COMMENTS OF JIM LONG IN OPPOSITION TO SPECIAL EXCEPTION #1378

Charles County Board of Appeals
c/o Carrol Everett
200 Baltimore St
La Plata MD 20640

September 19, 2017
via email: EverettC@charlescountymd.gov

Re: Docket #1378, Charles Station Compressor application for Special Exception

Dear members of the Board of Appeals:

Here I raise a number of issues that could justify denying the special exception (SE) as the Board strives to meet its legal obligation to protect the public's health, safety, and welfare, and to judge the compatibility of the compressor station with the surrounding area. At a minimum, the board should require significant additional information important to making an informed decision.

1. The probability of a significant fire or explosion is unknown. A Quantitative Risk Assessment should be required before making a decision.

Gas-compressor stations catch fire or explode with some regularity. Therefore, it is fundamental to know the probability of a significant fire or explosion and the consequences. A Quantitative Risk Assessment (QRA) would provide such information.

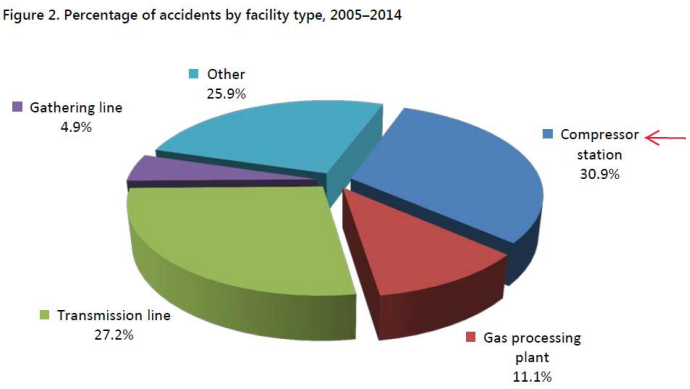

Figure 1 A figure taken from page 3 of the Canadian report cited in the text, showing compressor stations are the largest source of accidents among types of fossil-fuel pipeline facilities.

Evidently, U.S. regulatory agencies provide no comprehensive data on compressor accidents to the public. Canada does somewhat better. Figure 1 is copied from a report (appended) by the Transportation Safety Board of Canada showing that in the decade preceding 2014, of all pipeline facility types in Canada, *compressor stations were the single largest source of accidents*.[1]

I have counted news reports of fires and explosions at compressor stations in Pennsylvania (list appended). In the last five years alone, there were ten such events. This represents a lower limit as these are only the events large enough for me to find reported online. *Note that some or all of these compressors would have been approved as safe under FERC regulations*.

In a previous special exception where the board approved a "metering and regulation" station for the pipeline carrying gas from this same Dominion pipeline to the Keys power plant in

[1] Statistical Summary Pipeline Occurrences 2014, Transportation Safety Board of Canada (30 June 2015). http://www.tsb.gc.ca/eng/stats/pipeline/2014/ssep-sspo-2014.pdf

Brandywine, the applicant suggested that FERC only considers Quantitative Risk Assessments for LNG facilities. However, in 2015 Dominion produced a QRA for a smaller compressor station in Horseheads, NY (11,000 horsepower, about half that of Charles Station), albeit only to treat the cancer risk from emissions.[2] Note that in June, 2017, both U.S. Senators from Massachusetts called for a comprehensive risk assessment of a 7,700-horsepower compressor station proposed for Weymouth, MA.[3] Outside the U.S., QRAs specifically for compressor stations often appear, and appropriate software even exists.[4]

2. The board should inquire into the safety of ammonia trucked to and stored on site.

At the July 11 BOA hearing, a witness for Dominion touted the Selected Catalytic Reduction (SCR) system that would be used to reduce emissions of NOx, an ozone producing pollutant. Left unsaid was that the SCR process requires use of ammonia. FERC's draft Environmental Assessment (EA) states that emission of "ammonia slip" to the air would be 12.4 tons per year. (Dominion's application to MDE for an Air Quality Permit states that the resulting atmospheric concentration of ammonia meets state standards.)

Safety concerns for an accidental release from the large amount of ammonia stored on-site have not been addressed. FERC's draft Environmental Assessment (EA) states that 13,000 gallons of aqueous ammonia will be stored on site.[5] The concentrations and amounts of ammonia appear to be carefully calibrated to fall just under the thresholds that would trigger a Risk Management Plan (RMP) under the Code of Federal Regulations [40 CFR Part 68]. The on-site concentration of ammonia is 19% according to the MDE Air Quality Permit, just under the 20% trigger in the federal code. My calculations find that of the weight of ammonia in 13,000 gallons of 19% solution is ~19,100 pounds, just under the 20,000 pound trigger a RMP for a 20% or higher solution.

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[2] *New Market Project, Environmental Assessment*, FERC (October, 2015), Appendix B: Human Health Risk Assessment: https://www.dominionenergy.com/about-us/news-center/natural-gas-projects-and-initiatives/library/84b7814ab50745abbb008f99438d0a4b.ashx

[3] *Risk assessment requested for Weymouth compressor station site*, news article in the Weymouth WickedLocal: http://weymouth.wickedlocal.com/news/20170626/risk-assessment-requested-for-weymouth-compressor-station-site

[4] Aspects of a Quantitative Risk Assessments for compressor stations are contained in the following sources:

-*Risk Evaluation at Natural Gas Compressor Stations and Above Ground Installations*, a conference article by a group of authors from England, R.P. Cleaver et al., presented at the 9th International Pipeline Conference, American Soc. of Mechanical Engrs (2012): http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleid=1721599

-*Development of "AGI Safe,"* a QRA report for a compressor station in England: http://www.smarternetworks.org/NIA_PEA_Docs/NIA_NGGT0023_AGI_Safe_Final_Report_2016_vFinal1_pd_160722092135.pdf

-*The Role of Quantitative Risk Assessment in Improving Hazardous Installations Siting: A Case Study*, N. Badri et al., Iran J. Chem. Engr, volume 30, p. 113 (2011): http://www.ijcce.ac.ir/article_6122_7d63d86fa38aed46ffc9b8377cf0f86d.pdf

-Training for conducting a QRA, France: https://www.slideshare.net/hbaron/quantitative-risk-assessment-qra

[5] Relevant section of the EA is appended.

Since the quantity of ammonia on-site borders the amount that would trigger a Risk Management Plan, the Board might wish to inquire into the hazards associated with the use of ammonia, such spillage or leaks; the possibility of a tank rupture during an explosion; and the frequency of deliveries.

Also note that even with the use of Selected Catalytic Reduction, the plant would emit NO_2 to within 6% of the regulated maximum for the one-hour average concentration, according the EA[6] (177.5 $\mu g/m^3$ compared to the allowed value of 188 $\mu g/m^3$.)

