

**AFPM & API
ADVANCING
PROCESS SAFETY**

**Industry Learning &
Outreach**

Quarterly Webinar

December 5, 2017



AFPM

American
Fuel & Petrochemical
Manufacturers



Purpose of Industry Learning & Outreach Quarterly Webinars

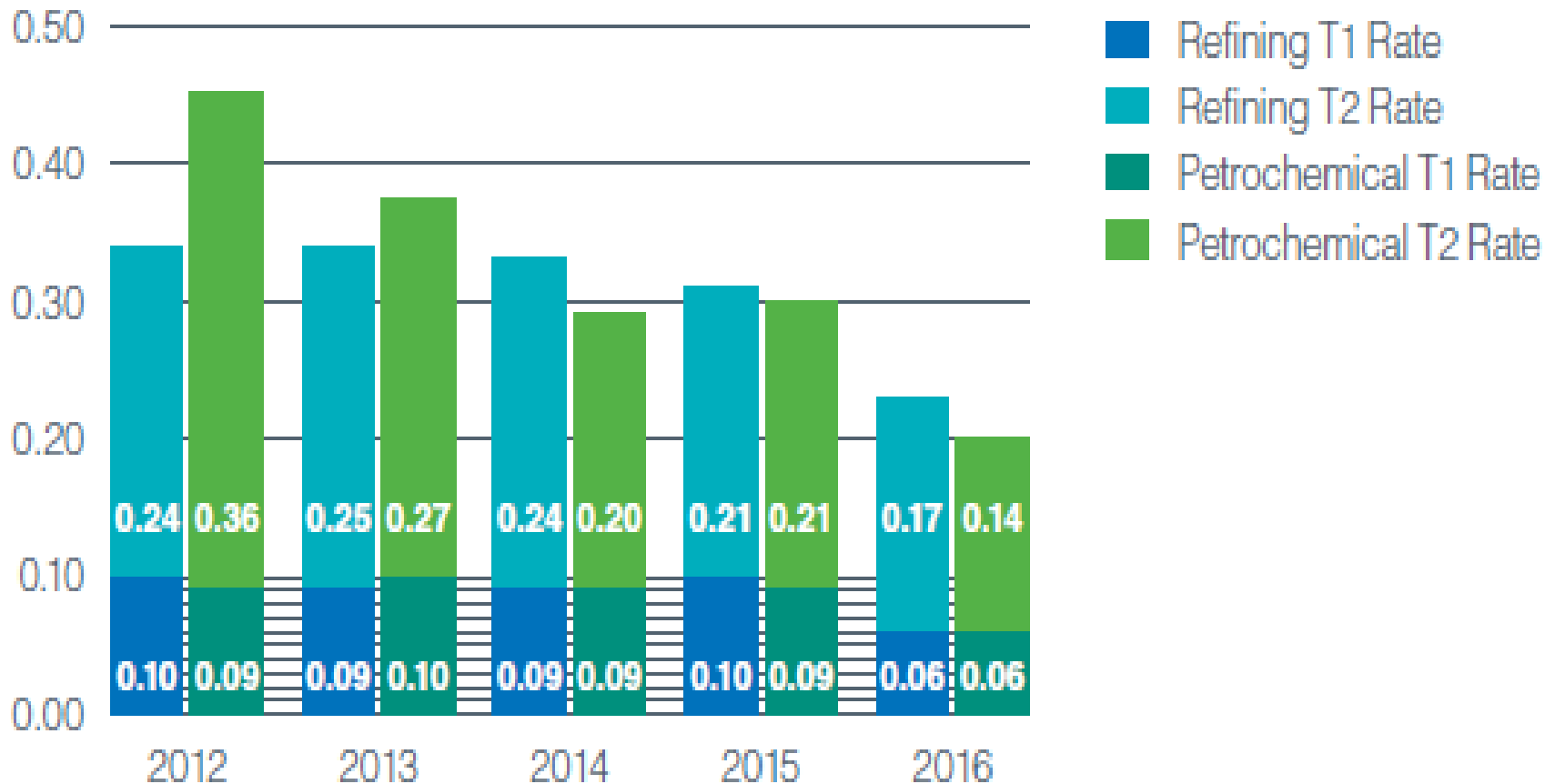
- To update participants on recent learnings stemming from the AFPM/API Advancing Process Safety Programs
 - Industry Learnings & Outreach (API RP 754 and Event Sharing)
 - Hazard Identification & Practice Sharing
 - Site Assessments
 - Regional Networks
 - Human Reliability: Permit to Work and Fired Heaters
 - Mechanical Integrity
- To ensure consistency in Tier 1 and 2 metrics reporting in order to establish credibility and validity
- To share learnings regarding the effective implementation of Tier 1-4 lagging/leading metrics

