

Responses to Comments on Draft Protocol 13. Screening Level Risk Assessment (SLRA)

Original Document Section(s)	Issue	Stakeholder Comments	Stakeholder Recommendation(s)	Ministry Response(s)*
General	Utility as screening tool	<p>It is likely that this protocol will release a limited number of sites, but it certainly will be useful for those sites and may assist in conducting further more detailed risk assessment by completing the initial steps in that process and screening out some receptors.</p> <p>The risk tool is overly conservative. Sites that clearly demonstrate acceptable risks will be required to undergo needless further investigation, remediation, or detailed risk assessment. The protocol will not effectively do what it was intended to do... None of the sites we screened against this protocol were removed from the process. The protocol is tied into others (e.g., Protocol 12, Technical Guidance Document 4) which also have issues which will further adversely affect the performance of this process.</p> <p>Uncertainties and questions arising as well as specific provisions will lead to concerns about implications of the SLRA process. Concerns are that SLRA cannot be carried out for high risk sites. The opportunity to use SLRA therefore will be limited not only by the precluding conditions but also by the</p>		<p>The ministry's objective is for SLRA to be an effective screening tool for demonstrating the absence of a receptor or pathway at contaminated sites. As stated in the document preamble, future changes or amendments to SLRA may be warranted as other ministry initiatives are completed and/or based on evolving science in the area of screening risk assessment.</p> <p>With respect to the linkage with the site risk classification test (Protocol 12), note that SLRA may be applied independent of the site risk test until such time as Protocol 12 is approved by the Director.</p>

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		restrictive nature of the high risk classification system.		
General	Process	The linkage is not clear between completion of site investigation and remediation reports (i.e., PSI, DSI, remediation plan, confirmation of remediation), completion of SLRA and preparation of the Summary of Site Condition form.		See the following responses for specific information on application of, and reporting requirements for, SLRA.
General	Outcomes	Confirm that a CoC will be available for SLRA. If a site has some exceedances above numerical standards, but the 'no' answer can be reached based on the methodology provided within, and the final paragraph is satisfied, does this mean that a Certificate of Compliance can be granted for the site?		A contaminated site with no unacceptable risks, as determined based on application of SLRA, would be deemed to meet CSR risk-based standards and would be eligible for a CoC (risk-based standards).
General	Outcomes	<p>Can SLRA be applied post-remediation? Does SLRA apply to "as exists" or "as built"? Can SLRA be used in a remediation plan?</p> <p>Allow completion of partial remediation to address points failing SLRA – and then re-completion of SLRA? Clarify this.</p>		<p>SLRA applies to the as-is state of the site when contaminated sites legal instrument application is made.</p> <p>SLRA may be applied both prior to and post-remediation activities. A post-remediation scenario may be where remediation was conducted to address a failed exposure pathway (e.g., removal of contaminated surface soil) or precluding condition (e.g., removal of LNAPL) identified in the initial application of SLRA. In such cases, only the final SLRA is necessary to be reported with any remediation activities documented in a confirmation of remediation report.</p> <p>An SLRA may also be used in a remediation plan as part of application for an Approval in Principle. The SLRA in this case would identify the failed (or “operable”) exposure pathways and the remediation plan would identify the proposed remediation activities to render the operable pathways as inoperative, i.e., the proposed activities that when applied would lead to a “no” response in the SLRA questionnaire (no unacceptable risk) for the</p>

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				respective pathway.
General	Outcomes	<p>For the human health and environmental health terrestrial soil exposure pathways, it appears that soil contamination located below a 1 m depth does not require further assessment for direct soil exposure (pathway is incomplete) and risks are therefore acceptable (fruit tree rooting depth excepted).</p> <p>Does this imply that MoE considers 1 m to define surface soil for the purposes of exposure to contaminants? If a site proceeded to DRA, would the 1 m depth also apply? If a remediation plan included placement of clean fill such that a 1 m clean layer of soil was present, would such an approach be acceptable?</p> <p>Clarification regarding the 1 m depth and how it is to be applied seems necessary.</p>		<p>The upper 1 m of soil is the exposure horizon that is considered in SLRA. Contamination below 1 m depth is not considered in the direct exposure zone to receptors except as identified as a precluding condition. However, this does not avoid the requirement for assessment of the full nature, degree and extent of contamination at the site including any offsite contamination in accordance with CSR section 59. Also, note that SLRA does not define the remediation standards applicable at a site which are determined in accordance with CSR Part 6.</p> <p>As noted above, a proposed remediation activity to render an operative pathway as inoperative would be acceptable in a remediation plan. With respect to the subject query, placement of soil of suitable quality as cover material at the site (or a surface barrier) would be considered an acceptable remedial activity. However, where such an activity is undertaken, long-term monitoring and maintenance of the cover system would be necessary as a component of the remediation plan, in the case of an Approval in Principle, or a condition, in the case of a Certificate of Compliance.</p>
General	Reporting	<p>Clarify reporting requirements: PSI, DSI, confirmation of remediation.</p> <p>Will additional submissions, documents and checklists (as for a Certificate of Compliance application under Protocol 6) be required?</p>		<p>The reporting requirements for SLRA have been modified and clarified in section 5.0 of the document and the overlap with the Summary of Site Condition Form has been removed.</p> <p>An SLRA report is separate from PSI, DSI, remediation plan, confirmation of remediation, and detailed risk assessment reports. Although SLRA is based on PSI and DSI reports, and a confirmation of remediation report if remediation has been conducted, SLRA is prepared as a separate report. In most cases, the SLRA report would be submitted as part of an application for a contaminated sites legal instrument for a low to moderate risk site under Protocol 6. For these cases, the submission requirements that must be met are</p>

