Alberta Energy Regulator

Contamination Management

[Month Year]

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Manual [XXX]: Contamination Management

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Abbreviations

AER	Alberta Energy Regulator
APEC	areas of potential environmental concern
CSM	conceptual site model
CSPF	*Contaminated Sites Policy Framework*
EM	electromagnetic
EPEA	*Environmental Protection and Enhancement Act*
ESA	environmental site assessments
OGCR	*Oil and Gas Conservation Rules*
RAP	remedial action plan
RMP	risk management plan
RoSC	record of site condition
SSRA	site-specific risk assessment

1 Introduction

1.1 Purpose of This Manual

Under section 112 of the *Environmental Protection and Enhancement Act* (*EPEA*) a duty to take remedial measures arises where a substance that may cause, is causing, or has caused an adverse effect is released into the environment. In such circumstances, the person responsible for the substance must, as soon as that person becomes aware, or ought to have become aware, of the release, take all reasonable measures to repair, remedy, and confine the effects of a substance, and remediate, manage, remove, or otherwise dispose of the substance to prevent an adverse effect or further adverse effect, and restore the environment to a satisfactory condition.

The purpose of this manual is to assist industry in understanding the regulatory requirements and expectations for remediating contamination related to conventional oil and gas, in situ, and pipeline activities regulated by the Alberta Energy Regulator (AER). For the purposes of this manual, contamination refers to substances released into the environment that may cause, are causing, or have caused an adverse effect on soil and groundwater.

Requirements under section 112 of *EPEA* and the *Remediation Regulation* are in addition to release reporting requirements; while discussed at a high level in section 6, release reporting is not the focus of this manual.

This manual is provided for information only and must not be used as a substitute for the applicable regulatory requirements, including regulatory requirements set out in legislation, regulations, rules, guidelines, standards and directives; the manual does not create, modify, or waive any requirements. The user remains responsible for complying with all applicable requirements. To the extent any inconsistency exists between this manual and the applicable requirements, the applicable requirements prevail.

1.2 How to Use This Manual

In this manual, the term “industry” is used broadly to encompass all persons who must complete remedial measures and report to the AER. These persons may include the person responsible, owner, or operator as those terms are defined in the applicable legislation and regulations.

In sections 2 and 3, the key documents and concepts that form the foundation of the AER’s regulatory requirements and outcomes are set out.

Section 4 outlines the overall remedial measures process, which is not strictly linear, in the context of Alberta’s *Contaminated Sites Policy Framework* (*CSPF*).

Sections 5 through 11 describe in detail the regulatory requirements and outcomes over the life cycle of a substance released to the environment affecting soil and groundwater, from its initial discovery to closure and certification that there is no further risk of adverse effect to human health and the environment.

Section 12 describes how the AER ensures compliance.

Appendix 1 uses four scenarios to give examples of reasonable remedial measures across the life cycle stages

2 Key Documents

Remediation requirements are spread out over a great many documents. This section lists the most important documents that deal with contamination most common to the energy resource industry. While this list is not comprehensive, it provides a brief overview of the key documents that should be consulted to understand the applicable regulatory requirements and expectations to undertake remedial measures for contamination. The manual is provided as an aid, but industry remains responsible for complying with all regulatory requirements, even if not listed here.

2.1 Legislation and Regulations

EPEA sets out the regulatory requirements related to the release of substances into the environment and remedial measures:

- Section 110 describes the duty to report a release of a substance into the environment.
- Section 111 describes the reports that are to be provided and how.
- Section 112 describes the duty to take "remedial measures" whenever a substance released into the environment may cause, is causing, or has caused an adverse effect.

Supporting regulations and rules that set out regulatory requirements include:

- The *Release Reporting Regulation*, *Oil and Gas Conservation Rules* (*OGCR*), *Pipeline Act*, *Pipeline Rules*, and *Oil Sands Conservation Rules* set out what must be reported, when, how, and to whom. Further information on release reporting requirements is given in section 6.
- The *Remediation Regulation* sets out requirements for reporting new information and carrying out and reporting on remedial measures and sets out options for closure.

2.2 Guidelines

The *CSPF* explains what is required to manage contaminated sites. It provides the framework for the following standards and guidelines, which are incorporated into and must be complied with in accordance with the *Remediation Regulation*:

- *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (Tier 1 guidelines) provides a standardized means to evaluate risk to human health and the environment.
- *Alberta Tier 2 Soil and Groundwater Remediation Guidelines* (Tier 2 guidelines) explains acceptable approaches to modify the Tier 1 guidelines to reflect the specific conditions of a contaminated site.

- *Environmental Site Assessment Standard* (the ESA standard) outlines minimum standards for environmental site assessments (ESAs).
- *Alberta Exposure Control Guide* explains requirements for risk management using the exposure control option identified in the *CSPF*.
- *Risk Management Plan Guide* supplements the *Alberta Exposure Control Guide* by explaining the minimum standards of a risk management plan.

Note: Alberta Environment and Parks are developing a guide on site-specific risk assessments, *Supplemental Guidance on Site-Specific Risk Assessments in Alberta*.

2.3 Additional Documents

- *Environmental Quality Guidelines for Alberta Surface Waters* must be referred to when evaluating contaminant concentrations in surface water.
- *Guidelines for Canadian Drinking Water Quality* outlines drinking water quality requirements.
- *Guidelines for Landfill Disposal of Sulphur Waste and Remediation of Sulphur Containing Soils* provides further details on how to address material contaminated with sulphur in a non-oxidized form.
- *Directive 050: Drilling Waste Management* and supporting guidance sets out the requirements for treating and disposing of drilling waste under the *OGCR*. The soil endpoints (guideline concentrations) have been largely harmonized with the Tier 1 guidelines, but *Directive 050* details options for disposal of drilling waste material including dilution by mixing (which is not permissible as a general approach under the Tier 1 guidelines).
- *Directive 055: Storage Requirements for Upstream Petroleum Industry* identifies requirements for storing materials produced, generated, or used at upstream petroleum industry sites, including wastes.
- *Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry* sets out requirements for handling, treating, and disposing of upstream oilfield waste.

2.4 AER Record of Site Condition Form

An AER Record of Site Condition (RoSC) form must be included with any submissions that detail remedial measures undertaken (described in sections 7 to 11). It must also be included with any other submission as directed (e.g., groundwater monitoring reports required by *EPEA* approvals).

The AER RoSC form must include a declaration from an environmental professional and an authorized representative. An AER RoSC form contains information on plans for implementing remedial measures and as such may form the basis of an acceptable remedial action plan (RAP), as described in section 8 of this manual.

Because the form may change, always download a new copy to ensure you have the most recent version. The form and guidance on how to complete it are available on the AER's website, www.aer.ca > Regulating Development > Rules and Directives > AER Forms > Remediation and Reclamation Forms.

3 Key Concepts

This section explains the key concepts around the AER's regulatory requirements and expectations for remedial measures for contamination.

3.1 Key Terms

Understanding of the following terms provides useful context to understand the content of this manual.

Release

Under *EPEA*, release "includes to spill, discharge, dispose of, spray, inject, inoculate, abandon, deposit, leak, seep, pour, emit, empty, throw, dump, place and exhaust."

Substance

Under *EPEA*, a substance means, among other things, any matter that is capable of becoming dispersed in the environment or is capable of becoming transformed in the environment into matter that is capable of becoming dispersed in the environment.

Environment

Under *EPEA*, the term environment refers to the components of the earth and includes air, land and water, all layers of the atmosphere, all organic and inorganic matter and living organisms, and the interacting natural systems that include these.

Adverse Effect

Under EPEA, adverse effect "means impairment of or damage to the environment, human health or safety or property."

Under the *CSPF*, "when adverse effects are evident, contaminants must be managed to alleviate adverse effects, regardless of whether a site meets Alberta Tier 1 or Tier 2 Guidelines."

Remedial Measures

Under the *CSPF*, "remedial measures involves key elements of Alberta's framework for the management of contaminated sites: source control, environmental site assessments, risk assessment, and contamination management, including remediation."

Under *EPEA*, persons responsible are required to take remedial measures when a substance that may cause, is causing, or has caused an adverse effect is released into the environment. This duty applies as soon as they become aware of or ought to have become aware of the release.

In relation to contamination the term remedial measures encompasses actions taken in support of characterization, contamination management, exposure control, and confirmation that remediation objectives have been met.

The steps taken as part of assessment and management of a released substance are collectively called remedial measures.

3.2 Environmental Professionals and AER Reliance on Submissions

The AER requires reliable information to determine if regulatory obligations have been met and must be able to rely upon the information, findings, conclusions, or recommendations contained within a submission regarding contamination.

Under the ESA standard, remedial measures for contamination must be carried out by or be under the supervision of a competent qualified professional. The ESA standard states that "Professionals must be practicing members in good standing with an organization that has professional legislation in Alberta that explicitly allows them to conduct remediation and reclamation work as defined in the *Professional Responsibilities in Completion and Assurance of Reclamation and Remediation Work in Alberta – Joint Practice Standard*." A professional declaration from a qualified member of one of the following professional organizations is required with any submission described in sections 7 to 11 of this manual. The declaration must include the professional's signature and registration number or stamp/seal.

- Alberta Institute of Agrologists (AIA)
- Alberta Society of Professional Biologists (ASPB)
- Association of the Chemical Profession of Alberta (ACPA)
- Association of Professional Engineers and Geoscientists of Alberta (APEGA)
- Association of Science and Engineering Technology Professionals of Alberta (ASET)
- College of Alberta Professional Foresters (CAPF)
- College of Alberta Professional Forest Technologists (CAPFT).

Under the ESA standard and *Joint Practice Standard*, professionals should disclose any possible or perceived conflicts of interest to industry and other relevant parties before entering into agreements for work.

In the discovery stage (section 5) or the initial response stage (section 6), there may be occasions when an interim submission is urgently required. Professional declarations may be omitted in these cases if it is impractical due to the timing and urgency. For example, in response to a pipeline spill, the AER inspector may require daily updates, including the results of chemical testing on soil samples around the spill area.

