

2018 PERFORMANCE REPORT

Measuring Pipeline Safety Performance





KEY PERFORMANCE INDICATORS

Measuring the performance of pipelines is a key way to determine how safe they are and whether their safety is improving. Pipeline operators and PHMSA collect hundreds of different data points measuring how safely pipelines are operating and the reasons behind pipeline incidents when they occur.

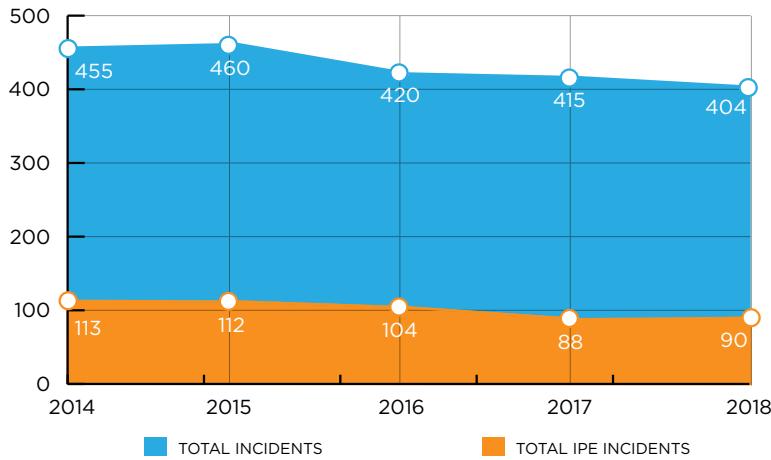
Particularly useful measures of pipeline safety examine incident size, location, commodity and cause. The liquids pipeline industry uses each one of the following measures to better understand pipeline incident trends and develop strategies for improving pipeline safety. As a sign of overall pipeline safety performance, the liquids pipeline industry tracks a core set of Key Performance Indicators (KPIs). These KPIs are based primarily on incidents impacting people or the environment. They were created through a recommendation of the U.S. National Transportation Safety Board in a collaborative effort between PHMSA, pipeline operators and public pipeline safety advocates represented by the Pipeline Safety Trust. They reflect the highest priority we place on protecting people and the environment. This year, the pipeline industry continued to demonstrate its commitment to safety, with incidents impacting people or the environment down 20% over the last five years, all while pipeline mileage has increased 12% in that time.

The four industry-wide KPIs are:

- 1) Total Incidents Impacting People or the Environment**
- 2) Integrity Management Incidents Impacting People or the Environment**
- 3) Operations & Maintenance (O&M) Incidents Impacting People or the Environment**
- 4) Participation in Pipeline Safety Management System (PSMS) Programs**

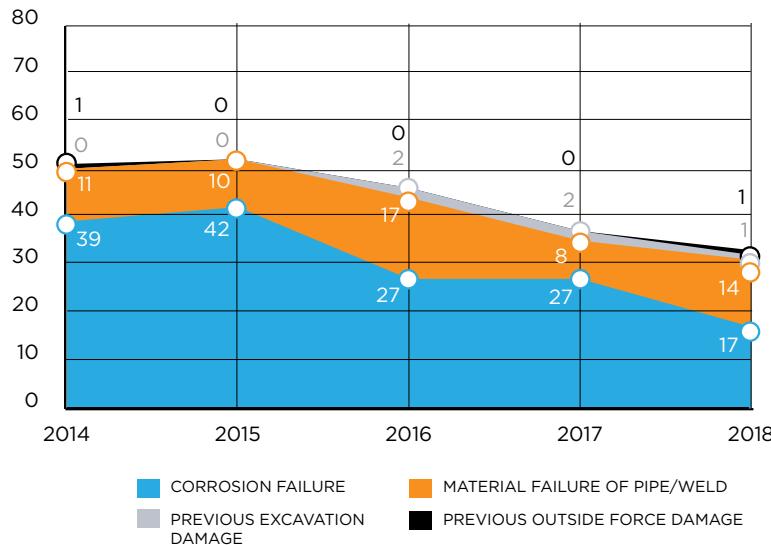
Integrity management incidents are those of the pipeline itself, such as corrosion, cracking or weld failure. Operations and maintenance causes include equipment failure or incorrect operations.

Key Performance Indicators



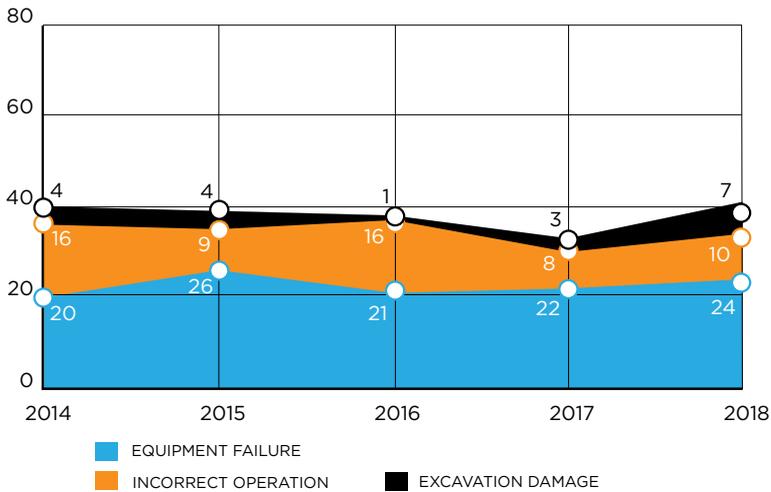
#1: TOTAL INCIDENTS & INCIDENTS IMPACTING PEOPLE OR THE ENVIRONMENT (2014-2018)

Pipeline incidents impacting people or the environment decreased 20% over the last 5 years. Total pipeline incidents were down as well, dropping 11% over 5 years with 51 fewer incidents in 2018 compared to 2014. A full description of the specific types of incidents impacting people or the environment can be found on page 44.



