Manual **026**

Alberta Energy Regulator

Emergency Preparedness and Response Guide

For Public Comment 2024

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1 Introduction

1.1 About this Manual

This manual provides guidance, explanation, and expectations that will enable a duty holder as specified in legislation (e.g., licensee, operator, company, applicant, approval holder, or permit holder) to develop, implement, and maintain an emergency management program (EMP) that meets the requirements of *Directive 071: Emergency Preparedness and Response*.

Directive 071 focuses on preparedness and response to emergencies that require the protection of the public and the environment. The prevention and mitigation measures for such emergencies are outlined in other AER regulatory instruments, including *Directive 023: Oil Sands Project Applications*, *Directive 056: Energy Development Applications and Schedules*, *Directive 065: Resources Applications for Oil and Gas Reservoirs*, *Directive 089: Geothermal Resource Development*, *Directive 090: Brine-Hosted Mineral Resource Development*, and other regulatory instruments.

Directive 071 applies to operations of different sizes, types, and hazards; therefore, the level of detail required for programs or plans will vary from one operation to another. The details of the duty holders' programs and plans must reflect the scale and complexity of their operations and the risks presented to the public and the environment.

1.2 How to Use this Manual

Sections 2 through 8 of the manual provide guidance on the overarching EMP requirements of *Directive 071*,which are applicable to all operations and hazards within the scope of the directive.

Sections 9 through 11 of the manual provide guidance on that apply only to EMP requirements for wells, pipelines, and facilities (including cavern storage) containing H_2S or HVP products. These sections apply only to duty holders whose operations involve H_2S or HVP products requiring an AER-approved emergency response plan (ERP).

2 Emergency Management Program

2.1 General

Duty holders are responsible for ensuring they are fully prepared and capable of a timely response to emergencies by developing, implementing, and maintaining an EMP that protects the public and the environment.

As described in *Directive 071*, the duty holder's senior management must review and approve the EMP to ensure its effectiveness and maintain accountability for the program.

The level of detail for each element of the EMP should be relative to the scale and complexity of a duty holder's operations, potential emergency scenarios, and the magnitude of associated risks. The duty holder may cover these elements in a standalone program or by integrating them into a management system as defined in *Directive 071*.

A duty holder may operate in multiple jurisdictions and be required to implement several safety-related management programs, including

- an EMP and ERPs under *Directive 071*,
- a safety and loss management system as per *CSA Z662: Oil and Gas Pipeline System* (free download at https://www.csagroup.org/store/petroleum-and-natural-gas/),
- a process safety management program as per *CSA Z767: Process Safety Management* (free view access at https://www.csagroup.org/store/product/CSA_Z767%3A24/),
- a dam safety program as per the *Alberta Dam and Canal Safety Directive*, and
- an occupational health and safety management program as per the *Occupational Health and Safety Code*.

The AER recognizes that these programs share common elements and encourages duty holders to integrate the elements of their EMPs with other management programs into one management system. This integration enhances the effectiveness of overall safety and risk management.

2.2 Emergency Management Program Evaluation and Continual Improvement

Section 2.2 of *Directive 071* sets out the requirements for ongoing evaluation of the duty holder's EMPs to ensure continual improvement, including a self-assessment to evaluate the performance of the duty holder's EMPs

The AER may use the collective performance of all duty holders, as indicated by the self-assessment results, to inform its strategy for auditing a duty holder's EMP.

2.3 Management of Change of the Emergency Management Program

Section 2.3 of *Directive 071* sets out the requirements for the management of change (MOC) for the duty holder's EMP. This section is adopted from clause 6.2 of *CSA Z246.2*.

Use the Emergency Management Program Self-Assessment Reporting form to evaluate the MOC system, including processes for

- defining accountability for managing change,
- identifying and analyzing changes that could affect the EMP,
- documenting the changes,

- approving changes,
- implementing changes, including communications, and
- reviewing the effectiveness of the changes made.

2.4 Management Review of the Emergency Management Program

Section 2.4 of *Directive 071* outlines requirements for management review. This section is adopted from clause 7.2 of *CSA Z246.2*.

Use the Emergency Management Program Self-Assessment Reporting form to evaluate the performance of the management review process based on whether

- the EMP is fully implemented and compliant with *Directive 071* requirements,
- the EMP meets the duty holder's policy and objectives,
- the EMP is adequate for its intended purpose, and
- required improvements have been implemented.

Consider the following when evaluating whether the EMP is fully implemented and compliant with *Directive 071*:

- the suitability of the current EMP policy, goals, and objectives
- setting objectives in the forthcoming period
- adequacy of the hazard identification and consequence analysis processes
- adequacy of resources (e.g., financial, personnel, material, mutual aid)
- effectiveness of the EMP evaluation process
- results of the self-assessment
- the state of preparedness for emergencies (e.g., ERP, training, and exercise reports)
- the results of any investigations into incidents or emergencies
- the assessment of the effects of foreseeable changes to regulations or technology
- emergency response arrangements and information sharing with appropriate authorities and municipal emergency service providers
- emergency communication plans (internal and external)

3 Hazard Identification and Consequence Analysis

Hazard identification and consequence analysis may involve using methodologies and techniques recognized in the industry and discipline, comparisons with similar historical incidents or near misses, analysis based on expert judgement, and considerations of social or cultural effects informed through engagement with Indigenous groups.

3.1 Potential Emergency Scenarios

A duty holder may need to activate emergency response procedures to ensure the protection of the public and the environment at the AER-regulated operations where

- substances (matter or energy) are extracted, stored, processed, disposed of, handled, produced, treated, or used;
- containment structures (natural or man-made) or geological features are used or modified;
- a natural hazard event could affect the safety of operations (e.g., wildfires, floods, extreme snowstorms); and
- any other hazards are present.

