

Quantifying Risk:

Calculating the probability of an Energy East
pipeline rupture



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TransCanada is proposing to build the Energy East pipeline, which would ship 1.1 million barrels of crude per day from the Alberta-based tar sands (or oil sands) to New Brunswick. The Energy East project is the largest tar sands pipeline proposed yet. It would be larger than any existing pipeline in Canada. The multi-use oil pipeline would convert an existing up to 40-year-old natural gas pipeline from Saskatchewan to Ontario. New pipeline would be added in Eastern Ontario, and would pass through Quebec to a new major export port in Saint John, New Brunswick.

This briefing paper examines the likelihood of a rupture and provides spill volume estimates for the proposed Energy East pipeline.

Energy East would have a 15 per cent chance of a full bore rupture per year. A catastrophic rupture could produce the largest oil spill in recent Canadian history – up to 30 million litres of diluted bitumen – in a worst case scenario. A leak of up to 2.6 million litres per day could also go undetected by TransCanada.

TransCanada's 39,000-page Energy East pipeline application, submitted to the National Energy Board, contains a section titled *Energy East Pipeline Project Volume 6: Accidents and Malfunctions – Section 2: Incident Frequency and Volume Analysis – Onshore Pipeline*. This section includes calculations on the likelihood of Energy East failing based on pipeline failure rates in North America from 2002 to 2013.¹

To arrive at its results, TransCanada assumes that its pipelines are as safe as the industry average. This is like a student referring to the class average instead of his or her own grade.

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TransCanada's history of catastrophic ruptures

Pipeline rupture data produced by the National Energy Board shows that TransCanada has the worst safety record in Canada, with 17 full bore ruptures since 1992.² TransCanada's most recent history is even worse, with eight ruptures in the last six years, and four ruptures in the last 22 months. TransCanada's rupture rate has gone from bad to worse.

When TransCanada's actual rupture history in Canada is used to calculate the likelihood of Energy East failing, the result is a 15 per cent chance of rupture per year.

Formula: Rupture probability = (number of ruptures / total length of pipelines) / number of years X pipeline length X 100%

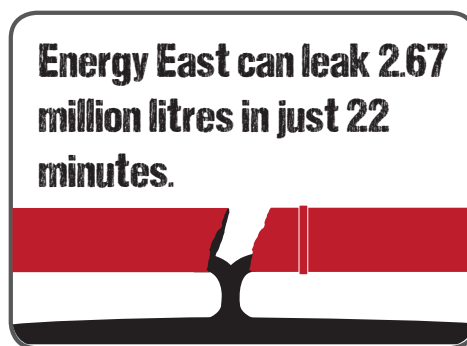
To arrive at this result, the number of ruptures (8)³ is divided by the number of kilometres of pipeline TransCanada operates in Canada (39,880km).⁴ Divide this by the number of years in the period examined (the last 6 years, 2009-2015)⁵ to calculate the rupture rate per kilometre, per year. Multiply this by the number of kilometres of Energy East (4,600 kms) to calculate the likelihood of a rupture per year somewhere along the pipeline.

The final result is 0.1537, which means there is a 15 per cent chance of a rupture per year. Over the 40-year projected lifespan of the project, this equates to six major ruptures. TransCanada's rupture rate has been increasing for more than a decade. If a period shorter than six years is considered, the likelihood of a rupture increases.

Difficulty of detecting leaks and ruptures

TransCanada can only detect leaks that are greater than 1.5 per cent of pipeline capacity⁶ because their “state of the art” monitoring system is actually less accurate than the average bathroom scale.⁷ A leak of 1.5 per cent would release up to 2.62 million litres⁸ of crude oil per day. In 48 hours this could cause the worst oil spill in Canadian history – and TransCanada would still not have any idea that there was a problem.⁹

TransCanada says it can detect a rupture and stop pumping oil within 22 minutes.¹⁰ The most crude oil that can escape from a ruptured Energy East pipeline in 22 minutes would be 2.67 million litres.¹¹ Adding to this is “draindown,” which is the volume of oil between the nearest valves that is released after the pumping is stopped as gravity pulls oil out of the pipe from higher elevations than the rupture. The amount released is influenced by local topography, the pipeline’s diameter, pressure, valve location and response time.¹² Currently, valves along the pipeline are approximately 30 kilometres apart, which means that a maximum additional 27 million litres¹³ of crude oil could spill, for a total of just under 30 million litres.



Challenges of diluted bitumen

The Energy East pipeline would ship diluted bitumen produced in the tar sands. Diluted bitumen, also known as dilbit, is created by diluting thick bitumen with various toxic and explosive chemicals to make it thin enough to transport.

In July 2010, an Enbridge pipeline ruptured in Michigan, spilling 3.2 million litres¹⁴ of diluted bitumen into the Kalamazoo River. Unlike conventional crude, which floats on water, the diluents evaporated and the bitumen sank to the riverbed, making cleanup efforts far more difficult.¹⁵ Five years and \$1.2 billion USD later, there is still submerged bitumen at the bottom of the river.

A recent draft document produced by the federal government found that very little information is available on the physical and chemical characteristics of tar sands-related products following a spill into water. The document noted that research on the biological effects of tar sands-related products on aquatic organisms is lacking, and that a better understanding of the fate and behaviour of these products is critical for assessing the potential risk to aquatic organisms.¹⁶

Potential causes of catastrophic pipeline failure

In 1990, a massive landslide on the Nipigon River exposed a section of a buried TransCanada natural gas pipeline.¹⁷ This pipeline is part of the same Mainline system that would, in part, be converted for Energy East. The landslide left more than 70 metres of the pipeline exposed and hanging, unsupported. If the pipe had been filled with oil, it would have been far heavier and much more likely to rupture.

