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Association of Oil Pipe Lines

PIPELINE SAFETY EXCELLENCE PERFORMANCE REPORT

2018

REPORT

ANNUAL LIQUIDS PIPELINE

AMERICAN PETROLEUM INSTITUTE (API)
is the only national trade association that represents all aspects
of America's oil and natural gas industry.

ASSOCIATION OF OIL PIPE LINES (AOPL)
Represents liquids pipeline owners and operators transporting crude oil,
petroleum products like gasoline,diesel jet fuel, home heating oil and industrial
products like propane and ethane.

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TODD DENTON

PRESIDENT, PHILLIPS 66 PIPELINE LLC

Chair, API-AOPL Pipeline
Safety Excellence
Steering Committee

Pipelines benefit consumers and working Americans. Our industry provides clean, safe, affordable energy and we help drive the economy forward. We make our modern way of life possible.

Whether we recognize it or not, pipelines provide us a way to get to our job, make a living, and care for our families. Sure, they provide the gasoline and diesel for our cars and trucks. But they also provide heating fuel for Americans in colder climates, jet fuel for our air travel, propane for farming and rural heating, and feedstocks that are the building blocks for the many things we use and often take for granted in our everyday lives: plastics, cars, clothing, carpets, cosmetics, and even pharmaceuticals. Pipelines and the energy they provide power America and improve our lives every day.

Knowing how important pipelines are to everyday living is a big reason why we as pipeline operators strive to keep them safe. Pipelines themselves are one of the safest ways to transport energy with a barrel of crude oil or petroleum product reaching its destination safely by pipeline 99.999% of the time. We continuously work on the safety of our operations to protect our pipelines, our people, communities and our environment.

Behind the scenes, pipeline operators are regularly inspecting their pipelines, conducting preventative maintenance, monitoring their safe operations 24/7 looking for signs of trouble, and practicing how to rapidly respond to a pipeline emergency if one were to occur. When you bought that gallon of gasoline at the gas station you were probably thinking about other things. That's ok, you've got a busy life to lead. We're just glad to be able to share with you some of the ways we are working to keep pipelines safe.

This safety report gives you a window into how we as a pipeline industry are working to make our pipelines even safer. It shows how we are strengthening safety culture within our organizations through safety management systems, and proactively applying technology to help us inspect our pipelines It describes the latest techniques our engineers use to maintain safe pipelines, and how we are partnering with local first responders and reaching out to key stakeholders in our communities.

We love our jobs and improving Americans' lives in many ways. Delivering energy that fuels our country, providing jobs that drive our economy, keeping our employees safe, and protecting the environment are what motivates us. We look forward to sharing more about our efforts.

Sincerely,

TODD DENTON
President, Phillips 66 Pipeline LLC
Chair, API-AOPL Pipeline Safety Excellence
Steering Committee

2017 PERFORMANCE SUMMARY

212,568 MILES
of liquid pipelines cross America from production areas to refineries to consumers and manufacturers (as of 2016)

American consumers rely on products made from pipeline-delivered feed-stocks like beverage containers, clothing, carpet, cosmetics and pharmaceuticals

18.4 BILLION
barrels of crude oil and petroleum products delivered by pipeline in 2016, a 34% increase since 2012

76,092 MILES
of pipeline transport crude oil from production areas to U.S. refineries, a 32% increase since 2012

99.999%
of crude oil and petroleum products delivered by pipeline reach their destination safely

Incidents Impacting People or the Environment (IPE) caused by Integrity Management failures

DECLINED BY 35%
over the last five years, since 2013

Incidents Impacting People or the Environment (IPE) caused by Operations and Management (O&M) failures

DECLINED BY 24%
over the last five years

68,831 MILES
of pipeline transport natural gas liquids to farmers and industrial manufacturers

From infrared cameras to fiber optic cables installed alongside a pipeline, operators are employing new technologies and techniques allowing for 24/7 monitoring, ensuring if a leak does occur it can be quickly identified and potential impacts mitigated

10.7 BILLION
barrels of crude oil delivered by pipelines in 2016, a 43% increase from 2012

Incidents impacting people or the environment (IPE)

DECLINED BY 19%
over the last 5 years

7.8 BILLION
barrels of petroleum products delivered by pipelines in 2016, a 17% increase from 2012

PIPELINE SAFETY

Even though you may not see pipelines, they are constantly working on your behalf. Similarly, pipeline operators are there behind the scenes constantly working to keep those pipelines operating safely.

HI-TECH INSPECTIONS

Pipeline operators inspect their pipelines on regular schedules with diagnostic tools called "smart pigs" that travel inside pipelines scanning the pipe walls. These hi-tech inspection tools can see inside the pipe like an ultrasound or MRI at the doctor's office. Smart pigs allow pipeline operators to look proactively for any potential issues a pipe may face and schedule preventative maintenance long before an issue becomes a problem.

For example, by using a smart pig a pipeline operator may detect a small amount of corrosion starting to form on the outside of the pipe in a certain section. It may not pose a problem yet, but the operator can schedule maintenance to keep the pipe in a safe condition. The pipeline operator can then reapply protective coating, install a patch or sleeve around the pipe or replace that section of pipe.

24/7 PIPELINE MONITORING

Pipeline operators keep a constant watch over their pipelines 24 hours a day, 7 days a week, 365 days a year. Specially trained personnel in a central control room monitor pipeline pressure, flow and volume. Pipeline operators can quickly shut down a pipeline if they suspect a leak. Pipeline control personnel are trained to shut down their systems, diagnose whether an alarm is showing a leak, and not restart the pipeline until they can determine the pipeline is safe.

PLANNING & PRACTICING EMERGENCY RESPONSE

While pipeline incidents are relatively rare, pipeline operators still train regularly with their first responder partners in states and local communities to be ready for a pipeline incident. Pipeline operators maintain detailed action plans to know in advance who to contact in case of an emergency and have support personnel and equipment ready to rapidly deploy to an incident site. Regular drills allow pipeline operators to practice deploying their equipment and working with local authorities and government officials. Together pipeline operators, supporting response personnel and first responders will keep any incident, no matter the size, and get it cleaned up as fast as possible to minimize impacts to the public or the environment.

ENVIRONMENTAL
PROTECTION

Every stage of a pipeline's design, construction and operation allows pipelines to operate safely within their environment. The impacts of pipelines on the environment are kept to a minimum with proactive inspections, preventative maintenance and 24/7 monitoring. While our motto is always "keep it in the pipe," pipeline operators also plan, prepare and practice for any emergency response.

PIPELINE PLANNING AND ENVIRONMENTAL REVIEW

During the planning for a new pipeline, project sponsors map out potential routes to avoid environmentally sensitive areas. Operators will also try to follow existing pipeline or power line routes to minimize new environmental impacts.

As part of the planning process, a major pipeline project must include a detailed study of its environmental impacts. The potential impact of a pipeline on natural resources, wildlife, habitat and cultural resources are all considered. For example, pipeline planners avoid impacting rivers or lakes by burrowing deep underground below major waterbodies allowing the pipeline to never meet the water itself.

PIPELINE CONSTRUCTION

Pipeline-grade steel required for pipeline projects must meet or exceed federal quality regulations. A protective coating is applied on the pipe to prevent corrosion. After pipe segments, usually 40 feet in length, are welded together end to end, the welds are inspected to ensure the strength of the welds. New pipelines can begin service only after they pass rigorous pre-operation testing demonstrating they are problem free and ready for safe operations.

PROACTIVE INSPECTIONS, PREVENTIVE MAINTENANCE AND 24/7 MONITORING

Pipeline operators inspect their pipelines on regular schedules looking for issues they can fix before they become a problem. This strategy of proactive inspections and preventive maintenance keeps the pipelines safe. Operators know their pipelines are operating safely through 24/7 monitoring from a central control room. If an issue is detected, pipeline control personnel are trained to shut down the pipeline, diagnose whether an alarm is showing a leak, and not restart the pipeline until they can determine the pipeline is operating safely.

EMERGENCY RESPONSE

Pipeline operators limit the impact to the environment if a release does occur with rapid response, trained personnel and specialized equipment. Operators have extensive emergency response plans approved by the federal government and shared with local authorities. Pipeline operators regularly train their employees and practice their response plans to be ready for a pipeline incident. Pipeline operators know in advance who to contact in case of an emergency and have support personnel and equipment pre-identified to deploy to an incident site.
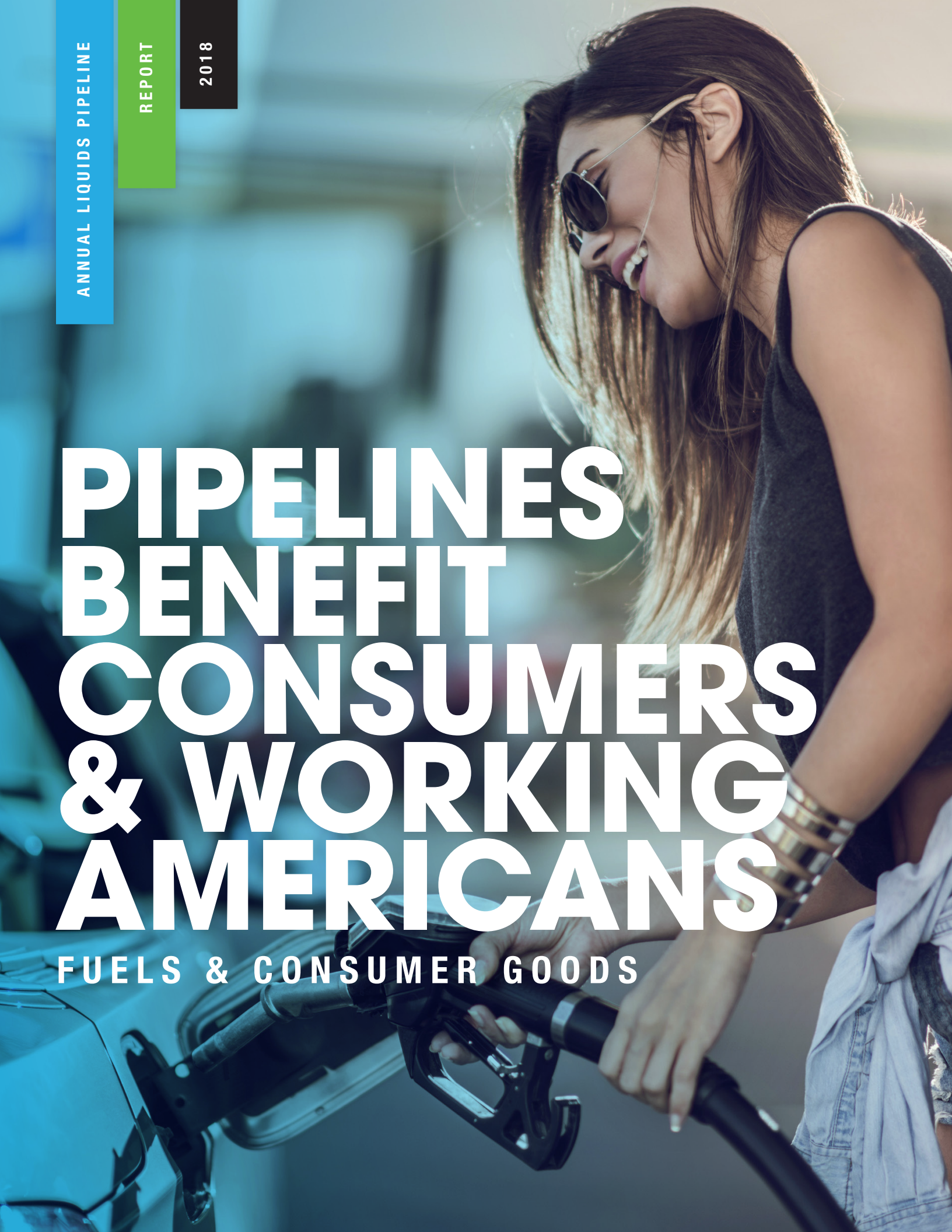
PIPELINES BENEFIT CONSUMERS & WORKING AMERICANS