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				specified in Protocol 6. Where an SLRA is submitted at the request of a Director, the Director should be consulted for advice on the submission.
General	Reporting	Are PSI and DSI reports required for DRA if SLRA submitted?		Any application for contaminated sites services, whether as a low to moderate risk site or for ministry review, must be based on the most recent investigation, remediation, and risk assessment information available for the site. Where a DRA report is submitted for ministry review, and PSI, DSI, and SLRA reports are already on file with the ministry and the information in the reports has not changed, then duplicate report submissions are not necessary.
General	Reporting	Is SLRA considered IR? Require NIR?		SLRA is a screening tool. It does not change the existing legislative and regulatory requirements that apply to independent remediation as specified in EMA section 54 and CSR section 57.
General	Reporting	Confirm any CSAP can do SLRA. Are risk assessors that are not CSAPs eligible to complete SLRA?		SLRA may be completed by any contaminated sites environmental consultant with experience in contaminated sites investigation and remediation with the ecological assessment components of SLRA (Questions TS-4 and TS-5) completed by a registered professional biologist. However, submission of an SLRA to the ministry in support of a recommendation for a contaminated sites legal instrument for a low to moderate risk site may only be completed by an Approved Professional.
General	Reporting	How would SLRA be applied to existing sites? For sites that are close to getting a Certificate of Compliance, would a site owner be required to go back and collect vapour and/or soil samples in the top 1 m? Request warning of effective date of new changes to allow for current applications to be completed (which don't satisfy all documents)?		SLRA now includes an effective date. Applications for contaminated sites services incorporating SLRA submitted on or after the effective date must meet the protocol requirements.
2.0	Definition for bioaccumulative substances	Interpretation of bioaccumulative substances may be too subjective and will result in some	List the bioaccumulative substances.	It is the ministry's opinion that the definition is specific enough that environmental consultants should be able to identify which substances are bioaccumulative using common reference sources.

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		variation and disagreement among environmental consultants.		
2.0	Definitions for LNAPL and DNAPL	<p>Use of the criteria "sheen" on soil for definition of LNAPL and DNAPL should be excluded from the definition. It is not uncommon for a sheen to be observed when water comes into contact with hydrocarbon contaminated soils during sampling. This is not a true indicator of the presence of LNAPL. Also, description of a "sheen" is subjective and prone to observational errors.</p> <p>Clarify "measurable LNAPL" doesn't include NAPL indicator concentrations. Also, apparent thickness or actual thickness?</p> <p>Define "measurable" LNAPL.</p>		<p>The definitions for LNAPL and DNAPL have been modified as follows: i) references to "sheen" have been removed; ii) reference to "free liquid presence" has been defined on the basis of observation in soil or a measurable thickness of LNAPL or DNAPL in a monitoring well along with the 1% solubility limit rule for DNAPLs; iii) VH_{w6-10} and EPH_{w10-19} concentrations are no longer part of the definition of LNAPL; and, iv) "measurable" has been defined as an apparent free liquid thickness of > 2 mm.</p> <p>As a result of the above changes, an additional exposure pathway has been included in SLRA for the default water use parameters VH_{w6-10} and EPH_{w10-19}. In addition, the definitions in SLRA for LNAPL and DNAPL are considered to constitute the Director's advice regarding application of the "nonaqueous phase liquids not present" generic numerical soil and water use standards at contaminated sites.</p>
2.0	Definition for preferential pathway	<p>Clarify definition of "preferential pathway".</p> <p>Nail down definition of "significant" in preferential pathway definition.</p>		The definition of preferential pathway has been expanded and clarified.
2.0	Definition for sensitive habitat	Modify definition of sensitive habitat to reference "published" sources rather than "identified" sources.		The sensitive habitat and associated potential terrestrial habitat definitions have been modified. In addition to Question TS-5, completion of Question TS-4 (assessment of potential terrestrial habitat) is required to be completed by a registered professional biologist. Assessors completing these questions should consult local, regional, provincial, federal and non-governmental organizations' (e.g., Ducks Unlimited) reference sources.