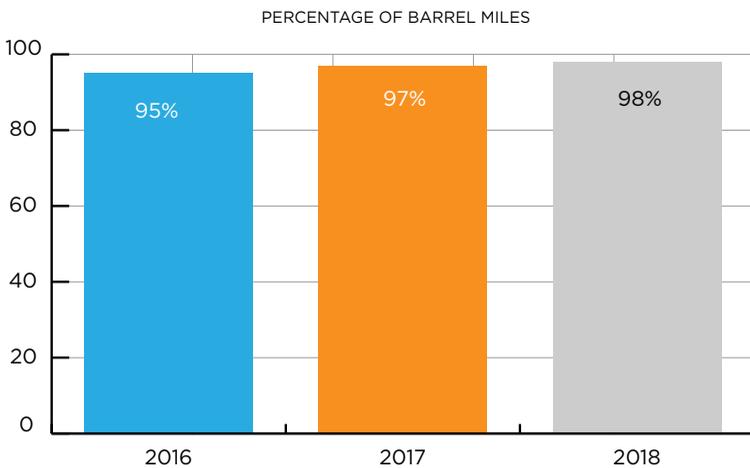
#2: INTEGRITY MANAGEMENT INCIDENTS IMPACTING PEOPLE OR THE ENVIRONMENT (2014-2018)

Incidents related to the pipeline itself, such as corrosion, cracking or weld failure, were down 35% over the last 5 years in areas impacting people or the environment. In these areas, incidents caused by incorrect operation decreased by 38% while equipment failure increased 20% from 2014 to 2018.



#3: OPERATIONS & MAINTENANCE (O&M) INCIDENTS IMPACTING PEOPLE OR THE ENVIRONMENT

Incidents related to installing and maintaining pipeline equipment or operating the pipeline and its valves or pumps were up 3% over the last 5 years in areas impacting people or the environment. In these areas, incidents caused by incorrect operations decreased by 38% while equipment failure increased 20% from 2014 to 2018.



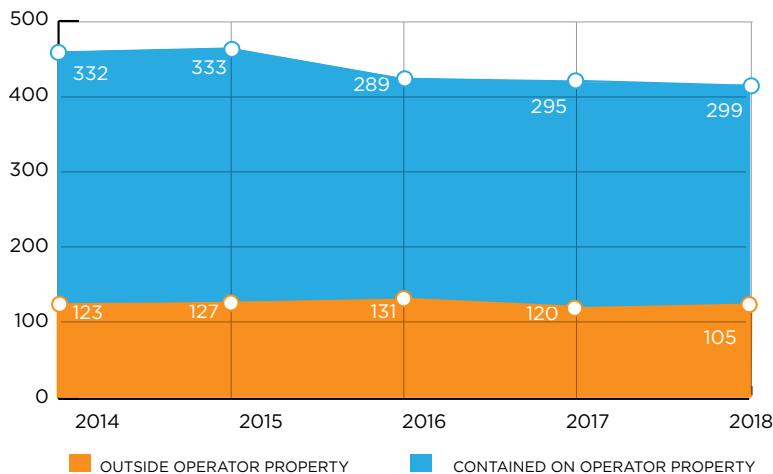
#4: PIPELINE SAFETY MANAGEMENT SYSTEMS OPERATOR COMMITMENT

In 2018, the pipeline industry increased liquids pipeline operator commitment to Pipeline Safety Management Systems from 95% of barrel miles to nearly 98% of barrel miles.

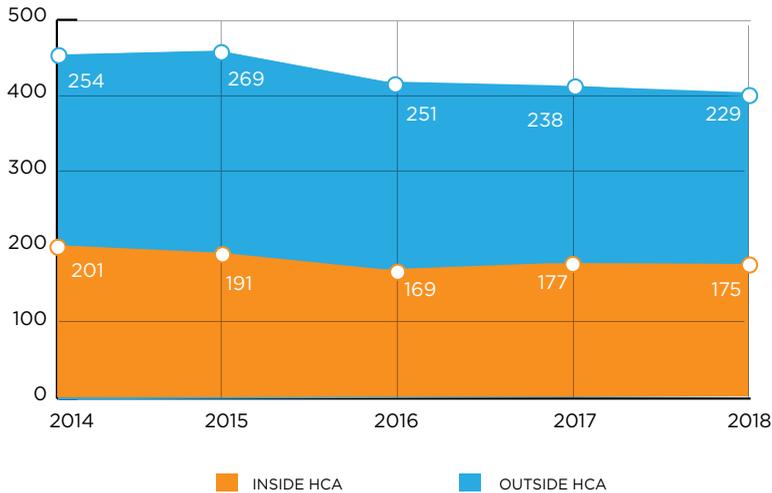
Incidents by Location

The location of a pipeline incident matters both when gauging the impact of an incident and developing strategies to prevent incidents in the future. Pipeline operators place the greatest emphasis on preventing and minimizing impacts to people or the environment. Tracking these incidents helps operators focus on this priority. Additional measures of incident impacts are whether they are contained on operator property or outside the operator’s facilities, specifically in high consequence areas (HCAs), a regulatory term used by PHMSA.

