

## Performance Verification Plans, Contingency Plans, and Operations and Maintenance Plans

This document focusses on performance verification plans (PVPs), describing what they are, when they are expected, and how they should be prepared, implemented and used. It also describes when contingency plans and operations and maintenance plans are necessary.

### Definitions

Acronyms and terms used in this guidance are defined in the ministry's [Procedure 8, "Definitions and Acronyms for Contaminated Sites"](#):

Act  
Approved Professional  
Certificate of Compliance  
contaminated sites legal instrument  
engineering control  
institutional control  
intrinsic control  
legal instrument  
Numerical Standards Approved Professional  
operations and maintenance plan  
qualified professional  
risk-based standard  
Risk-based Standards Approved Professional  
risk control  
risk management  
site-specific risk-based concentration  
Type 1A, 1B, 2 and 3 site

### Performance verification plans (PVPs)

#### What is a performance verification plan?

A PVP is a standalone document which describes the following: (a) the principal risk controls necessary to ensure that risk-based

standards are and continue to be met at a site and (b) the actions needed to ensure that these risk controls are implemented and maintained.

#### Note

Sites have been classified into Types 1A and 1B, 2 and 3. While Type 1A sites have no risk controls, Type 1B sites need one or more intrinsic controls, but no institutional or engineering controls to meet the risk-based standards. At Type 2 and 3 sites, institutional and/or engineering controls are necessary to meet those standards. Site type descriptions, associated risk controls, requirements for plans, record keeping and reporting are shown in Appendix 1, "Risk Controls for Different Site Types." Examples of principal risk controls are provided in Appendix 2.

#### What is the purpose of a PVP?

PVPs support the development, documentation and compliance with principal risk controls included as conditions in Schedule B of a contaminated sites legal instrument, commonly in a Certificate of Compliance or when needed for scenario 4 or 5 site profile releases under [Administrative Guidance 6 "Site Profile Decisions and Requesting Releases Where Local Government Approvals are Required"](#). While PVPs are not required other than for legal instrument applications and certain site profile releases, they may be useful for other purposes, e.g., to guide cleanups by independent remediation.

#### When are PVPs required?

As indicated in Appendix 1, a PVP is a necessary part of the application package for legal instruments that certify compliance with the risk-based standards of the Contaminated Sites

Regulation, and certain site profile releases, for any Type 1B, 2 or 3 site.

### **Who should prepare and recommend a PVP?**

While PVPs may be developed by any qualified professional or Approved Professional, they are only reviewed and recommended by an Approved Professional. PVPs based on screening level risk assessments may be reviewed and recommended either by a Numerical Standards or Risk-based Standards Approved Professional.

#### **Note**

At sites where vapour contamination is risk-managed to meet the Regulation's numerical standards, and where no risk assessment is conducted other than screening level risk assessment in accordance with ministry Protocol 13, a recommendation for a Certificate of Compliance with risk-based standards may be made by a Numerical Standards Approved Professional.

PVPs based on detailed risk assessments are only reviewed and recommended by a Risk-based Standards Approved Professional.

PVPs based on detailed risk assessments which consider and place reliance on the work of other qualified professionals (e.g., engineers, hydrogeologists, agronomists, biologists, etc.) or which include associated institutional or engineering risk controls should also be signed by all other qualified professionals who have contributed to the findings of the risk assessment or the implementation of associated institutional or engineering risk controls.

Table 1 in the ministry's ["Procedures for the Roster of Approved Professionals"](#) should be consulted for direction on when an arm's length review is required for a risk assessment.

### **What is the scope of a PVP?**

PVPs are site-specific. They vary in their complexity, monitoring activities, inspection frequencies, notification requirements, and type and extent of maintenance and contingency actions. For example, performance verification

at a Type 1B site (having only intrinsic controls in place to manage risk) may not need any associated inspection, monitoring or contingency considerations. An appropriate PVP for a typical Type 1B site might simply involve a notification requirement to advise the Director if and when an intrinsic control becomes compromised or stops functioning. In contrast, a PVP for a Type 2 or 3 site is typically more complex and detailed. If a Type 2 or 3 site is classified high risk, these will typically be remediated with involvement of the