Given the urgency of the information, professional sign-off may not be feasible at the time the updates are submitted.

3.3 Understanding Risk of Adverse Effect to Human Health and the Environment

To develop appropriate remedial measures, it is necessary to understand the risk that contamination may pose to human health and the environment. Acceptable approaches to assessing this risk include those detailed in the Tier 1 guidelines, the Tier 2 guidelines and supplementary materials, and the forthcoming site-specific risk assessment guide. These documents describe how to assess risk, how to develop remediation options for managing risk, and how to identify when remediation is complete and the risks have been adequately managed.

An ESA is done to determine whether soil or groundwater contains contaminants in excess of Tier 1 or Tier 2 guidelines. Where a substance has been released that causes an exceedance of the Alberta Tier 1 guidelines in soil or groundwater, it has the potential for adverse effect unless otherwise demonstrated through the Tier 2 guidelines process in a manner acceptable to the AER.

Under section 2.3 of the *Remediation Regulation*, a substance release to soil or groundwater must be remediated to meet the requirements of the Tier 1 guidelines.

Alternatively, under section 2.4 of the *Remediation Regulation*, a person may remediate an area of land or site in accordance with the Alberta Tier 2 guidelines if the AER is satisfied that a level of protection equivalent to the Tier 1 guidelines has been reached.

The *Remediation Regulation* and Tier 1 and Tier 2 guidelines require industry to consider the future use of the site when evaluating risk to human health and the environment. Under the *CSPF*, the risk to human health and the environment cannot be adequately understood until the extent of contamination has been determined (delineated).

3.3.1 Tier 1 Guidelines

The Tier 1 guidelines provide a simple, widely applicable, generic approach to the assessment of risk to human health and the environment posed by contamination. They include tables of concentrations for common contaminants in soil and groundwater. These are based on reasonable conservative assumptions and can therefore be used at most sites without modification. They are usually used at least as an initial screening tool in evaluating risk to human health and the environment posed by contamination. They also specify the minimum site-specific information that is required, including the following:

- land use and sensitivity factors
- physical conditions
- contaminant characteristics and distribution

The Tier 1 guidelines identify a number of conditions that preclude their use—for example, sites with organic soils or with fractured bedrock must be addressed through the Tier 2 guidelines process. The Tier 1 guidelines also cannot be used in cases where the specific chemical in the contamination is not listed within the Tier 1 guidelines.

3.3.2 Tier 2 Guidelines

A more detailed, site-specific evaluation of the risk posed by contamination can be undertaken by following the approach explained in the Tier 2 guidelines. The use of the Tier 2 guidelines is optional except where conditions preclude the use of the Tier 1 guidelines. The Tier 2 guidelines describe two more prescriptive approaches to the assessment of risk termed "pathway exclusion" and "guideline adjustment." A third approach, "site-specific risk assessment," is discussed in more detail in section 3.3.3.

The Tier 2 guideline process is more complex and requires more detailed assessments, but when appropriately applied, the use of the Tier 2 guidelines to assess risk can optimize the strategy for remedial measures and may support a conclusion that contamination does not pose a risk to human health and the environment and that remediation is not required.

The AER may notify industry of any deficiencies identified regarding use of the Tier 2 guidelines in submissions described in sections 7 to 10 of this manual, but will not provide formal acceptance. Upon receipt of an application for closure, as described in section 11 of this manual (remediation certificate, for example), the AER will provide formal acceptance that Tier 2 guidelines have been applied correctly and appropriately, and that there is adequate supporting evidence. Questions regarding the use of the Tier 2 guidelines can be submitted to csusubmissions@aer.ca.

3.3.3 Tier 2 – Site-Specific Risk Assessment

In addition to pathway exclusion and guideline adjustment, the Tier 2 guidelines describe an approach to evaluating risk to human health and the environment called a "site-specific risk assessment" (SSRA). This approach is less prescribed than the other approaches under the Tier 2 guidelines. A guide specific to SSRAs is forthcoming.

The Tier 2 guidelines specifically require industry to seek acceptance of any SSRA by the appropriate regulator. In the context of this manual, that is the AER. In addition to engagement prescribed by the guidelines, when conducting or planning to conduct SSRAs for a contaminated site, industry is encouraged to engage with the AER at appropriate stages and through scheduled updates.

Unlike the Tier 1 guideline approach and the prescribed approaches in the Tier 2 guidelines, the SSRA approach does not follow a prescribed methodology. Therefore, the AER needs details of the SSRA methodology employed to ensure that the approach is scientifically defensible and is aligned with the expectations and limitations described within the Tier 2 guidelines. Under the forthcoming SSRA guide, the accepted framework for an SSRA includes problem formulation, toxicity or effects assessment,

exposure assessment, and risk characterization. Examples of information that may be required to explain how the SSRA evaluated the risk to human health and the environment include the following:

- identification of any pathways excluded
- details of calculations performed
- sensitivity analysis
- groundwater model details
- statistical analysis

The AER expects the assumptions used in an SSRA to be adequately conservative to provide sufficient protection to receptors.

3.4 Conceptual Site Model

A conceptual site model (CSM) is described in section 4.4 of the ESA standard as "a visual representation and narrative description of the physical, chemical, and biological processes occurring, or that have occurred, at a site as related to the contaminants of potential concern and contaminants of potential concern migration." A CSM is a key component of reports that describe contamination.

Volume 1 of the Canadian Council of Ministers of the Environment's document *Guidance Manual for Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment* explains that a CSM should describe "the relationships between the physical, chemical, and biological processes of the site and the human and environmental receptors." To meet these expectations a CSM should describe

- how the site became contaminated,
- where the contamination is,
- how the contamination is interacting with the environment (is it expanding, migrating, degrading, fully contained etc.), and
- what remedial measures have been undertaken or are planned.

The intent of the CSM is to support an assessment of the risk to human health and the environment posed by contamination and to assist with demonstrating that a contaminated site is adequately understood. A well-developed CSM provides decision makers with an effective tool to organize, communicate, and interpret existing data and efficiently understand the risk posed by contamination, while identifying areas where additional data is required.

The elements described in the CSM are not all known with certainty, so it must rely on available information and reasonable interpretation. A CSM should therefore be supported by appropriate data and sufficient lines of evidence and should make clear what assumptions are being made.

A CSM can be very simple where the assessment of risk is simple and will be more comprehensive where a more detailed assessment has been undertaken. Since the Tier 1 guidelines are based on a simple, generic CSM, very limited CSM development is required where the Tier 1 guidelines have been applied. In relation to contamination that has been delineated, it is often sufficient to apply the CSM that forms the basis of the Tier 1 guidelines.

Where information is limited, the use of conservative assumptions in the CSM development may result in the CSM considering multiple exposure scenarios. Until it has been demonstrated otherwise, the CSM should identify all the possible exposure pathways considered in the Tier 1 and Tier 2 guidelines as potentially occurring, even where this may appear to be illogical.

Development of the CSM is an iterative process. In early stages, the CSM may contain little information beyond what contaminants are present or suspected and what areas of the site these may have originated from. As more information becomes available, the CSM can be progressively refined and may include information on the sources, types, and total extent of the contamination, release and transport mechanisms, possible subsurface migration pathways, and potential receptors and the routes of exposure. Since CSMs are dynamic in nature and are expected to be updated as circumstances change, additional, update submissions may be required if the CSM changes.

A CSM should include the following information on sources, pathways, and receptors:

- identification of contaminants of potential concern (CoPCs) and areas of potential environmental concern (APECs)
- a description of the current and future land use of the site and relevant surrounding area
- description of the site geology
- identification of human and ecological exposure scenarios and pathways
- a description of the vertical and horizontal extent of the contaminated area
- information or interpretation regarding the fate and transport of the contamination
- explanation of any existing measures preventing receptors being exposed to contamination
- identification of any assumptions made in determining the risk to human health and the environment, now and in the future

When using a CSM to describe more complex situations, more complex and detailed site-specific evidence is needed. More complex CSMs might also include information on the following:

- natural background chemistry
- spatial and temporal trends or variation in contaminant concentrations
- the site and regional hydrogeological regimes
- details of any numerical modelling undertaken

3.5 New Information

Section 2.1 of the *Remediation Regulation* requires that, in addition to the requirements of *EPEA* and the *Release Reporting Information*, new information about the impact of a released substance to a person or land be reported to the AER and affected persons once discovered. This means the AER must be informed on an ongoing basis when new information about contamination arises, including, for example, development of Tier 2 guidelines and exposure control measures as described within this manual.

These ongoing reporting requirements are in addition to requirements under *EPEA* (notably section 110) and the *Release Reporting Regulation* to report a released substance to the AER upon its initial discovery (as described in section 6). Complying with the guidance in this section does not mean that all applicable regulatory requirements have been met.

The AER considers "new information" about the impact of a released substance to a person or land to be information that changes the understanding of the site's CSM or the assessment of risk of adverse effect, or that requires revisions to exposure control measures. For example, if new data leads to a change in the interpretation about how contamination is behaving in the environment and suggests that receptors are at an increased risk of adverse effect, or additional receptors may be at risk of adverse effect, this is considered "new information." New information can also demonstrate that the risk of adverse effect is lower than previously understood.

In situations where new information about impact of a released substance to a person or land indicates any of the following, the new information must be reported immediately via the AER's 24-hour Energy and Environmental Emergency and Operational Complaint Line at 1-800-222-6514:

- an ongoing or imminent risk of adverse effects to human health or the environment
- where acute exposure could potentially occur
- new persons are, or may be, at risk of adverse effect

Examples include the following:

- Analytical results from a domestic water well show contaminant concentrations above guidelines and an adverse effect to human health has already occurred or risk is imminent.
- Analytical results from a surface water body show concentrations above guidelines and indicate an ongoing or imminent risk of adverse effects to aquatic life.
- Exposure control measures protecting a human receptor are found to be ineffective.
- Volatile CoPCs have moved from soil or groundwater and entered an indoor airspace.
- A change in land use means the contamination now affects new persons or parties.