#5: PIPELINE INCIDENTS INSIDE & OUTSIDE OF OPERATOR PROPERTY (2014-2018)

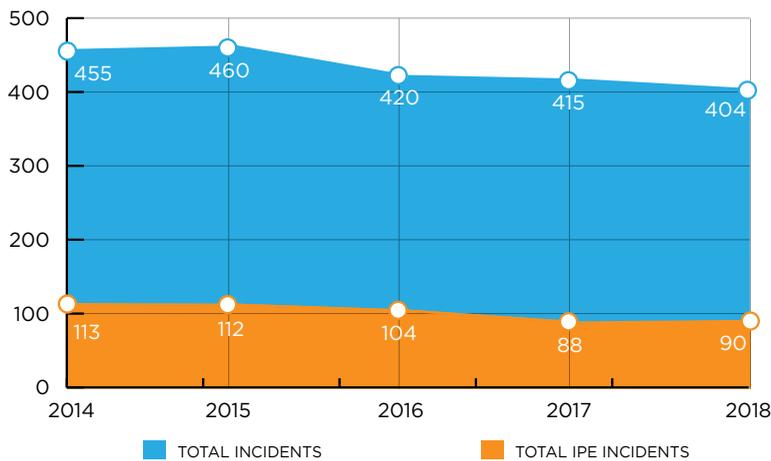


In 2018, 74% of incidents from liquids pipelines were contained within an operator’s property. Examples of pipeline operator properties include pump stations, tank farms and terminals. Incidents in public spaces outside of operator facilities decreased 15% from 2014 to 2018.



#6: PIPELINES INCIDENTS INSIDE & OUTSIDE OF HCAS (2014-2018)

Liquids pipeline incidents occurring in high-consequence areas (HCAs) declined 13% over the last 5 years. Through federal regulation, PHMSA defines HCAs as areas of population concentration, commercially navigable waterways, or sensitive environmental locations. The percentage of pipeline incidents occurring in HCAs versus non-HCAs also declined from 44% to 43% from 2014 to 2018. HCA data differs from incidents impacting people or the environment, because under PHMSA regulation an incident can have no impact on people or the environment, remain wholly within an operator’s facility, and still count as an HCA if that facility is surrounded by an HCA.



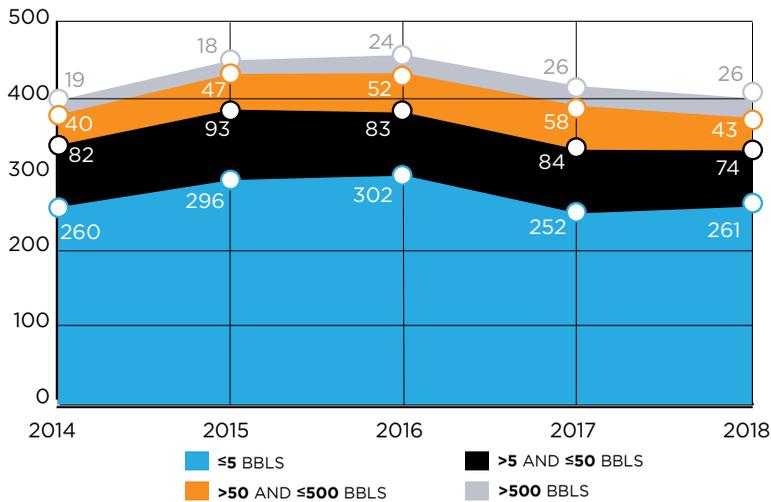
#7: TOTAL INCIDENTS AND INCIDENTS IMPACTING PEOPLE OR THE ENVIRONMENT (2014-2018)

In 2018, approximately 90 liquids pipeline incidents impacted people or the environment, a 20% decrease over the last 5 years. Total pipeline incidents were down as well, dropping 11% over 5 years with 51 fewer incidents in 2018 compared to 2014. A full description of the specific types of incidents impacting people or the environment can be found on page 44.

Incidents by Size

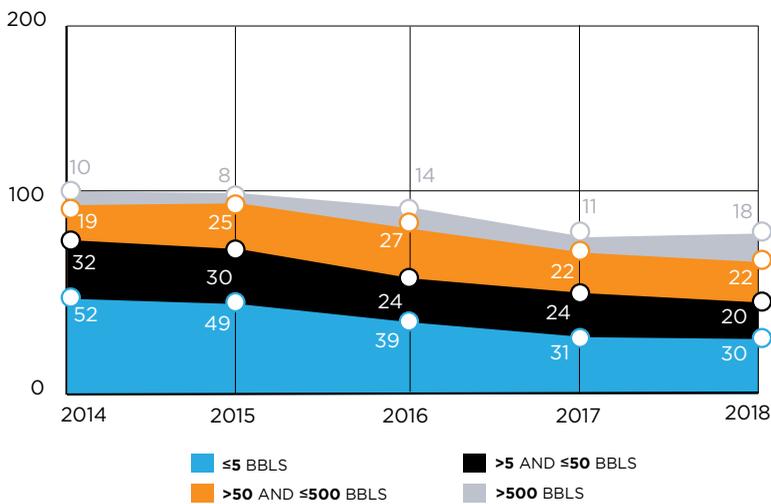
#8: LIQUID PIPELINE INCIDENTS BY SIZE (2014-2018)

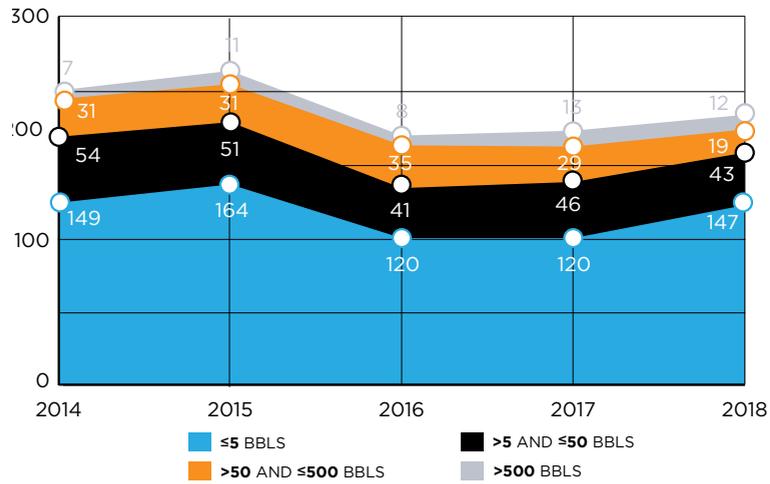
Most pipeline incidents are small in size. In 2018, 65% of incidents were less than 5 barrels and 83% were less than 50 barrels. Large pipeline incidents are also the rarest. In 2018, only 6% of incidents were 500 barrels or larger.