#### **Note**

For sites where a risk management condition has been imposed in a Certificate of Compliance that "groundwater must not be used as drinking water," the need to include monitoring or inspection as a principal risk control to ensure the absence of drinking water wells at such sites should be determined on a site-specific basis by the risk assessor preparing the PVP. The rationale for including or excluding monitoring should be provided.

ministry. At a Type 2 or 3 site, depending on the potential consequences of the failure of institutional or engineering controls implemented to manage risk, in addition to possible notification requirements, the PVP may also need to include detailed specifics on the engineering works to be implemented, along with associated schedules for inspection of those works and additional monitoring activities relevant to the site. Further, some Type 2 or 3 sites may also include separate operation and maintenance plans, and in the case of Type 3 sites, contingency plans related not only to installed engineered works but also to the general operations at the entire site.

### **What should a PVP contain?**

Every PVP is expected to provide or describe the following:

- the type of site,
- the necessary risk controls,
- the actions needed to implement the risk controls and ensure they remain effective, and
- the rationale for selecting the risk controls as well as the rationale for the recommended

actions to implement the risk controls and ensure they remain effective.

Only those elements essential to controlling the risk of exposure, or to controlling or eliminating the presence of receptors that could be exposed to contaminants, should be included.

**Note**

Liability limitation or waiver clauses should not be included in PVPs. If a PVP does include a liability waiver or liability limitation clause, it cannot preclude ministry reliance on the PVP.

In addition, the PVP may include or require the following:

- specified monitoring activities for risk controls implemented at the site;
- a schedule for verification activities for necessary monitoring at the site;
- compilation and maintenance of records for verification activities for necessary monitoring at the site;
- if it is necessary to maintain such records, the PVP should identify those responsible for maintaining the records (e.g., the responsible person or his or her agent), and the records need to be made available to the Director either upon request or on a scheduled basis specified in the plan;
- if referenced in the PVP, notifications to the Director when certain criteria specified in contingency or operations and maintenance plans for the site are met (e.g., failure of, or compromised risk controls).

**Note**

Those preparing PVPs should keep them simple and practical. For example, monitoring frequencies should be avoided which are inconsistent with timelines where changes at the site might be expected or be out of line with best engineering practices. For example, a liner with a 75 year life expectancy does not need to be inspected every year, but might be inspected at: 5, 25, 50, and 65 years, and yearly after that.

Refer to Appendix 2 for example scenarios and their associated risk controls.

**Does the ministry require a specific PVP format?**

At this time, the ministry does not require a specific format for a PVP. However, Appendix 3 provides a suggested outline for a typical PVP and Appendix 4 has an example of a completed PVP. Needed PVP elements are described above under the header “What should a PVP contain?”

**How is a PVP approved?**

When required, a PVP is typically submitted as part of an application package for a legal instrument or following completion of remediation as a condition imposed for certain site profile releases. The risk controls in the PVP included in Schedule B of the draft legal instrument, or in the PVP required as a condition for certain site releases, are carefully considered by the Director during his or her review of the draft legal instrument or assurance of compliance with conditions associated with a site profile release.

Approval of the risk controls for the site occurs when the Director signs and issues the legal instrument or acknowledges compliance with conditions imposed for certain site profile releases.

**Can an approved PVP be modified?**

A PVP may be subsequently modified based on the recommendation of an Approved Professional upon application to, and at the discretion of, the Director.

**Who is responsible for carrying out a PVP?**

The person(s) responsible for remediation of a site bears the ultimate responsibility for the execution of the PVP. Typically that would be the applicant for the risk-based standards Certificate of Compliance or the responsible person for ensuring compliance with the conditions of a site profile release.

## Contingency and operations and maintenance plans

### Are there similar requirements for contingency plans and operations and maintenance plans?

At present, the Land Remediation Section does not specify required components of contingency plans or operations and maintenance plans for risk controls implemented at contaminated sites. Instead, we rely on qualified and Approved Professionals to develop and specify the components of these plans on a site-specific basis, using their best professional judgement. These plans should be referenced in the PVP for the site and copies of the plans should be filed

with the ministry and retained by the responsible person(s) for the site. Table 1 in Appendix 1 also indicates when contingency and operations and maintenance plans may be needed.