3.1.1 Uncontrolled, Unplanned, or Accidental Release of Substances

Directive 071 requires duty holders to identify potential emergency scenarios, including uncontrolled, unplanned, or accidental release of substances. As defined in the *Environmental Protection and Enhancement Act*, "substances" include both matter and forms of energy.

- Matter can be gaseous, liquid, solid, dust, or mist. Matters that are flammable, combustible, ignitable, toxic, corrosive, explosive, reactive, radioactive, and asphyxiating are harmful to people and the environment. For example, hydrocarbons, hydrogen, mine dust, sour gas, brine, tailings, waste materials, naturally occurring radioactive material, or compressed carbon dioxide.
- Forms of energy include electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, thermal, gravitational, or any other form of energy. For example, geothermal heat or seismic energy.

The release of nontoxic and nonflammable substances (e.g., steam, hot water, or compressed air) may require emergency response actions, depending on the quantity released and the proximity to the public and environmental receptors.

Controlled or planned releases, such as those approved under *Directive 060: Upstream Petroleum Industry Flaring, Incinerating, and Venting*, are excluded from *Directive 071* hazard identification and consequence analysis requirements.

Not every uncontrolled, unplanned, or accidental release of substances requires the activation of emergency response procedures to protect the public and the environment. However, other AER regulatory requirements may require substance release reporting and remedial measures. See *Manual 021: Contamination Management* for guidance on substance release reporting and the duty to take remedial measures.

3.1.2 Failure of Containment Structures or Geological Features

Containment structures or geological features are used or modified as part of energy and resource development at AER-regulated operations. Containment structures include dams, tailings ponds, dumps, etc. Geological features include subsurface reservoirs, caprocks, open-mine pit walls, underground mine tunnels, etc.

Failure of a containment structure or geological feature could activate emergency response procedures (e.g., rock falls from mine pit walls, tailings liquefaction, or surface deformation). Such failures can lead to the release of substances. For example, a caprock integrity failure could result in reservoir fluids being released into groundwater formations or onto the surface.

Uncontrolled, unplanned, or accidental energy releases, such as induced seismic events (mechanical), may also potentially cause a containment structure to fail.

3.1.3 Natural Hazard Events Affecting Operational Safety

This section is adopted from *Annex C.3.4* of *CSA Z767*.

Natural hazard events, such as wildfires, floods, and snowstorms, can affect operational safety. Failure to maintain operational safety during these events, could potentially trigger the release of substances or cause earthen features to fail.

The duty holder should develop an assessment process identifying the time needed to restore safe operations based on the potential of a natural hazard event for their area of operation (e.g., an avalanche in a mountainous area). This information guides efforts to obtain reasonable advance notice of natural hazard events, identifying the early warning signs to monitor, and specific emergency response actions required.

An important aspect of emergency preparedness is ensuring that staffing levels are adjusted appropriately for responding to the type of emergency. For example, considerations be given to minimizing on-site staffing once operations are shut down, locked, and in a safe status. Another example is increasing staffing in the control room as appropriate to control a potentially dangerous condition caused by natural hazard events.

It is generally advisable not to rely on external emergency responders in the case of a natural hazard emergency, as the local community and response resources will also be affected. Roads are often impassable, and emergency services could be overwhelmed with other local demands. As part of its hazard identification and consequence analysis process, the duty holder may determine the best approach is shutting in all hazardous substances or energy and putting its operations into a safe state before the natural hazard occurs.

See the following for additional guidance:

- *CSA W211:21: Management Standard for Stormwater Systems* (CSA Group)
- *The Impact of Natural Hazards on Hazardous Installations* (Organisation for Economic Co-operation and Development)
- *National Risk Profile: A National Emergency Preparedness and Awareness Tool – Annex C Risk Assessment Methodology* (Public Safety Canada)

3.2 Hazard Identification Method

A hazard identification process identifies hazards and associated emergency scenarios that could result in activating emergency procedures to protect the public and the environment. The duty holder may use a variety of hazard identification methodologies, including

- comparative methods (e.g., checklists, what-if analysis, hazard indices, reviews of historical incidents, and near misses),
- structured methods (e.g., process hazard analysis, hazard and operability analysis, failure mode and effect analysis),
- methods that provide a logical pathway to translate various initiating events into potential emergency scenarios (e.g., event tree analysis and fault tree analysis), and
- any other method recognized within the industry and discipline.

The duty holder may refer to other AER regulatory instruments or regulations from other jurisdictions to gather information on the hazards that should be considered in its hazard identification. The duty holder may gather information on hazards for consideration in hazard identification from other AER regulatory instruments or regulations from other jurisdictions. For example, see *Directive 089*, *Directive 090*, and the *Environmental Emergency Regulations* under Part 8 (section 200) of the *Canadian Environmental Protection Act*.

The results of the hazard identification is a list of hazards and assessed emergency scenarios that include

- the initiating event,
- the worst-credible scenarios and less severe scenarios,

- the existing prevention and mitigation safeguards, and
- proposed new safeguards to prevent or mitigate the scenarios.

Typical documentation of hazard identification includes

- a description of the scenario pathway from an initiating event to consequences, including event relationships (e.g., linkages and interdependencies);
- previous incidents or near misses at the site and relevant events from other sites;
- hazards introduced or modified because of changes made at the site;
- hazards introduced or modified because of natural hazard events; and
- safeguards in place to reduce the likelihood or magnitude of a scenario consequence or to mitigate the consequence.

