

Four Proposed Tar Sands Oil Pipelines Pose A Threat To Water Resources



Figure 1: Map of 373 U.S. hazardous liquids pipelines spills from 2010 to present for TransCanada (green), Kinder Morgan (purple) and Enbridge (blue). Available online at greenpeace.carto.com. Data: PHMSA & EIA.

SUMMARY FINDINGS

- Oil spills anywhere pose serious risks to human health and the environment, and oil spilled into bodies of water is difficult to fully clean up. Diluted bitumen transported from Canada's tar sands fields represents a particular threat to water resources along the routes of proposed pipelines.
- Analysis of public data shows that the three companies proposing to build four tar sands pipelines -- TransCanada, Kinder Morgan, Enbridge, and their subsidiaries -- have seen 373 hazardous liquid spills from their U.S. pipeline networks from 2010 to present. A map of these spills is available at greenpeace.carto.com.
- These spills released a total of 63,221 barrels of hazardous liquids during that time period -- including Enbridge's 20,082 barrel diluted bitumen spill into the Kalamazoo River in 2010.
- The U.S. crude oil pipeline system as a whole has averaged one significant incident and a total of ~570 barrels released per year per 1000 miles of pipe, over the past 10 years.
- Assuming these rates, the Keystone XL pipeline could expect 59 significant spills over a 50-year lifetime. Similarly, the Line 3 Expansion could see 51 significant spills over a 50-year lifetime.
- Studies have found that a diluted bitumen spill into water is even more difficult to clean up than a conventional crude oil spill, due to the fact that bitumen sinks in water.

Canada's Destructive Tar Sands

The mining and processing of bitumen from Canada's tar sands is environmentally destructive and highly carbon-intensive when compared to conventional crude oil. When first proposed in 2008, the Keystone XL pipeline provoked widespread opposition both in Canada and the U.S., eventually leading to President Obama's 2015 decision to reject TransCanada's permit application. President Trump has attempted to revive Keystone XL via executive order. Additionally three other tar sands pipelines -- Kinder Morgan's Trans Mountain, Enbridge's Line 3 expansion, and TransCanada's Energy East -- are in various stages of development. Construction of one or more of these pipelines could lead to the expansion of the tar sands, with serious consequences for communities and the climate.¹

Unlike conventional crude oil, bitumen has the consistency of a thick tar and is too thick to be pumped out of the ground or flow through a pipeline. Bitumen is extracted by mining, or by injecting the oil sands with steam. Some bitumen is processed on-site into synthetic crude oil, but other projects seek to transport the bitumen to distant refineries for processing. To transport bitumen through a pipeline it must be mixed with light crude oil or natural gas liquids. Diluted bitumen is often referred to as *dilbit*.

Over 120 First Nations and Tribes on both sides of the Canadian/U.S. border have signed a treaty stating their explicit opposition to tar sands pipelines, trains, and tankers through their territorial lands and waters. The Treaty is an expression of Indigenous Law and opposes new or expanded pipeline infrastructure projects that would facilitate the expansion of the tar sands.²

Three Tar Sands Companies Have a History of Pipeline Spills

The three companies proposing to build the four tar sands pipelines -- TransCanada, Kinder Morgan and Enbridge -- own significant networks of crude oil, refined petroleum products, and highly volatile liquids (HVL) pipelines. Of these

three companies, Kinder Morgan and Enbridge have the most extensive hazardous liquid pipeline networks (>10,000 miles in the U.S.), whereas TransCanada's U.S. operations consist of the existing Keystone pipeline.

In the United States, the Pipeline and Hazardous Materials Safety Administration (PHMSA) maintains statistics on liquid and gas pipeline spills.³ Figure 1 shows the geographic locations of 373 U.S. incidents from 2010 to present (TransCanada in green, Kinder Morgan in purple, Enbridge in blue) against the backdrop of the U.S. hazardous liquids pipeline system.⁴ The scale of the dot reflects the volume of unintentionally released liquids, noting that in many cases some or all of that volume was later recovered by clean up operations.