3. **The board should review an emergency access plan to deal with road flooding and windfalls before making a decision.**

While flooding of Barry's Hill Rd was raised with FERC during the scoping process for its Environmental Assessment (EA), *FERC ignored the issue.* The possibility of a delayed emergency response amplifies the accident concerns raised above. Note that a large storm that would cause flooding also has a likelihood of blowing trees down that could block access from the unflooded direction as well.

To its credit, planning staff did not ignore flooding on Barry's Hill Rd in its staff report. However, the report recommends that this board cede full responsibility to staff for an "emergency access plan." The county Zoning Ordinance makes this untenable because the board *itself* must determine if the special exception "*will* not be detrimental to…safety." The board must wait for the plan before it can judge this special exception.

4. The board should clarify the frequency and mix of "silent" and "non-silent" blowdowns, the associated blowdown noise, and the effects of start-ups and shutdowns.

Below are excerpts from the record that are confusing as to the frequency of polluting and potentially noisy blowdowns, when gas is rapidly vented for maintenance and for regular testing of emergency procedures (Fig. 2). Given the stated frequency of start-ups/shutdowns (~100 per year, see below), during which a blowdown may occur, the board may want to clarify the effects of start-ups and shutdowns, and the frequency of "unsilenced," i.e. very noisy, blowdowns. I could find no description of the noise expected from an unsilenced blowdown in the Environmental Assessment (EA).

Figure 2 Example of a blowdown in Oregon, from https://www.youtube.com/watch?v=WtSH5V1YQvQ YouTube has numerous examples. Plume visibility is due to condensation caused by the rapid expansion of the pressurized methane.

[6] Computed stack emissions are found in Table B.8.1-5, p. 57, of the Environmental Assessment.

The EA, p. 55, describes blowdowns (I have added highlights and some comments in square brackets):[7]

> "Emissions would occur as a result of natural gas venting, or blowdowns. A blowdown event is the process of releasing natural gas from a pressurized system into the atmosphere. The primary pollutant emitted during a blowdown is methane, a GHG [greenhouse gas], but other natural gas constituents, including ethane, propane, butane, pentane, and hexane, are also emitted. At compressor station facilities, blowdowns typically occur during start-up/shutdown, for maintenance activities and, rarely, during emergencies. … Unit blowdowns would occur several times per year, but depends on the unit's usage and maintenance requirements. Blowdowns typically last about 5 minutes [seems to contradict 10-minute duration for shutdowns given by the compressor manufacturer below]. Landowners would be notified 1 to 2 days prior to planned blowdowns." [The previous three sentences suggest non-silenced blowdowns may occur several times/year.]

Dominion's application to FERC for a Certificate of Public Convenience and Necessity (CPCN), states that there would a large number of start-ups and showdowns (highlights added): [8]

> "The start-up process for the Solar Mars 90 and Taurus 70 turbines takes approximately 10 minutes from the initiation of start-up to normal operation (equal to or greater than 50% load). Shutdown takes approximately 10 minutes. Dominion has estimated there would be 100 start-up/shutdown events per year."

The EA acknowledges complaints from the public about blowdown noise at the Loudon County compressor. From the EA, p. 65 (highlights added):

> "In addition to normal operational noise, there may also be sources of noise due to maintenance or emergency operation. Specifically, emergencies and maintenance activities involve blow downs (depressurizing/emptying station equipment to remove natural gas). Annual testing of the emergency shutdown system would be required and may include unsilenced blowdowns. DCP stated that it would provide advanced notice prior to blowdown events. Advanced notice would not occur during an emergency, which is rare. Silenced blowdown events for scheduled maintenance of the compressor station equipment occur more frequently, typically several times per year. DCP's blowdown silencers at the Charles Station and Loudoun Compressor Station would reduce the gas velocity of the exiting gas and muffle the resulting noise to 60 dBA at 50 feet."

> "We received comments from Loudoun County's Department of Planning and Zoning regarding blowdown noise levels at the Loudoun Compressor Station. The county indicated that it receives calls and complaints regarding blowdown noise and provided recommendations to address these concerns."

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[7] Eastern Market Access Project, Environmental Assessment, p. 55.
[8] Abbreviated Application for a Certificate of Public Convenience and Necessity, Eastern Market Access Project (November 15, 2016). p. 2-4.

5. **This industrial use is not compatible with the vicinal Piscataway National Park and other land with conservation easements.**

Figure 3 shows that the compressor station site (white outline) is surrounded by preserved land, including Piscataway National Park. Privately owned land over which the National Park Service holds easements (pink) extends to Barry's Hill Road itself across the street from the proposed compressor property. In addition, the National Potomac Heritage Trail's bicycle route uses Barry's Hill Rd.

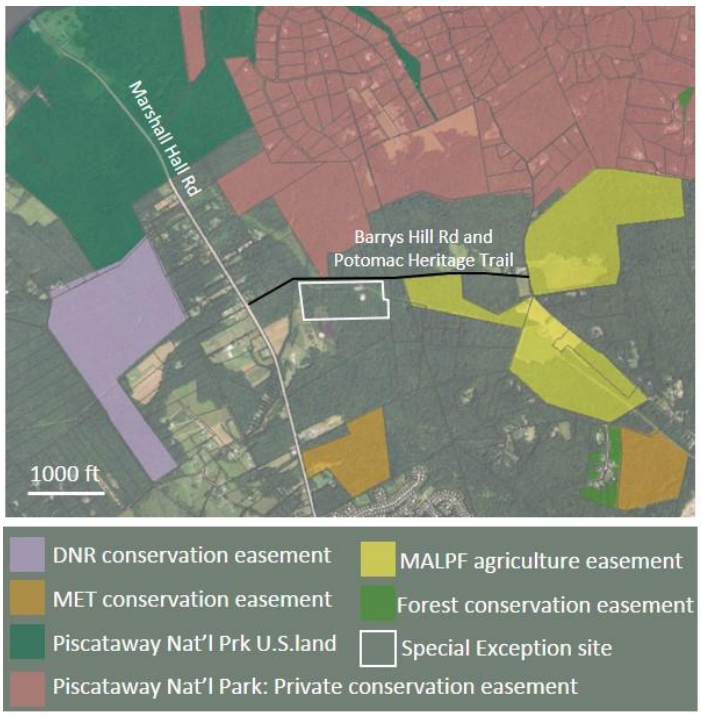

Figure 3 Preserved land around the 50-acre compressor station parcel, which is outlined by the white boundary.

An industrial complex of this magnitude is simply not compatible with the present and future surrounding land use, as is required for a special exception. The plant would introduce several buildings, two 50-foot stacks, and at least one large storage tank (for ammonia). It would be necessarily lit for security purposes. It would draw maintenance trucks and be regularly serviced by delivery trucks bringing aqueous ammonia and no doubt other supplies. And it would regularly subject the surrounding area to loud blowdowns.

