CENTER FOR OFFSHORE SAFETY™

ANNUAL PERFORMANCE REPORT

FOR 2015 REPORTING YEAR



September 29, 2016

NOTICE

Data published in the Center for Offshore Safety's (COS) Annual Performance Report for the 2015 Reporting Year are based on data voluntarily reported by exploration and production Operators and Contractors operating in the United States. Although COS reviews reported data to identify internal inconsistencies and unusual period-to-period changes, in general COS is not able to verify the accuracy of reported data. COS, API, and any of their employees, subcontractors, consultants, or other assigns make no warranty or representation, either express or implied, with respect to the accuracy, completeness, or utility of the information contained herein, or assume any liability or responsibility for any use, or the results of such use, of any information or process disclosed in this publication, or represent that its use would not infringe upon privately owned rights.

API is not undertaking to meet the duties of employers, manufacturers, or suppliers to warn and properly train and equip their employees, and others exposed, concerning health and safety risks and precautions, nor undertaking their obligations to comply with authorities having jurisdiction.

TABLE OF CONTENTS

Contents

1.0 INTRODUCTION

The Center for Offshore Safety is designed to promote the highest level of safety for offshore drilling, completions, and operations through leadership and effective management systems addressing communication, teamwork, and independent third-party auditing and certification. COS enables operational excellence in part by enhancing and continuously improving industry's safety and environmental performance and stimulating cooperation within industry to share and learn from each other.

This COS Annual Performance Report (APR) provides information shared by its members under two COS programs:

- Safety Performance Indicators (SPI), and
- Learning from Incidents and Events (LFI)

The COS member data provided through the LFI and SPI programs, in addition to SEMS audit results, enable continual improvement of performance-based systems.

The SPI originated from major hazard bow ties, developed within COS, that cover both process safety and personal safety. The information can be used for driving improvement and, when effectively acted upon, contribute to reducing risk of major incidents by identifying weaknesses in barriers intended to prevent the occurrence or recurrence of incidents and mitigate consequences.

The scope of this 2016 APR covers COS member wells, projects, and production facilities and operations in the U.S. Outer Continental Shelf (OCS) for SPI data. The LFI data covers the same scope, but also allows for the submittal of data for incidents and events which occur outside the U.S. COS Operators share both Operator and Contractor SPI and LFI data relative to activities that occur on their facilities and within 500 meters of their facilities. COS Rig Contractors and Service Companies share SPI and LFI data relative to activities occurring outside 500 meters of Operators' facilities. In the context of this report, the term safety is inclusive of personal safety, process safety, health, security, and the environment.

SPI Program

In January 2016, COS published an updated SPI Program User Guide for the U.S. offshore industry. The objectives of this program are twofold. First, it provides a means for sharing data related to key safety performance indicators and second, it assesses past performance to identify potential opportunities which could lead to improvements in future performance.

The SPI used in this program were selected from assessments of major hazards in the offshore industry. Most of the SPI are outcomes or consequences of the failure of prevention and/or mitigation barriers. Over time, the intent of this program is to move SPI focus to prevention barriers and activities that measure proactive management performance.

Publications by the American Petroleum Institute, UK Health and Safety Executive, Center for Chemical Process Safety, International Association of Oil and Gas Producers, and the Organization of Economic Cooperation and Development, as well as the experience shared by COS members, were valuable to the development of this program.

Unless otherwise specified, all frequencies stated in this report are normalized by total work hours multiplied by 200,000. Work hours are reported based on a 12-hour work day offshore.

To maintain data confidentiality, letters used to designate member companies are uniquely assigned for each individual chart and graph.

LFI Program

In January 2016, COS published an updated LFI Program (LFIP) User Guide. The main objective of the program is to provide COS members a mechanism for sharing information from incidents that meet the criteria for an SPI 1 or SPI 2, as well as other incidents that meet the criteria of a High Value Learning Event (HVLE). The LFIP also serves to complement the SPI Program by collecting additional information on SPI 1 and SPI 2 events that are submitted via the LFIP process. This information is analyzed and shared to enable industry learning and reduce the risk of recurrence.

2.0 2015 COS MEMBERS AND PARTICIPANTS

COS MEMBERS

Operators	***Rig Contractors***	***Service Companies***	***Associations***
Anadarko	Diamond Offshore Drilling	Baker Hughes	IADC
BHP Billiton	Ensco	Cameron International	MSRC
BP E&P	Noble Corp	FTO Services	NOIA
Chevron USA	Pacific Drilling	GE Oil & Gas	OOC
Cobalt	Transocean	Halliburton	Opito
ConocoPhillips		Helmerich & Payne	
ExxonMobil		Oceaneering	
Hess		Schlumberger	
Murphy E&P			
Noble Energy			
Shell International E&P			
Statoil North America			
TOTAL E&P			

Thirteen Operators and 10 Rig Contractors and Service Companies shared SPI data for use in this APR. Association members of COS do not provide data.

3.0 EXECUTIVE SUMMARY

The SPI and LFI Programs began implementation in 2014 reflecting 2013 data. This report provides the associated program information for the 2013-15 reporting years.

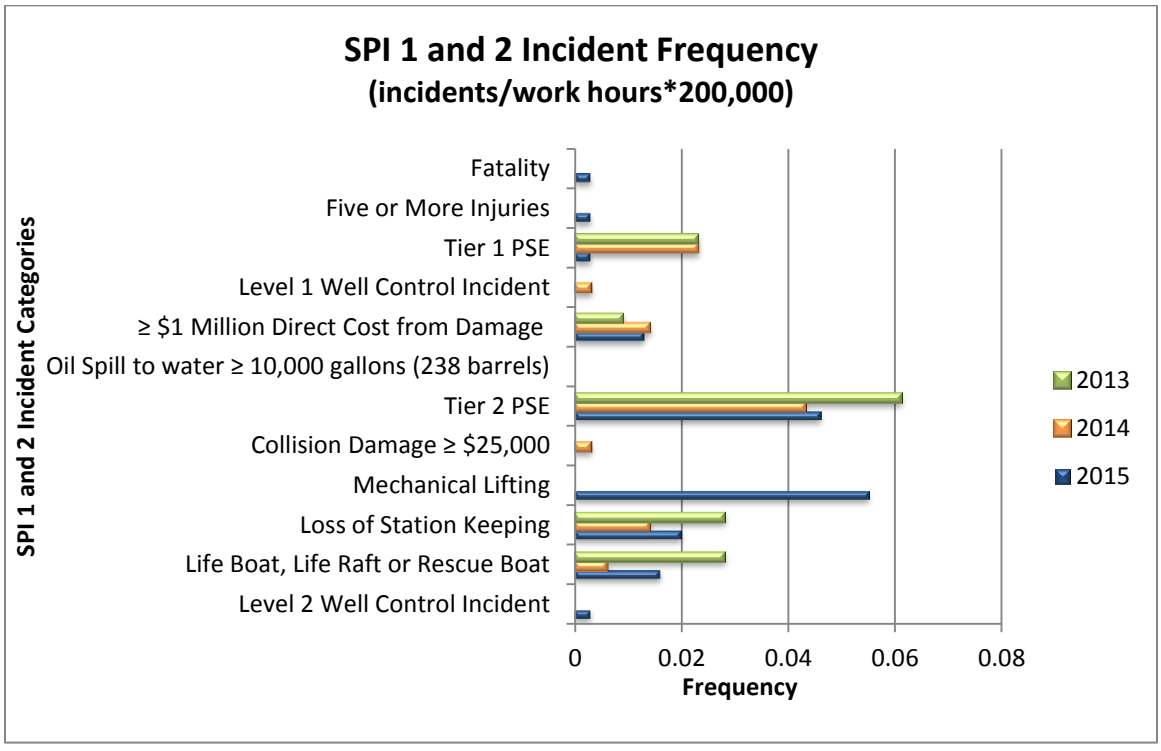
The 2015 SPI data includes one incident that resulted in a fatality in which a worker engaged in a lifting operation on a drilling rig was struck by a 6 5/8" stand of pipe. The pipe recoiled following the release of stored energy built when the stand was blocked from movement by a failed finger latch. Several areas of improvement were cited regarding equipment design and reliability, administrative processes and procedures for managing work, and personnel actions linked to the execution of work tasks.

The 2015 SPI data also includes one incident resulting in five or more injuries, one Tier 1 process safety event, and four incidents causing ≥ $1 Million direct damage to a facility, vessel, or equipment.

No Level 1 Well Control Incidents or oil spills ≥ 238 barrels occurred in 2015.

Participating members also reported 14 Tier 2 process safety events; 17 mechanical lifting or lowering incidents; six loss of station keeping incidents resulting in a drive off or drift off; five life boat, life raft, or rescue boat events and one Level 2 Well Control Incident.

The frequency of all SPI 1 and SPI 2 incidents are shown below.



There were two SPI 1 consequences that were reported for the first time since the SPI program was established – one incident resulting in a fatality and another resulting in 5 or more persons injured.

Tier 1 PSE frequency declined by 87% from the previous two years performance. The data indicates that the improvement occurred across the COS membership. Tier 2 PSE frequency was essentially flat with 2014.

Mechanical lifting incident frequency as depicted in the graph above shows only one year of data. The data shown in previous APR has been moved to SPI 4 as the new SPI 2C was redefined for 2015 with new thresholds to be consistent with other SPI 2 thresholds (see definition in Appendix 1). Mechanical lifting or lowering incident frequency was the highest of all SPI 1 and SPI 2 categories in 2015.

Nineteen of the 50 (38%) SPI 1 and SPI 2 incidents involved failure of equipment as a contributing factor. This is a decrease from 45% in 2014 and 68% in 2013. The largest contributors to equipment failures for 2015 are process equipment/pressure vessels/piping; mechanical lifting equipment; well pressure containment systems; and station keeping systems.

Eleven Operators shared SPI 5 critical MIT data. Of these, two Operators reported no MIT tasks due to not having ownership of facilities or equipment. Of the nine Operators that reported critical MIT data, the combined average for 2015 was 96.3%. This compares to a combined average of 99.1 % and 96.3% for 2014 and 2013, respectively. Eight Contractors shared SPI 5 critical MIT data. Of these, four Contractors reported no MIT tasks. Of the four Contractors that reported critical MIT data, the combined average for 2015 was 92.4% compared to 89.3% in 2014.

The combined 2015 Days Away From Work, Restricted Work and Transfer of Duty Rate (DART) (SPI 7) for COS participating members was 0.215. This is an increase from the 0.205 reported in 2014 but lower than 0.286 in 2013. The combined 2015 Recordable Injury and Illness Frequency (RIIF) (SPI 8) for COS participating members was 0.316, which is a continuing improvement trend over 0.406 and 0.581 in 2014 and 2013, respectively.

Ten oil spills to water ≥ one barrel (SPI 9) were reported by participating COS members. The oil spill to water frequency was 0.033. This was an increase from 0.023 in 2014 but lower than 0.089 in 2013.

With 2015 representing the third year of LFI data collection, there is now sufficient data to begin analyzing the records for trends. The following observations relate to the entire data set of 149 submittals for the reporting period from 2013 to 2015.

- The total number of LFI shared in 2015 was 49 compared to 48 and 52 in 2013 and 2014, respectively. Although the number of submittals remains consistent year-to-year, the higher proportion of HVLE indicates increased sharing behavior.
- The number of HVLE shared in 2015 represents a 162% increase over 2014, while the number of SPI 2 LFI shared reduced by 46% during the same period, due in part to the change in SPI 2C reporting thresholds.
- Site Type selection from 2013 to 2015 has moved from predominantly drilling rigs to a balance of drilling rigs and floating production facilities, and this may be reflective of the recent reduction in offshore drilling activity. Similarly, the Operation Type reporting is moving from wells towards production.

2015 LFI Learnings

A review of the 2015 reporting year incident and HVLE data resulted in the identification of multiple learning opportunities related to the following topics:

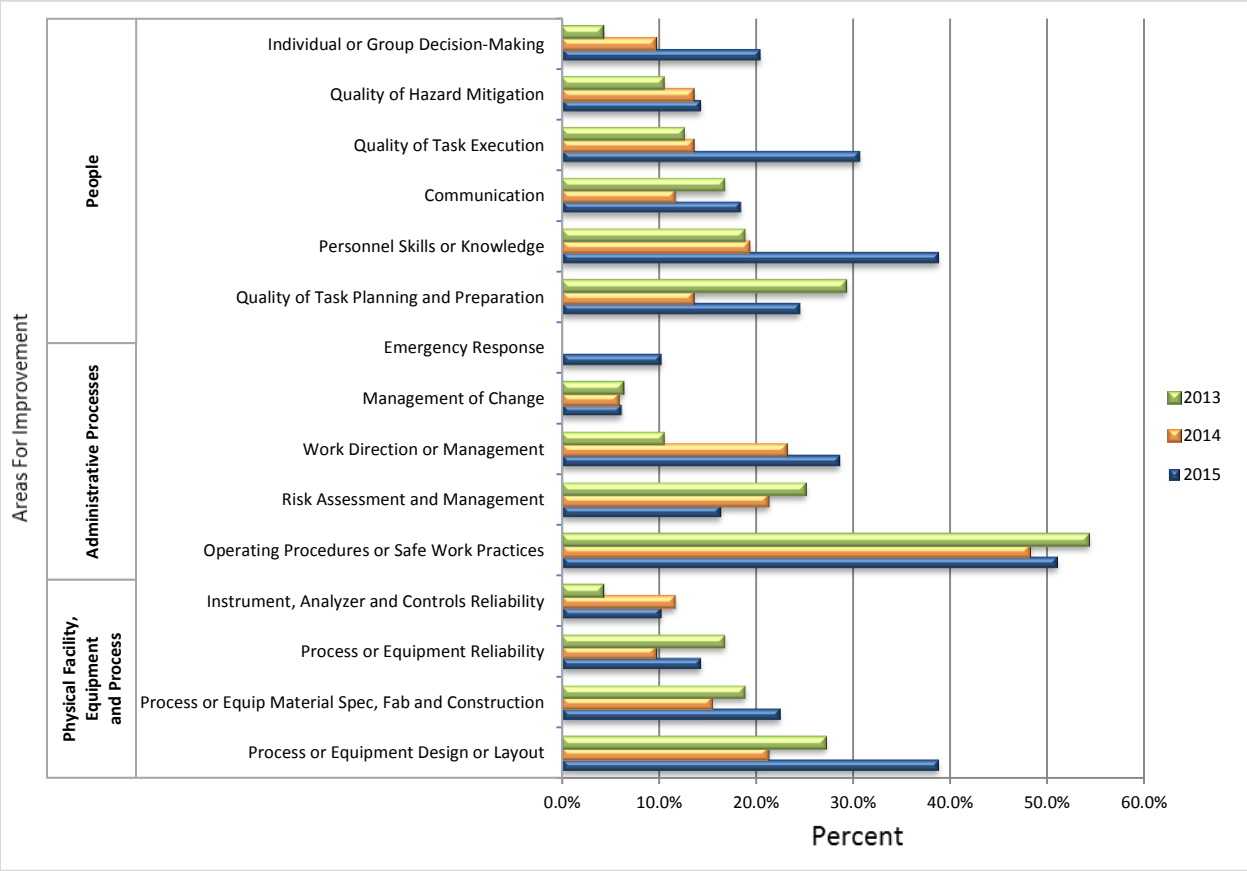
- Mechanical Lifting or Lowering
- Process Safety
- Dynamic Positioning / Loss of Station Keeping

The three topics listed above were also identified as learning opportunities in 2013 and 2014, with Operating Procedures or Safe Work Practices as the most commonly identified Area for Improvement for all three topics.

Areas for Improvement

The Areas for Improvement (AFI) data were distributed across the three general categories 1) Physical Facility, Equipment and Process, 2) Administrative Processes, and 3) People. For 2015, the largest changes in AFI selection from the prior reporting years were:

- Personnel Skills or Knowledge increased from 19% (prior two years) to 39%
- Quality of Task Execution increased from 13% (2013) and 14% (2014) to 31%
- Individual or Group Decision-Making increased from 4% (2013) and 10% (2014) to 20%
- Process or Equipment Design or Layout went from 27% (2013) and 21% (2014) to 39%



1 LFI submittals typically identified more than one AFI. The graph above illustrates the percent of times an AFI was identified relative to the number of LFI forms submitted (48 in 2013, 52 in 2014, and 49 in 2015). Because the number of AFI exceeds the number of LFI forms, the sum of the percentages will be > 100%.

Over the first three years of sharing LFI data, Operating Procedures or Safe Work Practices; Personnel Skills and Knowledge; and Process or Equipment Design or Layout stand out as areas for focused improvement.

Note: Not every SPI has an associated LFI, and not every LFI has an associated SPI. Analyses and trends of similar data from the SPI and LFI programs largely align, but can diverge due to the timing of the data submittal (e.g., incident investigation was still ongoing).

Other notable COS Accomplishments

- **Safety and Environmental Management System (SEMS) Audit Service Provider (ASP) Accreditation Program**
  - COS Recognized as SEMS Accreditation Body by BSEE – In accordance with the MOU signed in 2015, COS has established itself as the sole accreditation body approved to accredit SEMS ASP, as required by 30 CFR 250, Subpart S.
  - SEMS Auditors and Audits
    - As of the writing of this APR, COS has granted accreditation to five ASP:
      - ABS Quality Evaluations
      - BV Certifications
      - DNV GL Business Assurance
      - ERM CVS
      - Lloyd's Register Quality Assurance
    - In addition, the following three organizations, as of the writing of this APR, have qualified for provisional accreditation:
      - M&H Auditing
      - CICS-Americas
      - Gulf Tech
- **SEMS Audit and Certification Program**
  - Since the publication of the 2015 APR, the following COS Member Companies have successfully earned COS SEMS Certification:
    - Schlumberger in the Alaska region
    - Chevron U.S.A., Inc. (Deepwater assets)
    - Cameron International
    - Helmerich & Payne International Drilling Company
    - Cobalt International Energy, L.P.
    - Murphy Exploration and Production Company
- **COS Outreach and Communication Activities**
  - COS hosted its third-annual day at the 2015 Offshore Technology Conference
    - Keynote speakers included:
      - BSEE Director Brian Salerno
      - USCG Rear Admiral Paul Thomas
      - ASEA Director Carlos de Regules Ruiz-Funes

        - BSEE Chief of Offshore Regulatory Programs Doug Morris
    - Also at OTC, COS announced the winners of the 3rd Annual COS Safety Leadership Awards:
        - Anadarko (LiveSAFE)
        - Halliburton (Dropped Objects)

- **COS SEMS Workshops**
    - COS hosted a series of workshops for industry – ASP (May 2016), Operators (June 2016), and Contractors (TBD, Q4 2016). The purpose of these workshops was to:
        - Introduce upcoming changes to COS documents
        - Address a number of questions concerning SEMS audits
        - Solicit feedback on a number of issues related to SEMS audits and the COS accreditation process.
- **COS Offshore Workforce Engagement**
    - This biennial workshop was held in November 2015 at Shell's Training Facility in Robert, LA. The day-long workshop was a robust exchange of information and ideas between COS and COS field-level Member Company representatives. Feedback from the workshop has been delivered to the SPI and LFI Committees for review and possible action.

4.0 SAFETY PERFORMANCE INDICATORS

4.1 Introduction

COS members share Safety Performance Indicator (SPI) data with COS through the SPI Program. The data is confidential and blinded. This is the third year that COS members have shared SPI data. Benchmarks with other data sources are shown where definitions and metrics are comparable.

While the data for 2013 was limited to reporting of deepwater GoM COS member activity only, the data for 2014-15 includes all COS member activity on the US OCS. A normalization factor for work hours is utilized to enable year-to-year comparisons.

Data for the following SPI is provided:

SPI 1 is the frequency of incidents that resulted in one or more of the following:

A. Fatality
B. Five or more injuries in a single event
C. Tier 1 process safety event
D. Level 1 Well Control Incident - Loss of well control
E. ≥ $1 million direct cost from damage to or loss of facility / vessel / equipment
F. Oil spill to water ≥ 10,000 gallons (238 barrels)

SPI 2 is the frequency of incidents that do not meet the SPI 1 definition but have resulted in one or more of the following:

A. Tier 2 process safety event
B. Collision resulting in property or equipment damage ≥ $25,000
C. Mechanical Lifting or Lowering Incident
D. Loss of station keeping resulting in a drive off or drift off
E. Life boat, life raft, rescue boat event
F. Level 2 Well Control incident - Multiple Barrier Systems Failures and Challenges

SPI 3 is the number of SPI 1 and SPI 2 incidents that involved failure of one or more piece of equipment as a contributing factor.

SPI 4 is a crane or personal/material handling operations incident

SPI 5 is the percentage of planned critical maintenance, inspection and testing (MIT) completed on time. Planned critical MIT deferred with a formal risk assessment and appropriate level of approval is not considered overdue.

SPI 6 is number of work-related fatalities.

SPI 7 is the frequency of days away from work, restricted work, and job-transfer injury and illnesses (DART)

SPI 8 is the frequency of recordable injuries and illnesses (RIIF)

SPI 9 is the frequency of oil spills to water ≥ 1 barrel

SPI 1-5 are based on structured assessments of major hazards facing the offshore industry. SPI 6-9 are indicators that have been reported historically by industry and were not directly related to the assessment work.

