Saskatchewan Ministry of Environment

GUIDANCE DOCUMENT: Impacted Sites

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Government of Saskatchewan

Amendments

Periodic amendments to this guidance document are anticipated as opportunities for improvement arise. Please ensure that you are using the most recent version. If you have any questions, contact the Ministry of Environment.

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INTRODUCTION

The objectives of this guidance document are to:

- clearly describe the process for managing impacted sites in Saskatchewan within the framework set out by The Environmental Management and Protection Act, 2010 (EMPA, 2010), the Saskatchewan Environmental Code (code) and associated standards;
- describe the minimum elements of an acceptable solution for a site assessment, corrective action plan (CAP), and/or closure report;
- act as a bridging document between the provincial regulatory requirements and the science that must be applied to meet those requirements.

Saskatchewan maintains a risk-based approach that manages impacted sites using tiered endpoints, all of which are intended to be protective of human health and the environment. The person responsible for each impacted site has the option to use the endpoint that they consider most appropriate for the site, as long as compliance with the regulatory requirements is maintained. This guidance document is intended to apply to all impacted sites and substances of potential concern in environmental media focusing on soil, groundwater and surface water, and will be amended periodically to reflect advances in knowledge and industry best practices.

The ministry has adopted a nationally recognized phased approach for environmental site assessment to identify the contaminants of concern that may be present on a site. Site assessment forms the basis for corrective actions and for site reclamation. The Minister reserves the right to re-evaluate sites when new information comes to light, or if site activities or circumstances change such that:

- additional impacts or increase in contaminant migration is discovered;
- new transport pathways or receptors become evident; and/or
- changes in site condition are discovered that may otherwise pose a risk to the environment.

How to Use this Guide

This guidance document provides direction and guidance on the process and appropriate scientific methodologies for managing impacted sites in Saskatchewan.

This guidance document is not intended to be a technical manual, since many comprehensive environmental science resources are widely available. However, in some cases specific methods are adopted or developed and explained in detail. This occurs where a suitable method is not available or where the topic is one that necessitates detailed explanation in relation to the Saskatchewan Environmental Code. Where possible, effort was made to ensure that the methods adopted are harmonized with those of the Canadian Council of Ministers of the Environment (CCME), Canadian Standards Association (CSA) or other competent standard setting agencies.[1]

[1] Standards-setting organizations include bodies such as the Standards Council of Canada (SCC), Canadian Standards Association (CSA), Underwriters Laboratories of Canada (ULC), International Organization for Standardization (ISO), American Society for Testing and Materials (ASTM) International, and United States Environmental Protection Agency (EPA).

Who should use this document

In general, this document requires technical knowledge of environmental science or engineering and is intended for practitioners. It may be useful if you:

- are required to report a discharge;
- discover a historical discharge of a substance while doing work;
- are conducting or are required to conduct a site assessment where the site assessment discloses that the site is an environmentally impacted site;
- are developing or carrying out a corrective action plan;
- are transferring responsibility for an environmentally impacted site to another person; or
- are applying for notice of site condition (NSC).

Results-based Regulatory Model

A healthy environment and a healthy economy are not mutually exclusive. In the past, a command and control model worked reasonably well. Expertise resided within the government, and government could tell proponents exactly what was needed to achieve compliance with the Province's environmental rules.

Rapidly advancing technology, the demand for more specialized expertise, and the accelerated pace of development have challenged the effectiveness of the old regulatory system. The ministry's focus has changed to answering an important question for every activity that has an impact on the environment—what is the desired outcome that the regulated proponent needs to achieve?

Saskatchewan's new way of protecting the regulated environment is to define the desired outcome by law and empower the operator to determine how that standard will be achieved or surpassed.

Guiding principles of Results-based Regulation

Materiality: material environmental changes must be reported by the operator.
Transparency: environmental reporting will be accessible to the public.
Accountability: operators are responsible for protecting the environment from their actions and the ministry is responsible for monitoring and enforcing compliance.
Competence: environmental protection is based on science and knowledge applied by qualified persons.
Timeliness: government decisions will be made, communicated and implemented promptly to support economic efficiency and minimize delays to investment and development activity.
Respect: all levels of government have defined responsibilities to citizens that must be respected.
Affordability: an effective and efficient regulatory regime must be economically viable while maintaining environmental standards and protection.

Key features of the Results-based Regulatory Model

Code: a clear, concise statement of the policies, objectives, and best practices that govern the management and protection of the environment in Saskatchewan.
Emphasis on outcomes: developers, licensees, and citizens are accountable for meeting compulsory parts of the code and finding the most appropriate methods and processes to achieve the outcomes.
Compliance and awareness: enhanced educational efforts will improve everyone's understanding of how and why to comply with the new environmental code.
Online business services: doing business online will save time and resources and improve the ministry's ability to monitor activities on the landscape.

Applicable legislation, code, and standards

Act: The Environmental Management and Protection Act, 2010 (EMPA, 2010) enables the environmental impacted site process. The Act and the code should be used in conjunction when dealing with environmentally impacted sites.

Code: The Saskatchewan Environmental Code (code) contains a collection of legally-binding requirements to be followed by anyone conducting activities regulated by, in this case, The Environmental Management and Protection Act, 2010. The code provides clear directions for projects, allowing operators in many situations to proceed without waiting for a ministerial approval while ensuring enhanced protection of the environment is delivered as a routine business.

This guidance document covers activities regulated by five chapters of the Saskatchewan Environmental Code:

- Discharge and Discovery Reporting;
- Site Assessment;
- Corrective Action Plan;
- Transfer of Responsibility for an Environmentally Impacted Site, and
- Substance Characterization.

Standards: In general, standards are a set of rules for ensuring quality. The standards referenced in the code establish uniform specifications, procedures, criteria, methods, processes or practices. They represent a minimum acceptable benchmark developed from widely accepted and proven principles, practices or guidelines in a given area to help promote effective and efficient environmental and resource management.

Currently, 28 standards are adopted in the Saskatchewan Environmental Code. The following nine standards relate to impacted sites.

- Administrative Control Standard;
- Discharge and Discovery Reporting Standard;
- Endpoint Selection Standard;
- Qualified Person Certification Standard;
- Reclamation Technology Standard;
- Saskatchewan Environmental Quality Standard;
- Visual Site Assessment Standard;

- ASTM Standard E2516-11 Standard Classification for Cost Estimate Classification System;
- CAN/CSA-Z769-00 (R2013) Phase II Environmental Site Assessment Standard.

The standards become legal documents through adoption of the code. They are not to be used as standalone documents and only apply to the legislation, regulations or code chapter(s) that adopts them.

The standards referenced in this guidance document are either developed by the ministry or by standards-setting organizations. Some of the standards developed by these organizations are pay-for-use, and practitioners are responsible for purchasing them. Links and more information about the standards can be found on the ministry's web site.

Saskatchewan Environmental Code

The purpose of the code is to enhance environmental protection and resource management by providing regulatory clarity while fostering innovation, economic growth and social benefits. The code provides the regulated community with options on how to achieve the expected environmental outcomes or results by following the acceptable solutions (a predefined process) or proposing their own alternative solutions signed off by a qualified person and accepted by the Minister.

Acceptable Solution

The Saskatchewan Environmental Code (code) establishes an acceptable level of risk, as the code cannot describe in detail all possible compliance options. An acceptable solution represents the minimum level of performance required for the regulated community to meet the acceptable risk. The solution has been deemed acceptable by the content committee that developed the chapter, the advisory committee that recommended the chapters to the Minister and the Lieutenant Governor in Council who adopted the code.

An acceptable solution provides a pre-defined process proponents can follow. An acceptable solution is either step-by-step requirements that are found in the code, or referenced as a standard.

The acceptable solution may not be applicable to all sites. Under such conditions, proponents or qualified persons have the option of proposing an alternative solution to the Minister for consideration. It should be noted that alternative solutions will be required to meet the same standard of defensibility as acceptable solutions, and all methods employed should be scientifically justified.

Alternative Solution

When a proponent carries out an activity regulated by the code that does not conform to the applicable acceptable solution, or where an acceptable solution is not provided they must propose an alternative solution.

An alternative solution is a plan developed by the proponent which is designed to meet the results-based objectives and is signed off by a qualified person. The alternative solution must then be submitted to the Minister for review and acceptance.

The Minister will evaluate the proposed alternative solution for acceptance. On receipt of the plan, the Minister may: accept the plan; accept the plan with terms and conditions; or refuse to accept the plan. It should be noted that the ministry will only evaluate the activities that pertain to its mandate and it is the proponent's responsibility to ensure all other ministry or jurisdictional requirements are met.

For more information on the code, please see the ministry's website.

Qualified Persons

Public safety and environmental sustainability is based on having appropriate qualified persons responsible for delivering environmental and resource management protection and related services. Under the results-based regulatory model, the ministry focuses on setting regulations that establish required environmental outcomes while relying on the regulated community to be accountable for achieving those outcomes. Qualified persons are used in determining how the regulated community can meet those outcomes.

The use of qualified persons helps to streamline low-risk activities and leads to enhanced environmental protection through the following:

- improved environmental submissions and reports in all areas;
- improved compliance with code; and
- effective use of innovation and alternatives.

Generally speaking, qualified persons are associated with a profession and/or professional body of practice (e.g. applied science technologist, professional agrologist, professional engineer, etc.). In some circumstances, additional criteria are applied such as education and work experience. For those persons who are not associated with a profession listed in the code chapter, an individual can request to be designated by the Minister to become a qualified person.

Role of the Qualified Person

Each code chapter identifies which specific activities require the use of a qualified person. Under The Environmental Management and Protection Act, 2010, qualified persons are required when proposing an alternative solution or, in some circumstances, following the acceptable solution.

Signing off on an alternative solution

Alternative solutions typically require a senior professional person with a broad background to sign off as the qualified person for overall responsibility. Detail within the plan may require numerous persons with various competencies and it is up to the qualified person with overall responsibility to ensure they are relying on the appropriate people.

Following the acceptable solution

Typically qualified persons are not required for acceptable solutions; however, some chapters of the code require qualified persons with respect to designing certain works, environmental monitoring or performing certain duties.

If you do not meet the QP criteria, you may request to be designated a qualified person by the Minister. The process for designating QPs is described in detail on the Ministry of Environment's website. You may submit an application to the Minister of Environment for designation and provide your qualifications in the relevant area.

NOTE: Some of the classes of persons identified in the code as qualified persons are members of associations with scope-of-practice legislation. This legislation defines the procedures, actions and processes that are permitted for the licensed individual. The scope of practice is limited to that which the law allows for specific education and experience, and specific demonstrated competency.

The identification of a person as a qualified person does not entitle that person to engage in an activity if that activity is within the exclusive scope of practice of a profession and that person is not a member of that profession. Therefore, persons should not assume that since they are members of a class of persons referenced in the code that they can carry out activities that are within the exclusive scope of practice of a profession. Qualified persons should check with the provincial professional association to determine if the activity they will be carrying out falls within their scope of practice.

Introduction to Impacted Sites

Environmentally impacted sites are areas of land or water that contain a substance that may cause or is causing an adverse effect. In Saskatchewan, impacts are typically associated with transportation, manufacturing, industrial, commercial or mining activities and may occur on or off site.

The Ministry of Environment has adopted the source-pathway-receptor model in conceptualizing and managing sites.

The ministry has initiated changes to its impacted sites program to clarify the process for encouraging clean-up or risk management and redevelopment of unused or abandoned sites. Some of the changes include:

- enhanced capacity to track impacted sites;
- adopting the National Classification System for Contaminated Sites (NCSCS) to rank sites and help set priorities for reclamation;
- formalizing a process for individuals to transfer responsibility of an impacted site to someone else to facilitate the site's reclamation and redevelopment; and
- increased authority for the Minister to require a responsible party to conduct a site assessment and develop and carry out a corrective action plan.

Tiered endpoints

Tiered endpoints and a variety of reclamation technologies are used to manage impacted sites:

- **Tier 1:** endpoints are achieved when established criteria based on end use and basic site characteristics are satisfied. Tier 1 endpoints require the lowest level of understanding

of the site and associated impacts. Tier 1 values are the most protective values based on end use, and exposure scenarios and basic properties of the effected (media) within the Tier 2 tables of the Saskatchewan Environmental Quality Standard (SEQS).

- **Tier 2:** endpoints are specific to identified exposure scenarios and pathways as set out in the standards that support the code chapters. Tier 2 requires detailed understanding of the receptors, pathways, and source characteristics, and how to rationalize control of the exposure scenario or pathways.

- **Tier 3:** endpoint are developed through methodologies referred to in the Endpoint Selection Standard, where:
    - human health or ecological risk assessments are conducted;
    - site-specific criteria are developed; and/or
    - any defensible approach is used that meets the results-based objectives (RBOs) set out in the Corrective Action Plan chapter.

NOTE: Tier 3 approach requires Minister designation of QP and is always considered an alternative solution.

Reclamation technology

The Reclamation Technology Standard allows proponents, through a generic environmental protection plan (EPP), to propose technology and methodologies that are applicable across the province to be allowed as corrective actions in the accepted solutions.

Results-based Regulatory Approach to Impacted Sites

Improvements to the management of impacted sites were deemed necessary and identified by individuals and organizations both internal and external to government. As a result, the ministry has changed its approach in the following key areas of the site management process:

- **Financial assurance:** Assurances are required to guarantee that corrective actions can be carried out, and when statutory liability for the site is transferred where reclamation is incomplete or not practical. Adequately funded financial assurance ensures that future generations are not burdened by environmental liabilities from operations of today. Financial assurances and the processes for administering them will be discussed in detail in a separate guidance document.

- **Liability:** The ministry uses a polluter and/or beneficiary pays model to apportion liability to responsible parties. Impacted sites will be cleaned up and redeveloped through mechanisms that limit and transfer of liability in certain situations, by imposing financial assurances until sites are reclaimed, and by establishing a fund for dealing with orphaned sites. This fund will be managed by the Finance and Administration Branch of the Ministry of Environment.

  Previously, the concept of responsible parties was extremely broad. It is now narrower, but still contains the flexibility that encourages responsible parties to address impacted sites. In

addition, proponents can now transfer responsibility for reclamation when an acceptable corrective action plan and financial assurances are in place.

- **Reporting notification tracking:** The ministry has expanded requirements for reporting discovery of contaminated sites and has implemented the National Classification System for Contaminated Sites to prioritize urgency of corrective actions on contaminated sites. A registry has been created that will provide the public with access to information about environmentally impacted sites. Publically accessible information will be limited to that which can be published in compliance with The Freedom of Information and Protection of Privacy Act.

- **Environmental Protection Plans (EPP):** This term is used in EMPA, 2010 in reference to any conceptual plan that describes the methods employed in preventing, mitigating, or monitoring, an adverse effect. For example, a corrective action plan (CAP) or an environmental site assessment would each be considered and EPP and would be submitted to the Minister as an EPP.

- **Permitting:** Many of the traditional permits for medium- to low-risk activities are no longer required. The code has replaced the need for permits with a duty to register the activity with the Minister, supported by a declaration that the Saskatchewan Environmental Code or certified environmental protection plan will be followed. In cases where the code does not deal with the proposed activity, proponents may submit a certified environmental protection plan or have a permit issued. An EPP is considered certified when it is prepared by a qualified person. An EPP is considered accepted when accepted by the Minister.

- **Qualified person (QP):** qualified persons play an important role in providing opinions to ensure that the desired outcomes are achieved, or in doing the work itself. Public safety and environmental sustainability are predicated on having suitable QPs responsible for delivering environmental protection and related services. Additional information regarding QP requirements can be found on the ministry's website.

- **Legislation:** When The Environmental Management and Protection Act, 2010 was proclaimed, The Environmental Spill Control Regulations were repealed and all reporting requirements were amalgamated into the code chapters. New requirements in each of the five chapters related to impacted sites are detailed in the relevant sections in this guidance document.

Responsibilities

The key parties involved in impacted site management are as follows:

- person responsible;
- qualified person;
- Province of Saskatchewan;
- impacted third party, where applicable.

If environmental impacts are expected to cause direct and adverse effects to a third party (for example, applicable criteria are expected to be exceeded beyond the impacted site property line), the person responsible is required to inform the impacted third party as soon as they know or ought to have known of the release. This notification requirement is the same as that required under The Environmental Management and Protection Act, 2002 (EMPA, 2002).

The qualified person is ultimately responsible for providing an opinion when a site has been sufficiently reclaimed or how risk is to be managed to provide satisfactory protection to human health and the environment.

The ministry has specified the site management process to be used in this guidance document and is responsible for ensuring that the process is followed and for technical verification of the qualified person's work.

The person responsible retains the same historical responsibilities of financing remediation and due diligence, but now has more options available to reach closure.

The person responsible is not necessarily the polluter. The Minister does not usually determine or apportion liability unless done so through an Environmental Protection Order. Conflict between the person responsible and impacted parties are best resolved between the parties civilly.

Person responsible

The person responsible has a duty to:

- Notify impacted parties that they may be adversely and directly affected by impacts on the source property (for example, when impacts at the property line exceed applicable criteria).
- Immediately report the presence of impacts on the subject or third-party properties by calling the Provincial Spill Report Line.
- Take action necessary to ensure that human health and the environment are protected.
- Obtain the services of a qualified person to proceed through the site assessment and corrective action plan process in a timely manner.
- Remain informed and involved during the steps of the site assessment and corrective action plan process.
- Forward the closure report to the Minister of Environment.
- Demonstrate to the Minister that the site has been managed in compliance with the corrective action plan and is safe for the intended use.

Qualified person

The qualified person has a duty to:

- provide the necessary level of professional competence to resolve all technical issues in the environmental protection plan or the site assessment and corrective action plan process.
- advise the person responsible of any interim remedial action needed to mitigate immediate threats to human health or the environment.
- advise the Minister when, in their opinion, the person responsible fails to act in a manner necessary to mitigate an immediate threat to the safety or health of the public.
- upon completion of the work specified in the corrective action plan, provide a completed closure report to the person responsible, or to the Minister on behalf of the person responsible.
- ensure that the appropriate level of characterization and contaminant delineation is achieved.
- report to the Minister any adverse effects discovered while working on land.

Province of Saskatchewan

The Ministry of Environment has a mandate to ensure that adverse effects are addressed in the event of a discharge. The Province has a duty to:

- protect human health and protect and enhance the natural environment.
- identify the person responsible for managing each impacted site.
- if needed give written notice to the person responsible that a site assessment is required.
- ensure that the process is properly followed in a timely manner.
- establish standards, criteria, or guidelines.
- enforce compliance if the person responsible is delinquent or negligent, including ensuring that any necessary emergency action is taken and tracking a satisfactory rate of progress.
- provide acknowledgement when satisfied that the process is complete (closure).
- record and maintain information on reclaimed sites.
- review and revise this guidance document as deemed necessary from time to time.
- provide direction and guidance to environmental protection officers and other agents of government.

Emergency response activities

Part of the Ministry of Environment's mandate is to oversee emergency response actions and to assist in response activities where appropriate. The ministry will look for the following in the management of an incident:

- accountability system for the responders to ensure safety of those involved;
- command or leadership system; and
- leader/commander on scene, or actively engaged in the incident.

The ministry expects that any emergency response activities will be consistent with current best practices and will put responder safety first. Emergency response activities (incident action plan) shall address the following (in order of priority):

- responder safety;

- public safety;
- environmental protection;
- infrastructure integrity; and
- business continuity.

Appropriate emergency response activities and actions are beyond the scope of this document.

Impacted Site Management Process

The work-flow for managing impacted sites includes four basic stages:

- Stage 1: discovery of the discharge;
- Stage 2: assessment of the site;
- Stage 3: formulation and execution of a corrective action plan; and
- Stage 4: closure.

In many cases the four stages proceed in chronological order, but this is not always the case. In some cases, two or more of the stages may overlap, as shown in the **Figure a**. Examples of such instances are where:

(i) The CAP and site assessment may overlap when delineation is completed at the same time as the CAP.

(ii) The site assessment may confirm that there are no adverse effects and lead directly to closure.

(iii) The CAP and closure may overlap in an atmospheric discharge. Such a case would not require that a site assessment be completed within 30 days of the closure report.

(iv) Non-complicated reportable discharges, a 30-day report may encompass the site assessment, CAP, and closure.

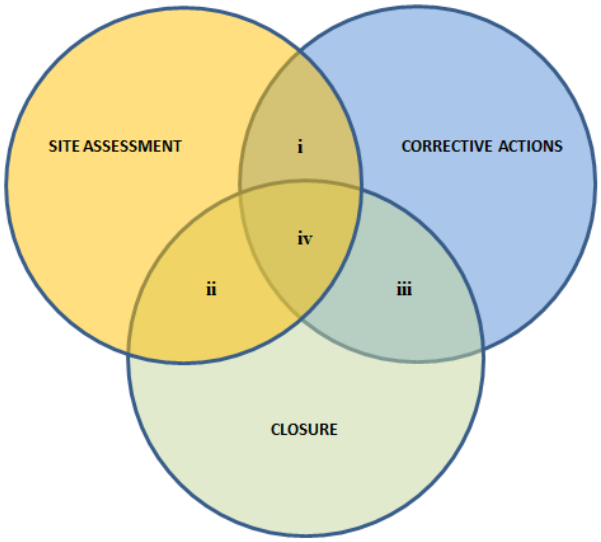


Figure a: Schematic of the Contaminated Sites Management Stages

Subsequent sections of this guidance document focus specifically on each of the four stages of impacted site management. The instances where these processes overlap will also be addressed.

Voluntary and Directed Processes

By default, the ministry prefers voluntary action at impacted sites. This allows responsible persons to assess and apply correctives actions in a fashion that best suits their needs yet still achieves the desired result of a reclaimed impacted site. In the voluntary process there is only one obligatory touch point with the ministry and that is notification. Reporting and review of site assessment, corrective action planning and execution are not required in the in the voluntary process, unless these actions are conducted as alternative solutions. Alternative solutions must be reviewed and accepted by the Minister. The ministry strongly urges, however that proponents who undertake alternative solutions maintain a level of defensibility equal to or better than that of the acceptable solution. The ministry may endorse voluntary actions at impacted sites. The endorsement may apply to a single site or to a group of sites in a portfolio if the plan for each site is presented and the ministry concurs with the approach.

The stages of the impacted site management process can be completed under two scenarios: As directed by the Minister or on a voluntary basis by the site stakeholders. The Minister may require that a site assessment be conducted if there is reasonable ground to believe that the site is impacted. In such a case, the proponent enters a directed process of assessment and subsequent corrective actions where required. The directed process requires that specific timelines be met through submission of appropriate reports to the Minister. In contrast those that follow the voluntary process do not necessarily have to conform to such timelines. However, it is still advisable to engage the ministry at critical points in the process. Examples of these touch-points are where alternative solutions are chosen at assessment or implementation of unapproved a reclamation technology is planned.

The voluntary process applies where the proponent has not been directed by the Minister to conduct a site assessment. Under the voluntary process, the proponent is free to devise site assessment and corrective action timelines that suit their business processes. The standard of technical defensibility is the same regardless of whether the voluntary or directed process applies to a site. The main difference between the process is that when then Minister agrees to the voluntary process the strict timelines specified in the code chapters do not apply to the site.

