BRITISH COLUMBIA | Ministry of Environment

PROTOCOL 20
FOR CONTAMINATED SITES

Detailed Ecological Risk Assessment Requirements

Version 3

Prepared pursuant to Section 64 of the
Environmental Management Act

Approved:	Kevin Butterworth	February 1, 2023
	Director of Waste Management	Date

Effective date: February 1, 2023

1.0 Definitions

Terms defined in the *Environmental Management Act* (EMA) and the Contaminated Sites Regulation (CSR) shall apply to this protocol, with the addition of the following:

"**conceptual site model**" means a written description and/or an illustrated diagram of the biologic, geologic, hydrogeologic, and environmental conditions of a site as it relates to actual or potential exposure to contamination which identifies all potential receptors and complete or incomplete exposure pathways for all contaminants of concern.

"**detailed risk assessment" [DRA]** means an ecological risk assessment and/or human health risk assessment carried out in accordance with this protocol and Protocol 1 that provides a systematic and detailed evaluation of potential adverse effects and related risks on human health and/or ecological health resulting from exposure to contaminants in environmental media.

"**ecological risk assessment**" means an assessment that quantitatively evaluates the actual or potential impacts, hazards, or risks of contaminants on biota other than humans completed in accordance with Protocol 1 and this protocol.

"**exposure pathway**" means the pathway through an environmental medium by which a contaminant is conveyed to a receptor.

"**potential contaminant of concern**" means any contaminant which might be expected to occur at a site based on the historical use of the site, whether or not that substance has been measured in any environmental medium or determined to exceed the numerical standards of the CSR.

"qualified professional", in relation to a duty or function under this protocol, means an individual who:

(a) is registered in British Columbia with a professional organization, acts under that organization's code of ethics and is subject to disciplinary action by that organization; and
(b) through suitable education, experience, accreditation and knowledge may reasonably be relied on to provide advice within the individual's area of expertise, which area of expertise is applicable to the duty or function.

"**receptor**" means a living organism that may be exposed to a substance.

"**risk-based standards**" means the standards prescribed in CSR sections 18 and 18.1.

"**screening level risk assessment**" [SLRA], a screening level risk assessment and report made in accordance with Protocol 13.

"**toxicity reference value**" [TRV], means a maximal estimate of exposure to a substance which would not elicit an unacceptable adverse toxicological effect in an organism, including without limitation: ecological soil screening level, lowest observed adverse effect level, no observed adverse effect level.

"**weight-of-evidence**", a structured framework approach for evaluating and assigning the relative or proportional contributions or weightings to each of multiple lines of evidence influencing the qualitative or quantitative estimation of risk or hazard in a risk assessment.

2.0 Introduction

This protocol identifies components of, and requirements for, the completion of a detailed ecological risk assessment (DERA). Under this protocol, ecological risk assessment is considered equivalent to environmental risk assessment described in the CSR.

Any DERA completed for regulatory purposes must be completed in accordance with Protocol 1, "Detailed Risk Assessment" and is expected to follow the ministry's risk assessment guidance. In the case that ministry guidance is not followed, the deviation and a rationale justifying the deviation, must be fully documented in the risk assessment report.

3.0 Detailed ecological risk assessment checklist

Appendix 1 of this protocol contains a checklist listing the key elements of any DERA submitted in support of a recommendation to issue a contaminated sites legal instrument based on compliance with the CSR's risk-based standards.

Section IV of the checklist takes the form of a four column table, which presents key DERA elements in the following subsections keyed to DERA methodology:

1) General Requirements,
2) Problem formulation,

3) Exposure assessment,
4) Effects assessment,
5) Risk characterization, and
6) Uncertainty Assessment.

For each subsection, Column I of Section IV lists the relevant DERA Checklist elements. A response to the question in Column I is required if "Mandatory" is listed beside that element in Column II. In Column III, the applicant's response to the checklist element must be recorded as either "yes" or "no." Column IV provides the applicant with an opportunity to include comments related to the answer provided in Column III.

A negative response to a mandatory checklist element may jeopardize a recommendation to issue a contaminated site legal instrument. In the case that a negative response is provided to a mandatory item in column III, a rationale justifying deviation from the mandatory element must be provided in Column IV. For example, if no operative ecological pathways exist now or in the future at a site, this lack of operative pathways would justify a "no" answer to exposure related mandatory elements in the checklist.

Checklist elements identified as "Optional" in Column I of Section IV of the checklist may or may not be answered at the discretion of the qualified professional. These optional elements involve general good DERA practice, which, while recommended, are not considered by the ministry to be critical to completion of detailed ecological risk assessments under the CSR.

The qualified professional(s) responsible for the DERA must complete and sign Part 3 of the checklist. Note that all signatories to Part 3 are jointly and equally responsible for all risk assessment aspects of the Detailed Ecological Risk Assessment.