See the following for guidance on hazard identification methodologies:

- *CAN/CSA – IEC/ISO 31010-10: Risk Management – Risk Assessment Techniques* (CSA Group)
- *Guidelines for Hazard Evaluation Procedures* (third edition) (Center for Chemical Process Safety)

3.3 Consequence Analysis Method

Consequence analysis helps to understand the effects of hazards and associated emergency scenarios to establish preparedness and response strategies.

Consequence analysis is performed according to the initial scope of the hazard identification and includes

- the consequences of potential emergencies on the public and the environment,
- the effects on the public and the environment,
- the combined effects of all released materials for a particular scenario, and
- any knock-on effects, if applicable.

Qualitative consequence analysis is a simple, conservative method that errs on the side of caution, which can be integrated into the duty holder's organizational risk matrix for determining emergency response strategies. Qualitative analysis for emergency scenarios may involve the following:

- research and comparison to historical incidents or near misses of a similar nature
- application of expert judgement

- linking a postulated emergency scenario to consequence categories identified in the risk matrix[1], such as injury, fatality, contamination, etc.

For emergency scenarios with potentially catastrophic consequences, as explained in appendix 4 of *Directive 071*, a duty holder may choose quantitative consequence analysis, a detailed but realistic method, to determine the specific distances from an identified hazard to its effects (e.g., injury, fatality, contamination, etc.) and use this data to develop emergency response strategies. Quantitative consequence analysis methods include modelling tools (software), data tables, or other resources evaluated and approved by a person or an organization knowledgeable in the industry and discipline.

See the following for guidance on consequence analysis methodologies:

- *Risk Assessment – Recommended Practices for Municipalities and Industries*, 2004 (Canadian Society for Chemical Engineering)
- *CAN/CSA – IEC/ISO 31010-20 Risk Management – Risk Assessment Techniques* (CSA Group)
- *Guidelines for Consequence Analysis of Chemical Releases* (Center for Chemical Process Safety). 1999
- *Technical Guidelines for the Environmental Emergency Regulations* (Environment and Climate Change Canada)
- RMP*Comp and ALOHA (U.S. Environmental Protection Agency)
- *Emergency Response Guidebook* (Transport Canada)

4 Emergency Response Plan

In accordance with section 5 of *Directive 071*, the duty holder's EMP may include two distinct ERPs: a corporate ERP and an AER-approved ERP. The duty holder must submit its corporate ERP and any AER-approved ERP to the AER. Although corporate ERPs are not subject to AER approval, the AER will assign a registration number to each corporate ERP and keep them on file for audit and emergency response purposes.

Section 5.3 of *Directive 071* outlines the components common to corporate and AER-approved ERPs. Section 11 of the directive details the additional requirements for ERPs submitted to the AER for approval.

[1] The *Canadian Dam Association (CDA) Consequence Classification Ratings for Dams* is considered a qualitative consequence analysis method. This approach involves evaluation of the potential downstream consequences of failure in terms of three categories: loss of life, environment and cultural values, and infrastructure and economics. However, this method is for dams regulated under the *Alberta Dam and Canal Safety Directive*, which is not within the scope of *Directive 071*.

An ERP addresses emergency scenarios, potential hazards to the public and the environment, and systems required for effective response. It is organized and prioritized to provide quick access to critical information and is intended to achieve the following objectives:

- coordinating activities among industry responders, emergency services, and appropriate authorities
- promoting communication with all persons involved in or potentially affected by the incident
- assisting personnel in determining and performing remedial actions
- establishing clear roles and responsibilities for all responders
- identifying response organizations and describing command and control structures
- identifying and describing predetermined resources, including personnel, equipment, and services

The duty holder is expected to maintain a list of the locations where approved ERPs will be placed.

4.1 *Quick Guide to Emergencies*

The purpose of the *Quick Guide to Emergencies* is to provide essential information from a duty holder's ERP, as detailed in section 5.2 of *Directive 071*, to the public and appropriate authorities who have the capability and are willing to be involved in the duty holder's emergency planning process (includes the AER, local authorities, the public, Indigenous communities, neighbouring businesses, industry operators, and others).

The *Quick Guide to Emergencies* purpose is to raise awareness of the public and appropriate authorities concerning potential emergency scenarios associated with a duty holder's operations. It highlights the hazards and emergency scenarios that may be present and the resources the public and appropriate authorities may use when requiring further information.

4.2 Common Components to All Emergency Response Plans

4.2.1 Communications Plan

The duty holder's communication plan should include a communication flowchart (an effective tool summarizing the communication process steps among the duty holder's first responders and the public, agencies, and other stakeholders during an emergency). This tool is particularly useful during incident management.

4.2.2 Emergency Contact Phone Numbers

List the potential external emergency support services that may be required, including the following:

- government departments and agencies
- First Nations and Métis contacts
- communication services
- air monitoring services
- emergency support services, including emergency social services
- spill cooperatives
- other contacts the duty deems relevant to their emergency response

4.2.3 Hazard Monitoring

Monitoring devices should be appropriate for addressing site-specific considerations, including

- hazard type,
- access and egress points,
- effects on people, environment, and infrastructure,
- local weather conditions,
- traffic patterns, and
- natural hazards (e.g., wildfire, flooding).

Examples of hazard monitoring devices include field soil and water sampling tools, electromagnetic surveys, air monitoring devices, plume modelling, and seismometers.

