



Can Diluted Bitumen be Cleaned Up?

Summary

- Environment Canada scientists are on record several times stating that more research is needed to understand whether and to what extent diluted bitumen will sink in the event of a marine spill.
- Environment Canada has expressed concern that Transport Canada, the body that oversees and certifies spill responses, has not planned for the submersion or sinking of diluted bitumen.
- The JRP acknowledges that more research is needed to understand the behavior of diluted bitumen in a marine environment, and has added a condition to its approval of the project that further studies be conducted.
- CPE finds the NEB's approval of the project to be presumptuous. We do not understand how the JRP can require further research as part of the approval, but not place any conditions on the findings of this research.

Background

Central to the assessment of the potential negative impacts of the Northern Gateway is an understanding of whether the product to be transported, in this case diluted bitumen, can be cleaned up in the event of a spill. The ability to clean up a spill of diluted bitumen depends greatly on whether or not the spilled product will remain floating on the surface, where it can be tracked, cleaned up, burned, or dispersed.

Much has been made of this topic in the past several years, with proponents stating unequivocally that the product is lighter than water (fresh and salt) and will therefore float, and opponents claiming that it might sink or become 'overwashed', a condition where it neither sinks to the bottom nor floats to the top, but remains trapped somewhere in the water column.

Much of this controversy is owing to the fact that there has been very little experience with actual spills of diluted bitumen and the behavior of this product in the natural environment has not been studied as closely as other more conventional petroleum products. The Kalamazoo, Michigan spill in 2010 is often cited as an example of the difficulties of cleaning up diluted bitumen, but this spill occurred in fresh water, in a river, where the behavior of the product and the strategies for its cleanup are significantly different than in a marine environment.

Some of the critical questions that are being asked are

- How does weathering (exposure to air, sunlight and wave action) affect density and viscosity over time?
- Will the density increase to such an extent that the product might sink, making it difficult or impossible to clean up?
- Will the viscosity (how runny or thick a fluid is) of the product change in a way that makes use of existing cleanup equipment ineffective?

What does the record show?

Written evidence submitted to the Joint Review Panel by Environment Canada

In written evidence submitted to the panel, Environment Canada states that syncrude and dilbit have been subjected to very little study by oil spill researchers. While studies of similar products may be "very applicable to understanding the behavior of diluted bitumen products"... "Environment Canada can find no reports of marine spills of diluted bitumen and synthetic crude products to date" (p18). Previous dilbit spill incidents were the result of a pipeline rupture, not a tanker accident. The Exxon Valdez spill, although it occurred in a similar environment, did not involve dilbit or synthetic crude. As such, Environment Canada states:

"Even considering these previous cases, Environment Canada is of the opinion that considerable gaps in the current state of knowledge of the behaviour, eventual fate and environmental effects of the products to be shipped continue to exist." (p19)

Environment Canada acknowledges the evidence submitted by Northern Gateway, but states:

"Environment Canada accepts the experimental data provided by the Proponent for behaviour of the hydrocarbon product classes, but notes that there continue to be significant uncertainties that are not addressed by the submissions. These include..." (p19)

- Response plan doesn't account for sinking oil or interaction of oil with suspended particulate matter.
- The model used for emulsion formation is limited and tests a very specific set of conditions which may not be representative of actual conditions.

Also:

"Because of these continuing, important uncertainties with respect to product behaviours in the marine environment, Environment Canada considers the response scenario results to be of limited value in use for spill response planning and risk assessment. Significant knowledge gaps remain for predicting what these relatively-unstudied products will do in a British Columbia northwest coast marine environment." (p19)

The Joint Review Panel hearings

These sentiments were repeated multiple times during the Joint Review Panel hearings, with Environment Canada Scientist Dr. Bruce Hollebone clarifying again and again that further study is needed to understand the behavior and fate of diluted bitumen spilled into marine environments.

April 25, 2013 JRP Hearing in Prince Rupert

The discussion of April 25, 2013, is representative of the examination of this issue by the Joint Review Panel. Environment Canada scientist Dr. Bruce Hollebone is questioned by Jesse McCormick, a lawyer representing the Haisla Nation.

- Line 21548:
 - There are circumstances where the oil can become 'overwashed', meaning that it neither floats nor sinks, but becomes trapped in the water.