There are characteristics of the data reported for SPI 1 and SPI 2 incidents that limit some aspects of the analyses and trending. An incident may have consequences that meet both SPI 1 and SPI 2 definitions, but are not counted in both classifications. The higher consequence drives the classification. For example, a collision that results in ≥ $1 million direct damage cost meets the SPI 1E definition, but also meets the SPI 2B consequence of collision resulting in ≥ $25,000 in damage. Yet per the SPI Program structure, it is only counted as an SPI 1E incident and not an SPI 2B collision.

Although definitions used for some of the SPI are the same or similar to regulatory definitions, the numbers in this APR will not necessarily match regulatory data due to this report being based on COS membership and not all companies operating in the US OCS.

4.2 Summary

This report provides COS member data for 2013-15. The 2015 data represents over 61 million operator and contractor work hours in the US OCS compared to 69 and 42 million reported in 2014 and 2013, respectively. This is a decrease of almost 12% from 2014.

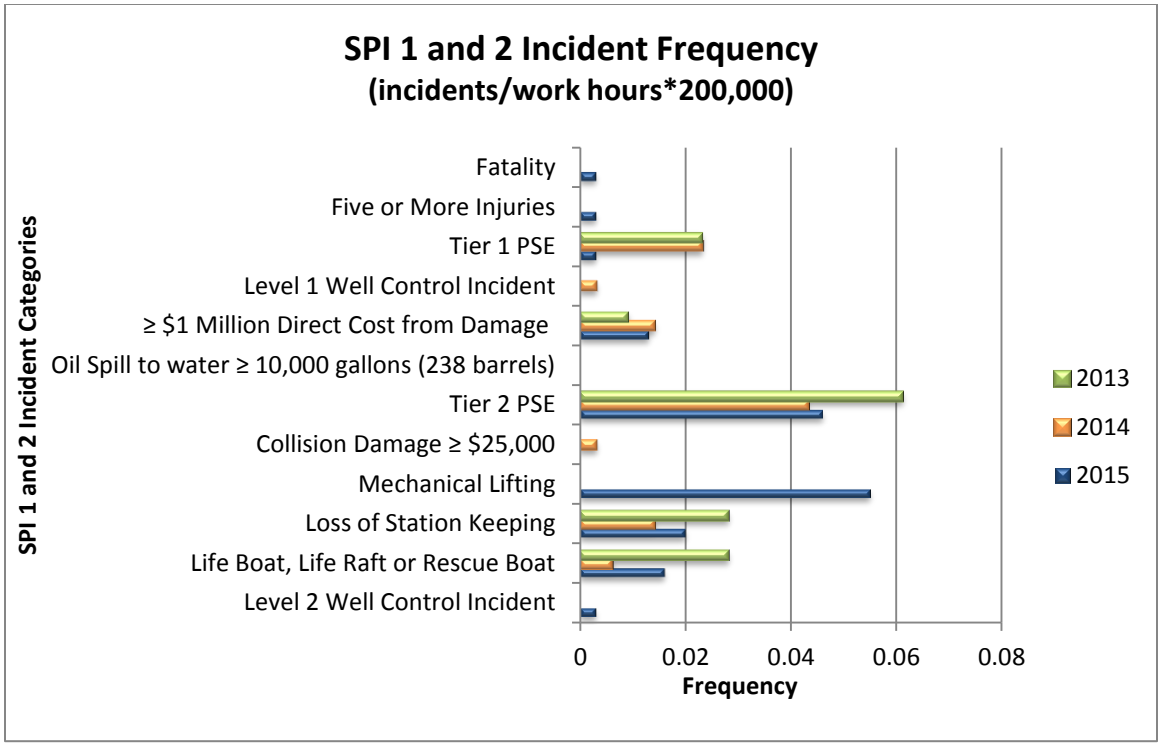
The 2015 SPI data includes one incident that resulted in a fatality in which a worker engaged in a lifting operation on a drilling rig was struck by a 6 5/8" stand of pipe. The pipe recoiled following the release of stored energy built when the stand was blocked from movement by a failed finger latch. Several areas of improvement were cited regarding equipment design and reliability, administrative processes and procedures for managing work, and personnel actions linked to the execution of work tasks.

Participating companies reported one incident resulting in five or more injuries, one Tier 1 process safety event, and four incidents causing ≥ $1 Million direct damage to a facility, vessel, or equipment. No Level 1 Well Control Incidents or oil spills ≥ 238 barrels occurred in 2015.

Participating members also reported 14 Tier 2 process safety events, 17 mechanical lifting or lowering incidents, six loss of station keeping incidents resulting in a drive off or drift off, five lifeboat, life raft, or rescue boat events and one Level 2 Well Control Incident.

No collisions occurred resulting in ≥ $25,000 damage.

The frequency of all SPI 1 and SPI 2 incidents are shown below.



There were two SPI 1 consequences that were reported for the first time since the SPI program was established – one incident resulting in a fatality and another resulting in 5 or more persons injured.

Tier 1 PSE frequency declined by 87% from the previous two years performance. The data indicates that the improvement occurred across the COS membership. Tier 2 PSE frequency was essentially flat with 2014.

Mechanical lifting incident frequency as depicted in the graph above shows only one year of data. The data shown in previous APR has been moved to SPI 4 as the new SPI 2C was redefined for 2015 with new thresholds to be consistent with other SPI 2 thresholds (see definition in Appendix 1). Mechanical lifting or lowering incident frequency was the highest of all SPI 1 and SPI 2 categories in 2015.

Loss of Station Keeping incident and lifeboat, life raft, or rescue boat event frequency trended up in 2015 vs. 2014 but remained below 2013 level.

19 of the 50 (38%) SPI 1 and SPI 2 incidents involved failure of equipment as a contributing factor. This is a decrease from 45% in 2014 and 68% in 2013. The largest contributors to equipment failures for 2015 are process equipment/pressure vessels/piping; mechanical lifting equipment; well pressure containment systems; and station keeping systems.

The definition of SPI 2C - Incidents involving Mechanical Lifting or Lowering - was modified in 2015 to include minimum thresholds an incident must satisfy to qualify as an SPI 2C. The previous broader definition has been retained as SPI 4.

SPI 2F – Level 2 Well Control Incidents – was introduced for the 2015 reporting year. The full definition may be found in Appendix 1.

11 Operators shared SPI 5 critical MIT data. Of these, two Operators reported no MIT tasks due to not having ownership of facilities or equipment. Of the nine Operators that reported critical MIT data, the

combined average for 2015 was 96.3%, ranging from 83.7% to 100.0%. This compares to a combined average of 99.1 % and 96.3% for 2014 and 2013, respectively. Eight Contractors shared SPI 5 critical MIT data. Of these, four Contractors reported no MIT tasks. Of the four Contractors that reported critical MIT data, the combined average for 2015 was 92.4%, ranging from 84.1% to 100.0%, compared to 89.3% in 2014.

One fatality occurred in 2015. The combined 2015 Days Away From Work, Restricted Work and Transfer of Duty Rate (DART) (SPI 7) for COS participating members was 0.215, ranging from 0.000 to 0.450. This is an increase from the 0.205 reported in 2014 but lower than 0.286 in 2013. The combined 2015 Recordable Injury and Illness Frequency (RIIF) (SPI 8) for COS participating members was 0.316, ranging from 0.000 to 1.455, which is a continuing improvement trend over 0.406 and 0.581 in 2014 and 2013, respectively.

Ten oil spills to water ≥ one barrel (SPI 9) were reported by participating COS members. The oil spill to water frequency was 0.033. This was an increase from 0.023 in 2014 but lower than 0.089 in 2013.

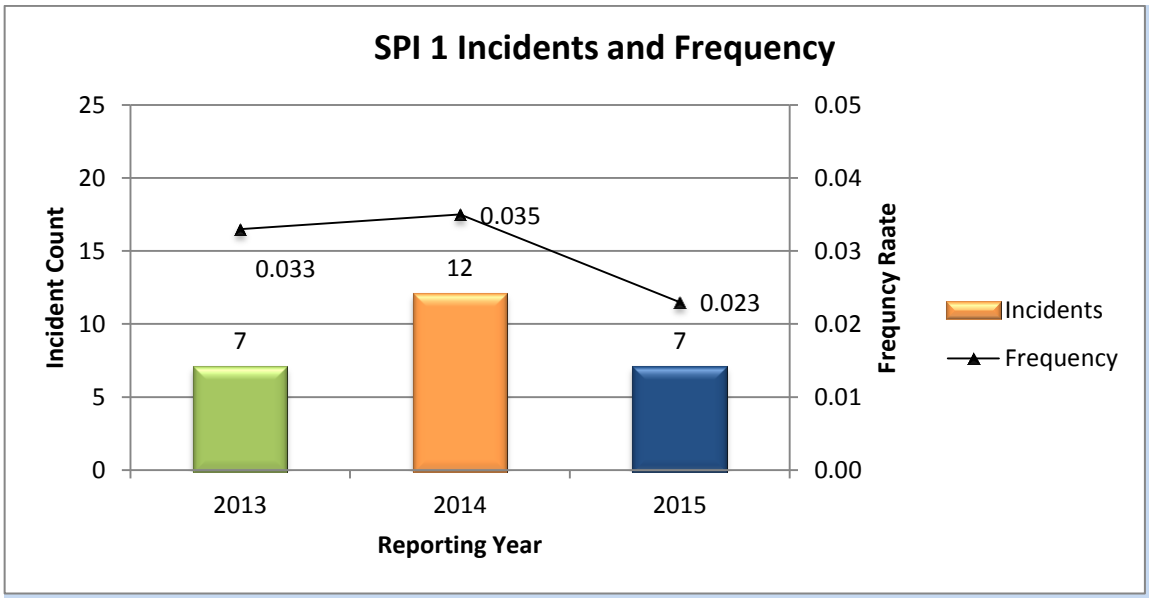
4.3 SPI 1 and 2 Results and Trends

SPI 1 is the frequency of incidents that resulted in one or more of the following:

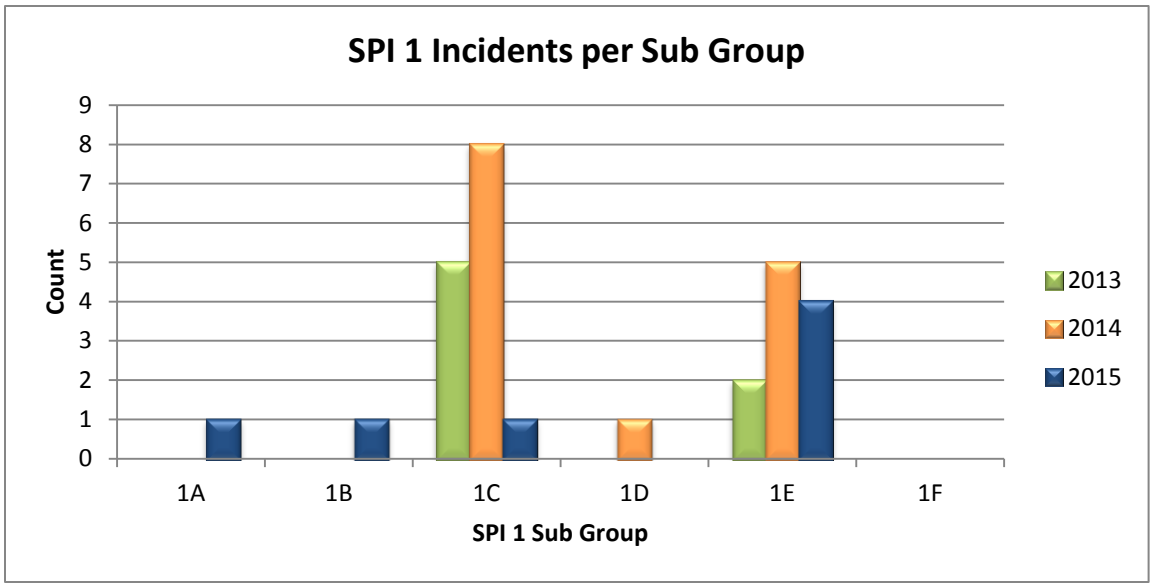
A. Fatality
B. Five or more injuries in a single event
C. Tier 1 process safety event
D. Level 1 Well Control Incident - Loss of well control
E. ≥ $1 million direct cost from damage to or loss of facility, vessel and/or equipment
F. Oil spill to water ≥ 10,000 gallons (238 barrels)

SPI 2 is the frequency of incidents that do not meet the SPI 1 definition but have resulted in one or more of the following:

A. Tier 2 process safety event
B. Collision resulting in property or equipment damage ≥ $25,000
C. Mechanical Lifting or Lowering Incident
D. Loss of station keeping resulting in a drive off or drift off
E. Life boat, life raft, rescue boat event
F. Level 2 Well Control incident - Multiple Barrier Systems Failures and Challenges

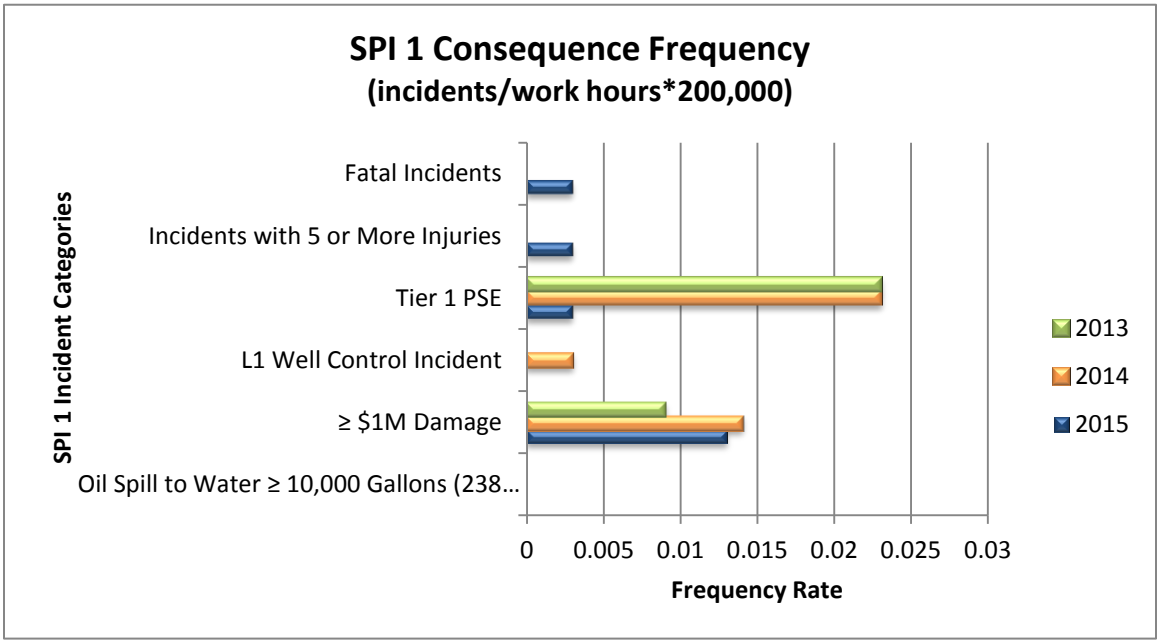


- Seven SPI 1 incidents were reported at a frequency of 0.023 in 2015. This is a reduction from 2014 and 2013 performance. Only the deepwater (> 1000 feet water depth) operations were in scope in 2013.
- All seven SPI 1 incidents reported in 2015 occurred on a facility or within 500 meters of a facility.

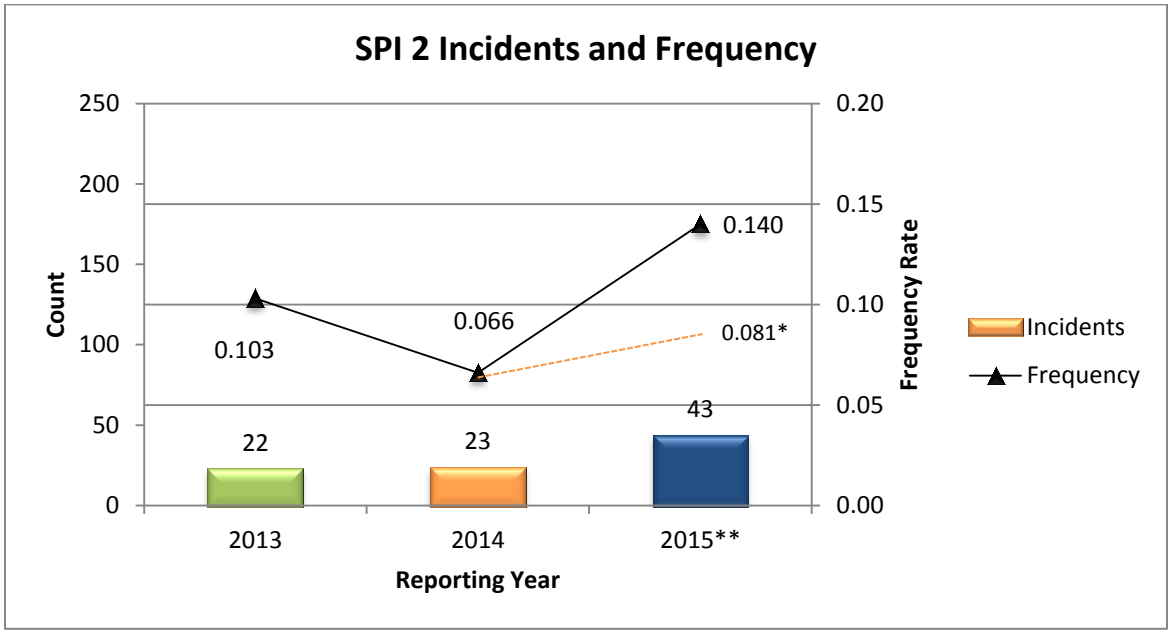


Year	Fatal Incidents (1A)	Incidents with 5 or More Injuries (1B)	Tier 1 PSE (1C)	L1 Well Control Incident (1D)	≥ $1M Damage (1E)	Oil Spill to Water ≥ 10,000 Gallons (238 bbls) (1F)
2013	0	0	5	0	2	0
2014	0	0	8	1	5	0
2015	1	1	1	0	4	0

[1] *The total count of SPI consequences shown in the table above for SPI 1A-1F may be > the total count of SPI 1 incidents, as one incident can have multiple consequences.*

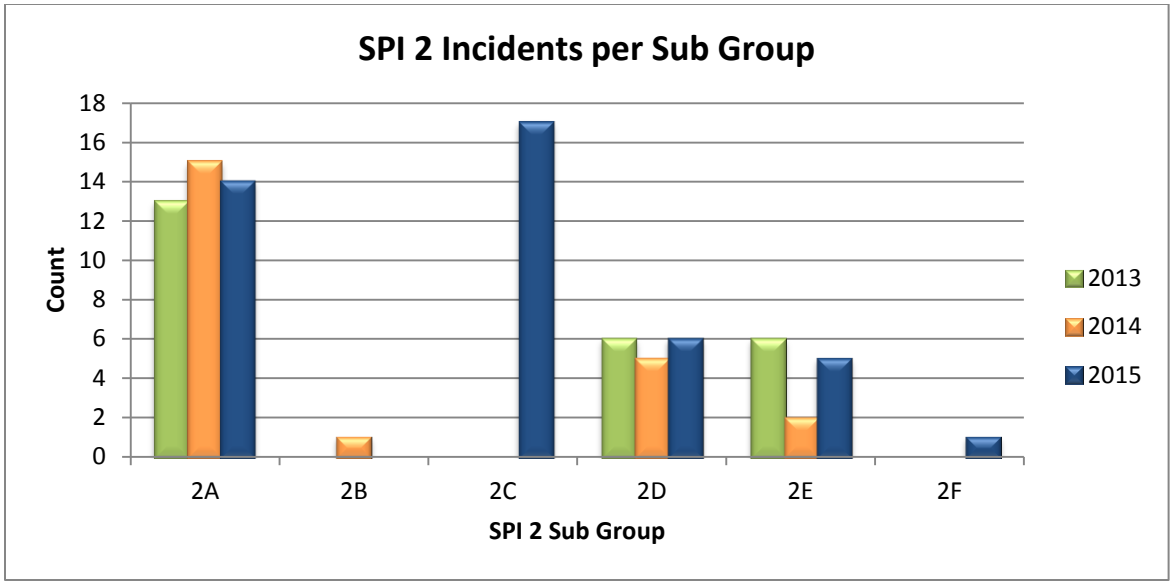


- There were two SPI 1 consequences that were reported for the first time since the SPI program was established – one incident resulting in a fatality and another resulting in 5 or more persons injured.
- Tier 1 PSE frequency declined by 87% from the previous two years performance. The data indicates that the improvement occurred across the COS membership. Tier 2 PSE frequency was essentially flat with 2014.
- Mechanical lifting incident frequency as depicted in the graph above shows only one year of data. The data shown in previous APR has been moved to SPI 4 as the new SPI 2C was redefined for 2015 with new thresholds to be consistent with other SPI 2 thresholds (see definition in Appendix 1).
- Mechanical lifting or lowering incident frequency remains the highest of all SPI 1 and SPI 2 categories.
- Loss of Station Keeping incident and lifeboat, life raft, or rescue boat event frequency trended up in 2015 vs. 2014 but remained below 2013 level.
- No oil spill to water ≥ 10,000 gallons (238 barrels) (1F) has occurred from 2013-2015.
- For loss of well control (1D), there was one incident reported for 2014, and zero reported in 2013 and 2015.
- The 2015 frequency of incidents resulting in ≥ $1M damage is essentially flat with 2014 (0.013 vs. 0.014).