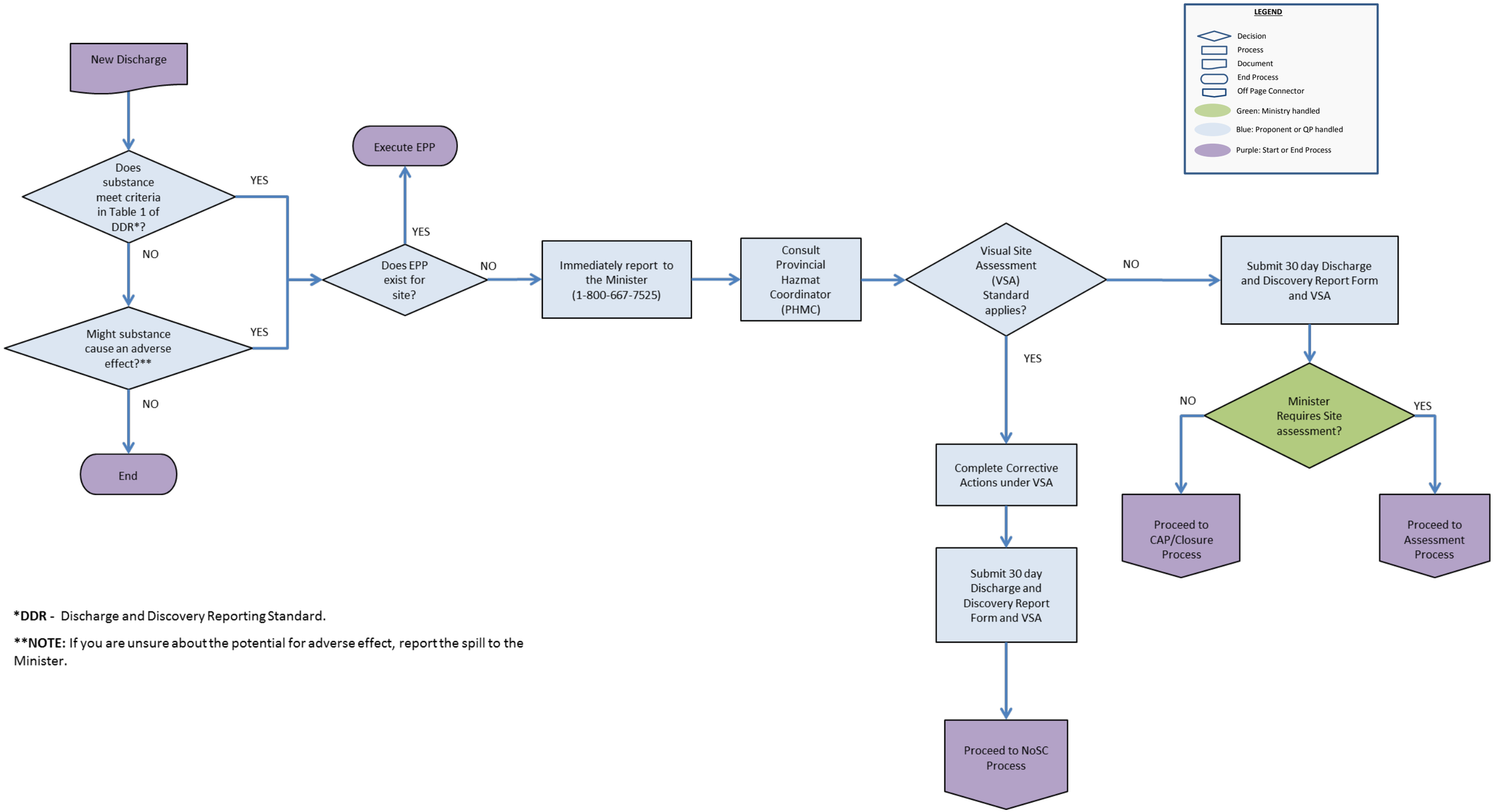
Note: In the site assessment and corrective action plan sections of this guidance document, certain timelines must be met for related activities and reporting. These timelines must be met for sites that are in the directed process, and not strictly required under the voluntary process.

STEP 1: REPORTING DISCHARGES AND DISCOVERY

Introduction

When pollutants or contaminants are discharged into the environment, the ministry's primary role is to ensure the safety of the public and protection of the environment. In addition, the ministry will ensure that whoever is responsible for the discharge takes all reasonable measures to contain and clean up the impacted area.

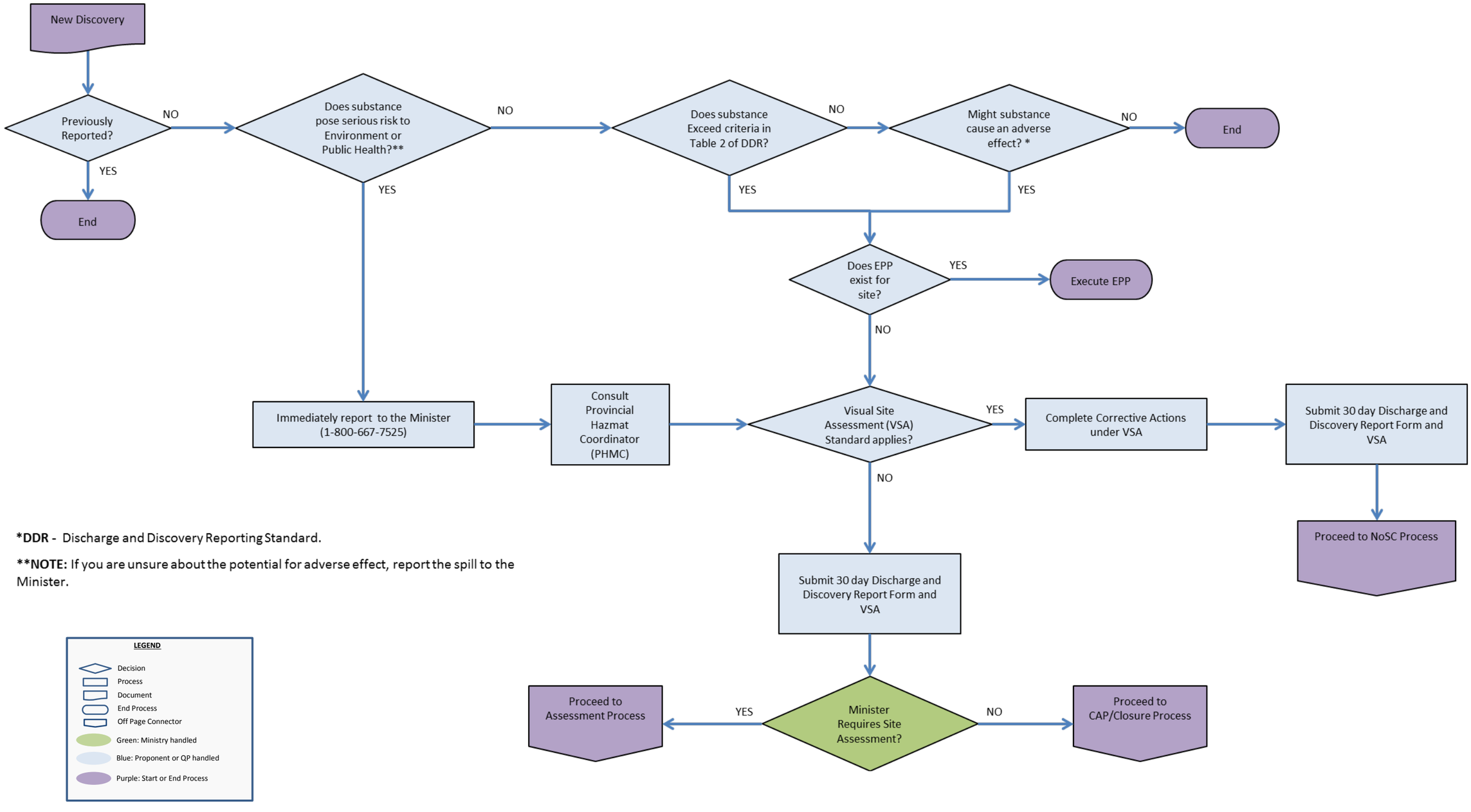
The reporting of a discovery of environmental impacts or a discharge causing adverse effects is the entry point to the management impacted sites process. The flowcharts in **Figures b** and **c** illustrate the administrative process for reporting a discharge or discovery of a substance within the environment that may cause an adverse effect.



***DDR** - Discharge and Discovery Reporting Standard.

****NOTE:** If you are unsure about the potential for adverse effect, report the spill to the Minister.

Figure b: Schematic of Discharge Reporting and Handling Process



***DDR** - Discharge and Discovery Reporting Standard.

****NOTE:** If you are unsure about the potential for adverse effect, report the spill to the Minister.

Figure c: Schematic of Discovery Reporting and Handling Process

The difference between a discovery and a discharge is temporal. A discharge is a release or emission into the environment that is transpiring in the present or recent past, while a discovery refers to instances where impacts from a historical discharge are uncovered. Some of the more common discharges of hazardous substances reported in Saskatchewan include hydrocarbons, anhydrous ammonia and wastewater. Immediate reporting helps to ensure that adverse effects are addressed properly and minimized, if possible, to safeguard the public and protect the environment.

Requirements

Table A highlights the new business process requirements introduced in EMPA, 2010.

Table A: Discharge and Discovery Reporting - New Business Process Requirements

New in EMPA, 2010
• Discovery of historical impacts must be reported to the ministry. • The list of discharged substances required to be reported in the previous regulations is replaced with Table 1 in the Discharge and Discovery Reporting Standard to align with the federal Transportation of Dangerous Goods legislation, as well as the addition of substances common in Saskatchewan. • The new written report form meets the needs of both federal and provincial regulatory reporting requirements. • The timing for submission of the report has been increased to 30 days to be harmonized with the federal requirements. These may be submitted through the ministry's online services (portal).

Who Must Report

The person who discharges, allows the discharge, or has control of the substance discharged is responsible for reporting. Police officers, employees of municipalities or government agencies and individuals conducting the work (including QPs) are also required to report. The same reporting obligations apply to a discovered substance that is causing or may cause an adverse effect. Discharges must be immediately reported to the Provincial Spill Report Center. Discoveries must be reported in writing or via a submission through the online services (portal) as soon as practically possible. Discoveries where the substance poses a serious risk to the environment or public health must immediately be reported to the Minister.

Standards Referenced

Table B provides an overview of the standards pertaining to discharge and discovery.

Table B: Standards Referenced in the Discharge and Discovery Reporting Chapter

Standard	Description
Discharge and Discovery Reporting Standard **Developed by:** Ministry of Environment (new)	This standard provides the reporting amounts and concentrations for discharges and discoveries of substances that may cause or is causing an adverse effect. The standard is provided in the form of Tables 1 and 2. These tables provide values for reportable substances, concentrations and amounts by chemical name.

Standard	Description
	Also referenced in: Site Assessment guidance section.
Qualified Person Certification Standard **Developed by:** Ministry of Environment (new)	This standard applies to qualified persons and provides clear direction on the information required when a qualified person provides a certificate of qualification to the Minister. The certificate is required when the qualified person is providing an opinion to the Minister on aspects such as an environmental protection plan, environmental sampling, operating plans, or design plans. In such cases the qualified person provides a certificate stating that, in his or her opinion, the quality assurance and quality control for sampling and analytical procedures produce accurate, precise and reliable results. The documentation helps ensure that consistent and valid information is provided to the ministry. Also referenced in: Site Assessment and Corrective Action Plan guidance sections.

When to Report a Discharge

There are two triggers for reporting a discharge:

1. The substance discharged exceeds the quantities in Table 1 of the Discharge and Discovery Reporting Standard; and/or
2. The substance may cause an adverse effect.

Discharge quantities

Table 1 of the Discharge and Discovery Reporting Standard (referred to as Table 1) must be used for reporting discharge quantities. Table 1 lists the *Transportation of Dangerous Goods Regulations* (Canada) hazard classes and the applicable quantity amounts for on-site and off-site discharges. The table also includes other substances that do not fit the hazard classes but do have high potential to cause adverse effects, including the following:

- **Industrial waste:** typically associated with substances generated at industrial works or mines – as defined by The Hazardous Substances Waste Dangerous Goods Regulations (HSWDG).
- **Sewage:** as defined in The Environmental Management and Protection Act, 2010.

The Ministry of Environment has integrated the notification trigger for discharges associated with the upstream oil and gas industry regulated by The Oil and Gas Conservation Act and associated regulations. This allows a one-stop approach to reporting and avoids duplication of regulation. Notification is made through the Provincial Spill Report Centre (1-800-667-7525). It should be noted that reporting directly to the Ministry of the Economy does not guarantee that the Ministry of Environment will be notified and that the proper reporting requirements will be met.

The Ministry of Environment and the Ministry of Economy have concurrent jurisdiction on discharges or releases associated with upstream oil and gas activities. It is both agencies' intention to ensure that discharges are reported and appropriate emergency response methods and corrective actions are implemented. As such, entities reporting discharges may work with either one of the ministries or with both, depending on the magnitude and type of incident. Reporting to the Ministry of Environment will fulfill the reporting obligations pursuant to The Oil and Gas Conservation Act and associated regulations. The Ministry of Environment will notify the Ministry of

the Economy of applicable discharges. Subsequent to reporting, the proponent will be notified of additional follow-up requirements. Unless otherwise instructed, upstream oil and gas proponents will not be required to meet remediation requirements of the Ministry of Environment, and will by default adhere to the requirements of the Ministry of the Economy.

Potential for adverse effect from a discharge

It should be noted that discharges in quantities less than those listed in Table 1, or of substance not listed in the table, may still cause an adverse effect. The ministry recommends erring on the side of caution and reporting a discharge or discovery when any potential for adverse effect exists. It should be noted that, reporting a discharge or discovery does not make you accountable for the clean-up. If the person responsible cannot be readily determined, the Minister will review all information and determine a suitable course of action. Examples of ambiguous instances that should be reported include:

- The accidental discharge of a load of canola seed into a water body may have a large oxygen demand on the water body and cause an adverse effect. While canola seed is not listed in either table, the discharge would need to be reported.
- The discharge of 20 litres of diesel fuel into a small water body inhabited by migratory birds. Though the quantity of the substance spilled is below the reportable threshold, adverse effect to the residing birds may result and should thus be reported.
- If one accidently discharged 500 grams of copper sulfate (blue stone) to a very sensitive aquatic environment it should be reported.

Discharges to ministry approved secondary containment do not need to be reported if the secondary containment is functioning as designed. However, any instance where discharge to a secondary containment poses a risk of adverse effect to the environment or human health must be reported to the Minister via the Provincial Spill Report Centre (1-800-667-7525). If you are unsure about the potential for adverse effect caused by a discharge, it is good practice to report the discharge to the ministry for further guidance.

Immediate Reporting

Reporting of a discharge in a timely manner is critical to coordinating an appropriate response. The following must be reported immediately:

- All discharges that meet the volume triggers in Table 1 or that may cause an adverse effect.
- Discovery of substances that pose a serious risk to the environment or public health or safety.

To report a discharge, you must call the Provincial Spill Report Centre (1-800-667-7525). You will be asked to provide as much detailed information as possible regarding the discharge. If the caller is the responsible party, the incident location, site contact, and contact information must be provided (cell phone number is desirable). It is important to listen carefully and provide as much information as possible. Engaging the ministry at the earliest possible stage of an environmental emergency will increase compliance with environmental legislation.

When to Report a Discovery

There are three triggers for reporting a discovery:

1. The substance may cause an adverse effect.

For example, significant vegetative stress of an unknown cause would trigger this reporting requirement.

2. The substance discovered is in a quantity or concentration that could pose a serious risk to the environment or public health or safety.
   For example, when conducting a site assessment drilling reveals free phase petroleum hydrocarbons that are in contact with a building foundation will trigger immediate reporting.

3. The substance discovered meets the concentrations in Table 2 of the Discharge and Discovery Reporting Standard (referred to as Table 2).
   For example, a property owner commissions a consultant to conduct a drilling program to facilitate a property transaction. The drilling program results in numerous soil samples being sent to the lab. The consultant is obligated to report any exceedances of the values in Table 2 within 30 days of receipt of the Certificate of Analysis.

In all instances, a discovery only needs to be reported when the triggers have been confirmed. There is no obligation to report a discovery if the Minister is aware of previous impacts (previous site assessment has been completed or as provided in reports issued to the Minister pursuant to an Approval to Operate or an approved EPP), unless those impacts aggravate or create new adverse effects.

Discovery Concentrations

Table 2 should be utilized to determine what concentrations of substances are required to be reported to the Minister as a discovery. Table 2 lists the substances of potential concern and the concentration amounts for the applicable media, including soils, groundwater, and surface water.

It should be noted that the numbers in Table 2 should not be viewed as 'pollute to' numbers and are intended to provide a point where the Ministry of Environment needs to be engaged to ensure that further investigative measures take place. The concentrations in Table 2 are also not cleanup or remediation objectives for impacted sites.

Follow-up Written Reporting Discharge or Discovery

When an immediate verbal report is required, it must be followed up with a written report within 30 days of the verbal report. The Saskatchewan Discharge or Discovery Report Form should be used to meet this requirement.

A follow-up written report is not required if the verbal report was made under The Oil and Gas Conservation Act or The Pipelines Act, 2012.

A written report is required for discovery of a discharge that may cause an adverse effect or that meets the requirement as outlined in the Act, code or standards within 30 days of the discovery. Use the Discharge or Discovery Report Form found on the ministry's website. In cases where a consultant's report is prepared, the form must be submitted in conjunction with the report.

When completing the written report, provide only the information applicable or known. If unknown, enter "UNK." If not applicable, enter "N/A." This avoids forms being returned as incomplete because the

ministry will know that the field was not forgotten or ignored. When all assessment and corrective actions have been completed within 30 days, the written report can serve as the closure report along with any supplemental documents attached such as internal incident reports, pictures and diagrams.

Reporting to others

In addition to reporting to the Minister, owners of any affected land that are not the responsible parties must be notified. The Minister may also require that others be notified.

If you are the landowner, or the person responsible, and discover a substance that may cause or is causing an adverse effect, you must report the discovery to the Minister and to any adjacent landowners or other individuals who may be affected. Even if a discharge is confined to a responsible person's property, it may affect neighbours (inhalation hazards), livestock and pets. The person responsible must take all reasonable measures to notify the affected property owner. Proponents are encouraged to contact the ministry for assistance if they are unclear about their discharge reporting obligations.

Joint report

If more than one party is involved in a discharge or discovery, a joint report may be prepared and submitted to the Minister to avoid duplication of effort.

Failing to report

In previous legislation, it was not clear whether historical discharges were to be reported. However, with EMPA, 2010, reporting the discovery of historical impacts is now a legal requirement. The reportable substance list and the Discharge or Discovery Report Form have also been updated to align with federal legislation and requirements. A person who fails to report discoveries of adverse effects may face administrative sanctions by the Minister and/or professional sanctions if governed by a professional association. Failure to report a discharge or discovery of a substance causing an adverse effect or the spill of a pollutant can, at the discretion of a court, result in a fine up to $1,000,000 and/or up to three years in jail.

The Discharge Reporting Process

If you experience an environmental discharge that exceeds the criteria specified in Table 1 of the Discharge and Discovery Reporting Standard, and/or may cause an adverse effect, as well as any other environmental emergency, call the toll-free Provincial Spill Report Centre (1-800-667-7525), and provide the following information to the best of your knowledge:

- your name and telephone number, fax number and email address;
- location and time of the discharge (e.g. city, town, address, highway number, land location);
- shipper name/consignee/point of origin;
- type and quantity of pollutant discharged (United Nations product number of dangerous goods if applicable, product name, volume spilled);
- description of the discharge site and immediately surrounding area (soil type, on or near surface water, drainage characteristics, groundwater depth, proximity to dwellings, location of domestic service lines, etc.);
- what agencies have responded and who is on scene;
- local weather conditions (wind direction and speed, rain, snow, etc.);

- names and contact information for all persons notified of the discharge;
- known causes and effects of the discharge;
- first response and remedial actions that have taken place with respect to the discharge (containment work at time of discharge), and
- further action or work that is contemplated or required (details of clean-up and restoration procedures, and details of disposal, including location and procedures).

The Discovery Reporting Process

The discovery of a substance that poses an immediate risk to the environment or human health must be immediately reported to the Minister using the toll-free Provincial Spill Report Centre (1-800-667-7525). A discovery of a substance that exceeds criteria specified in Table 2 of the Discharge and Discovery Reporting Standard, and/or may cause an adverse effect must be reported to the minister within 30 days using the Discharge and Discovery Report Form.

Exceptions to Reporting

You do not have to report a discharge if it has been reported as part of an approved permit, license, or Minister-approved order or environmental protection plan.

If you previously reported a discovery, you do not have to report it again under the new requirements. You can confirm the status of your site through the search feature at SaskSpills.ca or by contacting the ministry's Client Service Office at 1-800-567-4224 or by email at Centre.Inquiry@gov.sk.ca.

Alternative Notification Procedures in Environmental Protection Plan

Alternative notification procedures are only allowed if outlined in an approved environmental protection plan. As a minimum:

- For assigned fixed facilities, the minimum notification acceptable is telephone or email to the environmental protection officer or designate within three business days of the incident. Each approved EPP may have different time frames.
- The notification must include all information that would be covered in a call to the Provincial Spill Report Centre.
- The notification must include details of the immediate response.
- The Visual Site Assessment Checklist or other documentation (ICS forms or incident pre-plans) must be maintained for ministry review.
- A list of all incidents and immediate actions and reclamation status are to be included in the annual report.

Environmental Protection Plan

Discharge and discovery reporting can be included in an EPP and replace the requirements of the Discharge and Discovery Reporting code chapter. For an EPP to be approved, it must meet and address

results-based objectives and be in a form and format acceptable to the Minister. An EPP must ensure that:

- safety of responders is paramount;
- public safety and environmental protection have priority over infrastructure integrity and business continuity; and
- appropriate corrective actions are implemented in timely manner.

An EPP for discharges may not be applied to the following:

- substances that are classed as a "toxic inhalation hazard" in accordance with the *Transportation of Dangerous Goods Regulations* (Canada);
- any substance that is acutely toxic to human health in low doses;
- any industrial or mine waste discharge off site greater than 100,000 L;
- all EPPs that may affect adjacent landowners shall be approved by the effected person;
- a discharge or discovery that results in off-site impacts and impacts a third party, or
- discharges or discovery of substances that pose a serious risk to the environment or public health or safety.

Subjects that an EPP must address include the following:

- **Substance**: in all cases, the volume and concentration triggers in Table 1 and 2 of the Discharge and Discovery Reporting Standard will apply and the EPP shall address each substance individually that the proponent wishes to be covered by the EPP.
- **Incident action plan (IAP)**: must be consistent with the National Incident Management System Incident Command System (NIMS ICS) and the principles laid out by ICS Canada (http://www.icscanada.ca/en/about+ics+canada.html) and must include the information on the following ICS forms:
  - ICS 201, Incident Action Plan;
  - ICS 202, Incident Objectives;
  - ICS 203, Organization Assignment List (Who does What)
  - ICS 204, Assignment List (How work is done)
  - ICS 208, Site Safety and Control Plan
  - ICS 215A , Safety Analysis

  The plan is to include the following:
  - Immediate response action;
  - Medium-term corrective action, including reclamation options;
  - Risk management plans that are consistent with the facility's overall decommissioning and reclamation plans.

STEP 2: SITE ASSESSMENT

Introduction

Environmental site assessment, sometimes referred to as site characterization, is the process of evaluating the environmental condition of a site. This includes verification of the presence of contamination, identification of specific contaminants, understanding the affect and distribution of the contaminants in environmental media and evaluating the risk the contaminants pose to environmental and human receptors. **Figures d** and **e** show schematics representing the acceptable and alternative solutions for the site assessment process.