*Note: This document is solely for the convenience of the reader. It does not contain and should not be construed as legal advice. The current legislation and regulations should be consulted for complete information.*

*For more information, contact the Environmental Emergencies and Land Remediation Branch at (250) 387-4441.*

### Revision history

Approved Date	Effective Date	Document Version	Notes
February 18, 2014	February 24, 2014	1.0	
August, 2015	August, 2015	2.0	Clarified who can develop and recommend PVPs, added reference to Administrative Guidance 6 and updated Appendices
November 23, 2015	February 1, 2016	3.0	Embedded weblinks updated to Gov2.0 website

**Appendix 1**  
**Risk Controls for Different Site Types**

**Table1. Requirements for different types of sites**

Site Type	Risk Controls <sup>1</sup>	Plans <sup>2</sup>			Record Keeping	Reporting	Examples
		PV	O&M	CP			
<b>1A</b>	<ol style="list-style-type: none"> <li>1) No risk controls required.</li> <li>2) Site meets risk-based standards under current and future uses without risk controls.</li> </ol>	n/a	n/a	n/a	n/a	<ol style="list-style-type: none"> <li>1) Reporting on whether requirements and conditions in Schedule B are being met may be required if requested by the Director (e.g., in conjunction with a ministry compliance verification audit).</li> </ol>	<ol style="list-style-type: none"> <li>1) Passes SLRA or DRA based on existing or proposed site conditions and site use (despite operative exposure pathways quantified risks meet site-specific risk-based standards)</li> </ol>
<b>1B</b>	<ol style="list-style-type: none"> <li>1) Only intrinsic risk controls required.</li> <li>2) Site meets risk-based standards under current and future uses through use of intrinsic risk controls.</li> <li>3) No institutional or engineering controls are required.</li> </ol>	Yes	n/a	n/a	<ol style="list-style-type: none"> <li>1) Records of performance verification actions and results when required in a Certificate of Compliance, or as required under section 54 (3) (d) of the Act for a site profile release must be maintained by, or submitted by, a responsible person or agent.</li> <li>2) Types of records may be limited only to those for notification to the Director if and when an intrinsic control becomes compromised or no longer remains in effect.</li> </ol>	<ol style="list-style-type: none"> <li>1) Reporting on whether requirements and conditions in Schedule B, or as required under section 54 (3) (d) of the Act for a site profile release are being met may be required if requested by the Director (e.g., in conjunction with a ministry compliance verification audit).</li> </ol>	<ol style="list-style-type: none"> <li>1) Quantified risks meet site-specific risk-based standards due to presence of intrinsic controls at the site (e.g., DNAPL groundwater contamination beneath multiple impermeable aquitards or soil contamination at considerable depth below ground surface).</li> </ol>

**Table1. Requirements for different types of sites**

Site Type	Risk Controls <sup>1</sup>	Plans <sup>2</sup>			Record Keeping	Reporting	Examples
		PV	O&M	CP			
2	<p>1) Intrinsic, institutional and/or engineering risk controls required.</p> <p>2) Site meets risk-based standards under current and future uses through use of intrinsic, institutional and/or engineering risk controls.</p> <p>3) Failure of risk controls <b>will not likely</b> result in any of the following conditions:</p> <p>(a) immediate risk or exposure of humans to contaminants at levels exceeding risk-based standards or approved site-specific risk-based concentrations to protect human health,</p> <p>(b) sudden discharge of contaminants to an aquatic receiving environment at concentrations exceeding B.C. Water Quality Guidelines or approved site-specific risk-based concentrations,</p> <p>(c) sudden exposure to terrestrial non-human receptors to contaminants at levels exceeding approved environmental site-specific risk-based concentrations, or</p> <p>(d) sudden contaminant spreading to soil, sediment, air, surface water or groundwater such that contaminant concentrations exceed upper cap concentrations (see Protocol 11).</p>	Yes	May-be <sup>3</sup>	No	<p>1) Records of performance verification actions and results when required in a Certificate of Compliance, or as required under section 54 (3) (d) of the Act for a site profile release must be maintained by, or submitted by, a responsible person or agent.</p> <p>2) Types of records may relate to any of the following:</p> <p>(a) inspection of works,</p> <p>(b) monitoring of media to confirm efficacy of works,</p> <p>(c) maintenance of works (including repairs),</p> <p>(d) construction activities,</p> <p>(e) soil management or disposal,</p> <p>(f) maintenance of fencing or barriers,</p> <p>(g) maintenance of signage, etc., or</p> <p>(h) any other risk control action or activity specified in the PVP for a site.</p>	<p>1) Reporting on whether requirements and conditions in Schedule B, or as required under section 54 (3) (d) of the Act for a site profile release are being met and/or submission of performance verification records may be required if requested by the Director (e.g., in conjunction with a ministry compliance verification audit).</p>	<p>1) Engineering controls:</p> <p>(a) asphalt cover,</p> <p>(b) vapour barrier.</p> <p>2) Institutional controls:</p> <p>(a) fencing,</p> <p>(b) signage restricting use (e.g., no trespassing, no unauthorized entry, no digging, etc.),</p> <p>(c) receptor occupancy or use contractual restriction, or</p> <p>(d) land title restriction on soil disturbance or land use</p>