When determining whether something qualifies as "new information," which must be reported to the AER, we expect industry to take a precautionary approach, meaning if you are uncertain, report it.

Where new information has been identified through actions required under specific *EPEA* approval conditions (e.g., groundwater monitoring), alternative or additional reporting requirements may apply, as per the approval.

If the conditions outlined above do not apply (i.e., there is no ongoing, imminent or potentially acute risk and does not indicate that any new persons or parties are, or may be at risk of adverse effect), the AER should be notified by updating the most recent and relevant submission (see sections 7 through 9).The AER encourages proactive submission of new information and updates on related matters such as updates to site-specific liability estimates.

Relevant information must also be reported to any affected person (third parties), which may include providing copies of the submissions described in sections 6 through 9 and any subsequent updates.

4 Remedial Measures Process

Seven stages that industry may need to undertake in the event that contamination is identified are illustrated in figure 1. Table 1 summarizes the reports and outcomes for each stage as well. Each of the stages is discussed in detail in sections 5 through 11, including desired regulatory outcomes. Detailed examples are provided in appendix 1.

The AER has identified outcomes for each stage that must be achieved. However, achieving the outcomes articulated does not mean that all applicable regulatory requirements (discussed in section 2) have been met. Industry remains responsible for ensuring all applicable regulatory requirements have been met.

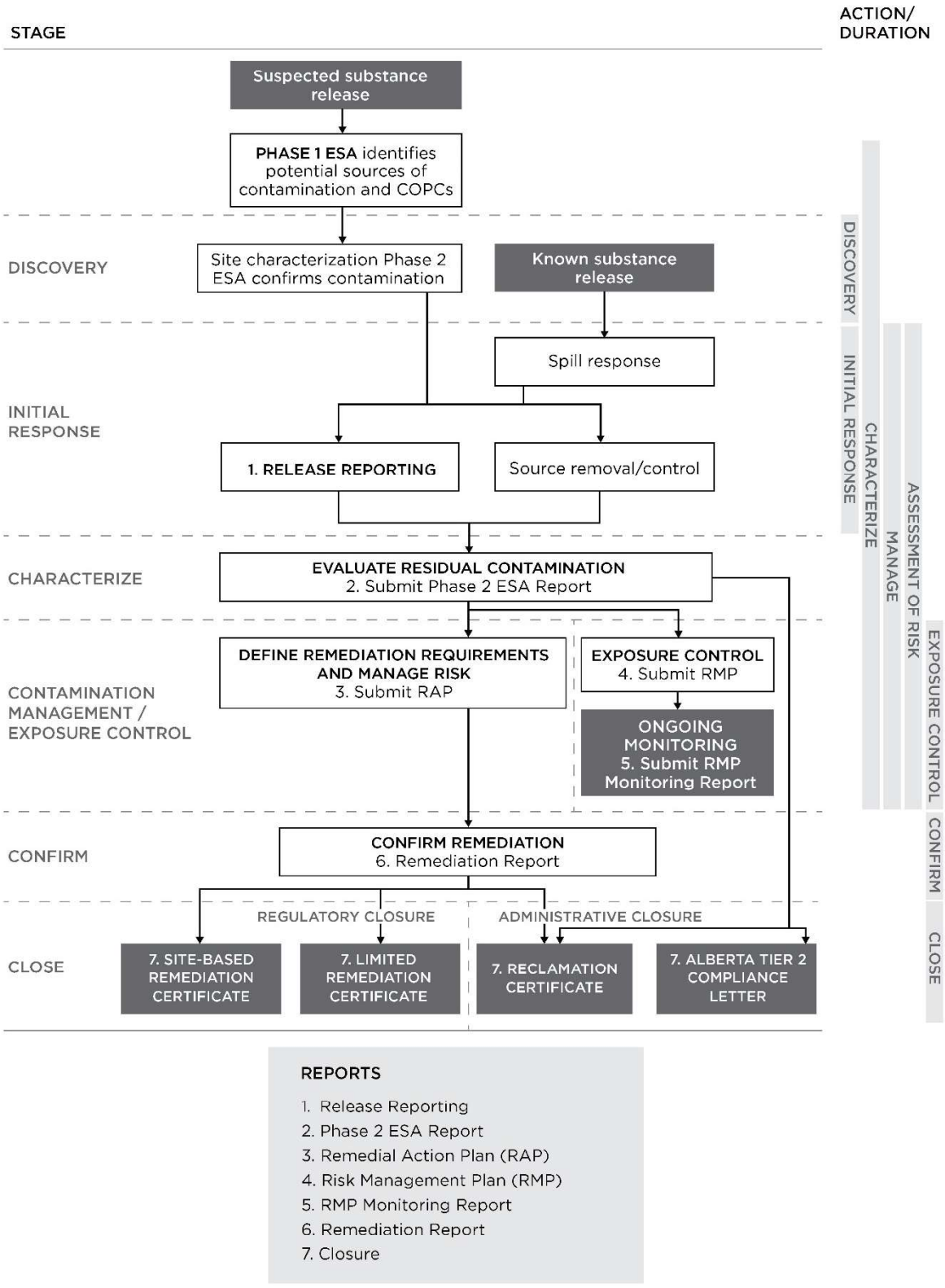

Figure 1. Stages of contamination management (modified from *CSPF*, figure 2)

Table 1. Summary of submissions and outcomes for each remedial measures stage

Stage	Submission	Outcomes Summary
Discovery		Contaminants of concern have been identified and the site has been assessed to determine if these are present in soil or groundwater.
Initial response	Release report	The release of substances to the environment has been stopped, remedial measures are being undertaken to mitigate any adverse effect of possible contaminants, and the AER and stakeholders have been informed.
Characterization	Phase 2 ESA report	A CSM has been developed, the risk of adverse effect to human health and the environment posed by contamination has been assessed, and the need for further remedial measures have been evaluated.
Contamination management	Remedial action plan	A strategy has been prepared to manage the risk of adverse effects to human health and the environment. Administrative or engineered control measures have been implemented to prevent adverse effects while this strategy is implemented. Contingency plans and trigger points have been developed if remedial measures do not prove as effective as planned.
Exposure control	Risk management plan update	All receptors potentially at risk of becoming adversely affected, and the exposure pathways, have been identified and documented. A plan for administrative or engineered exposure control measures acceptable to all affected stakeholders has been developed and implemented, and a monitoring system has been put in place to confirm effectiveness.
Confirmation	Remediation report	Laboratory analysis supports the conclusion that remedial objectives for the site have been met. Remedial measures are no longer required due to risk of adverse effect to human health and the environment, even in the absence of exposure control measures (land use conditions or restrictions).
Closure	Application	One of four closure instruments has been applied for and issued.

While on paper this framework appears linear, in practice, many of the stages can be undertaken concurrently, and some stages may be revisited multiple times, depending on the nature and urgency of the risk to human health and the environment caused by the contamination (see the “Action/Duration” bars along the right-hand side of the figure).

Regardless of what steps industry takes, or how it proceeds through the stages, it is not possible to achieve the outcomes of later stages while those of an earlier stage remain outstanding. For example, it is possible to undertake work to delineate contamination and then subsequently remediate, but it is not possible to complete remediation without having first identified contamination and developed an understanding of the extent of that contamination. However, it is possible to simultaneously satisfy outcomes of multiple stages. It is possible to both delineate the extent of contamination and demonstrate that contamination has been removed simultaneously—for example, by collecting samples from an excavation conducted to remediate contamination.

Although the outcomes of later stages cannot be fully addressed before those of earlier stages, it is often necessary to take steps that support the outcomes of later stages before earlier stages are complete. For example, where exposure is known to be ongoing or imminent, it would be reasonable to start contamination management where characterization is not yet complete. The AER encourages concurrent remedial measures where that is efficient and expects all appropriate remedial measures are undertaken where necessary.

The relevant submissions for each stage of the remedial measures process are discussed in more detail in the individual sections. Except where stated in legislation, regulatory requirements for submissions, plans, and reports cannot be waived, but the AER does have discretion to consider alternatives for how required information is submitted. Individual reports, including updates to preceding stages, may be combined in a single submission removing the need to submit separately, so long as it is demonstrated that the elements of the individual reports have been met.

5 Discovery Stage

The requirement to take remedial measures is triggered when industry becomes aware (or ought to have become aware) of a release of substances to the environment that may cause, is causing, or has caused an adverse effect. This stage includes the events and activities that lead up to the identification of contamination. Where contamination has occurred, duties under section 112 of *EPEA* are triggered.

5.1 Outcomes

- CoPCs have been identified.
- The site has been assessed to confirm if contamination of soil or groundwater has occurred.

5.2 Actions

5.2.1 Known Substance Releases

If a release is known to have occurred (e.g., a spill is observed), then industry is expected to demonstrate whether the release of substances to the environment has affected soil and groundwater (i.e., is soil or groundwater contaminated). In most instances, actions to assess and manage risk to human health and the environment are necessary, often including an appropriately scaled confirmatory Phase 2 ESA, as described in sections 6 and 7.

5.2.2 Suspected and Confirmed Substance Releases

There are various scenarios, however, where a release of substances into the environment may be only suspected:

- A Phase 1 ESA may identify APECs where activities may have led to soil or groundwater becoming contaminated.

- Where APECs have been identified, a surveillance monitoring program or Phase 2 ESA may then identify that soil or groundwater has been contaminated, which confirms that a substance release has occurred.
- Or site reconnaissance may discover poor vegetation growth, for example, that may indicate a substance release has occurred.

Monitoring or Phase 2 ESA activities may also provide information that helps to determine if any contamination could cause adverse effect to human health and the environment and may assist with characterization of the contamination as described in section 7. Some sites require monitoring programs to screen for contamination as part of the conditions of their *EPEA* approvals. The specific terms of the *EPEA* approval for the site and the *Soil Monitoring Directive* provide further information.

