

Incident Summary Q&A

(For the complete details of the analysis and conclusions, please see the incident summary report)

When did the incident occur?

On June 22, 2018, the CNSOPB was notified by BP Canada of a discharge of drilling mud to the marine environment.

What caused the discharge of drilling mud?

The discharge originated from a failed connection in the mud boost line fastened to the marine riser. The purpose of a mud boost line is to pump drilling mud into the riser to help lift drill cuttings from the well up to the drilling unit for processing.

How long was drilling mud being discharged into the marine environment?

An examination of operations and monitoring data after the event indicated that the drilling mud losses occurred over an approximate five-hour period on June 21, 2018.

When drilling mud losses were initially detected by the onboard monitoring systems, drilling was halted but drilling mud circulation downhole and boosting through the riser continued as it was suspected that the drilling mud was being lost to the formation (downhole). Loss of drilling mud to formation is not uncommon and can occur. For example, when drilling through a geological formation that is inherently fractured, includes voids, or that has high permeability. Losses may also occur when applying more mud pressure on the formation than it can withstand, thereby opening up a crack into which drilling fluids flow.

In the hours that followed, the monitoring system showed that losses might not be solely to the formation. Once critical operations were completed, drilling mud circulation was ceased, the well was secured and steps were initiated to determine the location, extent and cause of the drilling mud losses.

How much drilling mud was discharged to the marine environment?

The volume of drilling mud discharged was determined to be a maximum of 136 cubic metres and the discharge occurred about seven metres below the water surface. This was determined (conservatively) based on tank volumes, and the volume of drilling mud pumped into the mud boost line when monitoring systems first detected losses that day to when the discharge point was confirmed.

This calculation conservatively assumes that all drilling mud could have been discharged to the marine environment and does not subtract that quantity that may have been lost downhole to formation as it is not possible to accurately calculate this.

Drilling Mud

What is drilling mud?

Drilling mud is used to aid in the drilling of wells into the earth's crust. Drilling mud serves many purposes including lubricating the drill bit to enable drilling, carrying the cuttings from the well to the drilling unit for processing, and maintaining pressure control of the well.

How is drilling mud selected?

Drilling mud is specifically designed for each well and for use in the marine environment in the case of wells being drilled offshore.

It is recognized that some drilling mud will end up in the marine environment. Some quantity of drilling mud is routinely discharged with drill cuttings during regular drilling operations. Additionally, drilling mud could end up in the marine environment as a result of an accidental discharge, or during an emergency disconnect.

Is the drilling mud that was used by BP Canada toxic?

The drilling mud used in BP Canada's exploration well was designed for use in the marine environment. Drilling mud used must meet the CNSOPB's Offshore Chemical Selection Guidelines [<https://www.cnsopb.ns.ca/publications/offshore-chemical-selection-guide-lines-drilling-production-activities-frontier-lands>], which promotes the use of low toxicity mud components to minimize any potential environmental effects.

The largest volumetric component of the drilling mud used for the BP Canada's exploration well is synthetic base oil, and the drilling mud is thus referred to as a synthetic based mud (SBM). The synthetic base oil has low toxicity in the marine environment and the SBM is designed to biodegrade.

The drilling mud composition used for BP Canada's exploration well can be found on our website [https://www.cnsopb.ns.ca/sites/default/files/pdfs/Drilling_Mud_Composition_for_BP_Well.pdf].

Investigation

What was the purpose of the investigation?

- Determine if there were any non-compliances with the legislation in relation to the incident (in addition to the non-compliance with section 166(1) of the *Accord Acts*);
- Determine significance of environmental effects;
- Provide oversight to BP Canada's investigation;

- Confirm what happened, what the causes and contributing factors were, and what corrective and preventative actions were required to prevent reoccurrence;
- Evaluate BP Canada's due diligence with respect to the incident; and
- Verify regulatory compliance and implementation of corrective and preventative actions prior to recommencement of drilling operations.

Who was part of CNSOPB's investigation team?

The CNSOPB investigation team included a lead Safety Officer, a technical specialist with expertise in the primary engineering disciplines related to operations of the rig and drilling/well control systems, and an environmental specialist who carries the designation of Conservation Officer (Environmental Protection) to focus on the fate and effects of the drilling mud in the marine environment.

What was included in the investigation?

CNSOPB's incident review and investigation included:

- Immediately following the incident, confirming that the exploratory well was secure and that the mud boost line was isolated;
- Travelling offshore to interview key personnel;
- Reviewing procedures that were implemented by BP Canada related to the incident;
- Assessing the fate and environmental effects of the discharge;
- Collecting and reviewing monitoring data, reports and evidence;
- Reviewing photos and video footage of the mud boost line and the drilling mud discharged during the incident;
- Viewing and assessing marine riser joints, and specifically the mud boost line attached to it, at and adjacent to the area from which the discharge occurred after the marine riser joints had been pulled and laid on deck;
- Ensuring any damaged equipment was repaired or replaced, as required;
- Evaluating and confirming implementation of corrective and preventative actions taken by BP Canada to prevent reoccurrence of the incident, prior to an authorization being granted for the resumption of drilling operations;
- Independent analysis of the video footage and sediment samples collected from the seabed; and
- The identification of any non-compliances with legislation that contributed to the incident, noting that the occurrence of this drilling mud discharge is a non-compliance in itself.

