

EXPLORATION DRILLING IN ATLANTIC CANADA OFFSHORE



Exploration drilling in Atlantic Canada offshore began in the 1940s offshore Prince Edward Island. In Newfoundland and Labrador, the first exploration well was drilled on the Grand Banks in 1966, while the first well off Nova Scotia was drilled near Sable Island in 1967.

WHY ARE EXPLORATION WELLS DRILLED?

Exploration wells are drilled to confirm whether geological formations identified in seismic surveys contain oil and natural gas. If results are promising, a company may drill additional wells nearby to determine the size, shape and characteristics of the oil and natural gas reservoir discovered. Companies can then decide if the resources are economically feasible to develop.

HOW MANY OFFSHORE EXPLORATION WELLS HAVE BEEN DRILLED IN ATLANTIC CANADA?

More than 300 exploration wells have been drilled in the waters off Atlantic Canada – and the vast majority were drilled in the Newfoundland and Labrador and the Nova Scotia offshore areas.

BEFORE DRILLING BEGINS

Planning for an offshore exploration well take can 18 to 24 months. At each stage of the process, risk assessments are conducted to identify potential safety and environmental risks and to develop ways to reduce or eliminate those risks. When planning a drilling campaign, companies assess each activity offshore from a prevention-first point of view to protect people and the environment.

While focused on preventing environmental incidents, companies also develop safety plans and comprehensive spill response plans in the event of an emergency. Before drilling can begin, companies must apply for authorizations from the relevant regulatory body in Atlantic Canada – the Canada-Newfoundland and Labrador Offshore Petroleum Board or the Canada-Nova Scotia Offshore Petroleum Board.

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EXPLORATION DRILLING



KEY DRILLING EQUIPMENT

DRILL BIT: Rotating drill bits cut through rock formations below the seabed. The bits have teeth made from industrial diamonds or other hard materials. Drill bits wear out frequently during drilling and must be replaced.

DRILL STRING: The drill string is a series of drill pipe sections, connecting the drilling rig and the drill bit. To keep the drill bit turning and to help it penetrate the rock formation, rig workers must keep adding sections, or joints, of drill pipe screwed together to form the drill string. Each section is about 10 metres long. The drill string also carries drilling fluid pumped from the platform down to the drill bit.

DRILLING FLUID: In Atlantic Canada offshore, companies generally use water or synthetic-based drilling fluids, called muds, for multiple purposes. The mud is pumped inside the drill string to lubricate and cool the drill bit, carry rock cuttings to the surface for disposal, and to help control the well. Since the mud is heavier than the oil and natural gas, it maintains the pressure balance of the well. The mud itself is typically made with non-toxic mineral oil. A mixture of fluid and cuttings flows back to the rig, where the cuttings are removed and the drilling fluid is reconditioned before re-use. Drilling fluids must meet strict environmental requirements.

CASING: When a section of well is completed, the drill string is removed and sections of pipe known as casing are joined together, lowered into the well and cemented in place. The cement fills the space between the rock walls of the well and the pipe.

BLOW-OUT PREVENTER (BOP): The BOP is a series of specialized stacked valves that sit on top of the surface casing of a well. BOPs are used to monitor the well and are essentially back-up systems with the ability to seal and control the well if necessary. BOPs are inspected regularly.

REMOTELY OPERATED VEHICLES (ROVs): Underwater robots are used to perform a variety of subsea tasks during a drilling program, including inspections, seabed surveys and monitoring to ensure subsea equipment is functioning properly. In deep water, they can also repair equipment.

WHAT STEPS ARE INVOLVED IN DRILLING A WELL?

The first step is drilling a surface hole a few hundred metres into the sea floor. A continuous steel pipe called a surface casing is then lowered into the hole and cemented in place. A BOP is installed on the top of surface casing with a marine riser, which allows drilling fluids to flow from the well back to the drilling rig. The BOP provides a secondary barrier to prevent water and oil and natural gas from escaping into the environment.

Once the BOP is pressure tested, the next section of the well is drilled by lowering the drill bit and string through the BOP into the surface hole. When a section of well is completed, the drill string is pulled out and sections of casing are joined together, lowered into the well and cemented in place.

The rig's derrick lowers and raises the drill string using heavy wire cables. Floating drilling rigs that move in response to wave action pose a special challenge. To address this, a hydraulic device keeps the drill string stationary and also keeps a constant weight on the drill bit as the rig moves.