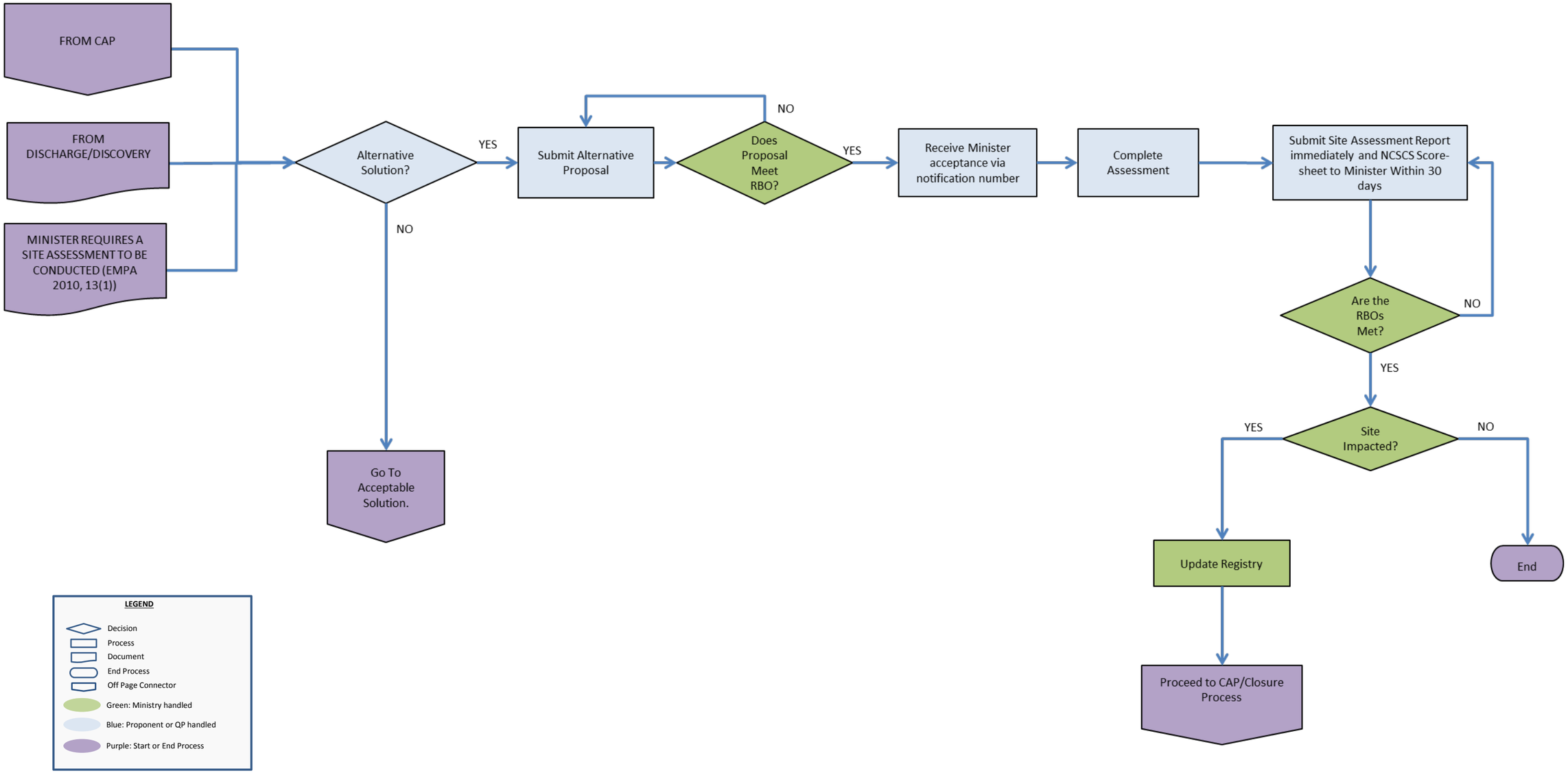


Figure d: Schematic of the Alternative Solution Process for Site Assessment

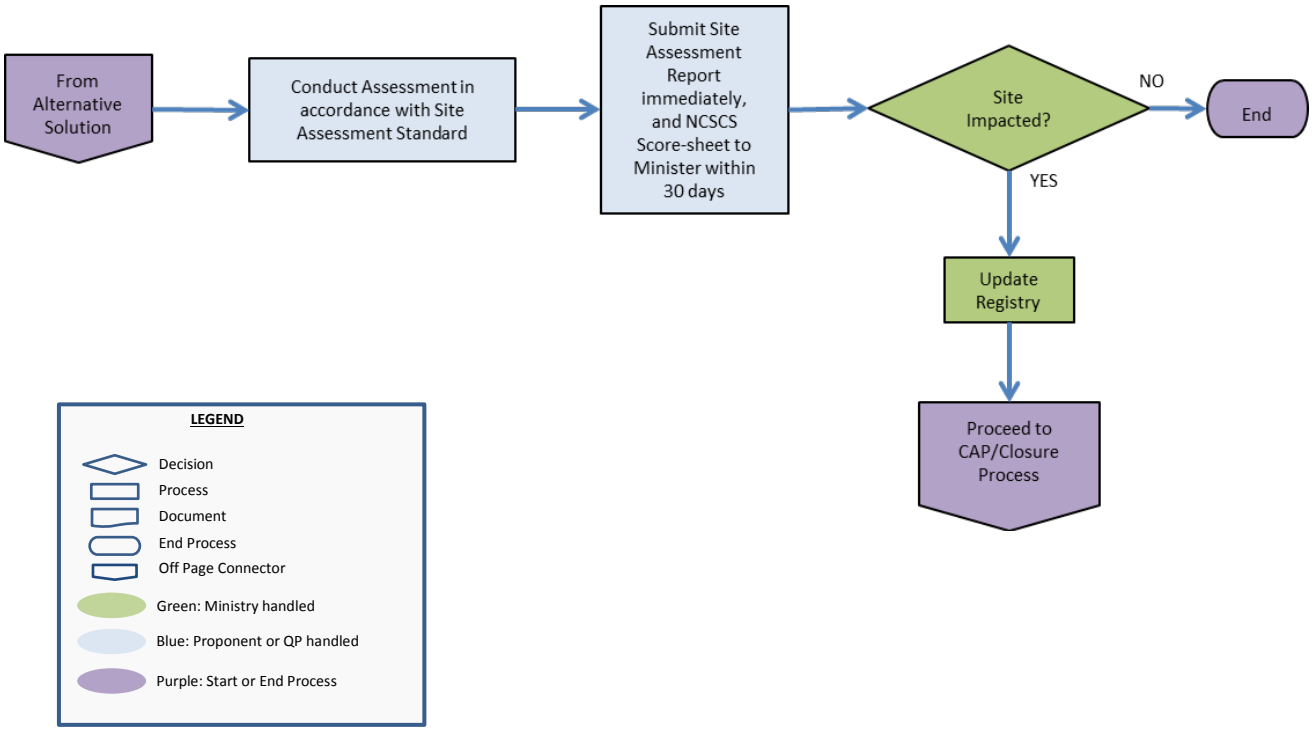


Figure e: Schematic of the Acceptable Solution Process for Site Assessment

Site assessment is a phased process, with each phase supplementing the subsequent phases. These phases are given different names in literature, but generally comprise of the same strategies at each stage. The first, Phase I, is often referred to as a preliminary site assessment or Stage I assessment. It consists of a non-intrusive investigation that identifies potential areas of concern and substances of potential concern which may need to be investigated further in subsequent phases of work (CAN/CSA 2012; Sara 2003). This phase of assessment is often followed by a more comprehensive approach referred to as a Phase II, Stage II or detailed site assessment. The latter is an intrusive survey, including physical testing and sampling of environmental media, intended to confirm the presence of substances of potential concern (SOPCs) and determine their spatial distribution (CAN/CSA 2013; Sara 2003).

The terminology used throughout this guidance document will be consistent with the Canadian Standards Association environmental assessment standards. This guidance document will primarily focus on Phase II site assessments. The elements of phase I assessments will be discussed in the context of providing background to a phase II assessment. The development of corrective actions based on the results of phases I and/or II is sometimes referred to as phase III of the assessment process. This later activity, i.e. the formulation of a corrective action plan will be addressed in later sections of the guidance document.

The Site Assessment code chapter was developed to ensure the information gathered during a site assessment will provide a scientifically defensible framework for the development of a corrective action plan. Proponents are expected to apply scientific rigor to data collection and analyses. This will provide a defensible framework for formulating corrective actions to achieve remediation endpoints. In turn the ministry will provide regulated parties with greater clarity regarding what the province expects in an

environmental site assessment. This document is intended to bridge the gap between the science of site assessment and the requirements set out in the environmental regulatory framework in Saskatchewan. It is not intended to be a comprehensive technical document.

Table C highlights the new business process requirements introduced in EMPA, 2010. The new assessment elements required under the code will be discussed throughout the following sections.

Table C: Site Assessment - New Business Process Requirements

New in EMPA, 2010
• The Minister has the authority to require a site assessment. This may occur in the event that off-site or third party impacts are suspected. • Site assessments must be signed off by a qualified person. • It is now a legal requirement to complete and provide the Minister with the National Classification System for Contaminated Sites Summary Score Sheet. • The Minister will file all acceptable site assessments received in the electronic registry. In the future, with some restrictions (e.g. protection of privacy), site assessments may be publicly accessible.

Who Conducts a Site Assessment?

Site assessment is the first critical step in addressing the effect of substances of potential concern within the environment. The assessment results will be used to determine whether corrective actions are required and what the most effective corrective actions will be. In this way, the assessment will have a bearing on the future value of the property.

Site assessments must be conducted by a qualified person as defined in section 1-3 of the Site Assessment code chapter. Qualified persons can be engineers, geoscientists, technologists, agrologists, and/or other professionals as designated by the Minister of the Environment depending on the activity undertaken. There are only three different activities within the site assessment code chapter that require review or sign-off by a QP:

- certifying an environmental protection plan;
- completing a visual site assessment; and
- certifying quality assurance and quality control sampling and analytical procedures.

Details regarding the evaluation and management of qualified persons can be found on the Ministry of Environment's website.

Standards Reference

The standards cited in **Table D** are referenced by the Site Assessment Chapter of the Saskatchewan Environmental Code.

Table D: Standards Referenced in the Site Assessment Chapter

Standard	Description
CAN/CSA-Z769-00 (R2013) Phase II Environmental Site Assessment Standard **Developed by**: Canadian Standards Association	This standard establishes the principles and practices that are applicable to a Phase II site assessment. The objective of a Phase II Environmental Site Assessment is to define the nature and extent of any environmental impacts at a site through an intrusive sampling program. It provides a consistent framework and minimum requirements for conducting Phase II site assessments, as well as addresses pertinent site-specific requirements. This framework involves developing a sampling plan, preparing for and

Standard	Description
	undertaking an investigation for sampling and measuring, and interpreting and reporting on the information gathered. The CAN/CSA-Z769-00 (R2013) and its use as an assessment framework will be discussed further in subsequent sections.
Visual Site Assessment Standard **Developed by:** Ministry of Environment (new)	This standard provides proponents the ability to do a visual site assessment (VSA) for those discharges that do not warrant a comprehensive Phase II site assessment. The Standard is intended for use with spill incidents, where the nature and distribution of the SOPC is precisely known. The standard provides an approach for timely reclamation where the nature of the impact does not warrant a comprehensive Phase II site assessment.
Discharge and Discovery Reporting Standard **Developed by:** Ministry of Environment (new)	This standard provides the reporting amounts and concentrations for discharges and discoveries of substances that may cause or is causing an adverse effect. The standard is provided in the form of Tables 1 and 2. These tables provide values for reportable substances, concentrations and amounts by chemical name. Also referenced in: Discharge and Discovery and Site Assessment guidance sections.
Qualified Person Certification Standard **Developed by:** Ministry of Environment (new)	This standard applies to qualified persons and provides clear direction on the information required when a qualified person provides a certificate of qualification to the Minister. The certificate is required when the qualified person is providing an opinion to the Minister on aspects such as an environmental protection plan, environmental sampling, operating plans, or design plans. In such cases the qualified person provides a certificate stating that, in his or her opinion, the quality assurance and quality control for sampling and analytical procedures produce accurate, precise and reliable results. The documentation helps ensure that consistent and valid information is provided to the ministry. Also referenced in: Discharge and Discovery, and Corrective Action Plan guidance sections.

Requirements

The Site Assessment code chapter allows assessments to be completed as an acceptable or alternative solution. In many ways, the required technical elements are the same for both assessment strategies and the proponent is required to achieve the same standard of defensibility regardless of which method is chosen. The two strategies differ in their scope and in their administrative handling by the ministry. In the case of the alternative solutions, the scope of work for the assessment must be submitted to the Minister for review and acceptance prior to commencement of assessment activities. An overview of the elements that must be considered when conducting assessments is discussed in subsequent sections.

The Site Assessment code chapter is comprised of three parts:

- Part 1 is a general section that applies to all site assessments;
- Part 2 outlines the requirements of an alternative solution, and
- Part 3 outlines the requirements of an acceptable solution.

Details of the technical considerations required to complete a site assessment are not provided by the ministry. It is the responsibility of qualified persons to be familiar with the current theory and practice prior to undertaking site assessments. In subsequent sections, references will be made to approved methods and critical reporting elements that must be utilized in conducting a site assessment

General Requirements

The provisions described in Part 1 apply to all site assessments activities. This section references section 13 of The Environmental Management and Protection Act, 2010 and defines the meaning of qualified person in the context of performing site assessments. Those completing a site assessment should maintain records pertaining to data collection and analysis for period of seven years. The records may be requested by the Minister in the event of an audit. A list of the records to be maintained is provided in section 1-5 of the chapter. As shown in **Figure d** and **e**, a National Classification System for Contaminated Sites evaluation should be submitted to the Minister within 30 days of completing the site assessment. The primary intent of a site assessment is to identify the vertical and horizontal limits of the substances of potential concern and report the findings to the Minister in a timely manner. Reporting requirements will be discussed in a subsequent section.

Alternative Solution

If it has been determined that an environmental site assessment must be done in pursuit of site closure or as directed by the Minister, then the results-based objective, as defined in the code chapter, must be met. The alternative solution explicitly defines the RBO that must be met when conducting a site assessment. For this reason it is presented ahead of the Part 3 Acceptable Solution.

The RBO of this chapter is to limit the probability of unacceptable adverse effects resulting from the discharge or discovery being addressed, and to ensure that the assessment itself doesn't further exacerbate the impact being assessed. Some of the performance objectives that are required to satisfy the RBO include:

- confirming the presence, characterization, location and extent of substances of potential concern and evaluating the sources, pathways and receptors;
- developing a sample plan that is representative of the site;
- ensuring that data is interpreted appropriately, and
- providing a scientifically defensible framework for corrective action that meets the results-based objective.

Please see section 2-1 of the Site Assessment code chapter for the full list of results-based objectives.

In certain cases, an alternative approach to site assessment may be required to adequately identify risk associated with an environmental contaminant in order to meet the results-based objective. An example of this scenario is the case where corrective action plans and environmental site assessments are completed simultaneously. This may occur when a regulated party conducts delineation while excavating in order to mitigate a discharge. Where a site assessment is carried out as an alternative solution, the scope of the assessment must be submitted to the Minister for acceptance prior to the work being undertaken.

An alternative solution to site assessment must meet the results-based objectives of the code chapter.

The purpose of a site assessment is to verify the presence of substances of potential concern, characterize the source, nature and distribution of the substances, and to evaluate the risk the substances pose to human health and/or environmental receptors. The approach must provide sufficient data so that meaningful conclusions can be drawn about the environmental state of the site. Based on these conclusions the proponent can develop corrective actions.

A phased site assessment approach begins with a review of documentation and historical information about the site, and will lead to field investigation of appropriate size and complexity to address the presence of SOPCs. The assessor must consider all relevant environmental media (e.g. water, soil and air) and characterize the sources of the substances that may cause or are causing an adverse effect in each media. The proposed assessment solution must result in characterization of the geological and hydrogeological site conditions, transport pathway for the migration of SOPCs, and potential receptors susceptible to the effects of the SOPCs.

The alternative site assessment must develop a systematic plan for sampling all relevant environmental media. The sampling plan must be included in the alternative solution scope of work proposed for ministerial review and must be appropriate to the level of complexity and severity of the adverse effect. The methods for acquisition of samples should be documented and explained. Analysis of environmental samples and interpretation of the resulting data must be completed using accepted methods and procedures.

The alternative solution must be conducted in a safe and acceptable manner by taking reasonable and prudent measures to avoid additional adverse effects; that is, the assessment itself should not become the source of additional adverse effect to the environment. This includes minimizing human contact with any SOPCs. For example, an extensive drilling program of improperly installed monitoring wells or inappropriately decommissioned test holes that would serve to connect two previously isolated geological units.

Proposing an alternative solution requires presenting the scope of the site assessment in the form of an environmental protection plan (Note: for the purpose of EMPA, 2010 section 2(k) an EPP is any document submitted to the Minister that details proposed action to prevent, investigate, correct an adverse effect, it is a nomenclature used in EMPA that has been adapted for effective and consistent implementation) that sets out the methods that will be employed to satisfy the results-based objective described above. The plan must be certified by a qualified person stating that the methods and components in the environmental protection plan, if carried out in accordance with that plan, will satisfy the results-based objective. The plan and the certification are submitted to the Minister for acceptance. As an example of an alternative solution site assessment if a proponent wants to assess only the applicable human health exposure scenario and has justified the elimination of the ecological scenarios this can be done and significantly reduce investigation costs as most human health scenarios are only applicable in the top 1.5 m of soil strata. Ultimately, any proposed site assessment solution must provide a scientifically defensible framework for the formulation of corrective actions which may include ongoing monitoring and management of the site.

Acceptable Solution

By implementing the acceptable solution, it is understood that the results-based objective, discussed above, is inherently satisfied. The acceptable solution references the Visual Site Assessment Standard as a starting point for site assessment activities. The VSA is intended as a

method for addressing minor impacts which can be controlled or remediated quickly. Details for the VSA will be discussed in a subsequent section. For discoveries of historical impacts or those sites where the environmental impact is beyond the scope of the VSA, a comprehensive site assessment must be completed.

Visual Site Assessment

Visual site assessment has already been referenced above. This standard provides a systematic approach to remediating impacts caused by discharges of hazardous substances or waste dangerous goods into the environment. It provides a reasonable assessment approach for those discharges that do not warrant a detailed environmental site assessment (ESA), where:

- the discharge was immediately reported;
- the precise location of the discharge is known;
- corrective actions can be implement within 72 hours of discharge reporting;
- corrective actions will be completed within 30 days;
- a sufficient buffer zone exists between the discharge point and sensitive receptors, and
- no fish-bearing waters have been affected.

The Visual Site Assessment Standard contains seven questions. These questions will help verify whether the VSA applies to the discharge scenario. The advantage of achieving closure under the VSA is that the scope of the remedial activities is well defined, low complexity and therefore closure can be achieved without a detailed ESA. For discharges that cannot be completed within the scope of the VSA, the proponent must proceed to a complete a detailed ESA as discussed in the following section.

Developing an Environmental Site Assessment Strategy

The Canadian Standards Association (CSA Group) document CAN/CSA-Z769-00 (R2013) - Phase II Environmental Site Assessment is the acceptable solution standard for completing a phase II site assessment in Saskatchewan. In the past, the ministry has informally referred to this document to provide guidance in conducting phase II assessments. Under the new regulatory framework, strict adherence to the document is mandatory.

The purpose of the CAN/CSA-Z769-00 (R2013) is described as a standard designed to establish the principles and practices that are applicable to a Phase II environmental site assessment. It is intended to provide a consistent framework for conducting Phase II ESAs and to specify minimum requirements intended to accommodate broader regulatory and liability requirements. The CAN/CSA-Z769-00 (R2013) describes environmental site assessment as an iterative process. The iterative nature of the ESA results from the assessors evolving knowledge of the site as environmental data is obtained and interpreted. Renewed understanding of the site may reveal increased complexities that will require modifying investigation methods or require changes of the scope of work. A large part of the iterative process should take place during the field investigation component of the ESA (Rowe 2001). **Figure f** presents a schematic of the iterative ESA process.

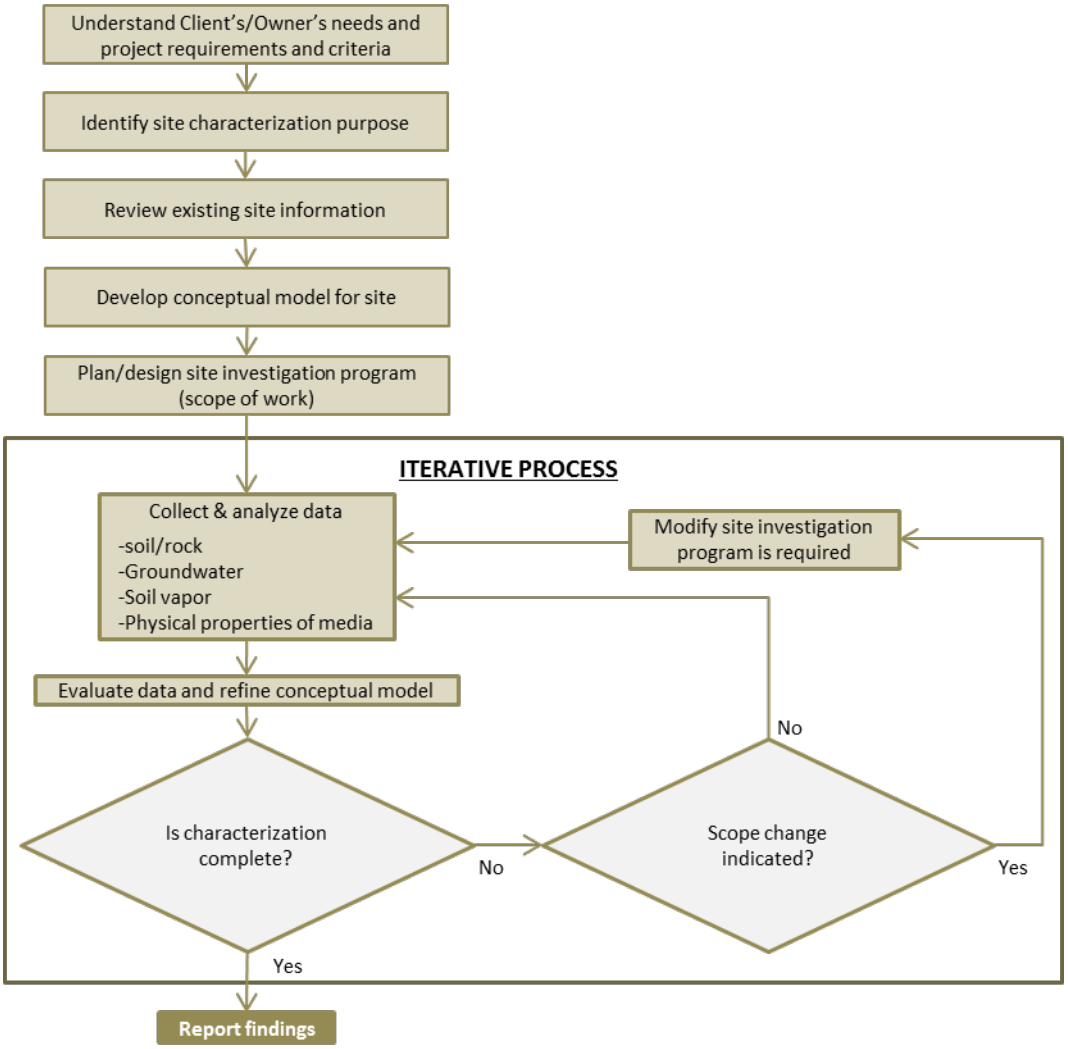


Figure f: The Iterative Process of Completing a Site Assessment

(Modified from Rowe, 2001)

The CAN/CSA-Z769-00 (R2013) strongly suggested that an assessor conduct a thorough Phase I investigation with reference to the CAN/CSA Z768-01 (R2012) - Phase I Environmental Site Assessment. If a formal Phase I assessment is not complete, key elements of a CAN/CSA Z768-01 (R2012) guided assessment must be completed in order to:

- provide background for the reviewer;
- ensure all SOPCs have been considered;
- provide the assessor with information to adequately plan the Phase II assessment; and
- provide a basis for the conceptual site model.