The checklist is designed to provide an opportunity for the qualified professional(s) to demonstrate that the risk assessment includes all required elements of a detailed ecological risk assessment. Determining if a particular required element of the risk assessment has been adequately addressed is the responsibility of the risk assessment reviewer (i.e., the ministry risk assessor or the risk assessment Approved Professional) for the site.

4.0 Reporting

A completed DERA Checklist must be provided with any DERA report submitted in support of a recommendation to issue a contaminated sites legal instrument based on compliance with the risk-based standards of the CSR.

For sites with operable pathways, the detailed ecological risk assessment report must be structured as a formal framework of related objectives, assessment endpoints and measurement endpoints. The report must summarize the pertinent information from site investigation and ecological risk assessment performed for the site.

In particular the DERA must:

a) provide context for the source of site contamination and the environmental fate and effect of contamination on ecological receptors at the site;
b) describe and evaluate: pertinent physical, chemical and biological processes which influence the effects of contaminants on ecological receptors at the site;
c) describe the process by which contaminants of concern and critical ecological receptors were selected for the site;
d) provide a conceptual site model which includes potential contaminants of concern, lists all potential contaminant exposure pathways, and identifies operative (i.e. open) pathways for the site;
e) provide sufficient methodological detail to allow risk equations and calculated risk estimates to be independently reproduced and validated;
f) provide a final conclusion on the acceptability of the level of ecological risk determined in the DERA completed for the site;
g) provide a comprehensive uncertainty analysis for all aspects of the DERA which contribute to the conclusion related to the acceptability of the level of ecological risk determined in the DERA completed for the site; and
h) in the case that weight-of-evidence based arguments or considerations are used to determine the level of ecological risk for the site, provide clear and preferably quantifiable, *a priori* weightings assigned with specific corresponding underlying rationale and an associated uncertainty assessment for all weighted aspects of the DERA which contribute to the level of ecological risk determined for the site.

For more information contact the Land Remediation Section at remediationFAQs@gov.bc.ca

Revision history

Approved Date	Effective Date	Document Version	Notes
	April 2013	1	New document
May 13, 2021	May 13, 2021	2	Revised to reflect application of the *Professional Governance Act*
February 1, 2023	February 1, 2023	3	Added a definitions section; updated the definition of qualified professional

Appendix 1

Detailed Ecological Risk Assessment Checklist

BRITISH COLUMBIA | Ministry of Environment

DETAILED ECOLOGICAL RISK ASSESSSMENT CHECKLIST

Land Remediation Section
PO Box 9342 Stn Prov Govt
Victoria B.C. V8W 9M1

General email: site@gov.bc.ca

Submission of this checklist is required by Protocol 20, "Detailed Ecological Risk Assessment Checklist" under the *Environmental Management Act.*

Part 1. Land, owner and qualified professional information

Section I Land Description				
Site ID Number (if known)				
PID		or	PIN	
Legal Description				
Latitude	Degrees	Minutes	Seconds	
Longitude	Degrees	Minutes	Seconds	
Site Civic Address	Street			
	City			Postal Code

Section II Property Owner and/or Operator (if applicable)				
Name				
Address	Street			
	City			Province/State
	Country			Postal/Zip Code
Phone		Fax	E-Mail	

Section III Qualified Professional(s)
Name(s)
Organization(s)
Address:
Street
City, Province/State
Country, Postal/Zip Code
Phone
Fax
E-Mail

Part 2. Detailed Ecological Risk Assessment Checklist[1]

Section IV Detailed Ecological Risk Assessment Checklist			
Column I	**Column II**	**Column III**	**Column IV**
DERA Checklist Element	**Response Requirement**	**Response (Yes or No)**	**Comments**
Subsection 1.0 General Requirements			
1.1 Does the DERA identify who the major participants are in the risk assessment and state their qualifications?	Mandatory		
1.2 Does the DERA describe how the method(s) of assessment and the findings of any previous investigation(s) were used to design and carry out the current assessment?	Mandatory		
1.3 Does the DERA describe the extent to which any previous assessment(s) were/were not relied upon?	Mandatory		