PHMSA data on hazardous liquid⁵ pipeline spills for these three companies, from 2010 to present, shows the following:

- **TransCanada** and its subsidiaries had 13 spills totaling 829 barrels of crude oil (mostly from two significant 400 barrel spills in 2011⁶ and 2016). TransCanada operates 1,869 miles of crude oil pipelines in the U.S.
- **Kinder Morgan** and its subsidiaries and joint ventures had 213 spills totaling 21,598 barrels of hazardous liquids. Of those spills 172 were refined petroleum products, 35 were crude oil and 6 were HVL. In total, Kinder Morgan saw 22 significant spills⁷ during this time -- 5 crude oil spills, 3 HVL spills, and 14 refined petroleum products spills. Kinder Morgan and its subsidiaries currently operate 10,451 miles of crude, petroleum products or HVL pipelines in the U.S., of which 2,631 are used to transport crude oil.
- **Enbridge** and its subsidiaries and joint ventures had 147 spills totaling 40,794 barrels of hazardous liquids. Of those spills 137 were crude oil, 7 were refined petroleum products and 3 were HVL. Around half of Enbridge's total comes from a catastrophic 20,082 barrel diluted bitumen spill into Michigan's Kalamazoo River in 2010.⁸ In total, Enbridge saw 17 significant spills during this time period, all crude oil spills. Enbridge and its subsidiaries and joint ventures currently operate 10,472 miles of crude, petroleum products or HVL pipelines in the U.S., of which 8,631 miles are used to transport crude oil.

¹ Greenpeace. 2017. Rex Tillerson Must Recuse Himself from the Keystone XL Decision. (<http://www.greenpeace.org/usa/research/policy-brief-rex-tillerson-must-recuse-keystone-xl-decision/>)

² <http://www.treatyalliance.org/>

³ There is no comparable national data set in Canada or a consistent format for data collection or release. The National Energy Board regulates inter-provincial pipelines and provincial agencies regulate pipelines that don't cross a provincial boundary. See: <http://www.cbc.ca/news/canada/pipeline-safety-canada-lags-u-s-on-making-data-public-1.2254793>

⁴ Shapefiles compiled by the U.S. Energy Information Administration (EIA) [https://www.eia.gov/maps/layer_info-m.php]. Pipelines in gray are not operated by any of the 3 companies. Some recorded spills correspond to pipelines that are not included in the EIA shapefile.

⁵ Unless otherwise noted, statistics in this report combine spills of crude oil, refined petroleum products, and HVL, but exclude a small number of biofuels and liquid CO2 incidents.

⁶ Swift, A. 2011. What the 21,000 gallon Keystone spill tells us about the safety of tar sands diluted bitumen pipelines. NRDC, May 10. [<https://www.nrdc.org/experts/anthony-swift/what-21000-gallon-keystone-spill-tells-us-about-safety-tar-sands-diluted>]

⁷ An incident is considered "significant" by PHMSA if it involved a fatality, a hospitalized injury, \$50,000 or more in costs, more than 50 barrels (or >5 barrels of HVL) spilled, or resulted in an unintentional fire or explosion.

⁸ U.S. National Transportation Safety Board. 2012. Pipeline Rupture and Oil Spill Accident Caused by Organizational Failures and Weak Regulations [<https://www.nts.gov/news/press-releases/Pages/PR20120710.aspx>.]

Trends in U.S. Oil Pipeline Spills

Over the past several years, spills of crude oil and liquid petroleum products from pipelines have increased, reversing earlier improvements.⁹ This trend reached its maximum in 2015 with a total of 455 reported incidents, of which 176 were classified as significant by PHMSA. These numbers dropped slightly in 2016 to 408 reported incidents (168 significant) but remained at an elevated level compared to earlier years (Figure 2).

