

Emergency Preparedness and Response Guide

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Alberta Energy Regulator

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1 Introduction

1.1 About this Manual

This manual elaborates on the requirements in [Directive 071: Emergency Preparedness and Response](#) and is intended to aid duty holders in developing, implementing, and maintaining their emergency preparedness and response programs, which include the following information:

- hazard identification and consequence analysis
- involvement of the public and appropriate authorities in emergency preparedness and response
- emergency response plan (ERP) preparation and contents
- public protection measures
- responder competency and training
- emergency response exercises
- incident response
- learning from incidents and continuous improvement

The AER will actively monitor the effectiveness of a duty holder's emergency preparedness and response programs, gather information on the efficiency of AER processes, and solicit feedback from stakeholders.

1.2 How to Use this Manual

This manual provides guidance, explanation, and expectations that will enable a duty holder to develop an ERP that meets the requirements of *Directive 071*. The manual also includes instructions on using the ERCBH2S model.

2 Hazard Identification and Consequence Analysis

Understanding hazards and their consequences involve

- identifying public safety and environmental hazards associated with a duty holder's operations;
- calculating the emergency planning zone (EPZ) for potential releases of hydrogen sulphide (H₂S) and high-vapour-pressure (HVP) product as required in *Directive 071*;
- identifying what in the surrounding area (i.e., surface developments) and aspects of the environment will require specific emergency preparedness; and
- developing the ERP at a level of detail that is proportionate to the operations and addresses hazards and potential consequences of the emergency scenarios posed by operations.

Guidance on EPZ calculation for releases of H₂S and HVP products is provided.

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

2.1 Calculating the EPZ for H₂S Releases

The [ERCBH2S model](#) and supporting documentation are available on the AER website.

Use ERCBH2S to calculate the EPZ size for operations with H₂S 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.

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.

The duty holder should be prepared to defend and provide documentation for all user-selected inputs used in the model. User inputs and selected outputs are in the comma-separated variable (CSV) file exported from ERCBH2S.

2.1.1 ERCBH2S Model Subcomponents

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

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

2.1.1.1 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 [m³:m³]) 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 (m³:m³) 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 H₂S release rate is an important factor in determining the EPZ size. The H₂S release rate for each potential formation zone that may contain H₂S is determined by multiplying the maximum H₂S content and absolute open flow rate as determined by the geological and engineering review of the available data. [Directive 056: Energy Development Applications and Schedules](#) provides requirements for H₂S release

rate assessments. The duty holder is strongly encouraged to submit the H₂S 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. For these wells

- input the solution gas composition at standard conditions into ERCBH2S and
- input the maximum H₂S release rate, which is precalculated by the user using the:
 - maximum expected H₂S 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.

2.1.1.2 Gas Pipeline

The gas pipeline subcomponent is for pipelines transporting gas (e.g., sour gas with H₂S greater than 10 mol/kmol, natural gas with H₂S 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 (m³:m³). 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. The equivalent segment length is used 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.

2.1.1.3 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 (m³:m³). 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 H₂S release rate affects the EPZ size. Calculate the EPZ using the maximum expected H₂S 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 H₂S 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 only used to determine pipeline level designation but 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.

2.1.2 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.

2.2 Calculating the IIZ and PAZ for H₂S Releases

Whereas the EPZ is used for planning purposes and reflects an area where significant exposure could result without prompt action, 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.

For H₂S 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 H₂S releases, use ERCBH2S to estimate the size of the PAZ.

2.3 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.

A dispersion model should be used to determine the EPZ for releases of HVP products. When using a dispersion model to calculate the EPZ, the AER may request documentation for review that clearly describes the methods, assumptions, and modelling uncertainties in enough detail that a third party could replicate the numerical results.

3 Public and Appropriate Authority Involvement

3.1 Involvement of Appropriate Authority

Various government authorities have jurisdiction regarding emergency planning and incident response in particular situations. The level of involvement by an appropriate authority in emergency preparedness and response will vary. Where an appropriate authority has the capability and is willing to be involved in the duty holder's emergency planning process, the duty holder is expected to engage them in the process.

The duty holder is expected to support the appropriate authority by helping with public protection, environmental protection, and control of hazardous releases from its operations. All parties need to have a shared understanding and a 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.

3.1.1 Developing Protocols with an Appropriate Authority

An appropriate authority may ask a duty holder to adhere to established communication and consultation protocols when consulting 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.

