October 2005

# Checklist for Reviewing a Preliminary Site Investigation

The Contaminated Sites Regulation requires investigators who carry out a preliminary site investigation (PSI) to perform it in two stages. This guidance document provides a summary of the general types of information expected in each stage, a detailed checklist, and an outline for a summary required by the ministry.

## Activities required in a preliminary site investigation

### Stage 1

The first stage of a preliminary site investigation includes:

- a review of site historical use and records, including a search of the Site Registry, to determine current and past activities or uses, accidents and spills, and practices and management relating to potential contamination at the site and adjacent sites;
- one or more site reconnaissance visits with visual inspection of buildings, property, equipment, land, surface water, and biota for indicators or presence of contamination;
- interviews with current or former owners, occupants, neighbours, managers, employees, and government officials who can, with reasonable attempts, be contacted respecting information on activities that may have caused contamination;
- any information as to which substances on the site may cause contamination; and
- activities as described in protocols established by a Director of Waste Management in accordance with section 64 of the *Environmental Management Act.*

Sampling relevant environmental media and investigations of subsurface conditions are not required at this stage.

### Stage 2

The second stage of a preliminary site investigation enables the general location and degree of any contamination to be determined. This stage includes:

- sampling of relevant environmental media;
- laboratory or field instrumental analysis of sampled and selected environmental media for substances that may cause or threaten to cause contamination;
- other intrusive or non-intrusive methods of investigating subsurface conditions;
- assessment of substance concentrations relative to the standards in the Hazardous Waste and Contaminated Sites Regulations; and
- activities described in any protocols approved by a Director.

A preliminary site investigation must also include a summary of the report, which may be entered on the Site Registry in a format specified by a Director.

## Checklist

The checklist in Appendix 1 highlights some (but not necessarily all) important features of a good preliminary site investigation. This should be considered as guidance only. Some features are legally required, but not all are relevant in all cases. Environmental consultants and others using the attached checklist when conducting and reviewing preliminary site investigations should also consider site-specific factors and the usefulness of information provided in the preliminary site investigation.

Items 1 to 14 and 25 to 29 in the checklist should be considered for stage 1 of a preliminary site investigation. Items 15 to 24 should be considered for stage 2.

An outline of a review summary is provided in Appendix 2. The summary should include a brief discussion for any question listed below not marked with a "Y".

The "Section" column of the checklist makes occasional reference to other ministry guidance documents. "SCS" refers to Technical Guidance document 12 "Statistics for Contaminated Sites" which contains a set of numbered documents on specific statistical issues.

Please note that the checklist is a dynamic document that is modified on the basis of input received. We welcome comments on suggested improvements to format and contents and we will continue to work to provide a document that is relevant to users.

### Disclaimer

This checklist does not replace the *Environmental Management Act* or its regulations. It does not list all provisions relating to preliminary site investigations. If there are differences or omissions in this document, the Act and regulations apply.

*For more information, contact the Environmental Management Branch at site@gov.bc.ca*

# Appendix 1
## Preliminary Site Investigation Checklist

| Section | Checklist<br>Preliminary Site Investigation Stage 1 (Items 1–14 and 25–29) | Status Y/N |
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| **SUMMARY**<br><br>*Analyses* | 1. Does the investigator:<br>a) identify who the major participants are in the investigation;.....<br>b) state his/her qualifications; .....<br>c) identify if the study is a first or second stage preliminary site investigation;.....<br>d) indicate whether the investigation proceeded in stages;.....<br>e) provide the objectives, methods and procedures which were used in each stage;.....<br>f) describe the relationship of the two stages; and.....<br>g) summarize the results, including an evaluation of data which clearly shows the classification, general location and degree of contamination in soil, groundwater, sediments, and surface water?..... | |
| | 2. Does the summary:<br>a) identify what contaminants the analysis program focused on; and.....<br>b) indicate how reliable the sampling methodology and laboratory analysis was?..... | |
| **OBJECTIVE**S<br><br>*Goals* | 3. Are the goals:<br>a) of the investigation clearly stated; .....<br>b) in compliance with the scope of work agreed upon with the client; and.....<br>c) consistent with Ministry of Environment goals and objectives?..... | |
| **SITE HISTORY & DESCRIPTION**<br><br>*Description of the site* | 4. Has the investigator provided:<br>a) a legal description of the property; .....<br>b) the civic address of the property; .....<br>c) results from a title search; .....<br>d) a legal plan from the Land Titles Office;……...<br>e) information from the ministry on the presence of contaminated sites within 500 metres of the property; .....<br>f) information from the ministry groundwater section (more relevant for rural properties); …….<br>g) municipal service plans (if relevant); .....<br>h) a synopsis of building plans from municipal building | |