#9: INCIDENTS IMPACTING PEOPLE OR THE ENVIRONMENT BY SIZE (2014-2018)

Most incidents impacting people or the environment are small in size. In 2018, approximately 56% of such incidents were less than 50 barrels, with only 20% of incidents 500 barrels or larger.



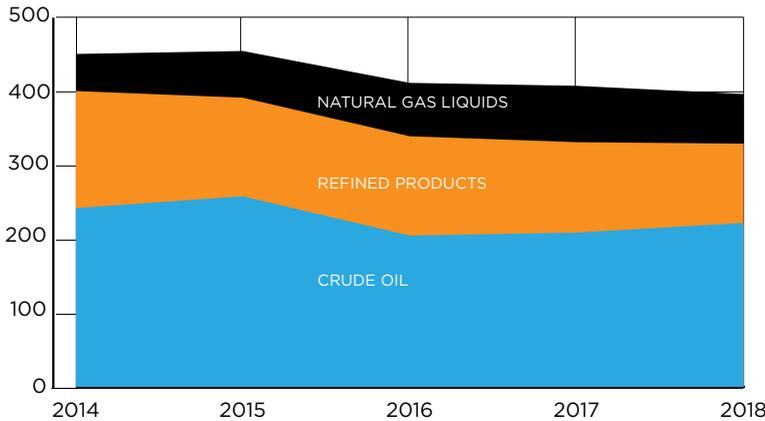


#10: CRUDE OIL INCIDENTS BY SIZE (2014-2018)

Similar to total incident trends, the majority of crude oil pipeline incidents are small in size. In 2018, 67% of crude oil incidents were 5 barrels or smaller and 86% of crude oil incidents were smaller than 50 barrels. Over the last 5 years, only 5% of crude oil incidents were over 500 barrels.

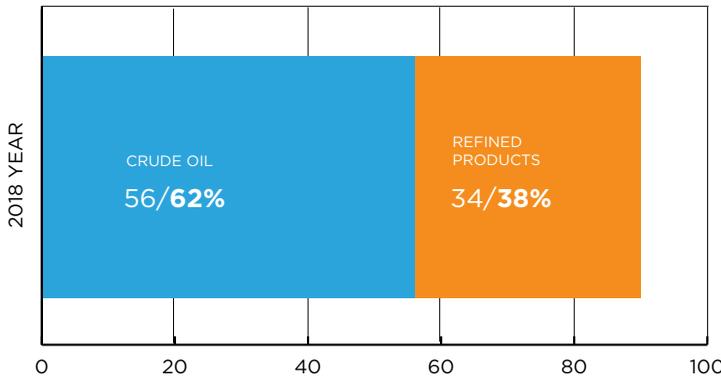
Crude oil incidents greater than 50 barrels have decreased 18%, from 38 to 31 incidents, even as pipeline mileage and barrels delivered have both increased more than 10% in the last five years.

Incidents by Commodity



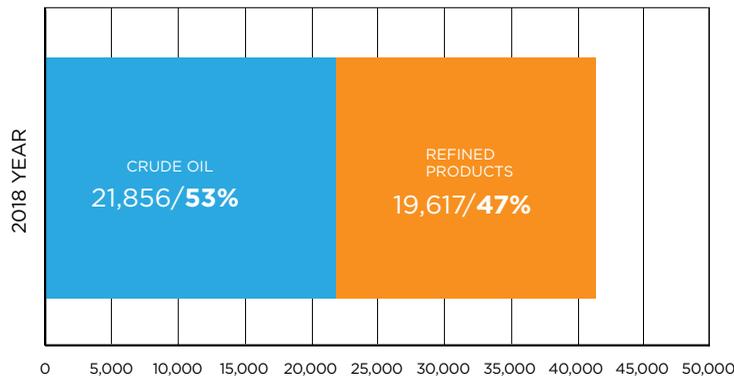
#11: ALL INCIDENTS BY COMMODITY (2014-2018)

In 2018, crude oil incidents represented 55% of total incidents, with refined products at 27% and natural gas liquids at 17% of total incidents. The number of annual crude oil incidents are down 14% from their peak in 2015 and down 8% from 2014.