Furthermore, if the SE is approved, requests for additional compressor capacity in the future are very possible because the Dominion LNG pipeline is instigating an increasing amount of gas infrastructure in southern Maryland. This includes three new gas-fired power plants in Prince George's and Charles Counties: the CPV plant in St. Charles, the Keys plant under construction in Brandywine, and the Mattawoman Energy plant proposed for Brandywine. *Supplying gas to the Mattawoman Energy plant is cited as one of reasons for the subject compressor station*. Note that there is no excess capacity designed into the compressor station. And in the last two years alone, this board has considered two other special exceptions for "metering and regulating" facilities on two different pipelines proposed to carry gas from the Dominion pipeline to Keys and Mattawoman Energy.

Once the camel's nose is under the tent with a Charles Station, it would be natural for Dominion to consider this site for any added capacity, further industrializing what is supposed to be a conservation area.

Finally, a number of actions recommended above would require time before the Board could review the results, e.g., of a Quantitative Risk Assessment and Emergency Access Plan. At a previous hearing, Dominion objected to any delay, citing WGL's need to acquire gas to supply customers. However, the gradual rate of increase in WGL gas deliveries, which I extracted from WGL annual reports[9] and plotted in Fig. 4, suggests it is unlikely WGL would run out of capacity in a time frame needed to review the effects of Charles Station on the public's health and safety.

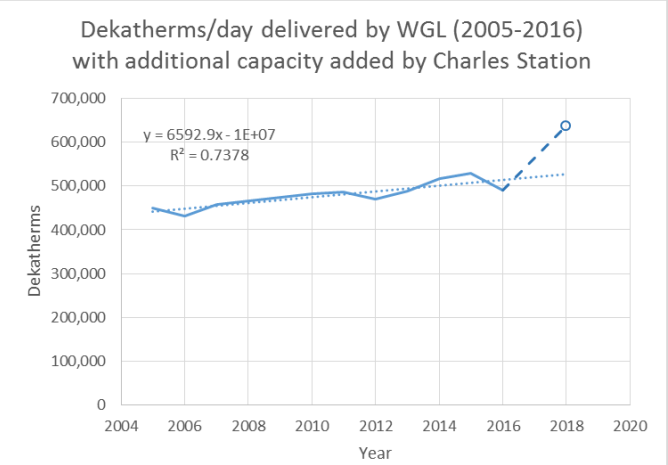

Figure 4 History of the amount of gas delivered by WGL. The additional capacity provided by Charles Station is plotted as an open circle. The trend obtained by extrapolation of a linear fit from 2005-2016 is shown as a dotted line.

Sincerely,
Jim Long
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Accokeek MD 20607

[9] http://www.annualreports.com/HostedData/AnnualReportArchive/w/NYSE_WGL_2014.pdf; https://www.washingtongas.com/-/media/767ab8858c0646519a012a631c52e252.pdf; http://files.shareholder.com/downloads/WGL-II/0x0x924442/15D97E63-0B8D-4587-835C-4133FFDB0303/WGL2016AR.pdf

List of new reports of compressor fires or explosions in Pennsylvania.

Date	Name	Description	Source
11/3/11	Artemas '11	Midnight Pennsylvania Explosion Fuels New Marcellus Gas Safety Concerns; Artemas PA	Google search
2/4/12	Mercer Co	Fire destroys Mercer County compressor station housing; electrical fire started it	Google search
3/29/12	Lathrop	From YouTube: Williams Lathrop Compressor Station in Springville, Pa., Susquehanna County. Explosion before noon, 3-29-12, shook nearby homes, and fire and black smoke billowing out for two hours… Confirmed by news reports e.g.http://wnep.com/2012/03/29/possible-explosion-at-pipeline/	Google search
3/20/13	Bradford Co	Gas Compressor Station Fire Injures Worker in Bradford County March 20, 2013: Yet another compressor station fire in Pennsylvania injured a worker last night in Bradford County. The fire chief on the scene reported the burns as "not serious." …The fire, burns, and unknown air emissions in Bradford County last night occurred just ten days before the one-year anniversary of the Lathrop compressor station explosion and fire, which emitted a loud "boom" and caused houses to shake on March 29th, 2012 in Susquehanna County.	Google search
5/15/13	Susquehanna Co '13	May 15, 2013 - A fire and possible explosion, at a Susquehanna County gas compressor station. [72]	Wikipedia
8/7/14	Artemas '14	Gas explosion, fire forces evacuations, Steve Bittner/Times-News, Cumberland Times-News, Aug 7, 2014 Artemas, PA	Google search
12/1/14	Susquehanna Co '14	December 1, 2014 - A gauge leaking methane most likely caused an explosion and fire, in a Susquehanna County natural gas compressor station. [78]	Wikipedia
8/9/15	Eagle Station	On August 9, 2015, at 10:19 p.m. EST, the compression units at Eagle Compressor Station in Chester Springs, PA, shut down due to an emergency shutdown device (ESD) signal triggered by the Fire Detection/Melt-out sensors over Unit 3. At the time of the ESD, all four units at the station were running. Gas Control called the station operator, who observed a fire in the compressor building after arriving at the station. Line 1804's blowdown stack was releasing material into the atmosphere and its suction header fire valve (L-7210) was not fully closed, allowing material to continue to flow to the station and out the blowdown stack.	Google search
12/13/16	Wharton	December 13, 2016 - Fire at a natural gas compressor station, located outside the village of Wharton Township, Potter County, Pennsylvania. [79]	Wikipedia
12/25/16	Armstrong Co	December 25, 2016 - A fire broke out at a gas compressor station, in Armstrong County. [80]	Wikipedia
3/9/17	Brooklyn	March 9, 2017 - A fire at a Susquehanna County gas compressor station. [82]: Brooklyn Township, Susquehanna County (WBRE/WYOU) - First responders were called out to a fire at a natural gas compressor station Thursday morning. The fire was reported at the station near Brooklyn Twp, Susquehanna County about 10:15 a.m.	Wikipedia

Links to the above accident news reports.

Date	Name	Link, other
11/3/11	Artemas '11	http://breakingenergy.com/2011/11/03/midnight-pennsylvania-explosion-fuels-new-marcellus-gas-safety-c/
2/4/12	Mercer Co	http://triblive.com/x/pittsburghtrib/news/regional/s_779962.html
3/29/12	Lathrop	http://wnep.com/2012/03/29/possible-explosion-at-pipeline/; https://www.youtube.com/watch?v=f4BRcCLKZ44
3/20/13	Bradford Co	https://protectingourwaters.wordpress.com/2013/03/20/breaking-gas-compression-station-fire-injures-worker-in-bradford-county/
5/15/13	Susquehanna Co '13	http://thetimes-tribune.com/news/fire-possible-explosion-at-susquehanna-gas-compressor-station-thought-to-be-accidental-1.1489789
8/7/14	Artemas '14	http://www.times-news.com/gas-explosion-fire-forces-evacuations/image_1e655f09-309c-5256-9acd-59be4a37ca1f.html
12/1/14	Susquehanna Co '14	http://thetimes-tribune.com/news/fire-broke-out-in-natural-gas-compressor-station-last-week-1.1800355
8/9/15	Eagle Station	https://www.phmsa.dot.gov/staticfiles/PHMSA/PipelineFailureReports/Columbia_Gas_Transmission_Eagle_Compressor_Station_Engine_Fire_2015_08_09.pdf
12/13/16	Wharton	http://www.bradfordera.com/news/compressor-fire-reported-at-williams-gas-co-in-wharton/article_9ff56ccc-c0e2-11e6-ba04-9fd31099ed06.html
12/25/16	Armstrong Co	Explosion according to : http://www.kittanningpaper.com/2016/12/27/back-up-gas-compressor-explodes-in-rose-valley/66417
3/9/17	Brooklyn	http://www.pahomepage.com/news/crews-respond-to-fire-at-susquehanna-county-compressor-station/669310226