5.2.3 Triggering the Duty to Take Remedial Measures

EPEA requires remedial measures to be implemented whenever a release of a substance causes, or has the potential to cause, an adverse effect. Regardless of whether a release of substances into the environment is known or suspected and then confirmed, the regulatory requirements and expectations stemming from section 112 of *EPEA* are triggered when industry "becomes aware" or "ought to have become aware" that contamination (as defined in section 1.1) is present. The duty to take remedial measures applies regardless of industry's assessment of their duty to report a substance release.

6 Initial Response Stage

This section describes the AER's expectations for initial response when contamination is discovered. If a release has occurred, an appropriate response is required from industry to protect the health, safety, and welfare of people, and to limit damage to property and the environment.

6.1 Outcomes

- Ongoing release of the substance into the environment has been prevented.
- Remedial measures have been initiated to mitigate any adverse effects of the contamination.
- The AER and affected persons have been appropriately informed of the substance release.

Unless specifically stated by the AER, information required in this stage, including updates and interim reports, do not replace any of the reporting requirements outlined elsewhere in this manual.

6.2 Initial Response Activities

A key component of the initial response stage is source control. Examples include the following:

- repairing an ongoing loss of containment, such as a leaking pipe or tank
- removing free fluids (like produced water or non-aqueous phase liquid) from the site

- removing contaminated material
- installing engineered controls such as booms or barriers to prevent further migration of contamination

The Tier 1 guidelines state that sources must be removed or controlled as soon as practicable. If complete source removal is not feasible, other source control measures must be implemented. Sources must not be left uncontrolled, even if Tier 1 or Tier 2 guidelines have not yet been exceeded.

Source control is not considered completed unless it can be demonstrated 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. Further information about source control is given in section 8.2.1.

6.3 Notification

Industry must report substance releases in accordance with applicable release reporting requirements. For details, visit our website, www.aer.ca, Regulating Development > Compliance > Release Reporting.

When determining whether something must be reported to the AER, we expect industry to take a precautionary approach, meaning if you are uncertain, report it. Under section 110 of *EPEA*, the release of a substance into the environment that may cause, is causing, or has caused an adverse effect must be reported as soon as that person knows or ought to know of the release.

Where substance releases have been identified through actions required under specific *EPEA* approval conditions (e.g., groundwater monitoring), alternative and additional reporting requirements may apply, as per the approval.

7 Characterization Stage

During this stage, an environmental site assessment (typically a Phase 2 ESA) is conducted in accordance with the requirements in the ESA standard. The assessment includes developing a CSM, evaluating the risks of adverse effect posed by the contamination, and determining the needs for further remedial measures. This should occur as soon as possible following discovery of contamination and may be undertaken in conjunction with the initial response stage.

The need to manage contamination risk of adverse effect applies throughout all stages, including the characterization stage.

7.1 Outcomes

- A CSM has been developed and identifies all receptors that could be adversely affected by the contamination, and the mechanism of exposure for each receptor.

- Adequate evidence has been provided to
  - explain how the potential for adverse effect has been assessed using the Tier 1 or Tier 2 guidelines,
  - demonstrate that potential for adverse effect is not being underestimated, and
  - support a conclusion as to whether further remedial measures are required.

7.2 Phase 2 ESA Report

A Phase 2 ESA report prepared in accordance with the ESA standard demonstrates that the outcomes of the characterization stage are being met. The effort required to assess a substance release varies with the complexity and risk of the situation. Phase 2 ESAs for lower risk, straightforward situations should be similarly straightforward and simple to complete and submit to the AER. A Phase 2 ESA report submitted to the AER must be accompanied by a properly completed AER RoSC form, as described in section 2.4.

7.2.1 When is a Phase 2 ESA Report Required?

In addition to other release reporting requirements at the initial response stage, under section 2.2(1)(a) of the *Remediation Regulation*, industry must submit a Phase 2 ESA to the AER as soon as possible after becoming aware, or having ought to have become aware, of a release. Where contamination has been remediated prior to conducting a Phase 2 ESA, a remediation report that includes Phase 2 ESA information may be submitted instead.

7.2.2 Updating a Phase 2 ESA Report

Where contamination is not fully characterized during the initial assessment (in the discovery or initial response stages) a supplemental environmental site assessment and associated Phase 2 ESA report is often required. For example, an initial Phase 2 ESA might identify contamination, but further assessment may be needed to complete the CSM (delineation, for example).

During earlier stages of an assessment, a CSM may contain little information beyond the CoPCs. Less detailed, more generic CSMs follow the conservative assumptions that form the basis of the Tier 1 guidelines and result in more conservative assumptions regarding the risks associated with contamination. As new information becomes available (including detailed information on the extent of contamination at the site or transport mechanisms), an updated CSM should be provided to the AER in a Phase 2 ESA report.

7.3 Actions Following Characterization

Conclusions of a Phase 2 ESA report must be stated as described in section 4.4.5 of the ESA standard.

After the characterization stage, if it is determined that contamination poses a risk to human health or the environment, the CSM presented in the Phase 2 ESA report will help to identify what further remedial measures are required to address the contamination.

For example, an exceedance of a Tier 1 guideline concentration for an anthropogenic contaminant shows that a release has occurred, demonstrating that there is a potential adverse effect to human health and the environment. Therefore, based on the information currently available, remedial measures are required, even though it may be subsequently determined that the contamination does not pose an actual risk of adverse effect to human health and the environment based on the collection of additional information (e.g., assessment of background conditions) or application of the Tier 2 guidelines.

If it is determined in the characterization stage that the contamination does not pose a risk to human health and the environment, the site may be eligible for closure (see section 11).

If remediation cannot be completed within two years from the date when the person responsible becomes aware or ought to have become aware of the release, then industry must submit a RAP (see section 8).

Duties under section 112 of *EPEA* apply at all times, and industry must continue to take remedial measures, regardless of submission of a Phase 2 ESA to the AER.

7.4 AER Process

When the AER receives Phase 2 ESA reports, the AER reviews the submission to reach an independent estimate of the risk to human health and the environment posed by the contamination. Based on its review, the AER may request additional information and may require that a RAP be submitted at any time.

The AER does not "approve" Phase 2 ESAs. The receipt of a Phase 2 ESA report by the AER does not indicate that the AER agrees that the outcomes have been met or that it accepts the evaluation of risk, the CSM, the guidelines, or that industry is making conservative assumptions that align with the requirements outlined in the *CSPF* and underlying documents. This determination is not made until the closure stage, where the broader scope of the AERs review means there is the potential that concerns will be identified then, which were not previously flagged.

8 Contamination Management Stage

During this stage, measures are taken to ensure that contamination does not cause adverse effect, or further adverse effect, are undertaken. Under the *CSPF*, contamination management includes remediation and exposure control.

Contamination management measures should begin as soon as possible after the contamination is discovered and continue until it is clear that there is no longer any contamination which poses a risk to human health and the environment.

During the contamination management stage, industry is expected to continually evaluate the effectiveness of the contamination management activities and respond as required with contingency plans or by amending the RAP as necessary.

A RAP builds on the outcomes achieved in the initial response and characterization stages to describe the contamination management measures that have been implemented or are proposed for the contamination management stage to manage the risk of adverse effect on human health and the environment, and leading to closure.

8.1 Outcomes

- A strategy, with estimated timelines, has been developed to manage the risk of adverse effect to human health and the environment posed by contamination to the point where remedial measures are no longer required.
- Administrative or engineered control measures have been implemented to manage contamination and prevent adverse effects while this strategy is implemented.
- Clear metrics have been developed against which the effectiveness of the contamination management measures can be validated.
- A contingency plan has been developed and conditions for triggering that plan have been established.

8.2 Aspects of Contamination Management

8.2.1 Source Control

The AER expects that obvious sources of contamination are removed during the initial response stage. However, under the *CSPF*, it is recognized that source control may not be immediately feasible and may require long-term exposure control measures.

To determine whether sources requiring removal or control are present, the person responsible should consider whether contamination is able to spread. In order to determine what action (such as containment or remediation) is required when contamination can spread, it is useful to consider whether contaminants may remain at high enough concentrations to have the potential to cause adverse effect.

The *CSPF* states that "where complete source removal is not feasible, the source must be removed to the greatest extent possible and treatment, control and/or management measures must be implemented to address the residual source" and "if source control measures are required, they must operate until the contaminant concentration meets Alberta Tier 1 or 2 Guidelines." This includes soil and groundwater that contain mobile contaminants that may act as source of further contamination.

If the following conditions are true, it is possible to conclude that a contaminant source that must be managed has been identified:

- The contamination is able to move into material (soil or groundwater) that was not previously contaminated.
- The concentration in material that was not previously contaminated will eventually exceed a relevant threshold that indicates possible adverse effect and therefore require management.

These considerations are only provided for illustration and should not be considered to constitute a definition or test for identification of a source or its adequate control. It is critical to recognize that contamination that does not meet the conditions described above may still represent a risk which requires management / remediation. For example, contamination within the soil root zone may not be spreading into more soil or groundwater, but it may be causing harm to plants at the location.

Under the *CSPF* "source control is not considered complete unless it can be demonstrated that the degree of contamination at any point is unlikely to worsen over time." Determining which sources require removal or control may rely on information collected during the characterization stage.

The scale of source control measures should be commensurate with the potential risk. For example, while the source control of a small-volume, localized crude oil release that has stained surface soil at an active lease can likely be achieved by hand shovelling soil into a waste bin, more significant effort will be required to achieve source control for a crude oil release that has led to a free-phase plume in surface water.

8.2.2 Remediation

During the contamination management stage, a strategy should be developed to remediate contamination where possible. Under the *Remediation Regulation*, remediation means reducing, removing, or destroying substances in soil, water, or groundwater through the application of physical, chemical, or biological processes. Examples include the following:

- excavation and disposal of waste at an approved waste management facility
- groundwater extraction and ex-situ treatment of impacted water
- stimulated bioremediation
- natural attenuation, with appropriate monitoring

Closure is only possible once contamination has been remediated and no longer poses a risk of causing adverse effect.

