required to take new samples to satisfy these requirements. This may include, for example, re-sampling contaminated material that has been taken to a land treatment facility or re-excavating the originating site to take new confirmatory samples.

8. Additional information

For more information about contaminated sites, please contact:

Email: envprot@gov.yk.ca

Phone: 867- 667-5683 or toll free in Yukon: 1-800-661-0408, ext. 5683.

Approved:

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