



Alberta Exposure Control Guide

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Introduction

1.1 Purpose

This document presents Alberta Environment and Parks' (AEP; "the Department") exposure control policy for contaminated sites and primary direction for site managers, stakeholders and environmental professionals. It outlines requirements for risk management using the exposure control option as outlined in the *Contaminated Sites Policy Framework* (ESRD, 2014). This exposure control policy applies when developing and assessing options for managing contaminated land in Alberta through administrative or institutional controls, and physical or engineered barriers, and provides guidance on Alberta Environment and Parks' (AEP; "the Department") and the Alberta Energy Regulator's (AER; "the Regulator") requirements. The AER also operationalizes the Department's policies, including policies for contaminated site assessment, risk management and remediation (ESRD, 2014).

1.2 Relationship to Other Documents

This document supports provisions outlined in Alberta's *Contaminated Sites Policy Framework* (ESRD, 2014). It is a companion document to the *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (Alberta Tier 1 guidelines; AENV 2007a, as amended), *Alberta Tier 2 Soil and Groundwater Remediation Guidelines* (Alberta Tier 2 guidelines; AENV 2007b, as amended), and the *Environmental Site Assessment Standard* (AEP, 2016).

1.3 General Requirements for Managing Contaminated Sites

Risk management on a contaminated site involves a process of assessment and action that considers the views of affected parties, proponents, environmental regulators, health agencies and planning authorities. Successful risk management on a contaminated site incorporates reasonable, practical and feasible efforts aimed at reducing risks to human and ecological health.

Good risk management decisions on contaminated sites will:

- Identify, manage, and reduce risks.
- Be based on a well-developed conceptual site model that identifies site-specific sources, pathways and receptors over an appropriate spatial scale of the site and region, using the best-available scientific and technical information.
- Address a clearly articulated risk management problem as it pertains to human health and ecological receptors.

- Use a decision-making process that is cognizant of potential discord between technical assessments and public values, knowledge and perceptions.
- Analyze the weight of scientific evidence that supports conclusions about potential risks to human health and the environment.
- Examine a wide variety of risk management options.
- Give priority to risk prevention, mitigation, and control.
- Be implemented effectively, expeditiously, flexibly, and with support from all pertinent parties.
- Be revised and changed when new information becomes available, in order to advance the project successfully.

2. Principles of Exposure Control

2.1 Introduction

Exposure control on contaminated lands involves removing or mitigating an exposure pathway or receptor, or controlling a contaminant source. This is done by various means as an interim step until remediation guidelines can be met, or where remediation is not an immediately viable option, or is not in the best interests of the environment. This can be accomplished by physical or chemical barriers to prevent exposure to receptors and/or by implementing administrative controls on a property. These options require continued care and control by responsible parties and may limit land uses.

The Department and Regulator will consider exposure control as an option for dealing with contaminated land if the proponent is willing and able to successfully implement a plan to manage risk for as long as necessary, the affected parties do not object to the plan, the plan meets Departmental requirements as outlined in regulatory and technical guidance, and the plan is not contrary to regulatory provisions in Alberta's *Environmental Protection and Enhancement Act* (EPEA).

Once implemented, the success of the exposure control program must be monitored on a long-term basis by the responsible party. Deviations from expected exposure control goals must be addressed and communicated in a timely fashion so that an adequate risk management plan (RMP) is maintained. This requires clearly identified exposure control goals, timelines, and benchmarks. Unexpected inadequacies of the RMP may require revisiting aspects of the decision-making process to reassess additional needs on the site. Unexpected inadequacies in the RMP include, but are not limited to, things such as unforeseen circumstances, changes that arise as the result of monitoring, and/or actual site conditions not matching the elements predicted in the conceptual site model. The Department and the Regulator require written notification and approval of deviations to the RMP.

Exposure control measures must be included in long-term contaminant management strategies that are designed to eventually meet Alberta Tier 1 or Tier 2 guidelines. Verification with soil and groundwater confirmatory sampling will be required to demonstrate remediation and/or exposure control is no longer necessary, and the site may then be eligible for a remediation certificate that meets Alberta Tier 1 or Tier 2 guidelines. Such remedial strategies may involve natural attenuation, biodegradation, source depletion and other transformation mechanisms. Although these mechanisms may be successful in meeting Alberta Tier 1 or Tier 2 remediation guidelines, exposure control is necessary until the closure condition is met.

2.2 Preference for Remediation

In management of contaminated sites, the Department and the Regulator prefer and promote full remediation of a release to Alberta Tier 1 or Alberta Tier 2 Guidelines over exposure control.