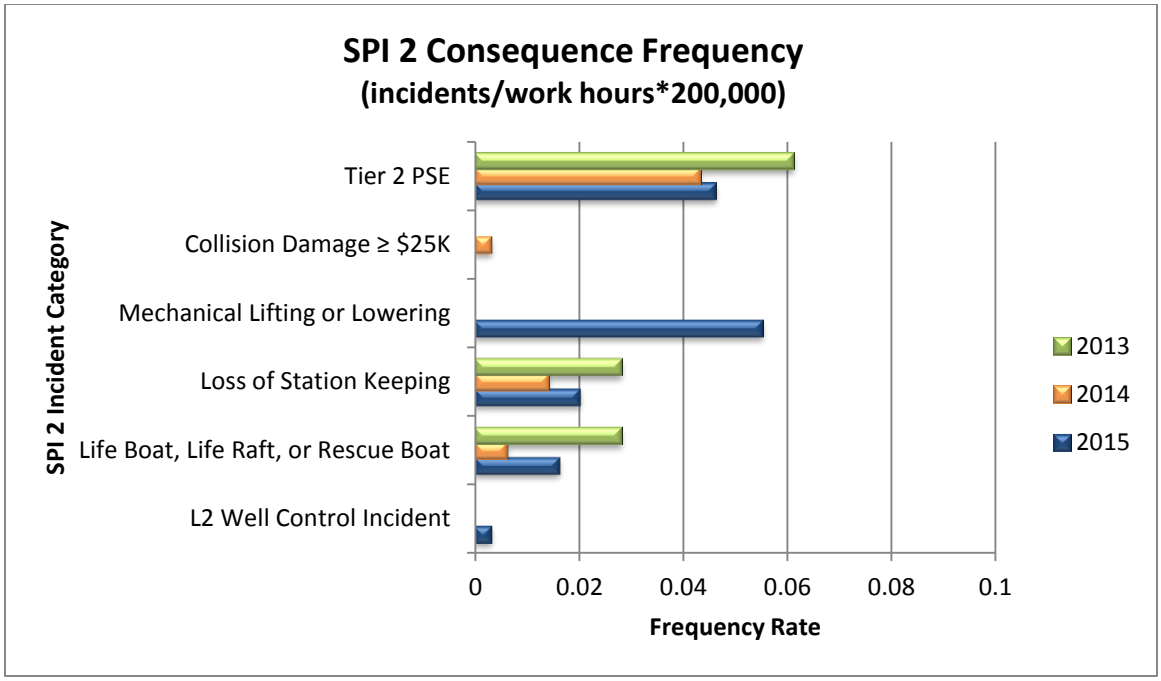


- A total of 43 SPI 2 incidents were reported in 2015 at a frequency of 0.140. This is an increase from the 0.066 frequency in 2014 and 0.103 in 2013. The increase is due to the addition of two new SPI 2 categories (Mechanical Lifting or Lowering Incident and Level 2 Well Control Incident). * Without the two new categories, the frequency of SPI 2 incidents still increased from 0.066 in 2014 to 0.081 in 2015.

- **The definition of SPI 2C "Incidents involving Mechanical Lifting or Lowering" was modified in 2015 to include minimum thresholds an event must satisfy to qualify as an SPI 2C. The previous broader definition has been retained as SPI 4.
- For 2015, 40 of 43 (93%) SPI 2 incidents occurred on a facility or within 500 meters of a facility.



Year	Tier 2 PSE (2A)	Collision ≥ $25K (2B)	Mechanical Lifting or Lowering (2C)	Station Keeping (2D)	Life Boat, Life Raft, or Rescue Boat (2E)	L2 Well Control Incident (2F)
2013	13	0	NA	6	6	NA
2014	15	1	NA	5	2	NA
2015	14	0	17	6	5	1



[1] *The total count of SPI consequences shown in the table above for SPI 2A-2E may be > the total count of SPI 2 incidents, as one incident can have multiple consequences.*

- COS participating members reported 14 Tier 2 Process Safety Events (2A) in 2015, for a frequency of 0.046. This is essentially flat with 2014 performance but remains below 2013 level.
- No collisions resulting in damage ≥ $25K (2B) were reported in 2015.
- Mechanical lifting incident frequency as depicted in the graph above shows only one year of data. The data shown in previous APR has been moved to SPI 4 as the new SPI 2C was redefined for 2015 with new thresholds to be consistent with other SPI 2 thresholds (see definition in Appendix 1). Mechanical lifting or lowering incident frequency is the highest of all SPI 1 and SPI 2 categories for 2015.
- Loss of Station Keeping incident and lifeboat, life raft, or rescue boat event frequency trended up in 2015 vs. 2014 but remained below 2013 level.
- Level 2 Well Control Incidents is a new category for 2015. One incident was reported in 2015.

Tier 1 and Tier 2 Process Safety Event Consequences

Tier 1 and Tier 2 PSE are determined by assessing the consequences of a loss of primary containment (LOPC) event against defined thresholds (see Appendix 3). If it meets or exceeds a threshold, then it is classified as either a Tier 1 PSE or a Tier 2 PSE, but not both. In 2014, participating COS members began sharing consequence data for reported Tier 1 and Tier 2 PSE. The 2015 consequence data is presented below.

Consequence data was collected for the one Tier 1 PSE shared for 2015, with the following consequences:

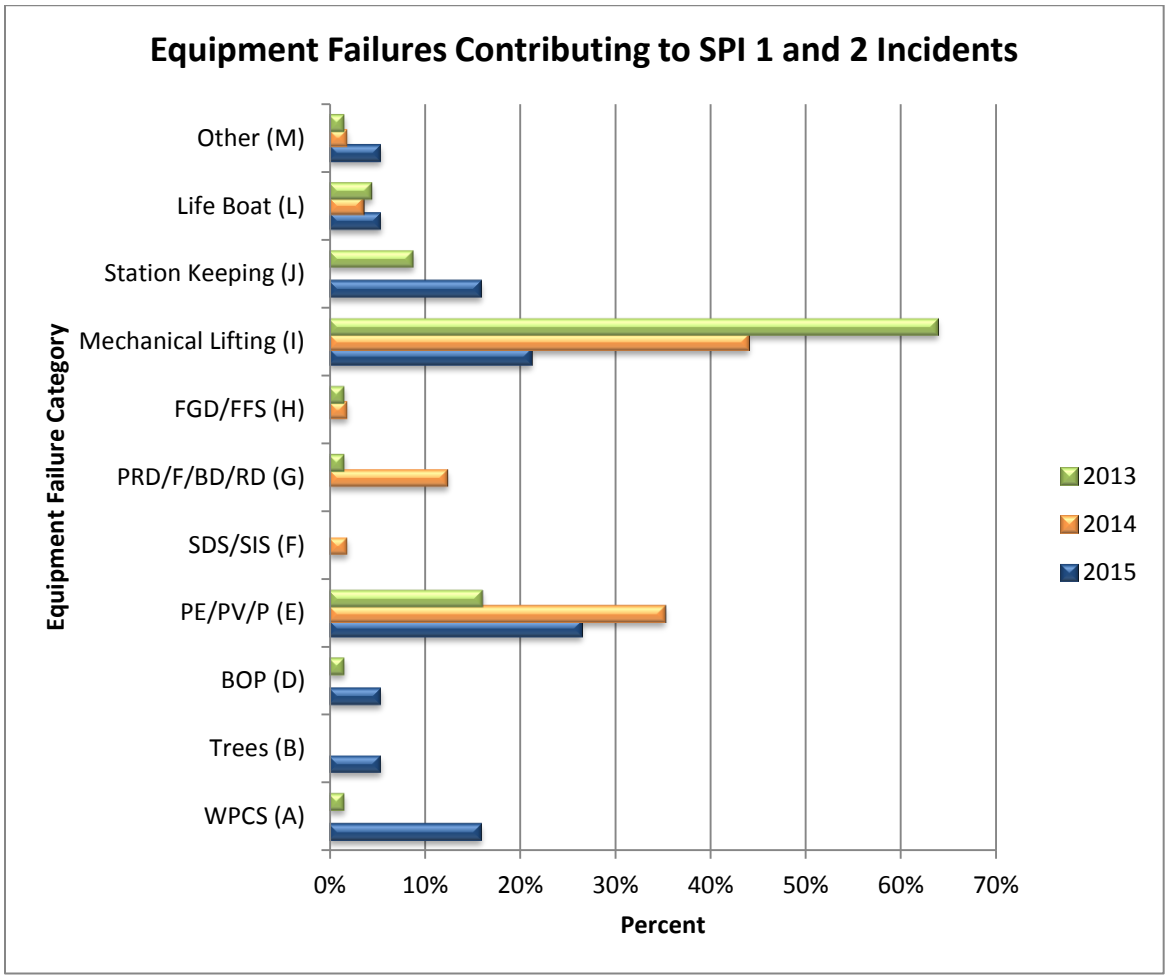
- Non-toxic materials
- Outdoor release

Consequence data was collected on 12 of the 14 the Tier 2 PSE shared for 2015. **No recordable injuries occurred in these 12 events**. The combined data resulted in the following consequences:

- One explosion resulting in $2,500 to $25,000 direct damage
- Two PRD discharges directly to atmosphere
- One pressure relief device discharge with a consequence of contained liquid carryover
- Nine releases of non-toxic materials, one toxic, and one other material. One was not categorized.
- Ten outdoor releases and one indoor release. One was not categorized.

4.4 SPI 3 Results and Trends

SPI 3 is the number of SPI 1 and SPI 2 incidents that involved failure of one or more piece of equipment as a contributing factor.

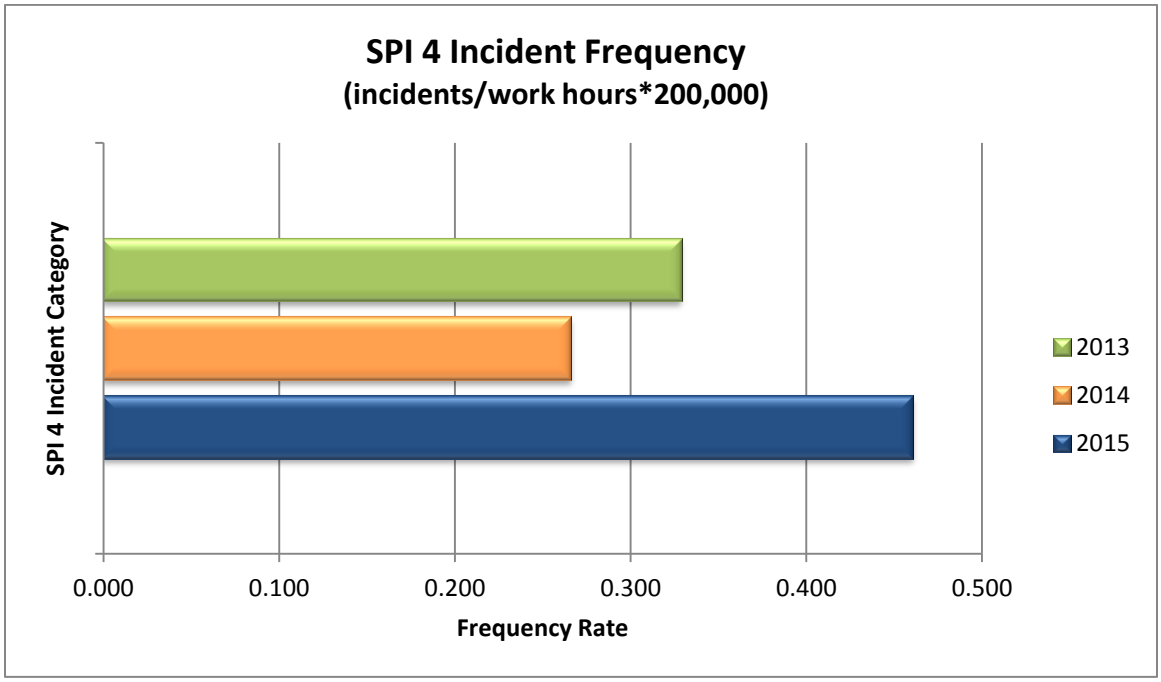


- 38% (19 of the 50) SPI 1 and SPI 2 incidents reported in 2015 involved failure of equipment which is down from 45% in 2014 and 68% in 2013.
- 26% (5 of the 19) SPI 3 reported in 2015 involved process equipment, pressure vessels, and piping failures. This is a decrease from 35% in 2014 and an increase from the 16% in 2013.
- 21% (4 of the 19) SPI 3 reported in 2015 involved mechanical lifting equipment. This is a decrease from 44% in 2014 and 64% in 2013. The drop in 2015 is due in part to the change in definition for the SPI.
- Both station keeping system and well pressure containment system categories were 16% of the SPI 3 reported in 2015. These were both up from the previous two years.

Equipment	2013 Failures (Count)	2014 Failures (Count)	2015 Failures (Count)
A - Well Pressure Containment System (WPCS)	1	0	3
B - Christmas Trees	0	0	1
C - Downhole Safety Valves	0	0	0
D - Blowout Preventers and Intervention Systems (BOP)	1	0	1
E - Process Equipment/Pressure Vessels/Piping (PE/PV/P)	11	20	5
F - Shutdown Systems/Automated Safety instrumented Systems (SDS/SIS)	0	1	0
G - Pressure Relief Devices/Flares/Blowdown/Rupture Disks (PRD/F/B/RD)	1	7	0
H - Fire/Gas Detection and Fire Fighting Systems (FGD/FFS)	1	1	0
I - Mechanical Lifting Equipment/Personnel Transport Systems	44	25	4
J - Station Keeping Systems	6	0	3
K - Bilge/Ballast Systems	0	0	0
L - Life Boat/Life Raft/Rescue Boat/Launch and Recovery Systems	3	2	1
M - Other	1	1	1

4.5 SPI 4 Results and Trends

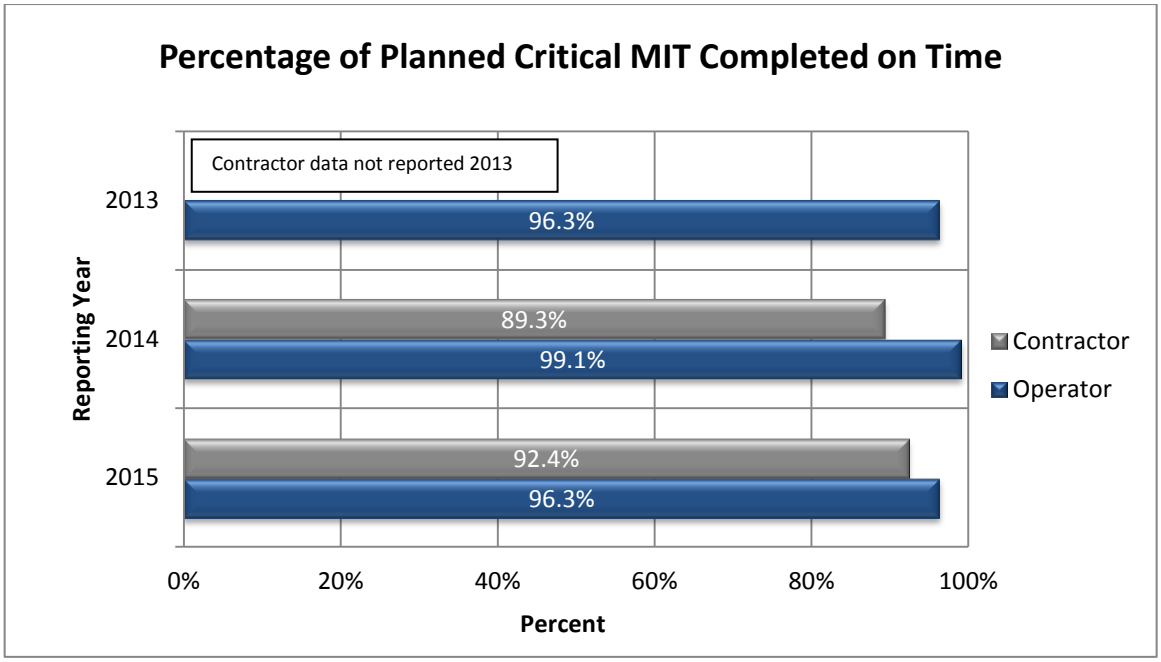
SPI 4 is the frequency of crane or personnel/material handling operations incidents



- This SPI is the SPI 2C data from 2013 and 2014 which has been moved to a new SPI 4 category with no change in definition.
- The 2015 incident frequency increased 74% vs. 2014.

4.6 SPI 5 Results and Trends

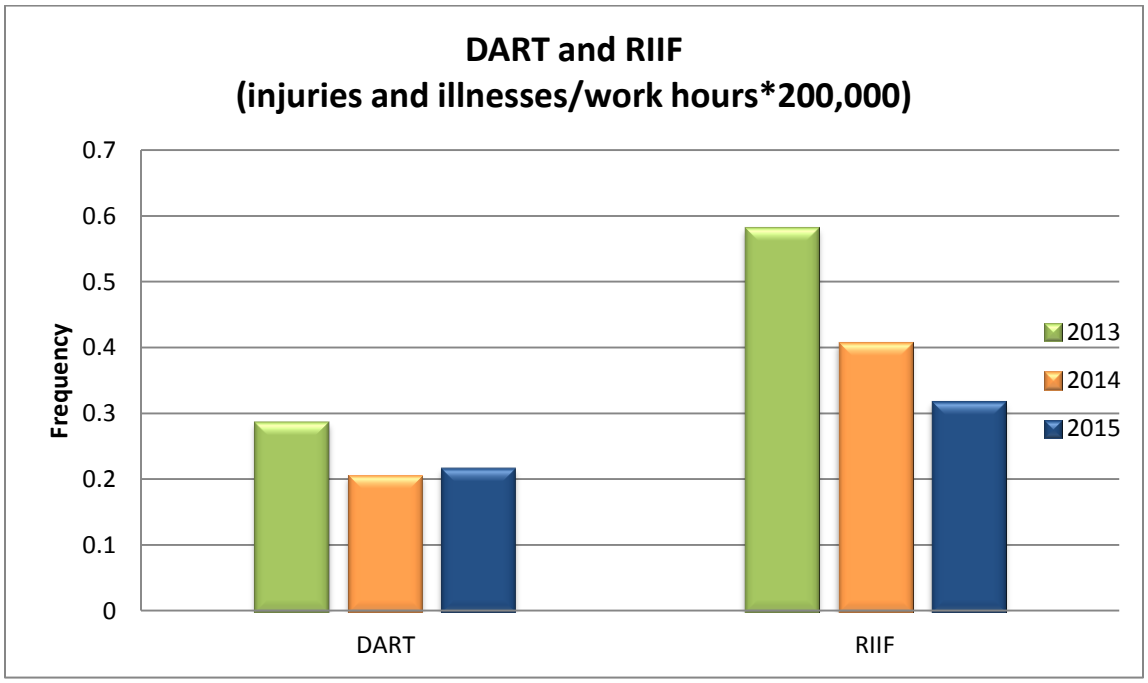
SPI 5 is the percentage of planned critical maintenance, inspection and testing (MIT) completed on time. Planned critical MIT deferred with a formal risk assessment and appropriate level of approval is not considered overdue.



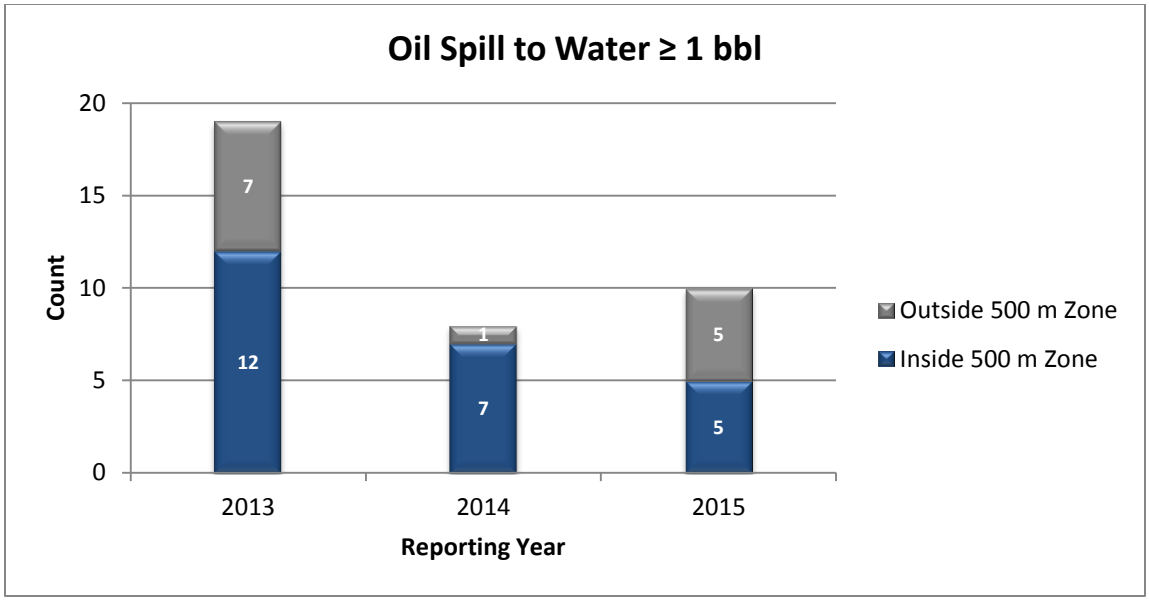
- Nine Operators shared SPI 5 critical MIT data. Additionally, two Operators reported no MIT tasks due to not having ownership of facilities or equipment. Two Operators reported not applicable.
- Of the nine Operators that reported critical MIT data, the combined average for 2015 was 96.3%, ranging from 83.69% to 100.0%. This compares to 99.1% for 2014 and 96.3% for 2013, ranging from 97.9% to 100.0% in 2014 and 90.5% to 100% in 2013.
- Four Contractors shared SPI 5 critical MIT data. Additionally, four Contractors reported no MIT tasks due to not having ownership of facilities or equipment.
- Of the four Contractors that reported critical MIT data, the combined average for 2015 was 92.4% with a range of 84.7% to 100.0%. In 2014, the average was 89.3%, ranging from 80.4% to 98.6%.
- The overall SPI 5 critical MIT data when combined for contractors and operators was 95.1% versus 94.7% in 2014.

