

Protocol 27: Soil Leachate Tests for Use in Deriving Site Specific Numerical Soil Standards

May 2018

Stakeholder Comments / Recommendations	Ministry Response(s)
<p>Reduces the utility of the protocol Alternative approaches may be justifiable</p>	<p>There is an opportunity to submit for a Director's Determination under Protocol 2 "Site-Specific Numerical Soil Standards". However, the ministry will not accept the use of alternative leachate tests other than those approved in Protocol 27.</p>
<p>It is common for residual GW contamination to be present after soil remediation complete. In such cases would require active GW remediation or MNA before SSS can be established, even if GW quality is risk assessable (or would have to risk assess soil instead of establishing SSS);</p>	<p>This is addressed in section 5.0</p>
<p>48 hour sampling holding times from sampling to commencement of extraction is a severe limitation, especially for rural sites. Could prescriptive handling and holding conditions such as procedures and specified temperatures be used to extend the holding time?</p>	<p>Holding times for the Liquid-Solid Partitioning of VOCs Leachate Test can be increased up to two weeks if samples are frozen within 48 hours of collection. This information is included in the leachate method that available in the BC Laboratory Manual.</p>
<p>The low sample holding times (48 hours) means that the testing for totals and leachables must be simultaneous and not allow time to determine if the samples tested are within 90th percentile of the highest concentrations, causing additional sampling and therefore increased costs.</p>	<p>See above answer.</p>
<p>Can oxidizing conditions be assumed in unsaturated mineral soil that is contaminated with PHCs or VOCs, either at residual saturation or lower concentrations?</p>	<p>It is assumed that soil contaminated with petroleum hydrocarbon contamination at residual levels will have a high organic content and will preclude the use of the BC Soil Leachate Test for redox sensitive substances.</p>
<p>For this situation oxidizing conditions must be confirmed in both saturated and unsaturated zones. There are cases where it may be useful to establish an SSS in saturated soil, but not in unsaturated soil (and vice versa). For example, in the case where concentrations of a redox sensitive substance exceed standards in un-saturated zone only (i.e., SSS not needed for saturated zone), is it necessary to confirm oxidizing conditions in the saturated zone underlying the impacted soils in the unsaturated zone.</p>	<p>The determination of oxidation potential in the saturated zone is not required if leachate testing is done in the unsaturated zone.</p>
<p>Can additional data be used to determine redox conditions? For example: speciation analyses? Without a director's determination it would be difficult to assess alternatives.</p>	<p>There is an opportunity to submit for a Director's Determination under Protocol 2 "Site-Specific Numerical Soil Standards". However, the ministry will not accept the use of alternative leachate tests other than</p>

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Testing “worst case” soil does not allow the use of SSS to determine delineation targets. The impracticality of delineating to very low standards in order to proceed with risk assessment is a common deterrent to the use of risk based approaches. So it would be good if this protocol and P2 could leave this option open.	those approved in Protocol 27. The wording in section 5.0 of the document has been changed to allow the development of a Site Specific Soil Standards (SSS) once highest concentrations in an AEC have been remediated via removal or risk assessment/management.
Comment only: limited utility, however it does allow remediation targets to be set and is helpful	No response required.
The wording suggests that one sample is required per 300m2 or 900 m3. This is not the intention. Perhaps refer to TG1?	Section 5.0 of the protocol indicates that a minimum of three soil samples are required. Wording has been added to the document to provide clarity.
There should be opportunity to just use the natural pH of the soil if environment has demonstrably low chance of being altered (e.g. remote or protected wildlands)	The BC Soil Leachate Test is a modified test from that recommended by the US EPA under their Leaching Environmental Assessment Framework. One of the main modifications was to reduce the leachate testing pH range from 2 to 13 pH units to 5 to 9 pH units. It was determined that over 90% of soil pH falls within this range in BC. This smaller range of pH testing may be considered overly conservative; however, some conservatism of the test is necessary to reduce the inherent uncertainty of field investigations.
This wording suggests that only one sample is required for smaller sources.	Wording has been adjusted in Section 5.0 to add clarity
3 leachate samples per AEC is conservative. Does this imply that samples require analysis first to determine which samples should be tested? This will have implications for holding times (TCLP ZHE).	Holding times for the Liquid-Solid Partitioning of VOCs Leachate Test can be increased up to two weeks if samples are frozen within 48 hours of collection. This increased holding time should negate the need to collect samples more than once in most situations.
Manual accessible on the Ministry of Environment and Climate Change Strategy’s website is dated 2015 and does not include the updated test. We recommend the Manual be updated as soon as possible to allow sufficient time for laboratories to adjust to new processes and to complete proficiency testing. Sufficient notice to industry should be provided once this update completes.	The approved and updated leachate test methods can be found in the BC Lab Manual: is updated with the approved leachate test methods. http://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/sampling-methods-quality-assurance/bc-environmental-laboratory-manual The ministry has worked closely with BC laboratories to update methods and provided adequate notification to industry.
Given the anticipated significant increase of cost to perform the new test as compared to the existing test (TCLP and SPLP),	The CSAP and ministry working group evaluated available leachate test methods and concluded that, currently, the BC Soil Leachate Test was