Section IV Detailed Ecological Risk Assessment Checklist			
Column I	**Column II**	**Column III**	**Column IV**
DERA Checklist Element	**Response Requirement**	**Response (Yes or No)**	**Comments**
1.4 If ministry preapprovals apply to the DERA, has all required preapproval documentation been provided with the risk assessment?	Mandatory		
1.5 Does the report make it clear what conditions are required (if any) for the instrument being applied for (e.g., Schedule B conditions for a Certificate of Compliance)?	Mandatory		
1.6 Has field data relevant to the ecological risk assessment been provided?	Mandatory		
1.7 Has laboratory data relevant to the ecological risk assessment been provided?	Mandatory		
Subsection 2.0 Problem Formulation			
2.1 Have the objectives of the ecological risk assessment been documented?	Mandatory		
2.2 Were assessment and measurement endpoints for operative exposure pathways warranting further assessment defined[1]?	Mandatory		
2.3 Were assessment and measurement endpoints linked to the risk assessment objectives[1]?	Mandatory		
2.4 Were all current and reasonable potential future land, water and sediment uses identified in the problem formulation and considered in screening for chemical exceedances?	Mandatory		
2.5 Were assumptions associated with current and future land use documented and rationale provided (e.g., development scenario)?	Mandatory		
2.6 Were potential contaminants of concern identified?	Mandatory		

Section IV Detailed Ecological Risk Assessment Checklist			
Column I	**Column II**	**Column III**	**Column IV**
DERA Checklist Element	**Response Requirement**	**Response (Yes or No)**	**Comments**
2.7 Was a conceptual site model included?	Mandatory		
2.8 Were all relevant exposure pathways (direct and indirect) identified and considered?	Mandatory		
2.9 If the site was previously assessed using screening level risk assessment (SLRA) and if exposure pathways excluded under the SLRA were not considered in the DERA; were the assumptions upon which the pathways were excluded in the SLRA confirmed in the DERA[2]?	Mandatory		
2.10 If statistics were used in the DERA, was a rationale provided for the statistical methods used?	Mandatory		
2.11 Was a rationale provided for any exclusion of contaminants that exceed applicable standards, criteria, or guidelines?	Mandatory		
2.12 Did a qualified professional visit and assess the site?	Mandatory		
2.13 Were receptors of potential concern identified based on commonly accepted risk assessment practice, including consideration of: ecological relevance, social importance, exposure potential and contaminant sensitivity?	Mandatory		
2.14 Was the site assessed for likely use by red and blue listed species?	Mandatory		
2.15 Were contaminant-pathway-receptor combinations that warranted further assessment clearly identified?	Mandatory		
2.16 If contaminant-pathway-receptor combinations were excluded from further assessment, was a rationale for the exclusion provided?	Mandatory		

Section IV Detailed Ecological Risk Assessment Checklist			
Column I	**Column II**	**Column III**	**Column IV**
DERA Checklist Element	**Response Requirement**	**Response (Yes or No)**	**Comments**
2.17 If bioassays were used, was detailed rationale provided for the selection of the toxicity tests used, (e.g., consideration of: sensitivity of the organism to the potential contaminants of concern; potential confounding factors; taxonomic diversity, etc.)?	Mandatory		
2.18 If the assessment of risk was based on several lines of evidence, was the approach used to evaluate individual lines of evidence and to integrate findings across lines of evidence documented?	Mandatory		
2.19 Were future contaminant concentrations and potential contaminant degradation products considered?	Optional		
Subsection 3.0 Exposure Assessment			
3.1 Was each contaminant-pathway-receptor combination identified for further assessment evaluated?	Mandatory		
3.2 Was each applicable land use scenario (current and future) evaluated?	Mandatory		
3.3 Was supporting rationale provided for methods used to estimate exposure point contaminant concentration(s)?	Mandatory		
3.4 If a fate and transport model or other exposure model was used, were model equations provided and referenced?	Mandatory		
3.5 If an exposure model was used, were equations and the input data provided to support an independent quality assurance check for each exposure route in the risk assessment?	Mandatory		

Section IV Detailed Ecological Risk Assessment Checklist			
Column I	**Column II**	**Column III**	**Column IV**
DERA Checklist Element	**Response Requirement**	**Response (Yes or No)**	**Comments**
3.6 Were all exposure model parameters defined and was rationale provided for all exposure model parameter values (with references where applicable)?	Mandatory		
3.7 If an exposure model was used, was uncertainty regarding both: (a) the structure of the exposure model and (b) the parameter values used in the exposure model, considered in any interpretation of the results of the exposure modelling?	Mandatory		
3.8 If an exposure model was used, were the model's results compared to, or calibrated to, empirical (i.e., measured data) to determine if the model adequately represents reality?	Optional		
3.9 For any models used, was a sensitivity analysis or a rationale for the absence of a sensitivity analysis provided?	Optional		
3.10 Were data quality objectives established for field parameters used in the risk assessment?	Optional		
Subsection 4.0 Effects Assessment			
4.1 If ecological surveys (e.g., plant, soil invertebrate, bird, fish, or benthic communities) were conducted, was the survey methodology used (including sampling locations and seasons) documented?	Mandatory		
4.2 If toxicity reference values (TRVs) were used, was a rationale for the selection and/or development of the TRVs provided?	Mandatory		
4.3 If TRVs were used, was the source of the TRVs referenced? If TRVs were developed *de novo*, was their derivation documented?	Mandatory		