8.2.3 Exposure Control

Exposure control is one aspect of contamination management. Regardless of plans for remediation, as long as contamination poses a risk of adverse effect to human health or the environment, exposure controls are necessary to ensure receptors are protected. Situations where the AER expects a risk management plan (RMP) detailing exposure control measures are discussed further in section 9. However, a RAP that describes an acceptable strategy for contamination management will also demonstrate that adequate exposure control measures are in place.

8.3 Remedial Action Plans

Section 2.2(2) states that if remediation cannot be completed within two years of discovering a release, a RAP must be submitted immediately. In relation to RAP submission timelines, the AER interprets "immediately" to mean "at the first available opportunity" when it becomes clear that remediation will not be completed within two years of discovery.

The AER expects that a RAP will explain the CSM and describe the contamination management activities that are planned or underway to address the risk of adverse effect to human health and the environment. The RAP must specify a period of time for completion of the remediation (i.e., to bring contaminant concentrations within guidelines) that is acceptable to the AER and how progress will be measured. It must at least summarize the following:

- what substances are present
- where the substances are
- the CSM
- how the substance releases will be managed, including further environmental site assessment, exposure control, and remediation
- timelines for actions and milestones to assess progress, including anticipated date for completion of remediation (which may coincide with the anticipated end of life of the facility)

A completed AER RoSC and (submission of accompanying professional reports) may form the basis of an acceptable submission to satisfy the RAP requirements in section 2.2(2) of the *Remediation Regulation*, provided all the elements of a RAP are present.

Industry may not wait until the two-year point to submit a RAP. For example, if contamination is known to be present beneath active infrastructure and cannot be remediated until operations cease in several years, it is clear that remediation will not be completed within two years, and a RAP must be provided immediately.

The AER expects that a RAP summarize the history and state of the site such that reference to any previous submissions is not necessary. This should include information obtained during the discovery and characterization stages and action undertaken during the initial response stage.

The AER expects that a RAP demonstrate that adequate characterization has been done to understand whether contamination is currently causing adverse effect to human health and the environment. The RAP may include plans for further characterization required to allow use of Tier 2 guidelines. If data gaps exist, the RAP should explain the conservative assumptions made regarding the risk contamination poses to human health and the environment and the exposure control measures that have been implemented to address this risk. For example, if it was uncertain whether contamination could be impacting a water supply well, the RAP may contain a plan for further characterization and urgent additional testing, but it will also document how anyone using that well was notified of the risk and how exposure was prevented, for example through provision of an alternative water supply.

The AER expects that a RAP detail the results of the Phase 2 ESA as described in section 7 of this manual. Provided the Phase 2 ESA submission deadline is met (see section 2.2(1) of the *Remediation Regulation*), where the full content of a Phase 2 ESA report (in accordance with the ESA standard) is contained within a RAP, the AER will not also require a separate Phase 2 ESA to be submitted as a standalone report.

The AER expects that a RAP summarize the measures in place, or planned, to prevent adverse effect on human health and the environment. It should document measures to protect all receptors at risk identified in the CSM, including potential and future receptors and routes of exposure.

The AER expects that a RAP demonstrate how proposed contamination measures will prevent spreading of contamination. For example, if concentrations exceed guidelines for freshwater aquatic life, there is a risk that the contamination will migrate and reach a surface water body. The RAP should explain that this exposure path is not yet active and may describe a monitoring program to confirm that that contamination migration will not be significant and that remediation could be completed before contamination reached the receptor.

A RAP should include a plan to verify that contamination management measures are effective, with clear triggers for implementing contingency measures as required (for example, placement of additional monitoring wells if contamination is detected in a sentinel well, showing delineation has been lost). The RAP should describe a monitoring plan designed to collect pertinent data to demonstrate that the contamination management measures are effective. The plan should explain how the data will be evaluated. This may include identification of tests or metrics to determine whether

- contamination is contained,
- any exposure control measures that are required are effective,

- remediation progress is aligned with expectations and whether anticipated timelines will be met, and
- the remediation strategy results in any secondary adverse effects, such as harmful degradation products or mobilization of secondary contaminants.

As per section 2.2(6) of the *Remediation Regulation*, the AER may modify or waive the requirements for a RAP on a case-by-case basis if remedial measures are being met or additional actions are required.

The AER expects additional RAP details, beyond those elements included in the RoSC, where warranted based on site complexity or if required by the AER, including under the following conditions:

- Contamination has been detected (or is suspected) in surface water (including dugouts but not industrial surface water retention ponds that are compliant with relevant guidelines or approvals).
- Contamination has been detected (or is suspected) in a water supply well.
- Contamination is present within an area with residential/parkland land use.
- Contamination is present within 100 m of a dwelling.
- Conditions precluding the use of Tier 1 guidelines apply.
- Testing is necessary to confirm whether human exposure to vapour arising from contamination is occurring.
- Leaking infrastructure is acting as a source of contamination.
- Non-aqueous phase liquid has been identified or is suspected.
- Contaminant concentration exceeds 75 per cent of a saturation limit published in the Tier 1 guidelines, meaning free-phase generation is likely.
- The RAP is being submitted because new information indicates that contamination management may not be effective.
- There are stakeholder concerns or affected third parties that the person responsible is aware of (or should be aware of).

The AER acceptance of a RAP indicates that the AER did not identify a failure to comply with the duty to take reasonable remedial measures. It does not signify that the AER agrees that the outcomes have been met; accepts the evaluation of risk, the CSM, or the guidelines used; or endorses the remediation strategy. Duties under section 112 of *EPEA* apply at all times, and industry must continue to take appropriate remedial measures, regardless of AER acceptance of a RAP.

8.4 Updating a RAP

It is expected that RAPs will be updated over time. If industry becomes aware of new information, a RAP must be updated. Examples include the following scenarios:

- The contamination management measures proposed in a RAP will be reduced.
- The risk to human health and the environment posed by contamination is found to be greater than originally anticipated.
- Additional source control, remediation, or exposure control measures are necessary.
- A third party becomes affected.

The updated RAP must be submitted as described in section 3.5.

9 Exposure Control Stage

The exposure control stage focuses on situations where a formal RMP and subsequent ongoing evaluation and monitoring reports are required.

Exposure control involves removing or mitigating an exposure pathway or receptor or controlling a source. This is done as an interim step until remediation guidelines can be met, where remediation is not an immediately viable option, or where remediation is not in the best interests of the environment. Exposure control is necessary to ensure the protection of receptors that may be exposed to contamination until remediation can be completed.

Exposure control measures include

- engineered or physical controls, such as physical or chemical barriers to prevent a receptor from being exposed to the contamination; or,
- administrative or institutional controls, such as worker health and safety programs or implementation of groundwater use restrictions.

As per section 2.6 of the *Alberta Exposure Control Guide*, exposure control measures can only be effectively implemented when source removal or control has been achieved and delineation of the contamination is adequate.

Exposure control measures in place during remediation work must be documented in a RAP. This section discusses when an RMP that provides a more detailed description of exposure control measures and any agreements with affected parties is needed.

Under the *Alberta Exposure Control Guide*, all RMPs must include timelines, milestones, and monitoring regimes to ensure the effectiveness of the plan. The AER expects periodic ongoing evaluation and

monitoring reports that demonstrate that exposure control measures remain effective and expects to be updated if new information arises.

9.1 Outcomes

- Risks to human health and the environment have been identified and the receptors and pathways are documented with a CSM.
- A plan, acceptable to all stakeholders, detailing the exposure control measures has been developed and initiated.
- A monitoring program and reporting schedule has been put in place to confirm the effectiveness of the exposure control measures.

9.2 Submissions

If industry chooses exposure control as the primary approach to contamination management, a RMP and RMP monitoring reports must be submitted to the AER.

9.2.1 Risk Management Plans

Acceptable exposure control measures are detailed in the *Alberta Exposure Control Guide*, and detailed requirements for RMPs are provided in the *Risk Management Plan Guide*.

Situations where the AER may require an RMP include

- exposure control measures or contamination affect third parties,
- remedial measures will be ongoing for over ten years, or
- the AER requires more detailed information to understand proposed exposure control measures.

9.2.2 Acceptance of Risk Management Plans

Under the *Risk Management Plan Guide*, RMPs need to be administratively complete, be based on source removal or control and comprehensive characterization of the contamination, and contain an acceptable level of discussion regarding the following:

- evaluation of risk to receptors and details on how these receptors will be protected until remedial objectives are met
- monitoring plan
- contingency plan
- timelines and plan requirements
- communication plan

- long-term care and control commitment

Under the *Risk Management Plan Guide*, RMPs must include the following:

- a list and description of the exposure control types and specific exposure controls that are required for the site
- the rationale for selecting the required exposure controls
- actions required to implement the exposure controls and monitoring to ensure that they remain effective over the lifetime of the RMP
- timelines for milestones or program endpoints to be achieved
- contingency plans and trigger conditions in the event that the RMP or portions thereof are ineffective, not achieved within scheduled milestones, or conditions worsen
- a schedule for updating the AER on the effectiveness of exposure control measures
- information on communication with affected parties
- a commitment letter signed by responsible party that aligns with the sample letter provided in appendix B of the *Risk Management Plan Guide*
- notification letters or letters of no objection signed by affected third parties, which align with the sample letters provided in appendix C or D of the *Risk Management Plan Guide*, if relevant.

The AER also expects an RMP to include

- a completed RMP review checklist (appendix A of the *Risk Management Plan Guide*) and
- an AER RoSC.

RMPs received by the AER are reviewed for acceptance. RMPs that are not acceptable to the AER must be updated accordingly.

9.2.3 Ongoing Evaluation and Monitoring

Following approval of an RMP, ongoing evaluation and monitoring update reports will be required at the frequency specified in the RMP. The specific content of these will be determined by the monitoring plan in the RMP, but they are required to demonstrate that the risk management measures remain in place and are effective at preventing adverse effect to human health and the environment. These updates must include an updated AER RoSC.