- Line 21551:
 - How does overwashing affect the ability to locate and track spilled oil?
 - Techniques exist to track submerged oil by plane, but these would be difficult to employ at night or in foggy/cloudy weather. The use of radar techniques for tracking submerged oil is briefly mentioned.
 - It is acknowledged that these techniques produce a high degree of false positives (line 21573), meaning that considerable time and resources would be needed to confirm that submerged oil was actually in the locations in which it was detected.

- Line 21581:
 - The discussion then shifts back to the general question of the state of knowledge regarding fate and behavior of submerged oil.
 - Environment Canada gives the impression that this topic is currently being researched.

- Line 21583:
 - Mr. McCormick (lawyer for Haisla Nation) asks whether it is thought that subsurface currents will play a significant role in determining the trajectory of submerged oil.
 - Environment Canada acknowledges that this is indeed the case, but it does not appear that any agency has answered that question (lines 21587 and 21590).

- Line 21609:
 - The discussion then focuses on the question of whether there are established techniques for recovering submerged oil from these kinds of environments.

- Line 21614:
 - Mr. Erik Kidd (from Transport Canada, the body that certifies spill response plans) asserts that the question is speculative in nature and that the "ongoing evidence" doesn't show that the oil will submerge. However, in written submissions (see above) Environment Canada has stated concerns about the validity of this evidence.

- Line 21623:
 - The discussion continues and Transport Canada acknowledges that there is "limited world expertise" in recovery of these products. Erik Kidd then mentions the 2007 spill from the

- Westridge terminal in Burnaby, BC as an example of how the product behaves in a marine spill.
- However, Environment Canada, in their written submission, feels that despite this previous experience significant gaps in the knowledge base still exist (p19 of the written submission, above).
 - Line 21627:
 - Mr. McCormick (lawyer for Haisla Nation) then asks directly whether Transport Canada is planning to clean up submerged oil, or if they are simply planning to clean up oil from the surface, given that they seem confident that the evidence demonstrates that it will float.
 - Lines 21636 and 21637; 21652 and 21654:
 - Environment Canada reiterates that they are not saying the product is certain to sink, just that they don't know enough to say anything quantitative in either direction and that more research is needed.
 - Line 21658:
 - Mr. McCormick submits that Transport Canada does not currently have the capacity to contain a spill of oil that is submerged to a depth of 10 - 15 meters.
 - Lines 21660 - 21724:
 - The discussion then focuses on previous spills, the Westridge spill in Burnaby and the Kalamazoo spill, with Transport Canada arguing that experience in these spills provides a reference point for the ability to clean up a spill (Line 21661) and Environment Canada maintaining that every spill is highly context-dependent and it's unclear whether lessons from these previous events inform the response capability for a spill in Douglas Channel (Lines 21709 and 21721).

From the above exchanges it is clear that Environment Canada is uncertain of the behavior of diluted bitumen spilled into a marine environment. Dr. Hollebhone states many times that further research is needed and that existing knowledge, developed in the handling of other heavy crude spills, is of limited value in planning the response to a cleanup of diluted bitumen.

Environment Canada, Fisheries and Oceans, and Natural Resources Canada: Latest Report on Dilbit Behavior, November 2013

Just before the Joint Review Panel released their report in December 2013, the Canadian Government released a report on a small study that tested the behavior of two types of diluted bitumen under simulated weathering. This project was undertaken as part of the Government of Canada's strategy to develop a "World Class" prevention, preparedness and response regime for oil spills from ships.

"The behaviour of the diluted bitumen products was studied under laboratory conditions in three phases. First, the properties and composition of two samples representative of products currently being shipped in Canada were measured before (fresh) and after (weathered) exposure to environmental conditions. Secondly, the potential for evaporation, exposure to light, mixing with saltwater, and sediments in the saltwater to affect whether diluted bitumen products float or sink

in saltwater was examined. Finally, the effectiveness of two existing spill treating agents meant to disperse spilled oil products was evaluated. " (p5)

Can weathering cause sinking?