Aqueous ammonia to be stored on site is described in this section on page 53 from the Environmental Assessment for Charles Station:

Risk Management Plan Rule

The EPA has established accidental release prevention and risk management plan (RMP) requirements as part of 40 CFR Part 68, *Chemical Accident Prevention Provisions*, implementing section 112(r) of the CAA. The Risk Management Program is about reducing chemical risk at the local level. The RMP information helps local fire, police, and emergency response personnel (who must prepare for and respond to chemical accidents), and is useful to citizens in understanding the chemical hazards in communities (EPA, 2009).

Part 68 lists regulated flammable and toxic substances and their "thresholds quantities" for determining the applicability. If a regulated substance is handled, stored, or processed in volumes greater than threshold quantities at a stationary source, then an RMP must be prepared (and revised/resubmitted every 5 years).

DCP would install an aqueous ammonia-based selective catalytic reduction (SCR) system to control NO_x emissions for the proposed turbines at the Charles Station. Ammonia is a regulated substance under the RMP Rule. Aqueous ammonia with a concentration of 20 percent or greater may be subject to Part 68 if 20,000 pounds or more is stored onsite. We received a comment regarding the amount of ammonia that would be stored onsite at the Charles Station. DCP's air permit application states that a 13,000-gallon aqueous ammonia storage tank would be stored onsite (about 108,000 pounds). However, the SCR system proposed for the Charles Station would have a concentration less than 20 percent and would not be subject to 40 CFR 68. Based on manufacturer data, the SCR system at the Charles Station would result in ammonia slip emissions of 12.4 tpy.

http://www.tsb.gc.ca/eng/stats/pipeline/2014/ssep-sspo-2014.pdf

See page 3 for a pie chart reporting that compressor stations are the single greatest source of accidents.

STATISTICAL SUMMARY

PIPELINE OCCURRENCES 2014

30 June 2015

Canada

Statistical Summary – Pipeline Occurrences 2014 (Transportation Safety Board of Canada)
Catalogue No. TU1-11E-PDF
ISSN 1701-6606
This document is available on the website of the Transportation Safety Board of Canada at http://www.tsb.gc.ca
This document is available in alternative formats upon request.

Foreword

This document provides Canadians with an annual summary of selected pipeline safety data. It covers federally regulated pipelines only. Non-federally regulated data reported to the Transportation Safety Board of Canada (TSB) are not included in this report. The TSB gathers and uses this data during the course of our investigations to analyse safety deficiencies and identify risks in the Canadian transportation system.

On 12 March 2014, the TSB issued new regulations that changed the reporting requirements effective 01 July 2014. These changes are reflected in the 2014 Statistical Summary.

Users of these statistics are advised that, in a live database, the occurrence data are constantly being updated. Consequently, the statistics may change slightly over time. Further, as many occurrences are not formally investigated, information recorded on some occurrences may not have been verified. The 2014 statistics presented here reflect the TSB database updated as of 13 February 2015.

The TSB is an independent agency operating under its own Act of Parliament. Its sole aim is the advancement of transportation safety.

Comments on this document can be forwarded to the following address:

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Telephone: 819-994-3741
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Statistical Summary – Pipeline Occurrences 2014

Pipeline system

In 2014, in the federally-regulated pipeline system, 37 companies, including 11 that transport both oil and gas, transported 216 million cubic metres (m^3) of oil (1.4 billion barrels) along 21 636 kilometres of oil pipelines. Sixty-seven companies, including the 11 that transport both oil and gas, transported 152 billion cubic metres of natural gas (5.4 trillion cubic feet) along 55 982 kilometres of natural gas pipelines.[1]

Accidents

Overview of accidents and casualties

Five pipeline accidents[2] (Table 1) were reported to the TSB in 2014, down from a total of 11 in 2013 and down from the annual average of 10 in the previous 5 year period (2009–2013).

Pipeline activity increased 6% from 2013[3]. An indicator of pipeline transportation safety in Canada is the pipeline accident rate. The 2014 rate (Table 2) was 0.3 pipeline accidents per exajoule[4], down from 0.8 in 2013, and down from the annual average of 0.8 in 2009–2013 (Figure 1).

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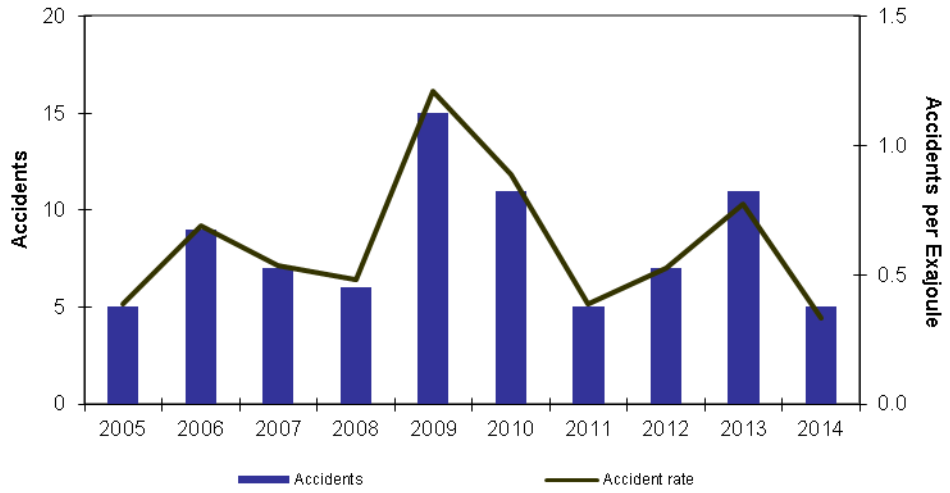
1 The size of the federally regulated pipeline system, the number of companies, and the volumes of product transported were provided by the National Energy Board (NEB).

2 Refer to Appendix B for the definition of pipeline accidents.

3 Pipeline activity is provided by the National Energy Board (NEB).

4 One exajoule = 10^{18} joules (A joule is a unit of work or energy equal to the work done by a force of one newton acting through a distance of one metre.)

