

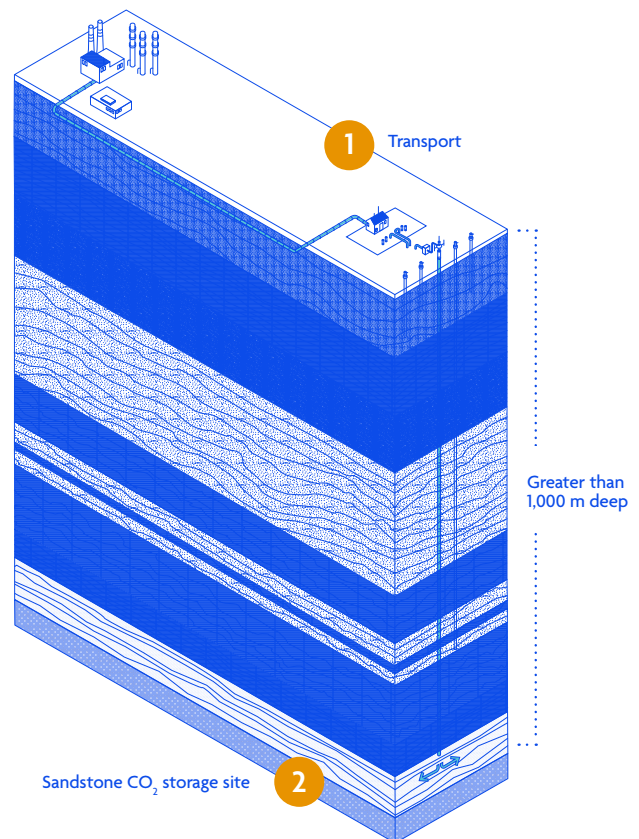
Pipeline safety and emergency management planning

Pathways Project

On behalf of fellow Pathways Project proponents Cenovus, ConocoPhillips Canada, Imperial and Suncor, Canadian Natural is proposing to construct and operate a carbon capture and storage network and pipeline project. When operational, the project would have the capacity to transport carbon dioxide (CO₂) from multiple oil sands facilities to a capped, sandstone formation in the Cold Lake area of Alberta for underground storage.

The safety of communities, infrastructure and workers underscores the project design and is important to all Pathways Project proponents. Our approach to emergency management planning is to focus on proactive risk identification, prevention, preparedness and response planning, and to adhere to industry standards and regulations as described below.

Communities, Indigenous groups and interested parties have requested information about emergency management planning for the project. This fact sheet has been prepared to provide that information as part of the consultation and engagement process.



Multi-layered safety system: pipelines and well pads

The proposed project will have a multi-layered safety system based on decades of oil and gas technical and operating experience, and scientific research. The safety system will include the following elements:

Prevention

- Population density and the type of developments (e.g., residential, industrial, commercial) in proximity to the pipeline are key factors in the selection of the pipeline location. Pipeline route (or location) selection is done in accordance with the Major Industrial Accidents Council of Canada (MIACC) guidelines.
- Pipelines will be designed, installed and routinely inspected in accordance with Canadian Standards Association (CSA) Z662 standards and the Government of Alberta Pipeline Rules under the *Pipeline Act*.
- Specifications will be in place for the CO₂ entering the Pathways Project CO₂ Transportation Network to limit impurities (e.g., water) to maintain pipeline integrity.
 - Analyzers will be installed to measure for these impurities.

Detection

- Field instrumentation will be used to continuously monitor the pipeline and well pads for changes in operating parameters as a part of the leak detection systems. Measured values

of these parameters (i.e., instrumentation readings) will be transmitted to a centralized control room.

- Pipeline integrity and corrosion management plans will be developed and in place prior to operations.
- Control room operators will continuously monitor instrumentation systems 24/7/365.

Response

- Operations outside of maximum and minimum operational settings will activate alarms and trips on the system.
 - For example, if a trip set point is exceeded, emergency shutdown (ESD) valves are designed to automatically isolate the pipeline segment to minimize any potential loss of containment.
- Emergency shutdown procedures will be in place to isolate individual pipeline segments, the entire CO₂ transportation network and individual well pads.
- Emergency preparedness plans will be in place outlining procedures to manage response, including public communication.

* Monitoring and surveillance of the subsurface storage hub will be managed through Monitoring, Measurement and Verification (MMV) plans developed and implemented according to requirements set by the Alberta Energy Regulator (AER). This is not covered in this fact sheet.

About Canadian Standards Association (CSA) standards

Thousands of kilometres of Canadian pipelines have been designed, installed and inspected using CSA Z662, which provides the essential requirements and minimum standards for the design, construction and operation of pipelines to transport dense phase/liquid CO₂. Below are some examples of where the CO₂ transportation network will meet or surpass CSA standards:

CSA standard	Reason for standard	Meet	Surpass
Hydrotesting to 1.25 times above the maximum design pressure	Confirms pipe can safely operate at design pressures	Yes	Yes. Hydrotest to 1.5 maximum design pressure
Placement of manual isolation valves	Allows isolation of a specific pipeline and supports pipe maintenance and emergency response	Yes	Yes. Remotely actuated valves at maximum every 15 kilometres
Development of emergency response plans	Public safety and environmental protection in case of CO ₂ release from pipeline	Yes	Yes. Following AER Directive 071
Minimum burial depth of 0.9 metres	Protects the pipe from damage due to freezing or surface load	Yes	Yes. Buried to minimum depth of 1.2 metres

What is an Emergency Response Plan?

