



Oil Sands

With more than 1.6 trillion barrels of bitumen in the ground, Alberta's oil sands are among the world's largest deposits of crude oil. But with big reserves come big responsibilities. This fact sheet explains how the Alberta Energy Regulator (AER)—through the energy resource enactments that we administer—ensures that oil sands development is responsible through rigorous and transparent regulatory action that continues to evolve to meet new challenges and opportunities.

» What are oil sands?

Oil sands are a mixture of sand, clay, water, and bitumen. Bitumen is a viscous hydrocarbon, similar to heavy crude oil. Oil sands deposits that are less than about 65 metres deep can be surface mined and the oil sands processed to extract the bitumen. However, about 80 per cent of oil sands deposits are buried too deep to mine, and the bitumen can only be recovered by in situ (Latin for “in position”) techniques, such as drilling wells.

» Where are oil sands deposits located in Alberta?

Alberta has the largest known oil sands deposits in the world. The following diagram of Alberta shows the surface area that active oil sands deposits cover and what portion is close enough to the surface to be mined. Within the 381 000 square kilometres (km²) of boreal forest in Alberta, about 90 000 km² contain active oil sands deposits. Of that, only 4800 km² (about 5 per cent) are close enough to the surface to be mined.





» **How many approved oil sands projects are there?**

There are nine approved oil sands mining projects in Alberta.

More than 50 thermal in situ projects are approved in Alberta, where techniques that involve introducing heat in the reservoir allow the bitumen to be recovered.

In addition, over 200 primary and enhanced recovery projects extract bitumen that flows sufficiently to be recovered from wellbores either on its own or with the injection of fluids into the reservoir. About 20 experimental schemes are currently approved that are testing unproven technology or new applications of existing technologies.

Alberta has 12 approved bitumen processing plants that upgrade bitumen to a variety of lighter hydrocarbon products.

» How are proposed oil sands projects assessed?

Before companies can construct a project, they must apply to us for approval. Even before that application is filed, however, companies must consult stakeholders to ensure that affected parties have an opportunity to understand how the project might affect them. The consultation process is extensive, and companies must demonstrate that they have made every effort to address outstanding concerns. In situations where unresolved issues or conflicts exist, stakeholders may submit a statement of concern to us about the project application, and the statement of concern may lead to a hearing.

Project applications are comprehensive. Alberta Environment and Parks requires environmental impact assessments for all new oil sands mines and any commercial in situ project or bitumen processing plant producing more than 2000 cubic metres of crude bitumen or its derivatives per day (about 12 500 barrels per day).

We review the technical aspects of the application and ask questions—called supplemental information requests (SIRs)—to elicit additional information that our experts need to assess the proposed project.

If you believe that you might be directly and adversely affected by an application, you may file a statement of concern with us. We decide whether to hold a hearing on an application. If we do hold a hearing, a panel of our hearing commissioners will conduct it.

Participant funding may be available to cover relevant costs incurred by participants during a hearing.

A hearing results in a formal written decision, which may set out additional conditions that must be met to address the unique impacts of the particular project.

We can cancel our approval if an operator does not follow legislative requirements, rules, and approval conditions throughout the construction and ongoing operation of a project.

More information on hearings and statements of concern is available at www.aer.ca. You can also see our EnerFAQs *Having Your Say at an AER Hearing and Expressing Your Concerns – How to File a Statement of Concern About an Energy Resource Project*.

» Do you inspect oil sands projects?

Yes. Once a project is approved, it must meet strict regulations and approval conditions during construction and operation. In 2013, the regulator conducted 141 mine site inspections.

The regulator also conducted more than 3000 inspections of component parts within in situ facilities in 2012.

When companies fail to meet our stringent regulatory requirements, we take action. In carrying out our enforcement activities, we can

- conduct more inspections,
- require detailed plans of action,
- issue enforcement orders,
- shut down operations,
- levy administrative penalties, and
- prosecute companies.

In addition, we keep Albertans informed about industry's record of meeting our requirements. This includes an easy-to-access incident reporting tool and regular posting of investigation reports and compliance activities on our website and in annual performance reports.

See our EnerFAQs *Inspections and Enforcement of Energy Developments in Alberta*.

» What is in situ oil sands development?

About 80 per cent of the bitumen reserves in Alberta are buried too deep to mine and can only be recovered by drilling wells. This is referred to as “in situ” recovery (Latin for “in position”).

Some bitumen flows sufficiently to be recovered without the need for heat or the injection of fluids. Most in situ bitumen recovery, however, uses steam to heat the bitumen in the reservoir, which allows it to flow to wellbores. This is referred to as “thermal in situ” recovery. Sometimes small amounts of solvent are injected along with the steam to further increase the flow of bitumen.

Two main thermal in situ recovery technologies are used: steam-assisted gravity drainage (SAGD) and cyclic steam stimulation (CSS). SAGD injects steam into a horizontal well to deliver heat to the surrounding bitumen so that it can flow more easily. Gravity then causes the bitumen to flow down to a second horizontal well positioned below the steam injection well so that it can be produced to surface.

CSS injects steam into a vertical or horizontal well with sufficient pressure to fracture the reservoir, allowing the steam to move rapidly out into the reservoir to deliver heat to the bitumen and allow it to flow more easily. The bitumen is then produced to surface using the same well.

» How is water use regulated at in situ oil sands projects?