3.1.2 Communication and Consultation Protocols for Emergency Response Planning

The duty holder should discuss the following items with the appropriate authority while planning. The duty holder or the appropriate authority may have additional items to discuss that are not listed below:

- When does the appropriate authority wish to be contacted for planning activities (e.g., specific types of operations, certain incident risk levels, ERP updates, ERP exercises)?
- What type of contact does the appropriate authority desire (e.g., in person, telephone, registered mail, email)?
- Who will be the initial contact, subsequent contact (if needed), and alternate contacts for the appropriate authority and the duty holder?
- Where will the appropriate authority and duty holder meet to discuss roles and responsibilities? This discussion should be at a time and place mutually agreeable to all parties.
- Would the appropriate authority or the duty holder like to provide a generic list of its roles and responsibilities for all ERPs, or is it preferred to develop a specific list of roles and responsibilities for each ERP?
- If a generic list of roles and responsibilities is used, how often would the appropriate authority and the duty holder wish to meet to confirm that it is still relevant?
- If the duty holder has developed a checklist for the appropriate authority to confirm its roles and responsibilities, would the appropriate authority like to use this checklist to provide the information? The duty holder should verify with the appropriate authority that the checklist contains the necessary information.
- What type of follow-up to the discussions would the appropriate authority and the duty holder like to see (e.g., a summary of the agreed-to roles and responsibilities and the completed checklist provided by email, registered mail, phone, or in person)?
- Does the appropriate authority wish to review any revisions to the ERP before its submission to the AER?
- Will the appropriate authority be provided with a written record of the duty holder's summary of roles and responsibilities?

- Does the appropriate authority wish to be involved in public safety and awareness programs (e.g., open houses)?
- How will the appropriate authority and duty holder resolve any disagreements?
- When an EPZ includes part of an urban centre or a rural subdivision, does the appropriate authority or the duty holder believe there is a need for public safety awareness within the entire urban centre or rural subdivision? If so, what information should be included, and what are the appropriate ways of doing this?
- When an EPZ includes a part of a rural subdivision, does the appropriate authority or the duty holder believe there is a need to collect emergency contact information from the surface developments beyond the EPZ but within the rural subdivision? If so, in what area beyond the EPZ boundary should the collection of emergency contact information occur? What are the appropriate ways of doing this? How will key decisions and discussions be documented?
- How will discussions with the appropriate authorities be documented to ensure proper documentation is in place if audited by the AER?

3.1.3 Command and Control Items to Discuss with an Appropriate Authority

- What does the appropriate authority expect concerning command and control of an incident?
- What are the views of the appropriate authority on establishing or participating in a single emergency operations centre?
- Does the appropriate authority wish to discuss the need for unified command, and what are its expectations if a unified command is used, including a unified emergency operations centre?

3.1.4 Roles and Responsibilities

All parties must be clear on their roles and responsibilities during an incident. Discussions should focus on the following:

- initial notification process and duty holder response to the incident
- command and control structure
- duty holder plans for notification of the public and public protection measures (e.g., shelter in place, evacuation)
- location, activation, and staffing of a reception centre
- incident control and monitoring, including providing well or pipeline control services, air monitoring plans, and communication systems
- the communication plans for the potentially affected public beyond the response area

- continuing roles and responsibilities once the municipal emergency plan or program is activated

The preceding list is not exhaustive; the duty holder is encouraged to discuss any aspect of roles and responsibilities it deems necessary.

The appropriate authority may wish to discuss its roles and responsibilities in emergency response with the duty holder. This discussion should include the following:

- the mandated role and responsibility of the appropriate authority to handle an emergency under the *Emergency Management Act* and the *Municipal Government Act*
- the process of issuing a “state of local emergency” and the role of the appropriate authority in determining the severity of an incident and in standing down an emergency
- the roles and responsibilities of the appropriate authority when its emergency plan or program is activated
- the ability of the appropriate authority to commit responders to an incident (e.g., law enforcement, the fire department, municipal and local disaster services capable of responding to a specific hazard) and to coordinate and handle notification, evacuation, and shelter in place outside of the EPZ

Additional topics may be discussed.

3.2 Public Involvement

3.2.1 Public Information Package

The public information package should contain sufficient information so that persons contacted may

- understand the nature of the operation,
- the effect an incident may have on them,
- the procedures in place to respond to an incident, and
- the public protection measures that may be implemented.

Public information packages should not include confidential information about area residence types (occupied, vacant, seasonal, etc.).

The duty holder should provide recipients of the public information package a reasonable time, considering the circumstances of each individual, for them to review it and have their questions and concerns addressed.

For EPZs that cover a large geographic area, a duty holder may elect to divide the EPZ into various planning areas with a specific public information package. Each package would include the information applicable to that planning area (e.g., release rates, volumes, and EPZ determination).

The duty holder should provide nonconfidential information requested by a resident for any well, pipeline, or facility included in the public information package.

3.2.2 Information Required from the Public Involvement Program

The duty holder's representative is expected to inform the public that they can be considered to have special needs without divulging personal health issues and receive early notification or evacuation.