#12: INCIDENTS IMPACTING PEOPLE OR THE ENVIRONMENT BY COMMODITY (2018)

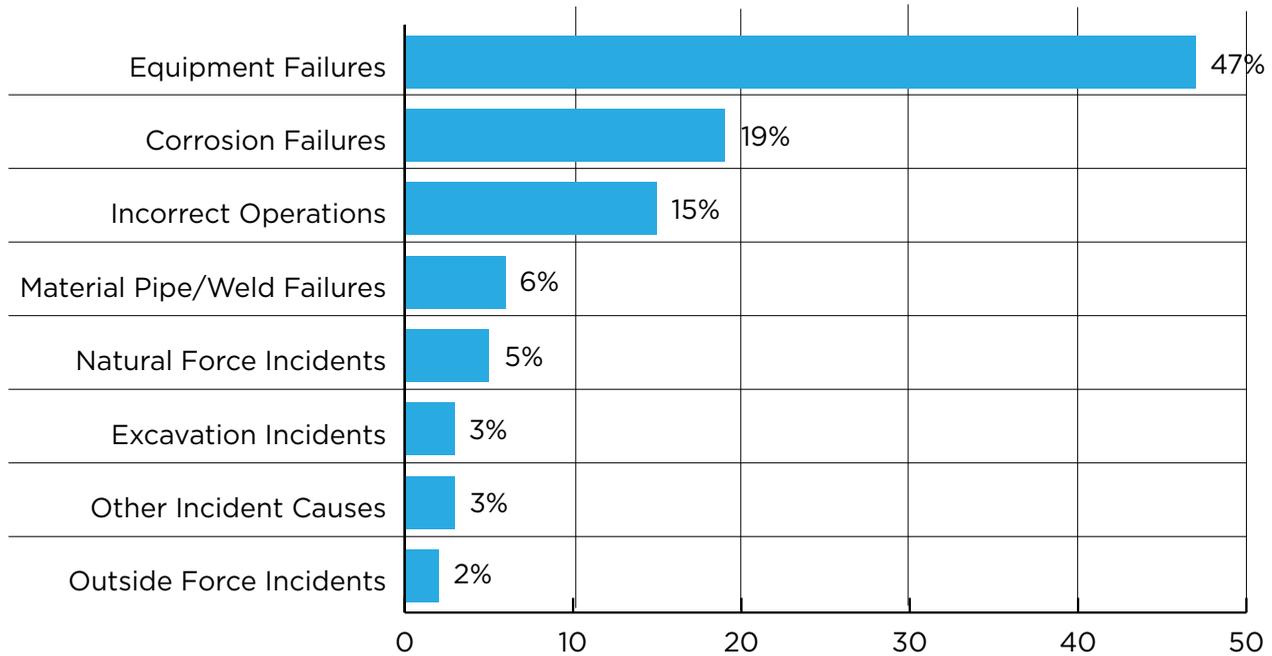
In 2018, there were 56 crude oil and 34 refined products incidents impacting people or the environment.



#13: PERCENTAGE OF BARRELS RELEASED IMPACTING PEOPLE OR THE ENVIRONMENT BY COMMODITY (2018)

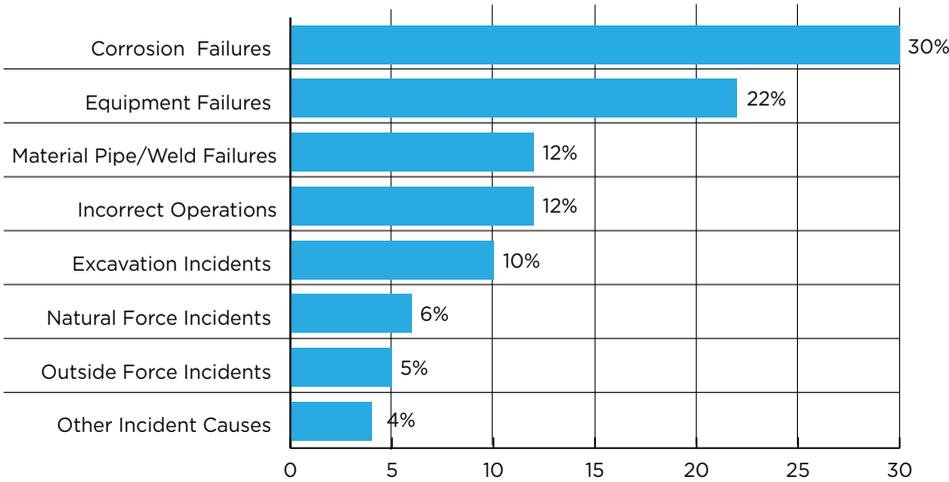
Crude oil incidents impacting the people or the environment in 2018 represented 53% of the total, with refined products representing 47% of total incidents impacting people or the environment. The percentage of crude oil barrels released out of all incidents impacting people or the environment is up 11% from 2014, while the percentage of refined products is down 11%.

Incidents by Cause



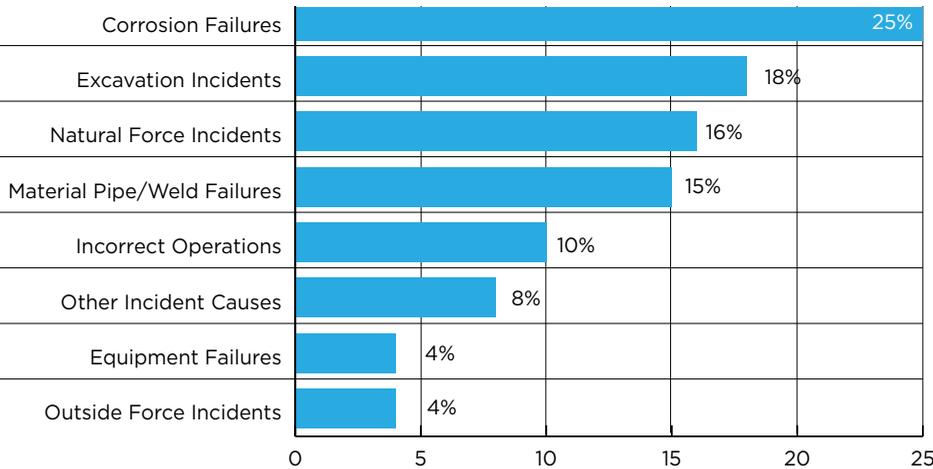
#14: LIQUID PIPELINE INCIDENTS BY CAUSE (2014-2018)

Equipment failure is the most frequent cause of liquids pipeline incidents. Over the last 5 years, equipment failure represented 47% of incidents, corrosion failure 19% and incorrect operation 15% of incidents. Material pipe/weld failures, which include cracking, a primary source of large volume releases, represented only 6% of incidents over the last 5 years.