**Table1. Requirements for different types of sites**

Site Type	Risk Controls <sup>1</sup>	Plans <sup>2</sup>			Record Keeping	Reporting	Examples
		PV	O&M	CP			
3	<p>1) Intrinsic, institutional and/or engineering controls required.</p> <p>2) Site meets risk-based standards under current and future uses through use of intrinsic, institutional and/or engineering risk controls.</p> <p>3) Failure of risk controls <b>will likely</b> result in any of the following conditions:</p> <p>(a) immediate risk or exposure of humans to contaminants at levels exceeding risk-based standards or approved site-specific risk-based concentrations to protect human health,</p> <p>(b) sudden discharge of contaminants to an aquatic receiving environment at concentrations exceeding B.C. Water Quality Guidelines or approved site-specific risk-based concentrations,</p> <p>(c) sudden exposure to terrestrial non-human receptors to contaminants at levels exceeding approved environmental site-specific risk-based concentrations, or</p> <p>(d) sudden contaminant spreading to soil, sediment, air, surface water or groundwater such that contaminant concentrations exceed upper cap concentrations (see Protocol 11).</p>	Yes	May-be <sup>3</sup>	May-be <sup>3</sup>	<p>1) Records of performance verification actions and results when required in a Certificate of Compliance must be maintained by responsible person or agent.</p> <p>2) Types of records may relate to any of the following:</p> <p>(a) inspection of works,</p> <p>(b) monitoring of environmental media to confirm efficacy of works,</p> <p>(c) maintenance of works (including repairs),</p> <p>(d) construction activities,</p> <p>(e) soil management or disposal,</p> <p>(f) maintenance of fencing or barriers,</p> <p>(g) maintenance of signage,</p> <p>(h) registration of a covenant,</p> <p>(i) notice of zoning restriction, etc., or</p> <p>(j) any other risk control action or activity specified in the PVP for a site.</p>	<p>1) Reporting on whether requirements and conditions in Schedule B are being met and/or submission of performance verification records may be required if requested by the Director (e.g., in conjunction with a ministry compliance verification audit).</p> <p>2) Notification if performance verification actions indicate that risk controls are not functioning effectively (excepting routine maintenance/repair), discharges exceed concentration limits required in any discharge authorization and/or contingency action is triggered.</p> <p>3) Regular reporting at a frequency set out in Schedule B. Reporting details and form of reporting (i.e., statement or report) would depend on site conditions and risk management approach.</p>	<p>1) Engineering controls:</p> <p>(a) secure containment of leachable contaminated soil in a lined cell,</p> <p>(b) groundwater extraction and treatment system,</p> <p>(c) soil vapour extraction and treatment system,</p> <p>(d) engineered barrier system or reactive wall,</p> <p>(e) <i>in situ</i> soil treatment system,</p> <p>(f) <i>in situ</i> water treatment system, or</p> <p>(g) <i>ex situ</i> soil treatment system.</p> <p>2) Institutional controls:</p> <p>(a) fencing,</p> <p>(b) signage restricting use (e.g., no trespassing, no unauthorized entry, no digging, etc.),</p> <p>(c) receptor occupancy or use contractual restriction, or</p> <p>(d) land zoning restriction.</p>

**Table1. Requirements for different types of sites**

**Footnotes**

- <sup>1</sup> Key risk controls must be summarized and included as conditions in Schedule B.
- <sup>2</sup> Details of plans for a Type 1B, 2 or 3 site may be developed on a site by site basis by any qualified professional at the recommendation of an Approved Professional. Plan implementation must be included as a condition in Schedule B of any contaminated sites legal instrument recommended for a Type 1B, 2 or 3 site. PV, O&M and CP stand for performance verification, operations, and maintenance and contingency plan, respectively.
- <sup>3</sup> An operation and maintenance plan may or may not be necessary for a Type 2 or 3 site; and a contingency plan may or may not be needed for a Type 3 site, depending on the nature of, the institutional or engineering risk controls implemented at the site.