Similarly, a recent review by oil industry trade organizations found that pipeline incidents “impacting the public or environment” (IPE) have increased in the past 4 years.¹⁰

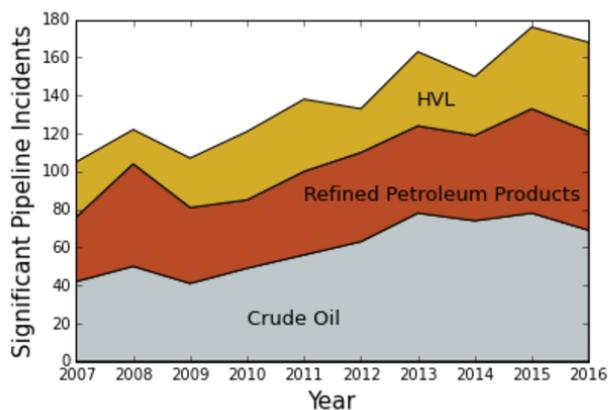


Figure 2: Ten year trends for significant U.S. pipeline incidents involving crude oil, refined petroleum products, and highly-volatile liquids (HVL). Data: PHMSA

The key takeaway from these statistics is that despite industry rhetoric to the contrary, there is no failsafe way to transport fossil fuels. Industry safety initiatives and an overmatched regulatory agency have been unable to eliminate the risk of spills, which remain a direct and seemingly unavoidable consequence of oil and gas activity. PHMSA employs a mere 208 inspectors responsible “for regulating nearly 3,000 companies that

operate 2.7 million miles of pipelines, 148 liquefied natural gas plants, and 7,571 hazardous liquid breakout tanks.”¹¹ The oil industry also has one of the highest rates of severe workplace injury among its workers.¹²

Over the past decade, hazardous liquid pipeline spills in the U.S. have led to 20 fatalities, 35 injuries, \$2.6 billion in costs, and over 800,000 total barrels spilled (34 million gallons, or more than 9,000 gallons every day)¹³ Common causes of pipeline spills include equipment failures, corrosion, operator error, material or welding failures, and excavation damage.¹⁴

Other significant pipeline spills in recent years include Exxon’s 2013 Pegasus pipeline spill in Mayflower, Arkansas, two spills into the Yellowstone River in 2011 and 2015,¹⁵ the 2015 Nexen Energy spill in the heart of Alberta’s tar sands region, and the 2015 pipeline rupture that closed a Santa Barbara beach.

These pipeline spills are in addition to spills from oil wells, disposal sites, and other oil and gas infrastructure, both onshore and offshore.¹⁶ [There is no comprehensive database of all hazardous material spills in the U.S. with data scattered across numerous federal and state agencies, and lacking consistent reporting rules.] Of total spills from all sources in 2015, a recent analysis found that 640 spills affected groundwater or surface water in some way.¹⁷

From 2007 to 2016, U.S. crude oil pipelines have averaged 0.001 significant incidents and 0.57 barrels spilled per year per mile of pipeline. Refined petroleum product pipelines have averaged 0.0007 significant incidents and 0.24 barrels spilled per year per mile, and HVL pipelines have averaged 0.0005 significant incidents and 0.53 barrels spilled per year per mile.

⁹ U.S. Pipeline and Hazardous Materials Safety Administration. Pipeline Incident 20 Year Trends. [https://www.phmsa.dot.gov/pipeline/library/data-stats/pipelineincidenttrends]; see also Lee, M. 2016. Number of leaks and spills continued to grow in 2015. EnergyWire, August 22. [https://www.eenews.net/energywire/2016/08/22/stories/1060041856]

¹⁰ API & AOPL. 2017. Pipeline Safety Excellence: Performance Report & Strategic Plan 2017-2019. [http://www.energyinfrastructure.org/~media/energyinfrastructure/images/pipeline/related-docs/api-aopl-pipeline-safety-report-high.pdf]; see also Mandel, J. 2017. Safety incidents on the rise after decade of decline. EnergyWire, April 26. [https://www.eenews.net/energywire/stories/1060053574]

¹¹ U.S. Pipeline and Hazardous Materials Safety Administration. Pipeline Inspection 101. [https://phmsa.dot.gov/pipeline/inspections]

¹² Soraghan, M. 2017. Oil and gas industry leads in severe injuries. EnergyWire, May 2. [https://www.eenews.net/energywire/2017/05/02/stories/1060053892]

¹³ PHMSA. Pipeline Incident 20 Year Trends.