#15: PERCENTAGE OF INCIDENTS IMPACTING PEOPLE OR THE ENVIRONMENT BY CAUSE (2014-2018)

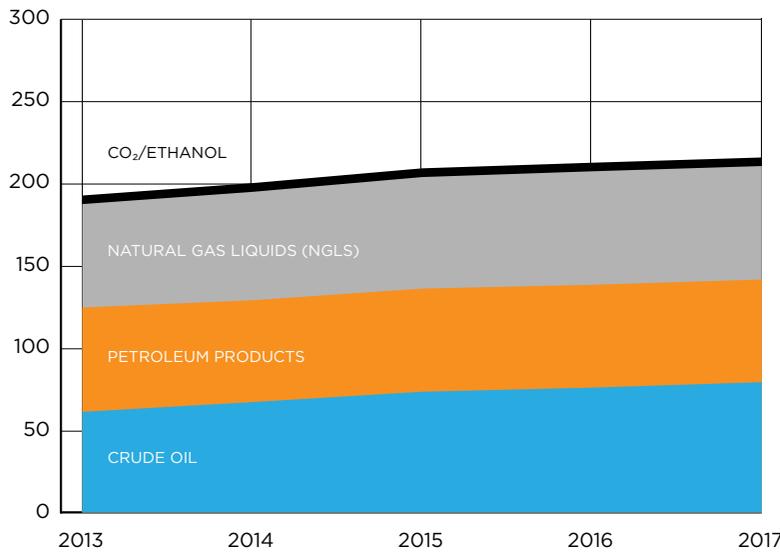
Over the last 5 years, corrosion (30%) was the most frequent cause of incidents impacting people or the environment, followed by equipment failure (22%), material pipe/weld failures (12%), incorrect operations (12%) and excavation incidents (10%).



#16: PERCENTAGE OF BARRELS RELEASED IMPACTING PEOPLE OR THE ENVIRONMENT BY CAUSE (2014-2018)

Corrosion (25%) was responsible for the most barrels released in incidents impacting people or the environment, followed by excavation incidents (18%), natural force incidents, such as flooding, earthquakes and lightning (16%), and material pipe/weld failures (15%). Equipment failure, the most frequent cause of all incidents, was the cause of only 4% of barrels released, reflecting the reduced proportion of operator property incidents impacting the people or the environment and the smaller average size of equipment failure incidents.

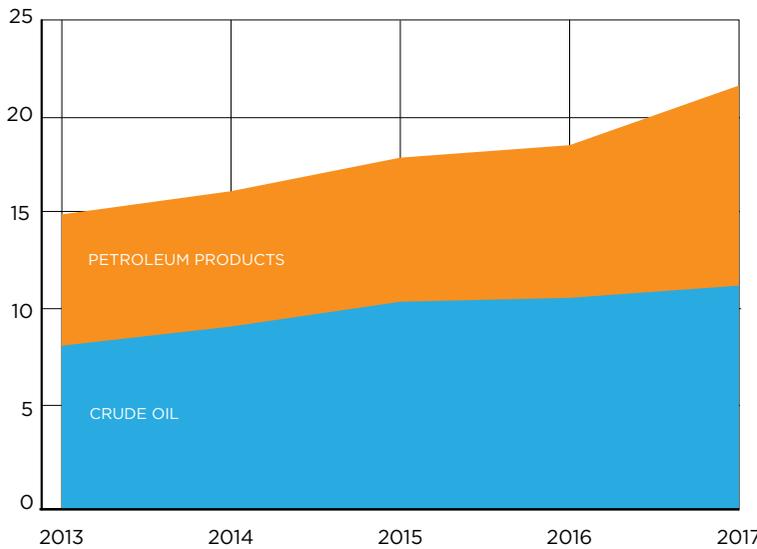
Pipeline Miles & Barrels Delivered



#17: MILES OF U.S. LIQUIDS PIPELINES BY PRODUCTS (2013-2017)

(Thousands)

At the end of 2017 (the most recent year this data is available), there were 215,736 total miles of liquids pipelines, with crude oil pipelines representing 37% of the total at 79,192 miles. Over the last five years, the total miles of liquids pipelines in-creased 23,324 miles or 12% and crude oil pipelines increased 18,105 miles or 30%.



#18: BARRELS DELIVERED BY U.S. LIQUIDS PIPELINE (2013-2017)

(Billions)

In 2017, there were a total of 21,572,198,940 crude oil and refined products barrels delivered by pipeline, with crude oil representing approximately 53% of the barrels delivered. Over the last five years, total liquid barrels delivered by pipeline have increased 44%, or 6,563,309,091. Crude oil barrels have increased 37%, or 3,058,440,600 barrels, while petroleum products have gone up 52%, or 3,504,868,491 barrels, in the last five years.

Data Appendix

GRAPH #1: TOTAL INCIDENTS & INCIDENTS IMPACTING PEOPLE OR THE ENVIRONMENT (2014-2018)

Year	Incidents Impacting People or the Environment	Total Incidents
2014	113	455
2015	112	460
2016	104	420
2017	88	415
2018	90	404
% Change from 2014	-20%	-11%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2019.