**Appendix 2**

**Certificate of Compliance Schedule B**

**Examples of Risk Controls for Type 1, 2 and 3 Sites**

## 1.0 General

While risk management can be implemented to mitigate or eliminate risks at a site, it is also possible that a risk assessment may identify an intrinsic control that passively mitigates or eliminates risks at a site. In some cases, intrinsic controls identified in a risk assessment must be present and sustained to ensure continued compliance with the risk-based standards. Even though no engineering or institutional control would be needed, the intrinsic controls that need to remain in place must be identified and included as mandatory risk controls in Schedule B of the Certificate of Compliance for a site.

Note that the ministry considers sites with roads and highways which act to ensure that an exposure pathway (e.g., to contaminated soil beneath the road) is inoperative, to be classified as either Type 2 or Type 3, because the road or highway is a type of engineering control.

## 2.0 Type 1 No immediate risk if intrinsic controls fail to be sustained

At Type 1 sites, no institutional or engineering controls are required.

### **Type 1A No risk controls required**

For Type 1A, the risk assessment indicates that the site meets the risk-based standards under current and future site circumstances and uses without the need for any intrinsic controls or the need to implement any engineering or institutional controls. Despite the presence of a toxic agent, a receptor and an operative exposure pathway at the site, the level of risk calculated in the risk assessment meets the risk-based standards. In that case, no risk controls would need to be identified or included in Schedule B of the Certificate of Compliance for the Type 1A site.

### **Type 1B Only intrinsic controls required**

At Type 1B sites, no institutional or engineering controls are required, but one or more intrinsic controls needs to be maintained to ensure that the risk-based standards continue to be met under current or future site circumstances and uses.

### **Example**

A site has a high density residential use and the risk assessment indicates that

the direct soil ingestion pathway of exposure is inoperative because contamination lies 20 m below ground surface. This is considered to be an intrinsic control since the 20 m of clean soil represents a substantive barrier to control exposure and has a natural (as opposed to anthropogenic) origin. This intrinsic control must be included as a mandatory risk control in Schedule B in the Certificate of Compliance for the site:

- (a) a minimum of 20 m of uncontaminated soil (natural as opposed to anthropogenic origin) must remain in place above contaminated soil at the site.

### **3.0 Type 2 No immediate risk if intrinsic, institutional or engineering controls fail to be sustained**

Under Type 2, in addition to any intrinsic controls which may or may not be present at the site, one or more institutional or engineering controls are required to meet risk-based standards. The principal risk controls must be identified and included in Schedule B of the Certificate of Compliance. For this site type, if the required risk controls fail, there would be no sudden spreading of contaminants or immediate exposure to, or discharge of, contaminants.

#### **Type 2, Case 1. One or more institutional or engineering controls and no intrinsic controls required**

If the risk assessment indicates that some conditions at a site will require implementation of institutional or engineering controls, but no intrinsic controls, to meet risk-based standards, the institutional or engineering controls must be identified and included in Schedule B of the Certificate of Compliance for the site.

#### **Example**

This example is for a site with engineering and institutional controls but no intrinsic controls.

At a high density residential site the risk assessment indicates that the direct soil ingestion pathway of exposure is operative and that quantified direct soil ingestion risks for children, but not adults, exceed the risk-based standards. A contractual renter's agreement is in place which limits site use of the lands only to adults. The risk assessment also identified exceedance of the risk-based standards for both children and adults related to uptake and bioaccumulation of soil contaminants, should fruit or nut trees be grown at the site. In addition, risks

related to long-term use of untreated groundwater as drinking water at the site exceed the risk-based standards. However, all groundwater used on the site is treated using a centralized engineered system to reduce contaminant concentrations to less than the Schedule 6 drinking water standards.

The institutional and engineering controls of Schedule B would include the following:

- (a) children must not reside at the site;
- (b) the site must not be used to grow fruit or nut trees;
- (c) untreated groundwater must not be used as drinking water;
- (d) a groundwater treatment system capable of reducing groundwater contaminant concentrations to less than the Schedule 6 drinking water use standards must be installed at the site;
- (e) the installed groundwater treatment system must be annually inspected and certified as operating correctly by a Professional Engineer.