4.7 SPI 6-9 Results and Trends

- SPI 6 is number of work-related fatalities.
- SPI 7 is the frequency of days away from work, restricted work, and job-transfer injury and illnesses (DART)
- SPI 8 is the frequency of recordable injuries and illnesses (RIIF)
- SPI 9 is the frequency of oil spills to water ≥ 1 barrel

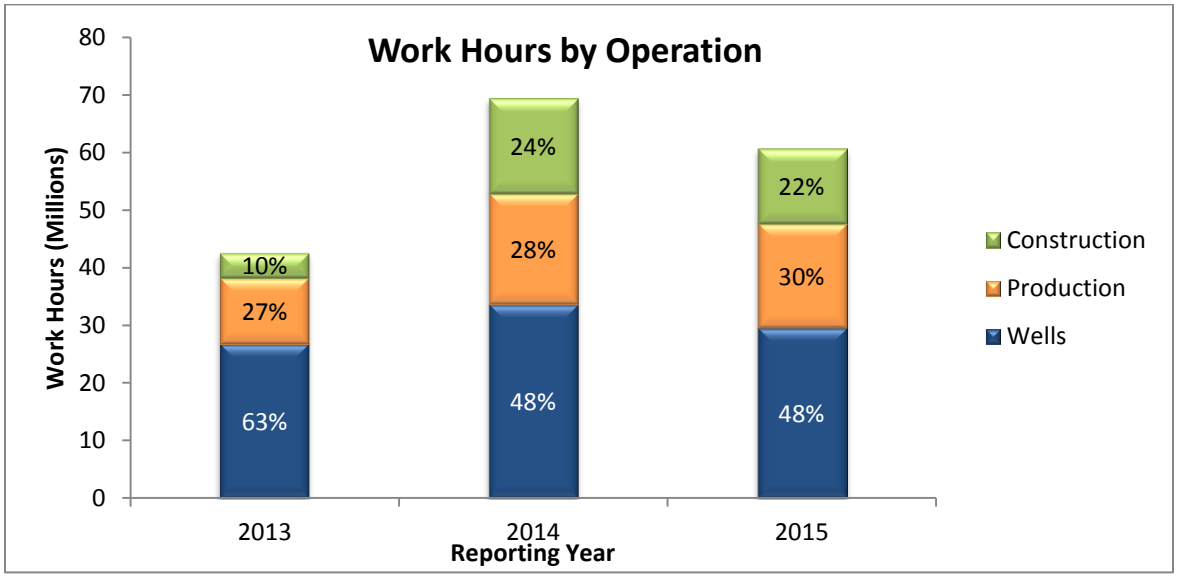


- There was one fatality reported by participating COS members in 2015. This was the first fatality reported by participating COS members since implementing the COS SPI program in 2013.
- The combined DART (SPI 7) in 2015 for COS participating members was 0.215 compared with 0.205 in 2014 and 0.286 in 2013, ranging from 0.000 to 0.450. This is essentially flat from 2014 and a decrease from 2013.
- The combined RIIF (SPI 8) in 2015 for COS participating members was 0.316, ranging from 0.000 to 1.455. This continues the downward trend from a RIIF of 0.406 in 2014, and 0.581 in 2013 for COS members.

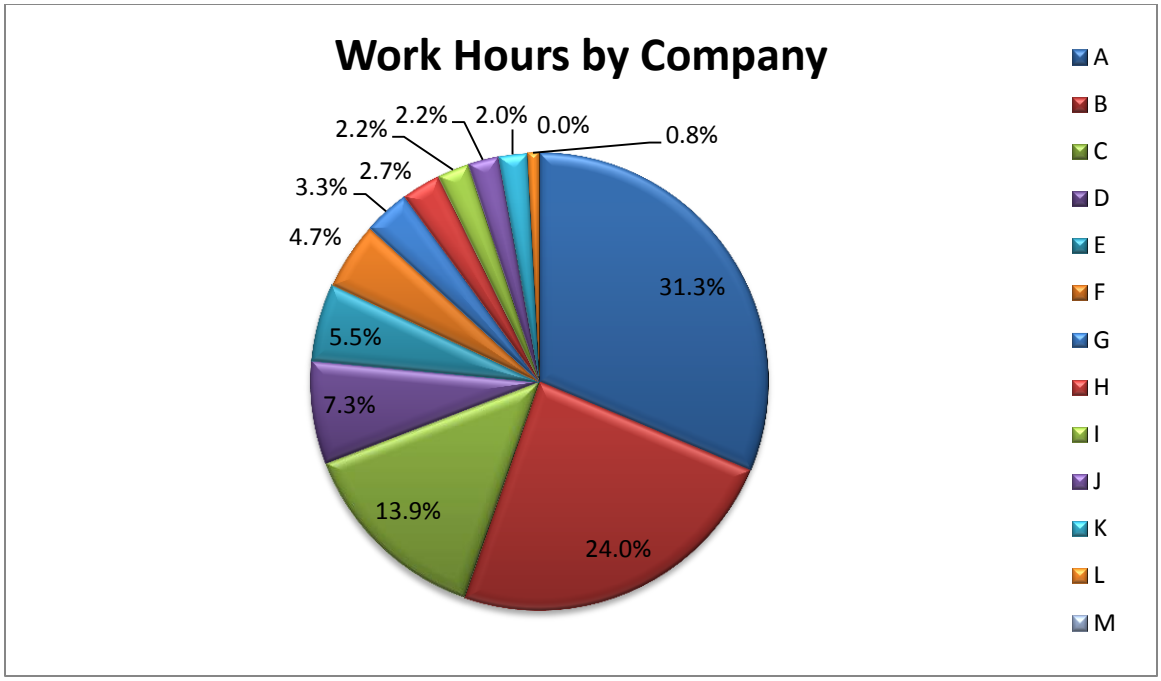


- Ten oil spills to water ≥ one barrel (SPI 9) were reported by participating members in 2015. The oil spill to water frequency was 0.033. This was an increase from 0.023 in 2014 and a decrease from the high of 0.089 in 2013.
- Of the ten oil spills reported in 2015, five occurred on a facility or within 500 meters of a facility.

4.8 Normalization Factor



- The scope of the COS SPIP expanded in 2014 to all of the US OCS vs. deepwater only for 2013.
- 61,358,927 work hours were reported by participating COS members in 2015, representing a decrease of 11.6% compared to 2014
- Work hours are reported by the COS member Operator, and include both Operator and Contractor work hours.
- Two operators reported 55.3 % of the work hours represented in the APR.


Work Hours by Company
31.3%
24.0%
13.9%
7.3%
5.5%
4.7%
3.3%
2.7%
2.2%
2.2%
2.0%
0.0%
0.8%
A
B
C
D
E
F
G
H
I
J
K
L
M

5.0 LEARNING FROM INCIDENTS AND HVLE

5.1 Introduction

The Learning from Incidents and Events (LFI) Program was established to provide a process for COS members to share and learn from incidents and HVLE that occur in offshore operations. Reporting is voluntary and data confidentiality is maintained through a process administered by a 3rd-party before submittal to COS.

The LFI section provides an analysis and comparison of the SPI 1, SPI 2, and HVLE LFI data submitted for reporting years 2013 to 2015, and includes learnings for COS members to share within their organizations to potentially prevent recurrence of similar or more severe incidents.

The data is comprised of SPI 1 and SPI 2 incidents and HVLE, which are defined as follows:

SPI 1 is the frequency of incidents that resulted in one or more of the following:

- Fatality
- Injury to 5 or more persons in a single incident
- Tier 1 Process Safety Event
- Level 1 Well Control Incident – Loss of Well Control *(see Section 4.1)*
- ≥$1 million direct cost from damage to or loss of facility / vessel / equipment
- Oil spill to water ≥ 10,000 gallons (238 barrels)

SPI 2 is the frequency of incidents that do not meet the SPI 1 definition but have resulted in one or more of the following:

- Tier 2 Process Safety Event
- Collisions that result in property or equipment damage ≥ $25,000
- Incident involving mechanical lifting or lowering (*see Section 4.1)*
- Loss of station keeping resulting in drive off or drift off
- Life boat, life raft, or rescue boat event
- Level 2 Well Control Incident - Multiple Barrier Systems Failures and Challenges *(See Section 4.1)*

HVLE is an event that may be considered by a COS member or the industry for use as a reference in process hazard analyses, management of change, project design, risk assessment, inspection, operating procedures review and / or training (see full definition in Appendix 1).

Submitted forms included three key fields:

- **Description of the Incident or HVLE**: A brief explanation of activities, conditions, and acts leading up to, during and after the incident or HVLE, including sufficient details to facilitate clear understanding.
- **Areas for Improvement**: A selection of pre-determined general categories and subcategories. Submitters had the option to add comments to provide further clarity and content.
- **Lessons Learned**: Companies outlined their incident investigation conclusions with the goal being to reduce the likelihood of similar incidents for other COS members.

Within the Areas for Improvement (AFI) fields, submitters chose from three general categories and 15 sub-categories. Multiple AFI could be selected for a single incident or event. The three general categories are:

- **Physical Facility, Equipment, and Process**: Enhancements in the quality of the physical process and equipment design, layout, material specification, fabrication, or construction were highlighted for improvement
- **Administrative Processes**: Enhancements in the quality, scope or structure of administrative processes for managing various aspects of work execution were highlighted for improvement
- **People**: Enhancements to the personnel actions linked to the execution of work tasks were highlighted for improvement

5.2 Summary

The effectiveness of this program is dependent on active participation by COS members to facilitate maximum learning opportunity through:

- Timely sharing of quality information from incidents and HVLE that meet the reporting criteria; and
- Reviewing submitted incidents and HVLE, and this COS APR in its entirety, in an effort to identify and implement applicable learnings appropriate to different levels and functions within their own organizations.

The LFI data included information and learning from 49 incident and HVLE forms submitted for the 2015 reporting year (7 SPI 1, 21 SPI 2, and 21 HVLE), 52 incident and HVLE forms submitted for the 2014 reporting year (5 SPI 1, 39 SPI 2, and 8 HVLE), and 48 incident and HVLE forms submitted for the 2013 reporting year (2 SPI 1, 39 SPI 2, and 7 HVLE). The incidents and HVLE were distributed across multiple operation and facility types. Refer to Appendix 6, charts 1 through 9 for additional information.

For the 2015 reporting year, all 49 reported incidents and HVLE occurred in U.S. waters, with 43 occurring in deepwater locations and 6 occurring in water depths < 1,000 feet or at shore-based facilities. The incidents and HVLE spanned a variety of consequence categories including personal safety, process safety, environmental impacts, and property damage.

A review of the 2015 reporting year incident and HVLE data resulted in the identification of multiple learning opportunities related to the following topics:

- Mechanical Lifting or Lowering
- Process Safety
- Dynamic Positioning / Loss of Station Keeping
- Additional Key Learnings

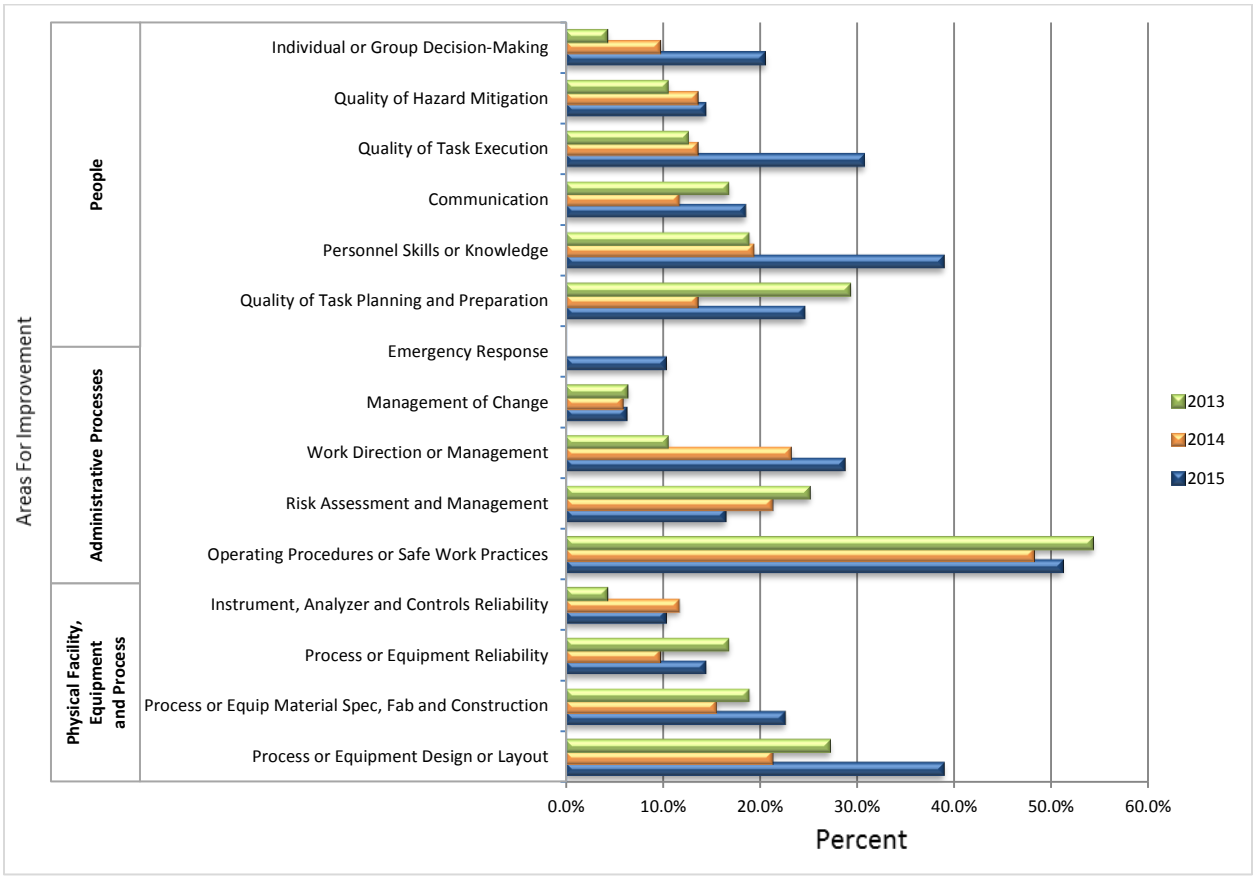
Mechanical Lifting or Lowering, Process Safety, and Dynamic Positioning / Loss of Station Keeping continue as focus areas as these topics were also identified as learning opportunities in 2013 and 2014. In addition to the key categories mentioned above, there were several key learnings captured from all LFI data.

The top three Areas for Improvement (AFI) identified for 2015 were Operating Procedures or Safe Work Practices, Process or Equipment Design or Layout, and Personnel Skills or Knowledge. Of these 3 AFI, the first two have been in the top 3 for all three reporting years. Refer to Table 1 and Chart 1 below.

Table 1 - Top Areas for Improvement – Combined 2013 to 2015 Data Set of 149 Submittals

Areas for Improvement	2013	2014	2015	3 Year Average %
Operating Procedures or Safe Work Practices	26 (54%)	25 (48%)	25 (51%)	51
Process or Equipment Design or Layout	13 (27%)	11 (21%)	19 (39%)	29
Personnel Skills or Knowledge	9 (19%)	10 (19%)	19 (39%)	26
Quality of Task Execution	6 (13%)	7 (14%)	15 (31%)	19
Work Direction or Management	5 (10%)	12 (23%)	14 (29%)	21
Quality of Task Planning and Preparation	14 (29%)	7 (14%)	12 (25%)	23
Risk Assessment and Management	12 (25%)	11 (21%)	8 (16%)	21

Chart 1 - Areas For Improvement Distribution



[1] *LFI submittals typically identified more than one AFI. The graph above illustrates the percent of times an AFI was identified relative to the number of LFI forms submitted (48 in 2013, 52 in 2014, and 49 in 2015). Because the number of AFI exceeds the number of LFI forms, the sum of the percentages will be > 100%.*

[2] *Refer to Appendix 6 for additional charts and supporting information regarding the distribution of incidents and HVLE across various categories.*

For 2015, the largest changes in AFI selection from the prior reporting years were:

- Personnel Skills or Knowledge increased from 19% (prior two years) to 39%
- Quality of Task Execution increased from 13% (2013) and 14% (2014) to 31%
- Individual or Group Decision-Making increased from 4% (2013) and 10% (2014) to 20%
- Process or Equipment Design or Layout went from 27% (2013) and 21% (2014) to 39%

5.3 2015 Learnings

A review of the 2015 reporting year incident and HVLE data resulted in the identification of learning opportunities related to the following topics:

- Mechanical Lifting or Lowering
- Process Safety
- Dynamic Positioning / Loss of Station Keeping'
- Additional Key Learnings

Mechanical Lifting or Lowering, Process Safety, and Dynamic Positioning / Loss of Station Keeping continue as focus areas as these topics were also identified as learning opportunities in 2013 and 2014.

Additional key learnings highlight specific findings from a variety of incident categories, and includes selected AFI and Lessons Learned opportunities. Although the frequency of these is relatively low they were deemed significant and worthy of sharing.

5.3.1 Mechanical Lifting or Lowering

LFI submittals continue to be dominated by Mechanical Lifting or Lowering activity despite the change in SPI 2C reporting thresholds (see new SPI 2C definition in Appendix 1). As in the prior two years, Mechanical Lifting or Lowering was the most frequently identified activity in 2015, with twelve incidents/HVLE reported. The associated AFI noted for this activity show some similarities across all three years, with Operating Procedures or Safe Work Practices and Personnel Skills and Knowledge AFI cited in the top 3 AFI categories for all years (See Appendix 6, Chart 7). Similar to prior years, Mechanical Lifting or Lowering incidents reported in 2015 included dropped objects and slinging/rigging failures.

Personnel Skills and Knowledge and Work Direction or Management AFI selection (as a percentage of Mechanical Lifting or Lowering activity events) have increased since 2013. In 2015, Personnel Skills and Knowledge was the most frequently selected AFI, followed by Work Direction or Management, and then Operating Procedures or Safe Work Practices. Selected opportunities within the top three 2015 AFI categories and Lessons Learned narratives are excerpted below:

<u>Personnel Skills and Knowledge</u> was cited in eight of the mechanical lifting or lowering incidents, with the following opportunities noted:

- The crane mechanic performing the *[job … had]* little experience working on the facility and had no experience changing out crane cable on the TLP.
- Several employees believed that a temporary repair did not require an MOC and determined it was acceptable to incorporate the new task to install the patch within the outstanding work order for crane repairs.
- Potential for dropped object not realized by the crew; wear can be tracked based on the sheave assembly design (bolt bushing and sheave wheel). This was not known by crews prior to failure of the sheave assembly.
- The team did not identify the test stand as a potential obstruction for the crane load.
- The crane operator trainee had limited experience performing this task at night.
- Not all trained riggers understand the unique hazards of lifting and rigging operations in a dynamic environment.

Work Direction or Management was cited in six of the mechanical lifting or lowering incidents, with the following opportunities noted:

- Investigation results discover that the understanding of accountability of the crane being safe to operate was unclear at the location.
- Operations Maintenance and Lifting & Hoisting had conflicting opinions about who held accountability for decisions around the maintenance and repairs of the crane exhaust.
- The permanent securing device was identified as needing to be repaired and was not scheduled to be repaired in a timely manner.
- The Fingerboard Spotter (IP) was identified to be in his first day promoted to Floorhand and colleagues took opportunities to check on him but the instructions given did not provide enough detail to monitor the fingerboards until the HR was clear of all latches and the HR arms fully retracted.

Operating Procedures or Safe Work Practices was cited in five of the mechanical lifting or lowering incidents, with the following opportunities noted:

- Our safe work practices do not adequately address lifting devices but instead focus on cranes. Additional detail on the range of lifting devices would be helpful to ensure that the concept of 'complex' lifts is understood at the appropriate stage.
- Maintenance and or change out interval (preventative maintenance policy) for sheave assemblies not defined properly to mitigate risk of failure.
- The Operator Standard does not properly address the need to replace slings due to possible damages incurred by repeatedly lifting same size of tubular. The Operator Standard and Guideline for Lifting and Rigging tubulars have conflicting info regarding proper rigging of 14” casing
- The Work Instruction for Tripping in Hole did not provide enough detail to watch latches to ensure that they opened and remained open until the stand is completely clear of the finger.