Section IV Detailed Ecological Risk Assessment Checklist			
Column I	**Column II**	**Column III**	**Column IV**
DERA Checklist Element	**Response Requirement**	**Response (Yes or No)**	**Comments**
4.4 If TRVs were used, was the toxicity endpoint associated with each TRV identified?	Mandatory		
4.5 Did the level of protection used in the DERA comply with the level specified in the ministry ecological risk assessment policy summary for the applicable land use or media?	Mandatory		
4.6 If risks were evaluated relative to: a reference site(s) or reference condition(s), was rationale for the selection of the reference site(s) or reference condition(s) provided? Were confounding variables (e.g., soil: texture, pH, grain size, depth etc.) addressed and considered in the evaluation?	Mandatory		
4.7 If site-specific toxicity testing was conducted, did the test method(s) used meet the quality standards of Environment Canada, ASTM or another recognized government agency?	Mandatory		
4.8 If site-specific toxicity tests were conducted, did the tests include samples from the most contaminated area of the site?	Mandatory		
4.9 Were potential toxicological interactions (e.g., synergistic or antagonistic effects) between potential contaminants of concern discussed?	Optional		
4.10 Were up to date toxicity profiles provided for each potential contaminant of concern?	Optional		

Subsection 5.0 Risk Characterization			
5.1 Was sufficient detail provided for equations used to calculate numeric risk estimates so that it is clear how the estimates were derived?	Mandatory		

Section IV Detailed Ecological Risk Assessment Checklist			
Column I	**Column II**	**Column III**	**Column IV**
DERA Checklist Element	**Response Requirement**	**Response (Yes or No)**	**Comments**
5.2 Was preference given to the use of hazard quotients in expressing numeric risk estimates?	Mandatory		
5.3 If hazard quotients were calculated, were they documented for each complete contaminant-receptor-pathway combination (as identified in the Problem Formulation)?	Mandatory		
5.4 If hazard quotients were not calculated, was rationale provided for using a different approach (e.g., site observations or plotting exposure with dose-response data)?	Mandatory		
5.5 If an ecological hazard quotient exceeded unity, but the level of risk was considered acceptable, was a rationale provided?	Mandatory		
5.6 Were risks for all operative contaminant-receptor-pathways detailed in the problem formulation assessed and categorized as acceptable or unacceptable?	Mandatory		
5.7 Were the conclusions (i.e., risk characterization) consistent with the assessment endpoints?	Mandatory		
5.8 Does the risk assessment provide an explicit risk conclusion in regard to the significance of the ecological risk posed by the contamination at the site?	Mandatory		

Subsection 6.0 Uncertainty Assessment			
6.1 Were uncertainties (e.g., measurement uncertainty, random variations, conceptual uncertainty and ignorance) explicitly evaluated and stated, including their implications on risk conclusions?	Mandatory		

Section IV Detailed Ecological Risk Assessment Checklist			
Column I	**Column II**	**Column III**	**Column IV**
DERA Checklist Element	**Response Requirement**	**Response (Yes or No)**	**Comments**
6.2 If a weight-of-evidence approach was used, was preference given to assigning quantifiable, *a priori* weightings to weighted aspects of the DERA?	Mandatory		
6.3 If a weight-of-evidence approach was used, were the weight-of-evidence conclusions determined in a manner consistent with the approach laid out in the problem formulation?	Mandatory		
6.4 If a weight-of-evidence approach was used, were uncertainties associated with the use of the assigned weightings explicitly evaluated and stated, including their implications on risk conclusions?	Mandatory		

Footnotes

1.This checklist should be completed in accordance with Protocol 1, "Detailed Risk Assessment".

2. Where both SLRA and DRA are applied at a site, pathways screened using SLRA should be re-evaluated in the problem formulation stage of the DRA to confirm that the assumptions and conditions inherent in SLRA are satisfied at the site.

Part 3. Professional Statements and Signatures

Section V Professional Statements and Signatures – To be completed by the Qualified Professional

In accordance with Section 63 of the Contaminated Sites Regulation, I confirm that:

1) the detailed ecological risk assessment for which this checklist is submitted has been performed in accordance with ministry approved methods, procedures, guidance and standards of professional practice;
2) the responses provided in this Detailed Ecological Risk Assessment Checklist are true and accurate based on current knowledge as of the date completed; and
3) I have demonstrable experience in conducting ecological risk assessments and in conducting investigations of the type used to prepare the detailed ecological risk assessment for which this checklist is submitted.

Print Name	Signature	Date completed (yy-mm-dd)

If multiple signatories add additional Part 3 forms as needed.

NOTE: All signatories to Part 3 are jointly and equally responsible for all risk assessment aspects of the Detailed Ecological Risk Assessment

Apply professional society stamp (if applicable)