**Type 2, Case 2. One or more institutional or engineering controls and one or more intrinsic controls required**

It is also possible that the risk assessment could indicate that:

- (a) some intrinsic controls need to be maintained to ensure that the risk-based standards will continue to be met under current and future site uses and circumstances, and
- (b) some conditions at the site will also require implementation of institutional or engineering controls to meet risk-based standards.

In this case, Schedule B would list those intrinsic controls and those institutional or engineering controls which would have to remain in place in order for the risk-based standards to be met at the site.

**Example**

This example is for a site with one intrinsic control and both institutional and engineering controls.

A site has a single family residential land use and the risk assessment indicates that the direct soil ingestion exposure pathway is inoperative because contamination lies 2 m below ground surface due to the presence of clean soil of natural rather than anthropogenic origin. The risk assessment also identified exceedance of the risk-based standards related to uptake and bioaccumulation of

soil contaminants, should fruit or nut trees be grown at the site. In addition, calculated acute risks related to the use of untreated groundwater as drinking water at the site exceed the risk-based standards. However, the groundwater to drinking water pathway is considered to be inoperative because the site is serviced by municipal water supply and no groundwater wells currently exist on the property.

The risk assessment also identified risks in excess of the risk-based standards related to chronic indoor exposure to soil vapours within the single family residential dwelling located at the site. However, indoor soil vapour exposure will be negated by an engineered passive soil vapour collection and ventilation system to be installed for the dwelling. If the soil vapour collection and venting system to be installed was to operate improperly or fail completely for an extended period of time, adverse long term impacts on the residents could result, but short term failure of the system would not represent an immediate health risk to residents.

The risk controls in Schedule B would include the following:

- (a) a minimum 2 m of uncontaminated soil must remain in place above contaminated soil at the site;
- (b) the site must not be used to grow fruit or nut trees;
- (c) groundwater must not be used as drinking water;
- (e) a passive sub-slab soil vapour collection and ventilation system having operational characteristics as described in the risk assessment must be installed for the residence located on the site;
- (f) the installed passive sub-slab soil vapour collection and ventilation system must be inspected and certified as operating correctly by a Professional Engineer within three months post installation and every five years thereafter.

#### **4.0 Type 3 Immediate risks if intrinsic, institutional or engineering controls fail to be sustained**

A Type 3 site is the same as a Type 2 site in that engineering, institutional and possibly intrinsic controls are required for the site to meet the risk-based standards. However, at a Type 3 site, additional provisions are required related to actions to be taken should failure of risk controls (e.g. works) be likely to result in the following:

- immediate risk or exposure of humans to contaminants at levels exceeding approved site-specific risk-based concentrations;

- sudden discharge of contaminants to an aquatic receiving environment at concentrations exceeding approved site-specific risk-based concentrations to protect aquatic life;
- immediate risk or exposure of terrestrial non-human receptors to contaminants at levels exceeding approved site-specific risk-based concentrations to protect terrestrial life, or
- sudden contaminant spreading to soil, sediment, air, surface water or groundwater such that contaminant concentrations exceed upper cap concentrations (see [Protocol 11, “Upper Cap Concentrations of Substances”](#)).

**Type 3, Case 1. One or more institutional or engineering controls and one or more intrinsic controls required**

**Example**

A site will be redeveloped for a high density multiple family residential land use and the risk assessment indicates that the direct soil ingestion pathway of exposure is inoperative because contamination lies 2 m below ground surface. The risk assessment also identified exceedance of the risk-based standards related to uptake and bioaccumulation of soil contaminants, should fruit or nut trees be grown at the site. In addition, calculated acute risks related to use of untreated groundwater as drinking water at the site exceed the risk-based standards. However, the groundwater to drinking water pathway is considered to be inoperative because the site is serviced by municipal water supply.