The background information about the site must be complete. It is the baseline by which the rest of the report is evaluated. Essential background information includes, but is not limited to:

- commodities handled at the site;
- type of storage facilities used;
- site operational history;
- companies who operated the site; and
- review of prior environmental investigations.

Factors overlooked at the assessment stage can become future liabilities for site users.

Conceptual site model

Conceptual Site Model (CSM) is a qualitative simulation of the environmental status of a site. It shows the interrelation between contaminant sources, pathways and receptors on a contaminated site (Rowe 2001). Developing a CSM is an essential part of systematic planning and will provide the assessor with the following:

- a better understanding of all potential sources, pathways and receptors in the impacted area;
- support the selection of sampling locations and establishing background concentrations;
- identify data gaps and uncertainties that can be addressed by sampling;
- a tool for summarizing and communicating the environmental state of the site.

The CSM is a scalable element of the site assessment. The CSM should be concise and only consider the key factors that affect the environmental status of the site. Many agencies provide peer reviewed guidance for development of CSMs. These include the Canadian Council of Ministers of the Environment (1996a), and the Contaminated Sites Working Group (1999). The ASTM Standard Guide for Developing Conceptual Site Models for Contaminated Sites (2008) provides concise guidance on developing a CSM.

Scope of assessment

The scope of work (SOW) outlines the elements to be evaluated. These elements will proceed directly from the background information, and conceptual site model for the site. The SOW must contain at minimum the following elements:

- objective of the assessment;
- environmental media being investigated;
- a site assessment plan; and
- proposed data gathering and interpretation methods.

Assessment must be a flexible process since findings during the ESA may necessitate changes of scope. The SOW can serve as a check to ensure the assessment objectives have been met.

Sample plan design

A soil sampling plan is designed in accordance with the background information covered in previous sections. An adequately designed sampling plan will at minimum contain the following:

- sampling objectives;
- justification for the proposed sampling strategy (See Table 1 in the Discharge and Discovery Reporting Standard);
- number of samples to be collected for vertical and horizontal delineation;
- detail of investigative methods to be used (e.g. hand auger, boreholes, test pits);
- consideration of ongoing monitoring locations (groundwater and/or gas monitoring);
- location (survey site map, depth and frequency of sampling). An accurate site map should be used;
- precautions to protect the environment, prevent cross contamination and prevent the creation of new adverse effects; and
- health and safety considerations for the protecting assessors.

The two primary types of sampling methods are Targeted and Non-targeted (i.e. systematic) sampling. A brief overview of these methods and their applicability is summarized in **Table E**. Composite sampling is a method that can be used in both a targeted and non-targeted sampling strategy (USEPA 2002). Composite sampling may be used as a decision making tool, provided the assessor is aware of its limitations. This includes, but is not limited to the following:

- Composite samples are subjected to handling and processing in the field making the technique not acceptable for soil or groundwater samples involving volatile organics (ASTM International 2006; Environment Canada 1994).
- Delineation of a contaminant plume cannot be accomplished using composite sampling.
- The sample processing required may compromise the integrity of samples or introduce contaminants.

Composite sampling can be a reliable decision making tool at various stages of site assessment, provided that the assessor evaluates all statistical considerations (ASTM International 2006).

Table E: Sampling Methods and Acceptable Usage

Method	Description	Acceptable Use
Targeted	Selective sampling of specific areas on-site. Used when: • location of contaminants known *a priori*; site history confirms specific area of impact. • exploring whether SOPCs exist; exploring characteristics of impacted media.	*Assessment*: To verify presence of SOPCs; preliminary assessment. *Closure*: Must be combined with a non-targeted, or systematic sampling. Cannot be used to verify site condition.
Non-targeted (systematic)	• used to obtain representative data on condition of entire site. • has a statistical basis; uses analytical method to determine appropriate number of samples for a desired confidence level.	*Assessment*: evaluation of contaminant distribution; defensible basis for CAP preparation. *Closure*: confirmatory sampling; choosing monitoring location for long-term CAPs (e.g. risk management).
Composite	• Amalgamation of 2 or more samples. • Requires careful consideration of representative size and sampling statistics.	*Assessment*: To verify presence of SOPCs; preliminary assessment. *Closure*: Waste characterization for disposal only.

Derived from the Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination (Monitor Environmental Consultants Ltd. 2000).

Sampling at most impacted sites will conform to one of three sampling scenarios:

1. The exact distribution of the contaminants is unknown at the site.
   An example of this is a former industrial facility where chemicals may have been handled or stored anywhere throughout the site. The site assessor must determine whether contaminant "hot spots" exist at the site.

2. The distribution of contaminants onsite is well known and verified according to historical operations records.
   An example is a service station where meticulous records confirm that no discharges have occurred at the site and the location of former storage containers (e.g. underground storage tanks or above ground storage tanks) is known.

3. Confirmatory (closure) sampling is being conducted subsequent to source material excavation. The samples are analyzed to ensure that a sufficient volume of source material has been removed.

In the first scenario, targeted sampling alone cannot be used to delineate contaminant pathways and distribution. A systematic sampling approach must be used in order to achieve closure for the site ((Gilbert 1987; Hutchings *et al*. 2006). The method used must be statistically defensible, such as the method presented in the Appendix (Gilbert 1987). The method is based on detecting a hot spot with 95 per cent confidence using a square sampling grid and considering an appropriate hot-spot size. Other similar methods include those presented in literature (Gilbert 1987), and the use of a program such as Visual Sample Plan. In all cases the methods used must be described and provided for review.

The method described in the Appendix requires the assessor to choose a "reasonable" hot-spot size. This is defined as: the largest area of contamination that could be dealt with if it were not identified during the investigation phase, but discovered only after development work on the site had started (BSI 1988). This implies that hot-spots remaining on site should not be large enough to cause future adverse effect to receptors. The determination of contaminant hot-spot size will require some analysis. In most cases this can be estimated using soil/groundwater information obtained during basic site assessment. The rationale for choosing a hot-spot size must be clearly presented.

In the second scenario, the background information or historical investigations definitively confirms that contamination is localized. In this case the assessor must determine the minimum number of samples required to delineate the suspected sub-area onsite (see Appendix). Where a contaminant hot-spot is detected, the assessor can use a step-out delineation technique to refine his estimate of the impacted soil volumes. Once lateral sample locations have been established the assessor must collect sufficient samples vertically at each location to achieve vertical delineation. When completing the site assessment as an acceptable solution, delineation is complete when measured concentration of the SOPCs is below the values in Table 2 of the Discharge and Discovery Reporting Standard. The requirement for delineation of SOPCs is limited to those anthropogenic substances identified, known to be present, or that may be reasonably expected to be present in soil, ground water or surface water based on past or present land use at the site. Alternative delineation guidelines may be proposed as an environmental protection plan in place of Table 2 criteria.

In the third scenario, impacted soil has been excavated to remove source material for off-site disposal. This should be considered when choosing a hot-spot size in confirmatory sampling according to the Appendix. A hot-spot diameter should be chosen such that the residual source material does not pose a risk to future on or off-site receptors. The chosen sampling strategy must be flexible and adaptable to accommodate uncertainties on site. Sampling locations should be recorded with sufficient precision to allow for future follow-up confirmatory sampling if required.

A strictly statistical approach to site sampling may not be applicable to every site, but is the method best suited to meet the minimum elements required for an acceptable solution in site assessment. There is no substitute for professional judgment. If at any time a qualified person feels that another approach is more applicable, an alternative solution can be proposed for consideration.

Groundwater monitoring wells

Where groundwater impacts are known or suspected, monitoring wells are typically installed following soil sampling. Groundwater monitoring wells can be used to:

- determine the predominant direction of groundwater flow;
- quantify the physical and transport properties of the soils and contaminants (e.g. hydraulic conductivity, dispersion coefficient); and
- monitor the concentration of contaminants in groundwater.

Monitoring well locations should be chosen to facilitate effective monitoring and evaluation of groundwater condition at the site. The following principles are minimum considerations for the best placement of monitoring well locations (Lu et al. 1985; Schwartz 2003):

- a minimum of 3 monitoring wells are required to approximate groundwater flow direction;
- a minimum of one well should be placed up-gradient to establish background water quality conditions;
- where a contaminant plume exists, sufficient number of wells should be installed to delineate the plume boundaries,
- sufficient number of wells should be placed to monitor down-gradient transport,
- where vertical migration is a concern, an evaluation of vertical hydraulic gradient and transport properties should be conducted; and
- monitoring well installation must avoid creating a conduit for contamination migration between multiple water-bearing strata. This includes both saturated and unsaturated soil strata.

A discussion of monitoring well design considerations must be included where groundwater investigations are conducted. To justify the number and location of groundwater monitoring wells, a systematic method similar to that used for soil sample collection may be used (CCME 1993).

Sample Collection and laboratory analysis

When collecting environmental samples, the assessor must collect, preserve, store and handle samples in accordance with a method approved by a standards-setting organization. Samples submitted for laboratory analysis must be analyzed by a laboratory accredited pursuant to the requirements of the Canadian Association for Laboratory Accreditation in accordance with the parameters for which the laboratory has been accredited.

If no standard or accredited method exists for the collection and/or analysis of the SOPCs at a site, the assessor must develop appropriate methods for the SOPCs. These methods should be appended to the site assessment report or available for review upon request. It is the responsibility of the qualified person to certify the quality assurance and quality control for sampling and analytical procedures produce accurate, precise and reliable results. Additional guidance on sampling is provided in the Corrective Action Plan section of this guidance document.

Additional Testing and Validation

Relative Per cent Difference (RPD)

Precision is a quality control measure that can be evaluated using duplicate environmental samples. It can be evaluated using duplicate samples. It can be applied to both field duplicates, to assess the consistency of samples collected in the field, or to laboratory duplicates to assess the precision of

the sample laboratory analysis. The RPD should be assessed with the characteristics of the analytical method and instrumentation used to determine laboratory concentrations, that is, with respect to the method detection limit (MDL) for the specific substance of concern (New Jersey Dept. of Environmental Protection 2014).

When evaluating sample duplicates precision may be considered poor if RPD values are outside of a reasonable range, even with sample heterogeneity considered (ANZECC 1996; USEPA 1990; USEPA 1997). Various values are proposed in literature for acceptable values of RPD. Some reference manuals designate analyte specific values for acceptable RPD (Perket 1986). It is possible to establish a program specific value of RPD by collecting a sufficient number of duplicate samples (Csuros 1994), and each laboratory will have its own RPD acceptability values. As a general rule, RPD values of less than 20 per cent indicate good correlation where the concentrations are greater than five times the MDL. Data yielding RPD values greater than 20 per cent should be viewed with caution and RPD values of 50 per cent indicate a lack of sample representativeness (BC Ministry of Water Land and Air Protection 2003; Mitchell 2006).

Background sample collection

For the purpose of this guidance document, background means locations that have not been influenced by discharges or activities from the impacted site under investigation, and represent the baseline conditions for the area in question. Background samples are often necessary to provide a baseline for comparison of site data. They are used to demonstrate whether the site conditions are truly different from the baseline condition. Areas where background samples are collected may be referred to as control areas. Control areas should be near the impacted site, and should have common characteristics with the impacted area except for the pollution source. Background samples should be collected:

- simultaneously with the on-site samples;
- under similar ambient conditions as the environmental test samples;
- prior to impacted site samples to avoid cross contamination from the sampling site;
- upwind, upstream or up-gradient of groundwater flow with respect to the impacted site; and
- from each strata (or soil-type variation within a strata), that correlates to the strata in which impacts occur. For example, if multiple soil types or soil horizons correlate to the zone where impacts are identified, then each should have a background established separately.

These will help normalize effects such as matrix interference on analysis and impart an acceptable degree of certainty to the analyses (CCME 1993). It is preferable to select a control area near the impacted site under investigation. The close proximity will improve similarity between the sites. However, when a suitable local control area cannot be found, a regional site can be used for background sample collection. In the latter case, background samples from other investigations in the region may be used if similarities exist between the media being tested, but site-specific background samples are preferable.

A minimum of four samples must be used to establish background concentrations in soils (DNR 1994) and one per 10 groundwater samples. More may be needed due to natural constituent occurrences and inherent variability within each distinctive soil horizon. Background samples must be collected in an area which has not been impacted by environmental contamination from the site and representative of natural background conditions. Based on SOPC, their mobility and soil type, an estimate of contamination depth should be made and background samples taken at comparable depths for the particular soil type. Multiple soil horizons should have background established

separately (e.g., minimum of four samples per each soil unit). The background concentration can be taken as the upper confidence limit for the samples obtained, assuming a lognormal distribution (DNR 1994; Gilbert 1987).

Reporting

Obligations

The report can be prepared in accordance with the acceptable solution format or an alternative solution format can be proposed to the Minister for acceptance. Regardless of the format, the report must fulfill the following obligations:

- unless otherwise justified, clearly identify any substance whose concentration meets or exceeds the limits set out in Table 2 of the Discharge and Discovery Reporting Standard;
- if a concentration other than those specified in Table 2 was used in delineation, this constitutes and alternative solution. Ensure that you include an explanation as to why that concentration was used;
- if the site is determined to be an environmentally impacted site as defined in EMPA, 2010, the proponent should include a statement to that effect;
- provide sufficient documentation to support that the results-based objective of the Site Assessment Chapter has been achieved, which is to limit the probability of unacceptable adverse effects resulting from the discharge or discovery being addressed, and to ensure that the assessment itself doesn't further exacerbate the impact being assessed; and
- be signed off by a qualified person.

After the site assessment is complete, and off-site impacts are verified, impacted third parties must be notified.

Acceptable solution format

The Environmental Management and Protection Act, 2002 and The Hazardous Substances and Waste Dangerous Goods Regulations both had requirements to assess the nature and extent of impacts prior to undertaking corrective actions; however, the form and format of environmental site assessments were handled by guidelines and policy. The Site Assessment chapter introduces a legal format previously handled by guidelines and policy. This will provide regulated parties with greater clarity regarding what is expected within an environmental site assessment report.

Once the field investigations and chemical analyses are complete, the environmental status of the site will be known. The Minister will consider a site impacted if:

- any of the substances of potential concern exceed concentrations listed in the reportable values listed in Table 2 of the Discharge and Discovery Reporting Standard; or
- if an adverse effect is noted regardless of the nature of the impacting substances.

The environmental site assessment report must provide the reviewer with the information necessary to support the conclusion about the site's status. This includes background information on the site and SOPC, details of the methodology employed, summary of the findings, discussion and interpretation of the findings, conclusions and recommendations, and any other supporting information. The information provided in the environmental site assessment report forms the scientifically defensible foundation for subsequent corrective action plans for the site.

In accordance the Site Assessment Code Chapter, all site assessments shall be submitted within 30 days of completing the assessment report. The site assessments shall report the results in a manner that meet the results-based objectives, or consistent with the manner described in this section of the guidance document. In addition, all site assessments shall be accompanied by the National Classification System for Contaminated Sites score sheet.

Table F provides a summary of the elements expected in an environmental site assessment report.

Table F: Contents to Include in the Site Assessment Report

Section	Content
Title Page	• Identify report type (Phase I Environmental Site Assessment, Phase II Environmental Site Assessment, etc.) • Provide site address/location (civic address, legal land description, and/or latitude/longitude co-ordinates) • Provide site owner contact information (company and contact name, telephone number, email address, mailing address) • Provide consultant information or author contact information (company and contact name, telephone number, email address, mailing address) • Provide ministry file reference information (file number, operation ID, case number, and/or notification number)
Executive Summary	• Provide synopsis of report, summary of work undertaken and key findings and conclusions.
Introduction	• Provide background information on site including a description of the processes at the facility associated with SOPCs and a summary of Phase I ESA findings. • Reference any regulatory requirements or directives given by the Ministry of Environment, such as acceptance requirements, environmental protection orders, or directions from the Minister or representative thereof. • Describe regional and site characteristics, including description of historical, current and anticipated land-use(s), description of current and historical structures (including known buried infrastructure), topography, preliminary site geology and hydrogeology. • Provide detailed site plan, photo mosaic, and/or aerial photograph with a 1:5,000 scale or finer resolution indicating major facility areas including waste handling areas and relevant surface features. • Describe objectives and scope of work. • Describe development of conceptual site model.
Methodology	• Provide basis for choosing applicable environmental quality standards. • Describe all field methods employed including: equipment used, methods of sample collection, field screening techniques, rationale table for the samples, sampling method, and analytical suite for each sampling location. • Provide statistical methods to support sampling frequency. • Describe quality assurance/quality control (QA/QC) protocol followed for sampling and handling soil. • Include details for any new non-standard method that was employed.
Results	• Identify sensitive receptors and pathways for soil and groundwater. • Provide summary of information on SOPCs discovered at the site, their concentrations and spatial extent (horizontal and vertical); include a description of potential for, or known, off-site migration of contamination. • Provide summary of all findings, including nil findings, resulting from the investigation • Provide dates to which all of the findings relate. • Present analytical results, including: tables of analytical results with values that exceed guidelines highlighted (compared to most relevant and current standard); and scaled

Section	Content
	figures showing site location, sample points, groundwater elevation maps (where applicable) and locations of exceedances. • Provide summary of hydrogeological and relevant geotechnical information and supporting survey information. • Provide a detailed site plan, or photo mosaic or aerial photograph at 1:5,000 scale or finer resolution indicating sampling locations where SOPCs concentrations are equal to or greater than the applicable criteria. • Provide statistical calculations to support sampling frequency. • Discuss analytical results as compared to applicable criteria, including consideration of potential sources and pathways to receptors. • Discuss anomalous data. • Discuss laboratory and field QA/QC results, including inconsistencies or anomalies in the data • Discuss novel approaches employed. • Provide results of NCSCS score evaluation
Conclusions and Recommendations	• Conclude whether SOPCs are present above applicable environmental quality standards; identify contaminants. • Describe the known physical extent of SOPCs on the property that are above applicable environmental quality standards. • Provide recommendations for further activities to address the identified impacts. • Provide professional sign-off, with original signatures, and registration/member number or a stamp/seal confirming the findings and conclusions contained in the report from a qualified person.
Limitations	• Identify parties authorized to use information in the report. • Provides information of limitations on liability and disclosure.
References and Supporting Documents	• Provide applicable citations for methods used. • Provide documentation and key exhibits to support findings and conclusions, including published works and guidelines. • Include all borehole logs where a sampling location is drilled, copy of laboratory data-sheets in appendices. • Provide all analytical results that must be presented on a site plan in a “pop” drawing (i.e. chemical analysis results tagged to the sample location in a balloon).

Alternative solution format

An alternative format to that described in the acceptable solution format section above may be proposed to the Minister for review and acceptance. The Minister will consider an alternative format if it fulfills the results-based objectives as described section 2-1 of the Site Assessment code chapter.

In accordance with Sec 13 of EMPA, 2010 all site assessments shall be submitted immediately upon completion. The National Classification System for Contaminated Sites score sheet must be completed within 30 days of completing the site assessment.

National Classification System for Contaminated Sites Spreadsheet

After completing the environmental site assessment, you have 30 days to complete and submit a National Classification System for Contaminated Sites Spreadsheet in the form provided by the Minister.

Information Note

A person may request a National Classification System for Contaminated Sites Spreadsheet from the Minister:

1) electronically by using the following link: www.environment.gov.sk.ca; or

2) by requesting a form from the Saskatchewan Ministry of Environment at:

Saskatchewan Ministry of Environment
1-800-567-4224 (toll free in Canada)
Centre.Inquiry@gov.sk.ca

The completed form may be submitted to the Minister in accordance with the directions set out in the form.

Review Process

Environmental site assessments are voluntary unless specifically requested or directed by the Minister. Regardless of whether a proponent conducts a site assessment through the voluntary or directed process, the requirements for an acceptable solution, as specified in this document, must still be met. Assessments submitted under the acceptable solution may not be reviewed, but all information associated with the assessment and corrective actions employed is reviewed with respect to the applicable results-based objectives when closure or notice of site condition is requested for the site. If, upon review of the information supporting closure of the site, the ministry identifies any deficiencies which call into question the validity of the conclusions being used to support the proposed closure of the site, the Minister may require the proponent to re-enter the assessment process to close the residual data gaps.

Assessments submitted as an alternative solution will be reviewed by the Minister with respect to the applicable results-based objectives and methodology initially proposed by the proponent when the alternative solution was approved. Consistently inadequate or deficient submissions may adversely affect the good standing of the qualified persons who complete the assessments. In other words, relying on ministry's comments through the submission process is not a substitute for adequately completing the assessment or sound and defensible practice.

The Minister will file all acceptable site assessments received in the electronic registry. In the future, the site assessments will, with some restrictions, be publicly accessible and therefore subject to public review and scrutiny.

General Records

Every person required to conduct a site assessment must ensure the following records are kept and retained for at least seven years from the date the record was created:

- all field notes related to the site assessment;
- all raw data used to prepare the site assessment;
- all correspondence and records respecting the site assessment, including any notifications sent to a person pursuant to section 1-8 of the code chapter and any access agreements that are entered into with any person;

- all information used to complete the National Classification System for Contaminated Sites Spreadsheet;
- records of any environmental sampling, analysis or monitoring that has been conducted, including:
  - results of any environmental analysis;
  - date, location and time of environmental sampling or monitoring;
  - name of the person collecting the environmental sample;
  - identification of the environmental sample type;
  - date of analysis of the environmental sample;
  - sampling method used;
  - name of the laboratory that performed the analysis of the environmental sample; and
- name of the person responsible for performing analysis of the environmental sample.