To ensure that contamination does not cause adverse effect to human health and the environment, ongoing evaluation and monitoring update reports will continue to be required until exposure control measures are no longer required.

10 Confirmation Stage

As required by the *Remediation Regulation*, once contamination has been remediated, a remediation report is required explaining the status of the site and documenting that no further remedial measures are required.

10.1 Outcomes

- Samples have been collected in accordance with sections 4 and 5 of the ESA standard. Laboratory analysis supports the conclusion that contamination concentrations meet the applicable guidelines and remedial objectives defined for the site.
- There is no longer a risk of adverse effect to human health and the environment, even in the absence of land use conditions or restrictions.

10.2 Remediation Report

A Remediation Report is also needed upon completion of remediation work outlined in a RAP.

The ESA standard sets out the requirements for remediation reports, which will demonstrate that no further remedial measures are required and that the outcomes of the confirmation stage have been met.

The AER expects that a remediation report demonstrates that the outcomes of the characterization stage (section 7) have been met. If required information has already been provided to the AER in previous submissions, the information may be briefly summarized with a reference to the previously submitted reports. The effort required to assess, manage, and remediate a substance release may vary with the complexity and risk of the situation. Remediation reports for lower risk, straightforward situations should be similarly straightforward and simple to complete and submit to the AER.

After a remediation report is received, the AER may issue a response detailing any concerns identified during a review. However, it is important to recognize the limited scope of the AER's review at this stage. A confirmation of receipt does not indicate that the AER agreed with all elements of the submission; the AER not identifying a problem with an assessment is not the same as AER agreeing that the assessment is adequate. A full review is not done until an application for closure is made (section 11). Issues could be raised then that were not previously identified.

11 Closure Stage

Closure is typically only possible if remedial measures are no longer required and there are no restrictions on the future use of the site within its given land use.

Under *EPEA* (sections 117 and 138) and the *Remediation Regulation* (sections 2.6 and 4), the AER may certify closure using two sets of instruments:

- regulatory closure instruments, which include
  - a limited remediation certificate or
  - a site-based remediation certificate, and
- administrative closure instruments, which include
  - an Alberta Tier 2 compliance letter or
  - a reclamation certificate.

Both sets of instruments certify that risk of adverse effects to human health and the environment have been assessed and managed or dealt with in a manner that meets regulatory requirements. Regulatory closure instruments give protection, subject to certain limitations, from future environmental protection orders that may require further remedial measures in relation to the substance and the remediated zones that are the subject of a remediation certificate. Administrative closure instruments do not.

While industry can voluntarily apply for either of the remediation certificates, or the Alberta Tier 2 compliance letter, a reclamation certificate is mandatory for specified land under Part 6 of *EPEA*. The issuance of a remediation certification or compliance letter does not satisfy the requirement to also obtain a reclamation certificate when required under *EPEA*.

Under the *CSPF* and the Tier 1 guidelines, sites that are managed under active exposure control measures are not eligible for closure, except where specified.

11.1 Outcomes

- Eligibility criteria to apply for a closure instrument are met.
- One of the four closure options has been applied for and a compliance letter, or one of the certificates, has been issued.

11.2 Applications for Closure

Application forms for remediation certificates and Alberta Tier 2 compliance letters are on the AER's "Contamination Closure Applications" webpage. Always refer to the webpage to make sure you are using the most current application form and method of submission. Reclamation certificates for well sites and associated facilities are applied for through the AER's OneStop system.

Applications must be accompanied by an AER RoSC form that accurately reflects the status of the site.

The AER does not charge any fees for applying for remediation certificates or Alberta Tier 2 compliance letters.

Complete and accurate applications are to be prepared in accordance with all applicable regulatory guidance. Supporting documentation on file with the AER from previous submissions does not need to be resubmitted with a closure application but should be appropriately referenced in order to ensure that it is connected to the application.

Omission of required information, failing to complete an application form, or submitting insufficient information may result in

- supplemental information requests that delay a decision from the AER or
- a decision to refuse to accept the application for a certificate or to issue a certificate or letter.

11.3 Remediation Certificate Applications

Remediation certificate applications to the AER are made under section 3 of the *Remediation Regulation*. Remediation certification is a voluntary program that provides regulatory liability closure for substance releases. Remediation certificates are available only to sites or areas where remediation has occurred.

To be eligible for a remediation certificate, the contamination must be within the AERs jurisdiction, and the requirements of section 3 of the *Remediation Regulation* must be met, including the following:

- Contamination, as defined in section 1.1, was present and required remediation.
- The area affected by contamination is remediated in accordance with all applicable terms, conditions, directions, objectives and guidelines (as per the *Remediation Regulation*) at the time of application.
- A written declaration that the applicant has complied with all terms, conditions, directions, objectives, and guidelines applicable to the remediated zone or site.
- For a site-based remediation certificate, an application requires a Phase 1 ESA and a Phase 2 ESA to be completed in accordance with section 3(2.1) of the *Remediation Regulation* and the ESA standard.

The *Remediation Regulation* contemplates scenarios where closure may be obtained where contamination remains outside of the remediated areas.

11.3.1 Risk Management Plans and Limited Remediation Certificates

As set out in section 4(3) of the *Remediation Regulation*, if contamination that is the subject of remediation is present on land outside the remediated area and those areas outside the remediated area are not entirely remediated in accordance with the guidelines (as per the *Remediation Regulation*), the applicant may still be eligible for a limited remediation certificate. To be eligible, the following must be true:

- Contamination within the remediated zone must be remediated in accordance with the guidelines.

- A risk management plan for land outside the remediated area that is in accordance with the guidelines and designed to effectively monitor, mitigate, or prevent any adverse effect from the contamination must have been previously submitted and accepted by the AER.
- The land that is the subject of the remediation and risk management is not within a natural area or on agricultural land.
- The AER is of the opinion that there is an adequate plan to monitor, mitigate, or prevent any adverse effect that may be caused by the contamination.

11.3.2 Risk Management Plans and Site-Based Remediation Certificates

As set out in section 4(6) of the *Remediation Regulation*, if the contamination that is the subject of remediation is present on land outside of the site and those areas outside the site are not entirely remediated in accordance with the guidelines (as per the *Remediation Regulation*), the applicant may still be eligible for a site-based remediation certificate. To be eligible, the following must be true:

- All areas of contamination within the site must be completely remediated in accordance with the guidelines.
- A risk management plan for land outside the site that is in accordance with the guidelines and designed to effectively monitor, mitigate or prevent any adverse effect from the contamination must have been previously submitted and accepted by the AER.
- The land that is the subject of the remediation and risk management plan is not within a natural area or on agricultural land.
- The AER is of the opinion that there is an adequate risk management plan in accordance with the guidelines to monitor, mitigate, or prevent any adverse effect that may be caused by the contamination.

As set out in section 3(2.2) of the *Remediation Regulation*, an applicant that wishes to obtain a site-based remediation certificate for a parcel of land that was not and is not a source of any contaminants of concern or APEC as defined in the ESA standard and does not wish to have a RMP referenced in section 3(2)(r) of the *Remediation Regulation* for the APEC outside the boundary of the parcel, must, in addition to all other applicable requirements, be able to demonstrate to the satisfaction of the AER that

- the parcel of land has never been a part of the site associated with the contamination, including any associated infrastructure,
- the parcel of land has been remediated in accordance with the guidelines (as per the *Remediation Regulation*), and
- the parcel of land has been remediated in such a way as to prevent recontamination from contamination released from outside the boundary of the parcel of land.

Sites which may have received a closure or "comfort" letter from a regulatory department in the past would not automatically qualify for a remediation certificate. Sites which have been issued a reclamation certificate or an AER evaluation regarding contamination information related to a reclamation certificate would also not automatically qualify for a remediation certificate.

Send applications to csusubmissions@aer.ca.

11.4 Alberta Tier 2 Compliance Letters

To be eligible for an Alberta Tier 2 compliance letter, the following must apply:

- No remediation is or was required to meet the Alberta Tier 2 guidelines for any substance release associated with the site or area of land.
- All APECs and CoPCs on and off site have been assessed and meet the Alberta Tier 2 guidelines.
- The contamination must be within the AERs jurisdiction.

Sites which may have received a closure or "comfort" letter from a regulatory department in the past would not automatically qualify for an Alberta Tier 2 compliance letter. Sites which have been issued a reclamation certificate would also not be automatically qualify an Alberta Tier 2 compliance letter.

Refer to sections 2.5 and 2.6 of the *Remediation Regulation* for the application requirements for an Alberta Tier 2 compliance letter. Requests for an Alberta Tier 2 compliance letter submitted to the AER must include the following:

- Phase 1 and Phase 2 ESAs that meet the requirements of the ESA standard, including contamination delineation
- An assessment of risk and supporting documents in accordance with Alberta Tier 2 guidelines, which specify
  - potential human health and environmental risks on and off site for all substances;
  - procedures, including monitoring results, to justify assumptions within the risk assessment; and
  - that no remediation is or was required to meet Alberta Tier 2 guidelines.

Send applications to csusubmissions@aer.ca.

11.5 Reclamation Certificates

Under *EPEA* and the *Conservation and Reclamation Regulation*, industry have a duty to reclaim specified land and obtain a reclamation certificate. Reclamation involves removal of equipment and infrastructure, decontamination, returning the land to an equivalent land capability. A reclamation certificate certifies that the AER reclamation requirements have been met.

A reclamation certificate does not offer regulatory liability closure for contamination at a site. Issuance of a reclamation certificate is another form of administrative closure for contamination. Refer to *Specified Enactment Direction 002: Application Submission Requirements and Guidance for Reclamation Certificates for Well Sites and Associated Facilities* and our "Reclamation Certificate Application Submissions" webpage for more information.