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| | inspection departments; .....<br>i) municipal zoning plan; .....<br>j) photos of subject property and adjoining properties; and.....<br>k) the dates when site visits were conducted?..... | |
| *Historical review* | 5. Has the investigator:<br>a) reviewed the following information;<br>⇨ site plans and diagrams.....<br>⇨ aerial photographs.....<br>⇨ Site Registry records. (mandatory, index results & detail reports to be included)……<br>⇨ city directories.....<br>⇨ property titles.....<br>⇨ fire insurance records.....<br>⇨ information provided by current site owners and those knowledgeable about the site.....<br>⇨ previous environmental or geotechnical reports relevant to the site.....<br>b) searched the BC Directory for history of occupiers at subject's civic address; .....<br>c) done additional title searches if necessary to determine site ownership history; .....<br>d) described the historical activities likely to have been present on site; .....<br>e) listed type of contaminants likely to have been associated with each site activity (past/present);……<br>f) outlined the mechanism of contamination (how, who, why, source, pathways, receptors); and .....<br>g) speculated on age of contamination?..... | |
| *Maps* | 6. Has the investigator:<br>a) provided a site map, including land use, relevant buildings found on site, dimensions in metres and area of property in hectares; .....<br>b) reviewed aerial photographs of the site and adjacent environs taken prior to and after development, in preparation of historic uses..……..<br>c) included natural features such as lakes, rivers, streams found at least partially within the boundaries of the property; .....<br>d) included constructed features such as, underground storage tanks, lagoons, ditches, sumps within buildings, and waste storage areas; ……..<br>e) provided an area topographic map of 1:20 000 or larger?..... | |

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| *Surface conditions* | 7. Has the investigator provided:<br>a) information related to topography (e.g., how it relates to possible ground water flow and direction of surface runoff); .....<br>b) an estimation of the percentage of the site presently occupied by buildings and paved areas; ……..<br>c) an estimation of the percentage of the site occupied by buildings and paved areas in past industrial/commercial configurations; .....<br>d) a general description of adjacent property, water resources; .....<br>e) the distance to surface water, drinking water supply sensitive environments; .....<br>f) a discussion of the flood potential of the site?..... | |
| *Groundwater* | 8. Has:<br>a) an attempt been made to determine if and where septic systems exist on site, using local government files etc.; .....<br>b) an assessment of groundwater vulnerability been provided through information about site soil conditions including texture, structure, thickness, and the content of organic matter and clay minerals;<br>c) a general interpretation of groundwater flow and depth been provided by a qualified hydrogeologist; and.....<br>d) the assumption behind interpretations of groundwater depth and movement been provided?... | |
| *Wells* | 9. If monitoring wells have been installed near the disposal areas previous to this investigation:<br>a) have the monitoring results been reviewed; .....<br>b) have data been included that indicate why and when a monitoring well was installed and by whom; and.....<br>c) has any previous geotechnical investigative work been identified and reviewed?..... | |
| *Soil types and soil depths* | 10. Has the investigator:<br>a) provided soil survey information; .....<br>b) contacted soil survey personnel, or soil scientists, if no soil survey information is available; .....<br>c) indicated whether there is visible signs or sources of pollutants on the surface of the soil?..... | |