The Department and Regulator offer regulatory closure in the form of Remediation Certificates on sites remediated to Alberta Tier 1 or Alberta Tier 2 guidelines (AENV, 2007a; AENV, 2007b, as amended). The Department and Regulator do not issue Remediation Certificates on contaminated sites managed through means other than remediation because alternative risk management methods depend upon the future diligence of those responsible for managing the site and may impede future land uses. The Department and Regulator will, however, participate in the risk management decision process with the site owner and other affected parties and issue a risk management plan acceptance letter if satisfied that the plan is acceptable.

Risk management through exposure control methods, such as exposure barriers or administrative controls, is an acceptable option only when remediation is severely restricted by constraints or if remediation cannot achieve acceptable environmental endpoints. This form of risk management requires regulatory and stakeholder consultation followed by effective and accountable action by those responsible for maintaining the management program into the future.

2.3 Role of Exposure Control in the Contaminated Sites Framework

In the context of Alberta's contaminated sites management framework, exposure control is not required if sites are remediated to Alberta Tier 1 or Tier 2 guidelines. A formal exposure control plan is needed when remediation cannot (or will not) be completed. Exposure control is required where land use restrictions are created that would not fall under the Alberta Tier 2 options, such as, but not limited to:

- Adjustments to site-specific parameters or exposure pathways/receptors that require management or control measures;
- Adjustments to site-specific parameters or exclusion of pathways that result in conditions or restrictions on land and/or water use; or
- Decisions to implement risk management in association with remediation, or management of contamination at an operating facility.

Examples of sites that would be considered to fall under the exposure control option are as follows:

- A remediation plan that requires a period of time to achieve Alberta Tier 1 or Tier 2 guidelines. Exposure control ensures that contaminant levels exceeding guidelines do not give rise to

unacceptable risks until remediated to Alberta Tier 1 or Tier 2 guidelines. For instance, remediation plans that involve some form of natural attenuation, biodegradation, source depletion or other transformation mechanisms may be used to achieve an acceptable risk level across the site, but may also require interim exposure control to manage immediate risk(s) to receptors.

- There are modifications to exposure assumptions or exclusion of exposure pathways that are not supported by Alberta Tier 2 guidelines. This type of modification is likely associated with administrative or physical requirements to manage exposure control for the given pathway. For example, use of a clean soil cover or permanent cap to exclude the human direct soil contact pathway requires measures to ensure the soil is not disturbed or placed in an accessible location.
- Site-specific parameters or modifications that are applied based on current site conditions or land uses that have a reasonable potential to change with time. Exposure control is required to ensure conditions do not change or worsen into the future. For example, use of site-specific building parameters to control risks from the vapour inhalation pathway requires ongoing site management to ensure that these parameters remain valid.

2.4 Comparison of Exposure Control to Alberta Tier 1 and Tier 2

Exposure control differs from Alberta Tier 1 and Tier 2 approaches in the following ways:

- A broader range of options exists for dealing with contamination on the proponent's property under exposure control;
- Future land use options may be restricted within a particular land category in exposure control;
- Exposure control requires the risk management plan be continually maintained by a responsible party to prevent future adverse effect(s);
- Affected party input is necessary for devising a suitable risk management plan to achieve exposure control; and
- The Department and Regulator will not offer remediation certificates or closure letters where exposure control is used.

2.5 Approaches to Exposure Control

Exposure control is typically divided into two categories:

- Administrative or institutional controls; and
- Engineered or physical controls.

2.5.1 Administrative or Institutional Controls

Administrative or institutional controls are measures applied through operational policies or approvals that ensure exposure conditions continue to conform to the assumptions used in the risk management plan.

Examples of exposure control by administrative or institutional controls may include, but are not limited to:

- Security programs to restrict access to a contaminated site;
- Groundwater use restrictions;

- Worker health and safety programs;
- Contingency soil management plans in the event of future excavation or other disturbance;
- Building placement restrictions on a property;
- Restrictions for design, installation and maintenance of utility service lines;
- Restrictive covenants and caveats on land titles aimed at development restrictions;
- Other forms of development restrictions established through zoning or land use bylaws;
- Contracts providing for obligations of a party to maintain a management plan; and
- Programs to prevent activities that place humans or the environment at risk.

