

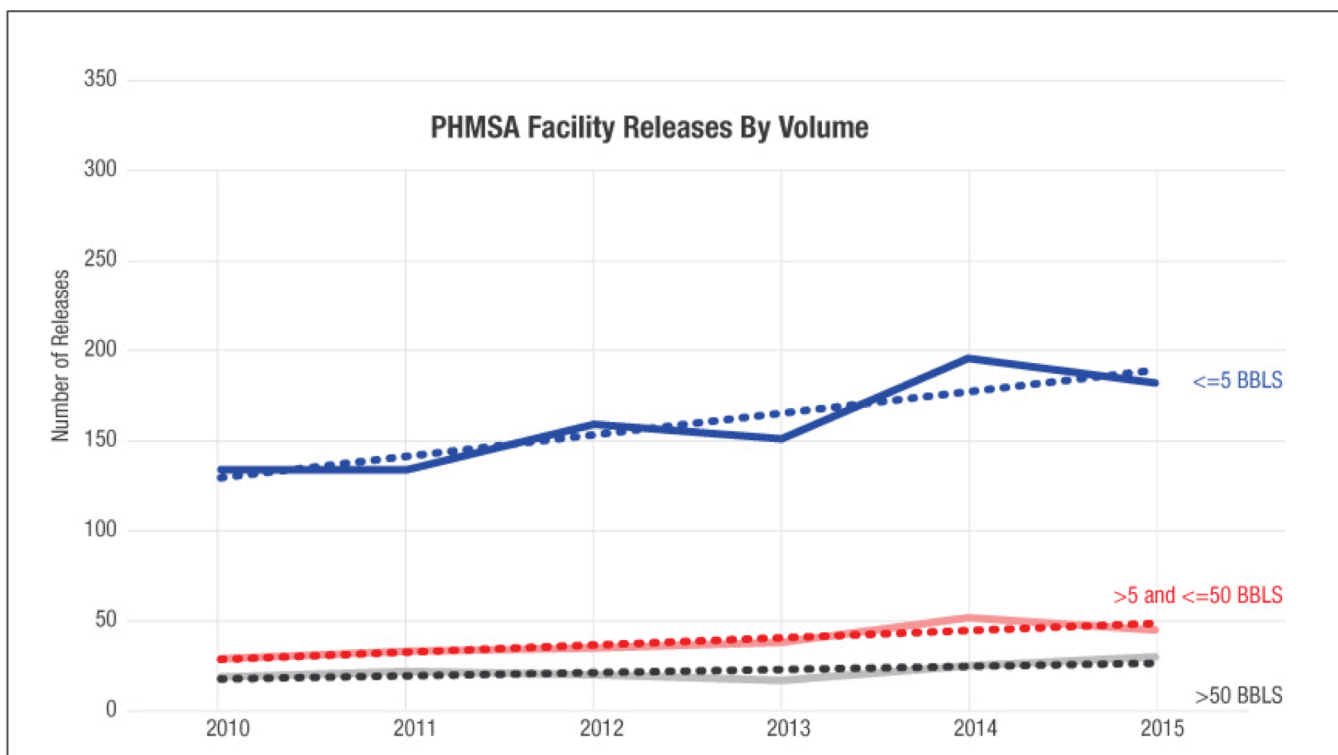
## PPTS OPERATOR ADVISORY FACILITIES PIPING AND EQUIPMENT

### Overview

The petroleum pipeline industry has undertaken a voluntary performance tracking initiative, recording detailed information about spills and releases with their causes and consequences. Industry members of the American Petroleum Institute and the Association of Oil Pipe Lines believe that tracking and learning from spills will improve performance, thus demonstrating the industry's firm commitment to safety and environmental protection. The advisory bulletin utilizes information captured in API's Pipeline Performance Tracking System, as well as data collected by PHMSA's accident report form to analyze the leading causes of facility releases and provide recommendations for industry operators.