¹⁴ Stover, R. America’s Dangerous Pipelines. Center for Biological Diversity. [http://www.biologicaldiversity.org/campaigns/americas_dangerous_pipelines/]

¹⁵ Douglas, E. 2015. Yellowstone Oil Spills Expose Threat to Pipelines Under Rivers Nationwide. InsideClimate News, February 6. [https://insideclimatenews.org/news/06022015/yellowstone-oil-spills-expose-threat-pipelines-under-rivers-nationwide]

¹⁶ King, P. & M. Soraghan. 2016. Spills dropped 8% in 2015 as new drilling slowed. EnergyWire, July 21. [https://www.eenews.net/energywire/2016/07/21/stories/1060040567]

¹⁷ Soraghan, M. & P. King. 2016. Drilling mishaps damage water in hundreds of cases. EnergyWire, August 8. [https://www.eenews.net/energywire/stories/1060041279]

Tar Sands Pipelines Spill Estimates

Using these decadal averages for crude oil (the most relevant category for tar sands) we can give a rough estimate of the potential number of incidents from the two U.S. proposed pipelines over a 50 year nominal lifespan.

The 1,179 mile **Keystone XL** pipeline could see around one significant spill per year, or around 59 such spills over its lifetime. TransCanada reported a much a lower estimate of 11 significant spills over the project lifetime,¹⁸ but an independent scientific assessment¹⁹ concluded that they relied upon overly-optimistic assumptions. Similarly, the 1,031 mile **Line 3 Replacement** would also see around one significant spill per year, or around 51 such spills over its lifetime.

For Further Information

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Spill Response Risks Higher for Diluted Bitumen

In July 2010, Enbridge's Line 6B pipeline ruptured, spilling 20,000 barrels of diluted bitumen into the Kalamazoo River near the town of Marshall, Michigan.²⁰ The spill impacted hundreds of families, polluted 36 miles of river, and only narrowly avoided contaminating Lake Michigan. The spilled bitumen sunk to the bottom of the river triggering a years-long, billion dollar clean-up operation that required dredging the river bottom. It has left the river degraded years later.

Cleaning up oil spills in water is an inherently difficult task. In typical situations only a fraction of the spilled oil can be recovered by deploying booms and skimmers, or via other methods. Dilbit spills pose an especially difficult clean-up challenge due to the properties of the oil.

A 2015 study conducted by the National Academies of Science identified unique problems associated with a dilbit spill.²¹ The dilbit mixture separates quickly after a spill, with the lighter volatile diluents evaporating and leaving behind the denser bitumen, which will sink in water. This complicates most oil spill response techniques designed to handle oil floating on the surface.²²

¹⁸ U.S. Department of State. 2014. Final Supplemental Environmental Impact Statement for the Keystone XL Project. [https://2012-keystonepipeline-xl.state.gov/finalseis/index.htm]

¹⁹ Stansbury, J. 2011. Analysis of Frequency, Magnitude and Consequence of Worst-Case Spills From the Proposed Keystone XL Pipeline. [http://engineering.unl.edu/downloads/civil/Worst-case-Keystone-spills-report-dis.pdf]

²⁰ McGowan, E. & L. Song. 2011. The Dilbit Disaster: Inside The Biggest Oil Spill You've Never Heard Of. InsideClimate News, June 26. [http://insideclimatenews.org/news/20120626/dilbit-diluted-bitumen-enbridge-kalamazoo-river-marshall-michigan-oil-spill-6b-pipeline-epa]

²¹ National Academies of Science, Engineering & Medicine. 2016. Spills of Diluted Bitumen from Pipelines: A Comparative Study of Environmental Fate, Effects, and Response. [https://www.nap.edu/catalog/21834/spills-of-diluted-bitumen-from-pipelines-a-comparative-study-of]

²² Hirji, Z. 2015. Unique Hazards of Tar Sands Oil Spills Confirmed by National Academies of Sciences. InsideClimate News, December 9. [https://insideclimatenews.org/news/09122015/unique-hazards-tar-sands-oil-spills-dilbit-diluted-bitumen-confirmed-national-academies-of-science-kalamazoo-river-enbridge]