Today's Agenda

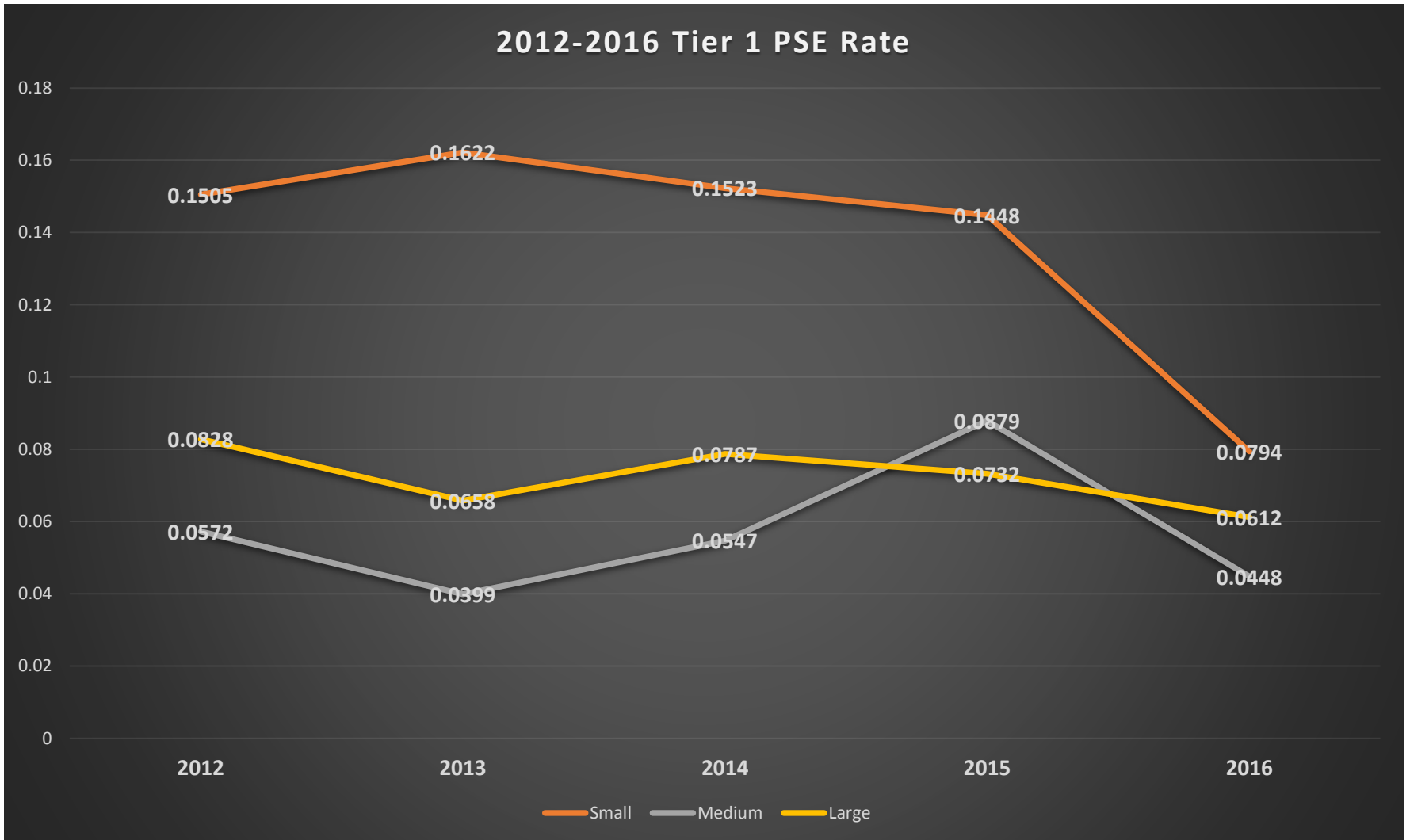
1. Trend Charts for PSE 1s & 2s for Refining and Petrochemical Facilities
2. Highlight on Hazard ID and Practice Sharing documents
3. 2017 Annual Learnings Report
4. Process Safety Queries
5. Outreach and involvement opportunities
6. Q & A