At the conclusion of the investigation, an assessment of, and recommendations for, appropriate compliance and enforcement actions to be taken by the CNSOPB, were made.

Investigation Findings

What were the findings of the investigation?

- The incident occurred as a result of a failed connection in the mud boost line that is fastened to the marine riser, approximately seven metres below the water surface. The volume of drilling mud discharged was determined to be a maximum of 136 cubic metres. This was determined (conservatively) based on tank volumes, and the volume of drilling mud pumped into the mud boost line when monitoring systems first detected losses that day to when the discharge point was confirmed.
- The discharge of the drilling mud into the marine environment is, in itself, a non-compliance with the section of the *Accord Acts* legislation that prohibits spills. The investigation determined that BP Canada was duly diligent in complying with other sections of the *Accord Acts* legislation that would be relevant to this incident.
- BP Canada completed the necessary investigation into the incident, and implemented appropriate corrective actions to prevent reoccurrence of such an incident, to the satisfaction of the CNSOPB, until authorized to resume drilling operations. These actions included repairs and operational improvements to the involved equipment, and improved inspection and monitoring procedures.
- The fate and effects analyses of the drilling mud discharge concluded that there were no significant adverse environmental effects as a result of the incident.

How did you determine that there were no significant adverse environmental effects as a result of the incident?

The CNSOPB required BP Canada to conduct a fate and effects assessment to determine the potential environment effects of the drilling mud discharge.

The assessment concluded that there were no significant adverse environmental effects of the drilling mud discharge.

In addition to BP Canada's activities, the CNSOPB conducted its own assessment of environmental effects.

Based on the results of the fate and effects assessment conducted by BP Canada and the assessment of the environmental effects conducted by the CNSOPB, it was concluded that there were no significant adverse environmental effects of the drilling mud discharge. For the complete details of the analyses and conclusions, please see the summary report.

Compliance and Enforcement

What were the compliance and enforcement considerations by the CNSOPB?

The unauthorized discharge of the drilling mud into the marine environment is, in itself, a non-compliance with the section of the *Accord Acts* legislation that prohibits spills.

A Notice of Non-Compliance with respect to the unauthorized discharge of drilling mud was issued to BP Canada by the CNSOPB's Chief Safety Officer and Chief Conservation Officer on October 15, 2019.

The Notice of Non-Compliance was issued in reference to S.166(1) of the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act*.

Spills Prohibited

166(1) No person shall cause or permit a spill on or from any portion of the offshore area.

The CNSOPB contemplated whether additional enforcement action is required as a result of this incident. A number of factors were taken into account when making our decision, including:

- The CNSOPB, based on the results of the fate and effects analyses, available advice and information (including comparison to pre-activity conditions), determined that there were no significant adverse environmental effects as a result of the incident.
- There are no known previous incidents of similar failure of the mud boost line within the industry globally, and the CNSOPB has accepted that the design, installation, testing, inspection and monitoring practices used by BP Canada and its contractors for the mud boost line equipment aligned with accepted industry practice at the time of the incident.
- The incident learnings in terms of improved equipment practices have been shared within BP globally and the contractors involved in the drilling program, and have also been shared with the global oil and gas industry to help prevent future such incidents.

The CNSOPB also considered the appropriateness of BP Canada's corrective and preventative actions, along with BP Canada's cooperation with the CNSOPB in response to this incident, recognizing the following:

- BP Canada reported the incident to the CNSOPB in a timely manner. The CNSOPB directed BP Canada to halt drilling operations, and BP Canada did not resume drilling until authorized by the CNSOPB.

- The CNSOPB visited the rig on a number of occasions following the incident to gather information relating to the incident occurrence, to verify regulatory compliance and implementation of corrective and preventative actions, and to provide enhanced regulatory oversight.
- BP Canada conducted its own investigation into the incident in accordance with regulatory requirements and their company management systems.
- The CNSOPB reviewed and followed up on the BP Canada investigation report and other information submitted as required following the incident, ensuring that appropriate actions were being taken by BP Canada, and that these measures were aligned with the CNSOPB's own information and expectations.
- On July 22, 2018, after drilling operations had been suspended for 31 days, the CNSOPB was satisfied that the necessary investigation along with the implementation of appropriate corrective and preventative actions had been completed by BP Canada. These actions included repairs and operational improvements to the involved equipment, and the implementation of improved inspection and monitoring procedures. Only then did the CNSOPB authorize drilling operations to resume.

The CNSOPB concluded that the facilitated compliance measures taken following the unauthorized discharge of drilling mud were appropriate for preventing reoccurrence and that further enforcement action on this matter was not necessary to ensure ongoing regulatory compliance.

The Notice of Non-Compliance will be taken into account should BP Canada have an incident in relation to any future activity in the Canada-Nova Scotia offshore area.