FUELS & CONSUMER GOODS

GASOLINE AND DIESEL FOR OUR CARS AND TRUCKS

Ever wonder as you are pumping gasoline into your car at the gas station how that fuel came to you? Pipelines are the connection-transporting crude oil to refineries and delivering gasoline to your region. The result of this long chain of pipelines is that you benefit by having plentiful, affordable transportation fuels for your car or truck.

HOME HEATING FUEL

Millions of Americans in colder climates depend on pipelines to keep their homes warm in the winter. Home heating oil, ultra-low sulfur diesel and propane are delivered by pipeline in large volumes to regional storage points, then by truck to your house or apartment building. Without pipelines, you wouldn't be able to get enough heating fuel delivered to your region to keep you warm.

JET FUEL FOR AIR TRAVEL

Airplanes take you on your vacation, to visit family or on a business trip, and the jet fuel for that plane traveled to your local airport by an underground pipeline. Just like gasoline for the car you drive, jet fuel for the airplane you ride is delivered from refineries to your local airport by pipeline.

PROPANE FOR FARMING AND RURAL HEATING

Homes across rural America are often too spread out or far away from towns to be connected to city gas lines for their heat, cooking and hot water needs. As such, farmers and rural America depend on propane delivered to their local areas by pipeline. A truck may travel the last few miles to fill the tank, but large volumes of propane to meet rural needs must be transported by pipeline. Farmers also use propane to dry their grain after harvest, reducing crop loss, adding harvest flexibility and improving yields through earlier harvest. Livestock operations use propane to heat barns and keep livestock warm throughout the winter.

CONSUMER GOODS MADE FROM PIPELINE DELIVERED FEEDSTOCKS

American consumers use products made from pipeline-delivered feedstocks. Beverage containers, clothing, carpet, cosmetics and pharmaceuticals all are made with raw material feedstocks delivered at some point by pipeline. U.S. workers drill wells and send petroleum products to pipelines, process raw materials into usable feed-stocks, process feed-stocks into base fibers, resins, and materials, and manufacture final products and packaging. Pipelines also deliver natural gas liquids from wells in eastern Ohio, western Pennsylvania, Texas and other locations in the U.S for ethane to make plastics, propane for gas barbeques and camping stoves and pentane to make styrofoam.

JOBS AND COMMUNITY BENEFITS

PIPELINE CONSTRUCTION SPURS JOBS

Building new pipelines means thousands of good-paying jobs that generate billions of dollars in worker income. A major pipeline construction project can directly employ thousands of tradesmen, teamsters, technicians and engineers. Pipeline construction will also support the jobs of tens of thousands more Americans whose jobs furnish the goods and services needed for the project, its workers and their personal spending. Good jobs support communities with wages that are spent on homes, at local restaurants, car dealerships and shops adding to the overall health of a state's economy.

COMMUNITY BENEFITS CONTINUE AFTER PIPELINE CONSTRUCTION

After construction, a major pipeline project will provide tens of millions of dollars in property taxes each year. Local communities can use these revenues to fund increases to fire and police departments, teachers and schools and government operations.

A STRATEGIC PLAN TO IMPROVE PIPELINE SAFETY

Industry's commitment to long-term safety includes the following shared pipeline safety principles:

ZERO INCIDENTS – Only with a goal of zero safety incidents can accidents be minimized.

ORGANIZATION-WIDE COMMITMENT – Safety is emphasized at every level of the organization from employees who accept personal responsibility for safety to managers who are vital to reinforcing a safety culture.

A CULTURE OF SAFETY – A workplace culture where safety is an enduring value that all employees share.

CONTINUOUS IMPROVEMENT – Pipeline operators believe that no matter how safe they already are, they can always improve safety.

LEARN FROM EXPERIENCE – Pipeline operators learn how they can improve safety from their own experiences and from other pipeline operators.

SYSTEMS FOR SUCCESS – Safety management systems bring a consistent, holistic structure to safety management, helping to improve safety performance.

EMPLOY TECHNOLOGY – From "smart pigs" to innovative ways to interpret integrity data, operators constantly develop new ways to advance pipeline safety.

COMMUNICATE WITH STAKEHOLDERS – Operators know communicating and establishing a positive relationship with the public and stakeholders who value safety is vital to improving safety.

Pipeline safety to us is more than just numbers and performance metrics, it's about operating safely within communities. Pipeline operators focus their safety improvement efforts on where they will have the greatest effect in reducing impacts on the people or the environment. Taking that strategic approach to pipeline safety also allows us to address persistent problems, halt growing trends or bring new levels of success to previous safety accomplishments.

That doesn't mean numbers aren't important. Later in this report are industry-wide metrics based on data collected by the federal government on how the pipeline industry is doing, where we are improving our pipeline safety record and where we can do better. Tracking progress and emerging trends are critical to our core value of continuous improvement. We also strive to learn from experience. Our strategic plan benefits from lessons learned from past pipeline incidents and recommendations made to us from our government agency regulators.

Throughout this report you will see descriptions of our efforts to improve pipeline safety and measures of our progress. We want to expand a culture of operating our pipelines safely, harnessing cutting edge technology and using the latest management techniques to help our companies improve their pipeline safety performance. We also want to communicate with our stakeholders, have conversations on what is working and what is not, and make sure we are focusing our efforts where they will do the most to reduce impacts to the people or the environment.

In 2017, the liquid pipeline industry introduced a three-year strategic plan that reflected the goals and objectives of over 50 pipeline member companies within API and AOPL. The pipeline industry made considerable progress towards improving pipeline safety through each of our four goals in 2017: (1) Organizational Excellence (2) Technology and Innovation (3) Emergency Response Preparedness and (4) Stakeholder Awareness and Involvement. Pipeline operators developed well-defined performance measures and a quarterly review process to assess industry performance, identify emerging trends, and ensure that pipeline operators are focusing their attention where they will have the greatest positive impact on pipeline safety. In 2018, pipeline operators will continue to track their performance through a variety of performance indicators.

STRATEGIC PLAN 2017–2019

In 2018, the industry continues to focus on the following goals in its push toward zero pipeline incidents

GOALS

1

PROMOTE ORGANIZATIONAL EXCELLENCE

Under Goal 1, industry will develop and promote an industry-wide safety culture through continuous improvement mechanisms, such as Pipeline Safety Management Systems (Pipeline SMS), Construction Quality Management Systems (QMS) and Integrity Management (IM). By implementing these programs, industry-wide sharing will be transformed into a robust sustainable program that emphasizes the benefits and power of data integration.

2

IMPROVE SAFETY THROUGH TECHNOLOGY AND INNOVATION

Through Goal 2, API and AOPL will drive industry-wide engagement in advancing Inline Inspection (ILI) capabilities to achieve the pipeline industry's goal of zero incidents, accelerate the development and adoption of the most effective ILI tools and create sustainable, workable frameworks for operator leak detection management.

3

ENHANCE EMERGENCY RESPONSE PREPAREDNESS

By implementing Goal 3, industry will increase rapid and effective emergency response efforts through the development and adoption of industry guidance on adaptive emergency planning and response processes. Such efforts will promote peer to peer opportunities for drilling/exercising emergency response plans and sharing of lessons learned from incidents.

4

INCREASE STAKEHOLDER AWARENESS & INVOLVEMENT

Under Goal 4 industry will share with the public how we are keeping pipelines safe, how the public can interact with pipelines safely when they need to, and how we will interact with private landowners when a pipeline project is in their area. We will also focus specifically on those who need to dig around underground pipelines to make sure everything is done safely.

Promote Organizational Excellence

Objective 1.1
Expand Safety Management Practices

STRATEGIC INITIATIVE:
PIPELINE SAFETY MANAGEMENT SYSTEMS

In 2017, the Pipeline SMS Industry Team (Team) issued the first Pipeline SMS annual report describing the benefits and achievements of industry-wide efforts to implement pipeline safety management systems. The Team has continued developing tools for companies to assess how well they are implementing the industry-wide, *API RP 1173 Pipeline Safety Management Systems* and how effective the company's new program is at improving pipeline safety performance. To measure progress, the Team developed a five-level maturity model with tools for assessing gaps in company programs and evaluating company efforts in detail. The Team will complete and introduce the planning and implementation tools to pipeline operators through a series of webinars and workshops in 2018. API is also developing a third-party assessment program, which will include assessment protocols and timelines, and inspector qualifications, etc.