Trend Charts for PSE 1s & 2s

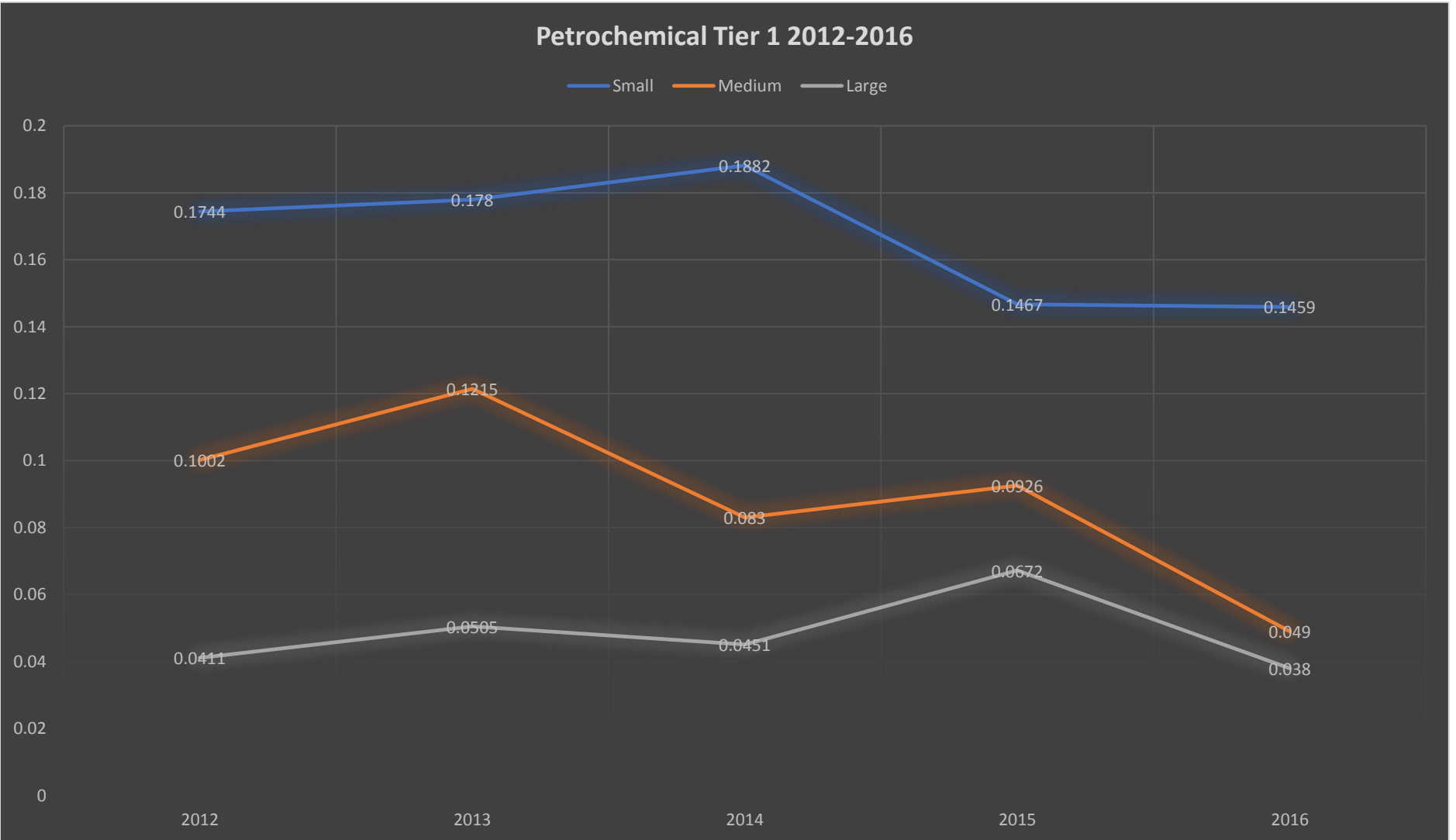
REFINING AND PETROCHEMICAL PROCESS SAFETY EVENT RATES