The risk assessment also identified risks in excess of the risk-based standards related to acute indoor exposure to soil vapours within the multiple family residential dwelling to be constructed on the site. Outdoor soil vapour contaminant concentrations measured in the breathing zone on the site do not exceed Schedule 11 vapour standards. Indoor soil vapour contaminant concentrations in the high density residence to be constructed on the site are predicted to exceed Protocol 11 vapour upper cap concentrations. However, indoor soil vapour exposure will be negated by an engineered active soil vapour collection and ventilation system to be installed for the dwelling. If the active soil vapour collection and venting system to be installed was to operate improperly or fail completely for even a short period of time, immediate risks to the residents would result.

The risk controls in Schedule B would include the following:

- (a) a minimum 2 m of uncontaminated soil must remain in place above contaminated soil at the site;
- (b) the site must not be used to grow fruit or nut trees;
- (c) groundwater must not be used as drinking water;
- (d) an active soil vapour collection and ventilation system having operational characteristics as described in the risk assessment must be installed in the multiple family residence to be located on the site;
- (e) the installed active soil vapour collection and ventilation system must be inspected and certified as operating correctly by a Professional Engineer as soon as practicable after installation and monthly thereafter;
- (f) the active soil vapour collection and venting system must incorporate an automatic alarm system to warn residents, the fire department and emergency services of any system failure;
- (g) residents must be informed of required evacuation procedures to be followed in the event of failure of the active soil vapour collection and venting system installed at the site.

## **Appendix 3**

### **Outline for a Typical Performance Verification Plan**

## Performance Verification Plan

**Site ID:**

**Date:**

**Site location:**

**Author:**

**Name of firm preparing the PVP:**

**Site type:** <1B, 2 or 3>

**Required risk controls:**

< (a), (b), (c), etc. as listed in the legal instrument, or as required in obtaining certain site profile releases >

**Required actions to implement the required risk controls:**

< (a), (b), (c), etc. These are actions (e.g., inspections, installations, works, monitoring and its frequency, etc.) which must be taken to implement and ensure continued efficacy of the required risk controls.>

**Summary rationale for selecting required PVP element(s):**

<A short summary and rationale for selected PVP element(s) including the required risk controls and actions required to implement the required risk controls >

**Professional signatures:**

<Completed signature block as follows>

The opinions, advice and recommendations expressed in this performance verification plan are made in accordance with generally accepted principles and practices as recognized by members of the applicable profession or discipline practising at the same time and in the same or similar locations.

PVP Component	Name of Approved or Qualified Professional	Signature of Approved or Qualified Professional	Date
Screening level risk assessment	Numerical Standards Approved Professional or Risk-based Standards Professional		
Risk assessment other than screening level risk assessment	Risk-based Standards Approved Professional		
Intrinsic risk control	qualified professional		
Engineering risk control	qualified professional		
Institutional risk control	qualified professional		

## **Appendix 4**

### **Example of a Performance Verification Plan**

## Performance Verification Plan<sup>1,2</sup>

**Site ID:** 123456

**Date:** MM, DD, YYYY

**Site location:** 10101 Chestnut Street, City of Petro Lake, B.C.

**Author:** John Doe

**Name of firm preparing the PVP:** ABC Consulting Ltd.

**Site type:** 2

### Required risk controls:

- (a) Future buildings at the site must be of slab-on-grade construction and groundwater at the site must not be used for drinking water or for irrigation.
- (b) A worker health and safety plan must be developed by a certified industrial hygienist and implemented in the event that subsurface work to the depth of groundwater and/or LNAPL is undertaken, and
- (c) Deep rooting vegetation must not be established at the site.

### Required actions to implement the required risk controls:

- (a) A *Land Title Act* covenant between the ministry and the owner/operator of the site to ensure:
  - i. future buildings at the site will be strictly limited to slab-on-grade construction, and
  - ii. groundwater at the site will not be used for drinking water or for irrigation.
- (b) Mandatory communication with the site owner/operator to ensure that a worker health and safety plan is developed by an occupational hygienist and is implemented before excavating to the depth of groundwater and/or LNALP at the site.
- (c) Mandatory communication with the site owner/operator to ensure that deep rooting vegetation as determined by a certified arborist is not established at the site.

### Summary rationale for selecting required PVP element(s):

- (a) Contamination remains in place in soil and groundwater 1.5 m – 4 m below ground surface at the site. The risk assessment for the site indicates that non-worker related exposure to this contamination can be effectively risk managed

by maintaining an exposure barrier consisting of uncontaminated soil to a depth of 1 m below ground surface at the site. Site redevelopment will include construction of a warehouse encompassing the majority of the site surface. To ensure the 1 m uncontaminated soil barrier risk control is not compromised, buildings on site need to be limited to slab-on-grade construction only (i.e., buildings with basements or underground facilities would be prohibited).