4.2.4 Mutual Aid Agreements

Mutual aid agreements should be developed by engaging with the parties providing aid and should

- be in writing,
- define the scope of the agreement and its objectives,
- define the agreement term (expiration date or renewal date, if applicable),
- the activation mechanism and process,
- list the 24-hour contact information for activating the agreement,

- clear roles and responsibilities of each party,
- list the type of aid agreed to (resources offered),
- include procedures for requesting and providing assistance,
- communication procedures, and
- explain the limitations on the response of each party.

The mutual aid agreement should be signed by individuals with requisite authorities and included in the ERPs of each signatory.

4.3 Licence Transfers and Amalgamations

During the transition period specified in section 5.4 of *Directive 071*, the parties involved in the licence transfer or amalgamation are expected to work together to develop a transition plan in accordance with *Directive 071*, including any site-specific ERPs.

The duty holder of record with the AER will remain responsible for emergency preparedness and response duties until a decision has been made concerning the proposed transfer of the licences or upon registering the amalgamation.

5 Training

Training is an essential element of emergency preparedness and response. Training should be conducted at all levels of the organization, including senior management.

5.1 Elements of Training Plan

This section is adopted from *Annex A.4.9.2* of *CSA Z246.2*.

Consider the following elements when developing a training plan:

- an analysis of training needs based on the results of the hazard identification
- the scope of the training plan
- training methods, such as case studies, coaching, discussions, lectures, online learning, simulations, and role-play
- course materials, such as
  - administrative material (e.g., accreditation/certification materials, course agenda/description)
  - evaluations, registration forms, course invitation/announcements, participant records (i.e., dates of enrollment, courses taken), and sign-in sheets

  - educational materials (e.g., handouts, job aids, manuals/plans, presentations, visual aids, workbooks)
  - instructor materials (e.g., attendees list, contact list, instructor notes)
- course modules and descriptions (including an overview of course objectives, content, timeframes, and instructors)
- training schedule for developing and delivering training
- evaluation of the training (in terms of the participants' acquisition of the requisite knowledge, skills, attitudes, and confidence in applying what they have learned)
- documenting changes to the training plan
- training records (who received what training and when; training certifications)
- reviewing and updating the training content and delivery

Before participating in an incident response, the duty holder's employees and other persons working on behalf of the duty holder who have with a role in an emergency have training appropriate to their assigned emergency response roles and responsibilities.

The type and frequency of training depends on

- the scope, size, and complexity of operations,
- the emergency response plans,
- roles and responsibilities of response personnel,
- response equipment,
- identified hazards,
- regulatory requirements,
- lessons learned from communications, and
- lessons learned from previous response activities (actual and simulated).

6 Exercises

This section is adopted from *Annex A.4.10* of *CSA Z246.2*.

Exercises can vary in size and complexity and provide an opportunity to

- promote emergency response preparedness,
- test and improve operational readiness,
- identify planning execution weaknesses,

- identify resource gaps,
- improve interagency coordination and communications,
- clarify roles and responsibilities,
- evaluate plans, policies, and procedures,
- trial emergency response equipment,
- demonstrate response capability, and
- develop and assess the knowledge and skills of participants for emergencies.

Figure A.1 of *CSA Z264.2* illustrates the activities associated with a planned exercise cycle.

6.1 Types of Exercises

There are three types of required exercises:

- **Tabletop**: A theoretical exercise conducted in a group discussion setting to test plans, procedures, and resource allocations with minimal effects or disruptions to operations. Tabletop exercises focus on implemented procedures for select hazards or activities with a specific scope. The benefits of tabletop exercises include low cost, easier to schedule and conduct, minimal disruption of field operations or resources, and allowing responders to focus on select details or components of an exercise, such as communication procedures.
- **Functional**: A focused activity conducted in the field designed to evaluate operational capabilities and integrated functions using an improvised event. Functional exercises differ from tabletop exercises as they involve real or live actions in the field, such as activating communication protocols (including notification to the AER), deployment of service or equipment providers, and any other response action that could benefit from an exercised scenario. The objective of a functional exercise is to improve the efficiency of response actions, including the ability to resolve unforeseen problems arising during a scenario. Functional exercises involve evaluating the command and coordination centres and assessing the adequacy and timing of emergency response plans and resources. A standardized functional exercise can test all forms of ERPs and associated risks or hazards with limited scopes (e.g., a minor event within an AER-approved ERP).
- **Major exercise**: An exercise that involves the duty holder and multiple agencies and jurisdictions. Resources are deployed in a coordinated response and may include turnover of response teams (i.e., multiday exercise beyond the initial response phase). Major exercises include simulated unit mobilization, personnel, and equipment and implementing response protocols to protect the public and the environment (e.g., notification, evacuation, or shelter in place). Participants assess plans and procedures and evaluate coordinated responses under crisis conditions. A full major exercise targets incidents that are level 2 emergencies or higher.

6.2 Exercise Quality

Exercises are not a substitute for the training requirements in section 6 of *Directive 071*. In addition to the exercise requirements outlined in section 7 of *Directive 071*, the AER considers the following when auditing an exercise:

- minimal difference between the simulated event and an actual emergency scenario
- a clearly defined scope and objectives before conducting the exercise
- participation by all required roles and personnel related to the targeted hazard or risk
- attempted inclusion of agencies
- documentation that is clear, concise, organized, and deliberate

6.3 Exercise Notifications and Invitations

A duty holder is encouraged to provide sufficient lead time between the date of the planned activity and the date of notification to the AER or invitations to appropriate authorities to facilitate participation. There is no time limit for inviting appropriate authorities in advance. However, the maximum advance notice through digital data submission (DDS) is 60 days for AER notification.