GRAPH #2: INTEGRITY MANAGEMENT INCIDENTS IMPACTING PEOPLE OR THE ENVIRONMENT (2014-2018)

Year	Corrosion Failure	Material Failure of Pipe/Weld	Previous Excavation Damage	Previous Outside Force Damage	Total IM IPE Incidents
2014	39	11	0	1	51
2015	42	10	0	0	52
2016	27	17	2	0	46
2017	27	8	2	0	37
2018	17	14	1	1	33
% Change from 2014	-56%	27%	-	0%	-35%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2019.

GRAPH #3: OPERATIONS & MAINTENACE INCIDENTS IMPACTING PEOPLE OR THE ENVIRONMENT (2014-2018)

Year	Equipment Failure	Incorrect Operation	Excavation Damage	Total O&M IPE Incidents
2014	20	16	4	40
2015	26	9	4	39
2016	21	16	1	38
2017	22	8	3	33
2018	24	10	7	41
% Change from 2014	20%	-38%	75%	3%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2019.

GRAPH #4: BAR CHART FOR 2018 INDICATING OPERATOR COMMITMENT TO PSMS	
Year	% Commitment
2016	95
2017	97
2018	98

Source: API and AOPL Membership Survey.

GRAPH #5: PIPELINE INCIDENTS INSIDE & OUTSIDE OPERATOR PROPERTY (2014-2018)			
Year	Outside Operator Facility	Contained on Operator Property	Total Incidents
2014	123	332	455
2015	127	333	460
2016	131	289	420
2017	120	295	415
2018	105	299	404
% Change from 2014	-15%	-10%	-11%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2019.

GRAPH #6: PIPELINE INCIDENTS IMPACTING HCAs (2014-2018)			
Year	Outside HCA	Inside HCA	Total Incidents
2014	254	201	455
2015	269	191	460
2016	251	169	420
2017	238	177	415
2018	229	175	404
% Change from 2014	-10%	-13%	-11%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2019.

GRAPH #7: TOTAL INCIDENTS & INCIDENTS IMPACTING PEOPLE OR THE ENVIRONMENT (2014-2018)		
Year	Incidents Impacting People or the Environment	Total Incidents
2014	113	455
2015	112	460
2016	104	420
2017	88	415
2018	90	404
% Change from 2014	-20%	-11%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2019.

Data Appendix

GRAPH #8: LIQUID PIPELINE INCIDENTS BY SIZE (2014-2018)					
Year	≤ 5 Bbls	> 5 and ≤ 50 Bbls	> 50 and ≤ 500 Bbls	> 500 Bbls	Total Incidents
2014	296	93	47	19	455
2015	302	83	52	23	460
2016	252	84	58	26	420
2017	248	100	42	25	415
2018	261	74	43	26	404
% Change from 2014	-12%	-20%	-9%	37%	-11%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2019.

GRAPH #9: IPE INCIDENTS BY SIZE (2014-2018)					
Year	≤ 5 Bbls	> 5 and ≤ 50 Bbls	> 50 and ≤ 500 Bbls	> 500 Bbls	Total Incidents
2014	52	32	19	10	113
2015	49	30	25	8	112
2016	39	24	27	14	104
2017	31	24	22	11	88
2018	30	20	22	18	90
% Change from 2014	-42%	-38%	16%	80%	-20%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2019.

GRAPH #10: CRUDE OIL INCIDENTS BY SIZE (2014-2018)					
Year	≤ 5 Bbls	> 5 and ≤ 50 Bbls	> 50 and ≤ 500 Bbls	> 500 Bbls	Total Incidents
2014	149	54	31	7	241
2015	164	51	31	11	257
2016	120	41	35	8	204
2017	120	46	29	13	208
2018	147	43	19	12	221
% Change from 2014	-1%	-20%	-39%	71%	-8%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2019.

GRAPH #11: INCIDENTS BY COMMODITY (2014-2018)

Year	Crude Oil	Refined Products	Highly Volatile Liquids (HVLs)	CO ₂	Biofuel/Ethanol	Total Incidents
2014	241	158	50	5	1	455
2015	257	133	63	7	0	460
2016	204	134	72	9	1	420
2017	208	122	76	9	0	415
2018	221	109	67	5	2	404
% Change from 2014	-8%	-31%	34%	0%	100%	-11%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2019.

GRAPH #12: INCIDENTS IMPACTING PEOPLE OR THE ENVIRONMENT BY COMMODITY (2014-2018)

Year	Crude Oil	Refined Products
2014	71	42
2015	75	37
2016	69	35
2017	54	34
2018	56	34
% Change from 2014	-21%	-19%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2019.

GRAPH #13: PERCENTAGE OF IPE BARRELS RELEASED BY COMMODITY (2014-2018)

Year	Crude Oil	Refined Products
2014	42%	58%
2015	70%	30%
2016	64%	36%
2017	56%	44%
2018	53%	47%
% Change from 2014	11%	-11%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2019.

Data Appendix

GRAPH #14: LIQUIDS PIPELINE INCIDENTS BY CAUSE (2014-2018)

Cause	Total Incidents	Percentage
Equipment Failures	1,014	47%
Corrosion Failures	405	19%
Incorrect Operations	317	15%
Material Pipe/Weld Failures	140	6%
Natural Force Incidents	102	5%
Excavation Incidents	75	3%
Other Incident Causes	59	3%
Outside Force Incidents	42	2%
Total	2,154	

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2019.

GRAPH #15: TOTAL IPE INCIDENTS BY CAUSE (2014-2018)

Cause	Total Incidents	Percentage
Corrosion Failures	152	30%
Equipment Failures	113	22%
Material Pipe/Weld Failures	60	12%
Incorrect Operations	59	12%
Excavation Incidents	52	10%
Natural Force Incidents	29	6%
Outside Force Incidents	23	5%
Other Incident Causes	19	4%
Total	507	

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2019.

