1. Introduction and Scope

This Standard Operating Procedure (SOP) provides operating guidelines and instruction for the collection of soil samples from excavations, test pits and stockpiles. Sample collection equipment includes shovels, excavator buckets, and hand augers. Analysis of the samples for specific contaminants may be completed for confirmatory testing following the excavation of contaminated soil, assessment during a test pitting investigation, or the initial, interim, or final characterization of excavated soil.

This SOP forms part of the British Columbia Field Sampling Manual (BCFSM). Additional information on soil sampling from excavations, test pits and stockpiles is provided in Part D1 – Soil Sampling, of the BCFSM which must be used in conjunction with the information provided in this SOP. Guidance documents, the Environmental Management Act (EMA) and the Contaminated Sites Regulation (CSR), are available on the Contaminated Sites webpage at:

https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/contaminated-sites.

Soil sampling conducted within the provincial jurisdiction of BC for regulatory purposes must be carried out with consideration to the EMA, the CSR, Part D1 of the BC Field Sampling Manual, and this document.

2. Quality Control

Quality control begins with thorough pre-trip preparation.

Ensure the sample plan considers and incorporates the requirements for sample containers, preservation, and hold times. The required sample containers, storage temperatures, preservation requirements and holding times are available from laboratories providing environmental testing. This information is provided on the ENV website at:


While enroute and in the field:

1. Prior to sampling, avoid smoking, pumping gas, using hand sanitizers, or coming into contact with sharpies or solvents, to prevent sample contamination.
2. Carefully document all field activities, sample locations and observations,
3. Accurately document sample locations with reference to an established grid.
4. Decontaminate sampling equipment between samples,
5. Submit an appropriate number of blind field duplicate samples (typically 1 for every 10 samples, minimum of 1 per day) for laboratory analysis.
6. A laboratory-prepared travel blank should accompany each cooler containing VOC/SVOC samples.
7. Disposable nitrile gloves must be worn when collecting samples. New gloves are required for each sample location.
3. Recommended Equipment and Materials

The following is a list of documents and equipment that may be required during soil sampling:

**Reference Documents:**
1. Site plan and results of previous field investigations, field screening correlations, etc.;
2. Soil sample logs;
3. Underground utility location plan(s);
4. Copies of any permits (e.g., lane closure, street area) required;
5. Field book and indelible felt pen (fine point); and
6. Sample submission and chain-of-custody forms.

**Field Equipment:**
7. Appropriate PPE;
8. Tape measure;
9. 50 m tape or odometer wheel;
10. Fluorescent orange spray paint (not used for VOC sampling) or nails to mark sample locations;
11. Survey stakes;
12. Flagging tape;
13. Disposable nitrile gloves;
14. Hand trowel;
15. Shovel;
16. Hand augers if required (helical style bit, Dutch style bit or bucket-style bit);
17. Core barrel with slide hammer;
18. Stainless steel coring device (preferred), trowel or spoon, if sampling for non-volatile compounds;
19. Syringe sampler (e.g. Terra Core™, Easy Draw Syringe™, Power Stop Handle™) or disposable sampler (e.g. EnCore™), if sampling for volatile compounds;
20. Sealable plastic bags (e.g. Ziploc®);
21. If field screening is required, field screening instrument appropriate for the PCOCs;
22. Calibration equipment and gas for field screening instrument;
23. Laboratory detergent (e.g. Alconox™ or Liquinox™ and water solution or solvents [as necessary]);
24. Distilled water in squeeze bottle dispensers;
25. Paper towels;
26. Appropriate laboratory-supplied containers;
27. Sample labels;
28. Double-bagged ice;
29. Clean cooler; and,
30. Camera.

4. Sampling Considerations

- Do not use acid rinse in the field decontamination procedure if pH is an analytical parameter.
- Stainless steel equipment is recommended for sampling; however, nickel has been found to leach from stainless steel. If nickel is a Potential Contaminant of Concern (PCOC) at a site, sample contact with stainless steel should be minimized. Plastic (e.g., PVC) tools are a good alternative to stainless steel.
- If field screening based on headspace vapour reading is required consult SOP D1-2 for appropriate equipment and procedures.
5. Procedures

General organics are more stable (i.e., less volatile and/or bio-degradable) than volatile organic compounds such as BETX. For this reason samples collected for laboratory analysis of volatile compounds should be collected first.

1. Obtain authorization from the owner for site access, if needed, and confirm that physical access to the site is possible (e.g., gates unlocked).

2. Confirm accuracy of the existing site plan, or keep sufficient notes so that a site plan can be developed or improved. For excavation and test pit sampling, review and ensure the accuracy of the grid system. Mark each grid line for easy reference during the field program.

3. Organize sample containers and prepare labels.

4. Decontaminate sampling equipment. Scrub the equipment in a mild detergent (e.g., Alconox®) water solution, and rinse with distilled water. Repeat this step for each sampling location.

5. Calibrate field screening instrument, if needed.

6. Determination of sample depth: a tape should be advanced into the test pit or excavation to determine the depth of the sample.

7. For samples obtained directly from equipment (e.g., trowel, shovel, hand auger, backhoe or excavator bucket), the outermost soil cuttings are scraped away to remove soil potentially cross-contaminated from overlying contaminated zones. A sample is then obtained from the remaining soil. Some contractors have sampling tools which can be attached to the bucket for sampling.

8. For samples obtained in-situ (e.g., from an excavation wall or floor), scrape the surface to a depth of approximately 0.05 m to expose fresh soil for sampling.

9. For samples obtained ex-situ (stockpile), collection of soil samples from the surface of the stockpile should be avoided, due to the potential loss of volatile compounds at the surface.

10. If there is any uncertainty with the quality of the sample, discard the sample and repeat the sample collection procedure.