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<p>some assessment of the results of the new method on a range of B.C. soils should be completed and shared, in order to provide a province-wide understanding of the sensitivities of the test. Without the understanding that can be provided by such an assessment, it will be very difficult for site owners and their consultants to determine whether it may be beneficial to conduct the more costly test. We recommend that government conduct comparative testing prior to the release of this method and that the results be made available to site owners and environmental professionals.</p>	<p>the most suited method for the purpose of determining SSS for select substances. Field studies using the BC Soil Leachate Test at contaminated sites in British Columbia are currently underway</p>
<p>Substances with low Kd values will exhibit leachate concentrations that are dependent on the amounts of water and air volumes. Thus, leachate tests done at a 20:1 L:S ration will severely under predict actual field conditions. Consider a correction factor or solution for these substances – perhaps similar to what NJ state does.</p>	<p>The ministry has included a correction in the final leachate concentrations for those substances that are highly soluble in the final version of the protocol.</p>
<p>Redox sensitive minerals in BC generally occur in a sulphide mineral form rather than oxide, sulphate or carbonate mineral form. Sulphide minerals are stable in a reducing environment but unstable in an oxidizing environment.</p> <p>Leaching occurs because of this chemical instability as described by the example acid rock drainage chemical reactions.</p> <p>The protocol does not permit the use of the leachate test if reducing conditions are present because the leachate test cannot simulate reducing conditions. However the leachate test does not consider chemical kinetics.</p> <p>The amount of leaching of ARD metals that occur is largely due to chemical kinetics as well as site specific climate and geologic/hydrogeologic conditions. Thus, it may take months to several decades for metals leaching to occur. In mining, static tests such as these short term leachate tests cannot be used to</p>	<p>The CSAP and ministry working group evaluated the prohibition of the BC Soil Leachate Test for all redox sensitive substances. This is a test that can be used to develop SSS for many of the Schedule 3.1 matrix substances with soil to groundwater standards, in particular inorganic substances. It is recognized that all short term leachate tests may not be suitable for prediction of Acid Rock Drainage (ARD) metals leachability. The leachate tests approved in Protocol 27 are not intended to replace more reliable methods of predicting ARD.</p>

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<p>predict if/when metals leaching due to sulphide oxidation will occur. Instead humidity tests are completed and sometimes run in the laboratory for several months to over a year to predict when these reactions will begin to occur.</p> <p>In light of the complexity and poor reliability of short term leachate tests, perhaps the best solution is to not allow leachate testing of redox sensitive inorganics irrespective of redox conditions, and allow leachate testing of only petroleum hydrocarbons or more soluble non-redox sensitive inorganics?</p>	
<p>It would be beneficial if the Protocol provided an alternative for cases where attempts to collect subsequent samples with contaminant concentrations within the 90th percentile are unsuccessful.</p>	<p>Holding times for volatile contaminants tested using the Liquid-Solid Partitioning of VOCs leachate test can be increased up to two weeks if samples are frozen within 48 hours of collection. , This should allow sufficient time to test soil for both total concentrations and leachate concentrations. This increased holding time should negate the need to collect additional samples for most situations.</p>