STEP 3: CORRECTIVE ACTION PLAN FOR REMEDIATION AND CLOSURE

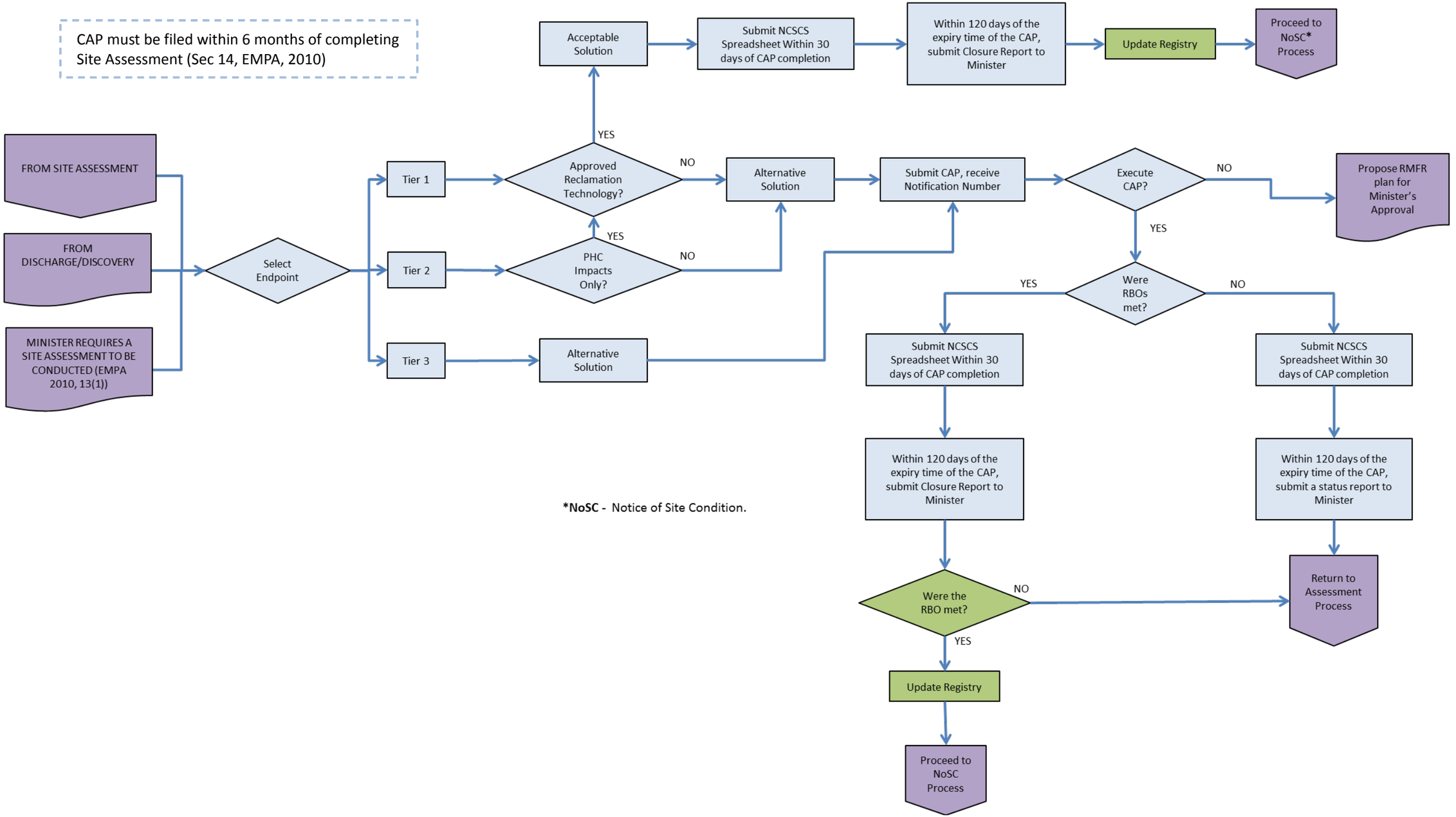
Introduction

A corrective action plan is a document that proposes remedial strategies to address environmental impacts at a given site. The document will outline the information required in order to assess the effectiveness of the proposed remediation activities. The effective corrective actions fundamentally depend on the information obtained from the site assessment. In brief, a CAP should provide background information about the site, assessment work completed, applicable standards for site remediation or chosen endpoints and what remediation techniques have been chosen in order to achieve the remedial endpoints.

In the past, every corrective action was reviewed by the Minister and only approved when the corrective action plan was comprehensive, containing all pertinent information. Under the new regulatory system, CAP submissions that meet certain criteria specified herein will no longer be subject to ministerial review. The proponent will be required to submit the CAP to the Minister, but can begin implementing the plan immediately upon submitting the CAP and receiving a Notification Number.

Some CAPs will continue to require ministerial acceptance prior to implementation. This depends on a number of factors that contribute to the complexity of the CAP, including the site and SOPC characteristics, the chosen remedial endpoint and the recommended remedial technology. In the latter case, the CAP will be reviewed by the Minister to determine its acceptability. When the plan is not acceptable, the Minister will identify deficiencies and ask that the plan be upgraded. When the plan is acceptable, the Minister will accept the proposal and issue a notification number then the project can begin. Submission of consistently deficient CAPs may adversely affect the good standing of the qualified person who completed the CAPs. The flowchart in **Figure g** outlines the process for CAP development, implementation and processing.

Specified timelines apply to sites within the directed process.



***NoSC** - Notice of Site Condition.

Figure g: Schematic of Corrective Action Plan Development and Processing

Table G highlights new business process requirements introduced in EMPA 2010. The requirements for Corrective Actions under the code will be discussed throughout the following sections.

Table G: Corrective Action Plans - New Business Process Requirements

New in EMPA 2010
• The Minister can require a CAP. • A CAP, as well as all chemical analysis conducted to support a closure report, must be signed off by a qualified person. • The proponent must complete and provide the Minister with the National Classification System for Contaminated Sites Summary Score Sheet. • Acceptable or alternative solutions are allowed. • Acceptable solutions, signed-off by a qualified person, replace detailed review and acceptance by the Minister. • A CAP completed under the acceptable solution, or an alternative solution that meets the RBOs of the CAP code chapter, is eligible for filing in the electronic registry. In the future, these will, with some restrictions, be publicly accessible. • For a CAP submitted as an acceptable solution, the Minister must be notified and the person submitting the plan must obtain the notification number prior to carrying out the corrective actions. • For a CAP submitted as an alternative solution the person submitting the CAP must receive acceptance from the Minister and obtain a notification number before carrying out the corrective actions.

Who Executes a Corrective Action Plan?

The corrective action plan must be certified by a qualified person as defined in section 1-4 of the Corrective Action Plan code chapter. Qualified persons can be engineers, geoscientists, technologists, agrologists and/or other professionals as designated by the Minister of the Environment depending on the endpoints (and the remediation techniques) chosen for the corrective actions.

Standards Referenced

The following standards are referenced by the Corrective Action Plan chapter of the Saskatchewan Environmental Code.

Table H: Standards Referenced in the Corrective Action Plan Chapter

Standard	Description
Administrative Control Standard **Developed by:** Ministry of Environment (new)	Describes administrative controls available for proponents wishing to use endpoints in CAPs that eliminate exposure pathways and/or receptors to ensure that the conditions that allow for the pathway/receptor modification remain applicable for the site. Exposure pathways are routes by which a receptor comes into contact with a contaminant (such as groundwater, inhalation and ingestion). To help ensure that the pathway can remain eliminated, some form of land-use controls will be required. These will take the form of administrative

<table>
<tr><th>Standard</th><th>Description</th></tr>
<tr><td></td><td>controls that may use some or all of the following:
title instruments;
zoning controls;
development restriction within a land use zone;
construction restrictions;
bylaws adopted by communities (for example, ground disturbance bylaw for certain land use);
access agreements;
transfer of liability agreements.</td></tr>
<tr><td>Reclamation Technology Standard

Developed by:
Ministry of Environment (new)</td><td>Allows proponents, through an EPP, to propose technologies and methodologies that would apply to impacted sites across the province to be allowed as corrective actions in the accepted solutions. Once the technology is proven and approved, it may be listed as an “approved technology.” Only a declaration in the CAP submission would be required and the technology would not have to go through the acceptance process again. Once notification was received the proponent could proceed with the CAP. Numerous technologies are suitable for remediation of impacted sites. Source removal by excavation is the primary technology used in Saskatchewan. Other in situ methods can be as effective without the disruption to infrastructure. Proponents need to describe the process to have technologies other than source removal by excavation approved and allowed in the accepted solution.</td></tr>
<tr><td>Endpoint Selection Standard

Developed by:
Ministry of Environment (new, use of existing guidelines)</td><td>Endpoint selection requires clearly established rules and an understanding of how endpoints are determined. This standard sets out the manner in which endpoint criteria are determined or referenced. This process has been used in a guideline format for petroleum-contaminated sites in Saskatchewan for a number of years. This standard formalizes the process and expands its use to apply to all types of contaminants.

Tier 1 endpoints: If you wish to choose the most conservative values for specific parameters, within a specified land use in the Saskatchewan Environmental Quality Standard, see the Tier 1 tables in the SEQS.

Tier 2 endpoints: You may reduce contaminant risks at a site by eliminating a certain exposure scenario and then referring to the next least conservative value for a particular substance in the SEQS. Performance, physical and administrative objectives describe what will be acceptable when justified and will be outlined for the following exposure pathways.

<table>
<tr><th>Human health:</th><th>Ecological:</th></tr>
<tr><td>soil ingestion;
soil dermal contact;
inhalation of indoor air;
protection of potable groundwater.</td><td>plant/invertebrate soil contact;
soil ingestion by livestock/wildlife;
protection of groundwater for aquatic life;
protection of groundwater for livestock and wildlife watering.</td></tr>
</table>

Application of the Endpoint Selection Standard and Reclamation Technology Standard will form the basis of the CAP.</td></tr>
</table>

<table>
<tr><th>Standard</th><th>Description</th></tr>
<tr><td></td><td>Tier 3 endpoints: Risk assessments or site-specific criteria derivations are classed as Tier 3 endpoints. This standard adopts the following documents to provide the methodology for human health risk assessments, ecological risk assessments, and development of site-specific criteria:
A Framework for Ecological Risk Assessment: General Guidance (PN 1195) (CCME 1996a).
Guidance Manual for Developing Site-specific Soil Quality Remediation. Objectives for Contaminated Sites in Canada (PN 1197) (CCME 1996b).
Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 2.0 (Health Canada 2012).</td></tr>
<tr><td>Saskatchewan Environmental Quality Standard (SEQS)

Developed by:
Ministry of Environment (new)</td><td>Prescribes concentrations of substances in the environment that are protective of the applicable pathway and land use. The standard contains all media (air, soils, sediments, and water) and is protective of the four CCME land use categories: agricultural, residential/parkland, commercial, and industrial.

The data is broken down into pathway-specific criteria, based on human health and ecological exposure scenarios as contemplated by the CCME. The most conservative values from the exposure pathways will be used as Tier 1 endpoints.

Tier 2 endpoints have pathway-specific values. The pathways are limited to those listed below as contemplated by the CCME.

<table><tr><th>Human health:</th><th>Ecological:</th></tr><tr><td>soil ingestion;
soil dermal contact;
inhalation of indoor air;
protection of potable groundwater.</td><td>plant/invertebrate soil contact;
soil ingestion by livestock/wildlife;
protection of groundwater for aquatic life;
protection of groundwater for livestock and wildlife watering.</td></tr></table>
The CCME provides guidance for a limited number of substances. The standard adopts those substances along with others from jurisdictions that used the same derivation methodology as the CCME.</td></tr>
<tr><td>Qualified Person Certification Standard

Developed by:
Ministry of Environment (new)</td><td>This standard applies to qualified persons and provides clear direction on the information required when a qualified person provides a certificate of qualification to the Minister. The certificate is required when the qualified person is providing an opinion to the Minister on aspects such as an environmental protection plan, environmental sampling, operating plans, or design plans. In such cases the qualified person provides a certificate stating that, in his or her opinion, the quality assurance and quality control for sampling and analytical procedures produce accurate, precise and reliable results.

The documentation helps ensure that consistent and valid information is provided to the ministry.</td></tr>
</table>

Standard	Description
	Also referenced in: Discharge or Discovery Reporting and Site Assessment guidance sections

Requirements

The Corrective Action Plan code chapter is closely tied to the Endpoint Selection Standard. Much of the terminology used in this chapter is defined in the definitions section of the Endpoint Selection Standard. To fulfill the requirements of the Corrective Action Plan chapter, the proponent must choose the most effective corrective actions or remediation technologies that result in meeting the chosen environmental objectives or endpoints at the impacted site. These actions will depend primarily on the current environmental state of the site, including SOPC and site characteristics which should be determined during the site assessment.

While developing a CAP, the proponent should consider factors such as remediation endpoints, substances of potential concern and the proposed remediation technologies. These factors will determine whether the corrective actions will be classified as acceptable or alternative solutions. In this way, the CAP process differs from the site assessment process, where the assessor chooses from the outset to use either an alternative or acceptable assessment solution.

Select an endpoint

There are three acceptable endpoints to address environmentally impacted sites. The three-tiered or risk-based environmental endpoint framework is a federally accepted approach to assessment and remediation (CCME 1996a; CCME 2008b). This approach has been adopted by Saskatchewan in the past for petroleum hydrocarbons and modified to suit the results-based regulatory framework. The endpoints and their application in remediation is discussed in detail in the Endpoint Selection Standard and briefly reviewed below.

General

The tiered endpoint selection framework relies on generic guidelines (Tier 1), exposure scenario based (Tier 2) or site-specific objectives (Tier 3). The generic Tier 1 guidelines are based on conservative assumptions and may not always be an appropriate remediation goal. When the site is adequately characterized, site-specific remediation objectives may be developed, either by modifying the generic remediation objectives based on site-specific conditions (Meridian Environmental Inc. 2008) that will allow for pathway receptor modification (Tier 2) or by conducting a human health and/or ecological risk assessment or development of site-specific objectives (Tier 3).

For Tier 1 and Tier 2 endpoint selection, the Saskatchewan Environmental Quality Standard specifies numerical values as endpoint goals. These values are the allowable environmental concentrations for specific constituents and were developed considering the receptors and resources to be protected, the pathways by which each could be exposed and the tolerable exposure along all applicable receptor/exposure pathway combinations (CCME 2008b). These concentration values are tabulated according to soil type, either coarse-grained or fine-grained, and according to land-use. The four acceptable land-uses are: agricultural, residential/parkland, commercial and industrial. The land-uses are defined in detail in the Endpoint Selection Standard and by the CCME (2006).

Tier 1 and Tier 2 environmental endpoints have been used extensively for petroleum hydrocarbon impacted sites and will be sufficient to manage most impacted sites within the province. Tier 3 endpoints require a significantly greater level of technical detail and site information. Endpoints may be blended for a discrete area of a site or particular contaminants. For example, Tier 1 endpoints may be applied for metals at a site while suitable hazard quotients and controls (Tier 3 endpoints) are established for polycyclic aromatic hydrocarbons.

The information gathered via the site assessment will be used to determine which of the endpoints will apply. Through the site assessment, the proponent must, determine the substances of potential concern, the predominant soil type, the applicable land-use and potential exposure pathways on and off site. These factors along with other management decisions factors, such as risk tolerance, budget and timelines determine which endpoint is the appropriate objective for the site. With this site information in hand, the proponent must consult the Endpoint Selection Standard to formulate the best strategy for the future activities for the site.

Tier 1

Tier 1 endpoints are intended to be the most conservative assumptions in their derivation. It is most used on sites of low complexity and smaller scale. It allows the proponent to proceed with corrective actions with no other analysis other than determination and delineation of the SOPCs, designated land use, soil texture for soils and applicability of the generic assumptions which are protective of the most sensitive receptors and exposure pathway combinations. Where the proponent has sufficient information to allow modification of the conservative assumptions, Tier 2 or 3 may be a more effective remedial strategy. Conversely, the QP should be aware of instances where the site characteristics, SOPC distribution and/or receptor factors on-site unduly accentuate exposure or risk beyond that envisioned in Tier 1 exposure scenarios. Examples of where Tier 1 guidelines would not apply include:

- volatile SOPCs are closer than 30 cm to the foundation of an occupied building;
- soils are predominantly coarse-grained with a bulk hydraulic conductivity greater than 10^{-3} cm/s;
- the land use does not fall into any of the generic land use scenarios;
- effected or potentially effected water is used for irrigation or food processing; and
- SOPCs are in fractured bedrock.

Modification of the SEQS guideline values is not permitted within the scope of Tier 1 remediation strategy. In other words, if there is any modification or assumptions applied to any contaminant pathways or receptor exposures Tier 1 endpoints are not applicable. For example, if the proponent has sufficient information to eliminate the potable groundwater exposure pathway, there is no provision for doing so at Tier 1. Justifying the elimination of an exposure would be considered a Tier 2 strategy. In general, CAPs with Tier 1 endpoints, with the exception of the examples above, should, at a minimum, show the following elements:

- dominant soil texture;
- land use;
- applicability of Tier 1 values based on exclusions, buffers, and proximity of receptors;
- plan for both on-site and off-site impacts if addressed in phases;
- notification of the proposed CAP has been provided to all impacted parties.

Tier 2

The current Tier 2 approach is analogous to the Tier 2B formerly adopted by the ministry (2009) and explained in detail in the *Canada-Wide Standards for Petroleum Hydrocarbons (PHCs) in Soil: User*

Guidance (Meridian Environmental Inc. 2008). The Tier 2A approach previously referred to in the Risk-based Corrective Actions For Petroleum Hydrocarbon Impacted Sites (Saskatchewan Ministry of Environment 2009), that allowed for site specific criteria by increased knowledge of site-specific data, is henceforth classified as a Tier 3 strategy. The Tier 2 approach allows one or more pathways or receptors to be eliminated, modified or controlled. The values from the next most sensitive pathway would then become the applicable endpoint objective.

Where pathways or receptors are eliminated, physical and/or administrative controls are necessary to preserve the assumptions used in the establishment of the Tier 2B objectives (Meridian Environmental Inc. 2008). In justifying a Tier 2 approach, the proponent must demonstrate that the controls in place at the site are adequate for elimination of the receptor and/or exposure pathway scenario. The Endpoint Selection Standard provides detailed descriptions of the exposure scenarios, or pathways, and the acceptable methods of eliminating or controlling them. In general, CAPs with Tier 2 endpoints should, at minimum, show the following:

- All of the elements of Tier 1
  - dominant soil texture;
  - land use;
  - applicability of Tier 1 values based on exclusions, buffers, and proximity of receptors;
  - plan for both on-site and off-site impacts if addressed in phases;
- scientific rationale for elimination of exposure scenario, for example the presence of physical or engineered controls;
- details regarding the mechanism of control where applicable (e.g. engineered control, administrative control), and
- a statement of how long these controls will remain in place and continue to eliminate the exposure scenario of concern.

Tier 3

A Tier 3 evaluation involves either the development of site specific criteria or the completion of an ecological and/or human health risk assessment. Detailed guidance on human health and ecological risk assessment is beyond the scope of this document. The reader is referred to the documents referenced in **Table H** for further guidance. The technical activities of Tier 3 must be conducted by professionals competent in the field of human health and ecological risk assessment. Qualified persons credentials are listed in **Table I**. CAPs developed based on Tier 3 endpoints must show:

- strong and peer-accepted rationale for the chosen approach;
- citation of the federally recognized protocol for determining hazard quotients or site-specific criteria;
- descriptions of the types of controls present to manage the exposure scenarios, and
- a statement of how long these controls will remain in place and continue to manage the exposure scenario of concern.

The ministry expects that if a risk assessment or site-specific criteria endpoint is chosen for a site, it must provide an equivalent level of health and environmental protection as if the generic numerical remediation criteria applied in a Tier 1 and Tier 2 endpoints. A CAP with Tier 3 endpoints should outline the controls that will be necessary to preserve the assumptions used in the establishment of the Tier 3 objectives. These controls may include engineered systems, designed to limit exposure via one or more exposure pathways through physical means such as barriers, and/or controls designed to limit exposure through land and water use restrictions.

Some examples of when a Tier 3 approach could be used occur where:

- the site does not fit into any of the four generic land uses;
- the assumptions used to develop a Tier 1 or Tier 2 criteria are not applicable to the site;
- unique natural controls exist at the site, such as impermeable soils or elevated biodegradation rates; and/or
- other approaches to remediation are highly impractical by virtue of the quantity, the characteristics or location of the contaminant and impacted media.

Identify Substances of Potential Concern

As shown in **Figure g**, CAPs with Tier 1 endpoints are considered to be acceptable solutions so long as they employ an approved reclamation technology. The latter applies to sites impacted by any type of SOPCs. Corrective Action Plans with Tier 2 endpoints are considered to be acceptable solutions where the SOPCs are limited to petroleum hydrocarbons and an approved reclamation technology is used. All other scenarios are considered alternative solutions, where a CAP must be submitted to the Minister for review and acceptance prior to implementation.

Choose Reclamation Technology

Once the endpoints are chosen and the SOPCs are known, the technology to achieve those endpoints must be decided. The Reclamation Technology Standard outlines the approved technology and describes the review process for proposing a method for addition to the list. Currently, source removal by excavation is the only approved acceptable solution CAP. The ministry encourages proponents to propose new technologies for addition to the list of approved technologies. Qualified persons can choose the method of remediation that best suits their site conditions. Corrective action plans using technologies that do not appear on the list must be submitted to the Minister for review and be accepted prior to implementation. The exception to this is instances where the SOPCs are completely contained within the property boundary of the person responsible, and they have been completely delineated both horizontally and vertically. This is discussed in more detail in the following sections. For further clarification on the use of reclamation technologies not included in the list within the Reclamation Technology Standard, please see section 3-1(1) of the Corrective Action Plan code chapter. The Reclamation Technology Standard itself also describes how to propose new technologies for the addition to the list of accepted reclamation technologies.

Corrective Action Plan Development

After selecting the appropriate endpoint for the site, confirming the SOPCs at site assessment, determining the appropriate reclamation technology, the proponent has determined whether the CAP strategy should be classified as an alternative or acceptable solution. The CAP would then be developed and submitted to the Minister as required for each type of solution. The CAP development process is discussed below within the context of the three parts of the Corrective Action Plan code chapter.

General requirements

Both alternative and acceptable solution CAPs must comply with Part 1 of the Corrective Action Plan code chapter. The section sets the general rules for notifications, qualified persons, and record keeping which apply to all corrective action plans.

Notification of Document Submission

If you have submitted a CAP to the Minister, the following must be completed before the CAP can be implemented:

- the Minister has been notified of the plan using the format provided in this document;
- you have submitted all of the required information, or
- you have received a notification number.

The notification number becomes the means of identifying all future correspondence relating to the original submission. It should be referenced on all documentation required by the Corrective Action Plan chapter or any correspondence relating to the CAP.

Some local municipalities have established bylaws with specific requirements for removal and decommissioning of hazardous substance storage tanks in order to reduce fire risks and protect publicly-owned utilities and infrastructures. It is the responsibility of anyone planning to carry out such decommissioning activities to contact the appropriate municipal authorities, such as municipal engineering or fire departments, for specific local requirements. Documentation including municipal authority names and contact information may be requested by the ministry.

Qualified person and certificates

The complexity of remediation activities varies depending on remediation endpoints, site characteristics, SPOCs and the corrective actions to be applied to the impacted site. Each successive (Tier 1 to Tier 3) endpoint requires a more detailed understanding of the environmental conditions at the site and a greater level of expertise to plan and carry out the remedial activities. As such the definition or requirements for a qualified person (QP) in the Corrective Action Plan chapter depends on the activity being completed. The code defines who is eligible to prepare a CAP and conduct the corrective actions based on the selected reclamation endpoint and the reclamation technology. These are listed in **Table I**.

Table I: Qualified Person Designation for Corrective Action Plans.

Activity	Qualified Person Credentials
CAP with Tier 1 Endpoint	The following individuals are designated as qualified persons for certifying Tier 1 endpoint CAPS: • a person licensed to practise professional engineering or professional geoscience pursuant to The Engineering and Geoscience Professions Act; • a person who is a practising member as defined in The Agrologists Act, 1994; • a person who is an applied science technologist pursuant to The Saskatchewan Applied Science Technologists and Technicians Act and who has eight years of experience in developing Tier 1 endpoint corrective action plans that is recognized by the Saskatchewan Applied Science Technologists and Technicians; or • an individual who is designated by the Minister or who is a member of a class of persons designated by the Minister pursuant to the Act to undertake the activity.