2.5.2 Exposure Barriers – Engineered or Physical Controls

Exposure barriers are engineered or physical controls that involve the use of physical or chemical measures to prevent or reduce exposure to contaminants at or near a site. Exposure barriers include site management measures designed and implemented to ensure that exposure to contamination does not result in risks to human and ecological receptors in excess of acceptable levels. Examples of exposure control by engineered or physical controls may include, but are not limited to:

- Soil cover to prevent direct exposure to contamination;
- Constructed barriers and liners to prevent contaminant migration;
- Hydraulic controls to limit or alter groundwater flow in order to reduce dissolved contaminant transport;
- Sub-floor vapour control systems or barriers to prevent ingress of volatile organic compounds into buildings;
- Physical access restrictions or barriers to a property;
- Physical or chemical modification or fixation of contaminants to reduce bioavailability or mobility; and
- Point-of-exposure or point-of-use controls, such as water treatment or air filtration.

2.6 Circumstances that Preclude Risk Management

If risks cannot be managed at a site, it is the proponent's responsibility to ensure that the site is remediated to the appropriate risk-based objectives based on either Alberta Tier 1 or Alberta Tier 2 guidelines.

While exposure control would be required in most situations where contaminant concentrations exceed Alberta Tier 1 or Tier 2 guidelines, including the implementation of long-term remediation measures designed to meet such levels, certain circumstances preclude the selection of exposure control for risk management as a primary strategy for the management of contaminated sites.

Sites that have an uncontrolled source and/or where the contamination is not clearly delineated, as outlined in policies under Alberta's *Contaminated Sites Policy Framework* (ESRD, 2014) are not eligible for risk management.

Sites that have prescribed outcomes by a regulatory order under the EPEA cannot be managed using exposure control, unless the order specifically allows this option.

Where exposure control is being sought for residential-only land use or agricultural-only land use, it will not be considered unless formerly authorized by the Director. This is due to infrastructure that has been impacted by a contaminated site. Nevertheless, there are increased logistical concerns related to requirements for long-term management at these sites and additional needs to address affected party concerns.

Remediation certificates cannot be issued for natural or agricultural lands where exposure control plans are required for areas that have not been remediated. Therefore, if a Remediation Certificate is being sought, complete remediation is required and no portion of the land is eligible for risk management plans (AENV 2011a, b).

3. Requirements for Risk Management Plans

3.1 Regulatory Requirements

3.1.1 Consideration of Present and Future Land Use

EPEA requirements for equivalent land capability and prevention of adverse effects consider past, present and future environmental management decisions as they affect land use. Equivalent land capability seeks to conserve future land viability through remediation and reclamation certification. Potential adverse effect (from contaminant releases) requires corrective action to prevent future potential harm. This seeks to preserve, recover and protect options for future land use and function. Consequently, Alberta's regulatory framework requires that risk management decisions on contaminated sites consider not only current, but future land and water use. This condition is also supported by the principle of sustainable development in the EPEA, which ensures that the use of resources and the environment today does not impair prospects for use by future generations.

3.1.2 Contravention of the Environmental Protection and Enhancement Act

Risk management plans must not contravene any provisions in the EPEA. The Department's (and Regulator's) representatives are available to participate in the risk management process to ensure that all regulatory requirements are met.

3.1.3 Source Control

Ongoing sources of contamination will continue to impact environmental media and put human and ecological receptors at potential risk from exposure by contributing to an increase in the extent and degree of contamination in the environment over time. As part of the risk management plan, contaminant sources must be remediated, removed or otherwise managed, as they are contributing to on-going degradation of soil, water, and air quality.

Some examples of sources could include:

- Sludge or solid waste in earthen disposal pits;
- Free hydrocarbon product impacting soil or groundwater;
- Soil or groundwater contaminants that still have potential to migrate;
- Volatile contaminants that can migrate in the gaseous phase; or
- Residual amounts of miscible contaminants that have the potential to continue to impact groundwater.

Source control is generally considered complete when monitoring data demonstrates that contaminant migration has either stabilized or decreased in all environmental media and that the degree of contamination at any point is unlikely to worsen over time. A source mobility assessment that evaluates multiple lines of evidence may be required to support an argument for source control versus active remediation.

3.1.4 Off-site Contamination and Impairment of Property

If contamination has migrated or can migrate off the proponent's property, the proponent is required under the EPEA to notify any affected party and take action to prevent adverse effect. The objective of a risk management plan (RMP) is to achieve a solution that no parties have objection to. In cases where neither the Department (Regulator) nor the proponent(s) have care and control of an affected property, a site-specific risk management decision must involve input from affected parties. If the RMP includes further exposure control restrictions on allowable land or water use than defined by the relevant land use, or requires site access for the third-party property, the affected parties must have no objections to the required land use restrictions.

Risk management plan restrictions that apply to a third party must not be objected to by the third party before the RMP can be deemed acceptable to the Department. Where risk management leads to restrictions on land or water use on public or third-party land, the third party can only object to the portions of the RMP that affect them or their use of the land. (i.e., the third party or public land).