GRAPH #16: IPE BARRELS RELEASED BY CAUSE (2014-2018)

Cause	Barrels Released	Percentage
Corrosion Failures	45,337	25%
Excavation Incidents	32,269	18%
Natural Force Incidents	27,806	16%
Material Pipe/Weld Failures	26,071	15%
Incorrect Operations	17,681	10%
Other Incident Causes	14,751	8%
Outside Force Incidents	7,606	4%
Equipment Failures	7,510	4%
Total	179,030	

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2019.

GRAPH #17: MILES OF US LIQUIDS PIPELINE (2013-2017)

	2013	2014	2015	2016	2017
Crude Oil	61,087	66,943	73,055	75,710	79,192
Petroleum Products	63,351	61,766	62,634	62,461	62,349
Natural Gas Liquids (NGLs)	62,768	65,792	67,673	68,725	68,943
CO ₂ /Ethanol	5,190	5,276	5,241	5,195	5,237
Total Miles	192,412	199,793	208,618	212,105	215,736

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2019.

GRAPH #18: BARRELS DELIVERED (2013-2017)

	2013	2014	2015	2016	2017
Crude Oil	8,324,012,774	9,300,051,343	10,563,693,124	10,760,706,300	11,382,453,374
Petroleum Products	6,684,877,075	6,891,170,199	7,335,091,475	7,774,085,019	10,189,745,566
Total Barrels	15,008,889,849	16,191,221,542	17,898,784,599	18,534,791,319	21,572,198,940

Source: U.S. Federal Energy Regulatory Commission

DEFINITIONS & NOTES

BARRELS

One barrel of crude oil or petroleum products is equivalent to 42 gallons.

BARRELS RELEASED

The Department of Transportation's Pipelines and Hazardous Materials Safety Administration (PHMSA) also requires operators to report intentional releases of natural gas liquids in gas form into the atmosphere during maintenance activities. Unintentionally released barrels of crude oil and petroleum products forms the basis of barrels released data and analysis in this report. PHMSA also requires operators to report intentional releases of natural gas liquids in gas form into the atmosphere during maintenance activities. This process displaces residual hydrocarbons in gas state from the section of pipeline set to undergo maintenance. Barrels released data in this report does not include intentional blowdown releases.

IN-LINE INSPECTION DEVICE OR "SMART PIG"

An in-line inspection (ILI) device, commonly referred to as a "smart pig", is a diagnostic tool that travels inside the pipeline scanning the pipe walls for imperfections and recording the data for later analysis.

NATURAL GAS LIQUIDS

Petroleum products that are liquid when traveling through a pipeline under high pressure and a gas at atmospheric pressure are referred to generally as natural gas liquids (NGLs). Examples of NGLs transported by pipeline include: propane, ethane and butane. They occur naturally in petroleum deposits and are produced along with crude oil or natural gas (methane). NGLs are separated from the crude oil and natural gas after production and sent to manufacturers (ethane, butane) as an industrial raw material sent to manufacturers to produce consumer goods such as polymers, fertilizers and home goods, or to other commercial, agricultural or residential uses (propane).

INCIDENTS IMPACTING PEOPLE OR THE ENVIRONMENT (IPE) CRITERIA

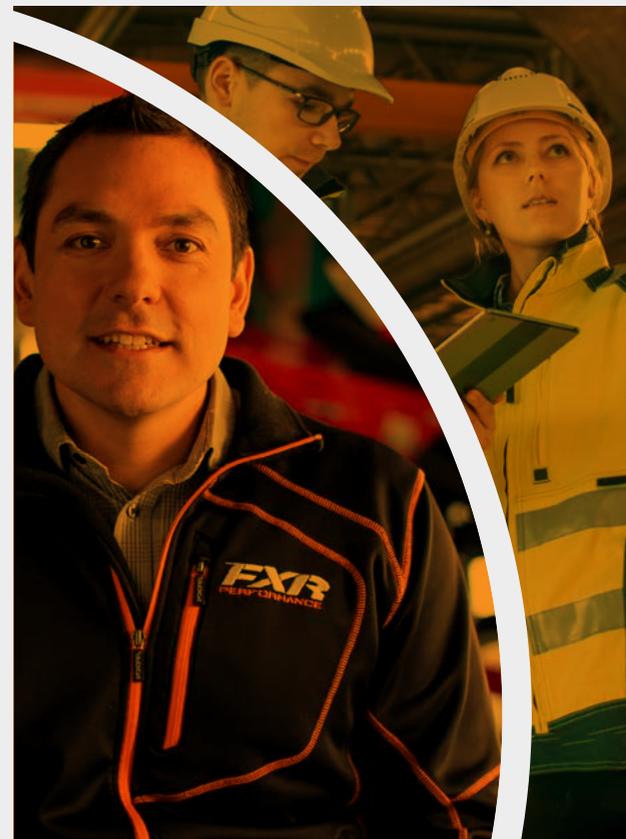
If either criterion 1 or 2 below is met for a crude oil or refined products pipeline the incident counts as IPE:

TIER 1. Regardless of location of incident:

Fatality; or
 Injury requiring in-patient hospitalization; or
 Ignition; or
 Explosion; or
 Evacuation; or
 Wildlife impact; or
 Water contamination = ocean/seawater, groundwater, or drinking water or public/non-operator private property damage

TIER 2. For location of incident "Not totally contained on operator-controlled property"

Unintentional release volume greater than or equal to 5 gallons and in an HCA; or
 Unintentional release volume greater than or equal to 5 barrels and outside of an HCA; or
 Water contamination; or
 Soil contamination



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