In general the report finds that weathering (evaporation and exposure to light) is not sufficient to cause the two types of diluted bitumen to sink in "fully salt marine waters". This conclusion is drawn from the data shown in the figure below, where AWB and CLB are the two types of diluted bitumen and the data series fresh, W1, W2, W3 and W4 represent different amounts of weathering (p46):

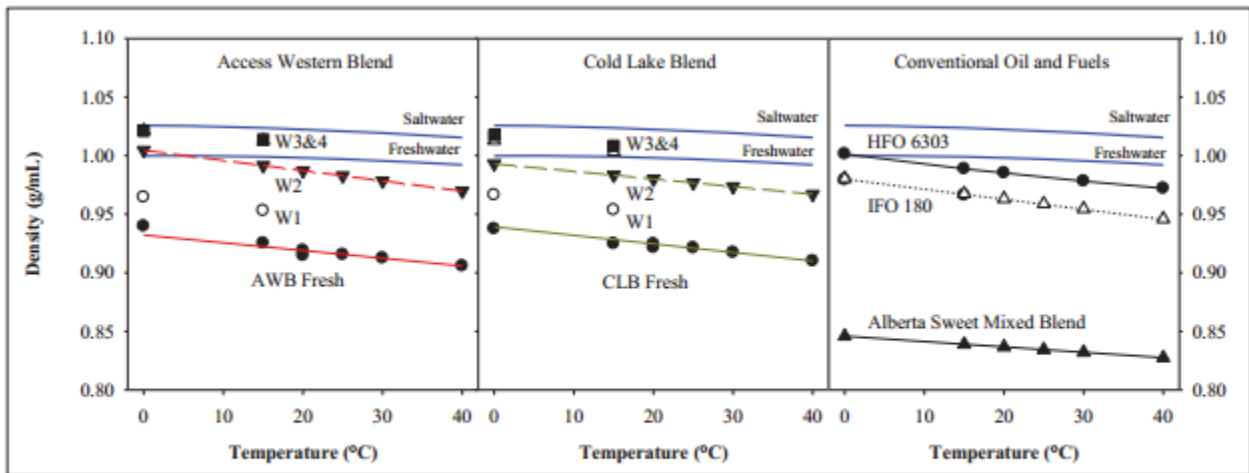


Figure 4-1. Effects of evaporative weathering changes on density as a function of temperature for AWB and CLB samples. Data on conventional fuels and a light crude type are provided for comparison. Lines for fresh water and natural seawater from Spiweck and Bettin, 1992 and UNESCO, 1981, respectively.

Douglas Channel contains a large amount of fresh water

What is not mentioned in the report, however, is the fact that the water in Douglas Channel cannot be assumed to be "fully salt" as there are often layers of less dense fresh water floating on top of the more dense salt water. If weathered bitumen is heavy enough to sink through fresh water, and a layer of fresh water sits on top of the salt water in Douglas Channel, the weathered bitumen could sink below the surface and remain trapped at the boundary between the fresh and salt water layers.

This is a topic that was discussed in the April 25, 2013 hearing as well. Although the discussion was brief, it referenced a report conducted by ASL Environmental Sciences (Sidney, British Columbia) in 2010: Marine Physical Environment, Enbridge Northern Gateway Project.

"The temperature and salinity profiles in the CCAA consistently reveal distinct upper layers ranging from a few metres to 10 to 15 m depth, characterized by much-reduced salinities compared to the underlying deeper waters. From late spring through the fall months, the salinities are much lower than those at depth, resulting in a large density gradient between the upper layers and the remainder of the water columns. These lower salinities result from the large amounts of freshwater land runoff and direct precipitation. The upper layers also have higher water temperatures in spring, summer and fall." (p 24)

If Douglas Channel contains a thick layer of fresh water, and diluted bitumen sinks in fresh water, how can a spill be tracked and cleaned up?

What were the JRP's findings?

Disagreements between Environment Canada and Transport Canada

In general, the Joint Review Panel's summary of this issue seems to track the items that were debated during the review, but fails to offer a critical analysis of the information presented. Despite an obvious disagreement between Transport Canada and Environment Canada as to whether or not diluted bitumen can be recovered in the event of a marine spill, the Joint Review Panel chooses to draw the conclusion that Northern Gateway's plans are "sufficient".