- (b) Contamination remains in place in soil and groundwater located 1.5 m – 4 m below ground surface at the site. The risk assessment for the site indicates that unacceptable worker related dermal and/or oral ingestion exposure could occur if the exposure barrier required under a) above was to be compromised (e.g., as a consequence of subsurface excavation of soil to the depth of groundwater and/or LNAPL at the site). To ensure that such occupational exposure does not occur, an appropriate worker health and safety plan incorporating protective measures (e.g., personal protective clothing, equipment and procedures) to substantively reduce or eliminate worker exposure to contaminated soil and groundwater must be developed and implemented in the event that subsurface excavation (other than for the installation of a trench) is undertaken at the site. Also, in accordance with standard industry practice, groundwater encountered in excavations on site also needs to be appropriately dewatered and disposed of. The health and safety plan must be developed by a certified occupational hygienist.
- (c) Contamination remains in place in soil and groundwater located 1.5 m – 4 m below ground surface at the site. The risk assessment for the site indicates that unacceptable risk to ecological receptors would result from the consumption, or use as habitat, of deep rooting vegetation (i.e., vegetation, primarily trees and shrubs, with a root depth capable of contacting the contaminated soil and groundwater which remains in place) at the site. To eliminate this ecological risk, instituting a prohibition on the establishment of deep rooting plants, as determined by a certified arborist, at the site is a required risk management action.

**Professional signatures:**

The opinions, advice and recommendations expressed in this performance verification plan have been made in accordance with generally accepted principles and practices as recognized by members of the applicable profession or discipline practising at the same time and in the same or similar locations.

**Example signature block**

PVP Component	Name of Approved or Qualified Professional	Signature of Approved or Qualified Professional	Date
Screening level risk assessment	N/A		
Risk assessment other than screening level risk assessment	John A. Roster (a Risk-based Standards Approved Professional)	<i>John A. Roster</i>	
Intrinsic risk control	n/a		
Engineering risk control	n/a		
<p>Institutional risk control</p> <p>Notification in Schedule B of the Certificate of Compliance of the following risk controls:</p> <p>(a) A <i>Land Title Act</i> covenant to ensure that construction on site is limited to slab-on-grade only, and that groundwater is not used as drinking water at the site.</p> <p>(b) A worker health and safety plan to substantively reduce or eliminate worker exposure to contaminated soil and groundwater be developed and implemented prior to conducting subsurface work to the depth of groundwater and/or LNAPL at the site.</p> <p>(c) Notice that deep rooting plants must not be established at the site.</p>	<p>For 1 (a): Bonny Ann Lawyer (a qualified professional)</p> <p>For 1 (b): Susan O. Hygienist (a qualified professional)</p> <p>For 1 (c): William B. Arborist (a qualified professional)</p>	<p><i>Bonny Ann Lawyer</i></p> <p><i>Susan O. Hygienist</i></p> <p><i>William B. Arborist</i></p>	

<sup>1</sup> In the example in this Appendix, there would be three types of publicly accessible records documenting the restrictions to slab-on-grade construction and prohibition of the use of groundwater as drinking water. They include a paper or electronic copy of the Certificate of Compliance (accessible by submitting a Site Information Request to the ministry); notations for the site in the Site Registry (obtained through a Site Registry search through BC OnLine); and the covenant (obtained through a LTSA search). However, for most sites with such risk controls, covenants are not created or registered on title, so the public could only learn about such risk controls by a search of the Site Registry or by obtaining a copy of the ministry's paper or electronic records of the Certificate.

<sup>2</sup>Approved Professionals and qualified professionals may sign a performance verification plan, providing opinions, advice and recommendations as long as those views are in accordance with generally accepted principles and

practices in their capacity as members of an applicable profession or discipline. Those Approved Professionals and qualified professionals who are not qualified to make an assertion about a particular risk control may seek the advice and support of other professionals or otherwise qualified individuals with expertise in the applicable subject areas. For example, the risk control restricting deep rooting plants in this example could have been signed by an Approved Professional, a landscaper, or a certified arborist, as long as the person signing the risk control had the appropriate qualifications to make the needed assertion.