Figure 1. Number of accidents and accident rate[5] (accidents per exajoule[6])



Location of accidents

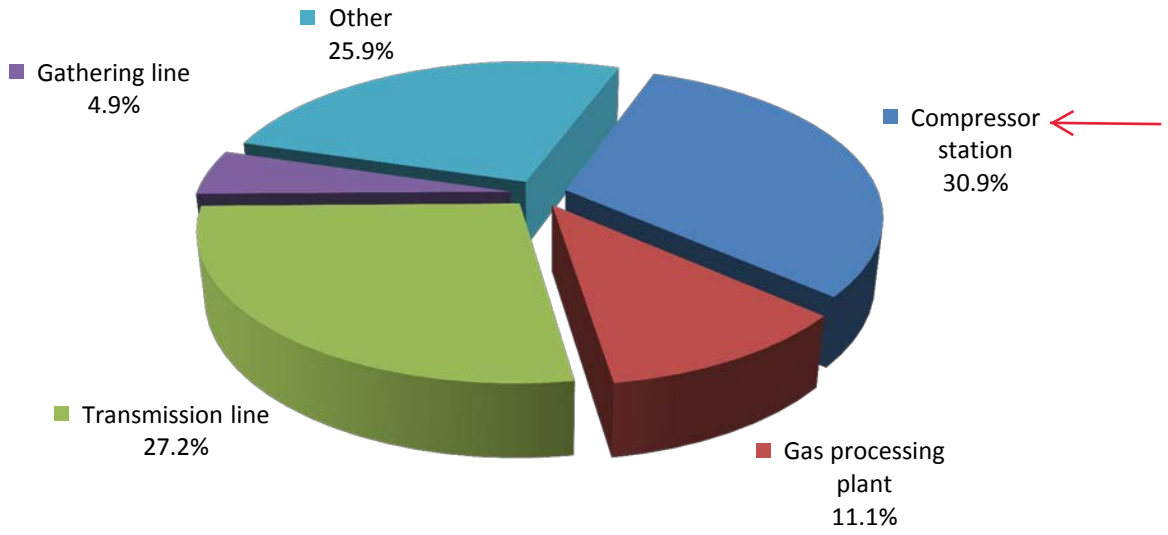
Over the past 10 years (2005–2014), 42% of pipeline accidents (Table 4) occurred at compressor stations and gas processing plants, and 27% occurred on transmission lines (Figure 2). The remaining pipeline accidents (31%) occurred at pump stations, terminals, meter stations, and on gathering lines.

In 2014, 2 pipeline accidents involved line pipe and 3 pipeline accidents occurred at facilities (2 at compressor stations and 1 at a transmission line remote valve site).

5 In 2009, there was a 38% increase in the size of the federally regulated pipeline system when an additional 23 705 kilometres of pipeline and associated facilities were transferred from provincial jurisdiction.

6 Source: NEB (estimated).

Figure 2. Percentage of accidents by facility type, 2005–2014



Fatalities

The last fatal accident on a federally-regulated pipeline system occurred in 1988.

Release of product

In 2014, two accidents with release of product occurred. Both resulted in the release of over 1 000 cubic metres of natural gas. Over the past 10 years (2005-2014), 44 of the 81 accidents (Tables 5 & 6) resulted in a release of product. Natural gas was released in 21 accidents, with 7 releases of less than 1 cubic metre, 2 releases between 1 and 25 cubic metres, 2 releases between 25 and 1 000 cubic metres, and 10 releases over 1 000 cubic metres. Crude oil was released in 14 accidents, with 8 releases of less than 1 cubic metre (6.29 barrels (bbl)), 2 releases between 1 and 25 cubic metres (between 6.29 barrels and 157 bbl), 3 releases between 25 and 1 000 cubic metres (between 157 and 6 290 bbl), and 1 release over 1 000 cubic metres (6 290 bbl).

Incidents[7]

In 2014, 133 pipeline incidents[8] (Table 1, Figure 3) were reported to the TSB, up from 118 in 2013 but down from the annual average of 144 in the previous 5 years (2009-2013). With the new TSB Regulations in effect starting 01 July 2014, there was a decrease in the number of incidents involving releases of low vapour pressure hydrocarbons in the last 6 months of the year. As the new TSB Regulations introduced the definition of "safety zone" (see Appendix B) to include 30

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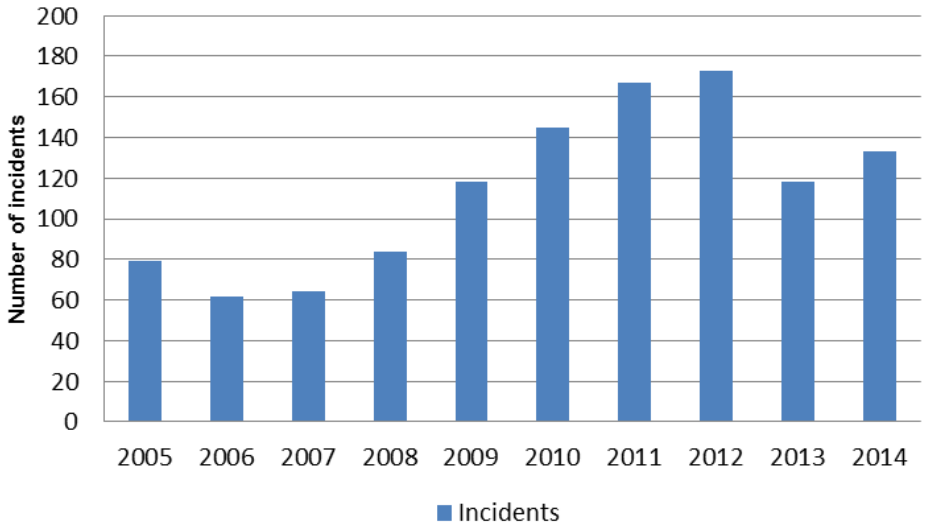
7 New TSB regulations came into effect on 01 July 2014. Under the new reporting requirements, unintended or uncontained releases of low vapour pressure hydrocarbons from pipelines are only reportable if they are in excess of 1.5 m^3 in volume.

8 Refer to Appendix B for the definition of pipeline incidents.

metres to each side of a pipeline, there was an increase in the number of incidents involving disturbance of supporting environment /no release in the last 6 months of the year.