STRATEGIC INITIATIVE:
CONSTRUCTION QUALITY MANAGEMENT SYSTEMS

In 2017, the pipeline industry completed the publication of *API RP 1177, Construction Quality Management Systems (QMS)*. This document systematically guides operators in the management of the overall pipeline construction process, including initial design verification, materials manufacturing, construction, inspection, testing and initiation of operations.

A key aspect of API RP 1177 is the focus on continuous improvement, through the use of the "plan-do-check-act" cycle, foundational to API RP 1173. API will develop tools to implement API RP 1177 across the industry through factsheets and outreach materials. Through the adoption and use of API RP 1177, pipeline operators intend to significantly decrease the number of construction related anomalies and improve new operations safety performance.

STRATEGIC INITIATIVE:
PIPELINE INTEGRITY MANAGEMENT

Integrity Management (IM) is a pipeline operator's first line of defense - a risk-based approach where operators utilize innovative inspection technologies, state of the art data integration and best practices to evaluate the integrity of their pipelines. API RP 1160, *Managing System Integrity for Hazardous Liquids Pipelines*, provides pipeline operators technical engineering guidance for assessing pipeline risk, using in-line or "smart-pig" inspections, criteria for performing repairs, analytic models for assessing pipe issues, and guidance for how frequently to re-inspect pipelines. In 2017, API continued its update of API RP 1160 with significant changes incorporating the "plan-do-check-act" cycle of pipeline safety management systems (API RP 1173), along with references to new industry-wide recommendations on crack detection and management (API RP 1176) and data integration (API Bulleting 1178). In 2018, the pipeline industry will develop a "road map" to support industry-wide understanding and implementation of these recommendations.

Promote Organizational Excellence

Objective 1.2
Promote Best Sharing Practices

STRATEGIC INITIATIVE:
SHARING & LEARNING

Pipeline operators have a long history of sharing safety lessons and learnings, which is also facilitated through API and AOPL. In 2017, the industry continued to promote and support the use of established industry learning opportunities through virtual tailgate meetings, safety culture forums and the Pipeline Information eXchange

(PIX). The 2017 PIX had over 100+ attendees who actively engaged in a wide range of pipeline and facility-related safety topics. API hosted two virtual tailgates in 2017 discussing topics like emergency response, excavation damage, and water crossings. Sharing capabilities were also expanded in 2017, with alerts to subscribers highlighting information uploaded to the PIPES safety sharing database and available for sharing.

Promote Organizational Excellence

Objective 1.3
Improve Pipeline Integrity Through Technical Data Analysis

STRATEGIC INITIATIVE:
DATA INTEGRATION

In 2017, API published API Bulletin *1178 – Integrity Data Management and Integration Guideline* along with an explanatory factsheet. The document provides a compilation of methodologies and processes for integrating data that support integrity management programs.

API will also include the data integration guidance in its update of API RP 1160 for integrity management programs, which will guide pipeline operators on the procedures needed to identify integrity management data for risk analysis and the collection of integrity management data from across the organization.

Improve Safety through Technology and Innovation

Objective 2.1
Improve Pipeline Integrity Inspection Technology

STRATEGIC INITIATIVE:
CONTINUOUS IMPROVEMENT OF ILI CAPABILITIES

In 2017, industry sponsored an initiative to work with ILI vendors to develop a roadmap for the next generation of ILI technology to achieve 100% probability of detection, identification and sizing of injurious pipeline anomalies. 2017 activities included industry-led visits and meetings with respective ILI vendors to review specific anomalies that were not detected by existing ILI technology with the goal of developing technology that will identify these features in the future.

Pipeline operators also started an initiative to enhance the performance of in-the-ditch Non-Destructive-Examination (NDE) of anomalies, which will likely include updates to existing API certification testing of NDE technicians with anomalies seen on pipelines and midstream facilities. This effort will contribute to the improvement of ILI technology by providing reliable identification and sizing data from the NDE technicians to the ILI vendors to check and adjust their process for the respective technologies.

Improve Safety through Technology and Innovation

Objective 2.2
Enhance Incident Identification and Response

STRATEGIC INITIATIVE:
LEAK DETECTION AND RESPONSE MANAGEMENT

In 2017, pipeline operators continued to emphasize the importance of API RP 1175, *Leak Detection Program (LDP) Management*. An implementation team pushed the importance of comprehensive leak detection program management through an industry-wide webinar and workshop aimed at increasing operator adoption of the RP.

The team also provided guidance on how to implement successful leak detection programs through completion of a gap assessment and development of tools. API RP 1175 provides the framework for operators to establish comprehensive leak detection programs in their respective companies.

Enhance Emergency Response Preparedness

GOAL

3

Objective 3.1
Boost Operator & First Responder Planning, Preparedness & Response Capabilities

STRATEGIC INITIATIVE:

PIPELINE EMERGENCY PLANNING, PREPAREDNESS AND RESPONSE

The pipeline industry is committed to ensuring effective and efficient emergency response efforts in the event of an incident or spill. Through API Recommended Practice (RP) 1174, *Onshore Hazardous Liquid Pipeline Emergency Preparedness & Response*, operators utilize a framework to develop such a comprehensive emergency response plan that enables continual improvement and promotes safe, timely, and effective response to incidents. The framework includes six fundamental steps: 1. Statements of the system's policies and objectives 2. Documented procedures 3. Documents, records, and job aids 4. Identification of legal and other applicable emergency response requirements 5. Processes intended to ensure continuity and promote system improvement 6. Measure goals and objectives.

In 2017, operators focused their efforts on a communications campaign to the hazardous liquid industry on API RP 1174 to heighten awareness and increase implementation. The communication strategy included integrating API RP 1174 with Pipeline SMS. A dedicated emergency response page was created on PipelineSMS.org with tools to help operators adopt API RP 1174. In 2018, API and AOPL began tracking operator conformance with API RP 1174. As of January 2018, 52% of API and AOPL membership (in barrel miles) committed to implementation. Going forward, operators will report their progress and conformance to API RP 1174 on a yearly basis through a gap assessment tool to be published on PipelineSMS.org. API and AOPL will continue to push for adoption of API RP 1174 which will help to align industry, government, and emergency response organizations on effective and safe emergency response.

Increase Stakeholder Awareness & Involvement

Objective 4.1
Improve Stakeholder Communication on Energy Infrastructure and Pipeline Safety

STRATEGIC INITIATIVE:
STAKEHOLDER ENGAGEMENT

In 2017, the pipeline industry developed and shared content describing how we operate our pipelines and keep them safe. State specific materials in the series "Pipelines: Bringing It All Within Reach" highlighted why new pipelines are essential and what operators do to protect the communities pipelines pass through. A new web platform "Pipelines: Connecting America to Energy" provides a hub for materials on how pipelines stay safe, provide good jobs, consumer benefits and community benefits.

API's "Power Past Impossible" campaign continued throughout the year, making the connection on the value of oil and natural gas to people at a personal level – reinforcing that these products make modern life, and beyond, possible. The campaign is also repositioning the industry, including pipelines, in the public's eye as high-tech and innovative. Specifically, liquid pipeline benefits and use of technology in pipeline construction videos were completed in targeted states. These overarching messages help support pipeline communications efforts in building a foundation for advancing the conversation on America's future energy and infrastructure needs.

Additional video and digital content is under development in 2018. New videos will demonstrate how pipeline operators keep their pipelines operating safely and protect the environment. Video production will share the stories of how pipeline operators responded to Hurricane Harvey, prepare for emergencies in challenging conditions, use technology to inspect pipelines, demonstrate a commitment to environmental stewardship, support veterans job security, and are good neighbors and good corporate citizens. A study of the economic benefits of pipelines will help operators better understand how and why selected audiences use energy delivered by pipelines.

Pipeline operators are also meeting their commitments under federal regulation to develop and implement programs to increase public awareness of pipelines in local communities. Work is underway to update the industry-wide standard, API RP 1162, *Public Awareness Programs for Pipeline Operators*. In 2018, pipeline operators will work together with representatives of the public to improve how operators must educate the public about pipeline locations, risks and hazards, damage prevention and emergency response. A theme for 2018 is developing ways to measure the effectiveness of public awareness programs and to help all stakeholders involved better understand "behavioral change" and communications.

Increase Stakeholder Awareness & Involvement

Objective 4.2
Promote Innovative Approaches to Enhancing Damage Prevention

STRATEGIC INITIATIVE:
EXCAVATION DAMAGE

The unintentional striking of a pipeline by digging or excavating near a pipeline is an avoidable incident. Pipeline operators work not only to prevent damage to their pipelines, but more importantly prevent harm to those accidentally striking a pipeline. One main tool to assist pipeline operators is the industry *Excavation Tool Box* with lessons learned and strategies for avoiding pipeline strikes. In 2017, the pipeline operators developed a new toolbox section on Excavation Job Planning.

In 2018, operators will work together to better understand how to minimize damage from company and contractor excavations and develop a plan to address these 1st and 2nd party excavation damage sources. Industry will also harvest the results of their Public Awareness Program Effectiveness Research Survey (PAPERS) conducted every two years to measure the effectiveness of communications with local public officials, excavators and the public.

2017
PERFORMANCE
# REPORT

KEY PERFORMANCE INDICATORS

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.

Each one of the following measures is used by the liquids pipeline industry to better understand pipeline incident trends and develop strategies for improving pipeline safety. However, the liquids pipeline industry also tracks a core set of Key Performance Indicators (KPIs) as a sign of overall pipeline safety performance. These KPIs are based primarily on incidents impacting people or the environment (IPE). They are newly created measures introduced in 2017 following a collaborative effort between PHMSA, public pipeline safety advocates represented by the Pipeline Safety Trust and the liquids pipeline industry. They reflect the highest priority we place on protecting people or the environment.