Activity	Qualified Person Credentials
CAP with Tier 2 Endpoint	The following individuals are designated as qualified persons for certifying Tier 2 endpoint CAPS: • a person licensed to practise professional engineering or professional geoscience pursuant to The Engineering and Geoscience Professions Act; • a person who is a practising member as defined in The Agrologists Act, 1994; • a person who is an applied science technologist pursuant to The Saskatchewan Applied Science Technologists and Technicians Act and who has eight years of experience in developing Tier 2 endpoint corrective action plans that is recognized by the Saskatchewan Applied Science Technologists and Technicians; or • an individual who is designated by the Minister or who is a member of a class of persons designated by the Minister pursuant to the Act to undertake the activity.
CAP with Tier 3 Endpoint **Risk Management With Future Reclamation**	For the purposes of certifying a Tier 3 endpoint corrective action plan or a risk management with future reclamation corrective action plan, an individual who is designated by the Minister or who is a member of a class of persons designated by the Minister pursuant to the Act to undertake the activity.

All CAPs must be accompanied by a certificate of QP designation that satisfies the requirements in the Qualified Person Certificate. This can be found in the Qualified Person Certification Standard. It should be noted that a designation of qualified person by the Minister does not entitle the designee to engage in an activity that is within the exclusive scope of practice of a profession unless you are a member of that profession. The QP designation is a requirement of the Minister for the purposes of fulfilling the requirement under EMPA, 2010 and does not authorize the person to conduct activities outside of those identified under EMPA, 2010. It is the responsibility of the QP to ensure that they do not infringe upon the exclusive right to practice maintained by certain professions (e.g. engineers).

Environmental Samples

The integrity of environmental samples relies on the sampler's use of sound sample collection techniques and equipment as well as accredited laboratory methods for analysis. The nature of the SOPCs, the equipment used to collect the samples, the use of substance appropriate preservation methods and the sampling techniques of the sampler are all factors that affect the quality and reliability of sample results. Qualified persons must consult with an accredited laboratory to ensure that substance specific field protocols are used.

In Saskatchewan, many of the environmental impacts result from petroleum hydrocarbons. The volatile fraction of hydrocarbons in PHC soils are subject to a substantial decrease in concentration during sample collection. In some cases samples collected and capped can lose between 70 per cent to 90 per cent of the volatile fractions F1 and BTEX, within 5 days of sampling (Curran 2005).

When collecting PHC impacted soil or water samples, special care must be taken to minimize volatilization. To promote more defensible sampling results, the ministry has adopted the methanol preservation of soil samples in accordance with USEPA (1996) and USEPA Guidance Document

#1210 (USEPA 1999). The CCME and other jurisdictions are moving toward adoption of this sampling method. The general procedure is as follows:

1. Collect the sample in a manner that reduces exposure in order to minimize the loss of the volatile components. Always wear gloves when handling samples and sample vials.
2. Using the sample collection device provided by the laboratory, collect an adequate size sample as soon as possible after the surface of the soil or other solid material has been exposed to the atmosphere.
3. Ensure the outside of the sample collection device is clean by wiping it with a clean cloth or towel. Transfer a portion of the sample collected from your sampling device to the sample collection vial. The size of the sample collected will be dictated by your laboratory and may vary between 2 g to 10 g for petroleum hydrocarbons Fraction 1 to Fraction 4, benzene, toluene, ethylbenzene and xylene (F1 – F4, BTEX) analysis. It is preferable that the exact amount of soil required be determined by measuring using a digital scale (±0.01 g).
4. Add the amount of methanol specified by laboratory to the sample vial.
5. Quickly brush off any soil or debris around the sample vial opening and immediately seal the vial with the septum and/or screw-cap. Place sample vial in an appropriate container, on ice at 4°C.

An alternative method is to collect several trial samples with plastic syringes, weigh each trial sample and note the length of the soil column in the syringe. This data can then be used to calibrate the length of soil in the syringe that corresponds to the desired amount of sample. It should be noted that the above is a general outline of the USEPA (1996) and each accredited laboratory may use a modified version of the method. It is advised to consult the laboratory for details on their specific practices.

Laboratory Analysis

Laboratory analysis of environmental samples must be certified by either a chemist licensed to practice or a person designated by the Minister to conduct chemical analyses. For the purposes of certifying the QA/QC for sampling and analytical procedures, a qualified person is an applied science technologist or certified technician under The Saskatchewan Applied Science Technologists and Technicians Act or any person as shown in **Table I**. If no laboratory accreditation process exists, a qualified person must certify that the QA/QC for sampling and analytical procedures produce accurate, precise, and reliable results. All methods of analysis and calculation are subject to audit and should be available for review upon request.

Reporting Obligations

Much of the focus of this section is on the technical considerations required when formulating a corrective action plan. The three components of reporting associated with corrective actions are:

1. the written corrective action plan;
2. a site status report (where required); and
3. a closure report.

The section on reporting obligations below outlines the required content of the written CAP, status and closure reports.

Additional Obligations

If all or part of the impacted land is owned by a person not responsible for the discharge or discovery, then the person submitting the CAP must ensure that a notification of the CAP is provided to the owner of the site.

The proponent is also obligated to ensure that any of the following substances, if removed from the site, are disposed of in a lawful manner and is reported:

- any substance that may cause or is causing an adverse effect;
- any substance of potential concern; or
- any substance mentioned in the Substance Characterization Chapter.

Alternative Solution

The alternative solution is provided as an option for developing and carrying out corrective actions that are different from the standard acceptable solution. The option for an alternative CAP solution provides the QP with the opportunity to be innovative in their approach to achieving the desired outcomes, provided the alternative solution meets the risk-based objective of the chapter. The objectives for an alternative solution CAP are to limit the probability of unacceptable adverse effects resulting from the corrective actions. Only those CAPs proposed as alternative solutions require acceptance from the Minister prior to implementation.

In legislative terms, the alternative solution CAP is considered to be an environmental protection plan. In accordance with the Corrective Action Plan chapter, when preparing a CAP, the QP must ensure that the plan meets all of the results-based objectives of the Corrective Action Plan chapter. These include, ensuring that the CAP:

- establishes scientifically defensible methods to remediate, manage, or monitor the sources, pathways, and receptors that may be or are affected by any substance that may cause or is causing an adverse effect;
- is appropriate given the level of complexity of the site and the identified impacts;
- clearly presents a conceptual design of the proposed corrective actions, and includes a description of the tasks necessary to implement those actions;
- establishes endpoints that:
  - comply with the Endpoint Selection Standard;
  - comply with the administrative controls set out in the Administrative Control Standard;
  - if applicable, provide for a reduction in the concentration of SOPCs to a level at or below the levels in the Saskatchewan Environmental Quality Standard for the Tier 1 or Tier 2 endpoint selected;
- describes the goals of the corrective actions and establishes methods of performance evaluation by which the effectiveness of the corrective actions will be monitored.

Please see 2-1 of the Corrective Action Plan code chapter for the complete list of requirements of the results-based objective.

Acceptable solution

In certain situations, CAPs will be classified as an acceptable solution. As discussed in pervious sections these CAPs must:

- Describe and justify the selection of a Tier 1 or Tier 2 endpoint for the impacted site such that selected endpoint:
  - complies with the administrative controls set out in the Administrative Control Standard;
  - complies with the Endpoint Selection Standard.
- Use an accepted technology as set out in the Reclamation Technology Standard, or use a reclamation technology not listed in the Reclamation Technology Standard if:
  - all SOPCs are completely contained within the property boundary of the person responsible;
  - all SOPCs have been delineated both horizontally and vertically;

- the delineation has established, by mathematical modelling, that all SOPCs will not migrate off the property identified within the time frame set out in the accepted CAP.
- If appropriate, provide for a reduction in the concentration of SOPCs to a level at or below the levels in the Saskatchewan Environmental Quality Standard for the endpoint within an estimated timeframe.

The qualified person must provide a certificate of opinion stating that any endpoint selected in the CAP properly addresses the SOPC impacts, and is appropriate for the land use, proposed future land use, and exposure scenarios for the environmentally impacted site. It should be noted that prior to their implementation, CAPs based on proven acceptable solutions require acknowledgement of receipt by the Minister via a notification number prior to being carried out.

Other Considerations

***Ex-Situ* sampling**

Remedial activities or proposed corrective actions may require the removal of impacted soil by excavation and it's temporarily storage prior to its use or disposal. In these cases, characterization of the soil may be required prior to disposal, or prior to proper management. As a result of the excavation activities, a proponent is likely to require soil as clean fill material at a site. In this case, the fill material must meet the applicable pathways specific guidelines for the intended land use. If the chosen backfill soil cannot be definitively identified as being free of anthropogenic SOPCs, it must be verified as such prior to being used. Proponents should be aware of background levels of SOPCs and provide rational and justification to support background levels of certain SOPCs.

When a soil is excavated and stockpiled the spatial context and *in-situ* distribution of its chemical constituents is lost, and mechanical sorting of the soil occurs. It is preferable to characterize materials intended as backfill *in-situ*; however, this may not be practical in many cases when the soil is being supplied from a third party or from an unknown source. When conducting *ex-situ* soil characterization, the assessor should be aware of the following:

- Materials tend to sort by grain size when excavated and stockpiled. This is especially true for materials on the surface of the pile where coarse-grain materials tend to accumulate at the toe of the pile.
- Soil at the pile surface is prone to weathering. These samples will not provide accurate measurements of volatile hydrocarbon constituents.

The methods used to characterize a soil stockpile consist of collecting a number of soil aliquots from a given volume of soil within the stockpile, and compositing these into batches. A number of batches are then submitted for laboratory analysis and the resulting concentrations used to characterize the stock pile.

For the results of the composite samples collected for characterization of a stockpile, the Minister will accept the upper confidence limit of the mean (UL_c) concentration as the representative concentration of the stockpile material. The sample collection and data analysis procedures below are the recommended method for characterizing a stockpile. An equivalent method may be used as an alternative method if sufficient justification is provided.

Sample Collection

To facilitate representative sampling, the pile must be conceptually arranged into smaller sampling cells. Sampling cell demarcation and sample collection is dictated by the size of the soil pile and whether the soil texture and contaminant distribution in the pile is generally homogenous or heterogeneous (BC Environment 2001; EPA Victoria 2009; Lame *et al*. 2005). The sample planning and collection procedures are described in **Tables J** and **K**.

Table J: Sample Planning and Procedures for Homogenous Soil and Contaminant Distribution

	Soil Vol. ≤ 50 m^3	**50 m^3 ≤ Soil Vol. ≤ 250 m^3**	**250 m^3 ≤ Soil Vol.**
Sampling Procedure	A minimum of 10 individual random samples should be collected and submitted for analysis.	Demarcate the stockpile into sampling-cells of 10 m^3 each. Collect samples from within each sampling-cell as follows: • Collect two aliquots of soil from each cell. • Label the aliquots for spatial referencing. • Batch aliquots together in such a way as to obtain a total of 10 batches to submit to the laboratory for compositing and analysis (volatile organic compounds - VOCs), or composite in the field.	Demarcate the stockpile into 10 sampling-cells, where each cell represents approximately 10 per cent of the total stockpile volume. Collect samples from within each sampling-cell as follows: • Collect a total of five individual random aliquots of soil from each sampling-cell (Lame *et al*. 2005). • The aliquots collected from each cell will be considered as one batch, thus yielding 10 batches. Submit batches for compositing and analysis (VOCs), or composite in the field.
Submit for Analysis	All 10 individual samples	10 batch samples each consisting of aliquots collected from sampling cells within the soil pile.	10 batch samples each consisting of aliquots collected from sampling cells within the soil pile.

Table K: Sample Planning and Procedures for Heterogeneous Soil and Contaminant Distribution

	Soil Vol. ≤ 50 m^3	**50 m^3 ≤ Soil Vol. ≤ 125 m^3**	**125 m^3 ≤ Soil Vol.**
Sampling Procedure	A minimum of 10 individual random samples should be collected and submitted for analysis	Demarcate the stockpile into sampling-cells of 10 m^3 each. Collect samples from within each sampling-cell as follows: • Collect four aliquots of soil from each cell. • Label the aliquots for spatial referencing. Batch aliquots together in such a way as to obtain a total of 10 batches to submit to the laboratory for compositing and analysis (VOCs), or composite in the field.	Demarcate the stockpile into 10 sampling-cells, where each cell represents approximately 10 per cent of the total stockpile volume. Collect samples from within in each sampling-cell as follows: • Collect a total of five individual random aliquots of soil from each sampling-cell (Lame *et al*. 2005). The aliquots collected from each cell will be considered as one batch, thus yielding 10 batches. Submit batches for compositing and analysis (VOCs), or composite in the field.
Submit for Analysis	All 10 individual samples	10 batch samples each consisting of aliquots collected from sampling cells within the soil pile.	10 batch samples each consisting of aliquots collected from sampling cells within the soil pile.

NOTE: According to the professional judgment of the sampler, it may be deemed necessary to collect more samples for a certain area or to divide the pile into a larger number of sampling cells to obtain better resolution on the contaminant distribution. Tables J and K represent the minimal sampling requirements.

While demarcating sampling cells within the soil pile, there is no requirement to move or disturb the bulk of the soil. The sampler must ensure that the aliquots from each cell are collected such that they are representative of the soil pile and labeled to identify the cell they were collected from. This may be required for further testing (see Quality Assessment section below). For more detailed guidance on sample collection procedures, the sampler is advised to consult the following:

- *ASTM Standard Guide for Composite Sampling and Field Subsampling for Environmental Waste Management Activities - D6051 – 96 (2006)* (ASTM International 2006).
- *ASTM Standard Guide for Sampling Waste Piles (D6009-12)* (ASTM International 2012).

For samples being analyzed for volatile organics, sample collection must be done in accordance with USEPA's Field Sampling Guidance Document #1210: Soil Sampling for Volatile Compounds (1999) or a certified laboratory approved equivalent method. The aliquots of soil collected are always batched in such a way as to obtain 10 batches, each containing a number of aliquots. The batches are then submitted for chemical analysis. The resulting 10 composite concentration values will result in a sufficient number of data-points from which the UL_c value can be calculated. The following are examples of this method applied to a homogenous stockpile of various volumes where VOCs are suspected:

- A stockpile of 50 m^3 requires that 10 individual samples of soil are collected and submitted for analysis. The resulting concentration values would be assessed to obtain the UL_c value.
- A stockpile of 70 m^3 may be viewed as consisting of seven cells, each cell being 10 m^3. Collecting two aliquots from each cell, and considering each of the two aliquots as one batch would only yield seven batch concentration values. To rectify this, the sampler may choose to further sub-divide three of the cells. This would yield four cells that each represents 10 m^3 of soil, and six cells that each represents 5 m^3 of soil. This would give a total of 10 batches. These batches would be summited for laboratory compositing and analysis. The choice for how to coordinate the sampling order to optimize results should be made on the basis of soil homogeneity, contaminant distribution and professional judgment.
- A stockpile of 370 m^3 breaks down to 10 cells each representing approximately 37 m^3 of the pile volume. The sampler would collect five aliquots from each and batch these five together. These batches would be summited for laboratory compositing and analysis.

As noted above, laboratory compositing of the samples is required where VOCs are suspected. Allowing the laboratory to composite samples at the time of analysis removes the potential for analytical artifacts resulting from sample collection handling/mixing of soil in the field. You must ensure that the laboratory retains the residual samples after the analysis for the maximum allowable hold time since follow-up analyses may be required (see following sections). Note that laboratory compositing is not required for non-volatile constituents.

Quality Assessment

Once the chemical analysis of the *ex situ* samples are complete, the resulting 10 composite concentration values obtained will be assessed as follows:

1. Using the composite SOPC concentrations[2], calculate the following parameters for the dataset: 1) mean, 2) standard deviation and 3) coefficient of variation for the dataset. The coefficient of variation (CV) is a unit-less parameter that is a measure of the spread or scatter of the dataset relative to the mean value.
2. If the CV is below 1.5, then proceed to step 7.
3. If the CV is between 1.5 and 6, proceed to step 8. Note that this value of CV is representative of typical gasoline and diesel hydrocarbons measured in soil samples. For all other constituents (e.g. metals, EC, SAR) the QP should cite/reference an acceptable value or range for CV for the given parameter (Kostecki and Calabrese 1992; Kostecki *et al*. 1992; Sumner 1999)
4. If the CV exceeds 6, proceed to step 5 and 6.
5. Instruct the laboratory to divide each of the 10 batches you submitted into two samples. This results in 20 analyzable samples. That is, each of the originally submitted batches becomes two independent samples.
6. Have the resulting set of batches reanalyzed and repeat step 1 above. If the results still produce a CV value exceeding 6, the samples collected are unreliable and the field sampling program must be repeated. Note that repeat sampling events can be avoided by taking more samples, or choosing a smaller sampling cell area from which to take the same number of samples. This could be beneficial where the soil type or contaminant distribution is highly heterogeneous.

Data Analysis

7. Using the resulting 10 concentration values, calculate the standard upper confidence limit of the arithmetic mean for the dataset.
8. Using the resulting 10 concentration values, calculate the upper confidence limit of the mean, the log-transformed dataset. The reader is referred to the Industrial Waste Resource Guidelines of EPA Victoria (2009), and chapter 13 of Gilbert (1987) for details of these calculations.

This procedure cannot be applied to *in situ* sampling due to the difference in data acquisition objectives between *in situ* and *ex situ* sampling. In the former case, the sampler's goal is to collect a sufficient number of samples in order to characterize the SOPC distribution throughout the site, whereas *ex situ* sampling seeks to obtain an average representative concentration for a soil stockpile. The method for *in situ* site characterization is discussed in the Site Assessment section of the guidance document and in the following sections.

The stockpile characterization method presented above is based upon accepted industry practice, published literature and guidance from other regulatory bodies. It sets forth the minimum elements required in an acceptable solution for incorporating this activity. If at any time the qualified person believes the acceptable solution is not applicable to a site, the QP has the option of proposing an alternative solution to the Minister for consideration.

Long-term management and remediation

Long-term management of a site can be accomplished using a variety of techniques and strategies. A need for a long-term management strategy arises where a proponent prefers to implement risk management measures without immediate active remediation. Examples of such situations include a site where natural attenuation is assessed to be effective at removing the SOPCs from the environment and is more favorable than using active methods of remediation. Another example is the case of an operating facility where infrastructure on-site prohibits the implementation of

[2] In the case where more than one substance of potential concern is present, evaluate the concentration for each substance independently.

corrective actions. Long-term management would be preferred in order to maintain business continuity and plan for remediation at a later date. These scenarios are collectively referred to in Section 17 of The Environmental Management and Protection Act, 2010 as Risk Management with Future Reclamation (RMFR).

Risk Management with Future Reclamation plans can be developed with either a Tier 1, 2 or 3 endpoint (see **Figure g**). A proponent may choose to develop a CAP, submit it to the Minister but propose a future implementation of the CAP with immediate implementation of RMFR. In other words, a CAP would be developed to reclaim the SOPCs at a site but would be implemented in the future. In the meantime, the SOPCs would be managed using administrative or engineered controls. The RMFR can be initiated either through the voluntary or directed processes and requires the following:

- An adequate site assessment has been completed at the site and all exposure/pathways have been identified and all SOPCs have been delineated vertically and horizontally.
- A CAP is developed for the site and submitted to the Minister. Without a CAP on file, an RMFR proposal will not be accepted.
- A financial assurance is provided to the Minister and is in a reasonable amount that will depend on the decommissioning and corrective actions required to reclaim the site.[3]
- A written RMFR proposal is submitted to the Minister for acceptance. The proposal must show that the financial assurance amount set forth is reasonable and must present a schedule for monitoring and status reporting.
- The Minister's required timelines for submission of all documentation are met.

There are a number of essential elements that must be contained in any RMFR proposal before acceptance. A monitoring schedule must detail the type and frequency of monitoring required for the site. This is especially important in the case of monitored natural attenuation where indicator parameters must be carefully chosen to track the progress of remediation (King *et al*. 1998). Periodic status reports must present the latest monitoring data in the context of historical results and (where applicable) with view of trends towards remedial endpoints.

National Classification System for Contaminated Sites

The National Classification System for Contaminated Sites was developed for the Canadian Council of Ministers of the Environment as a tool for evaluating contaminated sites according to their current or potential adverse impact on human health and the environment. The NCSCS establishes a scientifically defensible rational for comparative assessment of contaminated sites across Canada (CCME 2008a). The ministry has adopted the NCSCS as a management tool for assigning relative priority for action to impacted sites in the province. Proponents must complete an NCSCS both at the site assessment stage and after implementing the CAP for a site. This is required since the NCSCS is a snapshot of the current condition of the site, and as the site conditions change it must be reevaluated.

[3] Financial assurance requirements are site-specific and detailed discussion of financial assurance s is outside the scope of this document. A separate factsheet will be produced to elaborate further on financial assurance process and how costs will be determined.

An NCSCS evaluation is conducted using the spreadsheet calculator provided by the CCME. The reader is advised to review the NCSCS manual (CCME 2008a) for detailed information on how to use the calculator. A site score is generated when the user enters site specific information relating to:

- characteristics of the SOPCs;
- contaminant migration pathways for SOPCs; and
- the presence of exposure pathways and receptors in connection with the site.

The information used can be known or verified through previously conducted investigations, or can be potential information based on the professional judgment of the qualified person scoring the site. Based on the score generated, the site will fall into one of four categories:

- Class 1 – high priority for action (score > 70);
- Class 2 – medium priority for action (50 < score < 69.9);
- Class 3 – low priority for action (37 < score < 49.9);
- Class 4 – not a Priority for action (score < 37).

The specific type of action warranted is site specific and may include any remedial activities such as site characterization, risk assessment or remediation of impacted media. A low score such as class 3 or 4 sites does not mean that no action is required at the site. The ministry interprets low scoring sites as having a lower priority for action in relation to higher scoring sites. Proponents are required to address remediation objectives first for sites that score higher. As such, the ministry uses the NCSCS score as a:

- means of assigning priority for remedial actions to those sites that are of a more critical environmental nature;
- means of prioritizing technical review of projects, where higher scoring sites may be given review priority, and
- quality assurance tool to ensure that all sources, pathways and receptors are considered when evaluating the environmental condition of the site.

The general process to use the National Classification System for Contaminated Sites is:

1. Read and understand the related guidance document provided by the CCME (CCME 2008a).
2. Obtain sufficient site information to complete the site classification. At least a Phase I Environmental Site Assessment should be available. The Phase I ESA consists of a preliminary desk-top type study involving nonintrusive data collection to determine whether there is a potential for the site to be contaminated and to provide information to direct any intrusive investigations. If a Phase I ESA is not available, it may be necessary to complete a Phase I ESA for the site in conjunction with the NCSCS scoring exercise.
3. Refer to the pre-screening checklist in the NCSCS spreadsheet to determine if the site is appropriate for classification. In some cases, there may be site-specific indicators that would default the site to Class 1 priority ranking. In these cases, further classification beyond the pre-screening checklist would not be required.
4. Complete the worksheets (review and document existing information and consult specialists as required). It is recommended to document the rationale for the scoring decisions.
5. Review the summary score sheet and ensure the final values of certainty score and total site score are reasonable. Submit the pre-screening checklist and summary score sheet to the Minister.

Please note that if the uncertainty percentage for the site (the ratio of “Known” to “Potential”) is greater than 15 per cent, the proponent will be required to gather more site information and reevaluate the site.

Corrective Action Plan Reporting

The CAP report should describe the corrective actions recommended for the site in the context of the findings of the site assessment, and considering the factors discussed in the previous section of this guidance. EMPA, 2010 requires that CAPs are prepared within 6 months of completing the site assessment or any other period set out by the Minister. Note that this timeline applies only to the directed process, i.e. instances when the Minister has directed the proponent to conduct a site assessment.

The CAP can be submitted electronically using the Ministry of Environment's online services (portal) or by sending the hardcopy documents to a ministry office. The qualified person will be required to submit a qualified person certificate found in the Qualified Person Certification Standard. The certificate will state that in their opinion, the methods employed in the plan will satisfy the results-based objective described of the Corrective Action Plan chapter if carried out in accordance with that plan.