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.

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 involvement program and ERP.

4 Preparation of Emergency Response Plans

Directive 071 sets requirements on when ERPs are required to be submitted to the AER for approval.

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

- 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; and
- 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 Emergency Response Plans for AER Approval

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

4.1.2 ERPs for Operations

Operational ERPs may be used for sour operations, HVP pipelines, and cavern storage facilities storing HVP products.

A sour operations ERP can include all sour operations in an area (referred to as a sour production facility ERP). A sour operations ERP may be required for

- wells producing from a sour zone,
- wells producing from a sour zone that are currently shut-in but not suspended in accordance with [Directive 013: Suspension Requirements for Wells](#),
- wells on injection with sour gas in the injection fluid,
- wells that are completed or open to a sour zone but are not tied in,
- facilities that handle or process fluids containing sour gas, or
- any combination of the above.

A sour operations ERP is not required for

- a well properly abandoned in accordance with [Directive 020: Well Abandonment](#),
- a well suspended in accordance with [Directive 013](#),
- a standing well with unperforated casing and the sour zone isolated behind casing with adequate cement, or

- on a case-by-case basis, a well with a sour drilling and completion ERP that has recent resident updates and is less than one year old.

An AER-approved ERP will not be required for pipeline operations with an H₂S 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.

Approved ERPs for short-term operational phases (such as drilling, completions, testing, workover, or servicing for wells) expire when the short-term operations have been completed or when the licence approval expires or is cancelled.

4.1.3 Supplements to an AER-Approved ERP

Supplements to an approved ERP can be used 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*.

4.2 Incident Command Systems

In the duty holder's incident management system, one or more functions may be assigned to an individual or position depending on the complexity of the potential response to an emergency. The duty holder is expected to assign the following responsibilities to personnel as applicable:

- incident command
- public safety coordination, including evacuation and shelter in place
- access control and rovers
- air quality monitoring
- ignition to control a hazardous source
- communication with the responders, media, and public

The flow of information among the duty holder's representatives and other responders at the emergency site, corporate-level decision makers, the AER, and appropriate authorities is a crucial aspect of incident management. The duty holder is expected to clearly outline the communication protocols and procedures between its operational command and incident support facilities.

4.3 Emergency Response Plan Management

In accordance with *Directive 071*, the duty holder must demonstrate that its plan management process will keep its ERPs up to date. Any of the following events will trigger an ERP update:

- changes to emergency information (e.g., contact phone numbers)
- new mapping information—a small map of the affected area showing the changes would be acceptable for one year
- new resident information
- changes to response staff information or response capabilities
- facility additions such as well or pipeline tie-ins that do not require submission of a supplement

Before starting operations, the duty holder is expected to update its approved ERPs with information about on- and off-site emergency response team personnel.

The duty holder should provide copies (either full or partial) of the ERP to all responders requiring one, which should be determined through communication with all responders during plan development. The duty holder should maintain a record of ERP distribution, including amendments.

5 Public Protection Measures

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

5.1 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 transients, 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 circumstances when

- 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, or
- the public would be at greater risk if evacuated.

5.1.1 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 so that the public is not exposed to H₂S.

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., H₂S) and hazards generated from combustion (i.e., SO₂).

5.1.2 Releases of HVP Products

For releases of HVP products, the IIZ and PAZ define the regions where plume concentrations from a release may fall within the upper and lower explosive limits and where 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 initiation of a failure and then declines. Inadvertent actions in these response zones may lead to ignition. Consequently, sheltering in place is recommended until the plume's position can be assessed and evacuation can take place safely.

Evacuation is recommended for incidents where the plume is visible, and egress can occur in any direction away from the plume. Qualified individuals with access to lower explosive limit monitors should decide when to evacuate.

5.2 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 H₂S during a sour gas release, SO₂ following the ignition of the release, and the presence and lower flammable limit levels of HVP products following a release. Air quality monitoring equipment is used by the duty holder 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.

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 H₂S and SO₂ 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.

5.3 Ignition

5.3.1 Ignition for Sour Gas Releases

Duty holders are expected to act immediately and prepare for ignition at the first sign of a release or loss of well control to ensure no delay in responding. For manned well operations, prompt ignition mitigates the threat of H₂S 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.

The primary ignition system for a critical sour well should be installed to enable remote activation from a safe location through a triggering device. The secondary system may be a manual system, such as a flare gun.

Ignition does not negate the need for continuing with evacuation, as there may be residual pockets of H₂S or SO₂ in the area.

5.3.2 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 to do so.

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.

5.4 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 of their choice. The duty holder is expected to appoint a media spokesperson to carry out this communications role and interact with the AER and appropriate authorities.