The duty holder should notify the AER or appropriate authorities of the

- location, date, and time of the planned exercise,
- the registration number of the ERP being tested,
- an overview of the exercise scenario, and
- a contact number for the duty holder for communications related to the planned exercise and any additional resources required.

A duty holder can modify the original exercise notification for minor changes in DDS up to 48 hours before the original exercise date. A new 30-day notification period is not required. However, if after this time modifications are needed, a new exercise notification will need to be submitted through DDS.

Minor changes include

- changes to the location, date, or time and description of the exercise and
- changes to scenario details, such as conditions, targeted receptors, or individual participants with a role under the ERP (if applicable).

7 Incident Management

7.1 Incident Response

All incidents are assigned an incident level classification: alert, level 1 emergency, level 2 emergency, or level 3 emergency (see section 5.3.2 of *Directive 071*). Table 1 provides recommended responses by incident level.

The AER will request information from the duty holder regarding an incident. The AER may verify the information provided by the duty holder and may reclassify the incident.

Table 1. Recommended responses by incident level

Response	Alert	Level 1 Emergency	Level 2 Emergency	Level 3 Emergency
Actions				
Internal	Respond as necessary. Actions are limited to the site.	Respond as necessary. Actions are limited to the site. Initial response is in accordance with the AER-approved ERP or corporate ERP.	Predetermined public safety and environmental protection actions as required are underway.	Full activation or implementation of duty holder's incident management system.
External	Respond as necessary. Actions are limited to the site.	Respond as necessary. Actions are limited to the site.	Potential multiagency response (i.e., operator, municipal, provincial, federal).	Potential multiagency response (i.e., operator, municipal, provincial, federal).
Communications				
Internal	Discretionary, depending on duty holder's policy.	Notification of off-site management.	Notification of off-site management.	Notification of off-site management.
Public	Courtesy, at duty holder's discretion.	Mandatory for individuals in the EPZ who have requested notification.	Planned and instructive in accordance with the specific ERP.	Planned and instructive in accordance with the specific ERP.
Media	Reactive.	Reactive, as required.	Proactive media management to local or regional interest.	Proactive media management to national interest.
Government	Reactive. Notify AER if public or media is contacted.	Notify AER (i.e., coordinate communication) local/health authority if public or media is contacted.	Notify AER, local authority, and health authority.	Notify AER, local authority, and health authority.
Resources				

Internal	Immediate and local. No additional personnel required.	Establish resources required.	Supplemental resources or personnel are required.	Significant resources are required.
External	None.	Begin to establish resources that may be required.	Possible assistance from external support services as listed in the ERP.	Assistance from government agencies and external support services are required.

The requirements in *Directive 071* are in addition to any plans, measures, directions, or orders required or authorized by legislation. The AER may require the duty holder to prepare and submit specific action plans and reports authorized by legislation (such as the *Environmental Protection and Enhancement Act* and *Water Act*) outlining how they will mitigate and respond to effects on the environment and the public. See AER's incident response webpage for further guidance.

7.2 Communication During an Incident

As per section 5.3.3 of *Directive 071*, the duty holder must have redundant emergency communication and notification methods to ensure that those affected or potentially affected by an incident are informed. Methods of communication should include a process to confirm message receipt and can be supplemented by other communication methods, including the following:

- Door-to-door notification: This method is suitable to communicate with a small number of specific individuals. However, it is impractical when notifying large numbers of individuals as it is a personnel-intensive method, nor when personnel would be at risk giving the notification.
- Emergency notification systems: Systems can deliver specific messages to small and large groups of individuals (via telephone, short message service (SMS) messaging, email, pager, etc.). Each individual contacted can receive an incident summary and detailed reports. This method records message delivery time, confirmation of message receipt, and feedback from the person who received the message. Operators should ensure coordinated messaging with authorities having jurisdiction and using these systems.
- Sirens: For persons nearby, this method is suitable for alerting those within hearing distance. If sirens are to be effective, those alerted need to know the nature of the hazard and the action they are required to take. Sirens may not be audible inside a building or when the target audience is asleep.
- Other communications devices and services such as social media, broadcast media, software applications, and fax machines are secondary means of alerting specific groups or in combination with other technologies.

7.3 Access Control

The duty holder should be prepared to work with authorities to manage access to major highways and railways passing through the area potentially affected by the hazard.

The duty holder may need to obtain a fire hazard order from the local authority to declare a state of local emergency to restrict access to a designated area. The local authority may declare a state of local emergency if deemed prudent.

Also, NAV CANADA may need to issue a Notice to Airmen (NOTAM) to advise pilots of restrictions in the airspace above the EPZ or to close the airspace for a certain radius from the release (a no-fly zone). The AER may request NOTAMs or airspace closure for a level 2 or 3 emergency.

8 H_2S and HVP Products – Emergency Planning and Response Zones

The AER encourages optimizing mitigation systems and defining appropriate procedural actions as this demonstrates good hazard management practices.

8.1 Calculating the EPZ for H_2S Releases

The ERCBH2S model and supporting documentation are available on the *Directive 071* landing page.

Use ERCBH2S to calculate the EPZ size for operations with H_2S concentrations of 0.1 moles per kilomole (mol/kmol; 0.0001-mole fraction or 100 ppm) or more in the gas. Enter the gas phase composition at standard conditions (15°C and 101.325 kilopascals [kPa], dry gas) into ERCBH2S. Use the H_2S conversion calculator tool on the *Directive 056* landing page to convert concentrations between units.