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| *Climatic conditions* | 11. Has the investigator provided:<br>a) annual precipitation records; .....<br>b) along with a description of seasonal variations in precipitation; and.....<br>c) estimates of infiltration rates?..... | |
| *Industrial sites* | 12. For industrial/commercial sites currently operating:<br>a) has the investigator identified manufacturing processes, raw materials, chemicals or fuels used;<br>b) has the investigator identified the potential waste streams; .....<br>c) determined each waste stream's chemical characteristics, volume, and methods of treatment and disposal; and ….....<br>d) has the presence of electrical transformers or capacitors been determined?..... | |
| *Basic preliminary assumptions about contaminants and migration mechanisms* | 13. Has the investigator:<br>a) provided approximate concentrations and general locations of contaminants (random or non-random, large area extent or confined, near surface or at depth); .....<br>b) discussed reactivity (soluble or non-soluble, volatile or non-volatile)and the toxicity rating (human & ecological) of the potential contaminants of concern; .....<br>c) listed activities in neighbouring properties to a distance of at least 300 metres from the site under investigation; .....<br>d) provided evidence that migration has occurred (reliable or unreliable); and .....<br>e) examined surface waters (including ditches) for signs of contamination?..... | |
| *Basic preliminary information about liability* | 14. Does the investigator:<br>a) provide adequate information about any court or administrative actions, ministry orders, Federal charges under the *Fisheries Act*, etc.?..... | |

| | Preliminary site investigation Stage 2 may include 15–24 | |
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| **DATA**<br><br>*Goals of the study*<br><br>***Populations***<br>For additional information see: Identifying Populations, SCS No. 7<br><br>***Plans***<br>For additional information see: Sampling Plans, SCS No. 12 | 15. Has the investigator discussed the following about the potential contaminants of concern:<br>a) what are the goals of the preliminary site investigation; and .....<br>b) will analysis of the populations identified in the study lead to achieving these goals?……..<br><br>16. Does the sampling plan and data:<br>a) adequately identify the contaminants that exist and represent their general distribution; .....<br>b) establish the physical and chemical controls on contaminant distribution?.....<br><br>17. Has the investigator:<br>a) explained the rationale behind the sampling plan; …<br>b) provided a sampling plan that reflects the potential sources, pathways, and receptors of contaminants; ...<br>c) over-sampled to compensate invalidated results (broken bags, lost labels, etc.); .....<br>d) avoided collecting composite samples; .....<br>e) provided rationale for using composites or a combination of composite and discrete samples,……<br>f) detailed the procedures used to collect, record; confirm and verify the data base; .....<br>g) provided an adequate location for each sample (e.g. has the sample grid been tied into UTM co-ordinates); .....<br>h) has the investigator attempted to determine the background soil conditions for the parameters being investigated; and .....<br>i) does the investigator provide rationale for choosing the area used to represent ambient conditions?.....<br><br>18. If previous studies have been used:<br>a) have the data been summarized and presented in the report; .....<br>b) have the data been used to add to the density of sampling locations; .....<br>c) has the source of additional data been identified and its use justified; and.....<br>d) has the investigator given reasons for including or excluding data from previous studies?..... | |

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| ***Protocols***<br><br>For additional information see: Statistical QA/QC, SCS No. 11 | 19. Have field sampling procedures been carried out according to:<br>a) ministry protocols where available; and .....<br>b) if modified, presented justification for such modifications?.....<br><br>20. Has the investigator:<br>a) included the original quality assurance plan; .....<br>b) run a complete check of all data against original records; .....<br>c) provided documentation of reliability of any data that is significant to the study's conclusions;.....<br>d) shown that the analytical methods used for all samples conform with methods accepted by ministry recommendations; .....<br>e) used paired analyses of duplicate samples (where samples are collected separately in the same immediate area); .....<br>f) used paired analyses of split samples of the same material especially where suspected contaminant levels are believed to be at their highest concentrations; .....<br>g) discussed the possible reasons for differences between splits and field sample duplicates; .....<br>h) have recommended ministry lab services QA/QC protocols been followed; and.....<br>i) has the investigator documented any corrective action taken if QA/QC reveals significant bias or high imprecision?..... | |
| **EXPLORATORY DATA ANALYSES**<br><br>***Univariate descriptions***<br>For additional information see: Univariate Description, SCS No. 1<br><br>***Bivariate Descriptions***<br>For additional information see: Bivariate | 21. For univariate distributions, has the investigator:<br>a) made all distribution assumptions explicit in the report; .....<br>b) documented the integrity of the data; .....<br>c) made use of graphical representations of the data, such as histograms, or probability plots; …….....<br>d) used summary statistics that describe the centre, location, spread, and shape of the univariate distribution; and .....<br>e) used logarithmic scaling, if the data are skewed, to make graphical presentations more informative?.....<br><br>22. For bivariate distributions, has the investigator:<br>a) made all distribution assumptions explicit in the report; .....<br>b) documented the integrity of the data; and ..... | |