If the CAP is not completed within the approved or expected time frame, you must advise the Minister by submitting a status report in the form provided upon request. **Table L** summarizes the format and content, at minimum, that must be included in a corrective action plan.

Table L: Contents to Include in a Corrective Action Plan Report

Section	Content
Title Page	• Identify report type (i.e. Correction Action Plan). • Provide site address/location (civic address, legal land description, and/or latitude/longitude co-ordinates). • Provide site owner contact information (company and contact name, telephone number, email address, mailing address). • Provide consultant information or author contact information (company and contact name, telephone number, email address, mailing address). • Provide ministry file reference information (file number, operation ID, CAP notification number, and/or notification number).
Executive Summary	• Provide synopsis of report, summary of work undertaken and key findings and conclusions.
Introduction	• Provide background information about with reference to the site assessment (Phase I or II ESA). • Reference any regulatory requirements or directives given by the Minister of Environment, such as acceptance requirements, environmental protection orders, or directions from the Minister or representative thereof. • Provide objectives and scope of work – updates and changes resulting from the findings of the ESA. • Define conceptual site model – updates and changes resulting from the findings of the ESA.
Methodology	• Describe corrective actions to be performed, including rationale for choosing the corrective actions in the context of the ESA. • Provide clear description of the remediation endpoints targeted. • Explain how CAP effectiveness will be evaluated. • Describe all field methods employed including: equipment used, methods of sample collection, field screening techniques, rationale table for the samples,

Section	Content
	sampling method, quality assurance procedures and analytical suite for each sampling location. • Explain disposal/treatment facilities use for environmental media (if applicable). • Provide a timeline for completing corrective actions and meeting the site remediation objectives. • Define procedures for handling emergencies during operations, including procedures in place to ensure the occupational health and safety of all employees.
Limitations	• Identify parties authorized to use information in the report. • Provide information of limitations on liability and disclosure.
References and Supporting Documents	• Provide applicable citations for proposed methods. • Provide documentation pertaining to non-standard methods proposed for use, including newly developed procedures or those modified from existing methods. • Include all borehole logs where a sampling location is drilled, copy of laboratory data-sheets in appendices. • Include all analytical results on a site plan in a "pop" drawing (i.e. chemical analysis results tagged to the sample location in a balloon).

CAP Implementation and Assessment

Once acceptance is obtained from the Minister for an alternative solution and a notification number is received, the CAP can be implemented. Although ministerial acceptance is not required for acceptable solutions, a notification number must be obtained for either alternative or acceptable solution before proceeding. The effectiveness of any remedial strategy should be quantifiable and presented to the Minister as information with accompanying professional interpretation. Raw monitoring data with no historical or interpretive context will not be deemed accepted.

Confirmatory sampling

To assess the degree to which CAP endpoints have been reached, a sampling program must verify that the risk posed by any residual material is acceptable. Sampling should be planned in accordance with the method specified in the Appendix for all environmental media (i.e. soil, groundwater, sediment). Sample analysis, field observations and professional judgment may suggest that more samples than the minimum specified by the method should be collected. For example, confirmatory samples for a tank excavation should include samples from the tank bed and walls of the excavation. The number of samples required for each wall and the base can be calculated using the Appendix.

The use of volatile organic hydrocarbon vapour detection results is not acceptable as a confirmation of site status for closure. Such data may be useful as a guide for delineation of the impacted area during assessment, but will not be accepted as justification for reducing the number of samples submitted for laboratory analysis. The Minister evaluates if remediation criteria have been met and risk addressed through the closure report submission

Status and Closure Reporting

All CAPs that are submitted to the Minister must provide a timeline for periodic evaluation of progress and CAP effectiveness. Where applicable, provide an estimate of when corrective actions will start and when the chosen endpoints will be achieved. Once the corrective actions have been completed and the endpoints selected in the CAP have been reached, the following must be submitted:

- An updated NCSCS score-sheet within 30 days of completing the corrective actions.
- A closure report within 120 days of the expiry time of the corrective actions, along with any other documentation required to ensure that use of the site remains compatible with the selected endpoints. Note that expiry time is set by the approximate date of CAP completion specified by the proponent.

The closure report must include a description of the work performed, evidence that shows that the endpoints have been achieved (where applicable) and provide an updated environmental status of the Site based on the confirmatory data obtained at closure in comparison to applicable endpoint criteria. **Table M** summarizes the format and content, at minimum, that must be included in a closure report.

Table M: Contents to Include in a Closure Report

Section	Content
Title Page	• Identify report type (i.e. Closure Report). • Provide site address/location (civic address, legal land description, and/or latitude/longitude co-ordinates). • Provide site owner contact information (company and contact name, telephone number, email address, mailing address). • Provide consultant information or author contact information (company and contact name, telephone number, email address, mailing address). • Provide ministry file reference information (file number, operation ID, case number, and/or notification number).
Executive Summary	• Provide synopsis of report, summary of work undertaken and key findings and conclusions.
Introduction	• Provide background information on site including a description of the correction actions applied at the site that lead to the closure. • Reference any regulatory requirements or directives given by the Minister of Environment, such as acceptance requirements, environmental protection orders, or directions from the Minister or representative thereof. • Describe regional and site characteristics, including description of historical, current and anticipated land-use(s). • Provide detailed site plan, photo mosaic, and/or aerial photograph with a 1:5000 scale or finer resolution indicating major facility areas including waste handling areas and relevant surface features. • Describe objectives and scope of work.
Methodology	• Define statistical methods to support sampling frequency for confirmatory sampling, (applicable).
Results	• Provide a statement and explanation of whether the CAP objectives were met. • Present analytical results, including: tables of analytical results with values that

Section	Content
	exceed guidelines highlighted (compared to most relevant and current standard); and scaled figures showing site location, sample points, groundwater elevation maps (where applicable) and locations of exceedances. • Provide diagrams/site maps showing the final location/extent of excavations or other remedial strategies applied. • Present analytical and remedial objective results. • Evaluate the effectiveness of the corrective actions. • If corrective actions have been completed within the scope of the plan, confirm whether on-site impacts were fully remediated. • Verify presence/absence of off-site impacts. • If required, revise conceptual site model according to the new information available about the site.
Conclusions and Recommendations	• Conclude whether the objectives of the corrective action plan were met and to what extent. • Justify any future monitoring requirements where if necessary. • Recommend whether further work is required, along with timelines, to address any remaining impacts both on-site and off-site.
Limitations	• Identify parties authorized to use information in the report. • Provide information of limitations on liability and disclosure.
References and Supporting Documents	• Include applicable citations for proposed methods. • Include documentation pertaining to non-standard methods proposed for use, including newly developed procedures or those modified from existing methods. • Include all borehole logs where a sampling location is drilled, copy of laboratory data-sheets in appendices. • Include all analytical results of confirmatory sampling on a site plan in a “pop” drawing (i.e. chemical analysis results tagged to the sample location in a balloon).

Status reports will be required under two circumstances, where:

1. Long-term remediation strategies are used and on-going monitoring reports will be required.
2. Corrective actions were implemented but the selected endpoints where not reached.

Monitoring reports will be required for sites undergoing long-term remediation or those operating under RMFR. The format of these reports will resemble that outlined in the site assessment section (**Table F**). Other conditions, such as monitoring frequency or specific media to be monitored, may apply on a case-by-case basis.

If the endpoint selected in the CAP is not achieved by the date set out in the CAP a closure report is not required. Instead a status report must be submitted to the Minister within 120 days of the date set out in the CAP. The report is to detail the progress made on the CAP and include a description of the current status of the site. In terms of process timeline, failure to meet the chosen endpoints puts the site back to the beginning of the CAP process, giving the proponent 120 days to submit a revised CAP. **Table N** summarizes the format and content, at minimum, that must be included in a status report.

Table N: Content to Include in a Status Report

Section	Content
Title Page	• Identify report type (i.e. Status Report). • Provide site address/location (civic address, legal land description, and/or latitude/longitude co-ordinates). • Provide site owner contact information (company and contact name, telephone number, email address, mailing address). • Provide consultant information or author contact information (company and contact name, telephone number, email address, mailing address). • Provide ministry file reference information (file number, operation ID, case number, and/or notification number).
Introduction	• Include brief background of the site and why status report is being submitted. • Describe briefly the corrective actions that were implemented. • Reference any regulatory requirements or directives given by the Minister of Environment, such as acceptance requirements, environmental protection orders, or directions from the Minister or representative thereof.
Site Status	• Describe the current site status with respect to the corrective actions completed at the site. • Present relevant analytical and site characterization data to explain how the selected endpoints for the site have not been met.
Conclusions and Recommendations	• Describe briefly the strategies will be evaluated when re-formulating corrective actions at the site. • Specify the anticipated timeline for submission of the renewed CAP and demonstrate that the timeline is reasonable. Recall that you are allotted 120 days to submit a cap if the site is in the directed process.

Review process

Corrective action plans must be submitted to the Minister via the online services (portal) or as a hardcopy submission. A transaction number will be provided as acknowledgment that the submission was received. For CAPs submitted as acceptable solutions, the proponent may proceed to implement the corrective actions once receipt notification number has been received from the Minister. In the case where the CAP is an alternative solution, no corrective actions shall be implemented until acceptance of the CAP by the Minister and a notification number is issued. It is the responsibility of the proponent to ensure that approvals are obtained, where required, prior to proceeding with CAP implementation.

STEP 4: NOTICE OF SITE CONDITION AND TRANSFER OF RESPONSIBILITY

Introduction

Notice of site condition and transfer of responsibility represent the final stages of the impacted sites process. Once corrective actions have been completed, the proponent can apply for a notice of site condition from the Minister. The notice of site condition is similar to the closure letters previously issued by the ministry in that it is an acknowledgment by the Minister that an acceptable level of risk remains at the subject site. The level of acceptable risk is site specific and subject to review and acceptance by the Minister. Risk management plans (RMPs) and risk-based closure will be considered candidates for notice of site condition (NoSC) if the results based objectives for the site have been met; that is if the risk is controlled and those controls are shown to be maintained. In the latter case, the Minister will consider registration of the site with a NoSC. The issuance of the notice of site condition enters the site into a publically accessible database and releases the responsible party from having any future responsibility. A schematic of the notice of site condition process is shown in **Figure h**.

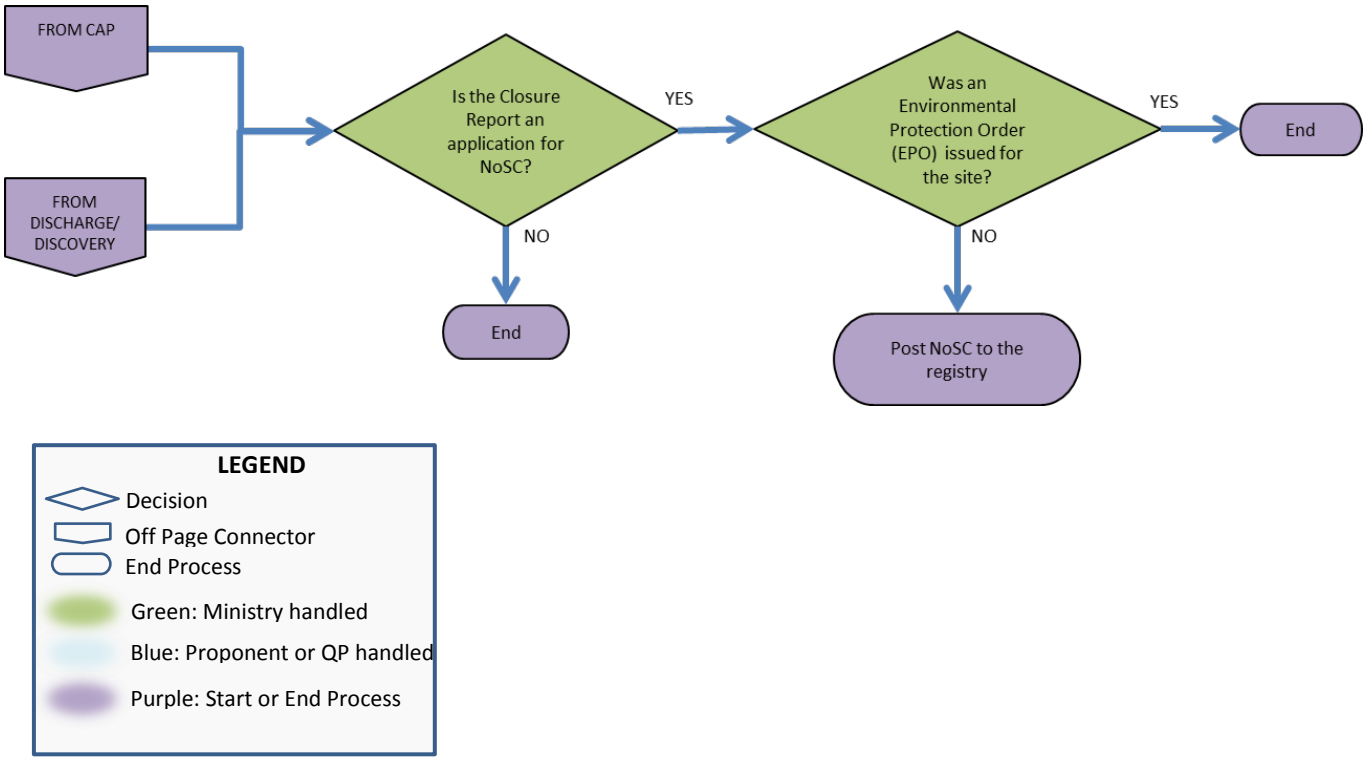


Figure h: Schematic of the Notice of Site Condition Process

At the notice of site condition stage the Minister will review all existing documentation for the site and determine if the result-based objectives of each applicable code chapter have been met. Upon review

of the file, if the Minister discovers that any of the previous investigations (i.e. site assessments, corrective action plans) were not completed adequately; additional work may be requested of the proponent by the Minister.

Table O highlights the new business process requirements introduced in EMPA, 2010. The requirements for closure and notice of site condition under the code will be discussed throughout the following sections.

Table O: Transferring Responsibility - New Business Process Requirements

New in EMPA, 2010
• Closure is now referred to as notice of site condition. • Proponent reports steps taken to achieve closure at the site and requests permission to post notice of site condition to the public registry • The Minister will review the notice of site condition application and determine whether it accurately depicts the state of the site and that it complies with the requirements of the Act and applicable code chapters. • Notice of site condition cannot be filed in the registry if the site was reclaimed pursuant to the requirements of an environmental protection order issued for the site. • A notice of site condition will release the proponent from environmental responsibility related to the site. • Sites will be entered into the notice of site condition database which will be publicly accessible. • All submissions of notice of site condition must be signed off by a qualified person. • Responsibility can be transferred from a responsible party to another person.

Standards Referenced

The following standard is referenced by the Transfer of Responsibility for an Environmentally Impacted Site chapter of the Saskatchewan Environmental Code.

Table P: Standard Referenced in the Transfer of Responsibility Chapter

Standard	Description
ASTM Standard E2516-11 Standard Classification for Cost Estimate Classification System **Developed by:** American Society for Testing and Materials (ASTM)	This standard provides a generic classification system for cost estimates and guidelines for applying the classification to cost estimates.

Requirements

Information related to notice of site condition can be found in The Environmental Management and Protection Act, 2010, the Transfer of Responsibility code chapter and Administrative Control Standard. The Transfer of Responsibility code chapter outlines the rules for transferring the responsibility for an environmentally impacted site from the person responsible to another person. This type of transfer would occur when notice of site condition is not the immediate objective. An example would be the sale of an impacted property used as a gas station that will continue to operate as a gas station following completion of the transaction. Rather than decommissioning the facility and reclaiming the site, the current owner could transfer responsibility for the impacts to the new owner thus relieving the previous owner of future liabilities. The new owner would still be required to manage impacts at the site in accordance with the Act, code chapters, and standard. A reliable mechanism for transfer of responsibility would also help to facilitate productive use of brownfields by reducing the barriers currently associated with impacted site property transactions.

The Administrative Control Standard identifies three different types of administrative controls that can be used to achieve closure at a contaminated site. In addition to the administrative controls, closure can be achieved by source removal and through risk assessment. Once a site has been given notice of site condition, the owner will no longer be held responsible for environmental impacts and the site can exchange hands without worry of future responsibility.

Select a method of control

There are different ways to achieve closure at a site. These include:

- application of administrative or engineered controls;
- source removal; and/or
- risk-based closure.

The three types of administrative controls outlined in the Administrative Control Standard are:

- title instruments;
- zoning controls; and
- land use restrictions.

Title instruments are a prohibited locked statement of interest. These should be placed on title at the expense of the responsible party with the ministry listed as an interested party. This ensures that anyone who is interested in the site is made aware of the environmental status.

A **zoning control** is a restriction made on the development of a site. It should be tied to municipal building permits and may require a zoning bylaw change. An example of a zoning control would be restricting the site to only industrial land use. These controls must remain in place on site forever unless the site's environmental status is reevaluated.

Land use restrictions are a type of development restriction can be applied by the authority that has jurisdiction over the land use of an impacted site. Specific bylaws or policies regarding exposure scenarios can be applied. For example, a ground disturbance policy can be put in place to limit exposure to impacts at depth. Should the allowable land use change to a more sensitive land use, through zoning amendments or other jurisdictional policy changes, responsibility for ensuring remaining impacts are below the new exposure risk scenario would be with the agency that authorized the change in land use. For example, a notice of site condition is posted to the registry for an impacted commercial site that was reclaimed to commercial land use standards. The

commercial property is sold to a residential developer who successfully petitions the municipal government to change the zoning of the property from commercial to residential to allow for a condominium development. In this example, it would be the responsibility of the municipal government that approved the zoning change from commercial to residential to ensure that residual contaminant concentrations at the site meet the more stringent residential standards or that risk associated with the residual impacts were assessed and managed in accordance with a residential receptor risk scenario.

Risk assessment and management is a method of identifying and assessing the risk associated with environmental impacts at a site, and proposing an approach for managing these risks. If the risk at the site is characterized and addressed properly risk-based closure can be applied to the site. This type of closure can be achieved by either completing a risk assessment, or through applying administrative controls. The risk assessment must be done in accordance with industry best practices, including Health Canada's Federal Contaminated Site Risk Assessment in Canada (2012), or any equivalent guidance, as approved by the Minister as an alternative solution. By evaluating the site on a site-specific basis, the risk can be properly assessed and potentially ruled out.

Transfer of Responsibility

Transferring responsibility can be done if there is an interested and willing party. A civil agreement can be made in which the interested party agrees to take on all environmental responsibility for a contaminated site. The agreement must be in writing and be signed and dated. Additionally it must include the two provisions listed in the code chapter. The provisions state that the interested party takes on full and complete responsibility and is aware of the requirements in EMPA, 2010 and the code chapter.

Before a transfer of responsibility is made, a site assessment must be conducted which fully characterizes any substances of potential concern on the site and adjacent properties. Once the site assessment is complete, a corrective action plan must be prepared in order to estimate the costs of reclamation. The party willing to take on environmental responsibility must agree to the corrective action plan and provide a financial assurance to the Minister.

When transferring statutory responsibility to a new site owner, and the property is still impacted, a CAP must be put in place that has been cost-verified and financially assured via an instrument that is acceptable to the Minister. The financial assurance is a new requirement set out in the Transfer of Responsibility code chapter. The person taking on environmental responsibility must provide a financial assurance that equals the reclamation costs and an additional contingency amount. This ensures the site will not be abandoned in the future with no clean-up occurring. The financial assurance must at minimum provide the applicable elements outlined in ASTM standard E2516-11 Standard Classification for Cost Estimate Classification System. Upon acceptance from the Minister, the corrective action plan will be filed in the registry. Financial assurances will be further discussed in the financial assurance guidance document.

Applying for Notice of Site Condition

Once a responsible party reclaims an environmentally impacted site in the manner set out in the approved corrective action plan, an application for notice of site condition can be submitted. The application can be made by the responsible party and if approved will be filled in the registry.

Any site which has been reclaimed in pursuant to an environmental protection order shall not be issued notice of site condition.

Consequences of Applying for Notice of Site Condition and Corrective Action Plan

If a notice of site condition is filed in the registry, the person responsible will no longer be required to prepare a site assessment or corrective action plan. Further, the Minister will no longer be able to issue an environmental protection order for the site in question.

If a corrective action plan is prepared for a site where the responsibility has been transferred, the person who transferred the responsibility will not be required to prepare any further site assessments or corrective action plans. In addition, the person who transferred responsibility will not be issued an environmental protection order for any matter set out in the corrective action plan.

The above statements do not apply in the event that the notice of site condition or corrective action plan do not accurately describe the condition of the site, reclamation activities undertaken or required to be undertaken. If the notice of site condition or corrective action plan contains false or misleading information the Minister may issue an environmental protection order or require further assessment. A notice of site condition will not be issued for work conducted pursuant to an environmental protection order.

A site with notice of site condition or corrective action plan filed in the registry may only be used for a compatible use. A compatible use will be specified in the notice of site condition or corrective action plan. For example, if a site has been cleaned up to industrial criteria and issued a notice of site condition, it cannot be used for a residential land use. In the event that a site is being used for an incompatible use, the Minister may issue an environmental protection order.

Registry

An environmentally impacted sites registry will be established by the Minister. The registry will contain the following documents:

- notices of site condition;
- corrective action plans;
- site assessments;
- environmental protection orders; and
- any other prescribed documents or prescribed classes of documents.

In the directed process, people may be required to prepare the above listed documents and register them with the Minister. In the future, with some restrictions (e.g. protection of privacy), site information may be publicly accessible.

If a site is the subject of a document filed in the registry, the municipality shall ensure the site is zoned for a compatible land use. The municipality may not issue any building permits or licenses if the activity is not compatible with the condition of the site as determined in the documents submitted to the registry.

APPENDIX

A Systematic Sampling Approach

Excerpt from *Gilbert (1987). Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold, New York. pp. 320.*

The following applies to instances where the objective of sampling is not to estimate an average but to determine whether "hot spots" or highly contaminated local areas are present. For example, it may be known or suspected that hazardous chemical wastes have been buried in a land fill but its exact location is unknown. This chapter provides methods for answering the following questions when a square, rectangular, or triangular systematic sampling grid is used in an attempt to find hot spots:

- What grid spacing is needed to hit a hot spot with specified confidence?
- For a given grid spacing, what is the probability of hitting a hot spot of specified size?
- What is the probability that a hot spot exists when no hot spots were found by sampling on a grid?

This discussion is based on an approach developed by Singer (1972, 1975) for locating geologic deposits by sampling on a square, rectangular, or triangular grid. He developed a computer program (ELIPGRID) that was used by Zirschky and Gilbert (1984) to develop nomographs for answering the preceding three questions. These nomographs are given in **Figures k, l,** and **m**. We concentrate here on single hot spots. Some approaches for finding multiple hot spots are discussed by Gilbert (1982) and Holoway *et al*. (1981). The methods in this chapter require the following assumptions:

1. The target (hot spot) is circular or elliptical. For subsurface targets this applies to the projection of the target to the surface (**Figure i**).
2. Samples or measurements are taken on a square, rectangular, or triangular grid (**Figure j**).
3. The distance between grid points is much larger than the area sampled, measured, or cored at grid points—that is, a very small proportion of the area being studied can actually be measured.
4. The definition of "hot spot" is clear and unambiguous. This definition implies that the types of measurement and the levels of contamination that constitute a hot spot are clearly defined.