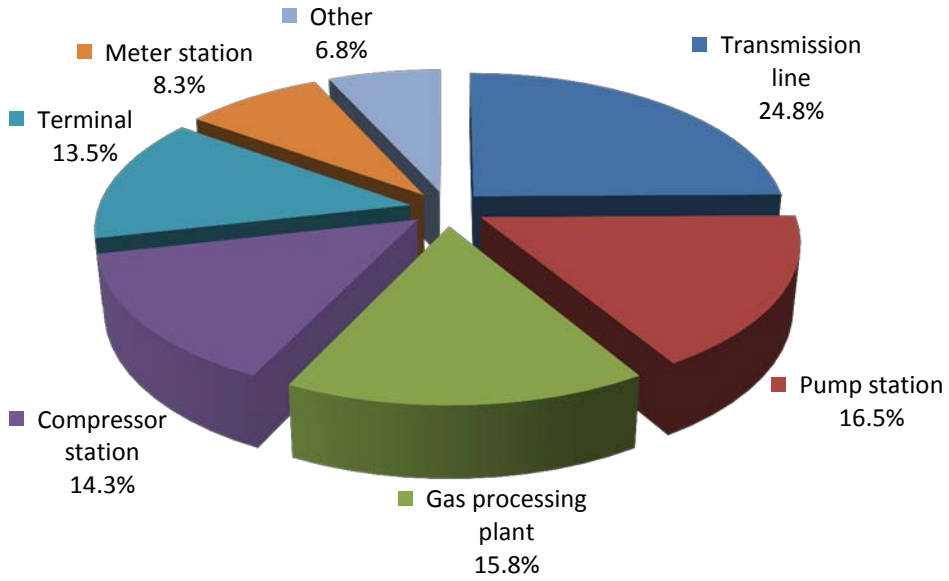
Figure 3. Number of pipeline incidents, 2005–2014



Location of incidents

In 2014, 25% of pipeline incidents (Table 4) occurred on transmission lines, followed by 17% at pump stations, 16% at gas processing plants, 14% at compressor stations, 14% at terminals, and 8% at meter stations. The remaining incidents occurred on gathering lines, at an injection/delivery facility, or at other facilities (Figure 4).

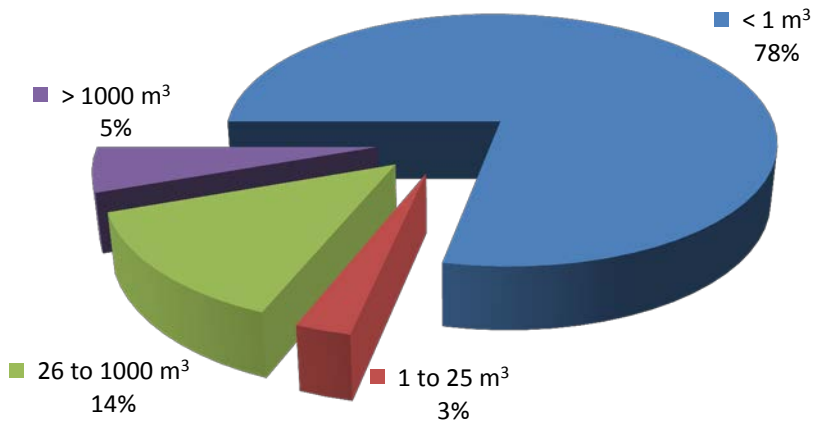
Figure 4. Percentage of incidents by facility type, 2014



Release of product

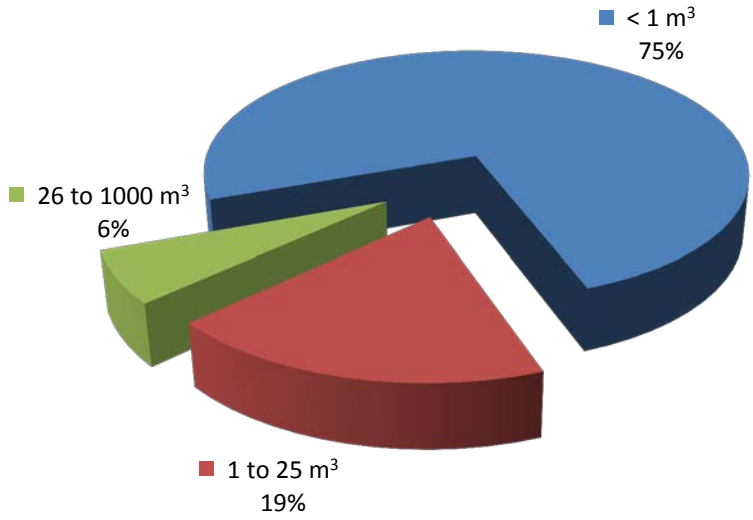
In 2014, 59% of the incidents (Tables 1 and 6) involved a release of less than 1 cubic metre of gas, oil, other petroleum product, or non-petroleum product (e.g., sulphur, ethylene glycol) and 22% of the incidents involved no release of product. Six incidents involved a release of 1 to 25 cubic metres (between 6.29 and 157 bbl) of crude oil, and 2 incidents involved a release of 25 to 1 000 cubic metres (between 157 and 6 290 bbl) of crude oil. Five incidents involved a release of 25 to 1 000 cubic metres of natural gas, and one incident involved a release of 25 to 1 000 cubic metres of sour gas. Two incidents involved a release of over 1 000 cubic metres (2 100 m^3 and 160 000 m^3 respectively) of natural gas (Figure 5). One incident involved a release of 63 cubic metres of sulphur.

Figure 5. Percentage of natural gas release incidents by quantity of release, 2014



Natural gas releases of less than 1 cubic metre decreased from 41 in 2013 (41% of all product releases) to 29 in 2014 (28% of all product releases).

Figure 6. Percentage of crude oil release incidents by quantity of release, 2014



Crude oil releases of less than 1 cubic metre (6.29 barrels) decreased from 27 in 2013 (27% of all product releases) to 24 in 2014 (23% of all product releases).

Appendices

Appendix A: Data tables

Table 1

Pipeline accidents and incidents by type
2005-2014

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Accidents	**5**	**9**	**7**	**6**	**15**	**11**	**5**	**7**	**11**	**5**
Total, line pipe	2	1	2	0	6	1	2	1	2	2
3rd party damage with release	1	1	1	0	0	0	0	0	0	0
Disturbance of supporting environment with release	0	0	0	0	0	0	0	0	0	0
Corrosion/Environmental cracking	0	0	0	0	0	0	1	0	0	0
Fire/Ignition/Explosion	1	0	0	0	3	0	1	1	2	1
Other damage with release	0	0	1	0	3	1	0	0	0	1
Total, other facilities (a)	3	8	5	6	9	10	3	6	9	3
3rd party damage	0	1	1	1	1	2	1	1	1	0
Corrosion/Environmental cracking	0	0	0	0	0	0	0	0	0	0
Fire/Ignition/Explosion	3	6	4	4	7	6	2	5	8	3
Other damage with release	0	1	0	1	1	2	0	0	0	0
Accidents with a release of product	**3**	**2**	**3**	**3**	**9**	**8**	**4**	**3**	**7**	**2**
Accidents with casualties	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**
Accidents with environmental damage	**0**	**0**	**1**	**0**	**1**	**0**	**1**	**1**	**0**	**0**
Accidents with a fire	**4**	**5**	**4**	**4**	**11**	**6**	**3**	**6**	**8**	**4**
Accidents with an explosion	**0**	**1**	**0**	**0**	**1**	**0**	**1**	**1**	**0**	**1**
Incidents*	**79**	**62**	**64**	**84**	**118**	**145**	**167**	**173**	**118**	**133**
Total, line pipe	21	11	14	13	20	16	18	18	21	26
3rd party damage no release	0	3	2	3	5	2	1	3	1	3
Disturbance of supporting environment no release	3	0	1	0	1	0	2	2	1	12
Uncontained release	16	5	9	5	9	7	12	12	15	4
Other	2	3	2	5	5	7	3	1	4	7
Total, other facilities	58	51	50	71	98	129	149	155	97	107
3rd party damage no release	0	0	0	2	1	0	0	1	2	4
Uncontained release	54	51	45	61	86	119	124	140	83	97
Other	4	0	5	8	11	10	25	14	12	6
Incidents with a release of product	**72**	**56**	**56**	**69**	**96**	**129**	**147**	**154**	**100**	**104**
Incidents with casualties	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Incidents with environmental damage	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**
Incidents with a fire	**0**	**1**	**1**	**5**	**0**	**1**	**9**	**6**	**1**	**2**
Incidents with an explosion	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**

Data extracted February 13, 2015.