The four industry-wide KPIs are **1) Total Incidents Impacting People or the Environment; 2) IPE Incidents due to Integrity Management (IM) Causes; 3) IPE Incidents due to Operations and Maintenance (O&M) Causes; 4) and Participation in Pipeline Safety Management System (PSMS) Programs.** Integrity management causes are those pipe issues designed to be prevented by operator programs focused on assessment of line pipe integrity, including corrosion and cracking. Operations and maintenance causes are typified by equipment failure or incorrect operations.
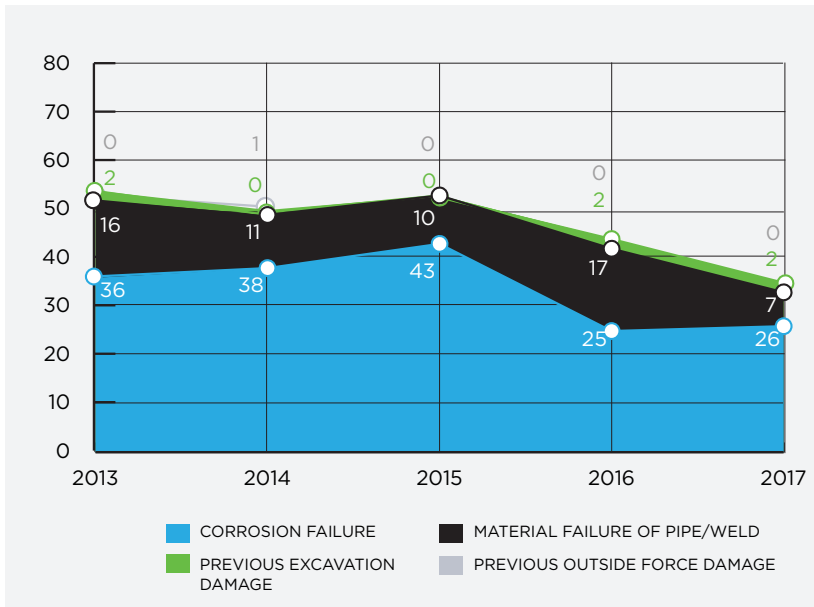
Key Performance Indicators
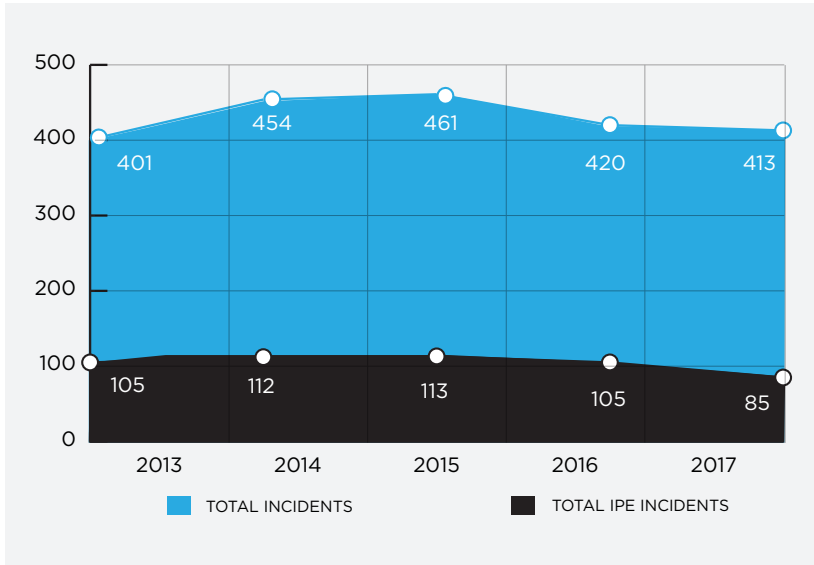
TOTAL INCIDENTS **TOTAL IPE INCIDENTS**

### #1: TOTAL INCIDENTS & TOTAL IPE INCIDENTS (2013-2017)

In 2017, approximately 85 incidents impacted the people or the environment, 20 fewer incidents than 2016, a 19% decrease in IPE incidents from 2016 as well as 2013. IPE incidents in 2017 represented 21% of total incidents (413) in that year. A full description of the specific types of incidents falling under the IPE criteria can be found on page 46.

CORROSION FAILURE

MATERIAL FAILURE OF PIPE/WELD

PREVIOUS EXCAVATION DAMAGE

PREVIOUS OUTSIDE FORCE DAMAGE

### #2: INTEGRITY MANAGEMENT IPE INCIDENTS (2013-2017)

Integrity Management (IM) IPE releases are caused by failures of the pipeline, such as corrosion, cracking or a failure of the pipe metal or weld. Over the last 5 years, total IM IPE releases are down 35% from 54 to 34, and incidents caused by corrosion are down approximately 31%. Incidents caused by a failure of pipe metal or weld seams are down approximately 60%.

EQUIPMENT FAILURE

INCORRECT OPERATION

EXCAVATION DAMAGE
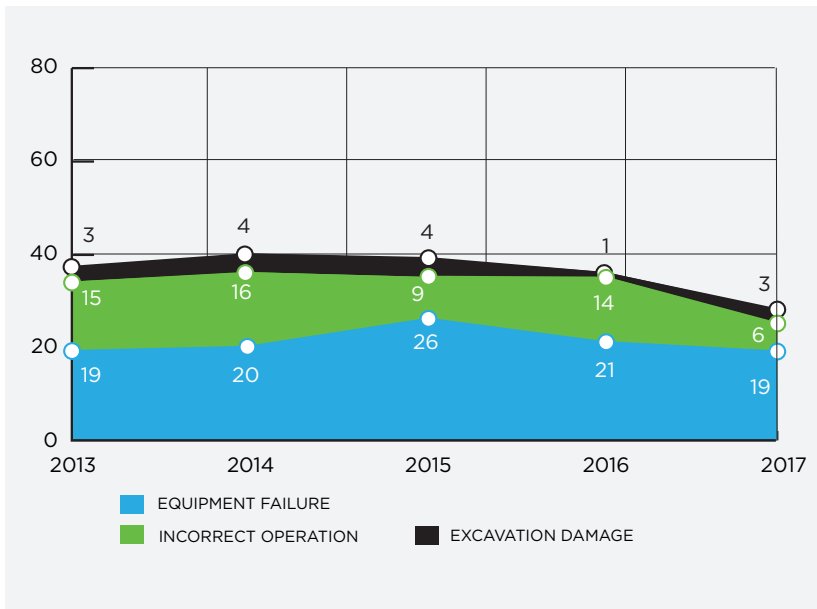
#3: OPERATIONS AND MAINTENANCE (O&M) IPE INCIDENTS

O&M IPE incidents reflect actions by operators during their day-to-day activities operating their pipeline network. Operations activities, such as installing and maintaining equipment and operating the pipeline and its valves, pumps and storage equipment, make up O&M IPE. Total O&M incidents are down 24% over the last five years. Equipment failure remained consistent from 2013 to 2017 and incorrect operations decreased by 60% from over the last 5 years.


PERCENTAGE OF BARREL MILES
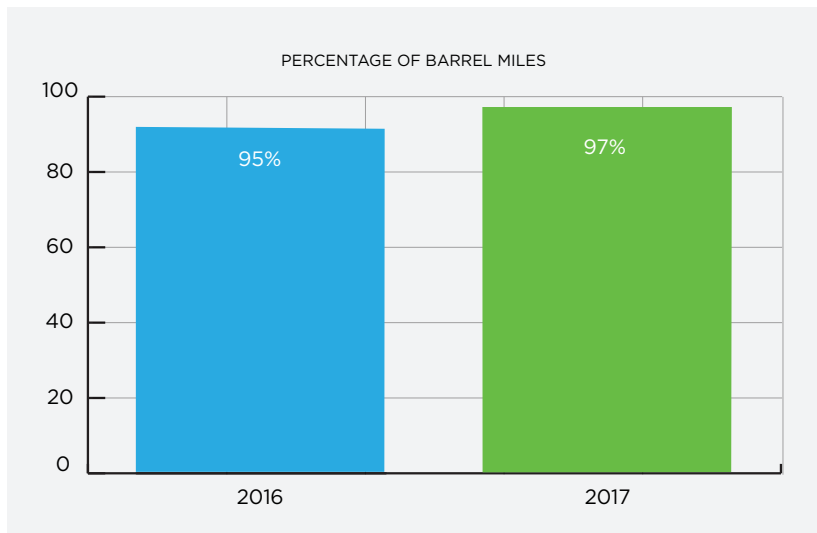
#4: PSMS OPERATOR COMMITMENT

In 2017, the pipeline industry increased operator commitment to pipeline safety management systems from 95% of barrel miles to 97% 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 (IPE). Tracking IPE 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.

CONTAINED ON OPERATOR PROPERTY   OUTSIDE OPERATOR PROPERTY
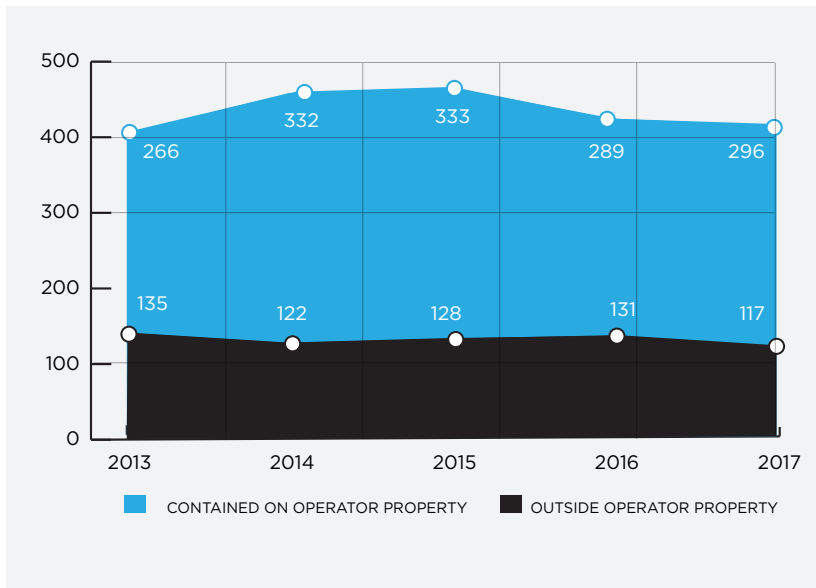
#5: PIPELINE INCIDENTS INSIDE AND OUTSIDE OF OPERATOR PROPERTY (2013-2017)

