

The Safety of Pipeline vs. Rail for the Shipment of Tar Sands Material

The following summarizes investigation done into the safety of shipping tar sands products by pipeline vs. rail.

1. Assumptions.

- Tar sands product shipped by rail is generally sent without diluent.^[2]
- If it is shipped by pipeline, tar sands product must have diluent added at approximately 30% by volume. This is required to make the material pumpable.^[3]

2. Discussion.

Shipment of Bitumen by Rail

Bitumen shipped by rail is generally shipped in its undiluted form. Upon arrival at its destination, steam is applied to the jackets or coils of rail cars to make the bitumen non-viscous enough to allow offloading.

Bitumen, often referred to as bitumen emulsion, has a United Nation Identifier Number (UN number^[1]) of 3257. It is considered non-flammable by the U.S. National Fire Protection Association (NFPA), as it has a flashpoint greater than 38°C. (The bitumen material safety data sheet cited here indicates a flashpoint of 148°C and a boiling point of 182°C.) The NFPA rates bitumen risks as follows: Fire: 2 / Reactivity: 0 / Health 3.^[3] Bitumen at room temperature has a viscosity of approximately 50,000 centipoise which is by comparison 5-10 times more viscous than molasses.

Shipment of Bitumen by Pipeline

To be shipped by pipeline, bitumen is generally mixed with diluent at 30% by volume. Diluent is not generally processed by refiners, and is often separated by the refiner and returned to Alberta for re-use, generally by rail^[2]. Diluent is often composed of natural gas liquids, but formulations stated on MSDS sheets fall into a broad range and are considered proprietary.

Interestingly, diluted bitumen is given the same UN number as crude oil (1267) meaning that the same recording number could represent two very different products. For example, diluted bitumen has a flashpoint of -35°C whereas the flashpoint of light crude averages 10°C and goes as high as 60°C. These quite different flashpoint temperatures means that diluted bitumen is a fire hazard during virtually all climatic conditions, unlike regular crude that often will not flash in common Canadian temperatures. The NFPA rates diluted bitumen risks as follows: Fire: 2 / Reactivity: 0 / Health 3,^[5] the same as bitumen emulsion. But diluted bitumen at room temperature has a viscosity over 100 times lower than undiluted bitumen, at a value of 250 centistokes. Diluted bitumen may contain up to 0.5% sediment by weight^[3], material that is potentially erosive to pipelines.

An additional risk associated with the shipment of diluted bitumen by pipeline is management of the diluent itself. Diluent must be shipped into bitumen-producing areas, generally by rail. If all the diluent put into the Energy East pipeline to move 850,000

barrels per day of diluted bitumen to St John, New Brunswick were moved back to Alberta by rail, a 120-car train of diluent would have to depart St. John for Alberta every eight hours. An e-mail sent to Irving Oil of St John, NB as to their plans for managing diluent arriving at the St John refinery and port, was not responded to after several weeks. These calculations show that Energy East would generate a large volume of rail traffic, with the associated risk of accidents. The natural gas liquids (NGLs) often used to dilute bitumen have a UN number of 1075 and NFPA ratings as follows: Fire: 4 / Reactivity: 0 / Health: 1. ^[6]

3. Analysis

The comparison table below rates and briefly discusses the chances of spills and their potential impacts.

Risk	Relative Risk Level Rating (1-10)		Comments
	Undiluted Bitumen by Rail	Diluted Bitumen by Pipeline	
Risk of a spill	8	2	Researched material but rail at equal or three times higher risk for a spill ^[2]
Spill volume	2	6	Spill volumes are generally larger with pipelines. For example, in a 2010 pipeline spill in Kalamazoo, MI, oil continued to be sent down a line 17 hours after the initial rupture. ^[7]
Fire Risk	2	8	Diluted bitumen is considered flammable by the NFPA. Bitumen alone is not.
Spill spread	1	10	The relatively high viscosity of undiluted bitumen will limit its spread.
Vapour hazard	1	10	The higher vapour pressure of diluted bitumen compared to undiluted product makes vapours a big issue with diluted material. In Kalamazoo, the release of diluted bitumen led to severe deterioration of local air quality. ^[8]
Risk from return diluent shipment	0	10	There is no return diluent risk when bitumen is shipped by rail.

Comparison Table: Shipment of Tar Sands Product by Rail vs. Pipeline
(Qualitative Ranking)

While there is less likelihood of a spill when tar sands product is shipped by pipeline, the table shows that pipeline transportation poses higher risks once a spill has occurred. So simple claims that pipelines are safer than rail should be called into serious question.

References:

1. Wiki free encyclopedia definition of UN number system at: http://en.wikipedia.org/wiki/UN_number
2. *Trains* magazine. p. 6-7. August, 2013.
3. Diluted Bitumen Chemical and Physical Properties. Heather D. Dettman. NAS Committee for a Study of Pipeline Transportation of Diluted Bitumen – Second Meeting. October 2012. Natural Resources Canada.
4. Material Safety Data Sheet – Bitumen Emulsion. Cenovus Energy Inc. 500 Centre Street SE, PO Box 766. Calgary, AB T2G 0M5.
5. Material Safety Data Sheet – Heavy Crude Oil Diluent Mix. Cenovus Energy Inc. 500 Centre Street SE, PO Box 766. Calgary, AB T2G 0M5.
6. Material Data Safety Sheet – Natural Gas Liquids. Cenovus Energy Inc. 500 Centre Street SE, PO Box 766. Calgary, AB T2G 0M5.
7. ^ ^a ^b "Enbridge, Inc. Hazardous Liquid Pipeline Rupture". *National Transportation Safety Board*. Retrieved 2012-07-11.
8. The Dilbit Disaster: Inside The Biggest Oil Spill You've Never Heard Of. *Inside Climate News*. Link: <http://insideclimatenews.org/news/20120626/dilbit-diluted-bitumen-enbridge-kalamazoo-river-marshall-michigan-oil-spill-6b-pipeline-epa>