Lessons Learned / Additional Comments

- Fingerboard latches are prone to be in a closed position when they are expected to be open. Stored energy can be built up in a blocked tubular and it is vital personnel are aware of this hazard.
- Internal standards referring to complex lifts need further detail to set clearer expectations around non-crane type lifting operations.
- More frequent inspection (7-day visual) and change-out (180-day day) is required on the iron roughneck proximity switch. The investigation revealed corrosion inside the head and base of the switch which resulted in the proximity switch signal remaining frozen in the break-out end of stroke position even when the torque wrench had travelled all the way to the make-up end of stroke. This proximity switch failure allowed the hydraulic pressure to build up against the dead end of the cylinder which was interpreted by the operator looking at the display panel as the connection being fully torqued.
- Due to the wide variety of crane makes and models throughout the GoM each crane requires job specific planning work packages and procedures to safely execute maintenance tasks. It was considered standard practice to secure crane cable to the crane boom with nylon rope tied in a “rolling hitch knot” using cable clamps as backup. In developing work packages it is important for work package technicians and craft technicians to collaborate to develop a job specific plan including work package and procedures. There are assumption that specialty workers contracted to perform specific jobs

regardless of experience are well versed in safe work practices equipment specific procedures and policies.

- The sling was within the inspection certification use window. The stress analysis expert observed a fatigue type of failure on the parted ends of the sling; subsequently destructive testing (Pull Test) results showed that the rest of the sling had the expected structural capacity (5 x Safe Working Limit). Therefore this incident did not have a singular or clear point of failure as its cause. Based on the evidence collected by the Investigation team it appears the sling failed due to a combination of age (4 years in service) localized damage (crimping) and reduced flexibility (lubrication and low count of wires per strands) that contributed to form a weak point and eventually causing it to fail under normal load weight.
- Supervisors must keep an eye on the big picture and not get caught up doing the work of the crew.

5.3.2 Process Safety Events

A total of nine Process Safety Events (PSE) were reported in 2015 (two Tier 1 and seven Tier 2 PSE). The frequency of reporting for PSE remains relatively constant over the 3-year reporting period with a total of 7 events reported in 2013 and 9 in 2014. For 2015, Work Direction or Management and Quality of Task Execution AFI were cited most frequently, followed by Personnel Skills and Knowledge, Operating Procedures or Safe Work Practices, and Process or Equipment Design or Layout (Refer to Appendix 6, Chart 9).

Specific opportunities within each of the top 4 AFI categories, and Lessons Learned narratives are excerpted below:

Work Direction or Management was cited in four of the PSE, with the following opportunity noted:

- Many crafts (Operators and Contractors) are allowed to install, adjust and/or remake tubing fittings in an uncontrolled manner. Inspections are usually only done for tubing installed by Electrical & Instrumentation contractors.

Quality of Task Execution was cited in four of the PSE, with the following opportunities noted:

- The fitting was also under tightened as demonstrated by multiple swage marks and ultimately allowing for the tubing to pull out of the fitting without the ferrules at a pressure lower than designed.
- The Night Job Sponsor/Isolation Authority assumed the associated methanol piping replacement job and crew had placed the valves to their normal operating position.
- Based on uneven gasket damage/compression nuts on U-bolts near a leak location were likely tightened in an effort to stop a leak. Repeated pressure cycling with the glass stressed eventually led the *[sight]* glass to fail.

Personnel Skills and Knowledge was cited in three of the PSE, with the following opportunities noted:

- General lack of awareness of Operating standard for Tubing Training Installation and Inspection requirements and the documentation required to demonstrate compliance.
- Inadequate training of personnel on the Glycol Heater: They receive generic training on fired vessels but not specifically this unit. They didn't understand the critical nature of air/fuel mixture. It is critical to understand how critical the sequences of the system are and the fuel/air mixture.

Operating Procedures or Safe Work Practices was cited in three of the PSE, with the following opportunities noted:

- Water pump impeller material dislodged into engine. Failure to discover metal fragments during water pump replacement in 2013 lead to significant blockage of water input to after-cooler. Procedure required that includes inspection of old pump prior to re-assembly.
- The Night Job Sponsor/Isolation Authority relied on experience and memory to construct the LOTO associated with the Methanol Piping Replacement Job and did not utilize the P&ID.

Lessons Learned / Additional Comments

- Create/implement an open-bleed policy to include tagging/flagging unattended open valves and communicate to workers involved in manipulating valves and a local policy to stipulate all LOTOs require P&ID/Drawings unless approved and signed off by local leadership.
- Install rate-of-change alarms on systems where significant changes in volume would indicate a need for further investigation and/or immediate action.
- Understanding of the importance of the purge cycle ignition source and air fuel ratio are critical when dealing with fired vessels to ensure equipment is operating safely & efficiently…Startup sequence quick reference guides should be posted at the units.
- Operating procedure needed to be updated to include: Prior to starting charge pump operators will open cooler bypass preventing excessive initial pressure on the plates which was determined to be causing the failures.

5.3.3 Dynamic Positioning / Loss of Station Keeping

Dynamic Positioning (DP) / Loss of Station Keeping was highlighted in the prior two APR as a focus area, and it continues to warrant mention with 6 events related to Dynamic Positioning / Loss of Station Keeping received in 2015, including three Loss of Station Keeping (SPI 2D) incidents, two HVLE, and one SPI 1E (> $1MM Direct Cost.) For 2015, the Process or Equipment Design or Layout AFI was cited most frequently, followed by Operating Procedures or Safe Work Practices (Refer to Appendix 6, Chart 8).

Specific opportunities within the top two AFI categories and Lessons Learned narratives are excerpted below:

Process or Equipment Design or Layout was cited in four of the 2015 DP / Loss of Station Keeping events, with the following opportunities noted:

- The DP software was upgraded to include an accuracy check prior to auto-switch of a reference signal.
- Only one bow thruster did not provide ample power to hold the vessel in position. Also, the PLC was not designed to operate in the environment (engine room) where it was installed.

Operating Procedures or Safe Work Practices was cited in three of the 2015 DP / Loss of Station Keeping events, with the following opportunities noted:

- Upgrade the current Collision Avoidance Radar System procedure to a high priority procedure that requires sign off and frequent reviews. Utilizing OSVs or other vessels for facility collision watch will be formally included in the latest revision of the GoM collision watch procedure.
- An operating procedure was developed to allow the vessel reference system (VRS) to stabilize prior to signal input transition.

Lessons Learned / Additional Comments

- Validate that proper self-verification and assurance are occurring against marine systems and procedures. Enhance the implementation of self-verification processes and culture of operating discipline within marine activities.
- Normal OSV operations such as transfer of cargo via transfer hoses should allow OSV to maintain a position that does not encroach *[upon]* the minimum safe distance standard of the operator/facility owner. Transfer hoses should be of a length that allows OSV DPO ability to make timely assessment should environmental conditions and/or operating parameters change.
- Review and improve current DCV Bridge Team oversight expectations by having two Officers focused on DP Operations. Review with DCV crew what Control of Work standards/guidelines for DP operations need development. Procedures shall detail the planning risk assessment and toolbox talk of repositioning activities. Activities need to be prioritized of the Bridge Team.
- The cause of the INS drift may be due to VRS-1 coming back into the system with about 0.3 degrees error. When VRS-1 was lost the first time INS automatically switched to VRS-2. When power was restored, it switched back to VRS 1 which now had an error. The original equipment manufacturer recommends *[allowing]* for the VRS to stabilize and align itself to the DP vessel's pitch, roll and heave motions for several minutes prior to enabling the VRS back into the HPR/INS.
- Vessel fleet should verify current software version. Drilling rig to update its DP Vessel Questionnaire to verify vessels alongside of the ship are not using DGPS as a primary reference sensor in their DP System.

5.3.4 Additional Key Learnings

Additional Key Learnings is a new category for 2015. This section highlights observations from a variety of incidents and categories, and includes selected AFI and Lessons Learned opportunities.

- When assembling critical pieces of equipment, a quality control process needs to be implemented to ensure all parts are compatible and matched to current equipment revisions.
- Personnel need to understand the importance of the purge cycle, ignition source and air fuel ratio when dealing with fired vessels.
- Completion engineers should be prepared to handle the possibility of original reservoir pressures when completing in pressure depleting fields through some combination of fluid weight, BHA and BOP. Include the original reservoir pressures in specifications and a completion risk register and discuss the likelihood of original reservoir pressure and geologic complexity, as applicable.
- Rigorous adherence to OEM manufacturing specifications for equipment and parts is needed to prevent failures.
- Super Duplex piping in a seawater service is susceptible to severe galvanic corrosion from graphite gaskets.
- When crews utilize one JSA on multiple work sites during a shift, a thorough hazard hunt should be done at each site to identify site specific hazards.
- Ensure that battery boxes have adequate ventilation so that vapors do not build up inside the box.
- The isolation authority relied on experience and memory to construct the LOTO associated with a piping replacement job and did not use the P&ID.

5.3.5 Noteworthy Trends for 2013-2015 Data

With 2015 representing the third year of data collection, there is now sufficient data to begin analyzing the records for trends. The following observations relate to the entire data set of 149 submittals for the reporting period from 2013 to 2015.

- The total number of LFI shared in 2015 was 49 compared to 48 and 52 in 2013 and 2014, respectively. Although the number of submittals remains consistent year-to-year, the higher proportion of HVLE indicates increased sharing behavior.
- The number of HVLE shared in 2015 represents a 162% increase over 2015 2014 while the number of SPI 2 LFI shared reduced by 46% during the same period, again due in part to the change in SPI 2C reporting thresholds.
- Site Type selection from 2013 to 2015has moved from predominantly drilling rigs to a balance of drilling rigs and floating production facilities, and this may be reflective of the recent reduction in offshore drilling activity. Similarly, the Operation Type reporting is moving from wells towards production.
- Where mechanical lifting or lowering operations dominated the activity associated with the LFI shared in 2013 and 2014, Normal Routine Production has been reported at nearly the same frequency in 2015. The reduction in the number of lifting LFI is driven in part by the change in SPI 2C reporting thresholds.

5.4 Areas for Improvement

This section summarizes the improvement areas identified across all 49 LFI submittals in reporting year 2015. The following information may be used by COS members to gain insight into potential improvement opportunities for their own operations.

A total of 169 Areas for Improvement (AFI) were selected for the 49 incidents and HVLE (Refer to Chart 1 in Section 5.2). Multiple improvement areas relating to a single incident or HVLE is consistent with industry experience, and demonstrates that a majority of incidents and HVLE can have multiple factors and associated barrier failures.

Within the Areas for Improvement (AFI) fields, submitters chose from three general categories (Physical Facility, Equipment, and Process, Administrative Processes, and People), and 15 sub-categories.

The AFI data were distributed across the three general categories listed above, with a slightly higher occurrence noted in the Administrative category. Where the percentage of Physical Facility, Equipment and Process, Administrative Processes and People AFI per LFI submitted appears to be balanced over the three reporting years, the data shows that LFI related to SPI 1 and SPI 2 incidents are associated with the first two categories, while HVLE are reflective of People improvement needs.

Among the 15 sub-categories, the most frequently reported improvement areas were (numbers in parenthesis indicates number of times chosen and percentage of reports that selected this improvement area):

- Operating Procedures or Safe Work Practices (25/49 – 51%)
- Process or Equipment Design or Layout (19/49 - 39%)
- Personnel Skills or Knowledge (19/49 – 39%)
- Quality of Task Execution (15/49 – 31%)

The selection of Operating Procedures or Safe Work Practices continued as the most often identified AFI for the past three years. Below is a list of AFI comments and observations not already shared in Section 5.3 Learnings above:

- Manufacturer had ineffective standard operating procedures for receiving and assembly inspections for preventing the use of mismatched equipment revisions during tool assembly.
- Maintenance and or change out interval for sheave assemblies not defined properly. GoM collision watch procedures should include utilizing OSV or other vessels for facility collision watch.
- When conducting preventative maintenance on lifeboats that require launching, include the hazard of propeller entanglement.
- Modify lifeboat preventative maintenance procedures to include check for fuel contamination, top off of fuel tanks and annual fuel replacement.
- Contractor on-site rig orientation *[should]* solicit pertinent information from arriving personnel to determine if experienced or short service employee.

Four other AFI also showed significant increased frequency per the number of LFI shared as compared to previous years: Process or Equipment Design or Layout, Personnel Skills and Knowledge, Quality of Task Execution, and Individual or Group Decision-Making. Additionally, Work Direction and Management AFI has shown an increasing trend from 2013-15.

- Process or Equipment Design or Layout
  - Iron roughneck operator did not recognize the torque wrench cylinder had reached the end of stroke as the control panel was located in a safe area 15 feet away for the iron roughneck.
  - Design of piping installed in a multiple riser Elephant Trunk should allow for appropriate maintenance and asset integrity inspections.
  - The location/position of a filter pot drain valve was shielded from plain view preventing visual leak checks on the methanol system.
  - The length of the transfer hose required the OSV's port stern to be 15 feet from the MODU with only 10 feet to spare which did not allow for a timely assessment and reaction as the OSV got lighter from previous cargo lifts which widened the DP footprint.
- Personnel Skills and Knowledge
  - Crane operator trainee had limited experience performing task at night.
  - Personnel did not fully understand what constitutes a 'complex' lift.
  - Changes in the operating procedures had not been clearly communicated and trained to all affected personnel.
  - Personnel had received generic training on fluid vessels but not training on specific vessels, particularly on the critical nature of air/fuel mixture.
  - OEM should train 3rd parties and rig contractor QA/QC personnel on critical bolting specifications.
  - Experienced pressure equipment inspector should perform final inspection of newly installed pressurized pipe and equipment as a condition of start-up.
- Quality of Task Execution
  - Manufacturer inspector was complacent and did not qualify control equipment per their procedure.
  - OEM 3rd party failed to capture process deviations or deviations from OEM specifications.
  - The Coxswain did not wait to verify the green indicator on the hydraulic release box prior to removing the box safety pin and pulling the release handle on a lifeboat.
- Individual or Group Decision-Making

- Personnel did not recognize that conditions for the task had changed and did not utilize *[Stop Work Authority]* .
- The team was heavily involved in conflicting projects which left little time for collaboration.
- The crane was considered critical to operations and the decision was made to continue using the crane with the damaged exhaust while the spare exhaust was being ordered.
- Worker was willfully non-compliant for the working at height requirement of 100% tie-off at all times while wearing fall-arrest systems.

6.0 Appendices

6.1 Appendix 1 - DEFINITIONS

Note: please reference **Appendix 3: SPI Definitions and Metrics** for detail on the SPI, their minimum-release threshold values and specific normalization factors for each SPI. Please reference **Appendix 4: Equipment Definitions** for specific definitions of equipment.

Barrier: A constraint on a hazard that reduces the probability of an incident or its consequences. There are two types of barriers: Prevention and Mitigation.

Consequence: The harm that could result from an incident.

Contractor: An individual, partnership, firm or corporation retained by the Owner or Operator to perform work or to provide supplies or equipment. The term Contractor shall also include subcontractors.

Deepwater: Exploration and production activity occurring in 1000 feet or deeper water depth.

Facility: All types of offshore structures permanently or temporarily attached to the seabed (mobile offshore drilling units, floating production systems, floating production, storage and offloading facilities, tension-leg platforms, and spars) used for exploration, development, production, and transportation activities for in the OCS, including pipelines regulated by the Department of Interior (DOI).

Formation Fluid: The subterranean fluid trapped by a reservoir formation; can include natural gas, liquid and vapor petroleum hydrocarbons, and interstitial water.

Hazard: Types of chemical, thermal, toxic, kinetic, or potential energy with the ability to cause harm to people, the environment, or facilities.

High Value Learning Event: An event that may be considered by a COS member or the industry for use as a reference in process hazard analyses, management of change, project design, risk assessment, inspection, operating procedure review, and/or training. An HVLE should meet one or more of the following criteria:

A. Identify a previously unknown risk, situation, operational or mechanical hazard, or critical equipment failure.
B. Identify a previously unknown combination of factors that resulted in an unexpected condition or event.
C. Identify a routine operation or activity that created a previously unidentified risk or consequence.
D. Identify a situation where established industry designs, controls or procedures failed to prevent an event (e.g. well kick, loss of wall thickness).
E. An event that is part of a pattern in industry events which could indicate that certain hazardous conditions are not well understood.

Incident: A work-related event that has one or more consequences.

Loss of Primary Containment (LOPC): An unplanned or uncontrolled release of material from primary containment.

Major Hazard: a **Hazard** that can reasonably be foreseen as having the potential to cause a SPI 1 consequence.

Mitigation Barrier: Barrier to the right of the top event in a bow tie that can reduce or minimize the probability of a consequence. For example, active fire protection is a mitigation barrier.

Operator: The individual, partnership, firm, or corporation having control or management of operations on the leased area or a portion thereof. The Operator may be a lessee, designated agent of the lessee(s), or holder of operating rights under an approved operating agreement.

Prevention Barrier: Barrier to the left of the top event in a bow tie that can prevent or reduce the probability of a top event occurrence. For example, a safety instrumented system is a prevention barrier.

Production: Production covers offshore oil and gas production activities including flow lines and pipelines.

Projects: Projects include all offshore construction activities.

Safety Performance Indicator (SPI): A measurement that provides insights into the strength of barriers. SPI are inclusive of those that measure performance with respect to protection of personnel, the environment, and offshore facilities and property.

Safety Performance Indicator Program: A program developed, implemented and continually improved through which SPI are established, collected, analyzed and reported for specific safety issues of concern so that actions can be taken by relevant stakeholders to improve safety performance.

Wells: Wells include all offshore exploration, appraisal and production drilling, wireline, completion, workover, and intervention activities.

6.2 Appendix 2 – ACRONYMS

API – American Petroleum Institute

APR – Annual Performance Report

BSEE – Bureau of Safety and Environmental Enforcement

COS – Center for Offshore Safety

DART – Days Away From Work, Restricted Work, and Job-Transfer Injury and Illness Frequency

F/G – Fire/Gas

GoM – Gulf of Mexico

HVLE – High Value Learning Event

LFI – Learning from Incidents and HVLE

LOPC – Loss of Primary Containment

MIT – Maintenance, Inspection, and Testing

NC – Non-conformance

OCS – Outer Continental Shelf

OFI – Opportunity for Improvement

PRD – Pressure Relief Device

RIIF – Recordable Injury and Illness Frequency

SEMS – Safety and Environmental Management System

SPI – Safety Performance Indicator

WPCS – Well Pressure Containment System

6.3 Appendix 3 – SPI Definitions and Metrics

SPI Number	SPI Definition	SPI Metric	Reporting Entity
SPI 1	Number of work-related incidents resulting in one or more of the following consequences: A. Fatality: One or more fatalities. B. Injury to 5 or more persons in a single Incident C. Tier 1 Process Safety Event: (API RP 754 Tier 1 Process Safety Event) An unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials (e.g., steam, hot condensate, nitrogen, compressed CO2, compressed air), from a process that results in one or more of the consequences listed below: ○ an employee, contractor or subcontractor "days away from work" injury and/or fatality; ○ a hospital admission and/or fatality of a third-party; ○ an officially declared community evacuation or community shelter-in-place; ○ a fire or explosion resulting in greater than or equal to $25,000 of direct cost to the Company; ○ a pressure release device (PRD) discharge to atmosphere whether directly or via a downstream destructive device that results in one or more of the following four consequences: ▪ liquid carryover ▪ discharge to a potentially unsafe location ▪ an onsite shelter-in-place ▪ public protective measures and a PRD discharge quantity greater than the threshold quantities in Table A-C in any one-hour period; or ○ A release of material greater than the threshold quantities described in Tables A-C in any one-hour period. D. Level 1 Well Control Incident: Loss of well control • Uncontrolled flow of formation or other fluids resulting in: ○ Seabed/surface release. ○ Underground communication to another formation or well. • Includes shallow water flows that result in damage or loss of facilities/equipment • *Excludes planned shallow gas mitigation operations.* E. $1 million or greater direct cost from damage to or loss of facility / vessel / equipment (excludes costs associated with downtime or production loss). F. Oil spill to water > or equal to 10,000 gallons (238 barrels)	# of SPI 1 incidents/ total work hours * 200,000	COS Operator for all incidents within the 500 meter zone and for incidents to direct employees while offshore COS Contractor for incidents outside the 500 meter zone while offshore
SPI 2	Frequency of work-related incidents that do not meet the definition of a SPI 1 incident but have resulted in one or more of the following: A. Tier 2 Process Safety Event: (API RP 754 Tier 2 Process Safety Event) An unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials (e.g., steam, hot condensate, nitrogen, compressed CO2, compressed air), from a process that results in one or more of the consequences listed below and is not reported as a Tier 1 PSE: ○ An employee, contractor or subcontractor recordable injury; ○ A fire or explosion resulting in greater than or equal to $2,500 of direct cost to the Company; ○ A pressure release device (PRD) discharge to atmosphere whether directly or via a downstream destructive device that results in one or more of the following four consequences: ▪ liquid carryover ▪ discharge to a potentially unsafe location ▪ an onsite shelter-in-place ▪ public protective measures and a PRD discharge quantity greater than the threshold quantity in Tables D-F in any one-hour period; or ○ a release of material greater than the threshold quantities described in Tables D-F in any one-hour period.	# of SPI 2 incidents / total work hours * 200,000	COS Operator for all incidents within the 500 meter zone and for incidents to direct employees while offshore COS Contractor for incidents outside the 500 meter zone while offshore

SPI Number	SPI Definition	SPI Metric	Reporting Entity
	B. Collision that results in property or equipment damage > $25,000 C. Incident Involving Mechanical Lifting A mechanical lifting (or lowering) incident that results in one or more of the following consequences. Mechanical lifting includes lifts of an asset or personnel (personnel transfer and man-riding). Consequences: • Four or less recordable injuries in a single incident that occurs during the lift • Between $25,000 and $1 million direct damage to or loss of an asset (including the load itself) • A loss of primary containment of a material meeting a Tier 2 Process Safety Event threshold quantity • A dropped load that strikes live process equipment Not included: • Lifting incident resulting only in a first aid injury • Lifting incident resulting only in direct damage to an asset (including the load itself) < $25,000 • Lifting incident resulting only in a slipped load • Dropped load or object into the water valued at < $25,000 • Manual lifting incidents D. Loss of station keeping resulting in drive off or drift off defined as a malfunction or improper operation of the dynamic positioning system E. Life boat, life raft, or rescue boat event that resulted in a recordable injury or equipment damage or malfunction during life boat, life raft, or rescue boat operations or that take it out of service. F. Level 2 Well Control Incident One barrier system within the well design failed and other barrier system(s) either failed or were challenged beyond design capacity resulting in an influx without uncontrolled flow.		
SPI 3	Number of SPI 1 and SPI 2 incidents that involved failure of one or more of equipment as a contributing factor. COS Equipment categories: A. Well pressure containment system B. Christmas trees C. Downhole safety valves D. Blow out preventer and intervention systems E. Process equipment/pressure vessels, piping F. Automated safety instrumented systems / shutdown systems G. Pressure relief devices, flare, blowdown, rupture disks H. Fire/gas detection and fire-fighting systems I. Mechanical lifting equipment/personnel transport systems J. Station keeping systems K. Bilge/ballast systems L. Life boat, life rafts, rescue boats, launch and recovery systems M. Other	Number of SPI 1 and 2 incidents involving failure of equipment / total number of SPI 1 and 2 incidents * 100	COS Operator for all incidents within the 500 meter zone and for incidents to direct employees while offshore COS Contractor for incidents outside the 500 meter zone while offshore
SPI 4	Crane or personnel/material handling operations defined as a failure of the crane itself (e.g., the boom, cables, winches, ball ring), other lifting apparatus (e.g., air tuggers, chain pulls), the rigging hardware (e.g., slings, shackles, turnbuckles), or the load (e.g., striking personnel, dropping the load, damaging the load, damaging the facility). Reference MMS NTL 2008-G17.		