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| Description,<br>SCS No. 2<br><br>***Outliers***<br>For additional information see:<br>Outliers, SCS No. 8 | c) used scatter plots that display the relationship between pairs of variables and linear and rank correlation coefficients that summarize the strength of the relationship?.....<br><br>23. For all distributions has the investigator:<br>a) used rank correlation as an alternative to linear correlation to reduce sensitivity to outliers when summarizing the relationship of two variables; ……..<br>b) used probability plots, scatter plots and data postings to identify outliers; .....<br>c) determined whether any outliers require that any critical assumptions need to be modified; .....<br>d) determined the reasons for the existence of the outlier; .....<br>e) documented the reasons for and provided all relevant information about any outlier value that has been discarded; and .....<br>f) taken a new sample at a random location within 1 metre of a discarded outlier sample?..... | |
| **STATISTICAL ANALYSIS AND INTERPRET-ATION**<br><br>***Assumptions*** | 24. Has the investigator:<br>a) described the statistical tools and procedures used to analyze and interpret the data along with their underlying assumptions; .....<br>b) included calculations and assumptions for population standard deviations estimated for the purposes of a confidence interval calculation; .....<br>c) provided rationale for method used to deal with non-detectable data; .....<br>d) used a nonparametric alternative as a way of checking the sensitivity of the conclusion to the distribution assumption; and .....<br>e) included a statement about the uncertainty of all estimated or predicted values?..... | |

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| **CONCLUSIONS AND RECOMMEND-ATIONS**<br><br>***Conclusions*** | 25. Has the investigator:<br>a) identified high risk concerns; .....<br>b) provided clear and unambiguous conclusions with specific references to the analysis and interpretations that support them; and .....<br>c) discussed how each conclusion is affected by any underlying assumptions, by the accuracy and precision of the available sample data and by the uncertainty in estimated or predicted values?..... | |
| ***Recommendations*** | 26. Has the investigator:<br>a) provided clear and unambiguous recommendations;<br>b) informed the client of any other issues of potential concern outside of the original goals of the study; and……..<br>c) provided rationale with any recommendations for further investigation?..... | |
| **REFERENCES**<br><br>***Complete Information*** | 27. Has the investigator referenced:<br>a) all data sources, previous studies and other sources (including interviews) that contributed information to the study; and .....<br>b) any technical literature that provides additional detail on procedures used in the study?..... | |
| **APPENDICES**<br><br>***QA/QC***<br>For additional information see: Statistical QA/QC, SCS No. 11<br><br>***Documentation*** | 28. Has the investigator provided:<br>a) analytical laboratory results, either in printed form or on a diskette (Excel preferred) (mandatory requirement); .....<br>b) Laboratory QA/QC procedures, sampling protocol and the results of check analyses (mandatory requirement); .....<br>c) drill logs and test pit logs (mandatory requirement); and .....<br>d) a site map showing sampling locations? (mandatory requirement – may be included in the main report)…<br><br>29. Has the investigator included:<br>a) details of statistical computations omitted from the main body of the report; and .....<br>b) if used, the name and version of the computer software utilized for the data base compilation and the statistical analysis, or a brief description and a reference for any other non-commercial software used in the study?..... | |

# Appendix 2

## Preliminary Site Investigation Summary

Using the information from the preceding checklists, please provide the ministry with a summary containing the following information:

Summary
- investigation work quality and thoroughness
- the need for additional investigation
- the need for a site visit by ministry staff
- levels of certainty
- compliance with the ministry's Provincial legislation, regulations and policy, criteria and guidelines, and
- sign-off sheets appropriately signed.

Statement of objectives

Description of investigation
- including what parameters were tested and why

Rationale for Sampling Program
- sampling locations and parameters
- sampling rationale

Data Presentation
- chemistry data
- hydrogeologic data
- other

Data Interpretation and Evaluation
- areas of environmental concern
- areas not of environmental concern
- contaminant migration
- level of confidence

Recommendations
- need for further investigation
- assessment of recommendations