In 2017, 72% of incidents from liquids pipelines were wholly contained within an operator's property. Specifically, in 2017, there were 296 operator property contained incidents and 117 had impacts outside of operator property. Examples of pipeline operator property include pump stations, tank farms and terminals. Pipeline operators report incidents contained on operator property to PHMSA. While incidents in public spaces constituted only 28% of total incidents, reducing this number is a top priority for industry.
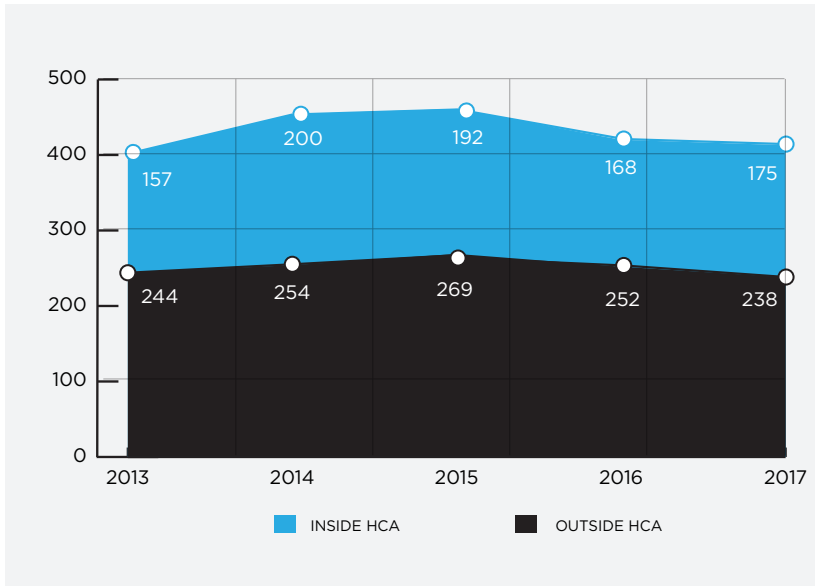
#6: PIPELINE INCIDENTS INSIDE HCAS (2013-2017)

Through federal regulation, PHMSA tracks incidents defined as occurring in high-consequence areas (HCAs). HCAs are defined as areas of population concentration, commercially navigable waterways, or sensitive environmental locations. IPE data differs from HCA data in that it can include incidents wholly contained within an operator's property if that property is within the boundaries of a surrounding HCA, even if that inside property-contained incident had no impact on the people or the environment. In 2017, 42% of total incidents were in HCAs.
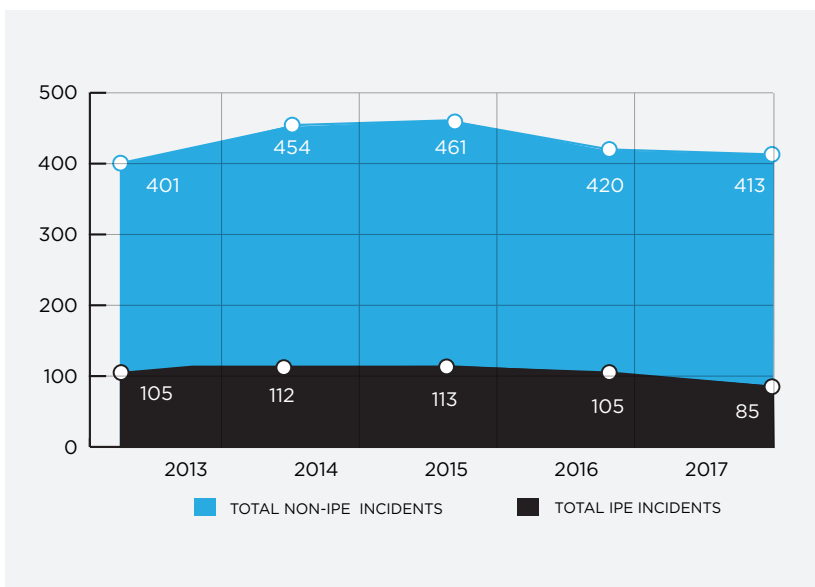
#7: TOTAL INCIDENTS & TOTAL IPE INCIDENTS (2013-2017)

In 2017, approximately 85 incidents impacted the people or the environment, 20 fewer incidents than 2016, reflecting 4% decrease in IPE incidents from 2016. IPE incidents in 2017 represented 21% of total incidents in that year. A full description of the specific types of incidents falling under the IPE criteria can be found on page 46.

Incidents by Size

#8: LIQUID PIPELINE INCIDENTS BY SIZE (2013-2017)

Most pipeline incidents are small in size. In 2017, 60% of the incidents were less than 5 barrels (1 barrel = 42 gallons) and 84% were less than 50 barrels. In 2017, only 6% of incidents were 500 barrels or larger.
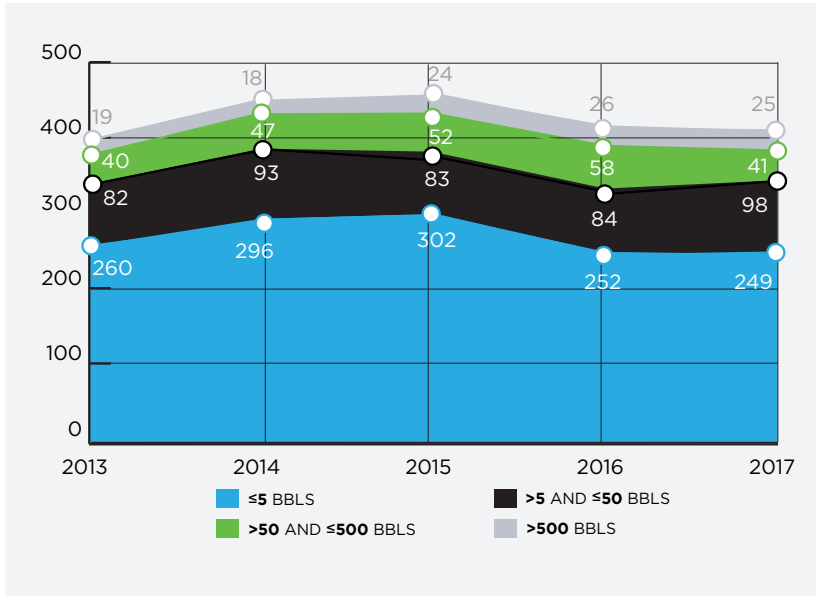
#9: IPE INCIDENTS BY SIZE (2013-2017)

Most IPE incidents are small in size. In 2017, approximately 61% of the IPE incidents were less than 50 barrels, with 12% of the incidents 500 barrels or larger.

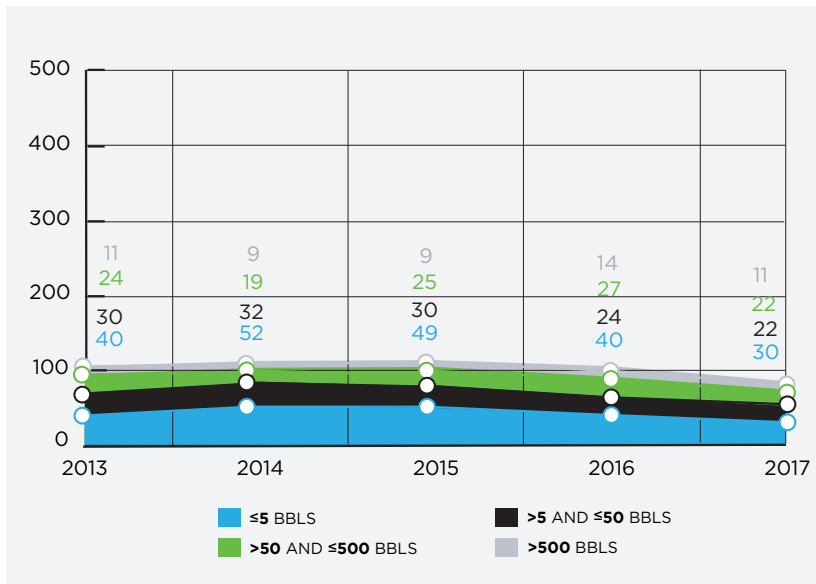| Year	≤5 BBLS	>5 AND ≤50 BBLS	>50 AND ≤500 BBLS	>500 BBLS
2013	123	49	25	8
2014	149	54	31	7
2015	164	51	31	11
2016	120	41	35	8
2017	118	45	29	13

Legend:
- ≤5 BBLS
- >5 AND ≤50 BBLS
- >50 AND ≤500 BBLS
- >500 BBLS
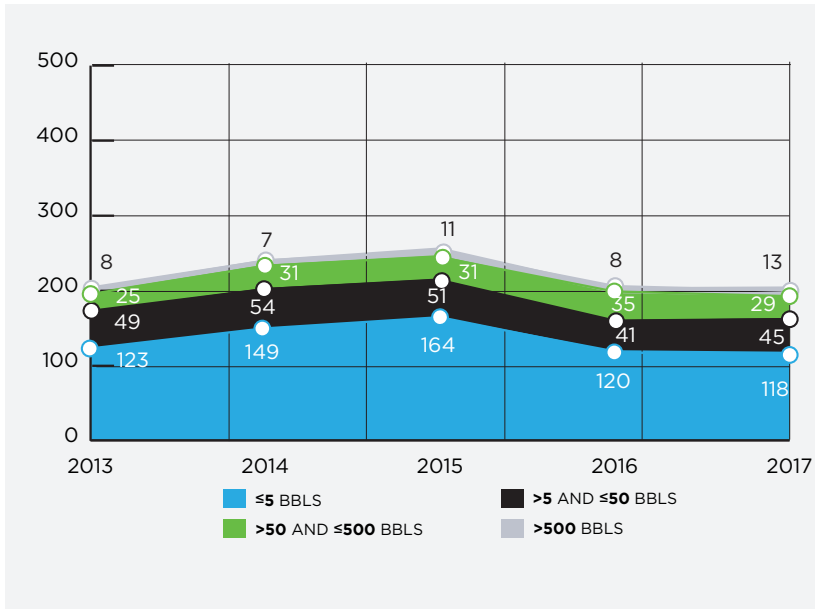
#10: CRUDE OIL INCIDENTS BY SIZE (2013-2017)

Similar to total incident trends, the majority of crude oil incidents are small in size. In 2017, 58% of crude oil incidents were 5 barrels or smaller. Over the last 5 years, crude oil incidents less than 5 barrels decreased 4% from 123 to 118 and the number of crude oil incidents 500 barrels or larger increased 40% from 8 to 13. Over the same period, total crude oil releases remained the same at 205 incidents.