SPI Number	SPI Definition	SPI Metric	Reporting Entity
SPI 5	Number of planned critical maintenance, inspections and tests completed on time. • A planned task can be deferred if a proper risk assessment was completed and approved, and a new due date set. • COS Equipment: o Well pressure containment system o Christmas trees o Downhole safety valves o Blow out preventer and intervention systems o Process equipment/pressure vessels, piping o Automated safety instrumented systems / shutdown systems o Pressure relief devices, flare, blowdown, rupture disks o Fire/gas detection and fire-fighting systems o Mechanical lifting equipment/personnel transport systems o Station keeping systems o Bilge/ballast systems o Life boat, life rafts, rescue boats, launch and recovery systems o Other	Number of critical maintenance, inspections and tests tasks completed on time / number of critical maintenance, inspections and tests tasks planned * 100	COS Owner of Equipment
SPI 6	Number of work-related fatalities	Number of work-related fatalities	COS Operator when within the 500 meter zone and for direct employees while offshore COS Contractor when outside the 500 meter zone while offshore
SPI 7	Number of DART injuries and illnesses. BSEE defines DART injuries or illnesses as those that resulted in "Days Away from work, Restricted duty, and Job Transfer' outcomes.	# DART / total work hours * 200,000	COS Operator when within the 500 meter zone and for direct employees while offshore (same as reported on BSEE-0131 Form)
SPI 8	Number of recordable injuries and illnesses	Number of recordable injuries and illnesses/ total work hours * 200,000	COS Operator when within the 500 meter zone and for direct employees while offshore (same as reported on BSEE-0131 Form)
SPI 9	Number of spills greater or equal to 1 barrel that enter the water	Number of spills > or equal to 1 barrel / total work hours * 200,000	COS Operator for all spills within the 500 meter zone COS Contractor for spills outside the 500 meter zone while offshore
Work Hours	For offshore workers, the hours worked are calculated on a 12-hour work day. Work hours are collected in the following categories: • Total U.S. OCS construction workforce hours inside 500 meters • Total U.S. OCS well workforce hours inside 500 meters • Total U.S. OCS production workforce hours inside 500 meters • Total U.S. OCS workforce hours inside 500 meters		COS Operator when within the 500 meter zone (same as reported on BSEE-0131 Form)

Table A – Tier 1 Process Safety Events - Non-toxic Material Release Threshold Quantities for LOPC

LOPC is a recordable when release is 'acute', i.e. exceeds a threshold quantity in any one hour period.

Material Hazard Classification (with example materials)	Outdoor Release	Indoor Release
Flammable Gases – e.g. • methane, ethane, propane, butane, • natural gas, • ethyl mercaptan	500 kg (1,100 lb)	250 kg (550 lb)
Flammable Liquids with Boiling Point < or equal to 35˚C (95˚F) and Flash Point < 23˚C (73˚F) – e.g. • liquefied petroleum gas (LGP), • liquefied natural gas (LNG), • isopentane	500 kg (1,100 lb)	250 kg (550 lb)
Flammable Liquids with Boiling Point > 35˚C (95˚F) and Flash Point < 23˚C (73˚F) – e.g. • gasoline, toluene, xylene, • condensate, • methanol, • > 15 API Gravity crude oils (unless actual flashpoint available)	1,000 kg (2,200 lb) or 7 barrels	500 kg (1,100 lb) or 3.5 barrels
Combustible Liquids with Flash Point > or equal to 23˚C (73˚F) and < or equal to 60˚C (140˚F) – e.g. • diesel, most kerosenes, • < 15 API Gravity crude oils (unless actual flashpoint available)	2,000 kg (4,400 lb) or 14 barrels	1,000 kg (2,200 lb) or 7 barrels
Liquids with flash point > 60˚C (140˚F) released at a temperature at or above its flash point – e.g. • asphalts, molten sulphur, • ethylene glycol, propylene glycol, • lubricating oil	2,000 kg (4,400 lb) or 14 barrels	1,000 kg (2,200 lb) or 7 barrels
Liquids with flash point > 60 ˚C (140˚F) released at a temperature below its flash point – e.g. • asphalts, molten sulphur, • ethylene glycol, propylene glycol, • lubricating oil	Not Applicable	Not Applicable

Table B – Tier 1 Process Safety Events - Toxic Material Release Threshold Quantities for LOPC

LOPC is a recordable when release is 'acute', i.e. exceeds a threshold quantity in any one hour period.

Material Hazard Classification (with example materials)	Outdoor Release	Indoor Release
TIH Hazard Zone A materials - includes • acrolein (stabilized), • bromine	5 kg (11 lb)	2.5 kg (5.5 lb)
TIH Hazard Zone B materials- includes: • hydrogen sulphide (H_2S), • chlorine (Cl_2)	25 kg (55 lb)	12.5 kg (27.5 lb)
TIH Hazard Zone C materials- includes: • sulphur dioxide (SO_2), • hydrogen chloride (HCl)	100 kg (220 lb)	50 kg (110 lb)
TIH Hazard Zone D materials- includes: • ammonia (NH_3), • carbon monoxide (CO)	200 kg (440 lb)	100 kg (220 lb)
Other Packing Group I Materials – includes: • aluminum alkyls, • some liquid amines, • sodium cyanide, • sodium peroxide, • hydrofluoric acid (> 60% solution)	500 kg (1,100 lb)	250 kg (550 lb)
Other Packing Group II Materials – includes: • aluminum chloride, • phenol, • calcium carbide, • carbon tetrachloride • some organic peroxides • hydrofluoric acid (< 60% solution)	1,000 kg (2,200 lb) or 7 barrels	500 kg (1,100 lb) or 3.5 barrels

Table C – Tier 1 Process Safety Events - Other Material Release Threshold Quantities for LOPC

LOPC is a recordable when release is 'acute', i.e. exceeds a threshold quantity in any one-hour period.

Material Hazard Classification (with example materials)	Outdoor Release	Indoor Release
Other Packing Group III Materials – includes:. • sulphur, • lean amine, • calcium oxide, • activated carbon, • chloroform, • some organic peroxides, • sodium fluoride, • sodium nitrate	2,000 kg (4,400 lb) or 14 barrels	1,000 kg (2,200 lb) or 7 barrels
Strong Acids or Bases - includes: • sulphuric acid, hydrochloric acid, • sodium hydroxide (caustic), • calcium hydroxide (lime)	2,000 kg (4,400 lb) or 14 barrels	1,000 kg (2,200 lb) or 7 barrels
Moderate Acids or Bases- includes: • diethylamine (corrosion inhibitor)	None	None

Table D – Tier 2 Process Safety Events - Non-toxic Material Release Threshold Quantities for LOPC

LOPC is a recordable when release is 'acute', i.e. exceeds a threshold quantity in any one hour period.

Material Hazard Classification (with example materials)	Outdoor Release	Indoor Release
Flammable Gases – e.g. • methane, ethane, propane, butane, • natural gas, • ethyl mercaptan	50 kg (110 lb)	25 kg (55 lb)
Flammable Liquids with Boiling Point < or equal to 35˚C (95˚F) and Flash Point < 23˚C (73˚F) – e.g. • liquefied petroleum gas (LGP), • liquefied natural gas (LNG), • isopentane	50 kg (110 lb)	25 kg (55 lb)
Flammable Liquids with Boiling Point > 35˚C (95˚F) and Flash Point < 23˚C (73˚F) – e.g. • gasoline, toluene, xylene, • condensate, • methanol, • > 15 API Gravity crude oils (unless actual flashpoint available)	100 kg (220 lb) or 1 barrel	50 kg (110 lb) or 0.5 barrel
Combustible Liquids with Flash Point > or equal to 23˚C (73˚F) and < or equal to 60˚C (140˚F) – e.g. • diesel, most kerosenes, • < 15 API Gravity crude oils (unless actual flashpoint available)	100 kg (220 lb) or 1 barrel	50 kg (110 lb) or 0.5 barrel
Liquids with flash point > 60˚C (140˚F) released at a temperature at or above its flash point – e.g. • asphalts, molten sulphur, • ethylene glycol, propylene glycol, • lubricating oil	100 kg (220 lb) or 1 barrel	50 kg (110 lb) or 0.5 barrel
Liquids with flash point > 60 ˚C (140˚F) released at a temperature below its flash point – e.g. • asphalts, molten sulphur, • ethylene glycol, propylene glycol, • lubricating oil	1,000 kg (2,200 lb) or 10 barrels	500 kg (1,100 lb) or 5 barrels

Table E – Tier 2 Process Safety Events - Toxic Material Release Threshold Quantities for LOPC

LOPC is a recordable when release is 'acute', i.e. exceeds a threshold quantity in any one hour period.

Material Hazard Classification (with example materials)	Outdoor Release	Indoor Release
TIH Hazard Zone A materials - includes • acrolein (stabilized), • bromine	0.5 kg (1 lb)	0.25 kg (0.5 lb)
TIH Hazard Zone B materials- includes: • hydrogen sulphide (H_2S), • chlorine (Cl_2)	2.5 kg (5.5 lb)	1.3 kg (2.8 lb)
TIH Hazard Zone C materials- includes: • sulphur dioxide (SO_2), • hydrogen chloride (HCl)	10 kg (22 lb)	5 kg (11 lb)
TIH Hazard Zone D materials- includes: • ammonia (NH_3), • carbon monoxide (CO)	20 kg (44 lb)	10 kg (22 lb)
Other Packing Group I Materials – includes: • aluminum alkyls, • some liquid amines, • sodium cyanide, • sodium peroxide, • hydrofluoric acid (> 60% solution)	50 kg (110 lb)	25 kg (55 lb)
Other Packing Group II Materials – includes: • aluminum chloride, • phenol, • calcium carbide, • carbon tetrachloride • some organic peroxides • hydrofluoric acid (< 60% solution)	100 kg (220 lb) or 1 barrel	50 kg (110 lb) or 0.5 barrel

Table F – Tier 2 Process Safety Events - Other Material Release Threshold Quantities for LOPC

LOPC is a recordable when release is 'acute', i.e. exceeds a threshold quantity in any one hour period.

Material Hazard Classification (with example materials)	Outdoor Release	Indoor Release
Other Packing Group III Materials – includes:. • sulphur, • lean amine, • calcium oxide, • activated carbon, • chloroform, • some organic peroxides, • sodium fluoride, • sodium nitrate	100 kg (220 lb) or 1 barrel	50 kg (110 lb) or 0.5 barrel
Strong Acids or Bases - includes: • sulphuric acid, hydrochloric acid, • sodium hydroxide (caustic), • calcium hydroxide (lime)	100 kg (220 lb) or 1 barrel	50 kg (110 lb) or 0.5 barrel
Moderate Acids or Bases- includes: • diethylamine (corrosion inhibitor)	1,000 kg (2,000 lb) or 10 barrels	500 kg (1,000 lb) or 5 barrels

6.4 Appendix 4- Equipment Definitions

Equipment	Equipment Definition
Well Pressure Containment System	The casing and wellhead (with cement support and isolation where applicable)" and tubing, tubing hardware and tubing hanger represent the equipment below the BOP or Christmas Tree comprise the "well pressure containment system", and as such represent the ability to contain pressure when a BOP or Christmas Tree has been closed.
Christmas Trees	Equipment attached to the uppermost connection of the wellhead or tubing spool to contain wellbore fluids in both the tubing and in the annular space between the casing and tubing during producing operations. The subsea tree may provide locations where nitrogen and chemical additives can be injected into the annulus or tubing string. The tree consists of assembled equipment that includes a wellhead connector, valves, choke, tree cap, and control system to operate the various components.
Downhole Safety Valves	• Downhole safety valve: A device installed in a well below the wellhead with the design function to prevent uncontrolled well flow when actuated, e.g. SSCSV or SCSSV. • Subsurface controlled subsurface safety valve (SSCSV): An SSSV actuated by the pressure characteristics of the well. • Surface controlled subsurface safety valve (SCSSV): An SSSV controlled from the surface by hydraulic, electric, mechanical, or other means.
Blow Out Preventer and Intervention Systems	Equipment installed on the wellhead or wellhead assemblies to contain wellbore fluids either in the annular space between the casing and the tubulars, in the tubulars or in an open hole during well drilling, completion, and testing operations. For the purposes of SPI data collection, this also includes pressure control equipment used in intervention operations, such as wireline and coiled tubing BOPs, lubricators etc.
Process Equipment, Pressure Vessels and Piping	• Process Equipment/Pressure Vessel: A container associated with drilling, production, gathering, transportation, and treatment of liquid petroleum, natural gas, natural gas liquids, associated salt water (brine) designed to withstand internal or external pressure above ambient conditions. This definition includes containers used for pressurized storage of toxic and hazardous chemicals. • Piping System: An assembly of interconnected pipes that are used to convey, distribute, mix, separate, discharge, meter, control, or snub flows of hydrocarbons or toxic and hazardous chemicals.
Automated Safety Instrumented Systems / Shutdown Systems	• Automated Safety Instrumented System - a system implementing one or more safety functions, with specified safety integrity level(s), that detect abnormal process conditions and take automatic, necessary actions to achieve or maintain a safe state for the process with respect to a hazardous event. • Shutdown Systems - a system of manual stations that, when activated, will initiate the shutting in (isolation and cessation) of all process stations of a platform production process and all support equipment for the process. May also be integrated with Fire and Gas Detection systems for automatic initiation.
Pressure Relief Devices, Flare Systems, Blowdown Systems, Rupture Disks	• Pressure Relief Device – A device actuated by inlet static pressure and designed to open during emergency or abnormal conditions to prevent a rise of internal fluid pressure in excess of a specified design value. The device also may be designed to prevent excessive internal vacuum. The device may be a pressure relief valve, a non-reclosing pressure relief device, or a vacuum relief valve. • Flare System – used to safely dispose of relief gases in an environmentally compliant manner through the use of combustion. • Blowdown System - a collection of controls, valves and pipes that allow controlled depressurization of liquid or gas pressure contained within a process, piping, or pressure vessel to reduce or eliminate pressure induced stresses during a time of potential heat weakening of vessels and piping, as well as a reduction of the inventory of fuel present on the facility. • Rupture Disk – A pressure containing, pressure and temperature sensitive element of a rupture disk device. A rupture disk device is a non-reclosing pressure relief device actuated by static differential pressure between the inlet and outlet of the device and designed to function by the bursting of a rupture disk. A rupture disk device includes a rupture disk and a rupture disk holder.
Fire and Gas Detection and Fire Fighting Systems	• Manual fire alarms (pull stations), call stations, and audible alarms / beacons • Automatic Fire Detection Systems - The primary function of an automatic fire detection system is to alert personnel of the existence of a fire condition and to allow rapid identification of the location of the fire. The detection system(s) may be used to automatically activate emergency alarms, initiate Emergency Shutdown (ESD), isolate fuel sources, start fire water pumps, shut-in ventilation systems, and activate fire extinguishing systems such as gaseous agents, dry chemical, foam or water. The types of fire detectors commonly used on offshore platforms are as follows: o Flame Detectors - e.g., Infrared (IR) Detectors, Ultraviolet (UV) Flame Detectors, Combination IR/UV) o Heat Detectors – e.g., Fusible Plugs or links, Heat-pneumatic or Theronistor Sensors, Rate of

Equipment	Equipment Definition
	Rise Detectors, Fixed Temperature Detectors ○ Products of Combustion / Smoke Detectors – e.g., Ionization Detector, Photoelectric Detector • Gas Detection System – The primary function of a fixed gas detection system is to alert personnel to the presence of flammable gases, toxic gases, or a combination of both. ○ Flammable Gas Detection – designed to respond to a broad range of hydrocarbon gases / vapors (e.g., methane, ethane, propane and vapors from the evaporation of hydrocarbon liquids). The predominant sensors for flammable gas detection in general, normally occupied spaces are the infrared (IR) sensor or the catalytic bead sensor. ○ Toxic Gas Detection – many gas detection systems include both flammable gas and toxic gas detection for hydrogen sulfide, sulfur dioxide, and fluorine in the same system. The semiconductor and electrochemical sensors are most commonly used for the detection of the toxic gases. ○ Excludes portable gas monitoring instruments. • Fixed fire-fighting systems include the following: fire water pumps & drivers, distribution piping, fire hoses, stations, and nozzles, water spray systems / monitors, foam systems (fixed or portable), dry chemical systems, gaseous systems (e.g., CO2, Halon, FM-200 & FE-13, Inergen), and water mist / fine water spray systems. • Fire water systems are installed on offshore platforms to provide exposure protection, control of burning, and/or extinguishment of fires. The basic components of a fire water system are the fire water pump, the distribution piping, the hose / nozzle, and deluge / sprinkler system. Additives such as foaming agents may be included to aid in extinguishing flammable liquid fires. • Excludes portable fire extinguishers
Mechanical Lifting Equipment / Personnel Transport Equipment	• Crane (includes base mounted drum winches) - a type of machine, generally equipped with a hoist, wire ropes or chains, and sheaves, that can be used both to lift and lower materials and to move them horizontally. Includes: ○ Boom chords, foot pins, hoist (hydraulics and brakes), lift cylinder, sheave assembly, stops, tip extension or jib, pendant lines ○ Counterweights ○ Gantry, mast or A-frame pins ○ Hook block ○ Overhaul ball ○ Main hoist (hydraulics and brakes) ○ Auxiliary hoist (hydraulics or brakes) ○ Pedestal or crane base ○ Load management system (MIPEG, CCM-7000 etc.) ○ Crane safety system (anti two block, high & low angle kick outs) • Top Drive - a device used on a drilling rig to actually rotate the drill pipe in order to drill the well. Includes main drill line hoist (hydraulics or brakes), crown-o-matic, top drive track, assembly rollers or wheels and bearings, hydramatics or hydromatics. • Pipe racking system (PRS) including main hoist (hydraulics or brakes), track, hydraulic system, claws or fingers. • Drawworks, Air Hoists, Tuggers • Chain fall - a type of hoist with a chain attached to a fixed raised structure or beam and used to lift very heavy objects. Includes clutch, brake and sprocket. • Rigging Accessories including hooks, chains, shackles, slings (below the hook), wire rope, D-ring, elevators, bails
Station Keeping Systems	The station keeping systems for a floating structure are typically a single point mooring, a spread mooring, vertical tension legs, or a dynamic positioning (DP) system. • Single point mooring components may include but not limited to: hoisting system, hawser, swivels, roller bearings, risers, u-joint connectors, counter weights, chain, chain table, wire rope, synthetic rope, connecting hardware, clump weight, buoy, and anchor. • Spread mooring components: winch / windlass, chain jack, brakes, power, fairlead, wire rope, synthetic rope, connecting hardware, clump weight, buoy, and anchor • Vertical tension leg moorings are used by TLPs or tension leg platforms and are comprised of: mooring tendons, seafloor foundations • Dynamic positioning system consists of components and systems acting together to achieve reliable position keeping capability. The Dynamic-positioning system includes the power system (power generation and power management), thruster system and Dynamic Positioning control system.
Bilge/Ballast Systems	The vessel structure, machinery, piping, or controls related to ballast movement, watertight integrity and stability.
Life Boat, Life Rafts, Rescue Boats and Launch and Recovery Systems	• Life Boat / Survival craft is a craft capable of sustaining the lives of person in distress from the time of abandoning the ship. • Rescue boat is a boat designed to rescue persons in distress and to marshal survival craft.