Refining PSE Trend by Site Size



Petrochemical PSE Trend by Site Size



Hazard Identification and Practice Sharing Subgroup Update

12/05/17

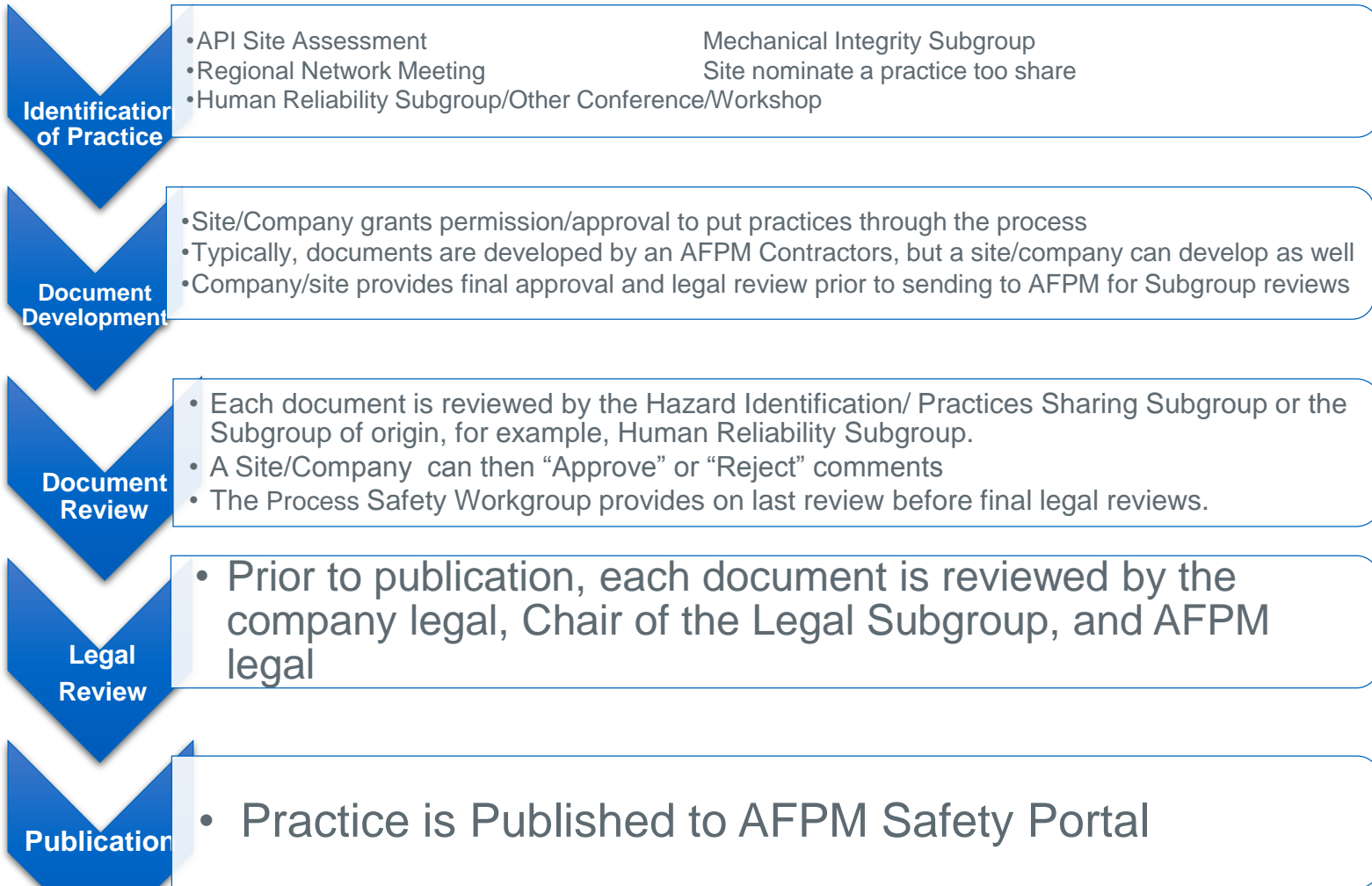


PRODUCTS
FOR YOUR LIFE.
EVERY DAY.

Purpose and Use

- Hazard Identification documents are meant to share process safety hazards for a particular equipment or practice
 - They can be used to create awareness, to use as a checklist when reviewing current practices, or to use when creating new practices
- Practice Sharing documents are meant to share a site specific practice that has worked at one company or site
 - These documents may be used when a site is updating their practices or is looking to develop a new practice.

Practice Sharing Development Process



Recent PS Documents

- **Integrity Operating Window (IOWs) Alarm Management (Site Assessment)**
 - Document is an example of a way to manage and communicate IOWs such that they are consistently followed.
- **Higher Risk Procedure (Regional Network Presentation)**
 - Provides process and checklists to ensure safe methods are used for tasks that have been identified as representing 'Higher Risk'
- **HAZOP Vulnerabilities List (Site Assessment)**
 - Provides a process to improve a site's HAZOP revalidation by identifying potential damage mechanisms and vulnerabilities
- **First Line Break Labeling (Walk the Line Workshop)**
 - Provides an example of an administrative barrier in human error in identifying and communicating the intended points of first breaks or cut lines – can supplement LOTO procedure
- **Open Valve Labeling and Management (Walk the Line Workshop)**
 - Provides and example of a way to label and manage bleeder/drain/vent valves that are left open to the atmosphere while unattended.
- **Flange Bolting and Gasketing (Site Assessment)**
 - Practice is meant to help assure correct design and installation of flange bolting and gasketing

Recent Hazard Identification Documents

- **Atmospheric Storage Tank Operation**
 - Hazards associated with in-service atmospheric tanks, including fixed roofs, external floating roofs, and internal floating roofs.
- **Maintenance/ Operations Turnover and Verification After Maintenance**
 - Hazards associated with equipment turnovers between Operations and Maintenance for the performance of routine maintenance work in a live unit
- **Temporary Repairs of Piping and Piping Components**
 - Temporary repairs of piping and piping components typically call in the categories of clamping, wrapping, or welding
- **Atmospheric Tank Preparation for Out of Services Maintenance**
 - Five year review
 - Original published 2012, updated in 2017

What's Coming Next

Practices:

- Temporary Leak Repair Checklist and Form

This practice provides a checklist that serves as a template for the review of potential hazards of temporary repairs that can include installation of clamps, enclosures, overlays, wraps and “Tell-Tale” (T-T) pins, including the re-tightening and reinjection of sealant in temporary repair enclosures to help prevent loss of containment events.