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		<p>Revise sensitive habitat definition - see MoE/SEI website.</p> <p>Provide full reference for "Riparian Areas Regulation" in definition of sensitive habitat.</p>		<p>The SEI website is one of the tools environmental consultants may use for identification of sensitive habitats. The website address is: http://www.env.gov.bc.ca/sei/.</p> <p>The Regulation is searchable on government legislation website at: http://www.gov.bc.ca/bc_home/statutes_and_regulations/statutes_regulations.html.</p>
3.2	Definition for surface water	Does the definition of "surface water", in respect of contaminated surface water as a precluding factor, include muskeg, ditches, standing water, storm retention ponds, etc.?	Define surface water for precluding condition.	<p>Surface water is by convention water that is not groundwater and the aforementioned media would all be considered surface water. This issue is under consideration by the ministry as part of review of groundwater guidance and application of water use standards at a site. Changes to the definition may be applied following completion of the review.</p> <p>As a related matter, note that different standards or criteria may apply to the aforementioned surface water media. For example, CSR aquatic life water use (AW) standards or the B.C. water quality guidelines may apply to ditches or storm water retention ponds depending on the site context. The Director should be consulted for guidance on the application of standards where in question.</p>
2.0	Definition for wildlife corridor	In the definition of "wildlife corridor", do you really want to clarify that a small area is an area that is greater than 1 m ² ?		The linkage to wildlife corridors in the definition of potential terrestrial habitat has been removed. Accordingly, the definition of wildlife corridors is no longer necessary.
3.1	Beneficial use exclusion – site size restriction	What is the rationale that the beneficial use exclusion is not applicable for sites over 0.1 ha?	Remove size limit.	The site size restriction was initially included from a potential habitat protection perspective. The size restriction is no longer considered necessary, based on the other habitat protection measures in SLRA, and has been removed.
3.1	Beneficial use exclusion - sediments	Contaminated sediments are a precluding factor for SLRA. Does this imply that the beneficial use exclusion is not applicable to sediments? Given that creosoted pilings are still viewed as a 'necessary evil' in the construction of piers and wharves, it would seem	Allow beneficial use exclusion for sediments. Expand distance from 0.3 m to 5 m.	<p>The ministry concurs with the rationale to apply the beneficial use exclusion to contaminated sediments where related to a beneficial use. This has been added to SLRA along with any surface water contamination that may also be related to a beneficial use. As a related matter, the precluding condition of the presence of sediment or surface water contamination has been modified in SLRA to account for the beneficial use exclusion now applicable to these media.</p> <p>Research studies on treated pilings in an aquatic environment indicate an approximate 1 m halo of contamination associated with such structures. Accordingly, a 1 m separation</p>

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		appropriate that the beneficial structure exclusion be applied to sediments and the affected area reflect the halo of contamination that is observed around treated wood structures throughout B.C.		distance has been included in SLRA for contamination in sediments or surface water as related to a beneficial use.
3.1	Beneficial use exclusion - separation distance	<p>0.3 m separation distance from source of beneficial use (i.e., contaminant) is not significant and impractical to assess without safety issues, i.e., it is usually not possible to drill within 0.3 m of a pile, utility, or a building in a safe manner.</p> <p>0.3 m beneficial use distance separation – I've assumed that the distance is a lateral measurement and not vertical. Also, drilling and installation of groundwater monitoring well within 0.3 m of source materials may be physically impossible and/or place drill operators at increased health and safety risks.</p>	Suggest the separation distance be at least 3 m to ensure no safety issues and provided there is adequate access.	<p>The stakeholder recommended 3 m separation distance is not considered conservative enough from a contamination perspective. The separation distance has been modified to 1 m consistent with the sediment assessment above. The separation distance has also been clarified to be a lateral measurement.</p> <p>With respect to safety risks, note that the Ministry of Environment does not regulate safe work practices at contaminated sites. Accordingly, any investigation or remediation activities at contaminated sites should be conducted in a safe manner and in accordance with WCB safety requirements.</p>
3.1	Beneficial use exclusion - application	Does the beneficial use exclusion only apply for "active sites"? If a site is closed, or will be closed (and hence no longer to be used for its intended purpose), will the exclusion then not apply?		The beneficial use exemption applies to active or closed sites as long as beneficial use still applies, i.e., the beneficial use materials are still being used for their respective beneficial use.
3.1	Beneficial use -	Clarify what are "applicable"		The descriptor "applicable" has been removed.