The ERCBH2S model includes both user input variables and fixed model parameters. Model parameters are variables selected by the AER that cannot be changed. The user input variables reflect the site-specific conditions, operating practices, and specific risk mitigation used by the duty holder.

8.1.1 ERCBH2S Model Subcomponents

The ERCBH2S model includes subcomponents for the following types of operations:

- gas well
- liquid well
- gas pipeline
- liquid pipeline

8.1.1.1 Gas Well and Liquid Well

The gas well subcomponent is for wells producing or injecting gas and multiphase fluid with a gas-to-liquid ratio of more than 1000 (cubic metres:cubic metres [m^3:m^3]) and assumes the blowout wellhead pressure is below the bubble point, so there is a gas phase.

The liquid well subcomponent is for wells producing or injecting liquid and multiphase fluid with a gas-to-liquid ratio of less than 1000 (m^3:m^3) and assumes the blowout wellhead pressure is above the bubble point, so there is no gas phase. The liquid well subcomponent assumes that, when a release occurs, the spill pooling on the ground will release sour solution gas dissolved in the fluid.

The H_2S release rate is an important factor in determining the EPZ size. The H_2S release rate for each potential formation zone that may contain H_2S is determined by multiplying the maximum H_2S content and absolute open flow rate as determined by the geological and engineering review of the available data. *Directive 056* provides requirements for H_2S release rate assessments. The duty holder is strongly encouraged to submit the H_2S release rate to Auth.Geology@aer.ca for review before submitting a licence application.

For producing oil using mechanical assistance or sour water injection wells operating with a vacuum, fluids may continue pumping and spill onto the ground if the wellhead piping breaks. Therefore, for these cases, wells, connected piping, and any associated pipelines are to be collectively considered in determining the EPZ. Input the following into ERCBH2S for these wells:

- The solution gas composition at standard conditions.
- The maximum H_2S release rate, which is precalculated by the user using
  - the maximum expected H_2S concentration in the gas phase at standard conditions,
  - the maximum gas-to-liquid ratio for the fluids at standard conditions, and
  - the maximum liquid flow rate.

8.1.1.2 Gas Pipeline

The gas pipeline subcomponent is for pipelines transporting gas (e.g., sour gas with H_2S greater than 10 mol/kmol, natural gas with H_2S less than or equal to 10 mol/kmol, or acid gas) or multiphase liquid (e.g., oil effluent) with a gas-to-liquid ratio of more than 1000 (m^3:m^3). Gas pipelines operate below the bubble point pressure, so there is a gas phase. The gas pipeline subcomponent assumes that any liquids present do not pool but are released as an aerosol as the pipeline depressurizes.

The volume of gas released from a pipeline segment will affect the size of the EPZ. The release volume depends on operating conditions (pressure and temperature), pipeline diameter and segment length, and emergency shutdown (ESD) valve closure. Pipeline ESD valves close according to a pressure drop set point by detecting a pressure rate of change or by remote or manual closure.

Use the pipeline networking section of the BATCH sheet in ERCBH2S to determine the equivalent segment length between the ESD valves and check valves. Use the equivalent segment length to determine the EPZ and the pipeline level designation. Complex pipeline systems with line looping and headers may require detailed analysis to determine the equivalent segment length between the ESD valves and check valves.

8.1.1.3 Liquid Pipeline

The liquid pipeline subcomponent is for pipelines transporting liquid or multiphase fluid (e.g., oil effluent, crude oil, low-vapour-pressure products, salt water) with a gas-to-liquid ratio of less than 1000 (m^3:m^3). The liquid pipeline subcomponent assumes the pipeline operating pressure is above the bubble point, so there is no gas phase. However, if a pipeline breaks, the spill pooling onto the ground will release sour solution gas dissolved in the liquid.

The H_2S release rate affects the EPZ size. Calculate the EPZ using the maximum expected H_2S concentration in the gas phase at standard conditions, the maximum gas-to-liquid ratio for the pipeline fluids at standard conditions, and the maximum pipeline liquid flow rate. A materials balance may be needed to determine the H_2S release rate for complex pipeline systems. Enter the dissolved gas composition at standard conditions into ERCBH2S.

Use the pipeline networking section of the BATCH sheet in ERCBH2S to determine the equivalent segment length between the ESD valves and check valves. However, the equivalent segment length is used only to determine pipeline level designation and not the EPZ. Complex pipeline systems with line looping and headers may require detailed analysis to determine the equivalent segment length between the ESD valves and check valves.

8.1.2 Source Mitigation

Analysis type (“no mitigation” or “with mitigation”) is an important input to ERCBH2S.

For wells, mitigation measures, such as ignition, surface-controlled subsurface safety valves, or downhole chokes, may limit release durations or reduce release rates and can be used to determine the EPZ. The “time from initial release until ignition or stop flow” is the time from the start of the release to when the flow is ignited or stopped and consists of time to

- detect and verify the release,
- assess the situation,
- decide to ignite, and
- deploy equipment and responders.

Timing for ignition of a release or shutting in of a well or pipeline depends on several factors, including

- travel time,
- automated leak detection devices,
- manual shut-in, or
- other notification of leakage.

8.2 Calculating the IIZ and PAZ for H_2S Releases

Whereas the EPZ is used for planning purposes and reflects an area where significant exposure could result without prompt action, the actual conditions during an incident need to be assessed to ensure an appropriate initial response. The response zones—initial isolation zone (IIZ) and protective action zone (PAZ)—are where resources are focused during an incident to protect public safety. Furthermore, duty holders are reminded that local authorities, such as the police or other first responders, may establish a different type and size of response zone during an emergency.