- Control of Defeat

The purpose of the Control of Defeat work practice is to ensure that the necessary analysis, authorization, communications and recordkeeping is performed when disabling or impairment of SHE (Safety, Health, Environment) Critical Devices occurs.

- Radio Communications Protocol

Defined radio communication protocol in an operation that requires close coordination between field and console operators is important to effective performance and avoidance of unintended consequences.

- Human Reliability Subgroups: Fired Heaters and Permit to Work will publish several documents soon around Fired Heater Management, Joint Jobsite Visits, LOTO University, Electrical Distribution Permitting

Current Practice Sharing Documents

Find more Practice Sharing documents as they are update on the Safety Portal at:

<https://safetyportal.afpm.org/HazardIdentification-access.aspx>

- Refinery Tank Farm & Terminal Product Transfer
- Tracking WTL Incidents
- Checklist SOP
- Maintenance/Operations Turnover Verification after Maintenance
- MOC Tagging
- Piping & Instrumentation Diagram walk-down
- Pre-startup Safety Review (PSSR)
- Soap Testing for Equipment Commissioning
- Use of Infra-red Camera to Detect Leaks During Start-up
- Bolting & Gasketing Management
- Line Labeling
- Shift Handover Process
- Safety Field Audit
- Operator Evaluation Rounds
- Informal Unit Walk-Through
- Operating Instructions
- Operator Shift Notes
- Shift Change Communications
- Shift Change Meeting
- Threaded Lanyard Plug
- Critical Bleeder Valves
- Spring Loaded Valves
- Cap & Plug Program
- Safe Operating Limits & Alarm Management
- Energy Isolation

Current Hazard ID Documents

Find more Hazard ID documents as they are update on the Safety Portal at:

<https://safetyportal.afpm.org/HazardIdentification-access.aspx>

- Atmospheric Storage Tank Operation
- Maintenance/Operations Turnover and Verification After Maintenance
- Temporary Repair of Piping and Piping Components
- Injection Point and Process Mixing Point Hazards
- Deadlegs
- Operator Line-up
- Winterization
- Hose Hazards
- Equipment Small Bore Piping
- Opening Flare System While in Service
- Fired Heaters
- Critical Crane Lifts
- Hot Taps
- Liquid Petroleum Gas
- Flare Operations
- Process Sampling for QA/QC
- Shift Handover
- Atmospheric Tank Preparation for Out of Service Maintenance
- Vacuum Trucks

2017 Learnings Report

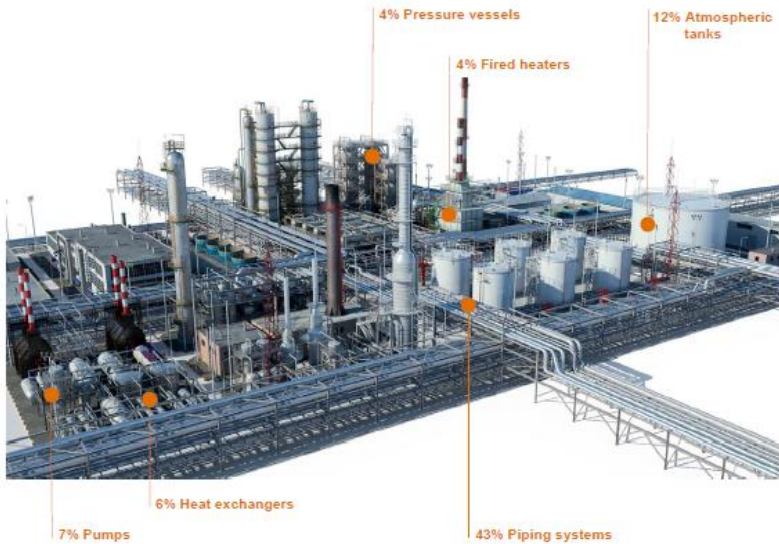
AFFPM ANNUAL LEARNINGS REPORT

Published November 2017



Published November 2017

Update on Lessons from Advancing Process Safety Data



2016 API 754 Event Data

(Based on RF and PC Tier 1 and Tier 2 Events submitted to AFFPM)

43% Piping systems

- 57% Large Bore (>2")
- 42% Small Bore (≤2")

AFFPM Annual Learnings Report

Summary

This annual report is a summary of the principal lessons that have been gleaned from data obtained by Advancing Process Safety efforts, including Metrics & Analysis collection of API 754 Tier 1 and 2 events, Event Sharing Database submittals, and Site Assessment results. Based on a deep dive of the data, key trends have not changed from previous years. Atmospheric storage tanks continue to be the significant process area contributing to process safety events. In addition, human error sources have been identified as a key cause in approximately 20% of events. For a historical perspective, see the 2015 Learnings Report.