In 1995 in Rapid City, Manitoba, one of TransCanada’s natural gas Mainlines (100-4) ruptured and exploded, causing damage to an adjacent line (100-3).¹⁸ For much of the planned route of Energy East, the converted gas pipeline will run within metres of other pipelines carrying natural gas. Nearly half of the ruptures on the Mainline were a result of stress corrosion and cracking, external corrosion, and coating and welding failures. This raises clear concerns about the design, construction and maintenance of these pipelines.

TransCanada whistleblowers

In recent years, two former TransCanada employees have come forward publicly as whistleblowers, warning of a culture at TransCanada that is inconsistent with pipeline safety best practices and regulation. Evan Vokes, a former TransCanada engineer, raised specific concerns that resulted in a National Energy Board (NEB) audit that found TransCanada non-compliant in a number of key safety areas.¹⁹ Since then, another whistleblower has come forward alleging natural gas safety code violations, including faulty or delayed repairs, sloppy welding work and a failure to report key issues to the NEB.²⁰ In April 2013, a mandatory inspection on TransCanada's Keystone 1 pipeline found a section of the pipeline's wall had corroded 95 per cent, leaving it "paper-thin" and forcing the company to immediately shut it down.²¹ It had been less than two years since that pipeline was built.



Evan Vokes, Former materials engineer at TransCanada

Conclusion

TransCanada assures residents along the proposed Energy East pipeline path of their capacity to quickly detect and respond to a pipeline rupture. TransCanada's actual safety track record in Canada indicates that there is a 15 per cent chance of a full bore rupture per year. A spill from the Energy East pipeline could produce the largest oil spill in recent Canadian history – up to 30 million litres of diluted bitumen – in a worst case scenario. A leak of up to 2.6 million litres per day could go undetected by TransCanada. As shown by a spill in northern Alberta in July 2015, where a Nexen pipeline ruptured and dumped an estimated 5 million litres of bitumen, sand and wastewater over a 16,000-square-metre area, massive leaks can – and do – go undetected causing immense and sometimes irreparable environmental damage. Increasing this risk is a decision that all Canadians have a right to participate in – and saying "no" must be an option.

Endnotes

1. https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2543068/ESA_V6_S2_IncidentFreqVol_-_A4E1F3.pdf?nodeid=2543678&vernum=-2
2. Note: This rupture total includes Nova Gas Transmission Ltd., which is a wholly owned subsidiary of TransCanada. <http://www.neb-one.gc.ca/sftnvrnmnt/sft/pplnrptr/index-eng.html>
3. <http://www.neb-one.gc.ca/sftnvrnmnt/sft/pplnrptr/index-eng.html>
4. Note: Adding together the total km of the NGTL System, Canadian Mainline, and Foothills System located in Canada. <http://www.transcanada.com/natural-gas-pipelines.html>
5. A period of six years was chosen for this report because that is the time period when TransCanada had a fixed amount of pipelines.
6. <http://www.ledevoir.com/environnement/actualites-sur-l-environnement/430234/energie-est-une-premiere-etude-independante-montre-des-faillles-de-securite>.
7. <http://www.biomedcentral.com/1471-2458/13/1194>
8. Capacity of 174,886,030 litres times 1.5% = 2.623 million litres. Also reported here: <http://www.ledevoir.com/environnement/actualites-sur-l-environnement/430234/energie-est-une-premiere-etude-independante-montre-des-faillles-de-securite>
9. <http://www.cbc.ca/news2/interactives/pipeline-incidents/>
10. Ontario Energy Board, TransCanada Pipelines Limited Energy East Pipeline Project: Assessment of Impacts on Pipeline Safety, March 2015.
11. Pipeline capacity of 1.1 million barrels per day converts to 174,886,030 litres, divided by 1,440 minutes in a day, multiplied by 22 minutes equals 2,671,870 litres.
12. https://books.google.ca/books?id=BriOO0E667AC&pg=PA382&lpg=PA382&dq=pipeline+draindown+after+rupture&source=bl&ots=lleb5beo_h&sig=yRX0O5LRMqODD2hcvlxmeHtDFm8&hl=en&sa=X&ved=0CDoQ6AEwBGoVChMIw7QzKXgxglVgdQeCh0xWwrl#v=onepage&q=pipeline%20draindown%20after%20rupture&f=false
13. The pipeline would contain approximately 900 L of crude per linear metre. 900L X 30,000 metres =27 million.
14. <http://www.epa.gov/Region5/enbridgespill/>
15. <http://www.desmogblog.com/2015/03/19/science-vs-spin-dilbit-sinks-real-world-not-studies-funded-oil-industry>
16. <http://www.cbc.ca/news/technology/bitumen-spill-effects-on-waterways-oceans-unknown-draft-federal-report-says-1.2940083>
17. <http://scholarsmine.mst.edu/cgi/viewcontent.cgi?article=2137&context=icchg>
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20. <http://ca.reuters.com/article/domesticNews/idCAKBN0ME2MS20150318>
21. <http://www.desmogblog.com/2015/04/30/exclusive-transcanada-keystone-1-pipeline-suffered-major-corrosion-only-two-years-operation-95-worn-one-section>