For H_2S releases under poor dispersion conditions, the IIZ is defined and calculated using the ERCBH2S model and is useful for planning purposes. The IIZ need not appear on the ERP map. However, IIZ information from the ERCBH2S model should be readily available to aid responders in protecting the public.

For H_2S releases, the duty holder may use ERCBH2S and wind direction to estimate the size of the PAZ.

8.3 Calculating the EPZ for HVP Products

HVP products are a hazard because of their flammability. Exposure to direct flame is a concern. Use the flash fire scenario to calculate the largest EPZ for HVP products.

The AER does not have a specific model for calculating the EPZ for releases of HVP products from pipelines, underground storage caverns, or storage facilities. The EPZ for HVP products should be determined using a data table, software, or other resources evaluated and approved by a person or organization knowledgeable in the industry and discipline.

9 H_2S and HVP Products – Public and Local Authority Emergency Preparedness

9.1 Public Preparedness Information Package

Public preparedness information packages should not include confidential information about area residence types (occupied, vacant, seasonal, etc.). Individuals have the right of refusal to provide personal information. The duty holder should discuss the protection of rights under the *Personal Information*

Protection Act (*PIPA*) with the public and clearly explain that the information would enable an effective incident response and ensure their protection and safety.

9.2 Public Preparedness Program

The duty holder's representative is expected to inform the public that they can seek evacuation assistance without divulging personal health issues and receive early notification or evacuation.

The duty holder may collect personal information solely to maintain public safety during an incident and provide this information to emergency responders and the AER. Personal information in the duty holder's possession is governed by PIPA, and when filed with the AER, it is subject to the *Freedom of Information and Protection of Privacy Act*.

Although public safety is the primary purpose of emergency preparedness and response, the duty holder is expected to address livestock and pet safety in its public preparedness program and ERP.

9.3 Emergency Preparedness with Local Authority

Various government authorities have jurisdiction regarding emergency planning and incident response in particular situations.

The duty holder is expected to support the appropriate authority by helping with public protection, environmental protection, and control of hazards from its operations. All parties need to have a shared understanding and coordinated approach to identifying and addressing emergencies.

Under section 11 of the *Emergency Management Act*, each local authority will be responsible for managing and controlling its response to an emergency. The local authority's emergency plans and programs describe its framework for response to major emergencies and disasters. The duty holder should be familiar with the structure of the local authority's emergency plans and programs, which can be accessed through the Alberta Emergency Management Agency.

An appropriate authority may ask a duty holder to adhere to established communication and engagement protocols when engaging on roles and responsibilities for emergency response. The scope of the protocols is often determined by the parameters of the duty holder's operation, the capacity of the appropriate authority, and the activity within the boundary of the appropriate authority.

9.4 Synergy Groups

Duty holders are encouraged to build good relationships with the public in their operating areas.

Synergy groups across Alberta provide communities with more meaningful, ongoing participation in decisions directly affecting them. A community or region forms a synergy group as an outlet to share information about energy development activity and discuss public safety concerns. Visit Synergy Alberta for more information about synergy groups in Alberta.

The AER encourages duty holders to pursue synergy groups as an effective means to address their emergency management obligations and ease the burden on regional authorities, members of the public and Indigenous communities. Synergy groups offer a collaborative mechanism to share resources and information and allow for participation at the local level.

10 H_2S and HVP Products – Preparation of AER-Approved Emergency Response Plans

10.1 ERPs for Wells

A well ERP may be used for drilling, completions, testing, workover, or well servicing operations.

For wells requiring AER-approved ERPs, on-site activities, such as rigging up and spotting of equipment, may proceed without having the approved ERP on site.

The AER reviews ERPs for critical sour well drilling and completion as part of the well licence application. The approval of the sour well ERP is effective for one year and automatically expires if drilling and completion activities have not started within the year.

Once drilling out for surface casing is complete for a sour well, the drilling and completion ERP is in effect immediately until completion operations are finished.

Drilling and completions ERPs for noncritical sour wells can be submitted to the AER before, during, or after the well licence application. Once the drilling of the surface casing is complete for a sour well, the drilling and completion ERP is in effect immediately until completion operations are finished.

10.2 ERPs for Operations

An AER-approved ERP will not be required for pipeline operations with an H_2S concentration of 0.1 mol/kmol or more, where the EPZ is less than or equal to 30 m, and egress through the EPZ is the only trigger for an AER-approved ERP.

10.3 Critical Sour Operations – Review Meetings

Critical sour operations include all critical sour well drilling, completions, workover, and well servicing.

All review meetings should include the following:

- verification of the assigned roles and responsibilities in the ERP
- identification of any revision to the ERP
- confirmation that the emergency contact numbers are correct
- communication of EPZ information to well-site personnel

10.4 Updates to AER-Approved ERPs

Updates to an existing AER-approved ERP may not necessarily require resubmission for AER approval. The duty holder may update an existing AER-approved ERP without resubmission for well or pipeline tie-ins, facilities, and operating areas if

- the EPZ size is unchanged or
- there are no surface developments within the area of a new EPZ extending beyond the boundary of the existing EPZ.

If the above conditions do not apply, please refer to section 11.2 of *Directive 071* for the requirements related to an AER-approved ERP supplement.

10.5 Supplements to an AER-Approved ERP

Use supplements to an AER-approved ERP for the following:

- sour drilling and completion operations
- sour well workover, well servicing, and testing
- HVP pipelines
- cavern storage facilities storing HVP products

For workovers, well servicing, or testing operations on sour wells currently included in an approved sour operations ERP, the duty holder may use that ERP for the operation provided that

- the sour operations ERP addresses emergency response procedures and personnel responsibilities specific to the operation,
- the sour operations ERP has up-to-date information on residents within the EPZ of the well, and
- a supplement is submitted for approval in accordance with *Directive 071*.