With the addition of expanded categories added in 2015, additional depth is now available regarding events providing more insight on point of release, cause, and mode of operation.

Event Sharing Database Participation Metrics

As of October 12, 2017, the Event Sharing database contained 580 process safety events of which 76% are Tier 1 events (according to API RP 754) and 20% are Tier 2 events. Of the events in the database approximately 10% were classified as high learning value events (HLVE) by the submitter.

Percentage of Causes listed in Event Sharing Database



Update on Lessons from Advancing Process Safety Data

Opportunities to Improve Process Safety Performance

A sampling of discoveries from the review of Advancing Process Safety data sources included the following:

- 30% of the Tier 1 & 2 events submitted in 2016 during 'Normal' Mode of Operation had a large bore (>2) piping failure; 42% of those events listed at least one Cause of fixed equipment inspection; Inspection Less than Adequate, No Inspection, or QA/QC Less than Adequate.
 - The results of the API Process Safety Site Assessments show that the lowest scoring subprotocols are from Mechanical Integrity; Process hoses, Integrity Operating Windows, and Critical Check Valves
- Leading causes of Incidents involved:
- Fixed Equipment Mechanical Integrity – Internal and external corrosion, erosion, cracking, inspection less than adequate
 - Equipment Reliability- premature failure, maintenance/repair less than adequate
 - Human Factors - valves left open, open-ended lines, loading/unloading, tank filling
 - Design - winterization, specs not adequate
 - 58% of design causes related to engineering less than adequate, followed by gaps in specifications and construction.

- Reviewing events with operating procedure gaps, 26% involved procedure available but not used/ignored, 19% with situation not covered, 17% with no procedure available, and 16% with procedure not accurate.

Additional Resources (atfm.org/safetyportal):

- Process Safety Bulletins**
- Hazards of Piping Vibration
 - Floating Roof Tanks Hazards
 - Hazards of Corrosion Under Insulation

Practices Sharing & Hazard ID Documents

- Temporary Repair of Piping and Piping Components
- Maintenance/Operations Turnover and Verification After Maint.
- Energy Isolation procedure
- HAZOP Vulnerabilities List
- First Break Point Labeling
- Integrity Operating Window Alarm Management
- Higher Risk Work Procedure
- Flange Bolting and Gasketing

When are Process Safety Events occurring based on Event Sharing Data?

- 59% during Normal operation – 50% of these events had at least one cause attributed to Equipment Reliability
 - 61% Steady state (when specified)
 - 12% Filling/Draining (when specified)
 - 5% Loading/Unloading (when specified)
- 13% during Startup
- 7% during Routine Maintenance
- 7% during Upset

Basics for Data:

- 691 Event Sharing submittals
- 2012-2016 Tier 1 & 2 Events (~3500 refining and petrochemical events)

Human Error Caused Events

Human Error was the Cause in 23% of all Tier 1 and 2 events submitted in 2016.

62% of those events occurred during 'Normal' Mode of Operation. The following represents the percentage of events that had at least one Cause of 'Human Error':

- 83% Equipment Prep/Taking Out of Service
- 57% Loading/Unloading
- 56% Equip. Commissioning/Putting In Service After Maint.
- 36% Filling/ Draining
- 36% Steady State
- 25% Changing Line-ups

Top Processes for Tier 1 & 2 Events 2012-2016

- | | |
|--------------------|------------------------------------|
| Refining: | Petrochemical: |
| • 27% Tank Farms | • 14.5% Specialty Chemicals |
| • 11% Crude Units | • 12.7% Ethylene and derivatives |
| • 7% Hydrotreating | • 6.6% Acetic Acid and derivatives |
| • 5% FCC | • 6% Polyethylene |
| • 5% Reforming | • 5% Tank Farms |



Process Safety Queries

- We continue to receive queries on potential Process Safety Tier 1 and Tier 2 Events.
- Scenarios are reviewed by the members of the Industry Learning & Outreach Sub-Team.
- Consensus is achieved through sharing and discussion.
- Detailed documented responses are provided to the requestor and saved for possible use in the 3rd Edition of API-754.
- Please continue to send your requests to AFPM (Lara Swett), API (Heidi Keller), or ACC (Karen Haase).

Binder

- 8 Safety Bulletins
 - 1 in development
- 19 Hazard ID Documents
 - 1 in development
- 29 Practice Sharing Documents
 - 22 in development
- 688 Events in the Event Sharing database
- Statistic Reports and Benchmarking opportunities

AFPM PROCESS SAFETY BULLETIN

 **AFPM**
American
Fuel & Petrochemical
Manufacturers

23 December 2014
#14-01

Hazards of Purged Tanks - Formation of Pyrophoric Iron Sulfide in Low Oxygen Environments

HAZARD IDENTIFICATION

Temporary Repair of Piping and Piping Components

Purpose and Use:

The Process Safety Hazard Identification documents serve to help facilities identify potential risks associated with work practices, safety practices, process equipment, and technology. Hazard Identification documents are meant to:

- Improve process safety awareness with a focus on higher potential risks,
- Provide information and ready reference guides for potentially overlooked and not widely known process safety hazards, and
- Share lessons from industry related incidents and near misses.