Equipment	Equipment Definition
	• A life raft is an inflatable appliance which depends upon non-rigid, gas filled chambers for buoyancy and which is normally kept not inflated until ready for use. • Launch and Recovery Systems - systems used to deploy or retrieve a lifeboat, life raft, or rescue boat. Components may include but not limited to: winch, fall wire (lifting wire), sheaves (pulleys), davits, davit arms, connecting hardware, secondary securing method (gripes, safety pendants), cradle, lifting points, releasing hook(s), brake, brake release, power source to winch / davit / davit arm, free fall railing.

6.5 Appendix 5 – LFI Category Descriptions

Site Type: The primary site where the incident or event occurred. Only one selection can be made.

- Aircraft
- Diving Vessel
- Drilling Rig on Production Facility
- Fixed Production Facility
- Floating Production Facility
- Floating Storage and Offloading Facility
- Mobile Offshore Drilling Unit
- Offshore Supply or Support Vessel
- Offshore Construction Vessel
- Seismic Vessel
- Subsea Production System
- Other

Operation Type: The primary operation that was underway at the time of the incident or event. Only one selection can be made.

- Aviation
- Marine-diving, seismic, transportation, rig moves, etc.
- Production-petroleum/natural gas production, flow lines, pipe lines
- Projects-includes offshore construction activities
- Wells-exploration, appraisal/prod drilling, wireline, completion, workover, abandonment, intervention activities
- Other

Activity Type: The primary (most closely linked to incident or event) activity that was occurring at the time of the incident or event. Only one selection can be made.

- Confined Space Entry
- Diving
- Drilling Operations - Normal, Routine
- Energy Isolation
- Emergency Response (Actual or Drill)
- Helicopter Flight
- Helicopter Landing or Take-Off
- Hot Work
- Maintenance, Inspection and Testing
- Marine Vessel - In-Transit
- Marine Vessel - Station Keeping
- Material Transfer or Displacement
- Mechanical Lifting or Lowering
- Production Operations - Normal, Routine
- Simultaneous Operations
- Start-up or Shut-down Operations

- Working at Height
- Other

Areas for Improvement: All of the Areas for Improvement that apply to the incident or event being shared. The Areas for Improvement cover three general categories: Physical Process and Equipment; Administrative Process; or People. Multiple Areas for Improvement can be selected across the general categories.

5.11.1 Physical Facility, Equipment and Process

Select one or more of the following AFIs when enhancements in the quality of the physical process and equipment design, layout, material specification, fabrication, or construction were highlighted for improvement, including:

5.11.1.1 Process or Equipment Design or Layout – Select this AFI if the design or layout of the process or equipment was highlighted for improvement. Include cases where issues with the design or layout were significant contributors to subsequent human actions.

5.11.1.2 Process or Equipment Material Specification, Fabrication and Construction – Select this AFI if the quality and compatibility of the material specification, fabrication or construction of the process or equipment, prior to its use was highlighted for improvement, including process or equipment provided by vendors or third parties on a permanent or temporary basis. This category includes the use of defective parts or equipment, or improper installation.

5.11.1.3 Process or Equipment Reliability – Select this AFI if the ability of the process or equipment to function without defects or breakdown was highlighted for improvement, including improvement in maintenance, inspection, testing and operating requirements.

5.11.1.4 Instrument, Analyzer and Controls Reliability – Select this AFI if the ability of instrumentation, analyzers, and control systems, including software, to function without defects or breakdown was highlighted for improvement including improvement in maintenance, inspection, testing and operating requirements.

5.11.2 Administrative Processes

Select one or more of the following AFIs when enhancements to the quality, scope or structure of administrative processes for managing various aspects of work execution were highlighted for improvement. **Note** - If the identified gap was related to **"failure to follow"** Administrative Processes, do **NOT** select these categories. Instead, use the appropriate category in Section 5.11.3 People.

5.11.2.1 Risk Assessment and Management – Select this AFI if the process for systematic identification and evaluation of potentially significant risks was identified for improvement. This includes but is not limited to HAZOPS, facility hazard assessments, and Job Safety Analysis (JSA).

5.11.2.2 Operating Procedures or Safe Work Practices – Select this AFI if the improvement opportunity involves creating or modifying operating procedures or safe work practices to prevent recurrence. This includes specific operations, maintenance, testing, contractor selection or other procedures and practices.

5.11.2.3 Management of Change – Select this AFI if the process for identifying, approving, and managing significant technical, administrative or organizational changes was identified for

improvement. Specific improvement areas may include MOC use not required (but should have been), MOC review incomplete or incorrect, or MOC actions not completed (e.g. drawings not updated).

5.11.2.4 Work Direction or Management – Select this AFI if the process for directing work activities or managing the number or types of work allowed at a given time or location was identified for improvement. This includes but is not limited to permit-to-work, simultaneous operations and supervision of the area or work team.

5.11.2.5 Emergency Response – Select this AFI if the capability or processes for responding to a situation to prevent the escalation of incident or event consequences was identified for improvement. This category includes opportunities related to emergency preparedness, such as access to equipment and trained personnel, insufficient or absence of drills, etc.

5.11.3 People

Select one or more of the following AFIs when enhancements to the personnel actions linked to the execution of work tasks were highlighted for improvement, including:

5.11.3.1 Personnel Skills or Knowledge – Select this AFI if personnel knowledge of the relevant tasks, or the ability of personnel to execute the task correctly and safely, was identified for improvement. This category includes gaps in training (e.g. not required, not completed, or training needs improvement), assessment/verification (not performed, needs improvement, etc.), or remediation (not required, not completed, etc.).

5.11.3.2 Quality of Task Planning and Preparation – Select this AFI if personnel planning and preparation of the task prior to initiating the activity were identified for improvement, including team actions such as reviewing procedures, and completing JSAs, toolbox talks, or job walkthroughs. Note – this category will most often apply when appropriate procedures were in place, but personnel failed to follow them in the pre-work planning phase.

5.11.3.3 Individual or Group Decision-Making – Select this AFI if decisions made by one or more people involved in the execution of the task were identified for improvement. This may be selected only if personnel involved in the task had sufficient skills and knowledge, but chose to execute the task in a manner different than the documented procedure or practice.

5.11.3.4 Quality of Task Execution – Select this AFI if the quality or thoroughness of executing the intended task procedure or practice was highlighted for improvement. This applies where the person or personnel were attempting to follow the prescribed procedures or practices, but errors or incomplete execution contributed to the incident or event.

5.11.3.5 Quality of Hazard Mitigation – Select this AFI if a person or personnel either failed to put in place barriers or the quality, number, or location of barriers were insufficient to mitigate the potential impacts of relevant hazards was highlighted for improvement.

5.11.4.6 Communication – Select this AFI if the effectiveness of communication was identified for improvement. This includes communication between team members and between the team and other individuals or groups. Also included are difficulties with language or terminology.

5.12 Additional Comments

Enter Areas for Improvement that were identified in areas outside the Physical Facility, Equipment and Process; Administrative Processes; and People categories described above. A detailed description of the identified improvements should be included. Also, any additional description of "Other" Site, Operation or Activity Types could be included in this Additional Comments section. This input cell is limited to 750 characters. The first use of an acronym should always be preceded by the term for which it is used.

5.13 Lessons Learned

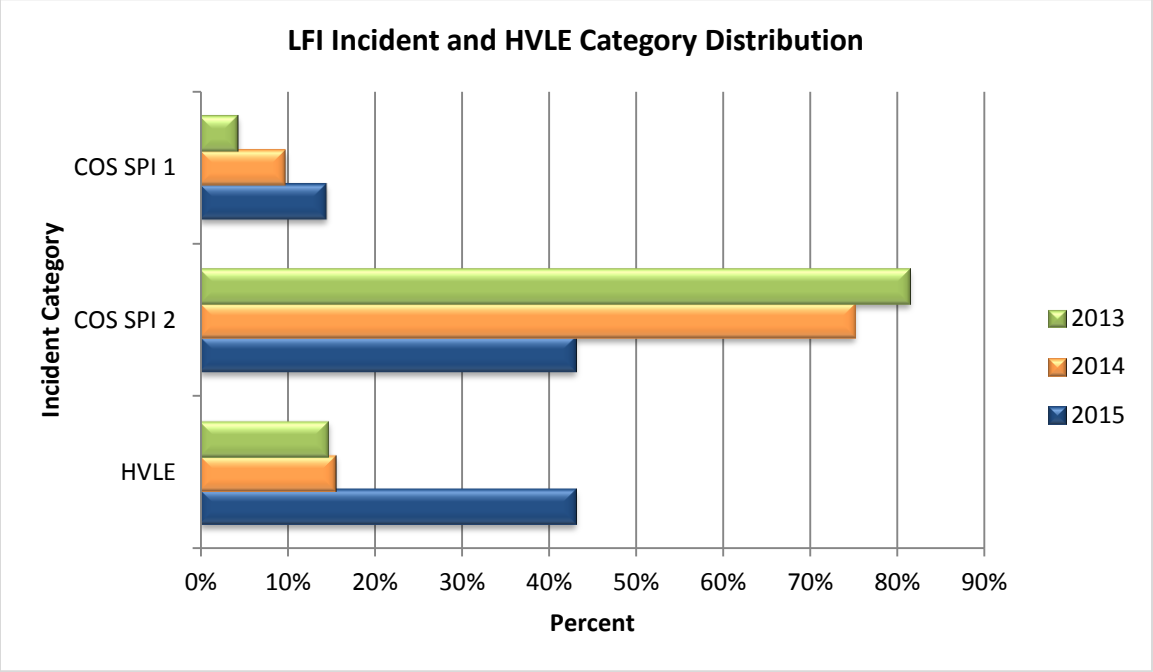
Enter a description with sufficient content to explain the context of the incident, lessons learned and actions taken to reduce the likelihood of a recurrence. These may include equipment, processes and/or human factors. Lessons Learned and actions taken should be directly related to the areas for improvement listed above. This input cell is limited to 750 characters. The first use of an acronym should always be preceded by the term for which it is used.

6.6 APPENDIX 6 – LFI DATA CHARTS

Refer to the charts listed in this appendix for additional details on the distribution of incidents and HVLE across reporting fields contained in the LFI Report Form (and not previously displayed in the body of the report). The following charts are contained in this Appendix:

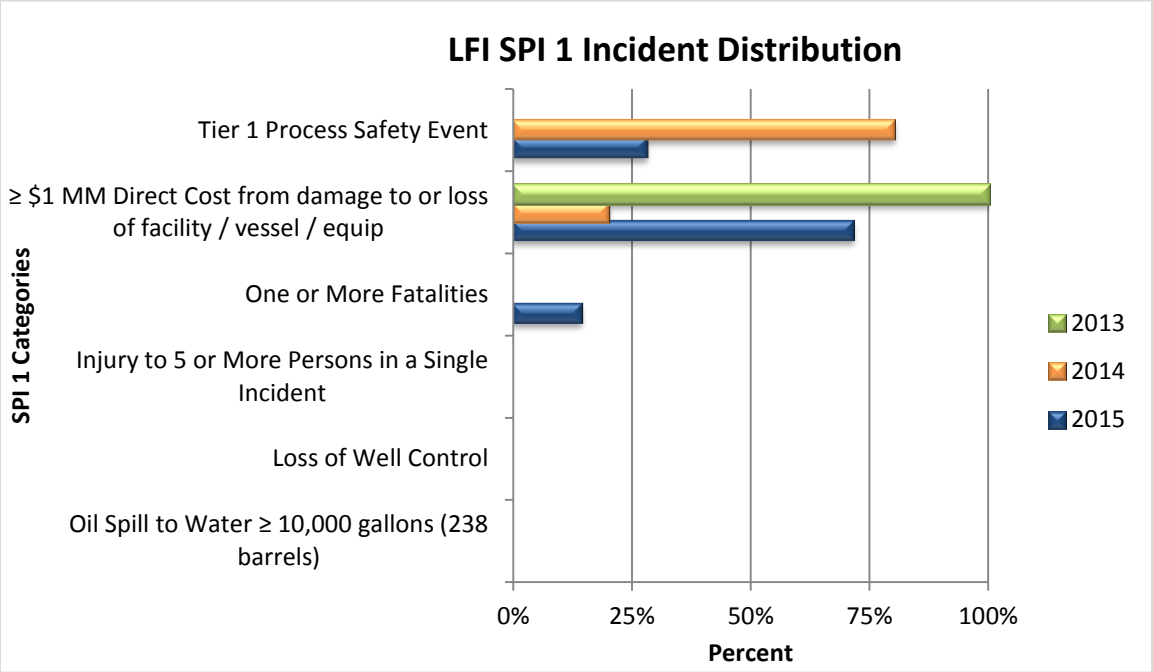
- Chart 1 – LFI Incident and HVLE Category Distribution
- Chart 2 – LFI SPI 1 Incident Distribution
- Chart 3 – LFI SPI 2 Incident Distribution
- Chart 4 – LFI Incident and HVLE Site Type Distribution
- Chart 5 – LFI Incident and HVLE Operation Type Distribution
- Chart 6 – LFI Incident and HVLE Activity Type Distribution
- Chart 7 – LFI SPI 2C (Mechanical Lifting or Lowering) AFI Distribution
- Chart 8 – LFI Loss of Station Keeping / DP AFI Distribution
- Chart 9 - Process Safety (Tier 1 and Tier 2) AFI Distribution

Chart 1 – LFI Incident and HVLE Category Distribution



- Number of occurrences represented above (by year): 2013 = 48, 2014 = 52, 2015 = 49
- Reported SPI 1 incidents increased to 14% in 2015
- Decrease in SPI 2 incidents and increase in HVLE for 2015 are due in part to SPI 2C (Mechanical Lifting or Lowering) definition changes

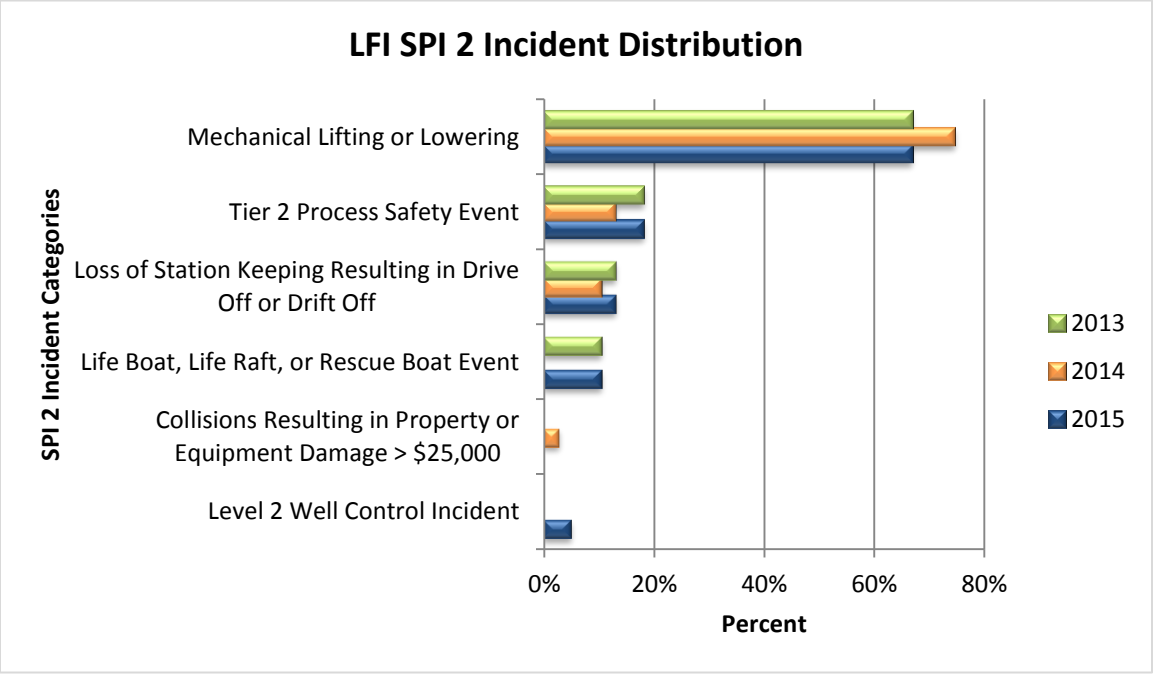
Chart 2 – LFI SPI 1 Incident Distribution



[1] *This chart depicts the number of SPI 1 consequences divided by the total number of SPI 1 LFI submitted in the given year. The total percentage in a given year can exceed 100% when multiple consequences occur for one incident.*

- 2015 is the first year with a fatality reported in the APR
- Number of occurrences represented above (by year): 2013 = 2, 2014 = 5, and 2015 = 8.

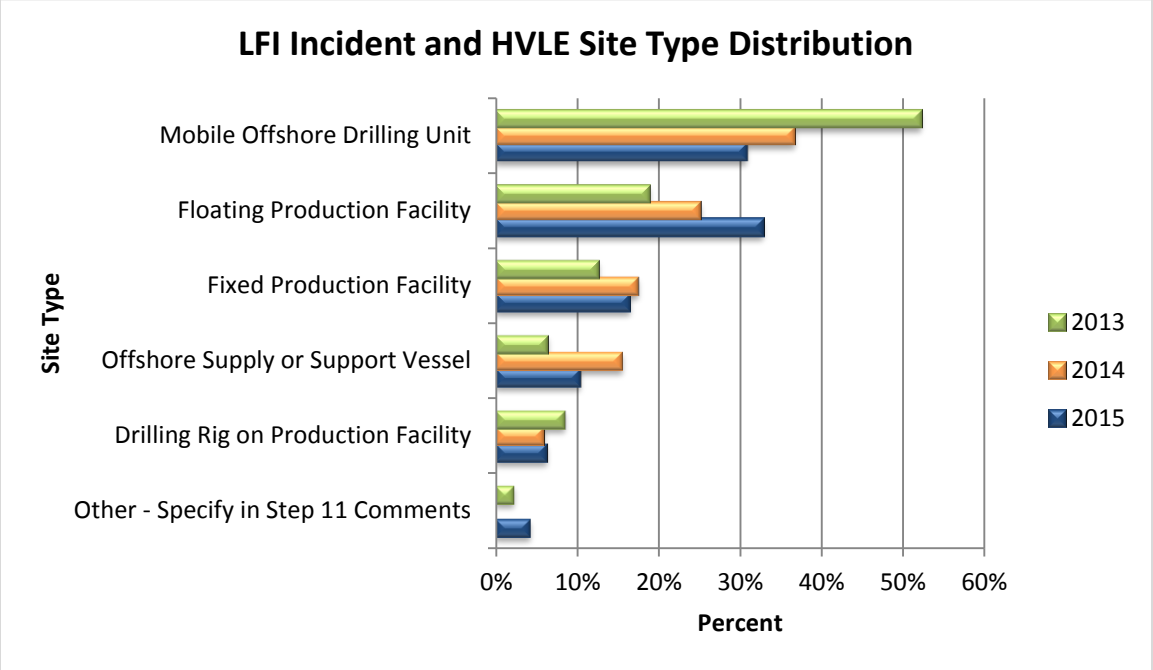
Chart 3 – LFI SPI 2 Incident Distribution



[1] *This chart depicts the number of SPI 2 consequences divided by the total number of SPI 2 LFI submitted in the given year. The total percentage in a given year can exceed 100% when multiple consequences occur for one incident.*

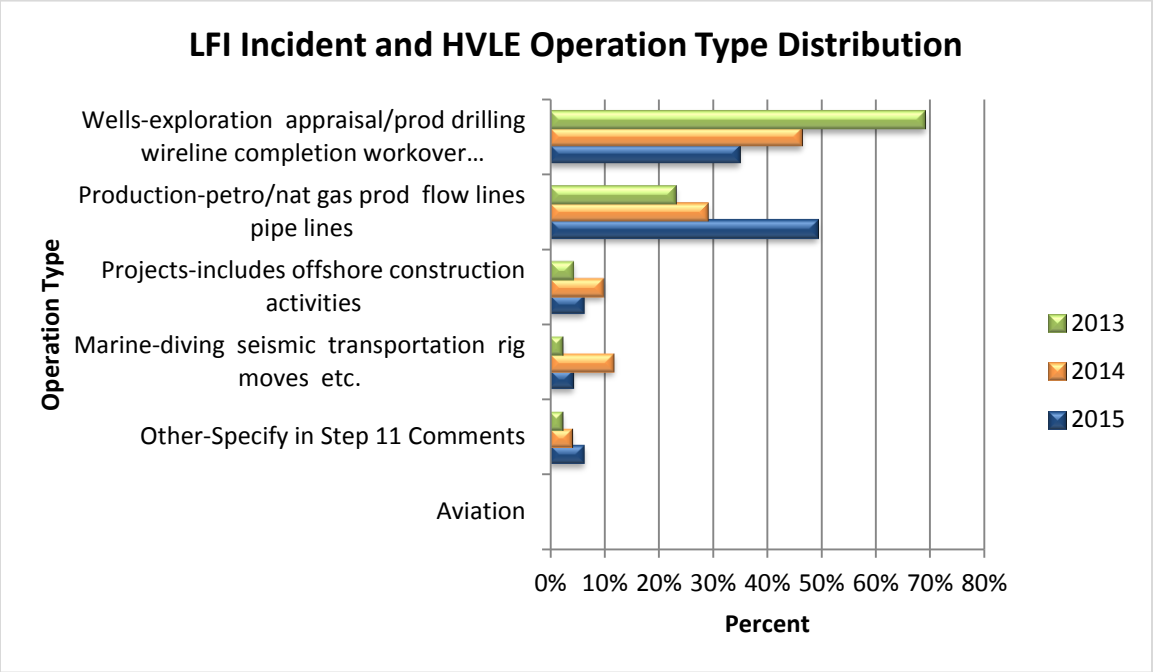
- Mechanical Lifting or Lowering category definition was modified in 2015. As such the 2015 data for this category can't be correlated to the corresponding data for 2013-2014.
- Number of occurrences represented above (by year): 2013 = 42, 2014 = 39, 2015 = 21. Three of the thirty nine 2013 SPI 2 submittals selected two consequences, bringing the occurrence total to 42, and one of the 2015 SPI 2 submittals identified two consequences, bringing the occurrence total to 22.
- Level 2 Well Control Incident is a new category for 2015. As such the 2015 data for this category can't be correlated to the corresponding data for 2013-2014.