Environment Canada said that, in its current form, the response scenarios included in Northern Gateway's fate and trajectory modelling were of limited value for spill response planning and risk assessment because of uncertainties related to the behavior of the product in the marine environment. (JRP Report vol 2, p163)

Two pages after this acknowledgement of Environment Canada's position the report goes on to say:

The Panel finds that Northern Gateway's extensive evidence regarding oil spill modelling, prevention, planning, and response was adequately tested during the proceeding, and was credible and sufficient for this stage in the regulatory process. (JRP Report vol 2, p165)

They draw this conclusion despite a number of troubling statements, documented earlier in the report, that this product will likely be difficult to track and clean up:

Northern Gateway said that oil may become entrained in the water column by wave- or current-induced water turbulence in freshwater and marine environments. It said that the depth and duration of submergence depends on factors such as oil density and viscosity, wave energy, and size of the oil particles. It said that entrainment in the water column would typically be temporary, and that the oil would resurface in calm conditions. (JRP Report vol 2, p91)

Northern Gateway said that, while dilbit is not likely to sink due to initial weathering alone, if not recovered in a cleanup operation, dilbit weathered over a period of weeks could eventually sink. (JRP Report vol 2, p91)

While dilbit may not sink, it is likely to submerge, making cleanup and tracking difficult. (JRP Report vol2, p100)

We are left to ask if the Panel is basing its approval on an optimistic view of the conditions under which a spill might occur. Given the complicated currents and geometry of the Douglas Channel area, is it reasonable to assume that the spilled diluted bitumen can be recovered before it weathers and sinks? What of the issues mentioned above with tracking overwashed oil, where a significant amount of time and effort may be required to actually locate overwashed oil so that it can be cleaned up before sinking?

More research is needed

Both Environment Canada, Northern Gateway, and the Joint Review Panel agree that more research is required to understand the behaviour of diluted bitumen spilled into a marine environment and the extent to which it can be cleaned up.

Environment Canada referred to its research indicating that the potential for oil to sink depends on many factors, such as evaporation, photo-oxidation, emulsion formation, water temperature, salinity, and oil particle size. It said that uptake of particulate matter is the most important contributor to increased density of spilled oil. It said that experience with previous spills shows that some of the oil could sink, some would float, and some would become neutrally buoyant and temporarily submerged or overwashed. It said that it did not have enough information to make quantitative predictions of dilbit behaviour, and was planning research on the topic. (JRP Report vol 2, p91)

[Environment Canada] also said that additional research would be required regarding the behavior, fate, and environmental effects of the products to be shipped, as the actual behavior of spilled oil depends on the environmental conditions at the time and the physical and chemical characteristics of the product. (JRP Report vol 2, p95)

The Panel finds that research on the behaviour and cleanup of heavy oils is required to inform detailed spill response planning and heavy oil spill response in marine and freshwater environments. Northern Gateway has committed to be responsible for this research. (JRP Report vol 2, p101)

But will the findings of this research be used?

If further research is needed to understand the details of how diluted bitumen behaves when spilled into the environment, is it not premature for the Panel to have approved the project before this research is completed?

Despite requirements to carry out further research on this issue, we are troubled by the Panel's closing statement on the topic of diluted bitumen cleanup:

In the Panel's view, the weight of evidence indicates that disagreement among experts on the fate and behaviour of spilled oil is related to specific details that may not be significant from a spill response perspective. Additional research is required to answer outstanding questions related to the detailed behaviour and fate of dilbit. All parties with technical expertise on the topic were in agreement with this.

The Panel finds that research on the behaviour and cleanup of heavy oils is required to inform detailed spill response planning and heavy oil spill response in marine and freshwater environments. Northern Gateway has committed to be responsible for this research. (JRP Report vol 2, p101)

The first paragraph seems to state that the disagreements among experts are not relevant to the problem of whether or not diluted bitumen can be recovered, while the second paragraph states that more research is required, presumably to resolve these disagreements.

If further research is necessary, the risks of the project should be considered unknown until this research is completed. As is the case with other parts of the report, we do not understand the methodology used by the Panel to determine that the risks are outweighed by the benefits, especially if the risks require further research. The Panel's approval of the project in advance of the research being completed carries disturbing implications:

1. Either the Joint Review Panel is comfortable approving the project with an incomplete understanding of whether a spill can be cleaned up, in which case the impacts and their associated costs are also unknown, or
2. The outcome of this research will not have an impact on the approval of this project

We do not understand how the Joint Review Panel can state that they find the risks to be acceptable yet simultaneously require more research to be completed. This is misleading and presents a false sense of assurance to the public.

Are you comfortable with this project proceeding if the costs and effectiveness of spill cleanup are unknown?

Do you trust Northern Gateway to adjust their plans if research shows that diluted bitumen cannot be effectively recovered?