PRACTICE SHARING

Higher Risk Work Procedure

Purpose and Use

The purpose of the Higher Risk Work procedure is to ensure safe methods are used for performing tasks that have been identified by the user as representing higher risk.

Practice Sharing Documents are meant to share information on process safety practices in order to help improve process safety performance and awareness throughout industry. The goal is to capture and share knowledge that could be used by other companies or sites when developing new process safety practices or improving existing ones. The Practice being shared has been used by an industry member, but this does not mean it should be used or that it will produce similar results at any other site. Rather, it is an option to consider when implementing or adjusting programs and practices at a site.

 Click on Tools, Sign, and Comment to access additional features.
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Member Outreach



Planned Outreach

- AFPM Committees
 - Executive, Board of Directors, Maintenance, Safety, etc.
- Company outreach will be customized per company
 - AFPM Board of Directors will direct AFPM on how they want binders rolled out at their company
- Regional Network Participants Operating Practices Symposium
 - Operating Practices Advisory Group

WHAT IS ADVANCING PROCESS SAFETY?

Advancing Process Safety (APS) is an industry led initiative to continuously improve process safety performance through enhanced information, communication, and collaboration.

PHILOSOPHY
It is everyone's best interest to improve process safety across the industry.

SELF-HELP
This initiative is designed as "self-help." There are a variety of tools available in the binder and it is up to each company to review, customize, and allow what will be of benefit to them. Programs are not mandatory and do not replace any regulatory requirements.

APL PROGRAM LEADING TO SUCCESS AT THE SITE
Based on industry of APFM membership feedback to date.

JOIN US!

141 COMPANIES, 1650 PARTICIPANTS

Waters Energy Corporation Contacts
Process Safety Advisory Group
Coby Young
Process Safety Workshop
Mark Scurie
Hazard Identification and Process Start
Mark Scurie

Process Safety Regional Network
California WSPN
John Bell
Central States
Kevin Jensen
Charles McCalla
Eastern Gulf Coast
Doug Fraith
Eastern Nuclea
Sallyman Koster
Joseph Morgan

Human Reliability Subgroup
Allen Mills
Industry Learning and Outreach
Wayne Howard

Topic Gulf Coast
Alison Abner
William Dale
Steve Soltner
Michael Spence
Tim Waldropic

Questions on the Safety Portal or want to participate in a Regional Network?
Lara Swell
American (and International) Manufacturers
JWS@AMM.org
lswell@apfm.org

Questions on the APFM Process Safety Site Assessment Program?
Andrew Orsland
American Petroleum Institute
aorsland@api.org
Orsland@api.org

ADVANCING PROCESS SAFETY

WHERE ARE YOU?

A bar chart showing the number of participants in the Advancing Process Safety initiative across various regions. The regions and their approximate participant counts are: California (140), Central States (100), Eastern Gulf Coast (100), Eastern Nuclea (100), Human Reliability (100), International (100), Midwest (100), Northern (100), Southern (100), and Western (100).

DATA-DRIVEN SOLUTIONS

APS is about moving the needle in process safety by identifying opportunities to address facility risks.

Site Analysis
Through collection of APFM's Process Safety Metrics of the Petroleum, Chemical, and Pharmaceutical Industries, APFM's Process Safety Metrics and Site Assessment Program results, APFM has identified a variety of opportunities for industry improvement. Analysis of tools available through APFM's website for the following topics:

- Open ended items
- Values all open or inadequately closed
- Permit to Work
- Field Equipment Management
- Safety Operating Practices

Walk the Line
Walk the Line is a program developed through APFM that provides a variety of tools to help ensure that operations occur with a high level of safety. The program includes a variety of tools to help ensure that operations occur with a high level of safety. The program includes a variety of tools to help ensure that operations occur with a high level of safety.

BENCHMARKING

Where is your site compared to the rest of the industry?

APFM has and Process Safety Site Assessments available opportunities for improvement. They can access a variety of tools through the Safety Portal or through benchmarking opportunities through the Regional Network program to help facilitate these improvements.

OPERATIONAL PERFORMANCE BY QUARTILE AGAINST INDUSTRY BENCHMARK

A line chart showing operational performance by quartile against industry benchmark. The chart tracks performance over time, with a red line representing the industry benchmark and a blue line representing the site's performance. The site's performance is consistently above the benchmark.

INFORMATION SHARING

The most effective means to improve process safety performance throughout the industry is to learn from each other.