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	description	wood preservatives for beneficial use clause.		
3.2	Precluding condition – edible fruit bearing trees	What about other deep-rooting plants (alfalfa) in the precluding condition? Will a single deep-rooted tree exclude application of SLRA? Can a proponent chop down that tree?		<p>It is acknowledged that other types of deep-rooting plants or trees may be encountered at contaminated sites throughout B.C. The issue may be more appropriately assessed in a DRA context than a simple screening tool. Accordingly, for purposes of application of SLRA, the precluding condition has been expanded to the presence of any type of deep-rooting plant or tree in the area of contamination at the site.</p> <p>In some cases it is understood that vegetation removal is necessary to effect remediation of contamination. In such cases, a complementary strategy from the ministry's perspective is to replace vegetation in uncontaminated areas of the site, or in remediated areas, where applicable.</p>
3.2	Precluding condition – measurable LNAPL, presence of DNAPL	<p>Precluding condition of measurable LNAPL and presence of DNAPL is too conservative.</p> <p>LNAPL/DNAPL precluding conditions are too conservative. In a query of our database, which has about 6 years of data, 85% of sites had measurable NAPL at one time or another. This preclusion will unnecessarily limit the use of this tool at a large number of sites.</p> <p>DNAPL precluding condition too conservative. Rules out drycleaners and creosote sites.</p>		The precluding condition is acknowledged to be conservative. The ministry considers the presence of LNAPL or DNAPL at a site as an ongoing source of contamination that cannot be effectively addressed using a simple screening tool. In the current regulatory environment, remediation to remove the source materials or DRA is considered warranted in these cases.
3.2	Precluding condition – measurable LNAPL, presence of	Is it the intent of MoE to exclude sites with LNAPL or DNAPL from assessment of the vapour intrusion pathway? This would be inconsistent with the soil		The ministry's intent is to exclude the presence of LNAPL or DNAPL from assessment under SLRA. Accordingly, the presence of LNAPL or DNAPL at a site requires remediation for an SLRA revealing no unacceptable risks or assessment under DRA.

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	DNAPL	vapour guidance which does not have this limitation.		
3.2	Precluding condition – bioaccumulative substances	Precluding condition of detectable "bioaccumulative substances" within top 1 m is too conservative.	Should be concentrations > standards.	The recommended change is not considered to be sufficiently conservative for bioaccumulative substances. The existing preclusion for bioaccumulative substances has been retained.
3.2	Precluding condition – preferential pathways	Clarify "receiving environment" in the preferential flow pathway precluding condition. Isn't all soil, sediment, water, air and soil gas a receiving environment?		A definition for receiving environment has been included in SLRA.
3.2	Precluding condition – preferential pathways	Storm water sewers typically discharge directly into the environment. Storm sewers are present in the vicinity of contamination at most urban sites.	Refine precluding condition to preferential pathways which can transport contaminants to receptor within specified time.	The existing preclusion has been retained in SLRA. The preferential pathway issue is to be re-evaluated following review and development of ministry groundwater guidance.
3.2	Precluding condition – detectable volatile and toxic substances.	<p>Precluding condition of "detectable concentrations of volatile contaminants in soil or groundwater within 1 m of building" is very conservative.</p> <p>What are detectable concentrations of volatile and toxic substances? Do CSAPs determine this, or should MoE provide concentrations?</p> <p>Over conservative and too much variability. Detection limits vary between labs.</p>	<p>Change precluding condition to presence of soil/groundwater exceedances within 1 m of building.</p> <p>Define "detectable concentrations" for all volatile parameters (with ACC), and/or supply list of required detection limits.</p> <p>Provide screening values for volatile parameters in soil and groundwater, rather than detection limits.</p>	See ministry response below to vapour exposure pathway query.
3.2	Precluding	Very high permeability media	This precluding condition	The existing preclusion is retained based on the uncertainties in calculating groundwater