Federally regulated pipeline occurrences.

In 2009, there was a 38% increase in the size of the federally regulated pipeline system when an additional 23 705 kilometres of pipeline and associated facilities were transferred from provincial jurisdiction.

*New TSB regulations came into effect on July 1, 2014. Under the new reporting requirements the minimum reporting threshold for incidents with release has been changed to be the same as NEB regulations which is 1.5 m^3 of low vapour pressure hydrocarbons.

Table 2
Pipeline activity and accident rate
2005-2014

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Accidents	**5**	**9**	**7**	**6**	**15**	**11**	**5**	**7**	**11**	**5**
Natural gas products (exajoules)	6.6	6.6	6.5	6.2	5.9	5.6	5.6	5.3	6.1	5.6
Petrolium products (exajoules)	6.3	6.5	6.6	6.3	6.5	6.8	7.3	8.0	8.1	9.4
Total (exajoules)	12.9	13.1	13.1	12.5	12.4	12.4	12.9	13.3	14.2	15.0
Number of accidents per exajoule	0.39	0.69	0.53	0.48	1.21	0.89	0.39	0.53	0.77	0.33

Data extracted February 13, 2015.

Federally regulated pipeline occurrences.

Source: National Energy Board (estimated).

One exajoule = 10^{18} joules (A joule is a unit of work or energy equal to the work done by a force of one newton acting through a distance of one metre.)

Table 3

Pipeline accidents and incidents by province
2005-2014

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Accidents	**5**	**9**	**7**	**6**	**15**	**11**	**5**	**7**	**11**	**5**
Newfoundland and Labrador	0	0	0	0	0	0	0	0	0	0
Prince Edward Island	0	0	0	0	0	0	0	0	0	0
Nova Scotia	0	0	0	0	0	0	0	0	0	0
New Brunswick	0	0	0	0	0	0	0	0	0	0
Quebec	0	0	0	0	0	0	0	0	0	0
Ontario	1	1	2	1	5	2	2	2	2	0
Manitoba	0	2	1	1	0	1	0	0	0	1
Saskatchewan	1	0	1	0	2	1	1	1	1	0
Alberta	1	1	0	0	4	4	1	2	6	2
British Columbia	2	5	3	4	4	3	0	2	2	1
Yukon	0	0	0	0	0	0	0	0	0	0
Northwest Territories	0	0	0	0	0	0	1	0	0	1
Nunavut	0	0	0	0	0	0	0	0	0	0
Incidents*	**79**	**62**	**64**	**84**	**118**	**145**	**167**	**173**	**118**	**133**
Newfoundland and Labrador	0	0	0	0	0	0	0	0	0	0
Prince Edward Island	0	0	0	0	0	0	0	0	0	0
Nova Scotia	1	1	2	1	0	1	5	2	3	2
New Brunswick	0	0	1	0	5	6	14	19	16	9
Quebec	4	1	3	2	4	2	2	1	1	1
Ontario	7	7	8	17	20	19	22	22	10	20
Manitoba	3	7	4	10	9	14	11	10	12	8
Saskatchewan	23	14	10	17	13	38	35	45	18	17
Alberta	21	11	11	16	36	51	55	45	35	35
British Columbia	16	20	23	19	26	13	11	18	17	41
Yukon	0	0	0	0	0	0	0	0	0	0
Northwest Territories	4	1	2	2	5	1	12	11	6	0
Nunavut	0	0	0	0	0	0	0	0	0	0

Data extracted February 13, 2015.
Federally regulated pipeline occurrences.
*New TSB regulations came into effect on July 1, 2014. Under the new reporting requirements the minimum reporting threshold for incidents with release has been changed to be the same as NEB regulations which is 1.5 m3 of low vapour pressure hydrocarbons.

Table 4

Pipeline accidents and incidents by facility type
2005-2014

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Accidents	**5**	**9**	**7**	**6**	**15**	**11**	**5**	**7**	**11**	**5**
Compressor station	0	4	2	2	3	5	0	3	4	2
Gathering line	0	0	1	0	1	1	0	1	0	0
Injection/Delivery facility	0	0	0	0	0	0	0	0	0	0
Meter station	0	1	0	1	0	1	2	1	0	0
Gas processing plant	1	1	0	2	3	0	0	0	2	0
Pump station	1	1	1	0	1	1	0	2	1	0
Storage facility	0	0	0	0	0	0	0	0	0	0
Terminal	1	1	0	1	0	2	1	0	1	0
Transmission line	2	1	3	0	7	1	2	0	3	3
Other	0	0	0	0	0	0	0	0	0	0
Incidents*	**79**	**62**	**64**	**84**	**118**	**145**	**167**	**173**	**118**	**133**
Compressor station	10	8	8	20	32	26	22	31	15	19
Gathering line	8	5	5	5	9	7	7	8	2	4
Injection/Delivery facility	0	0	0	0	0	1	1	0	1	1
Meter station	1	1	5	2	14	21	20	17	19	11
Gas processing plant	7	9	4	8	8	5	3	6	11	21
Pump station	27	18	15	20	26	30	48	37	19	22
Storage facility	0	0	0	1	0	0	1	1	0	0
Terminal	11	8	11	10	13	21	27	35	19	18
Transmission line	13	12	14	17	16	32	31	33	30	33
Other	2	1	2	1	0	2	7	5	2	4

Data extracted February 13, 2015.
Federally regulated pipeline occurrences.
*New TSB regulations came into effect on July 1, 2014. Under the new reporting requirements the minimum reporting threshold for incidents with release has been changed to be the same as NEB regulations which is 1.5 m3 of low vapour pressure hydrocarbons.