Note that the issuance of a remediation certificate or Alberta Tier 2 compliance letter does not affect the obligation to obtain a reclamation certificate under section of 137 of *EPEA*.

AEP has published several documents that set out reclamation criteria, and industry is required to meet these criteria before applying for a reclamation certificate.

11.5.1 AER Evaluation of Contamination Information for Reclamation Certificates

In order for a site to be eligible for a reclamation certificate, all contamination must have been remediated or dealt with. Therefore, as part of the review of a reclamation certificate application, the AER will evaluate whether there is sufficient evidence to support that any contamination has been dealt with. Under *SED 002*, where the AER considers a reclamation certificate application to be more complex, it is subject to additional review. This includes situations where the Alberta Tier 2 guidelines have been used.

In order to promote efficiency, the AER will, under certain circumstances, complete a review to evaluate whether contamination has been remediated or dealt with prior to application for a reclamation certificate. When industry deems any necessary remedial measures are complete, documentation demonstrating that relevant standards of remediation are met (that contamination does not pose a risk to human health and the environment) may be submitted. This process is intended to reduce the applicant's risk that the AER will find the status of the site unacceptable, necessitating further remedial measures that may result in a need to repeat reclamation work. Refer to the reclamation pages on the AER website for full details regarding eligibility. An industry request for a review prior to submission of a reclamation certificate application should include all the information with respect to contamination (presented as described in this manual) that would be needed for a reclamation certificate application. All such requests for reclamation certificate applications are to be submitted electronically to CSUsubmissions@aer.ca. This evaluation is based on the information provided at the time. Issues could be raised at the reclamation certificate stage that were not previously identified, and the evaluation may be changed if new information becomes available or concerns arise regarding contamination.

Other than as described above, the AER does not routinely provide any evaluation of remedial measures prior to the submission of a formal application, as described in this section of the manual. Formal evaluation of Alberta Tier 2 guidelines, including site-specific risk assessments, can be sought through an application for a remediation certificate or an Alberta Tier 2 compliance letter.

11.6 AER Decision Process

Applications for any of these closure instruments will go through our standard review and decision-making process, which includes the following:

- Public Notice

  Once the AER receives an application, a public notice of application is posted on the AER website on the Public Notice of Application tool. Anyone who believes they may be directly and adversely affected by an application can file a statement of concern. If a statement of concern is received it may take longer than normal to process the application. Details on how to submit a Statement of Concern is available on the AER website, www.aer.ca > Protecting What Matters > Giving Albertans a Voice > Statement of Concern.

- Notice of Decision

  The AER issues closure instruments if it is satisfied all requirements have been met. Under section 33 of the *Responsible Energy Development Act* and the *Alberta Energy Regulator Rules of Practice*, once the AER makes a decision on an application, notice of the decision is posted on the AER website on the Publication of Decision tool.

11.7 Cancellations

The AER may cancel a remediation certificate or Alberta Tier 2 compliance letter after it is issued. Circumstances in which the AER may cancel a remediation certificate include the following:

- The application was incomplete, inaccurate, or contained inconsistent, false, or misleading information.
- The site was not assessed for contamination where required.
- The site is found to be not compliant with applicable guidelines or standards at the time of issuance.

Circumstances in which the AER may cancel the Alberta Tier 2 compliance letter include the following:

- The application was incomplete, inaccurate, or contained inconsistent, false, or misleading information.
- Guidelines have changed.
- Site conditions or land use have changed.
- The site is found to be not compliant with requirements at the time the Alberta Tier 2 compliance letter were issued.

12 Compliance Assurance

To ensure that regulatory requirements are being met the AER undertakes performance evaluations and compliance and enforcement activities. The AER's compliance and enforcement activities are guided by the *Integrated Compliance Assurance Framework* and *Manual 013: Compliance and Enforcement Program*. More details can be found on our website, www.aer.ca > Regulating Development > Compliance > Compliance Assurance Program.

Audits are generally focused on information and data in the possession of, or requested by, the AER. Audits typically include analysis of available information. When conducting audits, the AER makes use of any reliable information to determine whether legislated duties are being met. The AER may audit sites where contamination is being actively managed or where sites have had remediation certificates or an Alberta Tier 2 compliance letter issued.

Audits conducted to assure compliance with regulatory requirements may identify noncompliances, which could result in action being taken by the AER. Examples of audit findings include the following:

- Substance releases were not immediately reported when there is evidence of adverse effect to human health and the environment.
- Reporting requirements were not met. For example, the RAP was not implemented, but an alternative strategy was. This may be considered failure to report new information to the AER under the *Remediation Regulation*.
- Industry has become aware or ought to have become aware of a release of substances to the environment, and the duty to take remedial measures has been triggered, but measures are not being taken. Industry was not taking reasonable measures to prevent adverse effect or further adverse effect.
- A RoSC does not accurately and reasonably reflect the information collected at the site.
- No issues identified.

Audits are separate from the complaint process (aer.ca > Protecting What Matters > Giving Albertans a Voice> File a Complaint).

13 Public Access to Contamination Information

For copies of public documents filed under *EPEA*, refer to our Product and Services Catalogue under Applications > EPEA Application and Supporting Documents, including the following:

- Phase 1 and 2 ESAs
- Tier 2 guideline development documents and reports
- Contamination status update reports
- Remedial action plans

- Remediation reports
- Risk management plans
- Remediation certificates and applications
- Alberta Tier 2 compliance letters and applications

Appendix 1 Examples of Remedial Measures

These examples are provided only to assist industry in understanding requirements and expectations related to contamination. They are not a substitute for the applicable regulatory requirements and are subject to the limitations described in section 1.1.

Example 1: Pipeline Leak

Discovery Stage

- A pressure drop is identified in a pipeline carrying an oil and produced water emulsion. An inspection of the pipeline right-of-way found emulsion seeping to the ground surface.
- Hydrocarbon and salts are identified as CoPCs associated with the emulsion.

Initial Response Stage

- The release is immediately reported to the AER and affected stakeholders; actions to meet release reporting requirements are carried out.
- The pipeline is taken out of commission to prevent any further release of emulsion.
- Some of the initial remedial measures taken to mitigate adverse effect included fencing around the spill area to restrict access and containment of pooled emulsion using absorbent pads.

Characterization Stage

- The area around the pipeline break is excavated to access the pipeline and conduct repairs.
- Contaminated soil from the excavation is characterized and disposed of according to waste management regulations.
- Soil samples are collected from the limits of the excavation and tested for the CoPCs; laboratory analytical certificates indicated hydrocarbon concentrations exceeding Tier 1 guidelines.
- The person responsible opts to apply Tier 1 guidelines and the Tier 1 CSM to assess the risk associated with release.
- Test pits and shallow hand auger holes advanced at the site to delineate the extent of hydrocarbon contamination above Tier 1.
- The person responsible is required to provide a Phase 2 ESA report or remediation report as soon as possible as per the *Remediation Regulation*. The person responsible communicates to the AER that they anticipate remediation to be complete within a few weeks; the AER determined that submission a remediation report within 90 days was acceptable.

Contamination Management Stage

- Weather conditions delay remediation, but the risk posed by the contamination does not significantly change and the exposure controls in place remain effective.
- The persons responsible notifies the AER of the delay and requests a 30-day extension to the remediation report deadline. The request is granted.
- Remediation activities are executed. It is anticipated that the site can be remediated within a two-year period, so the *Remediation Regulation* requirement to submit RAP does not apply.

Exposure Control Stage

- Exposure control measures are detailed and kept up to date in communications with the AER.
- No conditions requiring a formal RMP have been met.

Confirmation Stage

- A remediation report meeting the ESA standard is submitted to the AER concluding that no further remedial measures are required.

Closure Stage

- The person responsible does not elect to apply for closure of the substance release.

Example 2: Abandoned Well Site

Discovery Stage

- A Phase 1 ESA for an abandoned well site identifies a flare pit as an APEC and lists metals, hydrocarbons, and salts as CoPCs.
- A Phase 2 ESA is completed for the APEC and soil samples are submitted for laboratory analysis. The results indicate the following:
  - Petroleum hydrocarbon fraction 1 concentrations above Tier 1 guideline.
  - Chloride concentrations ranging from 300 mg/kg to 5000 mg/kg, with corresponding concentrations in saturated paste extracts (expressed as mg/L) that significantly exceed the Tier 1 groundwater guideline.
  - Elevated electrical conductivity and sodium adsorption ratios that fall into the poor rating category, compared to background values which are within the good category.
  - One sample showed an arsenic concentration above the Tier 1 guideline value. In the Phase 2 ESA report, this was compared to background soil conditions and determined to not be a contaminant of concern associated with the well site.
- Results confirm that contamination with potential for adverse effect is present.

Initial Response Stage

- Contamination is reported to the AER; person responsible confirms no other affected stakeholders need to be notified.
- The Phase 2 ESA is submitted to the AER and actions to meet release reporting requirements are carried out.
- Initial sampling suggests contamination is limited to the flare pit area and does not extend off lease.

Characterization Stage

- An electromagnetic (EM) survey is completed to assist with planning of next steps; the EM survey indicates that the extent of contamination is greater than originally estimated.
- A supplemental Phase 2 ESA is undertaken collect information for the CSM and delineate the flare pit area to Tier 1 guidelines.
- The Phase 2 ESA did not achieve complete delineation.
- Although additional information was collected, the CSM was not fundamentally changed, and an immediate update of the previously provided Phase 2 ESA report was not required.
- The person responsible decides to take a Tier 2 approach, including the use of the Subsoil Salinity Tool, to determine site-specific remedial objectives for the site. Additional assessment to complete delineation and obtain information to support Tier 2 guideline development is required.