10.5.1 ERP No Longer Required

When the duty holder meets all *Directive 071* requirements, but an ERP is no longer required due to reasons such as licence transfer or end of drilling operations, the duty holder is to change the status of the subject ERP in DDS to “archived.”

10.5.2 Sour Underbalanced Drilling

The duty holder may conduct underbalanced drilling operations before entering a sour zone with surface developments within the EPZ.

Before conducting underbalanced drilling operations, the duty holder is expected to

- file the sour well ERP as a nonroutine application in accordance with *Directive 056* and
- submit a letter to the AER providing the start and end dates for the underbalanced drilling operation and confirmation that no sour formation will be encountered while drilling underbalanced.

The AER will consider licensing sour underbalanced drilling operations if the public were to be relocated from the EPZ before the start of drilling operations.

11 H_2S and HVP Products – Incident Management

11.1 Air Quality Monitoring

Air quality monitoring is one type of hazard monitoring used to track and record the presence and concentrations of airborne hazards during a release. Examples include H_2S during a sour gas release, sulphur dioxide (SO_2) following the ignition of the release, and the presence of HVP products and their lower flammable limit levels following a release. Use air quality monitoring equipment to

- track the plume,
- determine if ignition concentration criteria are met,
- determine whether evacuation or sheltering concentration criteria are met,
- assist in determining when the emergency status can be downgraded,
- determine access control locations, and
- determine whether the concentrations in the areas being evacuated to are safe.

When mobile air quality monitors cannot be provided, the duty holder may consider alternative air monitoring techniques, provided they can demonstrate the necessity to do so and the alternative methods are considered reasonable by the AER.

Monitoring may occur downwind or upwind depending on how the plume is tracking, with priority directed to the nearest residence or areas where people may be present.

Monitoring multiple urban density developments or a large urban centre may require additional air monitoring units.

Throughout an emergency, the duty holder is expected to provide regular updates for monitored H_2S and SO_2 levels and the lower flammable limit levels for HVP products to the AER, Alberta Environment and Protected Areas, other appropriate authorities, and on request to the public.

11.2 Public Protection Measures

Public protection measures include notification, shelter in place, evacuation, isolation procedures, and hazard monitoring.

11.2.1 Evacuation or Shelter in Place

When safe to do so, evacuation should occur before a release of sour gas or HVP products has the potential to affect people near the release or as soon as possible to avoid any exposure to the hazard. Evacuation is considered when

- people are close to a release, creating a public safety hazard, and when conditions are known to allow for a safe evacuation;
- there are land users, such as hunters, trappers, recreational users, and nonresident landowners, who do not have the opportunity to shelter in place; and
- the release is prolonged.

If evacuation is not possible, sheltering in place can protect the public under certain conditions. Sheltering in place is a viable public protection measure in the following circumstances:

- There is insufficient time or warning to evacuate the public safely.
- Residents are waiting for evacuation assistance.
- The release will be of limited size or duration.
- The location of the release is unknown.
- The public would be at greater risk if evacuated.

11.2.1.1 Sour Gas Releases

Evacuation is the primary public protection measure during a sour gas release. Evacuation begins in the IIZ and will expand outward into the PAZ downwind of the release to prevent exposure of the public to H_2S.

Typically, residents outside the PAZ but within the EPZ will be contacted and advised to shelter in place, pending further instructions from the duty holder or the local authority, depending on existing arrangements.

A change in wind direction will require an immediate re-evaluation of the PAZ and the need for additional evacuation or sheltering in place. It may require immediate ignition of the well if ignition criteria are met. If the release has been ignited, the duty holder should continue to monitor response zones for hazards from incomplete combustion (i.e., H_2S) and hazards generated from combustion (i.e., SO_2).

11.2.1.2 Releases of HVP Products

The IIZ and PAZ define the regions where plume concentrations from an HVP product release may fall within the upper and lower explosive limits, and the public may be directly exposed to the flame if the plume ignited. For large failure events, this area reaches its maximum extent shortly after the beginning of the failure and then declines. Inadvertent actions in these response zones may lead to ignition. Sheltering in place is recommended until the plume position is assessed and it is safe to evacuate.

Evacuation is recommended for incidents where the plume is visible, and egress can occur in any direction away from the plume.

11.2.2 Ignition

11.2.2.1 Ignition for Sour Gas Releases

Duty holders are expected to prepare for ignition in the event of a release or loss of well control to ensure no delay in responding. For manned well operations, prompt ignition mitigates the threat of H_2S exposure that could threaten public safety during a major sour gas release.

During a sour well control problem, discussions between the duty holder and the AER about ignition should occur at preset intervals until the well is under control.

11.2.2.2 Igniting Releases of HVP Products

Igniting releases of HVP products should only occur after the position of the plume has been established, after careful deliberation, and when safe.

Until a decision has been made to ignite a release, the duty holder should take steps to minimize any chance of unplanned ignition in the area.

11.3 Media Releases

Information concerning incidents and emergency response should be released to the media whenever significant developments occur. The duty holder is expected to coordinate with the AER before issuing a media release to ensure the consistency and accuracy of information. The duty holder may choose the method for releasing information, including written news releases, news conferences, or other effective means. The duty holder is expected to appoint a media spokesperson to carry out this communications role and interact with the AER and appropriate authorities.