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	condition – very high permeability media	<p>precluding condition is too vague.</p> <p>Clarify "very high permeability media". When does a high permeability medium become a very high permeability medium?</p> <p>Very high permeability media not prescriptive enough. Definition based on permeability value? Velocity?</p>	<p>should be based on groundwater velocity or travel time to a receptor instead of permeability.</p>	<p>velocities or travel time in the precluded high permeability media.</p> <p>The term "very high permeability" is considered sufficiently descriptive based on the association to the identified media (fractured bedrock, karst terrain or cobbles).</p>
3.2	Precluding condition – offsite DW exceedances.	<p>Offsite groundwater contamination > DW standards as a precluding condition is too stringent.</p> <p>Does this precluding condition apply where other water uses are applicable or only where DW applies to the site?</p> <p>I observe that groundwater concentrations of iron and/or manganese exceeding DW standards offsite would fail SLRA. Since these metals are limited for aesthetic reasons only, and background concentrations often exceed DW standards, this would exclude many sites that might otherwise qualify for SLRA.</p> <p>Consider carefully the potential consequences of this condition with respect to concentrations of</p>	<p>Suggest that these parameters be exempted from the final matrix of "preclusionary" standards, whatever it ends up being.</p>	<p>The precluding condition only applies where drinking water use is applicable. The preclusion was included in SLRA to provide protection for potential future uses of groundwater in areas where groundwater may be used for drinking water. This is acknowledged to be conservative but is consistent with the future use provision in CSR section 12(5).</p> <p>It is acknowledged that some inorganic substances based on aesthetic criteria are problematic at sites where drinking water use standards apply. However, the substances are retained in SLRA for consistency with CSST policies. Note that this issue is currently under consideration as part of review of the CSST policies and may be subject to future revision. In the interim, iron and manganese concentrations exceeding DW standards may be addressed using a background argument (Protocol 9) or DRA.</p> <p>Schedule 10 PQLs are not standards and are not used in the determination of whether a site is a contaminated site. PQLs are expected to be deleted in the Stage 6 CSR amendments.</p>

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		<p>iron and manganese in groundwater (on the order of 25% or more of sites in the Lower Mainland contain concentrations > DW standards). Clarify if this also applies to Schedule 10 substances lacking numerical standards (do detectable concentrations of the Schedule 10 substances exceeding the PQL disqualify the site?).</p>		
4.2	Human health soil exposure pathway	<p>Can the human health soil exposure pathway be considered incomplete for upstream oil and gas sites? For contaminants located within 1 m of ground surface, and considering that the sites will be reclaimed to equivalent land capability, there will be essentially no likelihood of human exposure for non-ALR sites. As per the Salts Technical Advisory Committee, for contaminants such as salt, there is no human health risk in the surficial 1 m regardless of concentration.</p>	<p>Human health exposure pathway default to “no operable pathway” at upstream oil and gas sites.</p>	<p>The recommendation is not considered sufficiently conservative for other contaminants which may be present or based on the potential for hunter/trespasser exposure at upstream sites.</p>
4.2	Human health soil exposure pathway	<p>The human health exposure questions don't effectively evaluate exposure. Reconsider SAB advice in H-1 and H-2. H-1: humans within 10 m of where soil > intake or generic standards? H-2: humans living or working within site and</p>		<p>The human health soil exposure scenario in SLRA is considered to be representative of the potential for exposure. The substantive difference with the SABCS SLRA human health exposure pathway is removal of the SABCS question H-1 which was considered too subjective and open to interpretation.</p>

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		adjacent properties?		
4.2	Vapour exposure pathway	<p>The requirement to investigate vapours when humans can come within 30 m of detectable volatile concentrations in soil or groundwater is too conservative. We envision a positive response to this condition at almost all sites due to the potential outdoor air exposure pathway - almost all sites have the potential for humans to access all parts of the site (in an outdoor scenario) and thus come within 30 m of contamination.</p>	<p>If a 30 m cut-off is scientifically defensible for an indoor air exposure scenario, then a shorter distance would be defensible for outdoor exposure.</p>	<p>The vapour exposure pathway has been modified in SLRA in a number of ways. With the introduction of the ministry's interim guidance for site vapour assessment, soil vapour investigation is now a requirement at contaminated sites and SLRA was modified to reduce overlap with the interim guidance. Accordingly, the vapour sampling guidance and attenuation factors formerly located in Appendix A have been removed from SLRA. The attenuation factors are now housed in the interim guidance for site vapour assessment. The vapour sampling guidance is anticipated to be issued once the Air Concentration Criteria (ACC) have been incorporated into the CSR.</p> <p>Other modifications include limiting the pathway assessment to a transient exposure assessment. Accordingly, the previous separation distance rules no longer apply. Note that the pathway may only be evaluated in a wildlands land use scenario at the present time. For wildlands sites, where volatile or semi-volatile substance concentrations exceed the air concentration criteria in the subsurface and the trespasser scenario is not satisfied, then further remediation or a DRA is necessary. For all other land uses, further remediation or a DRA is necessary where air concentration criteria are exceeded at a site.</p>
4.2	Vapour exposure pathway	<p>The requirement to assess vapours if humans can come within 30 m of detectable volatile concentrations in soil or groundwater is excessively conservative especially for remote sites or wildlands.</p> <p>Also, it would be very hard to establish if humans can "come" within 30 m or 25 m or 20 m. A preclusion should not exist where the only exposure pathway is open air and contamination is 10 m deep. How would "coming" within a distance be applied – does this mean if someone visits a well site for one day a year, then this</p>	<p>Suggest off ramp where the land use/occupation is extremely limited.</p> <p>Suggest putting some parameters around the duration of potential exposure.</p> <p>Proper use of personal protective equipment can mitigate this risk.</p>	<p>See ministry response to previous vapour exposure pathway query.</p> <p>A trespasser exposure scenario has been added to SLRA. Also, as per the interim guidance for site vapour assessment, the air concentration criteria may be calculated on a depth-specific basis.</p>