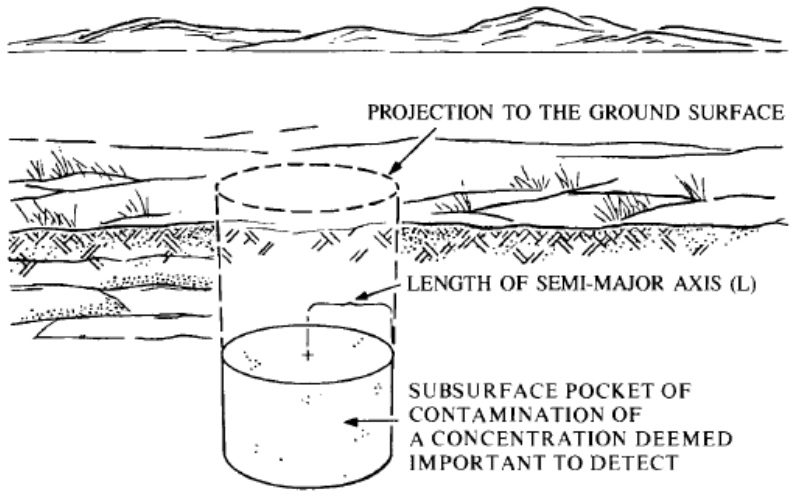


Figure i: Hypothetical Subsurface Pocket of Contamination

(Gilbert, 1982, Fig. 1)

5. There are no measurement misclassification errors – that is, no errors are made in deciding when a hot spot has been hit.

Parkhurst (1984) compared triangular and square grids when the objective is to obtain an unbiased estimate of the density of waste clusters in a hazardous waste site. He showed that the triangular grid was more likely to provide more information than the square grid. He also concluded that if the waste clusters are expected to follow an unknown but regular pattern, the wells should be drilled at randomly selected locations. For randomly located clusters, a triangular or square grid is preferred.

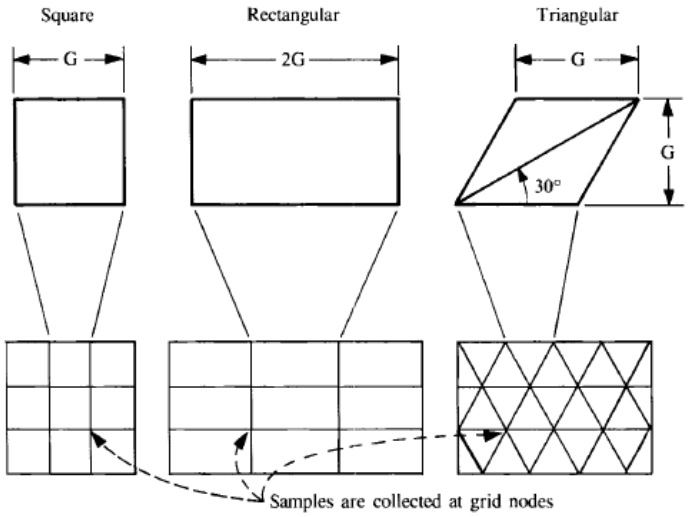


Figure j: Grid Configuration for Finding Hot Spots

(Zirschky and Gilbert, 1984, Fig. 1)

Determining Grid Spacing

The grid spacing required to find a hot spot of pre-specified size and shape with specified confidence may be determined from the following procedure:

1. Specify L, the length of the semi-major axis of the smallest hot spot important to detect (see **Figure i**). L is one half the length of the long axis of the ellipse.

2. Specify the expected shape (S) of the elliptical target, where

$$S = \frac{\text{Length of short axis of the ellipse}}{\text{Length of long axis of the ellipse}}$$

   Note that $0 < S \ll 1$ and that $S = 1$ for a circle. If S is not known in advance, a conservative approach is to assume a rather skinny elliptical shape, perhaps $S = 0.5$, to give a smaller spacing between grid points than if a circular or "fatter" ellipse is assumed. That is, we sample on a finer grid to compensate for lack of knowledge about the target shape.

3. Specify an acceptable probability (β) of not finding the hot spot. The value β is known as the "consumer's risk." To illustrate, we may be willing to accept a β = 0.2 (or 20%) chance of not finding a small hot spot, say one for which L = 5 cm. But if L is much larger, say L = 5 m, a probability of only β = 0.01 (1 chance in 100) may be required.

4. Turn to **Figures k, l** or **m** for a square, rectangular, or triangular grid, respectively. These nomographs give the relationship between β and the ratio L/G, where G is the spacing between grid lines (**Figure j**). Using the curve corresponding to the shape (S) of interest, find L/G on the horizontal axis that corresponds to the pre-specified β. Then solve L/G for G, the required grid spacing. The total number of grid points (sampling locations) can then be found because the dimensions of the land area to be sampled are known.

For elliptical targets (S < 1) the curves in **Figures k, l,** and **m** are average curves over all possible orientations of the target relative to the grid. Singer (1975, Fig. 1) illustrates how the orientation affects the probability of not hitting the target. If the orientation is known, Singer's (1972) program will give the curves for that specific orientation.

Example

Suppose a square grid is used and we want to take no more than a β = 0.1 (or 10%) chance of not hitting a circular target of radius L = 100 cm or larger. Using the curve in Figure h for S = 1, we find L/G = 0.56 corresponds to β = 0.10. Solving for G yields G = L/0.56 = 100 cm/0.56 ≈ 180 cm. Hence, if cores are taken on a square grid with spacing of 180 cm, we are assured the probability is only 0.10 (1 chance in 10) of not hitting a circular target that is 100 or more centimeter in radius.

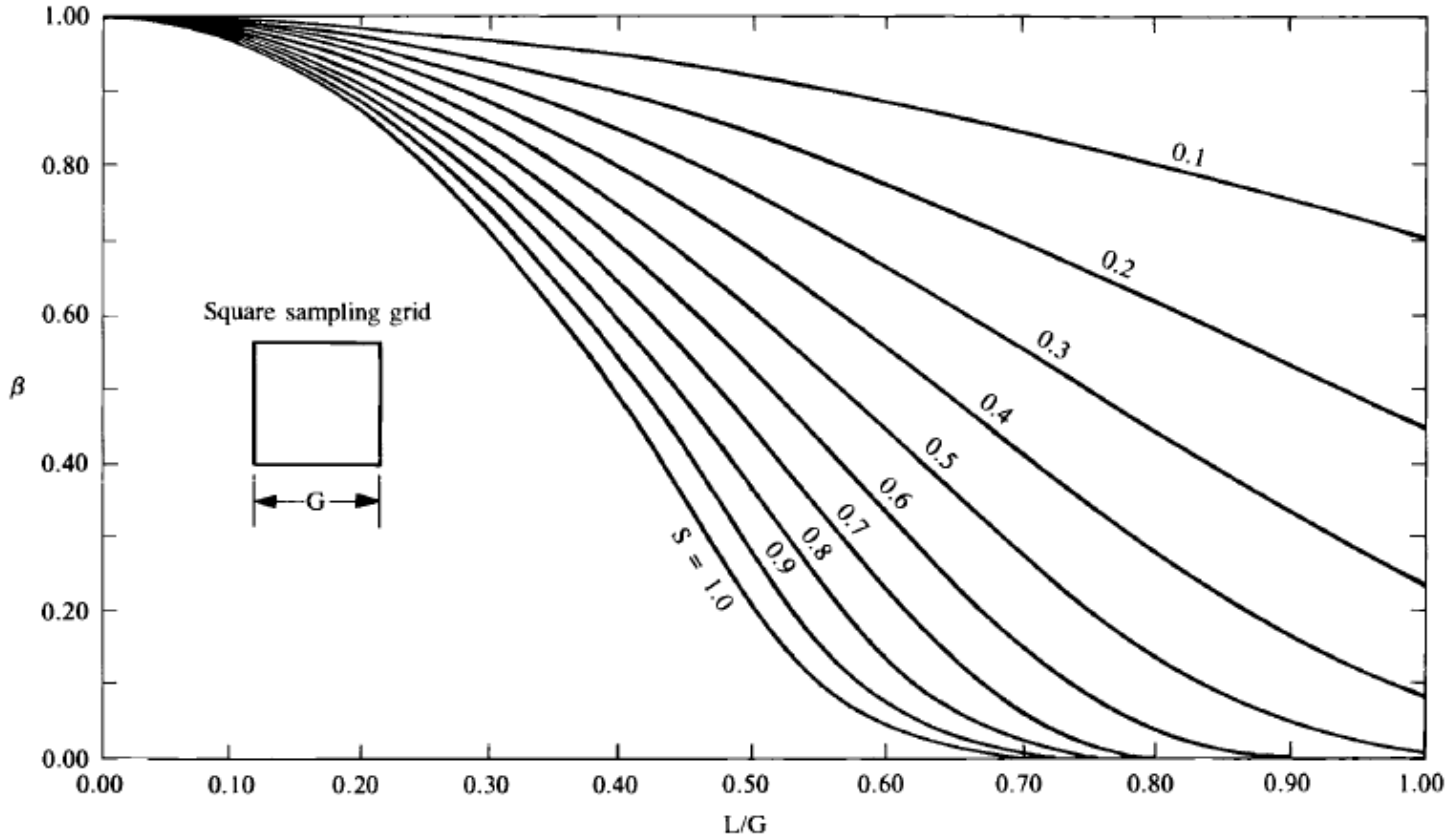


Figure k: Curves Relating L/G to consumer's Risk, β, for Different Target Shapes When Sampling is on a Square Grid Pattern

(Zirschky and Gilbert, 1984, Fig. 3)

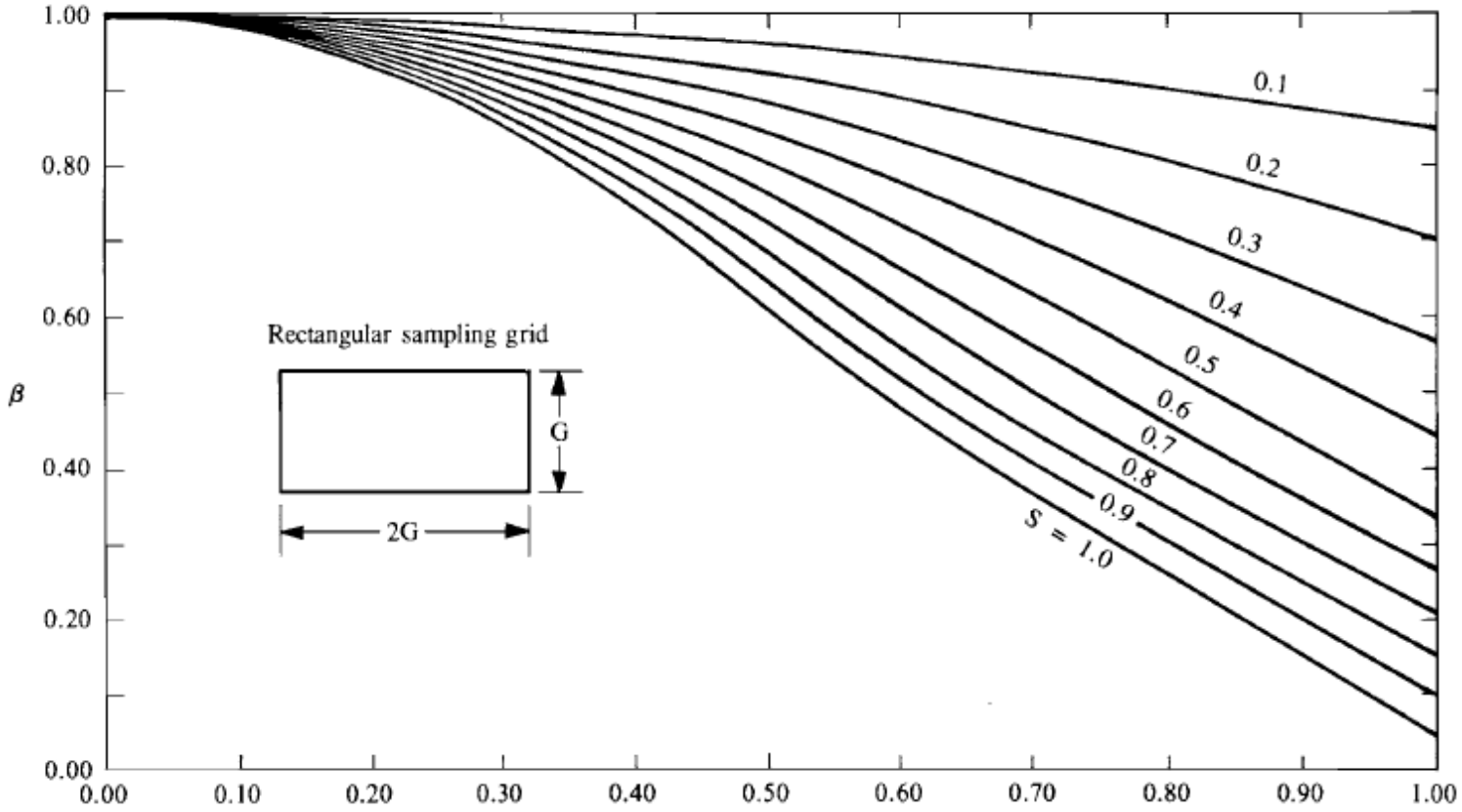


Figure l: Curves Relating L/G to consumer's Risk, β, for Different Target Shapes When Sampling is on a Rectangular Grid Pattern

(Zirschky and Gilbert, 1984, Fig. 5)

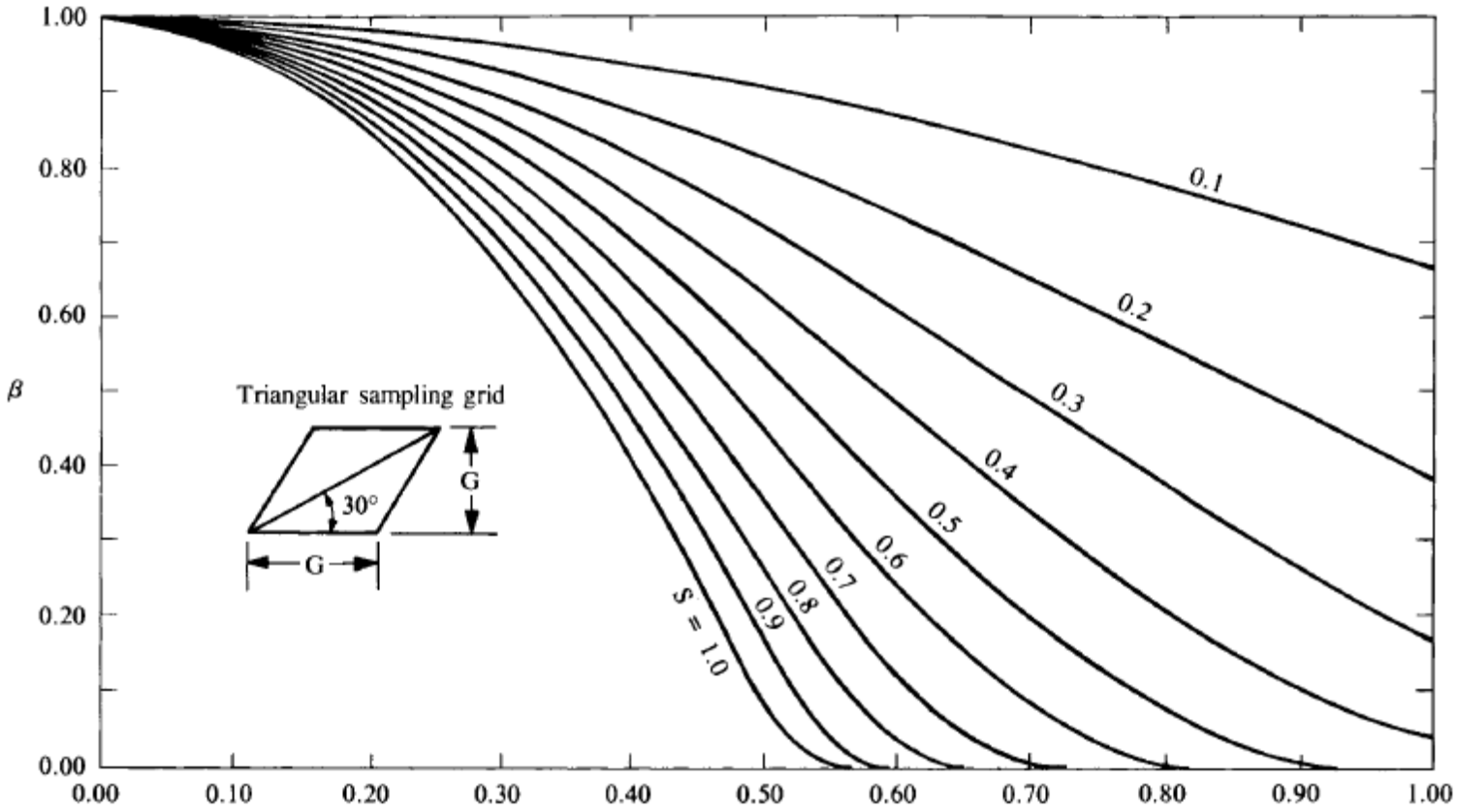


Figure m: Curves Relating L/G to Consumer's Risk, β, for Different Target Shapes When Sampling is on a Triangular Grid Pattern

(Zirschky and Gilbert, 1984, Fig. 4)

DEFINITIONS

Accepted Corrective Action Plan - a corrective action plan submitted to the Minister pursuant to subsection 16(1) of the Act and that includes any changes directed by the Minister pursuant to subsection 16(2) of the Act (Corrective Action Plan Chapter)

Accepted environmental protection plan - an environmental protection plan that is accepted by the Minister under section 27 of the Act (EMPA, 2010)

Act - The Environmental Management and Protection Act, 2010

Administrative control - a legal or administrative tool, as set out in the Administrative Control Standard, to safeguard against unacceptable exposures to substances of potential concern for specific pathways (Corrective Action Plan Chapter)

Adverse effect - impairment of or damage to the environment or harm to human health, caused by any chemical, physical or biological alteration or any combination of any chemical, physical or biological alterations or any combination of any chemical, physical or biological alterations (EMPA, 2010)

Aliquots - a portion of a larger whole, especially a sample taken for chemical analysis or other treatment

Analyte - a substance whose chemical constituents are being identified and measured

Corrective action - any action or process undertaken to achieve reclamation

Corrective action plan - a plan that details the methods employed to prevent, minimize, mitigate, remedy or reclaim adverse effects (EMPA, 2010)

Decommissioning -

(a) the process of removing a storage facility and associated infrastructure from operation, such that the facility no longer poses a risk of adverse effect to the environment; or

(b) removal of impacted media limited to the immediate vicinity of the tank and associated infrastructure

Delineation - determining the size, depth and areal extent of a contamination plume in soil or groundwater

Discharge - discharge, drainage, deposit, release, or emission into the environment (EMPA, 2010)

Discovery - a previously unreported discharge or historical discharge

Endpoint - a Tier 1, 2, or 3 endpoint selected as set out in the Endpoint Selection Standard (Corrective Action Plan Chapter)

Environment - includes the following:

- air and the layers of the atmosphere;
- land, including soil, subsoil, sediments, consolidated surficial deposits and rock;
- water;
- organic and inorganic matter and living organisms; and
- interacting natural systems and ecological and climatic interrelationships that include the components listed above.

Environmental protection order - an environmental protection order issued under section 56 of EMPA, 2010 and includes a replacement of that order, and any amendments or alterations to that order, made under section 58 (EMPA, 2010)

Environmental protection plan (EPP) - a conceptual plan that details the methods to be employed to prevent, minimize, monitor, mitigate, remedy, or reclaim an adverse effect before, during, or after any activity (EMPA, 2010)

Environmentally impacted site - an area of land or water that contains a substance that may cause or is causing an adverse effect

Exposure pathway - the route by which a receptor comes into contact with a contaminant (such as groundwater, inhalation, ingestion)

Hazardous substance - a substance that is prescribed or is set out in the code (EMPA, 2010)

Hazardous waste - a waste that is prescribed or is set out in the code (EMPA, 2010)

Hot spot - a localized area on-site where concentration of SOPCs in effected media exceed the applicable standards

Industrial waste - any waste that:

- is generated by any process of industry, manufacturing, trade, or business or by the development of a natural resource;
- is prescribed or is set out in the code;
- includes seepage, rainwater, or storm water that enters industrial waste works (EMPA, 2010)

Method detection limit (MDL) - the minimum concentration of a substance that can be measured and reported with 99 per cent confidence that the true value is greater than zero

Occupied building - any building, vehicle, or other place suitable for human occupancy, whether or not a person is actually present, including any outbuilding that is immediately adjacent to or in close proximity to an occupied structure and that is habitually used for personal use or employment

Off site - not on site

On site - on and completely contained within the boundaries of the property owned or occupied by the owner of a substance

Persistence - as defined in the *Persistence and Bioaccumulation Regulations* (Canada)

Qualified person - a member of a class of persons that is prescribed or are set out in the code, or an individual designated by the Minister for one or more purposes or activities that are governed by EMPA, 2010

Receptor - a living plant, animal, or human that may be exposed to a substance

Reclamation - the conversion of adversely effected land to a pre-disturbance level of productivity

Remediation - activities that remove, neutralize or reduce concentrations of SOPCs, to an acceptable land-use endpoint in order to prevent or minimize current or future adverse effects

Results-based objectives (RBO) - broadly describe the overall outcomes that the specific chapter intends to achieve

site assessment - any activity to determine the cause, nature or extent of a potential or existing adverse effect that satisfies any prescribed requirements or any requirements set out in the code (EMPA, 2010)

Split samples - a sample prepared in the field through homogenization by mixing and portioned into separate aliquots prior to laboratory analysis

Substance of potential concern (SOPC) - any anthropogenic substance found in soil, groundwater, or surface water that is present in a concentration that meets or exceeds the limits for a particular substance set out in Table 2 of the Discharge and Discovery Reporting Standard (Site Assessment Chapter)

Test methods for evaluating solid waste, physical / chemical methods - as adopted in the Adoption of Standards Chapter

ABBREVIATIONS AND ACRONYMS

ASTM	American Society for Testing and Materials
BSI	British Standards Institution
BTEX	benzene, toluene, ethylbenzene and xylene
CAP	corrective action plan
CCME	Canadian Council of Ministers of the Environment
code	Saskatchewan Environmental Code
CSA	Canadian Standards Association
CSM	conceptual site model
CV	coefficient of variation
DDR	Discharge and Discovery Reporting Standard.
EMPA, 2002	The Environmental Management and Protection Act, 2002
EMPA, 2010	The Environmental Management and Protection Act, 2010
EPA	Environmental Protection Agency (US)
EPP	environmental protection plan
ESA	environmental site assessment
ESCR	The Environmental Spill Control Regulations
HSWDG	The Hazardous Substances Waste Dangerous Goods Regulations
IAP	incident action plan
ICS	incident command system
ISO	International Organization for Standardization
MDL	method detection limit
NCSCS	National Contaminated Sites Classification System
NIMS	National Incident Management System.
NoSC	notice of site condition
PHC	petroleum hydrocarbons
PHMC	provincial hazmat coordinator
QA/QC	quality assurance/quality control
QP	qualified person
RBO	results-based objective
RMFR	risk management with future reclamation
RMP	risk management plans
RPD	relative per cent difference
SCC	Standards Council of Canada
SEQS	Saskatchewan Environmental Quality Guidelines
SOPC	substance of potential concern
SOW	scope of work
ULC	Underwriters Laboratories of Canada
UL_c	upper confidence limit of the mean concentration
USEPA	United States Environmental Protection Agency
VOCs	volatile organic compounds
VSA	visual site assessment

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