11. Samples collected for the analysis of volatile compounds should be collected prior to the collection of non-volatile samples. Samples collected for the analysis of volatile compounds should be collected with a syringe style sampler (e.g., Terra Core™, Easy Draw Syringe™, Power Stop Handle™) and immediately placed into methanol pre-preserved vials; or with a disposable sampler (e.g., EnCore™). If these devices are not feasible for your project, a trowel or spoon can be used in consultation with your laboratory.

   Note: Preserved samples should be accompanied by a non-preserved sample for moisture content analysis. Samples collected with an EnCore™ device are not preserved and must be cooled to ≤ 4 °C and received by the laboratory within 48 hours for processing. Consult your laboratory to ensure you collect the required number of vials or EnCore™ samples. Samples should be collected in accordance with SOP D1-9.

12. Samples collected for the analysis of non-volatile compounds should be collected with a coring device. For coarse grained material the diameter of the coring device should be a minimum of 3 times the diameter (3d) of the largest particulate in the matrix. For fine grained material the coring diameter should be at least 3d + 10 mm. Generally, the coring device should be at least 1.6 cm in diameter. If coring devices are not suitable for the soil composition and undisturbed sampling is not feasible due to sample locations (e.g. excavation floor or wall), a trowel or spoon can be used.

   Note: composite samples must be comprised of equal aliquot volumes. Homogenization of the aliquots must be completed before filling the sample bottles. The soil sample should be collected in accordance with SOP D1-10 non-volatile compounds.
13. Once the jar is filled, use a clean paper towel to scrape off excess soil. Using your fingertips (with nitrile gloves), ensure that all the threads on the jar are clean, and then fasten the lid securely.

14. Label the sample jar and lid separately using the appropriate sample nomenclature. Information included on the container label should include: Sampler’s initials, sample collection date, company name, sample site identification and/or the unique Sample Identifier, desired analytical parameters, and preservation method. Wrap the label and container with clear packing tape.

15. Place the sample in a cooler chilled with freezer packs or ice for transport to the laboratory. If using ice, be aware that melted ice can result in damaged or destroyed labels and can also be a significant pathway for cross-contamination of samples. As such either the ice or the samples should be double-bagged and sealed in Ziploc® bags.

16. Complete sample submission and chain-of-custody forms. Chain-of-custody forms should be filled out in their entirety and each cooler shipped should have its own chain-of-custody form listing only those samples contained in the cooler. Chain-of-custody forms should be enclosed in their own Ziploc® bag to protect them from possible water damage during shipment. Be sure to specify to the laboratory the analytical detection limit desired. Samples should be delivered to the laboratory within 24-hours if possible.

17. Record sample information including observations in the field book, soil sample log, or test pit log. Sample information should include sample identification, sample type, location (grid coordinates or scale drawing), depth, soil type, and sample date, visual and olfactory observations. Document site conditions and key observations using a camera.

18. For field screening, place a replicate sample from each sampling location/depth into a sealable plastic bag and conduct vapour screening in accordance with SOP D1-2.

19. Label a survey stake with the unique sample identifier and date and drive it firmly into the ground at the sampling location. In undeveloped areas, label survey flagging tape and hang from nearby tree branch for better visibility and duplication of labelling. In developed areas, locations may be marked on nearby concrete or asphalt surfaces. Collect GPS co-ordinates of the sample location, if possible.

20. If applicable mark off excavations in a clearly visible manner and ensure the site is secure. If applicable ensure that tarps are adequately secured at the end of the day to prevent blow off from stockpiles due to windy conditions.

21. Dispose of all wastes (liquids, used gloves and materials) in an appropriate manner. Leave the site in a tidy condition.

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6. Technical Notes

**SAMPLING FROM AN EXCAVATOR BUCKET**:  
1) *Excavator bucket sampling is usually required to obtain samples* from locations unsafe for entry (i.e., excavations or test pits over 1.2 m in depth). This type of sampling is also often used to collect samples from large soil stockpiles.

2) *Ensure that a representative sample can be collected* bearing in mind the excavator bucket's reach and angle. Difficulties may be encountered when sampling walls opposite to the excavator. If the bulk soil sample falls to the floor of the excavation, monitor the sample recovery carefully to ensure that mixing has not occurred. If there is any uncertainty with the quality of the sample, discard the sample and repeat the sample collection procedure.
HAND AUGER SAMPLING:

Hand augers are ideal for collecting soil samples from various depths (up to 3 m) in both disturbed and undisturbed soils. The auger will cause some disturbance to the sample. Remember to clean/decontaminate the auger between sample locations. If an undisturbed sample is desired, a core barrel attached to a slide hammer may be used.

Choice of auger bit style depends on application and soil conditions. The following is a summary of bit styles and associated uses.

<table>
<thead>
<tr>
<th>Method</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helical Style Bit</td>
<td>Very good for augering in dense (undisturbed) soil, including soil with coarse gravel</td>
<td>In general, not very well suited for collecting soil samples</td>
</tr>
<tr>
<td>Dutch Style Bit</td>
<td>Very good for collecting samples from soil piles (disturbed soil) and for augering in rooty or boggy soil conditions</td>
<td>Not very well suited for augering and collecting samples in loose material (sand, gravel) or for augering in dense (undisturbed) soil with gravel</td>
</tr>
<tr>
<td>Bucket Style Bit</td>
<td>Very good for collecting samples from soil piles (disturbed soil) and for augering and collecting samples in loose material (includes sand and fine to medium gravel) and clays (use open sided bucket auger)</td>
<td>Not very well suited for soils with coarser gravel</td>
</tr>
</tbody>
</table>

7. References


Revision History: 0.0 (New document)

Approval