Chart 4 –LFI Incident and HVLE Site Type Distribution



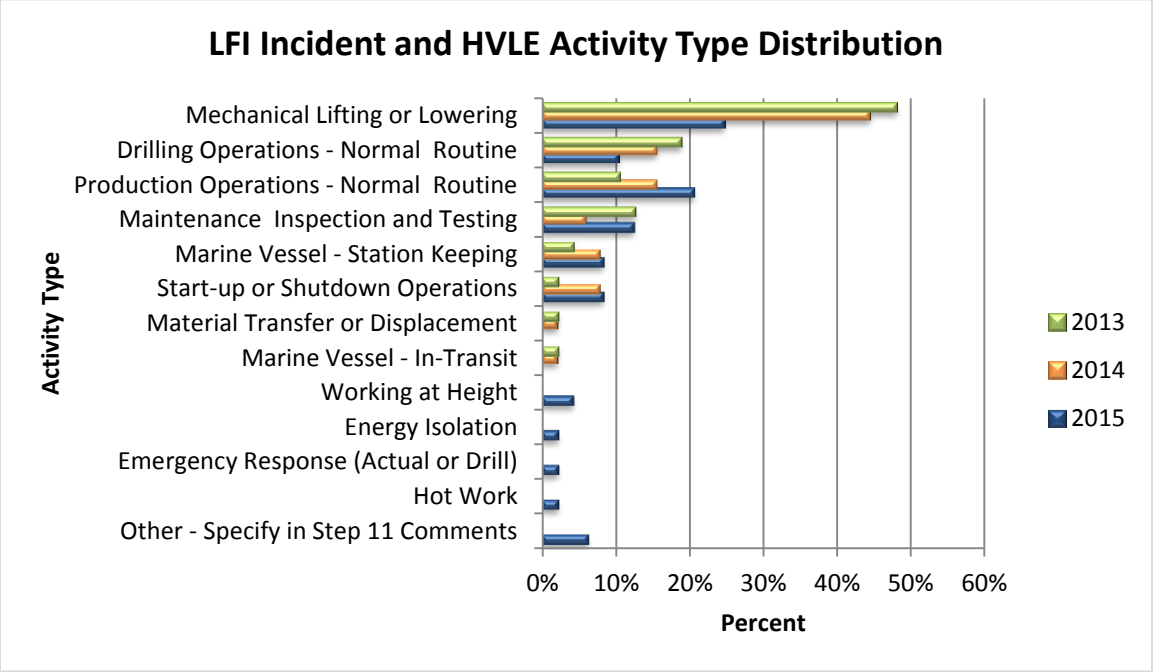
- Number of occurrences represented above (by year): 2013 = 48, 2014 = 52, 2015 = 49
- Trend from MODU to Production Facilities observed from 2013 to 2015

Chart 5– LFI Incident and HVLE Operation Type Distribution



- Number of occurrences represented above (by year): 2013 = 48, 2014 = 52, 2015 = 49
- Trend from Wells to Production Operations observed from 2013 to 2015

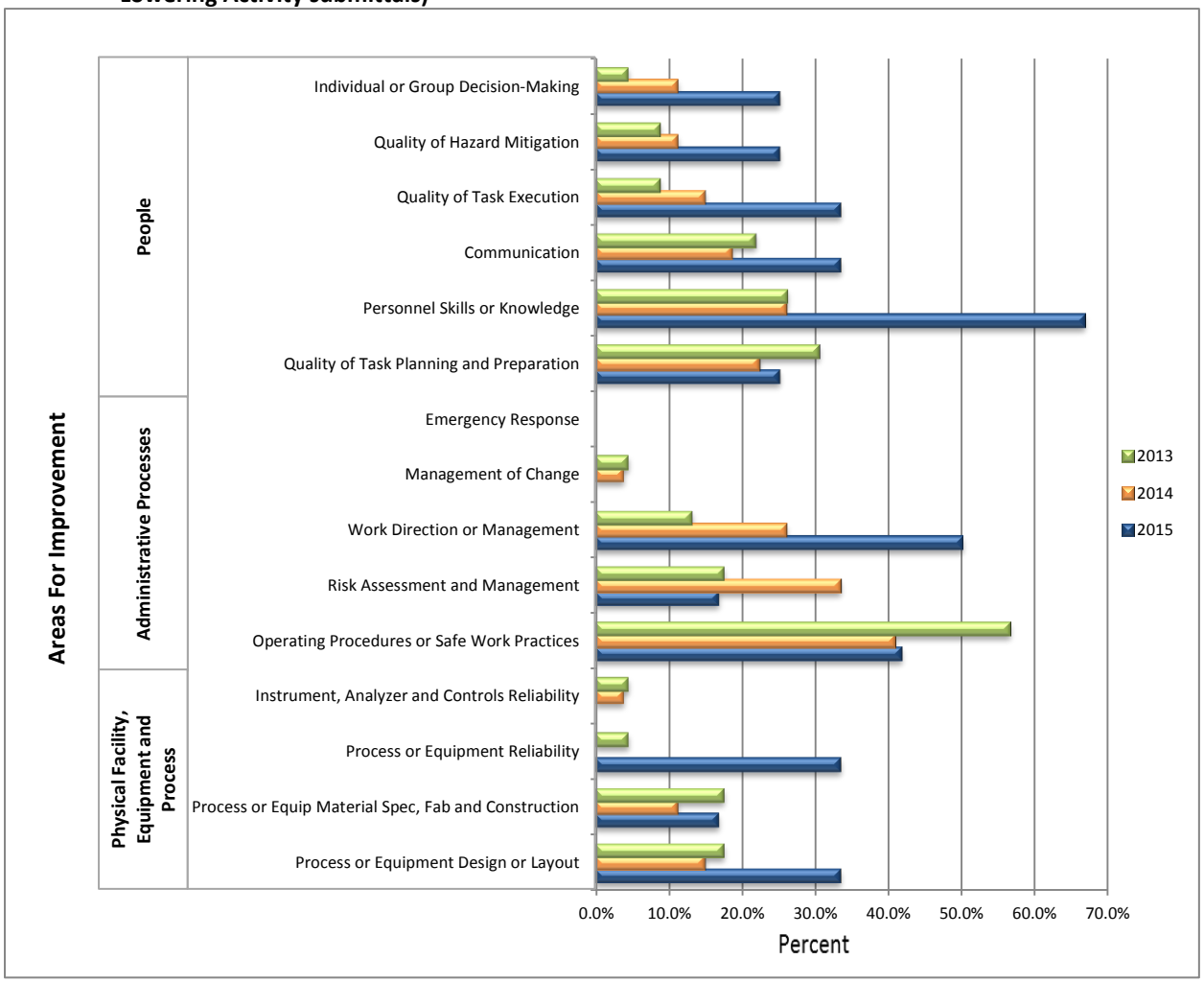
Chart 6 – LFI Incident and HVLE Activity Type Distribution

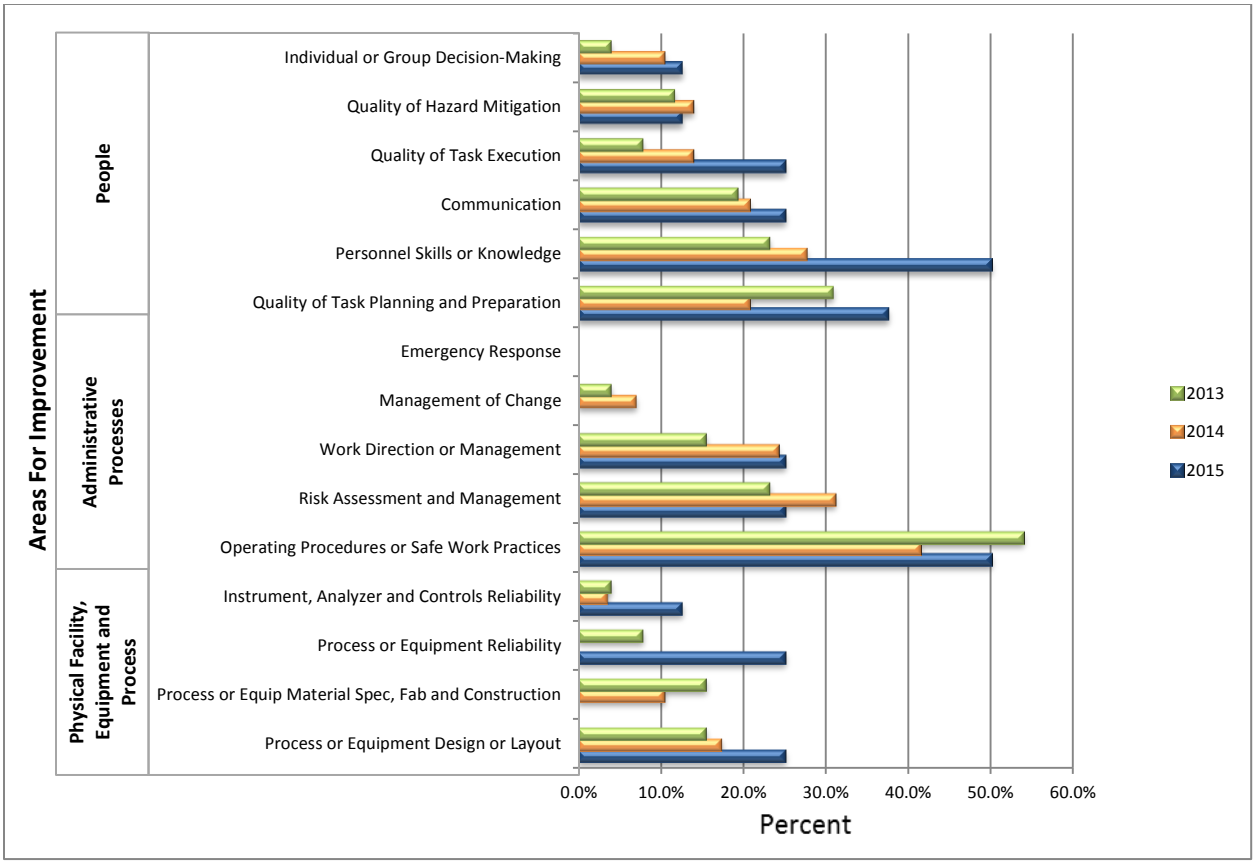


- Number of occurrences represented above (by year): 2013 = 48, 2014 = 52, 2015 = 49
- The decrease in mechanical lifting or lowering reported in 2015 is due in part to the change in SPI 2C reporting thresholds.

- The activities selected in 2015 for the first time (Working at Height, Energy Isolation, Emergency Response, Hot Work) may be reflective of additional guidance and training given to members to select the most specific activity associated with the incident or event before choosing a more generic option.

Chart 7 –Mechanical Lifting or Lowering AFI Distribution (AFI selection per total number of Mechanical Lifting or Lowering Activity submittals)

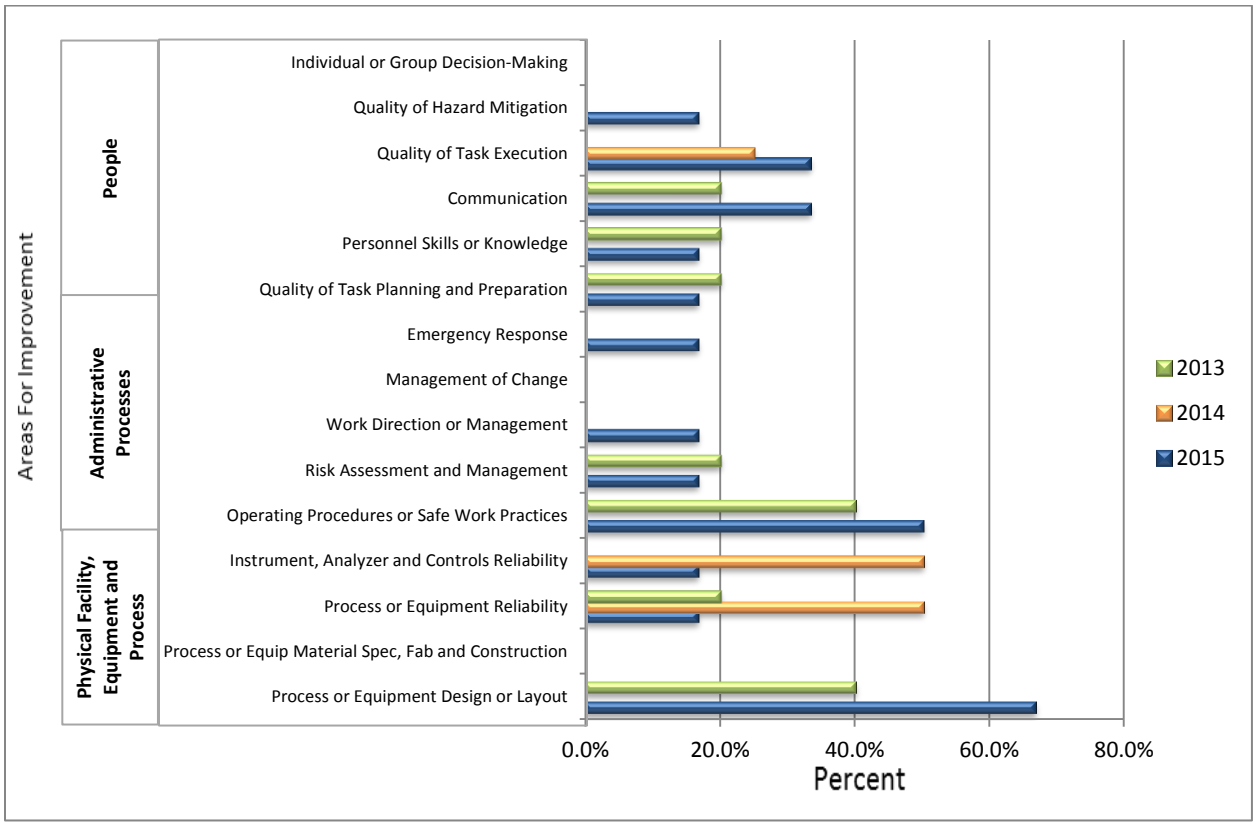




[2] *This chart depicts the number of Mechanical Lifting or Lowering Activity AFIs selected divided by the total number of Mechanical Lifting or Lowering Activity LFI submittals in the given year.*

- Number of incidents represented above (by year): 2013 = 23, 2014 = 27, 2015 = 12[1]
- Quality of Task Execution, Personnel Skills or Knowledge, and Process or Equipment Design or Layout show a steady increase over the 3-year period (2013-2015)

Chart 8 – LFI Dynamic Positioning (DP) / Loss of Station Keeping AFI Distribution (AFI selection per total number of DP / Loss of Station Keeping submittals)

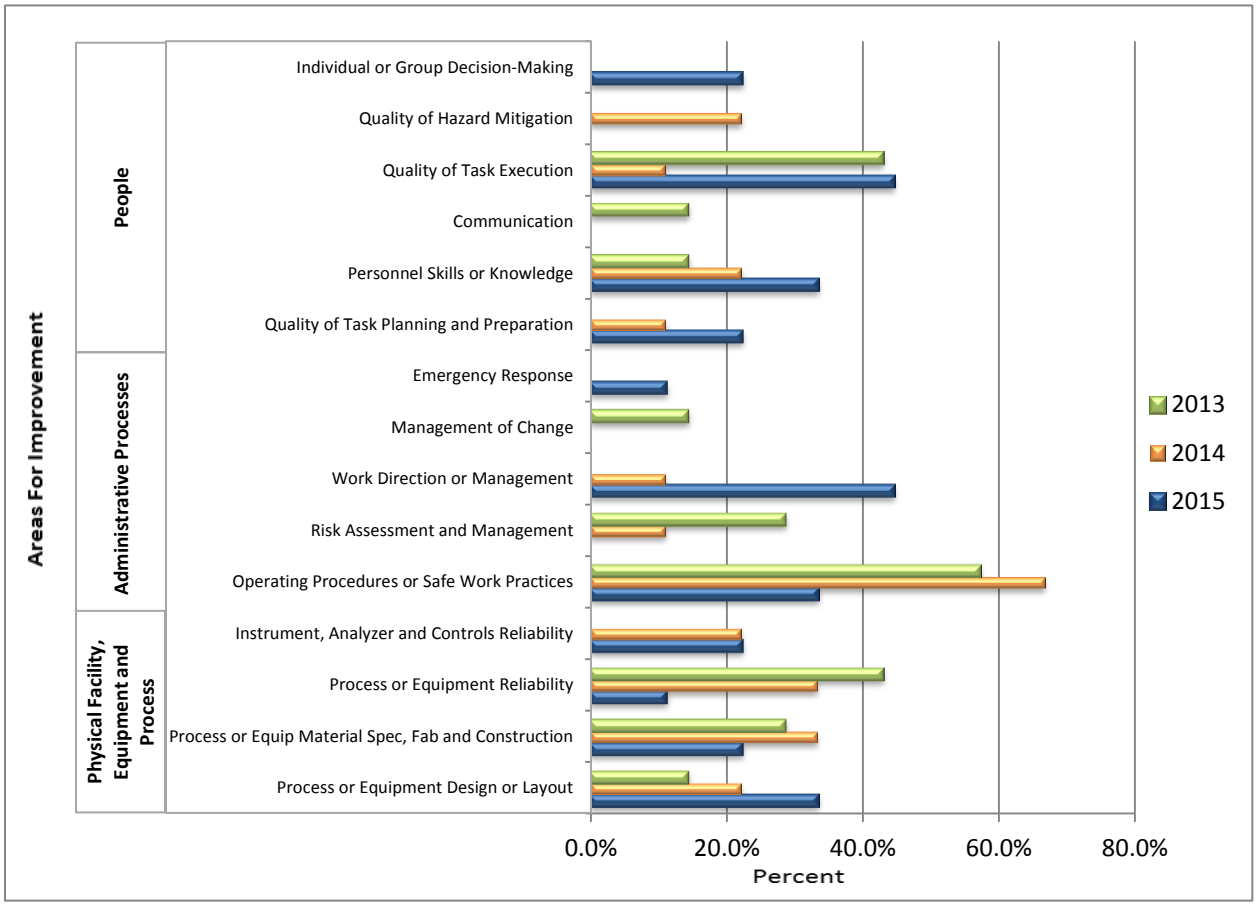


[1] *This chart depicts the number of AFIs selected divided by the total number of Loss of Station Keeping / DP submittals in the given year.*

- Number of incidents represented above (by year): 2013 = 5, 2014 = 4, 2015 = 6
- Process or Equipment Design or Layout and Operating Procedures or Safe Work Practices were the AFI most often selected in 2015

* Note - 2015 Total SPI 2D events was three, with two additional HVLE and one SPI 1E related to DP

Chart 9 – Process Safety (Tier 1 and Tier 2) AFI Distribution (AFI selection per total number of PSE submittals)



[1] *This chart depicts the number of AFIs selected divided by the total number of PSE submittals in the given year.*

- Number of incidents represented above (by year): 2013 = 7, 2014 = 9, 2015 = 9
- Personnel Skills or Knowledge and Process Equipment Design or Layout show a steady increase over the 3-year period (2013-2015)
- Process or Equipment Reliability has decreased over the 3-year period (2013-2015)