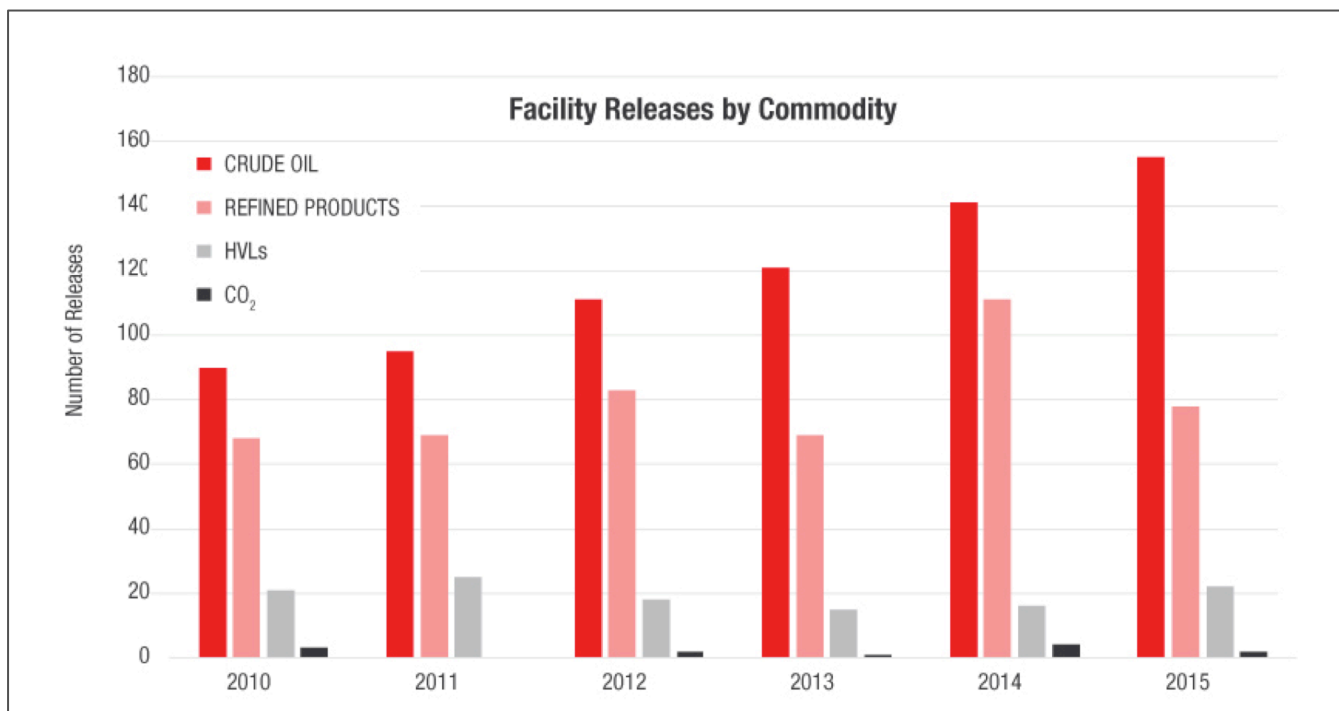
### Understanding Facility Releases

A review of the PHMSA hazardous liquid release data indicates that most releases from pipeline facilities are small ( $\leq 5$  BBLs).