Incidents by Commodity
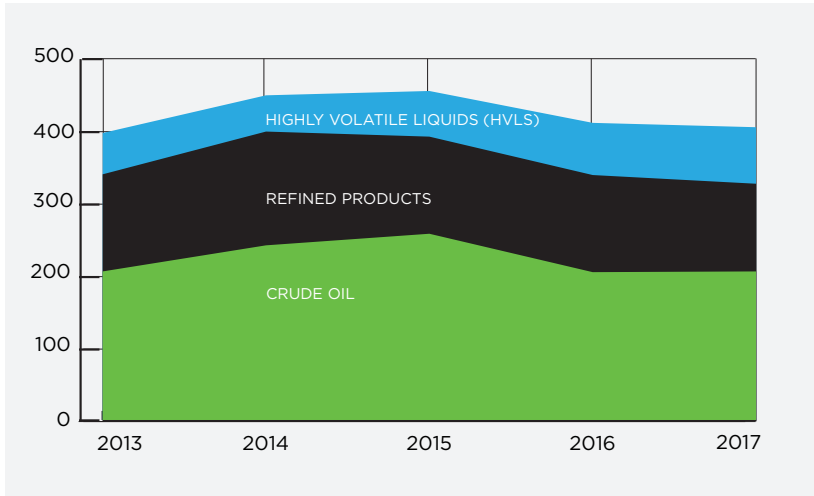
#11: ALL INCIDENTS BY COMMODITY (2013-2017)

In 2017, crude oil incidents represented 50% of total incidents, with refined products at 29% and natural gas liquids at 19% of total incidents. The number of annual crude oil incidents are down 20% from their peak in 2015 and unchanged from 2013.
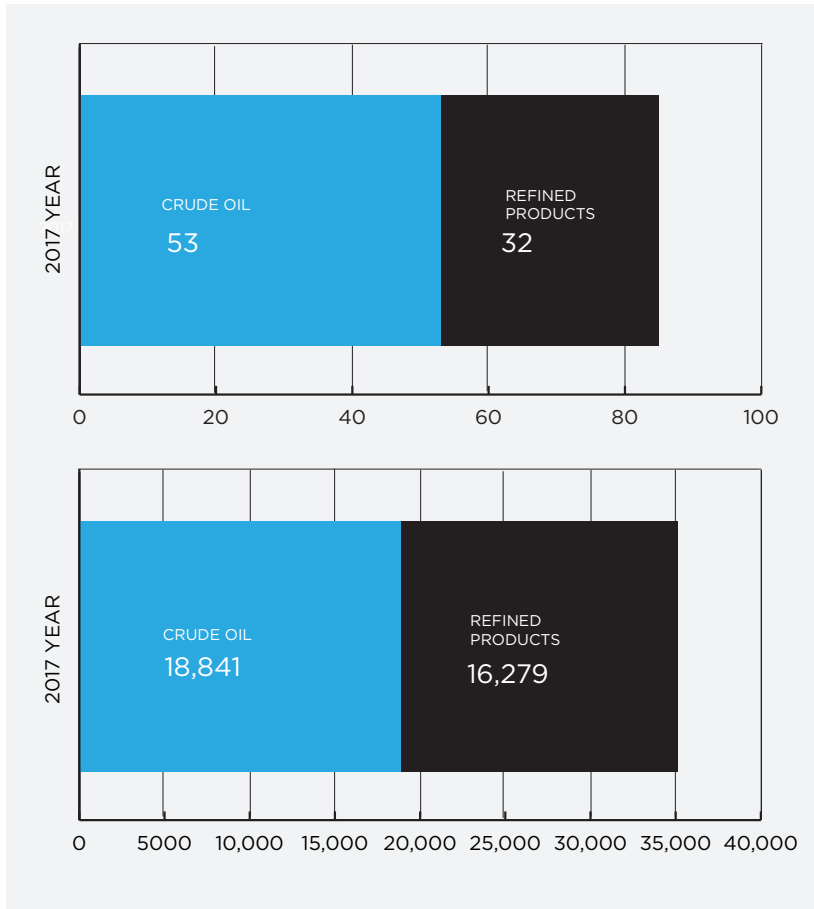
#12: IPE INCIDENTS BY COMMODITY (2017)

In 2017, there were 53 crude oil IPE incidents and 32 refined products IPE incidents.

#13: PERCENTAGE OF IPE BARRELS RELEASED BY COMMODITY (2017)

Crude oil incidents impacting the people or the environment (IPE) in 2017 represented 62% of total IPE incidents and 54% of total IPE incident barrels. Over the last 5 years, the percentage of crude oil IPE incidents is down 24%.

Incidents by Cause

Equipment Failures — 45%
Corrosion Failures — 19%
Incorrect Operations — 15%
Material Pipe/Weld Failures — 7%
Natural Force Incidents — 5%
Other Incident Causes — 4%
Excavation Incidents — 3%
Outside Force Incidents — 2%

(x-axis: 0, 10, 20, 30, 40, 50)
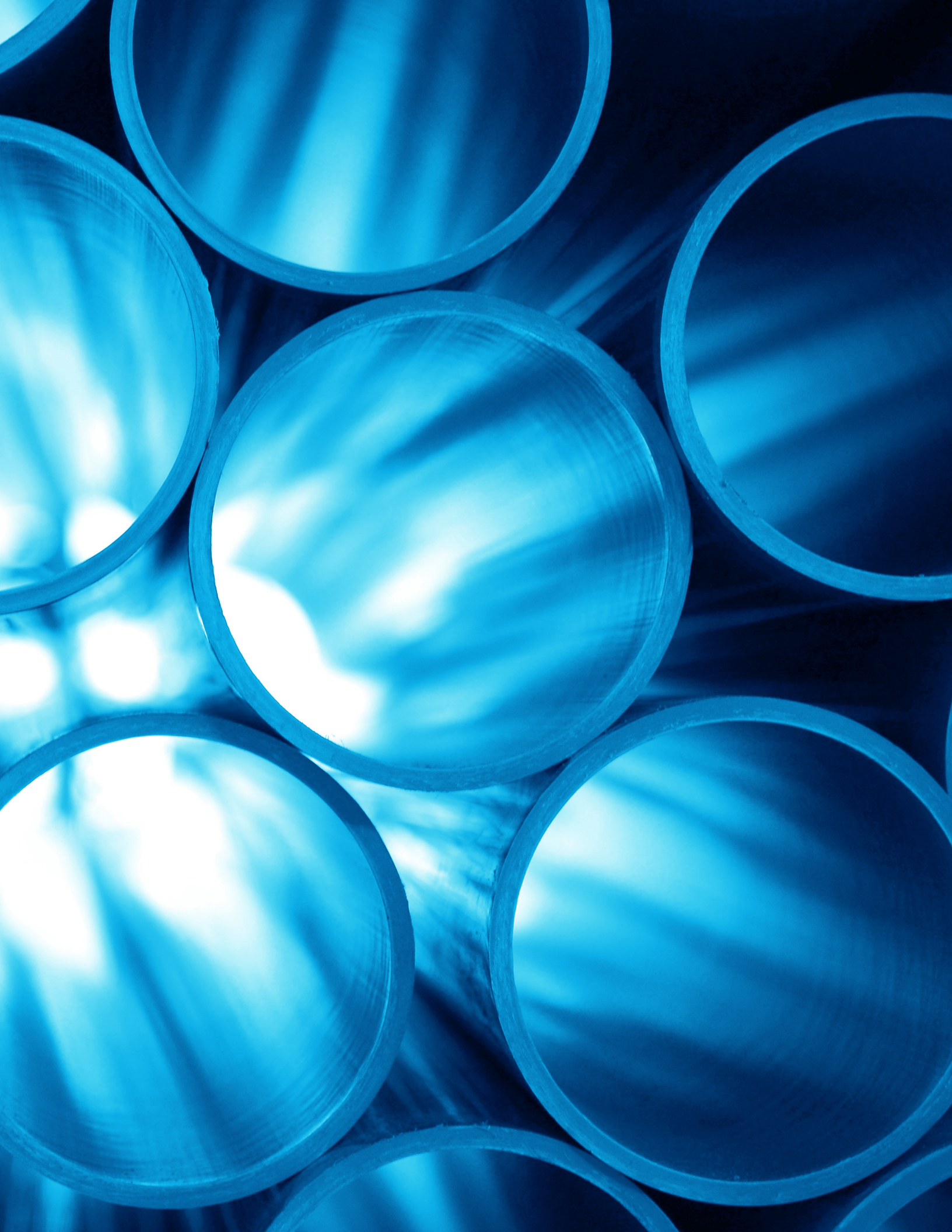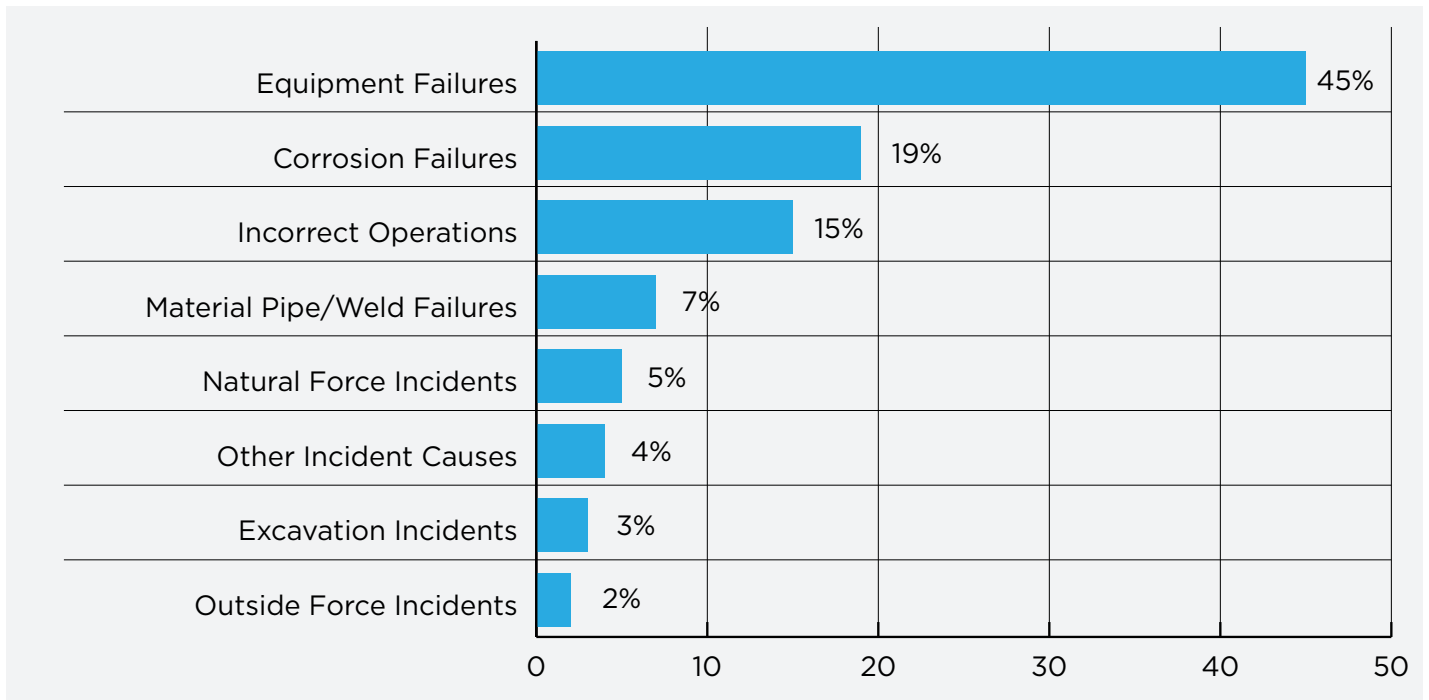
#14: LIQUIDS PIPELINE INCIDENTS BY CAUSE (2013-2017)