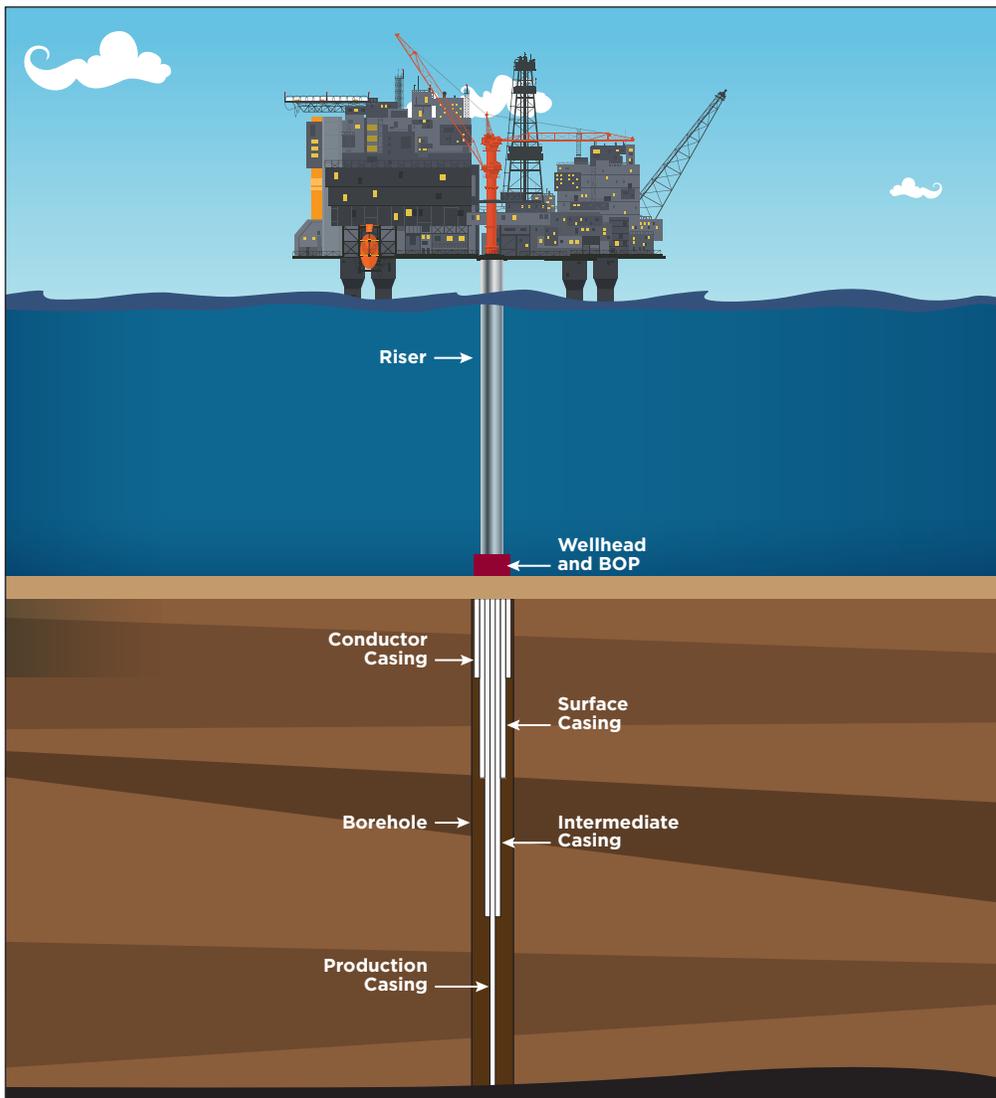
By international agreement, a safety zone of 500 metres is required while a drilling rig is on location. The only vessels permitted to enter this zone are ships supporting the drilling program with crew, food, equipment or other supplies.

Once drilling is complete, the well is ready to produce oil or natural gas. The company may use the pressure in the reservoir, pumps or other methods to stimulate the flow of oil and natural gas to the surface. A series of valves control the flow in a safe, controlled manner.

If the well does not contain commercial quantities of oil and natural gas, it is abandoned and sealed with a cement plug up to 100 metres in length or a series of plugs. Termination of a well and abandonment requires prior approval from the relevant offshore petroleum board.

Depending on water depth, environmental conditions and other factors, drilling an offshore well can take one to four months.

SCHEMATIC OF A COMPLETED OFFSHORE WELL



A COMPLETED WELL

A completed well looks like a very long cone, wide at the top and narrow at the bottom. A typical well **4,000 metres deep**, may contain five or six sections. It usually starts with a **90-centimetre surface hole**, and finishes with a **21.6 centimetre hole** in the deepest section, which is **about the diameter of a soccer ball**.

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WHAT TYPES OF EXPLORATION DRILLING RIGS ARE USED IN ATLANTIC CANADA?

Drilling rigs, also known as **MOBILE OFFSHORE DRILLING UNITS (MODUs)**, are large, stable, self-contained platforms used to drill wells all over the world.

In Atlantic Canada, three types of drilling rigs are typically used offshore: semi-submersible rigs, jackup rigs and drill ships. The type of rig selected depends on water depth, drilling depth, weather and ice conditions, along with the technical capabilities of the rig.

SEMI-SUBMERSIBLE DRILLING RIGS float on submerged pontoons. The drilling platform is supported by vertical columns that sit on two or more pontoons that float below the sea surface during drilling operations. The platform can be raised or lowered by adjusting the ballast in the pontoons. The deeper the pontoons below the sea surface, the less the rig is affected by surface wave action.

Semi-submersibles maintain their position over a well site in two ways. They can be anchored to the seabed or use computer-controlled thrusters and propellers to dynamically position the rig.

JACKUP DRILLING RIGS are typically used in shallow water depths of up to 120 metres and are equipped with three or four retractable legs that support the platform. Those legs, which can be adjusted to varying heights, are lowered until they rest on the seabed to elevate the platform above the sea surface during drilling operations. When drilling is complete, the legs are retracted from the seabed and the rig is towed to its next location.

DRILL SHIPS are large vessels equipped with drilling systems known as derricks. The drilling derrick and a large opening, known as a moon pool, are built into the centre of the ship's hull. Drilling takes place through the moon pool. Drill ships can use anchors or dynamic positioning systems to maintain position over the well site. These vessels can carry most of the fuel, water and supplies required when drilling a well, enabling them to operate at remote well sites with limited support over long periods.



MODUs

MODUs are designed, built and operated to safely drill wells thousands of metres deep into the ocean floor, often in challenging weather and sea conditions.

THE OFFSHORE EXPLORATION PROCESS

In total, the exploration drilling process can take **more than 2 years.**

Planning for an offshore exploration well is the longest time investment in the process, 18 to 24 months, while actually drilling the well takes 1 to 4 months and is influenced by environmental conditions.

For more information, visit: Atlanticcanadaoffshore.ca