An Emergency Response Plan (ERP) is a location-specific plan to protect the public and environment. It includes procedures for mobilizing response personnel and agencies, establishing communications and ensuring coordination of emergency response.

Key elements of an ERP typically include:

- **Comprehensive response procedures:** An ERP outlines specific response actions for various types of incidents, including shelter-in-place, evacuation, spill containment and communication protocols with local authorities and first responders. It uses a pre-established Emergency Planning Zone (EPZ) to identify communities and areas that may be affected.
- **Coordination with local authorities and first responders:** An ERP specifies how and when to collaborate with local emergency management agencies, law enforcement and fire departments to enable a coordinated and efficient response to any potential pipeline incident.
- **Public awareness and communication:** An ERP includes communication protocols for various types of incidents to help inform communities within the EPZ about safety measures, potential risks and what to do in case of an emergency. The goal is to assist residents in understanding how to respond and remain safe if an incident occurs.

The Pathways Project site-specific ERP will be developed for the project in accordance with AER Directive 071: Emergency Preparedness and Response requirements. Once the ERP is developed, it will be tested regularly through simulated exercises to help build readiness and resilience. Additionally, ERP components are reviewed periodically to account for changes in operations, technology and local community needs.



What is CO₂?

Carbon dioxide, or CO₂, is a colourless, odourless gas that is produced when animals and humans breathe, or when carbon-containing materials (including fossil fuels) are burned. CO₂ occurs naturally in the atmosphere and is essential to the photosynthesis process that sustains plant life, but it becomes hazardous in high concentrations. Risks related to CO₂ depend on the concentration released, duration of exposure and environmental conditions.

Timing of Emergency Response Plans (ERPs)

A Pathways Project site-specific ERP will be developed to address specific risks and emergency response requirements during project operations. This plan will focus on CO₂ transportation, distribution and injection. It will include communication and response strategies for unexpected CO₂ releases — ranging in size from minor to major releases — from pipelines or well pads for the safety of the surrounding communities and environment. Development of this ERP is planned to begin during the construction phase of the project in accordance with the AER's Directive 071.

Prior to the start of operations, Canadian Natural will use its corporate emergency management processes and ERP during pre-construction and construction activities. The ERP notification and communication practices will be modified to encompass Indigenous groups, communities and other interested parties where consultation and engagement processes are ongoing. Further information on Canadian Natural's emergency management plans and safety processes can be found here: cnrl.com/sustainability/workplace-process-safety.

Establishing Emergency Planning Zones (EPZs)

An EPZ is a calculated geographic area around wells, pipelines or facilities where potential exposure to a substance becomes hazardous in high concentrations, necessitating specific emergency response plans. For the Pathways Project, EPZs will be determined using CO₂ dispersion modelling to define its boundaries.

An EPZ incorporates representative (location-specific) release scenarios to ensure the area is inclusive of those who may be at risk. Factors influencing the size of an EPZ for a pipeline include the type and quantity of product being transported, design characteristics, operating conditions and various external and environmental conditions. Similar considerations are used for EPZs for well pads.

A comprehensive and effective approach to emergency management ensures proper preparedness for a safe and well-coordinated response to unexpected incidents throughout the project's life cycle. The Pathways Project site-specific ERP will follow notification and consultation requirements in accordance with AER Directive 071.

Learning from incidents

A key component of any major project is mitigating risk to help protect a company's assets, the environment and the local communities. One way Pathways Project proponents manage risk is by reviewing lessons learned from historical incidents — both ours and others — and improving project design and work practices to prevent similar incidents from occurring.

Case study: Mississippi pipeline leak

In 2020, there was a CO₂ pipeline leak in Satartia, Mississippi. The incident was the result of the location — the pipeline was in an area vulnerable to landslides. The response plan associated with the pipeline underestimated the EPZ, and as a result, some communities were not included within the emergency response plan. Local responders were also not made aware of the potential hazards. (Source: Failure Investigation Report, U.S. Department of Transportation, 2022)

What we learned: The proposed Pathways Project CO₂ Transportation Network will be built along a stable corridor primarily following existing right-of-ways. In the selection of the pipeline route, desktop geotechnical and environmental studies were done to identify and avoid areas of potential geotechnical instability to the extent possible. If geotechnical instability cannot be avoided, additional remote monitoring programs would be in place to help give us early warnings of any potential problems. Additionally, the EPZ and associated ERP would be in place to communicate, protect the public and mitigate potential impacts.



For additional details, visit PathwaysProject.ca
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