Equipment failure is the most frequent cause of liquids pipeline incidents. Over the last 5 years, equipment failure represented 45% of incidents, corrosion failure 19% and incorrect operation 15% of incidents. Material pipe/weld failures include cracking, a primary source of large volume releases, but represented only 7% of incidents over the last 5 years.

Chart #15

Cause	Percent
Corrosion Failures	32%
Equipment Failures	20%
Material Pipe/Weld Failures	12%
Incorrect Operations	12%
Excavation Incidents	9%
Natural Force Incidents	6%
Other Incident Causes	5%
Outside Force Incidents	4%

0   7   14   21   28   35

Chart #16

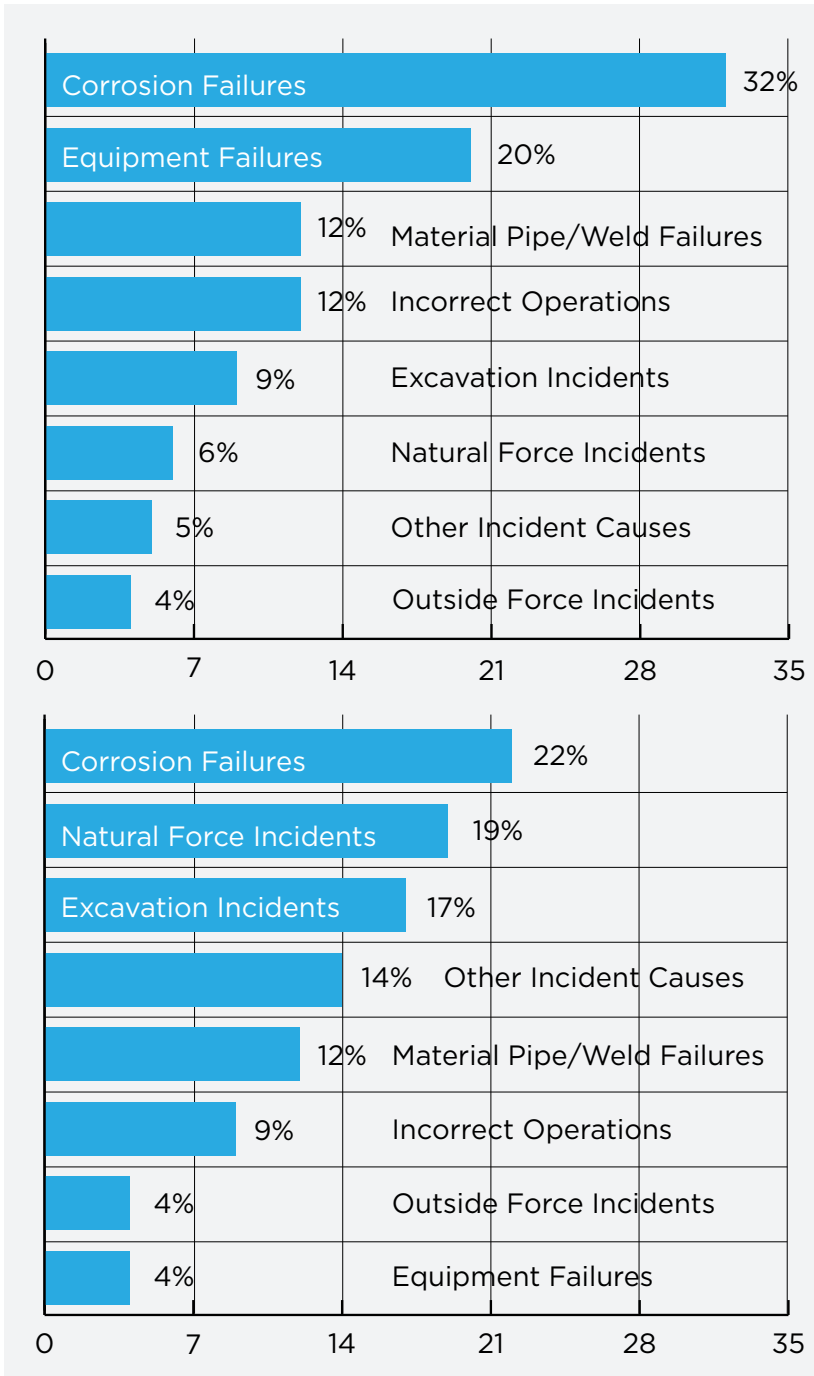| Cause	Percent
Corrosion Failures	22%
Natural Force Incidents	19%
Excavation Incidents	17%
Other Incident Causes	14%
Material Pipe/Weld Failures	12%
Incorrect Operations	9%
Outside Force Incidents	4%
Equipment Failures	4%

0   7   14   21   28   35

#15: LIQUIDS IPE PIPELINE INCIDENTS BY CAUSE (2013-2017)

The most frequent cause of IPE incidents over the last 5 years was corrosion at 32% of total IPE incidents.

#16: PERCENTAGE OF IPE BARRELS RELEASED BY CAUSE (2013-2017)

Corrosion was responsible for the largest number of barrels released from IPE incidents at 22%. Equipment failure, the most frequent cause of all incidents, was the cause of only 4% of IPE incident 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. Natural force incidents (19%) and excavation incidents (17%) account for 36% of the IPE barrels released over the last five years *(such as flooding, earthquakes, and lightning).*

Pipeline Miles & Barrels Delivered
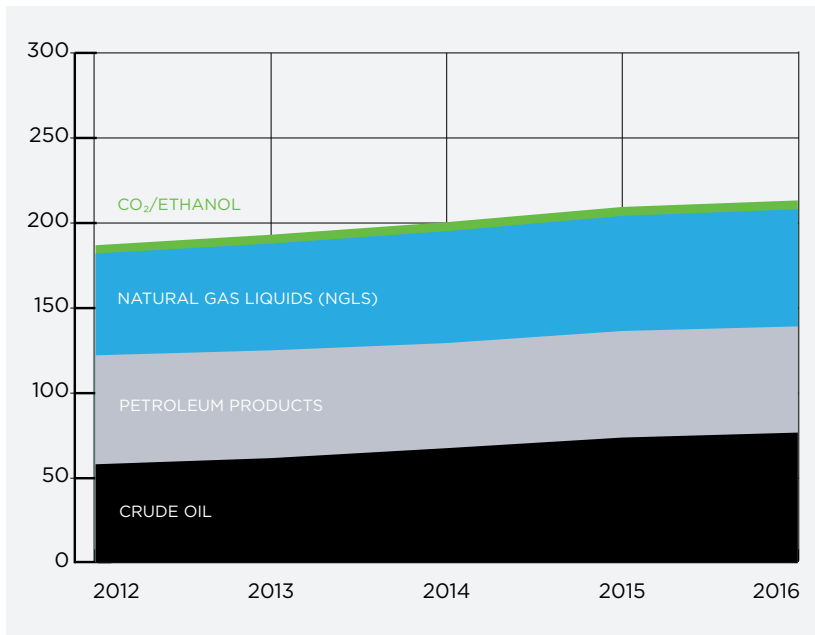
#17: MILES OF U.S. LIQUIDS PIPELINES BY PRODUCTS (2012-2016)

(Thousands)