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		<p>tool could not be used?</p> <p>For upstream sites, we should be able to eliminate this pathway given that no human will routinely come within 30 m of soil contamination over the long term. This is no different than the potential exposure during a site investigation.</p>		
4.2	Vapour exposure pathway	<p>Is testing of air/vapour required on sites adjacent to a potential contaminated site (where Schedule 2 activity has occurred) when the subject site is not contaminated?</p> <p>What about if the neighbouring site had a CoC but had not previously investigated vapours?</p>		<p>Yes, vapour investigation is a requirement at contaminated sites. As per the process of a Preliminary Site Investigation, the first step is to determine the APECs at both the site and adjacent properties. Should APECs be identified, the PCOCs are then determined. If the PCOCs are volatile or semi-volatile substances, investigation of the PCOCs is then conducted to determine if contamination is present.</p> <p>This query relates to site investigations and is outside the scope of SLRA.</p>
4.2	Vapour exposure pathway – ecological assertion.	It may be beneficial to state that ecological exposure to potentially harmful vapour concentrations is not considered for the reasons stated in the ACC document and that CSAPs must ensure that vapour concentrations will not result in an unreasonable environmental health hazard.		SLRA does not require an ecological assertion.
4.2	Water exposure pathway	Excluding sites with groundwater plumes within 30 m of aquatic receptor is too conservative.		The groundwater transport distance is constrained in SLRA by the term x_R in Equation A-5, Appendix A (current version). The minimum value for x_R has been modified to 10 m from the receiving environment (previously 30 m) to be consistent with CSST policies.
4.2	Water exposure	Limited dilution available in		The dilution factors in SLRA are based on the SABCS SLRA report. It is acknowledged that

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	pathway	transport model.		the mixing term in SLRA differs from CSST policies. The dilution term will be reviewed following review of CSST policies.
4.2	Water exposure pathway	Limited list of biodegradation rates in model. The half-life for naphthalene is indicated as 42 years. This rate is inconsistent with CSST policy.		Biodegradation rates were compiled from the SABCS SLRA report and referenced sources. These included only those substances known to degrade under most conditions. The SABCS biodegradation rates are inconsistent with, and not as comprehensive a list as, those in CSST policy. Literature review and compilation of updated biodegradation rates will be considered by the ministry following review of CSST policies.
4.2	Water exposure pathway	Clarify when leaching tests required. Prefer using actual groundwater data for exposure pathway determination and risk estimates rather than leach test results. Why calculate potential groundwater concentrations if there are already representative groundwater concentration data available for the site?	Suggest that leaching tests be used for site characterization while well-characterized groundwater data be used for risk evaluations, including exposure pathway analysis.	The objective of determining predicted groundwater concentrations from soil leachate with comparison to actual measured groundwater quality data is to use the highest of the actual or predicted substance concentration for groundwater transport assessment. This is a conservative measure given the limitations in obtaining representative groundwater quality data at all sites.
4.2	Water exposure pathway	Construction worker exposure to contaminated groundwater > DW is overly conservative (Note 7 in SLRA questionnaire). We do not support screening dermal contact scenarios against drinking water standards and feel sites may unnecessarily advance to full RA if this is done. Construction worker exposure to groundwater contamination >DW standards seems very onerous.	If evaluation of this pathway is desired, then appropriate exposure assumptions should be used to derive groundwater standards for the protection of dermal exposure of construction workers. Suggest application of a multiple of the DW standard for this scenario.	We concur with the comments provided and the note has been removed.
4.2	Water exposure	Will the use of other peer-	MoE should provide list of	The choice of using other groundwater transport models has been limited to Bioscreen