Table 5

Pipeline accidents and incidents with release, by product type
2005-2014

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Accidents	**3**	**2**	**3**	**3**	**9**	**8**	**4**	**3**	**7**	**2**
Condensate	0	0	0	0	0	0	0	0	0	0
Liquified petroleum gas	0	0	0	1	0	0	0	0	0	0
Natural gas	1	1	1	0	5	3	2	2	4	2
Natural gas liquids	0	0	0	0	0	0	0	0	0	0
Petroleum crude oil	1	1	2	1	1	4	2	0	2	0
Refined products	0	0	0	0	1	0	0	0	0	0
Sour gas	0	0	0	0	1	0	0	1	1	0
Well effluent	0	0	0	0	0	0	0	0	0	0
Sour condensate	0	0	0	0	0	0	0	0	0	0
Sour crude oil	0	0	0	0	0	0	0	0	0	0
Acid gas	0	0	0	0	0	0	0	0	0	0
Other	1	0	0	1	1	1	0	0	0	0
Incidents*	**72**	**56**	**56**	**69**	**96**	**129**	**147**	**154**	**100**	**104**
Condensate	0	1	0	1	1	2	0	0	3	4
Liquified petroleum gas	1	1	0	1	1	2	1	1	0	3
Natural gas	16	14	19	26	37	55	59	63	45	37
Natural gas liquids	5	1	0	0	0	0	4	1	5	4
Petroleum crude oil	38	24	24	28	32	54	71	77	31	32
Refined products	1	2	1	1	2	4	0	2	0	0
Sour gas	6	3	6	1	7	2	2	4	2	4
Well effluent	0	0	0	0	0	0	0	0	0	0
Sour condensate	0	0	0	0	0	0	0	0	0	0
Sour crude oil	0	0	0	0	0	0	0	0	1	0
Acid gas	2	0	0	1	0	0	1	0	0	0
Other	3	10	6	10	16	10	9	6	13	20

Data extracted February 13, 2015.

Federally regulated pipeline occurrences.

*New TSB regulations came into effect on July 1, 2014. Under the new reporting requirements the minimum reporting threshold for incidents with release has been changed to be the same as NEB regulations which is 1.5 m3

Table 6

Pipeline accidents and incidents by quantity released
2005-2014

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Accidents	**3**	**2**	**3**	**3**	**9**	**8**	**4**	**3**	**7**	**2**
Less than 1 cubic metre	2	0	0	3	3	8	1	2	5	0
1 to 25 cubic metres	1	1	1	0	1	0	0	0	0	0
26 to 1000 cubic metres	0	1	2	0	0	0	2	0	0	0
Greater than 1000 cubic metres	0	0	0	0	5	0	1	1	2	2
Incidents*	**72**	**56**	**56**	**69**	**96**	**129**	**147**	**154**	**100**	**104**
Less than 1 cubic metre	57	47	45	53	87	119	124	147	89	78
1 to 25 cubic metres	9	4	7	13	5	5	13	4	8	15
26 to 1000 cubic metres	4	5	2	3	3	5	5	3	2	9
Greater than 1000 cubic metres	2	0	2	0	1	0	5	0	1	2

Data extracted February 13, 2015.

Federally regulated pipeline occurrences.

*New TSB regulations came into effect on July 1, 2014. Under the new reporting requirements the minimum reporting threshold for incidents with release has been changed to be the same as NEB regulations which is 1.5 m3 of low vapour pressure hydrocarbons.

Appendix B: Definitions

Pipeline accidents and incidents prior to 01 July 2014

Prior to July 2014 (previous TSB Regulations), pipeline accidents and incidents are defined as follows:

Pipeline accidents

Reportable commodity pipeline accident means an accident resulting directly from the operation of a commodity pipeline, where

a) a person sustains a serious injury or is killed as a result of being exposed to

   (i) a fire, ignition or explosion, or

   (ii) a commodity released from the commodity pipeline, or

b) the commodity pipeline

   (i) sustains damage affecting the safe operation of the commodity pipeline as a result of being contacted by another object or as a result of a disturbance of its supporting environment,

   (ii) causes or sustains an explosion, or a fire or ignition that is not associated with normal operationg circumstances, or

   (iii) sustains damage resulting in the release of any commodity.

Pipeline incidents

Reportable commodity pipeline incident means an incident resulting directly from the operation of a commodity pipeline, where

   (a) an uncontained and uncontrolled release of a commodity occurs,

   (b) the commodity pipeline is operated beyond design limits,

   (c) the commodity pipeline causes an obstruction to a ship or to a surface vehicle owing to a disturbance of its supporting environment,

   (d) any abnormality reduces the structural integrity of the commodity pipeline below design limits,

   (e) any activity in the immediate vicinity of the commodity pipeline poses a threat to the structural integrity of the commodity pipeline, or

   (f) the commodity pipeline, or a portion thereof, sustains a precautionary or emergency shut-down for reasons that relate to or create a hazard to the safe transportation of a commodity;

Pipeline occurrences after 01 July 2014

As of 01 July 2014, the new reporting provisions of the TSB regulations came into effect. According to section 4(1) of the TSB Regulations, the operator of a pipeline must report the following pipeline occurrences to the Board if they result directly from the operation of the pipeline:

(a) a person is killed or sustains a serious injury;

(b) the safe operation of the pipeline is affected by

  (i) damage sustained when another object came into contact with it, or

  (ii) a fire or explosion or an ignition that is not associated with normal pipeline operations;

(c) an event or an operational malfunction results in

  (i) an unintended or uncontrolled release of gas,

  (ii) an unintended or uncontrolled release of HVP hydrocarbons,

  (iii) an unintended or uncontained release of LVP hydrocarbons in excess of 1.5 m3, or

  (iv) an unintended or uncontrolled release of a commodity other than gas, HVP hydrocarbons or LVP hydrocarbons;

(d) there is a release of a commodity from the line pipe body;

(e) the pipeline is operated beyond design limits or any operating restrictions imposed by the National Energy Board;

(f) the pipeline restricts the safe operation of any mode of transportation;

(g) an unauthorized third party activity within the safety zone[9] poses a threat to the safe operation of the pipeline;

(h) a geotechnical, hydraulic or environmental activity poses a threat to the safe operation of the pipeline;

(i) the operation of a portion of the pipeline is interrupted as a result of a situation or condition that poses a threat to any person, property or the environment; or

(j) an unintended fire or explosion has occurred that poses a threat to any person, property or the environment.

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[9] "Safety zone" means the area extending 30 m perpendicularly from the centre of a pipeline on either side of the pipeline.

Pipeline accidents after 01 July 2014

For 2014 statistical reporting, pipeline accidents as of 01 July 2014 consist of reportable pipeline occurrences that resulted in:

- loss of human life;
- a serious injury;[10]
- a fire or explosion that causes a pipeline or facility to be inoperative;
- a low vapour pressure hydrocarbon release in excess of 1.5 m^3 that leaves company property or the right-of-way;
- a rupture;[11] or
- a toxic plume.[12]

Pipeline incidents after 01 July 2014

For 2014 statistical reporting, pipeline incidents as of 01 July 2014 consist of all reportable pipeline occurrences other than pipeline accidents.

10 As defined in the Transportation Safety Board Regulations.

11 An instantaneous release that immediately impairs the operation of a pipeline such that pressure cannot be maintained.

12 As defined in Canadian Standards Association Standard Z662.