Water is heated to create steam at the surface, and the steam is injected into a reservoir to heat bitumen and reduce its viscosity so that it can flow to a wellbore. Managing water use is an important consideration for in situ production that results in efficient and sustainable in situ oil sands development.

Directive 081: Water Disposal Limits and Reporting Requirements for Thermal In Situ Oil Sands Schemes consolidates various aspects of water management requirements for thermal in situ oil sands development. The directive sets out water disposal limits, which require operators to recycle produced water efficiently and ensure that all make-up sources are effectively used.

To support transparency to all stakeholders, the [Thermal In Situ Water Publication](#)—a tool found on our website at www.aer.ca—provides monthly and annual water-use data from January 2012. This interactive tool allows users to filter and analyze the following information:

- maximum annual water disposal limits and actual water disposal
- produced water recycle and produced water-to-steam injection ratios
- water productivity ratios (fresh water, brackish water [i.e., saline groundwater], and disposal)
- make-up water use (fresh and brackish)
- volumetric data (fresh water, brackish water, steam injection, water production, total disposal, and bitumen production)

» What is reservoir containment and why is it important?

In thermal in situ recovery, steam is injected into a reservoir at high pressure to heat the bitumen and reduce its viscosity so that it can flow to a wellbore. The rock above and around the reservoir—known as caprock—must act as a barrier to ensure that operations are safe and fluids are contained; caprock is critical to protecting the environment.

When they apply for our approval, operators must show that they have assessed the geology of the caprock and that it will prevent steam and reservoir fluids from escaping. As well, legacy wellbores in the area must be examined for thermal compatibility, as they are a potential conduit to the surface.

We conduct a detailed technical assessment of the project application, including the integrity of the surrounding geology, the geomechanics (understanding how the rocks, pressures, and temperatures will interact), and the engineering behind the project itself.

Given the relatively new technologies being used in thermal in situ development, reservoir containment is still an emerging issue and is being assessed on a project-by-project basis. We are engaging technical experts both internally and externally as we continue to analyze what constitutes a safe operating pressure for thermal in situ developments in Alberta.

» What are tailings?

Tailings are a by-product of the process used to extract bitumen from mined oil sands and consist of water, silt, sand, clay, and residual bitumen.

Tailings are stored in tailings ponds, where most of the sand quickly separates from the water; the water can then be recycled for use in the bitumen extraction process. However, smaller particles of clay and silt remain in suspension and form fluid tailings. Fluid tailings can take decades to settle, and even then only to a consistency of soft mud. The increase in oil sands mining development means that the volume of fluid tailings that must be stored will also grow. Managing these fluid tailings is an ongoing challenge for the oil sands mining industry.

» How are tailings regulated?

When fluid tailings are not managed effectively, their volumes increase and more tailings ponds are needed to store them. To address this problem, the Government of Alberta has released a new policy titled the *Tailings Management Framework for Mineable Athabasca Oil Sands* (TMF). The TMF aims to clarify the policies that guide tailings management.

The AER has reviewed this policy and will be replacing *Directive 074: Tailings Performance Criteria and Requirements for Oil Sands Mining Schemes* with a new directive that will establish a set of requirements focusing tailings regulation on the end state instead of year-to-year progress.

While we develop this new directive, we have suspended *Directive 074*, but we still expect oil sands mine operators to proactively manage and monitor fluid tailings volumes and refrain from making any material changes to current

tailings management programs that might be inconsistent with the TMF. We will be monitoring industry progress in managing fluid tailings while we develop new requirements.

We will explore a variety of options for an expanded engagement process that includes stakeholder groups. Before the end of 2015, the AER will seek feedback from Albertans on draft requirements and release a final directive. By spring 2016, we will review the new tailings plans for each oil sands mining operation and begin publically reporting on the progress of each operation.

» **How do you ensure that Alberta's oil sands resources are not wasted?**

Part of the AER's mandate is to ensure that Alberta's resources are not wasted. *Directive 082: Operating Criteria; Resource Recovery Requirements for Oil Sands Mine and Processing Plant Operations* sets out operating criteria to identify the oil sands that an operator is required to mine and estimate the volume of bitumen that an operator is required to recover. We strive to allow industry appropriate operational flexibility, while at the same time ensuring the conservation of Alberta's oil sands resource.

For thermal in situ operations, AER geologists and reservoir engineers assess the amount of bitumen in the ground and what has been produced. They then work with the companies to determine when production should be halted.

» Additional Information

For additional information on the AER and our processes or if you wish to speak with your local field centre or have general questions about energy projects in the province of Alberta, contact our Customer Contact Centre: Monday to Friday (8:00 a.m. to 4:30 p.m.) at 1-855-297-8311 (toll free).

This document is part of the EnerFAQs series, which explains the AER's regulations and processes as they relate to specific energy issues. Please visit www.aer.ca to read more of the EnerFAQs series.

Every year, we collect, compile, and publish a large amount of technical data and information about Alberta's energy development and resources for use by both industry and the general public. This includes raw data, statistics, hearing materials, and information on regulations, policies, and decisions.

Publications can be viewed at the AER library or obtained from the Information Product Services Section (IPSS). Both are on the tenth floor of our head office in Calgary. Publications may also be downloaded free of charge from our website (www.aer.ca).

To obtain a print or CD copy of a specific publication, contact IPSS by phone (403-297-8190), fax (403-297-7040), or e-mail ([infoservices@aer.ca](mailto:infoservices@ aer.ca)).

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