Opportunities to Network
APFM's National Occupational & Process Safety Conference, May 19-21, 2014 in San Antonio, Texas. The APFM National Occupational & Process Safety Conference is the premier safety conference for the refining and petrochemical industry. The theme for the 2014 conference will be "Promoting Technologies to Improve Performance and Reduce Risk."

APFM's Process Safety Network
APFM's Process Safety Network provides safety practitioners of the site an opportunity to exchange ideas, learning from incidents, practices in order to enhance process safety performance across the region.

ADVANCING PROCESS SAFETY TOOLKIT

ADVANCING PROCESS SAFETY

APFM

ADVANCING PROCESS SAFETY

To learn about Advancing Process Safety and to view tools available, access the APFM Safety Portal: www.apfm.org/safetyportal/

SAMPLING OF DOCUMENTS BY TOPIC

| Safety Subject | APFM Document | APFM Document |
|------------------------------|------------------------------|------------------------------|
| • Accident Investigation | • Accident Investigation | • Accident Investigation |
| • Permit to Work | • Permit to Work | • Permit to Work |
| • Process Safety Metrics | • Process Safety Metrics | • Process Safety Metrics |
| • Safety Operating Practices | • Safety Operating Practices | • Safety Operating Practices |
| • Walk the Line | • Walk the Line | • Walk the Line |
| • Work Order Management | • Work Order Management | • Work Order Management |
| • Hazard Identification | • Hazard Identification | • Hazard Identification |
| • Process Safety | • Process Safety | • Process Safety |
| • Safety | • Safety | • Safety |
| • Training | • Training | • Training |
| • Incident Investigation | • Incident Investigation | • Incident Investigation |
| • Process Safety | • Process Safety | • Process Safety |
| • Safety | • Safety | • Safety |
| • Training | • Training | • Training |

APFM SAFETY PORTAL

APFM

APFM SAFETY PORTAL

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LEVEL 1 CASES - 100 RESPONDING 2016

A donut chart showing the distribution of Level 1 cases - 100 responding 2016. The categories and their percentages are: 100% Design, 100% Change Management, 100% Risk Management, 100% Safety Work Practices, 100% Knowledge and Skills, 100% Equipment Inspection, 100% Human Factors, and 100% Task Assessment.

APFM SAFETY PORTAL

APFM

OPERATING PRACTICES

A bar chart showing operating practices. The categories and their values are: 100% Safety Work Practices, 100% Knowledge and Skills, 100% Equipment Inspection, 100% Human Factors, 100% Task Assessment, 100% Change Management, 100% Risk Management, 100% Safety Work Practices, 100% Knowledge and Skills, 100% Equipment Inspection, 100% Human Factors, 100% Task Assessment.

APFM SAFETY PORTAL

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REGIONAL NETWORKS

A map of the United States showing regional networks. The regions are: Northern WSPN, California WSPN, Rocky Mountain Regional Network, Central States, Eastern Gulf Coast, Midwest Regional Network, and APFM Process Safety Regional Networks.

For more information and the benefits of participating, view our video at www.apfm.org/zero/

ADVANCING PROCESS SAFETY ZERO

Ways to Get Involved

- Regional Networks
 - Sharing data analysis and tool
 - Getting APS into the sites
 - Opportunity identification
 - Practice Sharing Documents
- Quarterly Webinars
 - Data analysis and tools
 - Sharing observations for data collection improvements
 - Range of 100-200 individuals in attendance
- Annual Walk the Line Workshops
 - 200 individuals
- Email Distribution Lists
 - ~ 1650 individuals
 - Every 1-2 months sharing new tools
- Industry Conference Presentations
 - ~5 a year
- Safety Portal
 - Weekly digests
 - Anyone who logs in automatically receives digests
 - ~2000 individuals

To be added to lists, contact Lara Swett, lswett@afpm.org at AFPM

2017 Webinar Dates

- February 28 – 10:00 am Eastern (Complete)
- June 6 – 11:00 am Eastern (Complete)
- September 19 – 11:00 am Eastern (Complete)
- December 5 – 11:00 am Eastern
- February 27 – 11:00 am Eastern

Questions? / Discussion!

How to Access the Safety Portal?

All AFPM Members have access to the AFPM Safety Portal

To see if you are a member:

<https://www.afpm.org/membership-directory/>

Safety Portal Link:

www.afpm.org/safetyportal/

You will need your AFPM Username and Password to access the Portal. If you have forgotten it or need to set one up, follow the instructions on the login page.

Note: For Access to Process Safety Metrics, Injury & Illness Metrics, and Event Sharing database, you will need to get permission from your company's database administrator. Those individuals are listed in the bottom right hand corner of the Portal Homepage.

For all questions and information, contact:

Lara Swett

Senior Director, Safety Programs

AFPM

202-552-8476

lszett@afpm.org