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	pathway	reviewed groundwater transport models require MoE validation and documentation?	acceptable models.	which is a peer-reviewed model freely available in the public domain.
4.2	Water exposure pathway	Groundwater model – distance to receiving environment not constrained for sites where impact to drinking water resources may occur.		The distance to the receptor, where drinking water use standards apply, is constrained in two ways in SLRA: i) precluding condition – SLRA cannot be applied where groundwater contamination exceeding drinking water use standards is present offsite; and ii) transport modeling – the receiving environment is defined as the site boundary.
4.2	Water exposure pathway	Groundwater model – there is no consideration of the errors that can be introduced when extrapolating groundwater transport over long distances. The issue here is uncertainty in the geologic and hydrogeologic conditions downgradient of a site. Much of B.C. is glacially influenced and hydraulic conductivities are by no means uniform and homogeneous. Unless the consultant can conduct an extensive site assessment, I think we need to come up with a reasonable minimum velocity for this type of risk screening exercise.		Recommendation accepted. The minimum average linear groundwater velocity of 5 m/year recommended in SABCS SLRA has been incorporated into SLRA.
4.2	Water exposure pathway	Provide flowchart for groundwater pathway assessment for process clarity.		A flowchart has been developed and incorporated in SLRA.
4.2	Water exposure pathway	What infiltration rate, I, should be used for paved sites?		The infiltration rate is a site-specific parameter. A representative value is to be selected by the environmental consultant based on professional judgement with supporting rationale.
4.2	Water exposure	Clarify how dissolved oxygen		Dissolved oxygen concentrations are to be determined based on field measurement. A

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	pathway	concentrations >3 mg/L are to be confirmed for demonstrating aerobic conditions in groundwater.		reference to the B.C. Field Sampling Manual has been included in SLRA.
4.2	Water exposure pathway	When comparing to the CSR standards in sections 2 and 3 of Appendix B, clarify if the groundwater pathway must be considered for parameters > schedule 10 and > PQL.		Schedule 10 contains water standards for drinking water use. Accordingly, where drinking water use applies at a site, the water standards in Schedule 10 apply (in addition to the drinking water use standards in Schedule 6). See response to PQL issue above.
4.2	Water exposure pathway	Clarify interpretation of the term "receiving environment" in Appendix B.		The term "receptor" is used in the current version of SLRA in place of "receiving environment". A definition for receptor has also been included in SLRA. Application of the "receptor" term in Appendix A (current version) for the groundwater transport pathway is determined based on two factors: i) the water use standards that apply at the site; and ii) the prescribed location of the receptor for the respective water use. There are four cases summarized as follows. Where drinking water use applies, the receptor is considered present at the site property boundary. Where aquatic life water use applies, the receptor is considered present at a distance of 10 m from the high water mark of a surface water body to allow for dilution of groundwater prior to the receiving environment. Where livestock water and irrigation water use apply, receptors are considered present at the water wells.
4.2	Terrestrial exposure pathway/habitat assessment	The habitat assessment is overly onerous and subjective. An opinion as to whether a receptor is present/absent or terrestrial vegetation is stressed due to site contaminants or other factors is subjective, varies with season, time of day and presence of people on the site. Several specialists would likely be necessary to complete Form C-2 including bird, reptile, amphibian, raptor, herbs and forbs, etc. Field test habitat/receptor assessment (Forms C-1 to C-3)	Scope of habitat assessment should be reduced to evaluation of the type and quality of available habitat and the determination of whether any rare/endangered (red/blue-listed) species have been reported for the site or surrounding area.	The recommendation is not considered sufficiently conservative or consistent with an overall ecological risk assessment approach. The ministry's objective for the assessment is that professional biologists would rely on existing information and a site visit as opposed to conducting extensive, multiple site reviews. The habitat assessment process is anticipated to be reviewed following implementation of SLRA and associated stakeholder feedback. [Note: Forms C-1 through C-3 are now Forms B-1 through B-3].

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		for effectiveness. Don't want it too be onerous or discourage use of SLRA.		
4.2	Terrestrial exposure pathway/habitat assessment	Do you need to consider habitat assessment in Appendix C if there is no undeveloped land or exposure pathway?	If not, suggest that exemption(s) be included to clarify sites where a habitat and receptor assessment does not need to be completed.	If there is no undeveloped land, then the exposure pathway should be exited at Questions TS-3 or TS-4 and a habitat assessment, as triggered by a "yes" response to TS-5, would not be required. [Note: Appendix C is now Appendix B].
4.2	Terrestrial exposure pathway/habitat assessment	Reassess linkages in definitions of "undeveloped land", "potential terrestrial habitat" and "wildlife corridors". What about large undeveloped land that is not near/part of wildlife corridor?		A flowchart has been included in SLRA to aid in the evaluation process. The linkages and connectivity between the different elements identified are anticipated to be reviewed following implementation of SLRA and associated stakeholder feedback.
4.2	Terrestrial exposure pathway/habitat assessment	App C, section 1. Compiling a list of terrestrial plants too encompassing. Should be confined to plant types (Form C-1) and predominant species.		A compilation of individual terrestrial plant types is not necessary. The environmental consultant only needs to identify whether the identified plant type group is present at the site.
4.2	Terrestrial exposure pathway/habitat assessment	Form C-1. Why are fields with annelids blank? Why aren't arachnids listed? What about arachnids and other soil invertebrates including protists?		The blank fields were a typographical error. The subject field has also been modified to "Soil Invertebrates" to encompass the variety of invertebrates that may be present at a site.
4.2	Livestock exposure pathway	It is requested that the flowchart include questions and a means to address/potentially eliminate the 'livestock ingesting soil and fodder' exposure pathway. In the context of this pathway	Revise flowchart/Q to include "livestock ingestion" exposure pathway.	The potential for exposure to livestock is considered as part of the environmental health terrestrial soil exposure pathway as per Question TS-1 in the questionnaire. The term "livestock" is not used in the flowchart as the flowchart is only for summary illustration purposes.