At the end of 2016, there were 212,568 total miles of liquid pipelines, with crude oil pipelines representing 36% of the total. Over the last five years, the total miles of pipeline have increased by 26,346 or 14%.
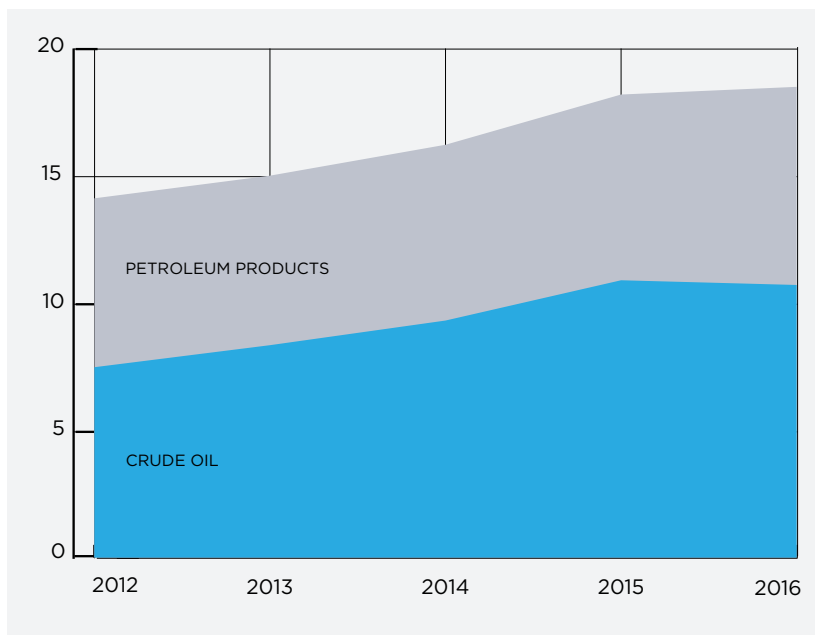
#18: BARRELS DELIVERED BY U.S. LIQUIDS PIPELINE (2012-2016)

(Billions)

In 2016, there were a total of 18,447,493,712 barrels delivered by pipeline, with crude oil representing approximately 58% of the barrels delivered. Over the last five years, crude oil barrels delivered by pipeline have increased by approximately 31% or 4,368,303,450 barrels.

Data **Appendix**

GRAPH #1:	TOTAL INCIDENTS & TOTAL IPE INCIDENTS (2013-2017)	
Year	Total IPE Incidents	Total Incidents
2013	105	401
2014	112	454
2015	113	461
2016	105	420
2017	85	413
% Change from 2013	-19%	3%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2018.

GRAPH #2:	IM IPE RELEASES (2013-2017)				
Year	Corrosion Failure	Material Failure of Pipe/Weld	Previous Excavation Damage	Previous Outside Force Damage	Total Incidents
2013	36	16	2	0	54
2014	38	11	0	1	50
2015	43	10	0	0	53
2016	25	17	2	0	44
2017	26	7	2	0	35
% Change from 2013	-28%	-56%	0%	0%	-35%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2018.

GRAPH #3:	O&M IPE INCIDENTS (2013-2017)			
Year	Equipment Failure	Incorrect Operation	Excavation Damage	Total Incidents
2013	19	15	3	37
2014	20	16	4	40
2015	26	9	4	39
2016	21	14	1	36
2017	19	6	3	28
% Change from 2013	0%	-60%	0%	-24%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2018.

GRAPH #4:	PSMS OPERATOR COMMITMENT (BARREL MILES)
Year	% Commitment
2016	95
2017	97

Source: API and AOPL Membership Survey.

GRAPH #5:	PIPELINE INCIDENTS INSIDE AND OUTSIDE OF OPERATOR PROPERTY		
Year	Outside Operator Property	Contained on Operator Property	Total Incidents
2013	135	266	401
2014	122	332	454
2015	128	333	461
2016	131	289	420
2017	117	296	413
Total	633	1,516	2,149
% Change from 2013	-13%	11%	6%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2018.

GRAPH #6:	PIPELINE INCIDENTS IMPACTING HCAS		
Year	Outside HCA	Inside HCA	Total Incidents
2013	244	157	401
2014	254	200	454
2015	269	192	461
2016	252	168	420
2017	238	175	413
Total	1,257	892	2,149
% Change from 2013	-2%	11%	6%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2018.

GRAPH #7:	TOTAL INCIDENTS & TOTAL IPE INCIDENTS (2013-2017)	
Year	Total IPE Incidents	Total Incidents
2013	105	401
2014	112	454
2015	113	461
2016	105	420
2017	85	413
% Change from 2013	-19%	3%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2018.

Data Appendix

GRAPH #8:	LIQUID PIPELINE INCIDENTS BY SIZE (2013-2017)				
Year	≤ 5 Bbls	> 5 and ≤ 50 Bbls	> 50 and ≤ 500 Bbls	> 500 Bbls	Total Incidents
2013	260	82	40	19	401
2014	296	93	47	18	454
2015	302	83	52	24	461
2016	252	84	58	26	420
2017	249	98	41	25	413
% Change from 2013	-4%	20%	3%	32%	3%

Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2018.

GRAPH #9:	IPE INCIDENTS BY SIZE (2013-2017)				
Year	≤ 5 Bbls	> 5 and ≤ 50 Bbls	> 50 and ≤ 500 Bbls	> 500 Bbls	Total Incidents
2013	40	30	24	11	105
2014	52	32	19	9	112
2015	49	30	25	9	113
2016	40	24	27	14	105
2017	30	22	22	11	85
Total	211	138	117	54	0
% Change from 2013	-25%	-27%	-8%	0%	0%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2018.

GRAPH #10:	CRUDE OIL INCIDENTS BY SIZE (2013-2017)				
Year	≤ 5 Bbls	> 5 and ≤ 50 Bbls	> 50 and ≤ 500 Bbls	> 500 Bbls	Total Incidents
2013	123	49	25	8	205
2014	149	54	31	7	241
2015	164	51	31	11	257
2016	120	41	35	8	204
2017	118	45	29	13	205
% Change from 2013	-4%	-8%	16%	63%	0%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2018.

GRAPH #11:	INCIDENTS BY COMMODITY (2013-2017)					
Year	Crude Oil	Refined Products	Highly Volatile Liquids (HVLs)	CO$_2$	Biofuel/Ethanol	Total Incidents
2013	205	134	57	5	0	401
2014	241	157	50	5	1	454
2015	257	134	63	7	0	461
2016	204	134	72	9	1	420
2017	205	121	78	9	0	413
% Change from 2013	0%	-10%	37%	80%	0%	3%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2018.

GRAPH #12:	INCIDENTS BY COMMODITY (2017)	
Year	Crude Oil	Refined Products
2013	70	35
2014	71	41
2015	75	38
2016	70	35
2017	53	32
% Change from 2013	-24%	-9%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2018.

GRAPH #13:	PERCENTAGE OF IPE BARRELS RELEASED BY COMMODITY (2013-2017)	
Year	Crude Oil	Refined Products
2013	78%	22%
2014	45%	55%
2015	65%	35%
2016	64%	36%
2017	54%	46%
% Change from 2013	-49%	53%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2018.

Data Appendix

GRAPH #14:	LIQUIDS PIPELINE INCIDENTS BY CAUSE (2013-2017)	
Cause	**Total Incidents**	**Percentage**
Equipment Failures	968	45%
Corrosion Failures	418	19%
Incorrect Operations	322	15%
Material Pipe/Weld Failures	149	7%
Natural Force Incidents	101	5%
Other Incident Causes	80	4%
Excavation Incidents	69	3%
Outside Force Incidents	42	2%
Total	**2,149**	

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2018.

GRAPH #15:	TOTAL IPE INCIDENTS BY CAUSE (2013-2017)	
Cause	**Total Incidents**	**Percentage**
Corrosion Failures	168	32%
Equipment Failures	105	20%
Material Pipe/Weld Failures	61	12%
Incorrect Operations	60	12%
Excavation Incidents	47	9%
Natural Force incidents	30	6%
Other Incident Causes	26	5%
Outside Force incidents	23	4%
Total	**520**	

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2018.

GRAPH #16:	IPE BARRELS RELEASED BY CAUSE (2013 -2017)	
Cause	**Barrels Released**	**Percentage**
Corrosion Failures	40,577	22%
Natural Force Incidents	34,817	19%
Excavation Incidents	30,675	17%
Other Incident Causes	25,936	14%
Material Pipe/Weld Failures	21,279	12%
Incorrect Operations	16,973	9%
Outside Force Incidents	6,712	4%
Equipment Failures	6,483	4%

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2018.

GRAPH #17:	MILES OF U.S. PIPELINE AND BARRELS DELIVERED (2012-2016)				
	2012	**2013**	**2014**	**2015**	**2016**
Crude Oil	57,463	61,087	66,943	73,171	76,092
Petroleum Products	64,042	63,351	61,767	62,634	62,435
Natural Gas Liquids (NGLs)	59,861	62,768	65,792	67,667	68,831
CO_2/Ethanol	4,856	5,206	5,292	5,256	5,210
Total Miles	**186,221**	**192,412**	**199,793**	**208,728**	**212,568**

Source: Pipeline and Hazardous Materials Safety Administration, PHMSA Pipeline Safety as of March 2018.

GRAPH #18:	MILES OF U.S. PIPELINE AND BARRELS DELIVERED (2012-2016)				
	2012	**2013**	**2014**	**2015**	**2016**
Crude Oil	7,460,710,613	8,324,012,774	9,289,972,460	10,868,122,224	10,683,361,776
Petroleum Products	6,618,479,649	6,643,084,825	6,888,545,527	7,278,500,447	7,764,131,936
Total Barrels	**14,079,190,262**	**14,967,097,599**	**16,178,517,987**	**18,146,622,671**	**18,447,493,712**

Source: U.S. Federal Energy Regulatory Commission

DEFINITIONS & NOTES

BARRELS

One barrel of crude oil or petroleum products contains 42 gallons.

BARRELS RELEASED

Pipeline operators report to PHMSA the number of barrels released unintentionally during each pipeline incident. 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, called "blowdown," vents the gas product 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 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

PHMSA INCIDENT REPORTING

Pipeline operators regulated by PHMSA are required to report data related to pipeline incidents including location, cause and consequences. PHMSA compiles this information in a publicly available online database. The pipeline safety data used in this report was obtained from PHMSA in March 2018.

API RECOMMEND PRACTICE

Documents that communicate proven industry practices; RPs may include both mandatory and non-mandatory provisions.

REFINED PRODUCTS

Products derived from the process of refining crude oil. Examples of refined products include: gasoline, kerosene, and lubricating oil.

CRUDE OIL

Includes condensate, light, medium, and heavy unrefined hydrocarbons extracted from underground petroleum formations.

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