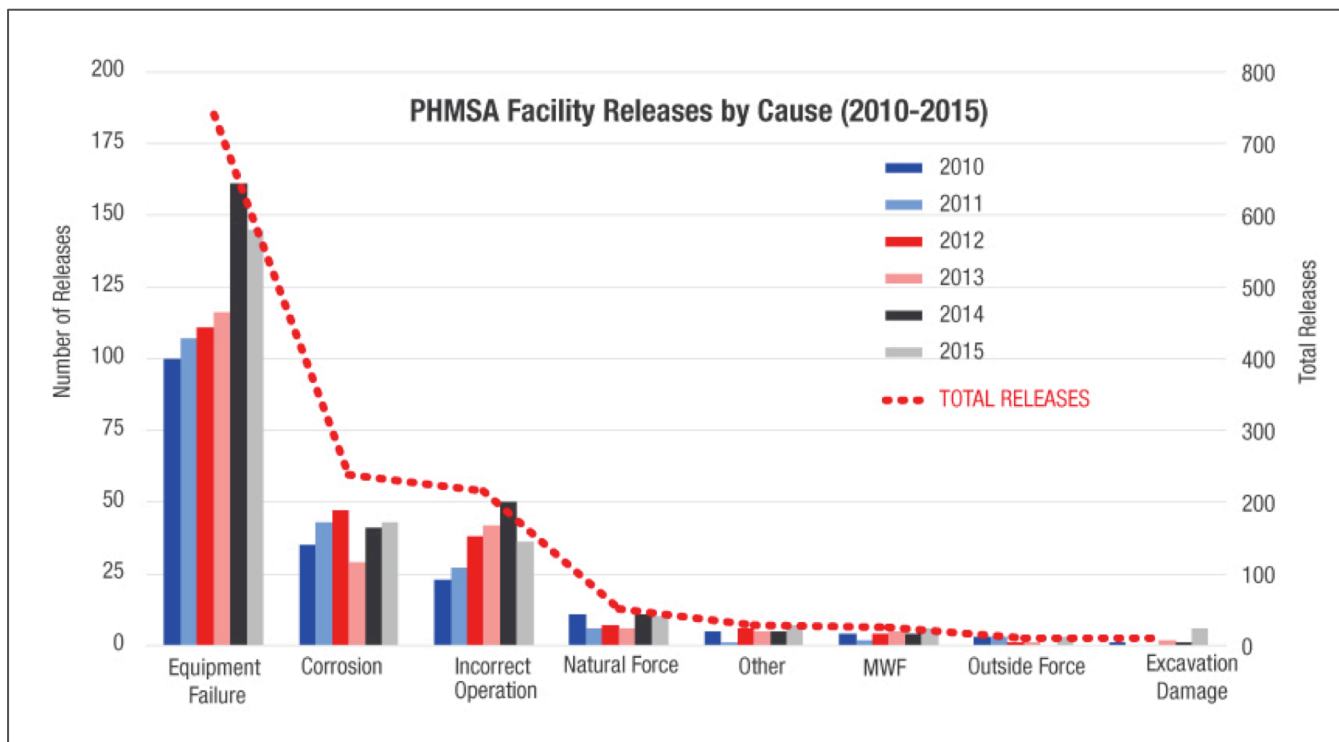


Sources for figures 1, 2, 3, 4, and 5: PHMSA 7000-1 (Hazardous Liquids Accident Report)

PHMSA facility releases seem to be driven mostly by crude spills followed by refined product spills.



The leading causes of facility releases are equipment failure, corrosion and incorrect operation. The number of releases due to both equipment failures and incorrect operation are increasing while corrosion has remained relatively constant since 2010.



## Key Findings:

- Within the equipment failure category, pumps are the leading cause. This is due primarily to seal /packing failures, followed by gasket or O-ring failures. Additional factors that contribute to pump failures are excessive vibration, improper installation, manufacturing defects, breakdown of soft goods and thermal stress
- The main contributing factors for facility releases under incorrect operations included: incorrect valve positions, tank overfills and improperly installed equipment.
- The information above is based on large amounts of raw data; therefore, determining the solutions to the root causes needs further individual operator investigation.

## Operator Considerations

### ❖ Seal failure recommendations include:

- Failure of the pump shaft seal is the most common cause of facility releases. Even though pump seal failures depend highly on the seal, type and material pairing, common causes for failure include excessive heat, high vibration, excessive friction (inadequate lubrication and/or running dry) and improper material construction for commodity transported.
- Best practices to extend the seal life and minimize failures include performing failure analyses when seal failures occur and adopting recommendations found in API Standard 682 (Pumps-Shaft Sealing Systems for Centrifugal and Rotary Pumps), Fourth Edition into the operators' preventative maintenance program(s).
  - API Standard 682, Fourth Edition includes seal technology advancements; improved seal cooling processes, improved seal leakage detection methods, and recommendations for updated design features. The standard also includes methods to periodically test pump seals that enhance failure detection in order to prevent unwanted releases

### ❖ Internal corrosion recommendations include:

- Of the facility releases caused by internal corrosion, at least 50% occurred at the low point in the pipe where corrosion is most likely to occur.
- Dead legs, intermittently used facility lines, drain lines and relief lines all have a common denominator: limited, sporadic flow or no flow and the issues this entails. Dead Legs have historically shown that they are susceptible to internal corrosion, particularly in crude oil service, and should be considered at higher risk for this specific threat. As a result, many operators have or are in the process of eliminating dead legs in their systems.