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		(elimination) and for cases in which the standards are exceed (e.g., barium), the determination that there is no unacceptable risk could be made where the soil contamination is not within 1 m of ground surface.		
5.0	Future changes	<p>The owner can only confirm that site conditions do not change during their ownership. What measures would be available to ensure that future owners are aware of the conditions in the SLRA (i.e., no change in site conditions)? Do previous owners have any liability if new owner does change site conditions or work is done that conflicts with the statements on which the original SLRA was based.</p> <p>Re: "no site change" requirement, if this requirement is not met, is the SLRA not acceptable?</p> <p>Confirm/clarify whether "site conditions will not change" requirement applies to offsite owners.</p>		<p>The issue is similar to that for CoCs where risk-based standards have been applied. This is the basis of the following condition included in such certificates - "Any changes to the conditions or circumstances described in the risk assessment could invalidate the assessment". Accordingly, the duty to check any proposed site changes to the existing risk assessment (SLRA or DRA) applies to the owner considering such changes – this may be the current or future owner. Note that this owner statement is now in the Summary of Site Condition Form.</p> <p>Where offsite contamination is present unrelated to the subject site for which the SLRA was completed, the duty is on the offsite party to ensure that offsite contamination does not pose an unacceptable risk to the subject property. If conditions change, then the subject site owner would have legal recourse against the offsite party.</p>
Miscellaneous	Inconsistency re: SLRA and TG4	<p>SLRA requires "delineation of vapour" which is inconsistent with TG4.</p> <p>We note that the preclusion of</p>		See ministry response to previous vapour exposure pathway query.

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		sites with NAPL appears to be contradictory to guidance provided in the appendices (in Appendix A, guidance is to collect vapour samples in areas where NAPL was observed).		
Miscellaneous	Inconsistency re: precluding condition and groundwater exposure pathway	The aquatic preclusion in section 4.2 (“exposure of aquatic biota to contaminated soils, sediments and surface water”) makes reference to soils while the precluding condition in section 3.2 does not. Clarify the linkage between these sections.	Suggest a separate exclusion in section 3.2 as “a matrix numerical soil standard for the groundwater flow to surface water used by aquatic life pathway is exceeded”.	The reference to soils in section 4.2 has been removed.
Miscellaneous	Figure 1	Specify that flowchart is for illustrative purposes, and that questionnaire should be used to assess site. Wording differences between Figure 1 and Questionnaire arise from format limitations, but are significant.		The flowchart language has been simplified to represent a summary of the process only. In addition, language has been added to indicate that the flowchart is for illustrative purposes only and that the questionnaire takes precedence over the flowchart.
Miscellaneous	Figure 1	Should define “ground surface” and “uncovered/bare”.		The terms are used more fully in the questionnaire and are considered to be self explanatory.
Miscellaneous	Figure 1	With respect to question IW-3, is it possible for contaminated groundwater to be collected in irrigation ditches and redistributed as irrigation or livestock water sources?		Contamination in surface water (i.e., ditch) precludes use of SLRA.
Miscellaneous	Analytical procedures	Test procedures not standardized for parameters such as porosity, density, f_{oc} , etc. There are variations between	MoE should standardize testing procedures for soil parameters.	Analytical methods currently have been developed and are used in other fields of practice for the subject parameters. Development of standardized test procedures for the parameters is beyond the scope of SLRA.

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		agricultural/soil science applications and geotechnical/ASTM procedures.		
Miscellaneous	Precluding conditions as pathways	Precluding conditions relate to specific exposure pathways (i.e., are particular to specific pathways).	Present precluding conditions as a function of the relevant exposure pathway.	Some precluding conditions apply to more than one pathway and would lead to duplication in the questionnaire/flowchart. The precluding conditions have been retained in present form.