When a directly affected party objects to a risk management decision, the Department requires remediation of the third-party property to the Alberta Tier 1 guidelines (AENV, 2007a, as amended) or Alberta Tier 2 guidelines (AENV, 2007b, as amended). Therefore, such sites cannot be managed using exposure control options and would not be eligible for risk management. However, in some circumstances (e.g., presence of buildings or infrastructure over contamination) interim exposure control may be required before remediation to Alberta Tier 1 or 2 guidelines can be achieved.

3.1.5 Safety, Odours and Nuisance

Aesthetic objectives such as offensive odours (for example, from some sulphur compounds, formic acid, etc.) or taste (e.g. some drinking water quality guideline aesthetic objectives); safety issues (for example, explosive hydrocarbon vapours, dangerous accumulation of soil gas) and nuisance conditions (for example, unsightly property, dust) are regulated under the EPEA and other legislation but are not strictly related to human health or ecological effects. These issues require resolution, independent of the level of human and ecological health risk on a contaminated site.

3.2 Technical and Administrative Requirements

Exposure control requires development of a risk management plan (RMP) that will detail how the proposed site management strategy will be implemented. The Department's *Risk Management Plan Guide and Checklist* (in development) are intended to be used for preparation and review of RMPs submitted to the Department (or Regulator) for: approved or regulated facilities, facilities under Codes of Practice, and unapproved or non-regulated facilities, including petroleum storage tank (PST) sites, upstream oil and gas contaminated sites (CSU), other sites contaminated and decommissioned (SCD), and other sites as designated by the Director. The RMP Guide and Checklist (in development) outlines more specific administrative requirements and the minimum site investigation requirements needed for an RMP.

All RMPs must include timelines, milestones and monitoring regimes to ensure the effectiveness of the plan. Content may be limited in simple, administrative plans but this information is still required. The plan must also include commitment from the owner/operator as it relates to any long-term management, monitoring, and exposure controls for the duration of the exposure control requirements. The Department requires contingency planning be determined prior to acceptance of exposure control as part of risk management or acceptance of a risk management plan.

All risks from areas of potential environmental concern (APECs) or contaminants of potential concern (CoPCs) must be considered in the potential scope of the RMP and must be accounted for in the development of the conceptual site model. The RMP must provide clear and unambiguous conclusions that there are minimal or acceptable levels of risk to receptors (e.g.: meeting or below Tier 1 or Tier 2 guidelines). If exposure controls are to be used in conjunction with the RMP, sufficient details regarding the exposure controls must be provided. The RMPs must show prevention of further deterioration to soil and/or groundwater conditions. In addition, an RMP must adequately outline and establish an on-going monitoring plan, and it must assess changes to on-site and off-site conditions. The process should include risk assessment in absence of risk management. Risk management needs to be clearly tied to risk assessment and should specifically address all residual risks.

Requirements that must be met where exposure control is included in the proposed RMP for a site are listed below

3.2.1 Monitoring

Monitoring includes the monitoring, sampling and/or analysis of contaminant concentrations in an

environmental medium (i.e., soil, soil vapour, groundwater, surface water, and air) where needed, such as at a contaminant source, a point of compliance or at an intermediate location. Monitoring is conducted as part of a risk management plan for a number of reasons, including, but not limited to:

- Determining contaminant concentrations in potential exposure media;
- Ongoing confirmation of site or subsurface conditions, particularly those that may be expected to change with time;
- Field validation of fate and exposure models used in site-specific risk assessment;
- Monitoring the progress of long-term remediation or natural attenuation processes;
- Verification that guidelines are being met at points of compliance; and
- Triggering further risk management actions outlined in a contingency plan, as needed, such as when identified thresholds are not met, exceeded, and/or a CoPC is trending towards threshold.

Monitoring is an essential component of any exposure control scenario and must be adequate to cover any of the above reasons that apply to the site. Commitment to a monitoring plan and continuance of the monitoring plan until such a time as contaminant concentrations are at acceptable levels is required for any exposure control scenario. Monitoring also includes inspection and maintenance of exposure control measures.

The effectiveness of exposure controls, such as exposure barriers, must be considered in the monitoring plan and a timeframe to establish this through monitoring or modelling must be demonstrated. The Department or Regulator can request an evaluation or reassessment of exposure barriers, usually in the first three years of exposure control, in the event that modifications are required to limit the further spread of a contaminant of potential concern. The proponent may request a change in monitoring where long-term monitoring has demonstrated a decreasing trend in contaminant concentrations with time, or where efficacy of the long-term risk management plan has been shown.