Operators should consider the following:

- Draining and isolating dead legs in crude oil service that serve no further process purpose.
- Developing a phase-out plan for systematically removing these dead legs.
- Create a schedule for flushing dead legs and intermittently used lines with fluids that contain biocide(s) to inhibit microbial growth and reduce the threat of internal corrosion.
- Incorporate a dead leg program within the facility.
- Incorporate a piping inspection program within the facility, which includes elevation as a variable.

❖ Incorrect operations recommendations include:

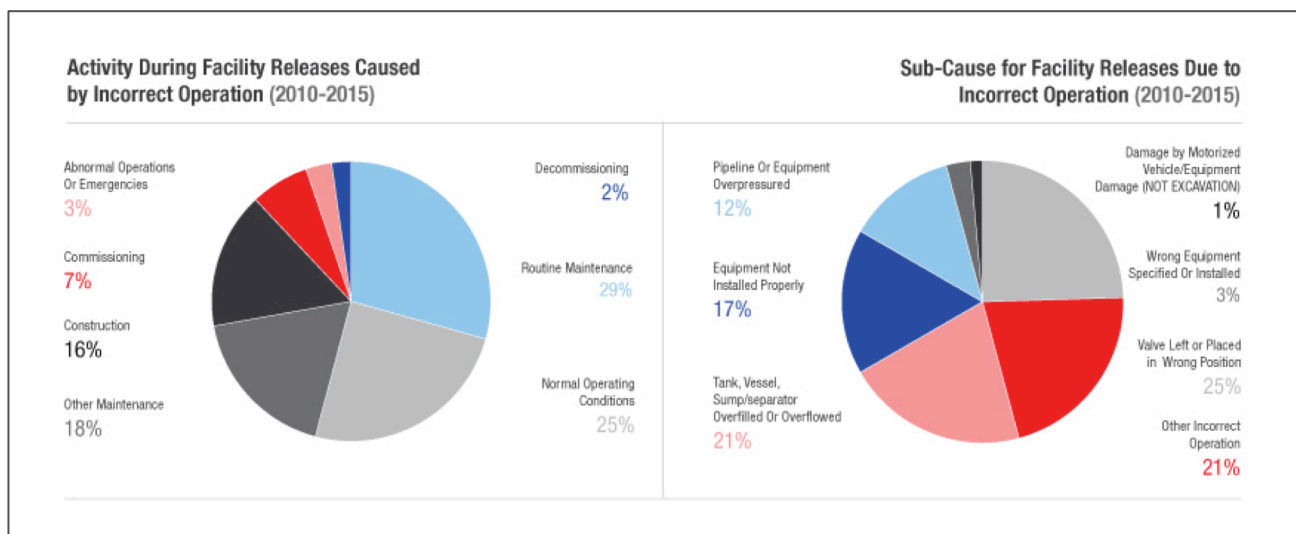
- Although much of pipeline operations can now be automated, humans continue to serve a primary role in many activities touching nearly all aspects of pipeline operations. Operator error / incorrect operations accounted for 16% of all incidents and 6% of the spill volume reported to PHMSA via the Hazardous Liquid Accident Report form from 2010 to 2015. While the data indicates that volumes released during incorrect operation incidents tend to be smaller in volume, the number of incidents has increased.

Operators should consider the following:

- Reevaluate Operator Qualification program for improvement.
- Implementation of RP-1173 Pipeline Safety Management System (PSMS).
- Plan carefully for unusual operations and one-time events. Develop and review detailed work plans with subject matter experts through a Process Hazard Analysis, HAZOP, and pre-start up safety reviews, or management of change process to help reduce risk due to unfamiliar situations.
- Plan for the changing work force: as experienced personnel retire or move on and are replaced by less experienced personnel, the opportunity for operator error could increase without appropriate training and retraining.
- Analyze abnormal events and unintentional releases using root cause analysis methods to expose possible operator errors.
- Refer to PPTS Advisory 2008-2 A Look at Operator Error or Other Incorrect Operation
- Refer to PPTS Advisory 2003-7 An Expanded View of Operator Error

❖ Additional information for operators:

- For more details, please refer to PPTS Advisory 2009-5 New Findings on Releases from Facilities Pipeline and PPTS Advisory 2003-5 Facility Piping and Equipment Facts for more details.



Find this and other advisories drawn from the hazardous liquid industry's Pipeline Performance Tracking System at [www.api.org/ppts](http://www.api.org/ppts)

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For more information, contact [ppts@api.org](mailto:ppts@api.org)

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