Contamination Management Stage

- The person responsible determines that it is unlikely remediation would be completed within two years of becoming aware of the substance release and therefore understands a RAP is to be submitted to the AER.
- A professional report and accompanying AER RoSC form (forming the basis of a RAP) is submitted to the AER. The RAP details the source of the contamination, existing contamination management measures, and plans to undertake further assessment within the next year. Remediation is expected to be complete within five years.
- Following subsequent rounds of assessment, which involved the installation of groundwater monitoring wells, it is discovered that the contamination extends off site in the direction of a creek. Surface water sampling at the creek does not identify contamination.
- The AER and affected parties are notified of this new risk posed by the contamination.
- The RAP and the CSM are updated to reflect the new information. Remediation is now expected to be complete within fifteen years.

Exposure Control Stage

- Because mobile groundwater contamination was found near a surface water body, and contamination extended off site, an RMP is requested by the AER.
- The RMP outlines a plan to install a groundwater containment and remediation system with sentinel wells to evaluate the effectiveness of the exposure control measures. The RMP includes confirmation that the affected third parties have no objection to the plan and that the responsible party commits to maintaining the RMP until guidelines are met.

Confirmation Stage

- Containment and remediation measures detailed in the RAP and RMP remained effective, and eventually contaminant concentrations decrease and meet the relevant guidelines.
- A remediation report is submitted to the AER confirming that remedial objectives for the site have been met.
- Containment measures are removed. The conditions of the risk management plan are no longer necessary, and the site is eligible for closure.

Closure Stage

- The person responsible applies for and receives a reclamation certificate.

Example 3: Sour Gas Plant

Discovery Stage

- A groundwater surveillance monitoring program at a sour gas plant identified elevated concentrations of amines near the amine treatment infrastructure. Although concentrations did not exceed Tier 1 guidelines, further assessment was warranted, and a potential release source was identified in the process building.
- As part of a contamination management program, additional soil testing was conducted in proximity to the potential source, and concentrations of amines exceeding guidelines were identified.
- Amines have been released and resulted in contamination which has the potential to cause adverse effect on human health and the environment.

Initial Response Stage

- Groundwater has been contaminated with amines, but the volume of amine release is unknown. As per the site's *EPEA* approval, assessment into the cause of the amine release is underway and measures to address the potential source of the release have been implemented.
- Actions to satisfy the release reporting requirements detailed in the sour gas plant's *EPEA* approval were carried out.

- Data collected during a groundwater monitoring program demonstrated that the extent of amine contamination was currently confined to the vicinity of the amine treatment buildings and did not extend off lease.
- No affected stakeholders, other than the AER, were identified for notification.
- While the initial evaluation suggests there is no immediate risk to human health and the environment, there is the potential for adverse effect in the future. Further evaluation of risk is undertaken in the characterization stage and beyond.

Characterization Stage

- Additional assessment is completed to further refine the delineation of the contamination and support development of Tier 2 guidelines.
- As soon as the Phase 2 ESA report summarizing additional assessments completed was prepared, it was submitted to the AER.
- Because contamination was present beneath active infrastructure, it was determined that remediation could not be completed within two years, so a RAP would be required. Development of the RAP continued during the contamination management stage.

Contamination Management Stage

- A RAP was submitted to the AER outlining plans to conduct partial remediation and a plan to manage residual contaminants to remain in situ. The RAP included a groundwater monitoring program to confirm the rate of amine migration and associated contingency plans if the rate of migration was found to be faster than predicted. Note: it is possible to include a RAP as part of functionally similar instruments required under particular approvals—for example, a soil management plan—provided all the elements of a RAP are present.
- After five years of monitoring, it was concluded that the rate of migration was less than was initially predicted. An updated RAP was submitted to the AER proposing to reduce monitoring activities in light of the new information.

Exposure Control Stage

- Although exposure control measures were needed, they were detailed in the RAP. The nature of the impacts did not require a separate formal RMP.

Confirmation Stage

- Following decommissioning of some site infrastructure, contaminated soil is excavated from the previously inaccessible area. Sampling of the walls and the base of the excavation confirm that all contaminated soil has been removed, and the excavation is backfilled.

- A remediation report is submitted to the AER; the site is eligible for select closure options.

Closure Stage

- The person responsible elects to apply for a limited remediation certificate for the area where the contamination excavation occurred.
- Upon a review of the application, the AER concludes that the information used to develop the Tier 2 guidelines did not identify the geological variability at the site and issues a supplemental information request.
- The person responsible collects additional measurements of hydraulic conductivity and provides information to the AER.
- The AER completes the review of the application and issues a limited remediation certificate.

Example 4: Vegetation Stress

Discovery Stage

- A Phase 1 ESA is conducted for a former well site and concludes that all APECs associated with it have been previously properly assessed and resolved with the exception of an area of stressed vegetation. The Phase 1 ESA indicates CoPCs for this area include salinity, metals, and petroleum hydrocarbons.
- A Phase 2 ESA is conducted, focusing on the area of stressed vegetation, and soil samples were tested for each of the CoPCs.
- Laboratory results confirm that all contaminant concentrations meet Tier 1 guidelines. It is concluded that the vegetation stress was not caused by a substance release.
- As all APECs have been investigated at this site and all reported contaminant concentrations meet Tier 1 guidelines, the site can progress to the closure stage.

Closure Stage

- The person responsible amends the soil in the area of apparent vegetation stress by adding fertilizer. Upon documenting healthy vegetation in this area after two growing seasons, and confirming that reclamation certificate criteria are met, they apply for and receive a reclamation certificate.

Appendix 2 Useful Reference Documents

Alberta Energy Regulator

Documents

- Assessing Drilling Waste Disposal Areas: Compliance Options for Reclamation Certification
- Directive 001: Requirements for Site-Specific Liability Assessments in Support of the ERCB's Liability Management Programs
- Directive 006: Licensee Liability Rating (LLR) Program and Licence Transfer Process
- Directive 011: Licensee Liability Rating (LLR) Program: Updated Industry Parameters and Liability Costs
- Directive 024: Large Facility Liability Management Program
- Directive 050: Drilling Waste Management
- Directive 055: Storage Requirements for the Upstream Petroleum Industry
- Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry
- How to Fill Out the AER Record of Site Condition Form
- Manual 13: Compliance and Enforcement Program Integrated Compliance Assurance Framework
- Release Reporting Requirements
- Suspension, Abandonment, Decontamination, and Surface Land Reclamation of Upstream Oil and Gas Facilities (IL/98-02)

Forms

- Application for Exemption from Requirement to Obtain a Reclamation Certificate Due to Presence of an Overlapping Activity
- Assessing Drilling Waste Disposal Areas – Calculation Tables for Compliance Options 1 and 2
- Assessing Drilling Waste Disposal Areas – Checklist for Compliance Options 1 and 2
- Professional Declaration for Reclamation Certificate Applications
- Record of Site Condition
- Remediation Action Plan Checklist
- Subsoil Salinity Tool Assessment Checklist

Government of Alberta

Documents

- 2010 Reclamation Criteria for Wellsites and Associated Facilities
- Alberta Environmental Site Assessment Standard
- Alberta Limited Remediation Certificate Guide
- Alberta Site-Based Remediation Certificate Guide
- Alberta Tier 1 Soil and Groundwater Remediation Guidelines
- Alberta Tier 2 Soil and Groundwater Remediation Guidelines
- Alberta Tier 2 Compliance Letter Guide
- Alberta's Water for Life Strategy (AENV, 2003)
- Burial of Material On-Lease (C&R/IL/97-5)
- Beneficial Use of Waste Policy (ESRD, 2012).
- Certification Requirements for Wellsites with No Surface Disturbance (Surveyed Only) (C&R/IL/94-3)
- Competencies for Reclamation and Remediation Recommendations Report
- Conservation and Reclamation Guidelines (C&R/IL/97-1)
- Contaminated Sites Policy Framework
- Directive for monitoring the impact of sulphur dust on soils
- Environmental Quality Guidelines for Alberta Surface Waters
- Exposure Control Guide
- Frequently Asked Questions on the Remediation and Reclamation of Soil and Groundwater
- Guide to Certification for Wellsite Reductions, Additions, Overlaps, Multi-Well Facilities, and Forced Leased Boundary Changes
- Guide to Site Specific Risk Assessment (DRAFT)
- Glossary of Reclamation and Remediation Terms Used in Alberta
- Ground Water Monitoring Directive (under development)
- Native Prairie Protocol for reclamation certification of salt-affected wellsites
- Pre-Construction Assessment Report for Wellsites (C&R/IL/00-08)
- Problem Introduced Forages on Prairie Reclamation Sites (R&R/03-05)

- Professional Declaration Requirements (R&R/12-05)
- Remedial Action Plan Guide
- Risk Management Plan Guide
- Salt Contamination Assessment and Remediation Guidelines
- Sites Reclaimed Using Natural Recovery Methods: Guidance on Site Assessment (R&R/03-06)
- Soil Monitoring Directive
- Subsoil Petroleum Hydrocarbon Guidelines for Remote Forested Sites in the Green Zone
- Subsoil Salinity Tool Fact Sheet
- Supplemental Guidance on Site-Specific Risk Assessments in Alberta (under development)
- Third Party Impact on Reclamation (C&R/IL/97-4)
- Water Act
- Weed Management on Industrial Sites (R&R/12-01)
- Wellsite Construction: Guidelines for No-Strip and Reduced Disturbance (R&R/03-07)

Forms

- 2010 Assessment Tool and Record of Observations Data Sheets
- Limited Remediation Certificate Application
- Phase 2 Environmental Site Assessment Checklist
- Site-Based Remediation Certificate Application

Federal Documents

- Canada Energy Regulator – Remediation Process Guide
- Canadian Council of Ministers of the Environment Guidance Manual for Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment (Volumes 1-4)
- Canadian Council of Ministers of the Environment Canadian Environmental Quality Guidelines, Protocols, and Reference Documents
- CSA Group Standard Z768-01 Phase 1 Environmental Site Assessment
- CSA Group Standard Z769-00 Standard Phase 2 Environmental Site Assessment
- Health Canada Conceptual Site Model Builder Tool

Other

- Professional Responsibilities in Completion and Assurance of Reclamation and Remediation Work in Alberta: Joint Practice Standard