3.2.2 Appropriateness of Site conditions for Risk Management

In order for ongoing risk management to be approved for the site, the following conditions must be met:

- Contamination in soil and groundwater must be fully delineated both horizontally and vertically. For volatile contaminants, where risks are associated with soil vapour concentrations, soil vapour must also be delineated for the site.
- All sources must be managed according to the principles outlined in Alberta Tier 1 and Tier 2 guidelines (AENV, 2007a and 2007b, as amended).

- Where there is non-aqueous phase liquid (NAPL), the NAPL must be fully remediated, removed, or controlled.
- Where there is heavily-impacted soil exceeding Alberta Tier 1 and Tier 2 guidelines that are acting as ongoing sources of contamination, the heavily-impacted soil must be remediated, contained or controlled.
- Where the efficacy of the exposure control option (e.g., engineered barrier) has the potential to be negatively affected by contamination that may be present, alternate management options must be employed or steps taken to mitigate the impact.
- The exposure control must prevent the contamination from causing further adverse effects to receptors.
- Where monitoring indicates that health or ecological protection objectives in the exposure control plan are not being met, alternate more aggressive management options must be employed. A contingency plan will need to be implemented should monitoring indicate that the plume is migrating; conditions are deteriorating beyond points of compliance established in the risk management plan; identified thresholds are not met or are exceeded; and/or a CoPC is trending towards threshold.

3.2.3 Approval and Commitment of Affected Parties

In order for the risk management plan to be acceptable to the Department, the owner or responsible party for the plan must:

- Commit in writing to maintenance of the exposure control scenario until compliance with governing remediation guidelines has been demonstrated.
- Develop a monitoring plan that is acceptable to the Department and confirm in writing that affected parties do not object to ongoing monitoring, if required.
- Implement a communication schedule so that all affected parties are kept informed.
- Ensure continued viability of the risk management plan for the site.

Where the risk management plan impacts affected parties, the following conditions must be met:

- All land or water use restrictions and/or administrative or institutional controls must be clearly defined and communicated to affected parties. This must include clearly defined points of compliance where the contaminant concentration is expected to meet the required Alberta Tier 1 or Tier 2 guidelines.
- The affected parties must have no objection to exposure control options that directly affect their use of the land. This may include any required land use restrictions, administrative controls, institutional controls and access requirements. The arrangement between responsible party and affected parties to show they do not object must be documented in the risk management plan.

3.2.4 Technical Adequacy of Risk Management Plans

The Risk Management Plan must:

- Mitigate and manage any potential for adverse effect to human health and the environment.

- Monitor on-site and off-site conditions. The scope and frequency of monitoring must be adequate to assess the effectiveness of the plan, including both engineered and administrative controls.
- Include contingency measures to respond to adverse changes in conditions. For example, if contaminant concentrations in a plume are not stable or decreasing with time, alternate risk management or remediation measures are required.
- Prevent worsening of off-site conditions.
- Manage contamination if disturbed by future activities (e.g., excavation).
- Notify future affected parties of site conditions. Including notification for future land owners or parties with interests in the land.

3.3 Department Acceptance of Plan

Risk management plans for exposure control are reviewed by the Department (or Regulator). Following review, the Department (or Regulator) will reply by letter to the proponent where needed, noting deficiencies or acceptability of the plan. Larger or more complex plans may merit longer reviews.

3.4 Conclusion of Risk Management

A proponent will provide updated confirmatory sampling results showing that Alberta Tier 1 or Alberta Tier 2 guidelines have been met. An Environmental Site Assessment (ESA) report with an updated *Record of Site Condition* (ESRD, 2012) is submitted to the Department (or Regulator) to demonstrate confirmatory results meeting guidelines.

The Department and Regulator offer Remediation Certificate programs as a means to provide formal closure in situations where risk management was required at a site that now meets the Alberta Tier 1 or Tier 2 guidelines. To be eligible for a remediation certificate, applicants must demonstrate remediation success with confirmatory sampling to show that Alberta Tier 1 and/or Tier 2 guidelines have been met. Soil and groundwater confirmatory analyses are required to demonstrate that the site achieves the Alberta Tier 1 guidelines (AENV, 2007a, as amended) or Alberta Tier 2 guidelines (AENV, 2007b, as amended).

For more information on remediation certificates, refer to *A Guide to Remediation Certificates for Upstream Oil and Gas Sites* (AENV, 2011a) or *A Guide to Remediation Certificates for Contaminated Sites* (AENV, 2011b).

Original signed by: Kem Singh, Executive Director
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Date: May 3, 2016

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